A Critical Benefit Analysis of Artificial Gravity as a Microgravity Countermeasure

by

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B.S. Mechanical Engineering
B.S. Materials Science and Engineering

University of California at Berkeley, 2006

SUBMITTED TO THE DEPARTMENT OF AERONAUTICS AND ASTRONAUTICS IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF SCIENCE IN AERONAUTICS AND ASTRONAUTICS
AT THE
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

June 2010

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Abstract

Human physiological systems, especially the cardiovascular and musculo-skeletal systems, are well-known to decondition during spaceflight. Several countermeasures that are in use today have been rigorously developed over the decades to combat this deconditioning. However, these countermeasures are system specific and have proven to be only partially effective. Artificial gravity has been persistently discussed as a countermeasure that potentially has salutary effects on all physiological systems, though few ground-based studies have been performed in comparison to other countermeasures. The current analysis attempts to elucidate the effectiveness of artificial gravity by directly comparing results of previously published and unpublished deconditioning studies with those of more traditional, ground-based countermeasures (i.e. resistive exercise, aerobic exercise, lower body negative pressure, or some variation of these). Animal studies were also evaluated to supplement the knowledge base and to fill gaps in the human countermeasure literature. Designs of published studies, such as study duration, deconditioning paradigm, subject selection criteria, measurements taken, etc., were confounding variables; however, studies that had some measure of consistency between these variables were compared, although notable differences were cited in the analysis and discussion. Results indicate that for prolonged spaceflight an artificial gravity-based countermeasure may provide benefits equivalent to traditional countermeasures for the cardiovascular system. Too few comparable, human studies have been performed to draw any conclusions for the musculo-skeletal system, although animal studies show some positive results. Gaps in the current knowledge of artificial gravity are identified and guidance for future deconditioning studies is offered. Based on the results of this study, a comprehensive artificial gravity protocol is proposed and future research topics using this countermeasure are addressed.

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This work was supported by the NASA Johnson Space Center contract number NNX09AE50G as well as by the W. A. Brookshire Foundation.

Acknowledgements

Firstly, I would like to thank Dr. John Charles for funding this research through NASA contract number NNX09AE50G. This research would not be possible without his support.

To my advisors:

Professor Laurence Young: Thank you for giving me the opportunity to work on this project. It has truly been a pleasure having you as a mentor, a professor, and traveling companion. I greatly value your guidance and I look forward to working with you in the future.

Professor Bill Paloksi: For almost half of this research, I had only known you by your voice through our weekly telecons until we finally met in person. Thank you for your wealth of knowledge and guidance that you have contributed to this project.

To Liz: Thank you for always being there to answer all the administrative questions I have had over the past two years.

To Dr. Alan Natapoff: Thank you for the long hours we spent together trying to figure out how to analyze such a hodge-podge collection of data. Also, thank you for all the trivia you have imparted to me; the volume of interesting information you know never seizes to amaze me.

To my officemates: Thank you for not getting too upset when my papers and books somehow make it onto your desk space.

To the students of the MVL: I can honestly say that I have never had such a great work environment as the MVL. Plus, the extracurricular activities have been fantastic…beer brewing, sailing, squash playing, and, of course, warfish. It has been great getting to know every one of you and I look forward to staying in touch in the future.

To Mom, Dad, Kendra, and Aunt Sharon: Thank you for being so supportive of me and my endeavors. Your words of encouragement have kept me going through the thick and thin.

And finally, to my love, Tiffany: Thank you for always being there for me, even when I have been difficult to reach the past few weeks as the semester came to a close. You always have a way of putting a smile on my face. I can't wait for our travels this summer and where this road takes us in the future.

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Acronyms

AG	Artificial gravity
ARED	Advanced resistive exercise device
ATV	Automated transfer vehicle
BMD	Bone mineral density
BSAP	Bone specific alkaline phosphate
CEVIS	Cycle ergometer with vibration isolation system
CO	Carbon monoxide
CSA	Cross-sectional area
DPD	Deoxypyridinoline
DXA	Dual energy X-ray absorptiometry
EDO	Extended duration orbiter
EKG	Electrocardiogram
ESA	European Space Agency
HDBR	Head-down bed rest
HF	High frequency
ISS	International space station
JAXA	Japanese aerospace exploration agency
LBNP	Lower body negative pressure
LEO	Low earth orbit
LF	Low frequency
MPLM	Multi-purpose logistics module
MRI	Magnetic resonance imaging
MVC	Maximum voluntary contraction
NTX	n-telopeptide cross-link
OC	Osteocalcin
OTTR	Otolith tilt-translation reinterpretation
PPG	Photoplethysmograph
pQCT	Peripheral quantitative computed tomography
PTH	Parathyroid hormone
PYD	Pyridinoline
RER	Respiratory exchange ratio
SRC	Short-radius centrifuge
SUS	Suspension (Hindlimb unloading)
TPR	Total peripheral resistance
TVIS	Treadmill with vibration isolation system
ULLS	Unilateral lower limb suspension
UTMB	University of Texas Medical Branch
VSR	Vestibulosympathetic reflex

1.0 Introduction

As humankind prepares to venture from the safety of low-earth orbit (LEO) to more ambitious and novel destinations, countermeasures for microgravity and partial gravity deconditioning of astronauts will play a vital role in mission success. For a hypothetical three year, round-trip mission to Mars, astronauts would need to maintain nearly a pre-flight level of fitness on the outbound one-year segment in order to safely endure a Martian landing and gravitational stress (3/8G). In addition, astronauts would also need to maintain a high level of fitness on the return one-year voyage in order to endure a more violent Earth reentry and gravitational stress. Regardless of which celestial destination humans will next embark, countermeasures to physiological deconditioning of humans will undoubtedly remain a high priority.

1.1 Effects of Spaceflight on Human Physiology

Spaceflight deconditioning has been a well-documented problem since orthostatic hypotension was first observed following the final two Mercury missions. This deconditioning affects many physiological systems with effects that manifest at different time scales for the astronaut; some are realized upon entering microgravity while others take weeks in microgravity to become noticeable. The following sections give a brief introduction to body systems and how these systems are affected by spaceflight.

1.1.1 Cardiovascular System and Deconditioning

The cardiovascular system is a profoundly intricate body system that has several critical functions. Its primary tasks are to perfuse the body with oxygenated blood (the brain and central nervous system receive highest priority), to act as a communicative medium to different parts of the body, to remove waste and to meet metabolic needs of the human system. In an oversimplified model, the cardiovascular system can be thought of as the heart, which acts as the pump, the pulmonary exchange, and the peripheral vasculature (Figure 1). Within the heart, blood enters the right atrium from the vasculature and then enters the right ventricle. Blood then proceeds through the pulmonary loop to conduct gas exchange with the alveoli in the lungs and then flows to the left atrium and left ventricle and exits to the peripheral vasculature. This vasculature consists of the collective arteries, which are – in order of decreasing size – the aorta, arteries, arterioles, pre-capillaries, and capillaries, and carry oxygenated erythrocytes, and the veins, which are – in order of increasing size – the venules, veins, and vena cava, and carry carbon dioxide waste. Vasculature structure from the inside-out consists of an endothelium lining, which is a permeable membrane, smooth muscle cells, which can constrict and relax the vessel, and a collagen outer lining. All of the vasculature, except the true capillary and venule, has these structures in varying degrees, which is shown in Figure 2.

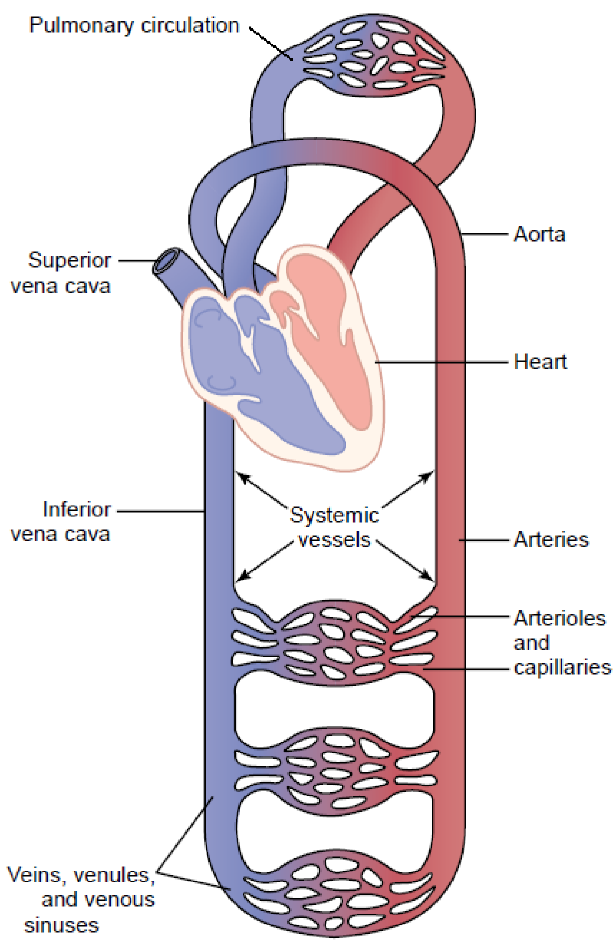


Figure 1. Circulation schematic of the human cardiovascular system (Guyton and Hall 2006)

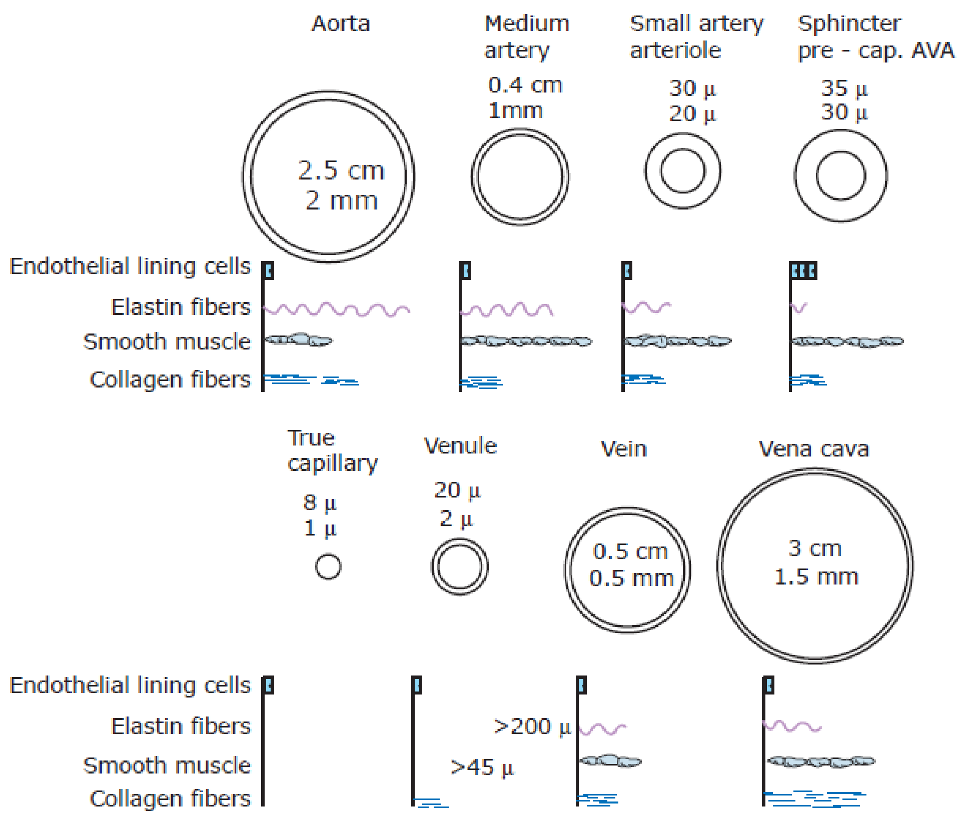


Figure 2. Vasculature composition and cross-section

The cardiovascular system has several methods of coping with systematic stress. One of the primary mechanisms of mediating stress, such as moving from a supine to an upright position, is the baroreceptor reflex (also known as the baroreflex). The baroreceptors are pressure sensors located in several areas of the body, including the aortic arch and the carotid arteries. Unloading of these receptors in response to standing triggers the baroreflex, which initiates an autonomic nervous system response that increases heart rate, vasoconstriction and venous constriction, in order to maintain arterial blood pressure.

Within minutes of entering the microgravity environment, blood and body fluids, which are normally pooled in the lower extremities in a gravitational environment, shift into the thorax and upper extremities (Figure 3). This fluid shift is the reason astronauts exhibit ‘chicken legs’ and ‘puffy face’ and causes an increase in central venous pressure, which in turn increases cardiac stroke volume and cardiac output. An increased transmural pressure in microgravity along with this cardiac distension results in plasma volume migrating from intravascular to extravascular compartments (Beckers et al. 2006). Plasma volume reduction on the order of 17% has been observed on the first day of spaceflight, thus leading to an increase in hematocrit. This triggers a decrease in the level of erythropoietin, which is a regulating hormone of red blood cells, and results in a decrease in hematocrit over the first few days to a week (Buckey 2006). However, hematocrit ultimately remains elevated from pre-flight levels.

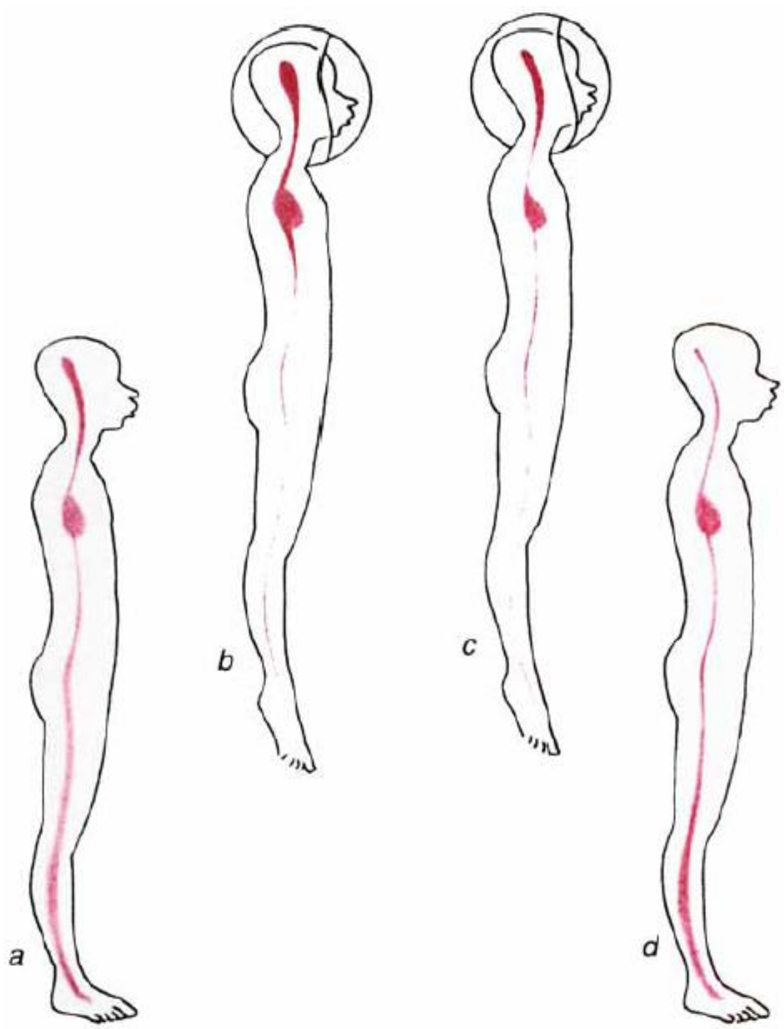


Figure 3. Fluid shift in space. a) Normal 1G fluid distribution, b) Initial fluid shift in space, c) fluid shift from long duration spaceflight, d) fluid distribution upon return to Earth (Vernikos 1996)

Long term adaptation in space has several implications for the astronaut. Loss of plasma volume and elevated hematocrit persist throughout the spaceflight. The cardiac muscle atrophies, which results in lower stroke volume and lower cardiac output. For the arterial vasculature, the lack of a gravitational stress results in increased vasoconstriction in space, which results in a reduction of vasoconstrictive reserve upon return to Earth. This adaptation could contribute to the lower total peripheral resistance rise seen upon standing in astronauts post-flight versus pre-flight (Zhang et al. 2008).

Orthostatic intolerance is observed in a number of astronauts returning from spaceflight; depending on how the orthostatic tolerance is defined, the incident rate of astronauts is as high as 63% (Buckey 2006). The exact mechanism for orthostatic intolerance has yet to be determined; however, it is most likely a combination of the adaptive changes above, including decreased plasma volume, stroke volume, and increased total peripheral resistance. Moreover, data has shown that astronauts who are orthostatic intolerant exhibit a significantly lower norepinephrine response to standing than their tolerance counterparts (Fritsch-Yelle et al. 1996).

Finally, aerobic capacity is affected by spaceflight. Upon return to Earth, astronauts have exhibited a decrease in maximal oxygen uptake despite maintaining fitness in space with the use of countermeasures. This decrease in oxygen uptake may occur as a result of the detrimental changes listed above.

1.1.2 Muscular Physiology Deconditioning

Skeletal muscle fibers are divided into predominately three groups: slow twitch (type I), fast-twitch non-fatigueable (type IIa), and fast-twitch fatigueable (type IIx). Muscle groups that have a majority of slow twitch fibers are usually postural muscles that support the weight of the body in a 1G environment (e.g. soleus and gastrocnemius), whereas muscle groups with a majority of fast-twitch fibers are explosive muscles that are useful, for example, in sprinting (e.g. vasti group and rectus femoris).

Postural muscles play a small role in the locomotion of astronauts in space. In the absence of gravity, locomotion is performed by small bursts of muscle activation, followed by ‘flying’ through the spacecraft, and then again small muscle bursts to arrest the astronaut. Thus, antigravity muscles, which are predominantly extensor muscles such as the plantar flexors (soleus and gastrocnemius) and quadriceps (vastus lateralis, vastus intermedius, vastus medialis, and rectus femoris), atrophy initially to a greater extent than flexor muscle groups. After long-duration flight, the extensors and flexors exhibit similar levels of atrophy (Fitts et al. 2000). Whole muscles also show evidence of a reduction of peak force and power after spaceflight. The anatomical location of these muscle groups is shown in Figure 4, with the rectus femoris (not shown) located just anterior to the vastus intermedius.

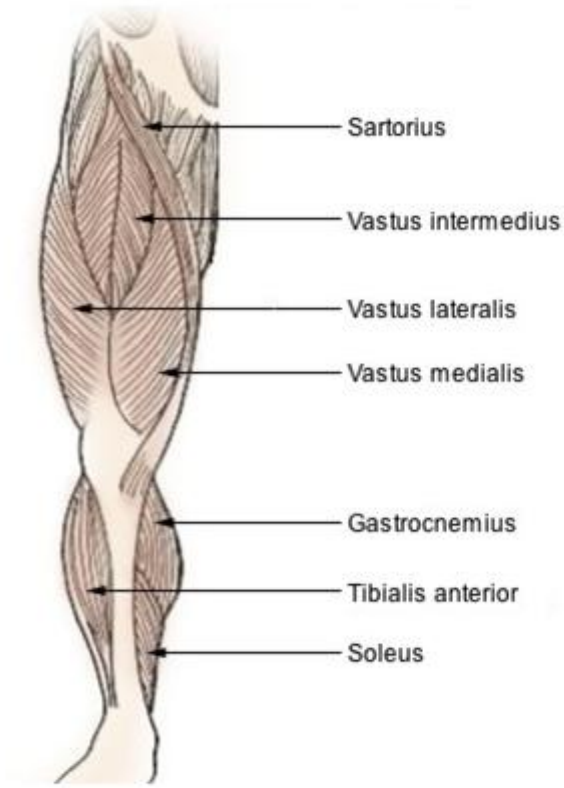


Figure 4. Leg muscles of the left leg (anterior view)

Atrophy of the muscles begins with an imbalance of muscle protein homeostasis. During spaceflight, there is a decrease in rate of protein synthesis while the rate of breakdown remains the same. This imbalance causes a decrease in fiber cross-sectional area (CSA), which ultimately results in atrophy of the whole muscle.

Several changes take place within the muscle fiber itself. Contractile proteins are lost disproportionately compared to other cellular proteins and actin molecules are lost to a larger extent than myosin molecules (Fitts et al. 2000). This results in a decrease in force per CSA and an increase in the shortening velocities of the fibers. In addition, slow-twitch fibers have a tendency to transition from a slow type I to fast type II fiber.

1.1.3 Bone Physiology and Deconditioning

The human skeleton is composed of a collagen protein matrix as well as a mineral matrix of calcium carbonate. Long bones of the body have an outer, dense region called the cortical bone while the inner trabecular region is of a much lower density matrix. In a 1G environment, bone health is maintained through a process called remodeling, where osteoblast (used in bone formation) and osteoclast (used in bone resorption) activities are coupled and are constantly occurring. Conversely, modeling is the adaptive process of bone that – according to Frost's mechanostat – tries to maintain bone mass to keep bone strain within an acceptable daily range (Frost 1997). Modeling usually takes place on the periosteal, or outer surface of the bone, while the majority of remodeling occurs on the endosteal, or inner surface of the bone. The aging process of bone of a normal ambulatory human results in an expansion of the endosteal as well as an expansion (to a lesser extent) of the periosteal so the section modulus of the bone is constant. This process is shown in Figure 5A.

During spaceflight, normal bone homeostasis is disturbed due to the absence of gravity. Osteoclast activity has been found to increase, while osteoblast activity decreases. This imbalance results in a net loss of bone mineral density (BMD). Furthermore, without gravity and stress on the bone, no modeling takes place in space. The aging process of bone in space is an expansion of the endosteal while the periosteal remains constant, which results in a decrease in section modulus and decrease in bone strength. This process is shown graphically in Figure 5B.

Because of the absence of gravity in space, the normal load bearing sections of the skeleton will have the greatest loss of bone mineral density (BMD). These sections include the hip, lumbar spine, and calcaneus. Bone loss rates for various anatomical regions of the body are shown in Figure 6. It is interesting to note that the upper regions of the body may increase bone mass. This phenomenon might result from an increase in extracellular pressure due to fluid shift, which in turn increases osteaoblast activity in the region.

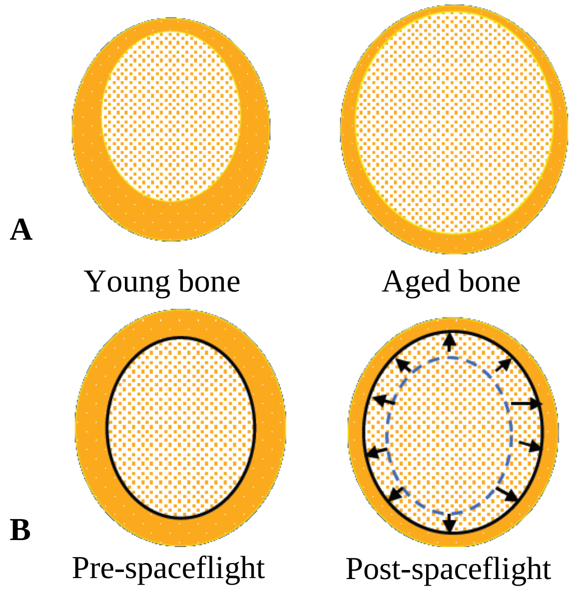


Figure 5. Bone changes due to A) normal aging – periosteal and endosteal expansion and B) spaceflight – only endosteal expansion

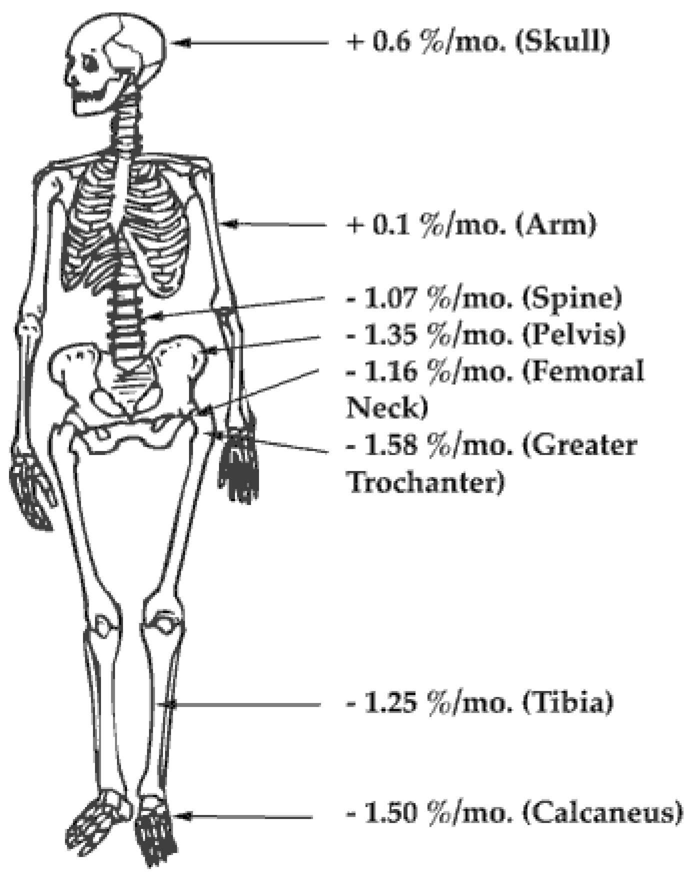


Figure 6. Rate of bone loss per month at different locations of the body (Buckey 2006)

1.1.4 Vestibular Physiology and Deconditioning

The vestibular system plays a crucial role in balance control of the body, such as in normal locomotion or running. It lies in the inner ear and is comprised of two organs: the semicircular canals and the otoliths. The semicircular canals are three, roughly orthogonal, fluid-filled canals that detect angular acceleration of the head; however, due to the inherent design of the canals, the signal transmitted to the brain closely follows angular velocity. The otoliths consist of the utricle and the saccule, which are two roughly orthogonal planes of calcium carbonate stones embedded in a sensory epithelium. The otoliths detect linear acceleration, which includes gravity as well as linear acceleration from translational movement. Because of this dual role, certain ambiguities – somatogravic illusions – arise that the otoliths cannot resolve. For instance, pitching the head backwards to 45° past vertical will have the same otolith response as accelerating forward at a specific acceleration with the head upright, as seen in Figure 7. This ambiguity is resolved by a number of mechanisms, including any visual cues, prolonged acceleration (interpreted as tilt), or a history of prior motions.

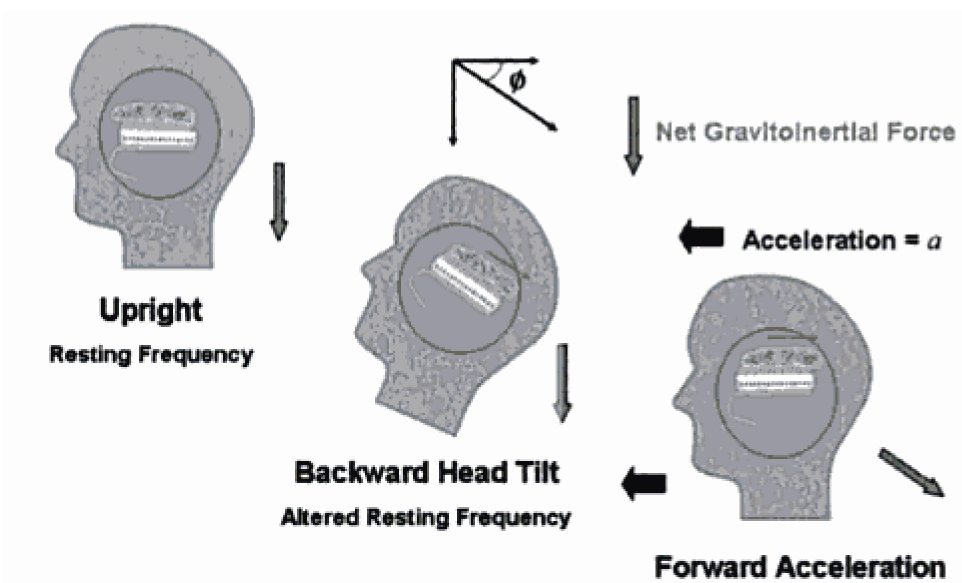


Figure 7. Tilt-translation ambiguity of the otoliths. Backward head tilt has the same effect as forward acceleration (Previc and Ercoline 2004)

In spaceflight, one important adaptation of the vestibular system is the otolith tilt-translation reinterpretation (OTTR). Because there is an absence of gravity in space, the otoliths must adapt by interpreting any acceleration as translation of the body instead of tilt. While this adaptation is perfectly suitable for spaceflight, it has detrimental effects with the reintroduction of a gravity field. Upon return to Earth, several astronauts have experienced translational acceleration with a given head tilt (Parker et al. 1985). In addition to OTTR during spaceflight, the central nervous system may also reduce the weighting of the otoliths and rely more heavily on the visual scene to determine orientation. Post-flight, experiments performed on a rotating chair have determined that astronauts tend to overestimate tilt (Clement et al. 2003).

Finally, there exists some evidence that the sensitivity of the otolith afferents increases after spaceflight. This phenomenon was observed in oyster toadfish that flew on STS-90 (Neurolab) and STS-95. Otolith sensitivity was reduced to the pre-flight baseline 30 hours post-flight (Boyle et al. 2001). The full extent of afferent adaptation due to spaceflight is still an open area of research.

2.0 Background

2.1 Evolution of Countermeasures

Countermeasures for spaceflight deconditioning have continually evolved throughout the human experience in space. This evolution has in part followed the continual refinement of how the human body adapts to life in space. The following two sections present an overview of countermeasures on spacecraft through the 1990's and the countermeasures used in the International Space Station (ISS) era.

2.1.1 Countermeasures from the Advent of Spaceflight through the 1990s

The first manned spaceflights of Project Mercury witnessed medical advisors who were concerned not with how the astronauts' bodies would adapt to spaceflight, but rather if the human body could even survive in space. There persisted a debate among the scientific community on whether astronauts could breathe in space, swallow in space, and so forth. The first few Mercury spaceflights, however, quelled these concerns.

Following Mercury-Atlas 8 and more dramatically after Mercury-Atlas 9, astronauts Walter Schirra and Gordon Cooper, respectively, experienced an exaggerated increase in heart rate and decrease in blood pressure upon standing from their capsule. This orthostatic hypertension after the final two flights of the Mercury Project gave scientists their first indication that the human body changes with spaceflight. Projects Gemini and Apollo soon followed Mercury, and astronauts were given a bungee device with which to exercise in space. Because of the small size of the capsules, this bungee exercise was performed from the astronaut's seat by pushing on the bungee with the feet and restraining it with the hands. This 'exercise' was not intended to be a countermeasure, but rather a diagnostic tool to obtain a time-course history of the cardiovascular changes in space. In addition, bone mineral density of Apollo astronauts was measured pre- and post-flight in the hand and foot by single-photon densitometers and was found to have decreased substantially, which indicated bone adaptations might take place during flight.

Skylab was the first American spacecraft to truly have countermeasures for spaceflight deconditioning. Though because astronauts did not want to feel like guinea pigs in medical experiments and due to potential personal inconvenience, they strongly objected to a prescribed exercise plan. Exercise was therefore not regulated on Skylab, but astronauts were still required to report how long and how hard they exercised and they were required to undergo periodic fitness tests (Compton and Benson 1983). Skylab 2 was equipped with an upright cycle ergometer device as the primary countermeasure, which could be peddled with either the hands or feet (Figure 8). Though the cycle ergometer was adequate for aerobic exercise, it did not provide the appropriate forces to maintain muscle mass. Skylab 3 introduced additional countermeasure devices, the MK-I and MK-II (Figure 9), to perform isokinetic exercises. These exercises provided appropriate forces to the upper body; however, the force transmitted to the legs was still less than 1G equivalent (Thornton and Rummel 1977). Skylab 4 added a treadmill to the countermeasure gamut, although this treadmill was passive due to severe weight constraints. The astronaut was restrained by bungees and ran on a low friction Teflon sheet, as shown in Figure 10. Skylab also had a Lower Body Negative Pressure (LBNP) device, which was used to periodically test the integrity of the cardiovascular system. A subsequent analysis of the Skylab data revealed that the periodic LBNP use did not significantly improve the post-flight performance of astronauts (Nicogossian et al. 1988). [LBNP is a device that fits around the lower half of the body and evacuates some air to create a partial vacuum around the lower extremities. This in turn causes blood to pool in the lower extremities as it would normally in 1G to create cardiovascular stress.]

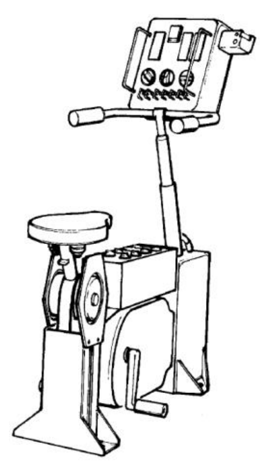


Figure 8. Skylab upright cycle ergometer (Diamandis 1997)

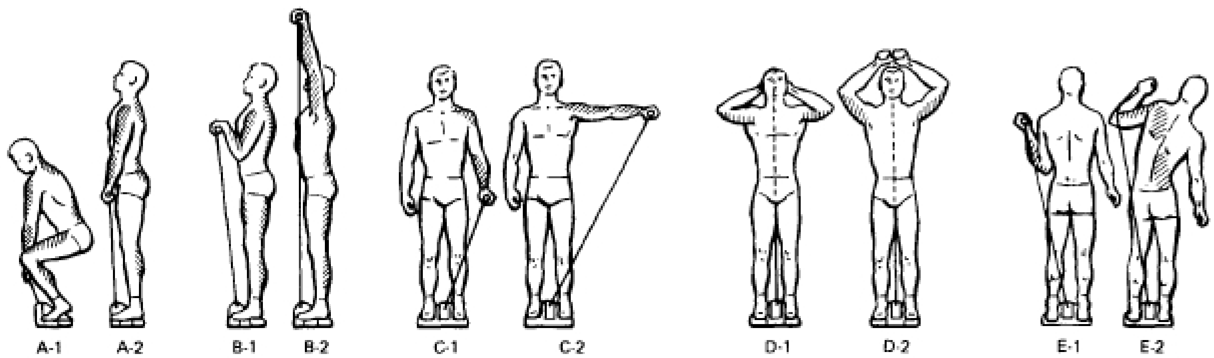


Figure 9. MK-I exercise device and exercises. MK-II was similar in design to MK-I. (Thornton and Rummel 1977)

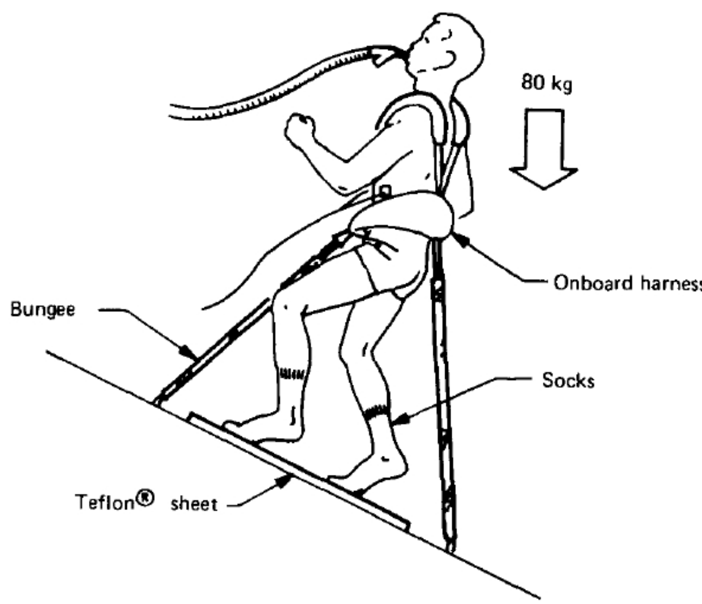


Figure 10. Skylab passive treadmill device (Thornton and Rummel 1977)

Early shuttle missions had only a few countermeasures because of the small size of the cabin as well as the short duration (8-10 days) of the missions. Astronauts made use of a treadmill, although the tread length was extremely short due to stowage requirements, and a cycle ergometer. When a series of Extended Duration Orbiter (EDO) missions began with STS-50 in 1992, a broader range of countermeasures was developed to assess their effectiveness in 16-day missions. These countermeasures included a cycle ergometer (Figure 11), an EDO treadmill, which had a longer running surface and more comfortable harness than the shuttle treadmill, a collapsible LBNP device (Figure 12), and a rowing device, which was similar to the MK-I and MK-II devices of Skylab.

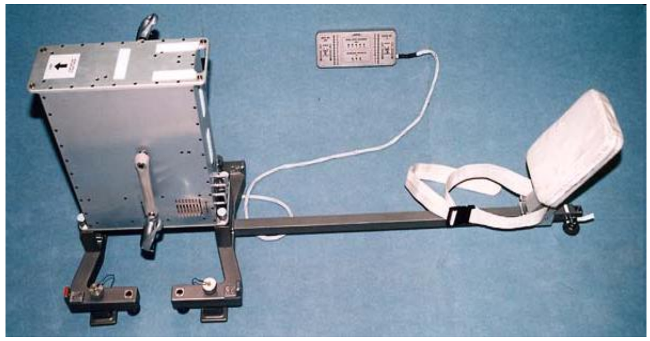


Figure 11. Deployed EDO cycle ergometer (Sawin et al. 1999)

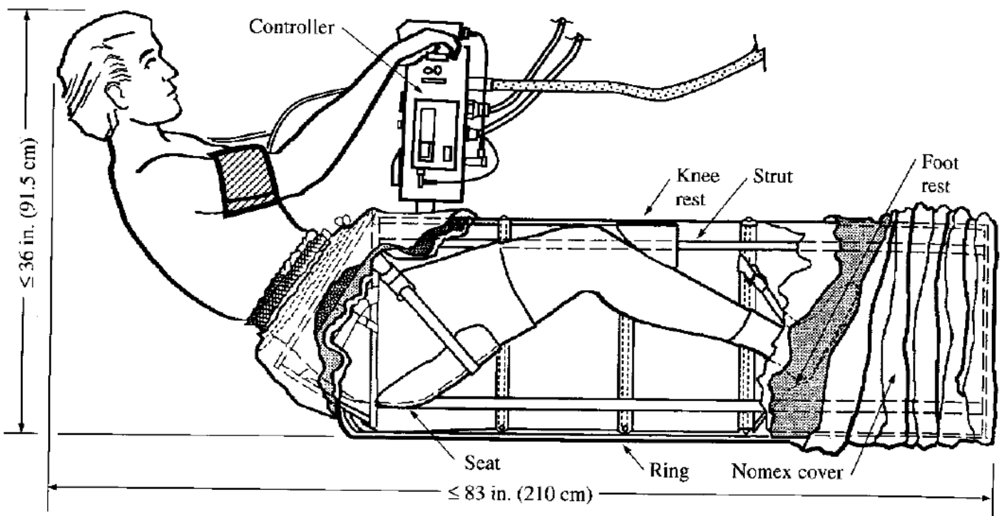


Figure 12. Collapsible LBNP device (Sawin et al. 1999)

The Russians have also developed a series of countermeasures to deal with the problem of space deconditioning, especially countermeasures with respect to long-duration spaceflight since that has been the focus of their space program. The devices developed for their space stations include: a treadmill with bungee cords and restraints for running, walking, or jumping; a cycle ergometer; the 'Penguin' suit, which is a suit that exerts forces on the body through elastic cords and is worn throughout the 8-hour workday (Figure 13); an LBNP device; and the 'Tonus-2' system, which is a multichannel device for electrically stimulating muscle (Kozlovskaya et al. 1995). The intensity and use of the countermeasure regime has depended in which of the three flight segments the astronauts were. During the first flight segment, exercise was relatively light and mainly performed on the cycle ergometer. The second phase of flight utilized all the countermeasures except for the LBNP device and exercise was performed on a 3+1 schedule (3 days of exercise, 1 day of rest). During the final stage of flight (4-6 weeks before landing), cosmonauts performed exercise at the highest intensity, and, in addition, a steadily increasing LBNP regiment was applied (Kozlovskaya et al. 1995).

Figure 13. Penguin suit (Clement 2003)

2.1.2 Current Countermeasures and Protocols on the International Space Station

From this evolution of space exercise, a suite of countermeasures has been developed for use on the ISS. Current facilities include: the advanced resistive exercise device (ARED), which replaced the interim resistive exercise device and is capable of exercising the arms and legs (Figure 14); the cycle ergometer with vibration isolation system (CEVIS), which is very similar to the EDO ergometer; and the T-2 treadmill with vibration isolation system (TVIS) (also known as COLBERT). In addition, Russian cosmonauts continue to wear the Penguin suit and also continue to utilize the LBNP device that they maintain. Finally, some non-traditional countermeasures have made a debut on the ISS; namely, a trial phase has begun using the bisphosphonates alendronate and zoledronic acid as a pharmaceutical countermeasures for bone.

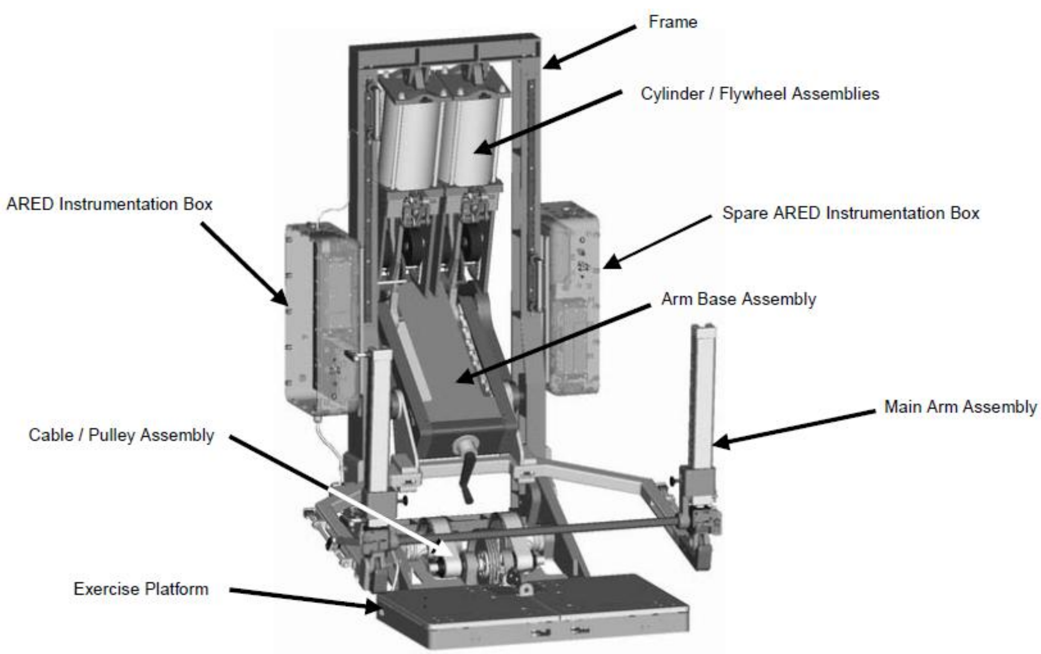


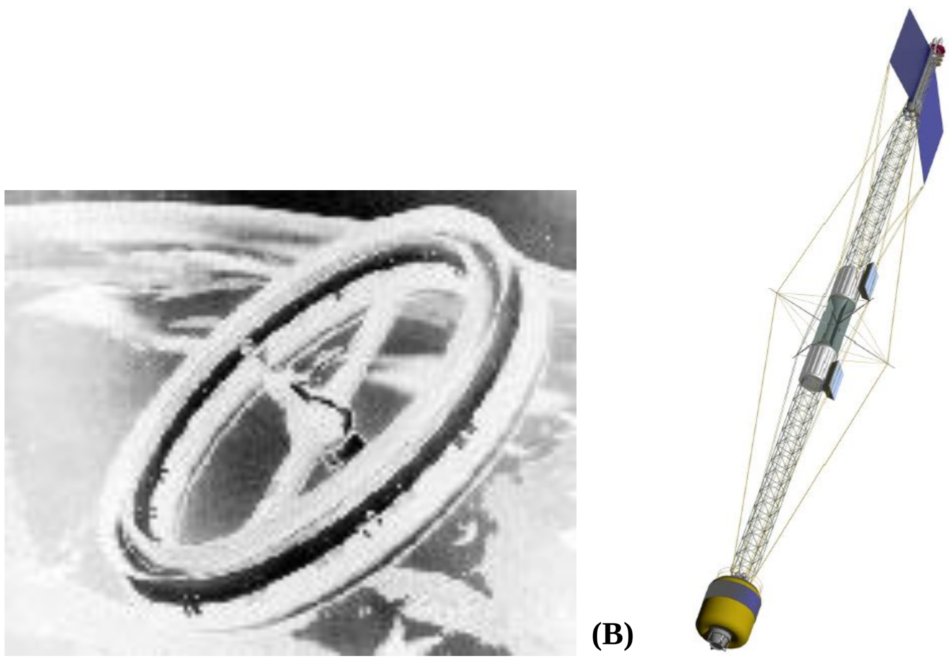
Figure 14. Advanced resistive exercise device (Bentley et al. 2006)

2.2 Artificial Gravity

One potential countermeasure approach that has been persistently discussed is artificial gravity (AG), which was first conceived by Konstantin Tsiolkovsky for application in space well before the space age (Clement and Bukley 2007). AG has the potential to be a comprehensive multi-system countermeasure for human deconditioning because it directly supplies the missing stimulus – gravity – in space. AG can be supplied via two distinct methods: 1) a large, continuously rotating spacecraft or 2) a short-radius centrifuge (SRC) within a conventional spacecraft.

2.2.1 Continuous, Rotating Spacecraft

A rotating spacecraft would be ideal from a countermeasure standpoint because it could provide a continuous, 1G acceleration, just as humans experience on Earth. This rotating spacecraft could take the form of a rotating torus, such as one envisioned by Werner von Braun with the crew contained on its outside perimeter (Figure 15A), or the spacecraft could be a rotating truss with the crew habitability module at one extremity (Figure 15B). Recent studies have shown that rotating vehicles like Figure 15B need to only be 130 meters in diameter to create 1G while maintaining a tolerable rotation rate (Joosten 2002). In addition, these designs are technically feasible and could be developed for costs comparable to conventional vehicle designs; however, this approach has not been popular with program managers.



(A) (B)

Figure 15. Concepts for continuously rotating spacecraft. A) Werner von Braun's rotating torus, B) Jooston 2007 rotating truss.

2.2.2 Short-Radius Centrifuge

AG can also be supplied by a short radius centrifuge, which typically has a radius in the range of two or three meters (Figure 16). This rotating platform would apply artificial gravity only intermittently, with astronauts experiencing weightlessness for the remainder of the day. Astronauts could be nominally rotated at 1G, or they could be rotated in hypergravity (>1G) to try to make up for the lack of gravity in space. Because the acceleration level is dependent on radius in a rotating environment,

$$\mathbf{a_c = \omega^2 r} \qquad \textbf{(1)}$$

there exists a near 100% gravity gradient on an SRC as the head is near the axis of rotation.

Figure 16. Example of a short radius centrifuge at the University of Texas Medical Branch (NASA)

AG via SRC was first investigated by White et al. in 1965 (White et al. 1965), and SRC research has since continued intermittently in multiple countries around the globe. To date, only one human centrifuge has flown in space on the STS-90 Neurolab mission, although this was an off-axis centrifuge and not primarily intended to be used to prevent deconditioning. In addition, some Russian biosatellites (Cosmos series) have flown centrifuges that contained mice; however, these centrifuges did not supply AG intermittently, but rather continuously. Despite this research, the questions of 'how many Gs?', 'how long for centrifugation?', and 'how often to apply centrifugation?' to prevent human deconditioning still remain due primarily to the overall low number of AG studies performed.

Several SRCs exist throughout the world that are still operational. On some centrifuges, the subject only passively rides, such as the centrifuge at the University of Texas Medical Branch (UTMB), while others have the capability for subjects to perform exercise while undergoing centrifugation, such as cycling or squats. One example of this type is the centrifuge at the Massachusetts Institute of Technology, Man Vehicle Laboratory. A list of known short radius centrifuges in the world and operational details are compiled in Appendix A: World Centrifuges.

2.3 Motivation

Despite over four decades of optimization to the 'traditional countermeasures', a high rate of deconditioning is still observed in astronauts returning from ISS Expeditions. Specifically, a study by Trappe et al. has shown that calf muscle maximum voluntary contraction (MVC) and muscle volume was significantly decreased after six months aboard the ISS (Trappe et al. 2009). Of particular concern, however, is the precipitous loss in bone mineral density (BMD) after six month ISS expeditions, with losses of 1.2–1.5%/month ($p < 0.0001$), 0.4–0.5%/month ($p < 0.01$), and 2.2–2.7%/month ($p<0.001$) observed in the hip integral, cortical, and trabecular regions, respectively (Lang et al. 2004). Some individuals from this study incurred losses equivalent to one-half the BMD loss that they would experience in a lifetime of normal aging. While these rates of deconditioning are deemed acceptable by NASA for low earth orbit and perhaps even 6-month excursions to the Moon, they will certainly not be acceptable for exploration-class missions (e.g. a Mars mission currently has an estimated mission time of three years). The need for improved comprehensive countermeasures from the status quo is clear.

Space agencies have invested far more resources into studies using traditional countermeasures, which have resulted in advanced, although only partially effective, protocols that are well past a definition phase. Before increasing investment in an AG-based countermeasure approach, a study is needed to investigate scientific merit of pursuing an AG countermeasure instead of only continuing with system specific countermeasures. The present study addresses this problem and is an exploratory analysis on comparing the effectiveness of AG-based studies to the effectiveness of traditional countermeasure-based studies. The hypotheses for this analysis is that AG will be as effective as the traditional countermeasures for the cardiovascular system, while not enough data exists to make a judgment on the musculoskeletal system. Moreover, AG coupled with exercise is hypothesized to be a greater benefit to physiological systems than AG alone.

2.4 Ground-Based Analogs

One of the greatest hindrances for evaluating countermeasures during spaceflight is the lack of rigorous controls, whereas in the laboratory investigators can control almost all aspects of research. For instance, falling behind the flight plan often led to abbreviating or completely skipping exercise sessions in early spaceflight. Only since the ISS era has the exercise block been completely preserved and only until the installation of ARED and T-2 in 2009 can the actual workload and ground reaction forces be recorded and correlated to each astronaut (no results yet of this endeavor). In addition, the lack of a control group in space also serves to hinder evaluations of countermeasures as there is no one to which the astronauts can compare, save for their own fitness level pre-flight. Indeed, having a control group in space that did not exercise would present a major ethical dilemma, which is most likely the reason it has not been executed.

Because of these difficulties in evaluating countermeasure effectiveness in space (not to mention the cost of performing iterative studies), it became necessary to develop methods for ground-based studies to represent an analog environment.

2.4.1 Human Ground-based Deconditioning Paradigms

Methods to create an analog space environment began almost with the dawn of spaceflight. Some method was needed to immobilize the subject as well as reduce the effect of gravity, if possible. A few deconditioning paradigms met these goals.

2.4.1.1 Wet or Dry Immersion

Immersion in water seemed like a logical choice as water offloads much of the effect of gravity. The Russians have had vast experience with this method and first utilized wet immersion, in which the subject is submerged to the neck, as a deconditioning measure. However, subjects cannot stay submerged in water for extended periods of time and this method was only used for very short studies on the order of a few days or less. A suitable modification to wet immersion for longer duration studies is dry immersion in which the subject dons a rubber suit and thus remains dry throughout the experiment.

2.4.1.2 Bed Rest

Another method developed to immobilize subjects is through the bed rest model, in which subjects are confined to a bed for the duration of the study. The only exceptions to bed rest would be for countermeasure exercise (ideally it would still be in a recumbent position). In order to elicit appropriate responses, such as fluid shift, Russian investigators adjusted the paradigm to a head down bed rest (HDBR) regime and experimented with angles until 6° head down was deemed optimal (Pavy Le Traon et al. 2007). A 6° HDBR has since become the standard of bed rest deconditioning.

2.4.1.3 Unilateral Lower Limb Suspension

Another method to immobilize subjects is through unilateral lower limb suspension (ULLS). In this paradigm, the subject uses crutches and moves about on only one leg with a shoe that has a large sole. Thus, the other leg does not receive any weight support. Because this paradigm only immobilizes one leg and does not mimic the fluid shift and other deconditioning aspects associated with spaceflight, it is not commonly employed.

2.4.2 Animal Ground-based Deconditioning Paradigm

Animals are extremely valuable to medical research because they are much cheaper than human studies, and animals have the added benefit of enabling the use of invasive or destructive techniques. Large bipedal primates, such as monkeys, can still utilize the HDBR model and produce a similar response to humans. Quadrupeds, such as mice or rats, on the other hand cannot use the HDBR model because they would still be standing and not immobilized. A head-down, hindlimb unloading model (tail suspension, or SUS) was developed by E. R. Morey in 1979 to simulate a fluid shift and hindlimb immobilization (Morey-Holton et al. 2005). In this model, the rat, for instance, is suspended from its tail so the hindlimbs are suspended and the head is angled sharply downward. The rat usually retains some mobility with its front limbs; the bar to which the tail is attached can swivel 360°. Since its inception in 1979, the hindlimb unloading model has become the standard space analogue for rodents. One example of the model is shown in Figure 17.

One problem does arise with animal experiments that is not present in human experiments. In taking most physiological measurements, animals must be sacrificed because many techniques (discussed later in 2.5) require the removal of parts of the anatomy. Because of this nuance, animal experiments require an additional experimental ‘control’ group that are killed at the beginning of the experiment.

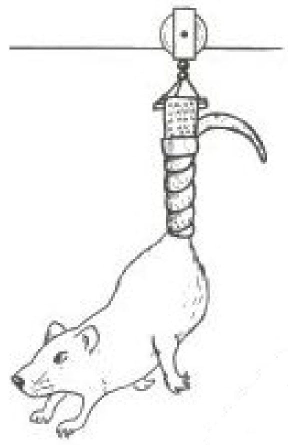


Figure 17. Hindlimb suspension model (Morey-Holton et al. 2005)

2.4.3 Ground-based Countermeasures

Countermeasures that have been assessed in human, ground-based studies have tended to closely parallel countermeasures used in space. For example, the cycle ergometer, LBNP, and isokinetic exercise of ground studies closely resemble the cycle ergometer, LBNP, and MK-I/MK-II, respectively, which have been used in space. Other countermeasures, such as squats and calf presses, have been performed on the ground with a flywheel device, such as that shown in Figure 18. In addition, some countermeasures for ground studies have been developed that are a combination of these countermeasures. For instance, an LBNP device with a vertical treadmill (Figure 19) has been developed in California. This device uses LBNP to pull the horizontal subject onto the vertical treadmill with the force equivalent to 1G. Another example is the specially designed resistive exercise device for rigorous strength training as shown in Figure 20. This device was used only in the Shackelford et al. 2004 study and had the capability to exercise the lower and upper body for a total body workout.

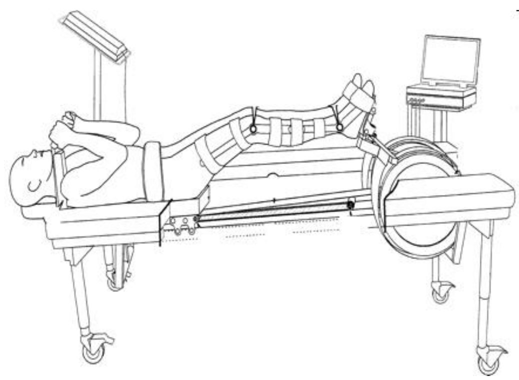


Figure 18. Flywheel exercise device for performing supine squats and calf presses

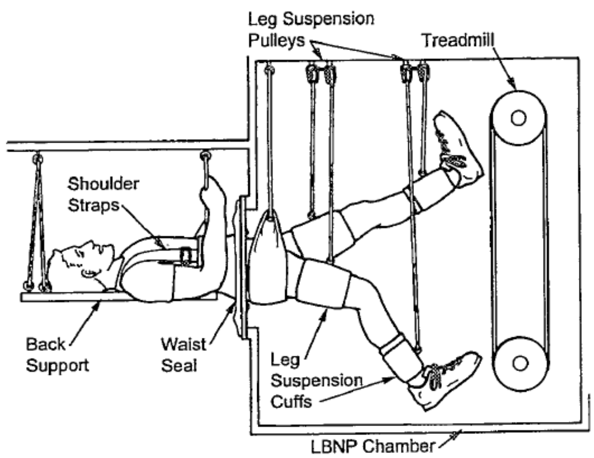


Figure 19. LBNP device with a vertical treadmill (Lee et al. 2007)

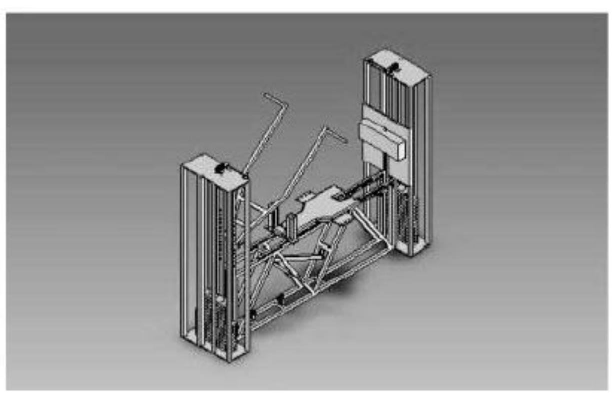


Figure 20. Specially designed resistive exercise device for high intensity training for a long-duration study (Shackelford et al. 2004)

As previously mentioned, ground-based studies investigating AG as a countermeasure have either had subjects passively ride the centrifuge or have coupled centrifugation with exercises such as cycling. In addition to centrifugation *per se*, some investigations have used standing or walking (in 1G) to simulate the AG countermeasure.

A variety of countermeasures have also been developed for animals, with many being similar to their human counterpart, such as passive centrifugation (in the –Gx direction), standing or walking in 1G, or head-up tilt. On the other hand, some countermeasures to simulate resistive exercise differ substantially from their human counterpart, such as dropping the animal from 58cm (Hauschka et al. 1987), climbing an 85° grid (Herbert et al. 1988), mechanical stimulation where the rat's leg undergoes external loading (Innman et al. 1999), or electrical stimulation to trigger muscle contraction (Haddad et al. 2006). In addition to these countermeasures, animal testing is also very valuable for pharmaceutical countermeasures, where effectiveness and dose rates can be investigated before progressing to human trials. These studies will be detailed in the following chapter.

2.5 Measurement Techniques of Ground Studies

The measurement techniques used for assessing subjects in ground-based studies are vast. Notable diagnostic techniques are discussed in the following sections, which are portioned into body systems that the measurements diagnose. Special attention is given to where and how the measurement is performed. This discussion of techniques will greatly aid in comprehending the results of a number of studies.

2.5.1 Cardiovascular Measurements

2.5.1.1 Orthostatic Tolerance

Orthostatic tolerance is measured through a test that stresses the cardiovascular system. This test usually takes the form of a head-up tilt to 60°-80° from a supine starting position. However, Russian and Japanese investigators have used a $+3G_z$ (measured at the feet) overload to provide cardiac stress, while other investigators have used a graded LBNP test as the stressor. These tests are terminated when either the subject reaches a preset time limit or the subject undergoes presyncope. Presyncope itself is defined in a variety of manners, though the most common definition is any occurrence of the following: sudden drop in heart rate (>15 beats per minute), systolic blood pressure (>25mmHG), or diastolic blood pressure (>15mmHG), sweating, nausea, or clammy skin. Orthostatic tolerance time is the measured by the time elapsed in the stress test.

2.5.1.2 Vital Signs / Cardiac Measurements

Vital signs that were typically measured in experiments are resting heart rate and blood pressure. If the experiment involved an orthostatic tolerance test or an exercise test, these vital signs were typically measured at the termination of the test as well. Heart rate was measured by a standard electrocardiogram (EKG). Blood pressure was measured either by a sphygmomanometer and cuff at the arm, by a photoplethysmographic method (PPG) in the ear lobe, or by a finger blood pressure cuff. The PPG and finger blood pressure cuff could be used to obtain continuous blood pressure measurements. Blood pressure was presented in the literature by either systolic/diastolic pressure or by the mean arterial pressure, which is the weighted average pressure of an artery over one heart cycle.

Cardiac function was measured through an EKG analysis. Stroke volume was calculated as the product of the aorta cross sectional area (CSA) and the integral of the beat-to-beat aortic outflow (measured by ultrasound). Cardiac output was generally calculated as the product of the stroke volume and heart rate. Total peripheral resistance (TPR), which is the sum of resistances in the systemic vasculature, was calculated as the mean arterial pressure divided by the cardiac output. The degree of change in TPR with cardiovascular stress is indicative of the baroreflex.

Blood samples drawn from subjects provided the means to measure hematocrit, which is the fraction of packed erythrocyte volume of blood. Blood assays could also be performed to measure catecholamines, such as epinephrine and norepinephrine. Plasma volume – the liquid component of blood – is also measured in a variety of manners. Older investigations used the Evan’s blue dye dilution method; however, this method has now been banned in many countries because it involved the use of a radioisotope. Plasma volume is also estimated through hematocrit measurements, although this method yields only percentage change of plasma volume. A newer method to measuring plasma volume is the carbon monoxide (CO) rebreathing method, which has been used extensively in recent studies.

2.5.1.3 Aerobic Capacity

Aerobic capacity was measured by a graded exercise test – either graded cycle ergometer or graded treadmill – until the subject underwent volitional fatigue. Total exercise time, which is a measure of endurance, was the total elapsed time of the exercise test. Gaseous exchange studies were performed on these tests and included measurements such as VO_2 – the rate of oxygen uptake per minute, V_E – the volume of air inhaled in one minute (minute ventilation), and Respiratory Exchange Ratio (RER) – the ratio between exhaled CO_2 and inhaled O_2. Several degrees of these measurements are made with the exercise test, including a resting measurement, possible submaximal measurements, and maximum measurements (the maximum measurements usually occur close to volitional fatigue).

2.5.1.4 Spectral Power Analysis

A relatively new technique to measure the autonomic nervous system is through heart rate variability. A frequency analysis of heart rate variability divides the response into low frequency (LF) and high frequency (HF). The high frequency (0.15 – 0.04 Hz) is indicative of parasympathetic activity, while the low frequency is affected by both sympathetic and parasympathetic activity. The ratio LF/HF reveals the sympathetic activity alone.

2.5.1.5 Measurements from Biopsies

Invasive techniques used for animals have involved the excision of sections of the basilar and femoral arteries. These sections were used to analyze the artery CSA, media (i.e. smooth cells and elastin fiber layers) thickness, intraluminal diameter, CSA of smooth cells, and number of smooth cells. In addition, contractile responses of the samples were also obtained with the addition of 100 mM potassium chloride (KCl).

2.5.2 Skeletal Muscle Measurements

The primary concern with muscle deconditioning lies with the antigravity muscles. Therefore, measurements in experiments are almost exclusively performed on the soleus, gastrocnemius, and quadriceps.

2.5.2.1 Non-invasive Techniques

Non-invasive techniques for assessing human muscle are widespread. Magnetic resonance imaging (MRI) was used to determine the muscle CSA as well as the whole muscle volume. A dynamometer was used to obtain muscle strength and maximum voluntary contraction (MVC) data.

2.5.2.2 Muscle Fiber

Muscle biopsies were performed to determine muscle fiber characteristics. In many studies, the biopsy was stained to differentiate between type I, type IIa, and type IIx fibers. From these biopsies, fiber CSA (or diameter) and fiber type ratios could be obtained. In addition, fiber performance characteristics were determined, such as V_o, fiber shortening velocity, and P_o, peak force. Finally, a common measurement with animal experiments – since the whole muscle is excised – is the wet weight of the muscle.

2.5.3 Bone Measurements

2.5.3.1 Direct Bone Measurements

Dual energy X-ray absorptiometry (DXA) scans have been used extensively throughout manned spaceflight for BMD measurements. Many experiments still utilize this method for the ability to compare to historical data. The major inhibitor to DXA scans, however, is that density [g/cm^3] is not really measured, but rather it is an areal density [g/cm^2]. Another measurement technique that has been used (often in conjunction with DXA) is peripheral quantitative computed tomography (pQCT), which can make volumetric measurements and distinguish between cortical and trabecular bone. Measurements are usually performed on the weight bearing bones, with special attention given to areas of the hip such as the femoral neck and greater trochanter. Other sights of interest are the calcaneus, lumbar spine, and tibia.

Because the bone (specifically the femur) is removed in animal experiments, mechanical testing can be performed. Measurements that have been obtained are wet weight, dry weight, elastic load, and maximum load.

2.5.3.2 Bone Markers

Bone can also be assessed through an array of bone markers found in blood serum and urine, although they tend to be extremely variable depending on the time of day the sample is taken. To reduce variability as much as possible, a 24-hour sampling period is performed. One downside of bone marker measurements is that they represent the entire skeletal homeostasis and are not capable of translating site-specific information. Bone markers can represent either osteoblast or osteoclast activity; a detailed list is found in Table 1.

Table 1. Bone markers of the body

BONE FORMATION		
Acronym	**Name**	**Location**
25(OH)D	25-Hydroxy vitamin D	Serum
1,25(OH)2D	1,25-dihydroxy vitamin D	Serum
OC	Osteocalcin	Serum
BSAP	Bone specific alkaline phosphate	Serum
PTH	Parathyroid hormone	Serum
BONE RESORPTION		
NTX	n-telopeptide cross-link	Urinary
PYD	Pyridinoline	Urinary
DPD	Deoxypyridinoline	Urinary
	Calcium	Urinary
	Calcium	Serum

3.0 Methods

An exhaustive review of AG literature – published and unpublished studies using either human or animal subjects – was performed. Owing to the absence of long-radius centrifuge experiments that investigate countermeasures to deconditioning, this study was limited to analyzing results from intermittent AG experiments (via SRC). Paradigms of standing, walking, or head-up tilt were also included as a variant of AG.

A review of the literature was also performed on traditional countermeasures, which are defined as the types of countermeasures, or some variation, currently available on the ISS (Section 2.4.3). It was impossible to perform an exhaustive review of this body of literature, as there are a vast number of studies that have been performed. To bring some order to the literature search, a method was adopted to start with the most recent studies and progress backwards to older studies. This method was justified by reasoning that the most recent studies will have the most advanced countermeasure protocols, and thus theoretically have the greatest salutary effect on the subjects.

This literature was compiled into a master database that details the experimental methods as well as the results of each study. The following tables are abridged versions of the master database and serve to inform the reader of the experiments that were included in this study. AG deconditioning studies that use human subjects are listed in Table 2, while those that use animals as subjects are listed in Table 3. AG training studies (no deconditioning) with humans are found in Table 4. Traditional countermeasure deconditioning studies using human subjects are found in Table 5 and that use animals are found in Table 6. The complete database is shown in Appendix B: Master Database.

3.1 Artificial Gravity Studies

Table 2. Human AG deconditioning studies

	Location	Days	Deconditioning	Subjects (Control / Treatment, M/F)	G level (Feet)	G level (Heart)	Session Duration (min)	Frequency (Times/Day)	Daily Exposure (min)	Days / Week	Treatment
Shulzhenko et al. 1979	Moscow	3	Wet Immersion	6M / 5M	1.6		40	3	120	7	AG
Vil-Viliams et al. 1980a	Moscow	3	Dry Immersion	6M / 5M	1.6		40	3	120	7	AG
Grigoriev et al. 1979	Moscow	13	Dry Immersion	5M / 5M	0.6-2.0		60-90	1	60-90	Days 8-13	AG
Iwasaki et al. 2001	Nihon	4	HDBR	10M / 10M		2	30	2	60	7	AG
Sasaki et al. 1999	Nihon	4	HDBR	4M / 8M		2	30	2	60	7	AG
Caiozzo et al. 2009	UTMB	21	HDBR	7M / 8M	2.5	1	60	1	60	7	AG
Smith et al. 2009	UTMB	21	HDBR	7M / 8M	2.5	1	60	1	60	7	AG
Moore et al. (Unpublished)	UTMB	21	HDBR	7M / 8M	2.5	1	60	1	60	7	AG
Stenger et al. (Unpublished)	UTMB	21	HDBR	7M / 8M	2.5	1	60	1	60	7	AG
Iwasaki et al. 2005	Nagoya	14	HDBR	6M / 6M		1.2	30	1	30	3-4	AG+Cycling
Iwase 2005	Nagoya	14	HDBR	6M / 6M		1.2	30	1	30	3-4	AG+Cycling
Katayama et al. 2004	Nagoya	20	HDBR	5M / 5M	1-5	0.3-1.4	40	1	40	3-4	AG+Cycling
Akima et al. 2005	Nagoya	20	HDBR	5M / 5M	1-5	0.3-1.4	40	1	40	3-4	AG+Cycling
Vil-Viliams et al. 1980b	Moscow	28	Dry Immersion	4M / 4M	0.8-1.6		60	2	120	Days 9-14, 23-28	AG, Cycling, AG+Cycling
Vernikos et al. 1996	Ames	4	HDBR	9M / 9M	1	1	15	8, 16	120, 240	7	Standing

	Location	Days	Deconditioning	Subjects (Control / Treatment, M/F)	G level (Feet)	G level (Heart)	Session Duration (min)	Frequency (Times/Day)	Daily Exposure (min)	Days / Week	Treatment
Vernikos et al. 1996	Ames	4	HDBR	9M / 9M	1	1	15	8, 16	120, 240	7	Walking
Lee et al. 1997	UTMB	5	HDBR	8M / 8M	1	1	30	1	30	7	Running

Table 3. Animal AG deconditioning studies

	Location	Animal	Days	Deconditioning	Subjects (per group, M/F)	G level (if applicable)	Session Duration (min)	Frequency (Times/Day)	Daily Exposure (min)	Days / Week	Treatment
Korolkov et al. 2001	Moscow	Macaca Rhesus Monkeys	28	HDBR	6M	1.2, 1.4, 1.6	30-40	1	30-40	4-5	AG
						1.2	30	1	30	4-5	AG
Belozerova et al. 2000	Moscow	Rhesus Monkeys	30	HDBR	11M (6 control / 5 AG)	1.2	5 to 20	1	5 to 20	5	AG
D'Aunno et al. 1990	Houston	Sprague-Dawley Rats	7	SUS	8F	1.5	60	1	60	7	AG
					8F	1.5	120	1	120	7	AG
					6F	2.6	60	1	60	7	AG
					7F	2.6	120	1	120	7	AG
					6F	N/A	120	1	120	7	Standing
D'Aunno et al. 1992	Houston	Sprague-Dawley Rats	7	SUS	9F	1.2	15	4	60	7	AG
					5F	N/A	15	4	60	7	Standing
Zhang et al. 2000	Xi'An	Sprague-Dawley Rats	21	SUS	7M	1.5	60	1	60	7	AG
						2.6	60	1	60	7	AG
						N/A	120	1	120	7	HUT
							240	1	240	7	HUT
							60	1	60	7	Standing
							120	1	120	7	Standing
							240	1	240	7	Standing

	Location	Animal	Days	Deconditioning	Subjects (per group, M/F)	G level (if applicable)	Session Duration (min)	Frequency (Times/Day)	Daily Exposure (min)	Days / Week	Treatment
Zhang et al. 2003	Xi'An	Sprague-Dawley Rats	28	SUS	7M	N/A	60	1	60	7	Standing
							120	1	120	7	Standing
							240	1	240	7	Standing
			28	SUS	6M	1.5	60	1	60	7	AG
						2.6	60	1	60	7	AG
						N/A	60	1	60	7	Standing
			28	SUS	10M	N/A	60	1	60	7	Standing
							120	1	120	7	Standing
							240	1	240	7	Standing
Zhang et al. 2008	Xi'An	Sprague-Dawley Rats	28	SUS	8M	N/A	60	1	60	7	Standing
Sun et al. 2003	Xi'An	Sprague-Dawley Rats	28	SUS	7M	N/A	120	1	120	7	HUT (45°)
							240	1	240	7	HUT (45°)
Sun et al. 2004	Xi'An	Sprague-Dawley Rats	28	SUS	7M	N/A	60	1	60	7	Standing
							120	1	120	7	Standing
							240	1	240	7	Standing
							120	1	120	7	HUT (45°)
							240	1	240	7	HUT (45°)
			28		6M		240	1	240	7	HUT (45°)
			28		5M		60	1	60	7	Standing
			28		7M		120	1	120	7	Standing
Thomason et al. 1987	UCI	Sprague-Dawley Rats	28	SUS	6F	N/A	120	1	120	7	Standing
				SUS	7F		240	1	240	7	Standing
				SUS	8F		90	1	90	7	Walking

	Location	Animal	Days	Deconditioning	Subjects (per group, M/F)	G level (if applicable)	Session Duration (min)	Frequency (Times/Day)	Daily Exposure (min)	Days / Week	Treatment
Widrick et al. 1996	Marquette University, Wisconsin	Sprague-Dawley Rats	14	SUS	7M	N/A	10	4	40	7	Standing
Pierotti et al. 1990	UCLA	Sprague-Dawley	7	SUS	8M		10	4	40	7	Walking
Graham et al. 1989a	UCLA	Sprague-Dawley	28	SUS	7F		10 to 90	1	10 to 90	7	Walking
Hauschka et al. 1988	UCLA	Sprague-Dawley	7	SUS	12M		10	4	40	7	Walking
Graham et al. 1989b	UCLA	Sprague-Dawley	7	SUS	12M		10	4	40	7	Walking

Table 4. Human AG training (no deconditioning) studies

	Location	Days (or sessions)	Number of Subjects (Control / CM)	G level (Feet)	G level (Heart)	Frequency	Restraint
Iwase et al. 2002	Nagoya	4 sessions	8M / 8M		1-2	N/A	AG, AG+Cycling
Stenger et al. 2007	Ames	21	13 / 13 (14 Male 12 Female)	1-2.5		5	AG, AG+Cycling
Evans et al. 2004	Ames	21	7 / 7	1-2.5		5	AG, AG+Cycling
Caiozzo et al. 2004	UC - Irvine	4 sessions	14 (8 Male, 6 Female)	1-3		N/A	AG, AG+Cycling
Iwasaki et al. 1998	Nihon	7	9M		2	7	AG
Greenleaf et al. 1999	Ames	sessions	4M, 2F	Varied		N/A	AG+Cycling
			7M	2.2		N/A	AG+Cycling
			7M	Varied		N/A	AG+Cycling
Yang et al. 2007a	UC - Irvine	4 sessions	14 (8 Male, 6 Female)	1.5-3		N/A	AG+Squats, AG+Cycling
Yang et al. 2007b	UC - Irvine	N/A	22M, 19F	1.5, 2.0, 2.5, 3.0		N/A	AG+Squats, AG+Cycling
Edmonds et al. 2007	MIT	N/A	8M, 5F	0.7, 1.0, 1.3		N/A	AG+Stair Stepper
Duda 2007	MIT	N/A	7M, 8F	2.0		N/A	AG+Squats

3.2 Traditional Countermeasure Studies

Table 5. Human deconditioning studies using traditional countermeasures

	Location	Days	Deconditioning	Subjects (Control / Treatment, M/F)	Session Duration (min)	Frequency (Times/Day)	Daily Exposure (min)	Days / Week	Treatment
Sun et al. 2002	Xi'An	21	HDBR	6M / 6M	60	1	60	Days 15-21	LBNP
Guell et al. 1995 Series 1	MEDES	28	HDBR	5M / 5M	20	3-6	120-240	7	LBNP
Lee et al. 1997	UTMB	5	HDBR	8M / 8M	30	1	30	7	LBNP w/ Treadmill
Schneider et al. 2002	Ames	15	HDBR	7M / 7M	40	1	40	7	LBNP w/ Treadmill
Watenpaugh et al. 2000	Ames	15	HDBR	8M / 8M	40	1	40	7	LBNP w/ Treadmill
Lee et al. 2007	UCSD	30	HDBR	8M / 8M (Twins)	45	1	45	6	LBNP w/ Treadmill
Lee et al. 2009	UCSD	30	HDBR	7F / 7F (Twins)	45	1	45	6	LBNP w/ Treadmill
Watenpaugh et al. 2007	UCSD	30	HDBR	8M, 7F / 8M, 7F (Twins)	45	1	45	6	LBNP w/ Treadmill
Smith et al. 2003	UCSD	30	HDBR	8M / 8M (Twins)	45	1	45	6	LBNP w/ Treadmill
Zwart et al. 2007	UCSD	30	HDBR	7F / 7F (Twins)	45	1	45	6	LBNP w/ Treadmill
Guinet et al. 2009	MEDES	60	HDBR	7F / 6F	50	1	50	6	LBNP w/ Treadmill, Squat and Calf Press
Edgell et al. 2007	MEDES	60	HDBR	7F / 6F	50	1	50	6	LBNP w/ Treadmill, Squat and Calf Press
Schneider et al. (Unpublished)	MEDES	60	HDBR	7F / 6F	50	1	50	6	LBNP w/ Treadmill, Squat and Calf Press

	Location	Days	Deconditioning	Subjects (Control / Treatment, M/F)	Session Duration (min)	Frequency (Times/Day)	Daily Exposure (min)	Days / Week	Treatment
Trappe et al. 2007a	MEDES	60	HDBR	7F / 6F	50	1	50	6	LBNP w/ Treadmill, Squat and Calf Press
Trappe et al. 2007b	MEDES	60	HDBR	7F / 6F	50	1	50	6	LBNP w/ Treadmill, Squat and Calf Press
Trappe et al. 2008	MEDES	60	HDBR	7F / 6F	50	1	50	6	LBNP w/ Treadmill, Squat and Calf Press
Smith et al. 2008	MEDES	60	HDBR	7F / 6F	50	1	50	6	LBNP w/ Treadmill, Squat and Calf Press
Guell et al. 1995 Series 2	MEDES	28	HDBR	6M / 6M	30	1	30	Days 7-28	LBNP and Squats
Maillet et al. 1996	MEDES	28	HDBR	6M / 6M	20	1	20	6	LBNP and Isokinetic Exercise
Hughson et al. 1994	MEDES	28	HDBR	6M / 6M		1		Days 7-28	Cycling, Isometric, Isokinetic Exercise, LBNP
Suzuki et al. 1994	Tokyo	20	Horizontal Bed Rest	6M / 3M	60	1	60	7	Cycling
Greenleaf et al. 1989	Ames	30	HDBR	5M / 7M	30	2	60	5	Cycling
Wu et al. (Unpublished)	Beijing	30	HDBR	5M / 5M	30	1	30	6	Cycling
Shibata et al. 2010	Dallas	18	HDBR	6M, 1F / 6M, 1F	30	3	90	7	Cycling, Cycling+Dextran
Greenleaf et al. 1989	Ames	30	HDBR	5M / 7M	30	2	60	5	Isokinetic Exercise
Bamman et al. 1998	UTMB	14	HDBR	8M / 8M	30	1	30	3-4	Squat

	Location	Days	Deconditioning	Subjects (Control / Treatment, M/F)	Session Duration (min)	Frequency (Times/Day)	Daily Exposure (min)	Days / Week	Treatment
Belin de Chantemele et al. 2004	MEDES	90	HDBR	9M / 9M		1		2-3	Squat and Calf Press
Alkner et al. 2004	MEDES	90	HDBR	9M / 8M	40	1	40	2-3	Squat and Calf Press
Trappe et al. 2004	MEDES	90	HDBR	6M /6M	40	1	40	2-3	Squat and Calf Press
Wu et al. (Unpublished)	Beijing	30	HDBR	5M / 5M	30	1	30	6	Squat and Calf Press
Tesch et al. 2004	MEDES	35	ULLS	7M, 4F / 7M, 3F	40	1	40	2-3	Squat and Calf Press
Koryak et al. 1997	Moscow	120	HDBR	4F / 4F	60	1	60	6	Squat and Arm Press
Shackelford et al. 2004	Houston	119	Horizontal Bed Rest	13M, 5W / 5M, 4W	60	1	60	6	Resistive Exercises

Table 6. Animal deconditioning studies using traditional countermeasures

	Location	Animal	Days	Deconditioning	Subjects (per group, M/F)	Session Duration (min)	Frequency (Times/Day)	Daily Exposure (min)	Days / Week	Groups
Herbert et al. 1988	UCLA	Sprague-Dawley	7	SUS	8M	1.5	4	6	7	Climbing
Hauschka et al. 1987	UCLA	Sprague-Dawley	28	SUS	5F		1		7	Dropped
Haddad et al. 2006	UCI	Sprague-Dawley	6	SUS	7F	27	Days 1, 2, 4, 5		7	Isometric Exercise
Inman et al. 1999	TAMU	Sprague-Dawley	42	Immobilized Leg	10F		1		3	Mechanical loading
Fluckey et al. 2002	University of Arkansas	Sprague-Dawley	28	SUS	5M		1		3	Squats

3.3 Statistics

In order to perform statistical tests across studies, it was imperative to have a single parameter that embodied both control group and treatment group data. This single parameter was the so-called treatment effect, which is a difference of differences that was calculated as the control group difference minus the treatment group difference. The control group difference, for example, was the difference between post- and pre-bed rest means. Each study was weighted by the inverse variance of its treatment effect, which was determined by first calculating the group (e.g. control group) variances with

$$s^2\left(\overline{x_1}-\overline{x_2}\right)=\frac{\left(n_1-1\right)n_1 s^2\left(\overline{x_1}\right)+\left(n_2-1\right)n_2 s^2\left(\overline{x_2}\right)}{\left(n_1+n_2-2\right)\left(n_1+n_2\right)} \qquad \textbf{(2)}$$

where the subscripts 1 are post-bed rest values and 2 are the pre-bed rest values. Then, Eq. (2) was used a second time where subscripts 1 were for the treatment group values and subscripts 2 were for control group values.

The treatment effect was calculated for parameters in which there were 1) enough studies within a countermeasure group to perform statistical analysis and 2) homogeneity in the measurement calculation (e.g. some plasma volume measurements were only presented as percentage change from pre-bed rest, so treatment effect could not be calculated). The treatment effect was normalized by dividing by its standard error to find its t-value. The t^2 values were summed for each countermeasure group and were compared against a X^2 distribution to test whether the countermeasure was effective (i.e. the countermeasure was effective if the treatment effect was significantly different from zero). Then, a least squares linear regression over study duration was performed with each countermeasure group to determine if a time effect was present in the parameter. If no significant effect of study duration was observed, the data were collapsed into box plots and AG was compared to traditional countermeasures with a two-sample t-test. In all cases, the criterion for statistical significance was set as $p < 0.05$. All data are reported as mean ± SEM unless otherwise noted.

In cases where treatment effect could not be calculated, data were presented in the form of percent change graphs. Physical measurements were analyzed on a study-by-study basis that used the published statistical tests of each study as a gauge of countermeasure efficacy.

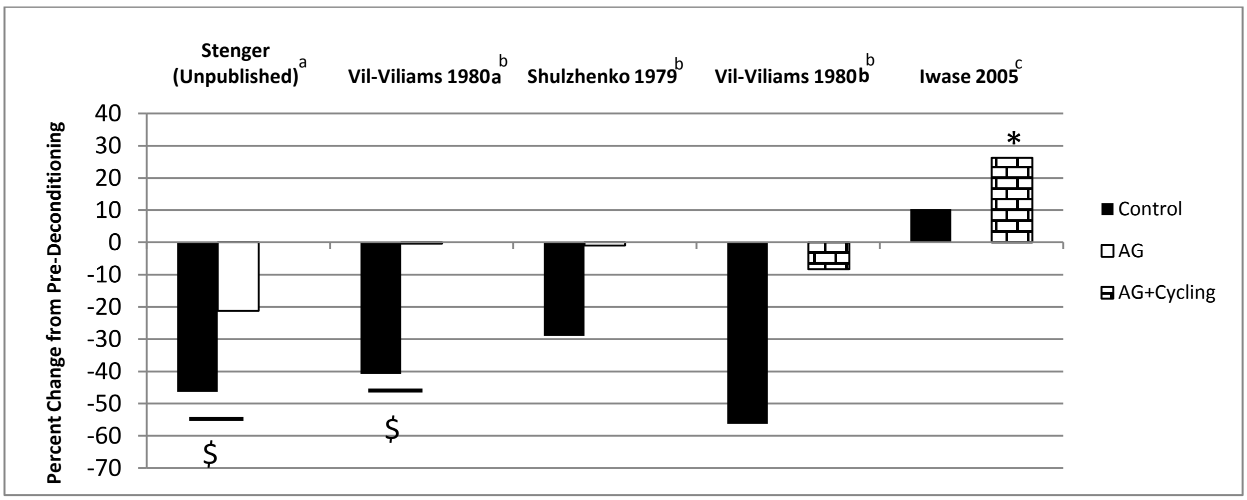
4.0 Results

4.1 Cardiovascular System

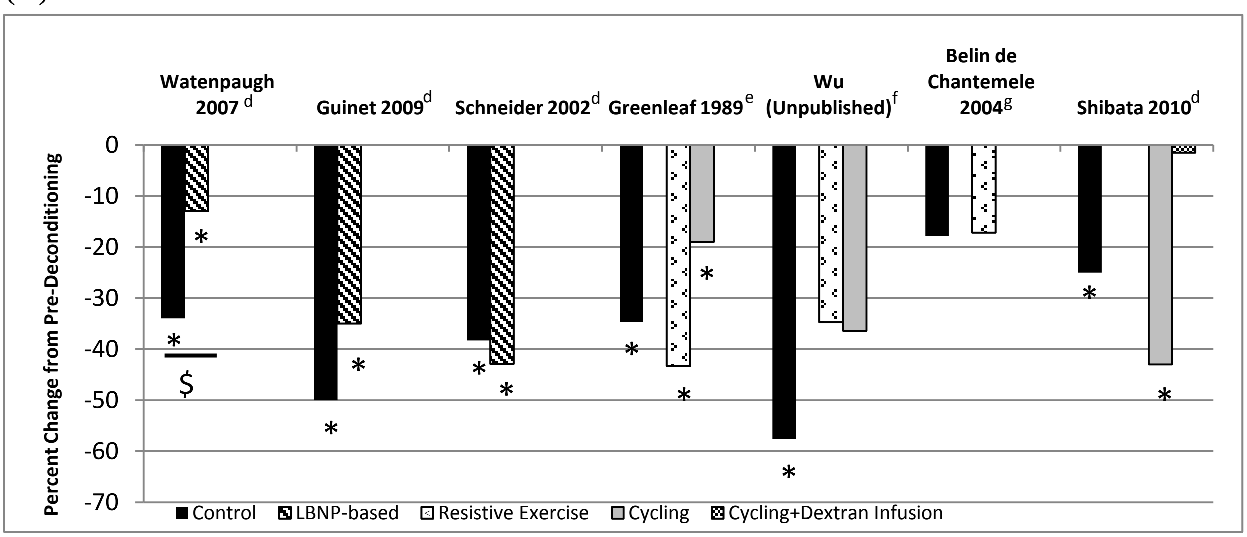
Orthostatic tolerance time in the form of a percentage graph is presented in Figure 21A for artificial gravity studies and in Figure 21B for traditional countermeasure studies. AG was successful at either preventing the degradation of orthostatic tolerance time or increasing tolerance time from baseline in three of the five studies. No statistical analysis was published with the Shulzhenko et al. 1979 study. Iwase et al. 2005 was the only AG study to stress all subjects to presyncope conditions. In this study, it is curious that the control group increased orthostatic tolerance time post-bed rest, since this measurement is well-established to degrade with deconditioning. This phenomenon might have occurred because subjects did not have a practice trial with the orthostatic tolerance test (graded $+G_z$ overload) before the study (Iwase, personal comm. 2009). In contrast, the LBNP-based traditional countermeasure studies (Watenpaugh et al. 2007, Guinet et al. 2009, and Schneider et al. 2002) along with Shibata et al. 2010 stressed all subjects to presyncope conditions. Most of the traditional countermeasure studies did not protect orthostatic tolerance; only Wu et al. (unpublished), which had a step increase in countermeasure intensity halfway through the protocol, and Shibata et al. 2010, which infused Dextran for volume loading after completing a cycling countermeasure protocol, prevented a degradation in orthostatic tolerance time.

Plasma volume is shown in Figure 22A for the AG studies and in Figure 22B for the traditional countermeasure studies. Only the studies that coupled AG with cycling – Iwasaki et al. 2005 and Vernikos et al. 1996 – showed a significant benefit of the treatment group to maintain plasma volume. However, only thirty minutes of upright cycling in Lee et al. 1997 was not enough exercise to maintain plasma volume. In contrast, many traditional countermeasure studies maintained plasma volume in the treatment groups. The 30-day study of Lee et al. 2009 did not show much of a decrease in the control group because the subjects were women with unregulated menstrual cycles.

Also of interest is that the cycling countermeasure of Greenleaf et al. 1989 prevented a decrease in plasma volume while a similar exercise regime of Shibata et al. 2010 did not prevent the decrease. The treatment group in the Greenleaf study had two bouts of 30 minutes of cycling for five days per week at an intensity that varied from 40% to 90% of their pre-bed rest VO_2 max. On the other hand, the treatment group of the Shibata study had three bouts of 30 minutes of cycling seven days per week at a constant intensity of 75% of their pre-bed rest maximum heart rate. Even though the treatment was of longer duration in the Shibata study, the higher intensity exercise of subjects in the Greenleaf study may be the reason plasma volume was maintained.



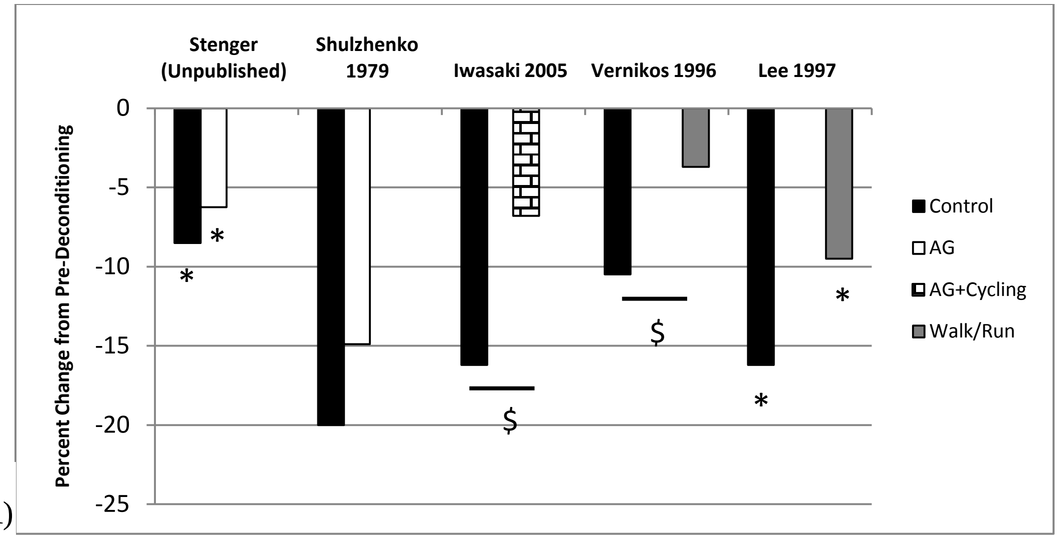
(A)



(B)

Figure 21. Orthostatic tolerance time for AG studies (A) and traditional countermeasures (B). * $p<0.05$ vs. pre-bed rest, $ $p<0.05$ group effect. [a] - 80° tilt for 30 minutes; [b] - $+3G_z$ overload; [c] – graded $+G_z$ overload; [d] - graded LBNP; [e] - 60° tilt for 60 minutes; [f] - 75° tilt for 20 minutes; [g] - 80° tilt for 10 minutes

(A)



(B)

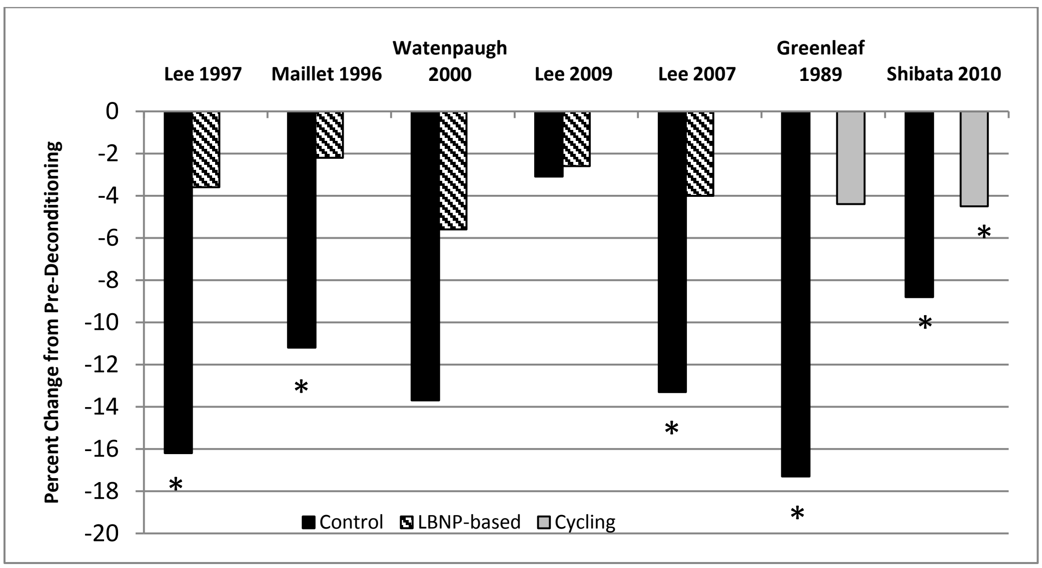


Figure 22. Plasma volume for AG studies (A) and for traditional countermeasure studies (B). * $p<0.05$ vs. pre-bed rest, $ $p<0.05$ group effect

Hematocrit response is shown in Figure 23. All of the countermeasure studies except for Maillet et al. 1996 (no statistical significance in either group) prevented the increase in hematocrit.

Figure 24A shows stroke volume for AG studies and Figure 24B shows stroke volume for traditional countermeasure studies. Katayama et al. 2004 was the only study to prevent the decrease in stroke volume with AG coupled with cycling. There was no significant decrease in the control group of the other AG plus cycling study, Iwasaki et al. 2005. This might be due to its shorter duration of 14 days versus a duration of 28 days for the Katayama study. Only two of the traditional countermeasure studies prevented the decrease in stroke volume. The countermeasure of cycling 90 minutes per day at 75% of maximum heart rate in Shibata et al. 2010 prevented stroke volume decrease. However, this duration and intensity of countermeasure was calculated specifically to normalize stroke work for bed rest, so its efficacy at maintaining stoke volume was somewhat expected.

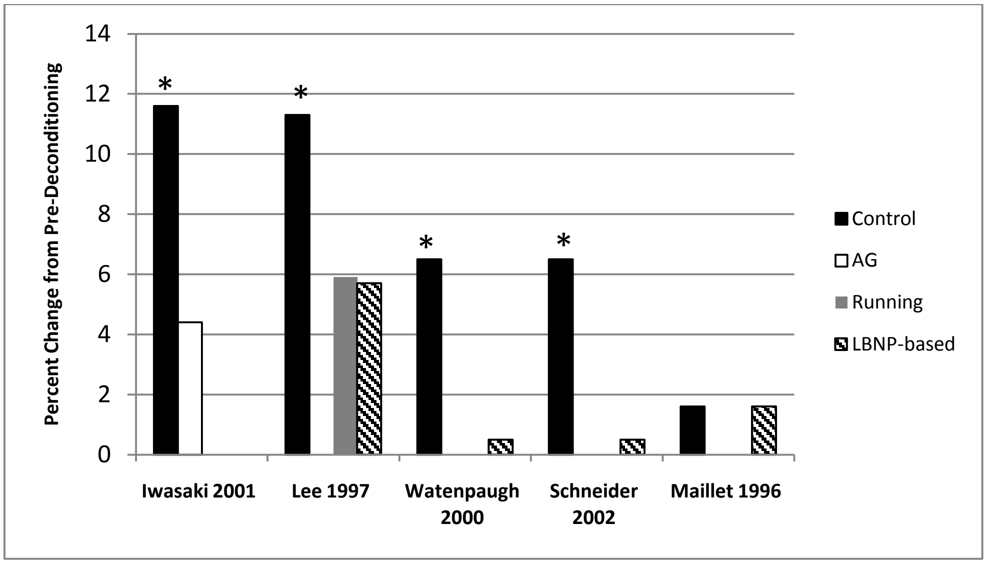
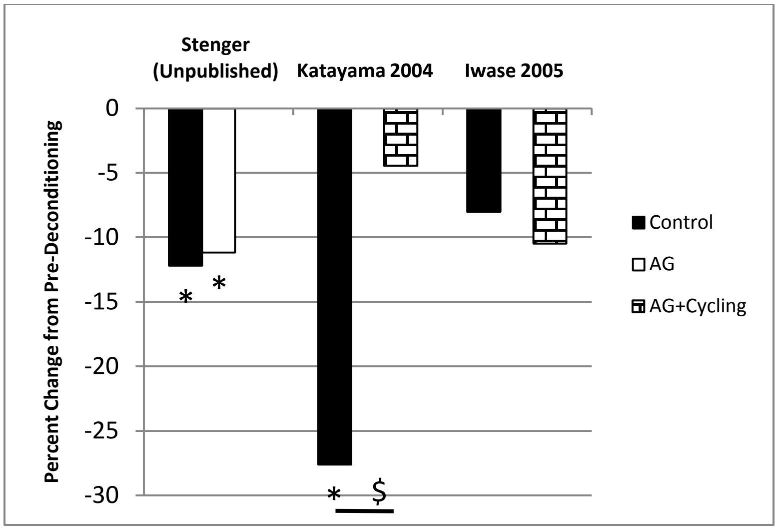


Figure 23. Hematocrit measurement. * p<0.05 vs. pre-bed rest

(A) 

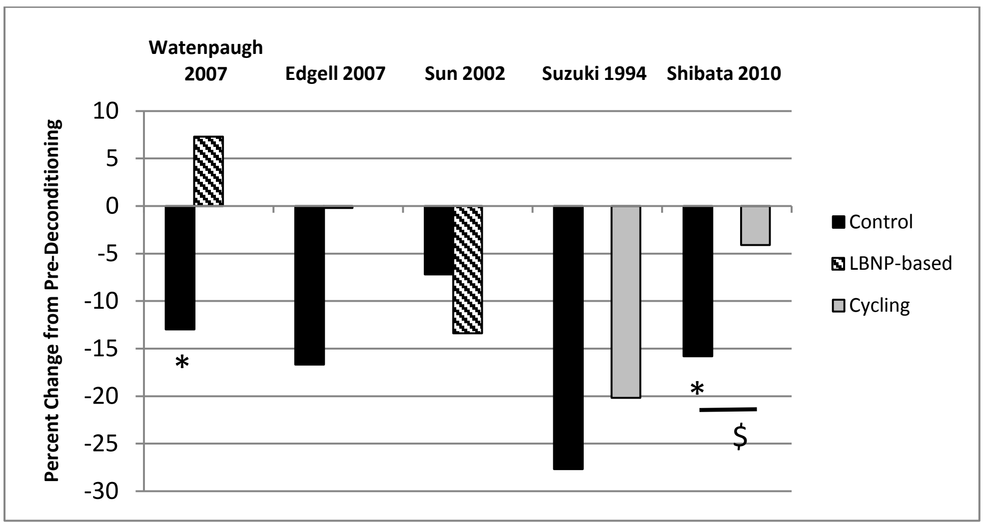
(B) 

Figure 24. Stroke volume for AG studies (A) and for traditional countermeasure studies (B). * p<0.05 vs. pre-bed rest, $ p<0.05 group effect

Cardiac output, which is inherently related to stroke volume and heart rate, is shown in Figure 25. No statistical significance was seen in any AG countermeasure, and indeed, the only study to prevent the decrease in cardiac output was Shibata et al. 2010. The cause of the large decrement in the treatment group of Sun et al. 2002 is unknown. In this study, the LBNP countermeasure was only applied at a relatively mild pressure (-30mmHG for one hour/day) during the last week of the three week study.

Spectral analysis data for AG studies are shown as high frequency (HF) heart rate in Figure 26 and high frequency / low frequency (HF/LF) heart rate in Figure 27. No spectral analysis was performed in any traditional countermeasure study that was reviewed. For parasympathetic activity, or HF heart rate, all three Japanese studies prevented its decrease. However, the increase in sympathetic activity, or HF/LF heart rate was only prevented with AG coupled with cycling (Iwasaki et al. 2005).

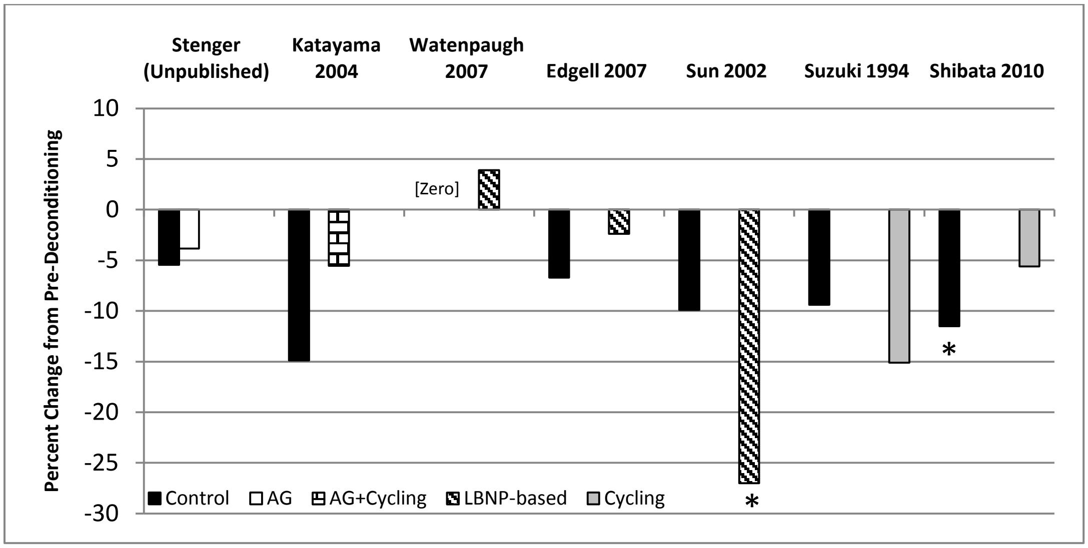


Figure 25. Cardiac Output. * p<0.05 vs. pre-bed rest.

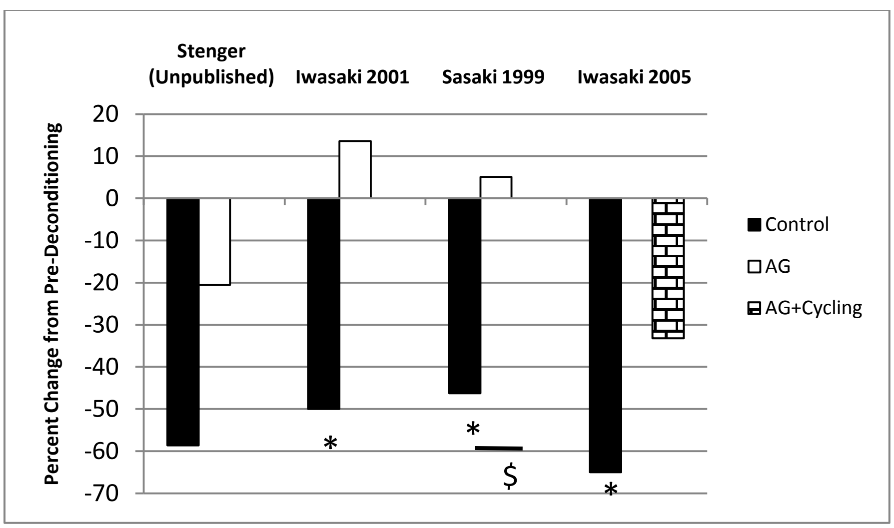


Figure 26. High frequency heart rate. * p<0.05 vs. pre-bed rest, $ p<0.05 group effect

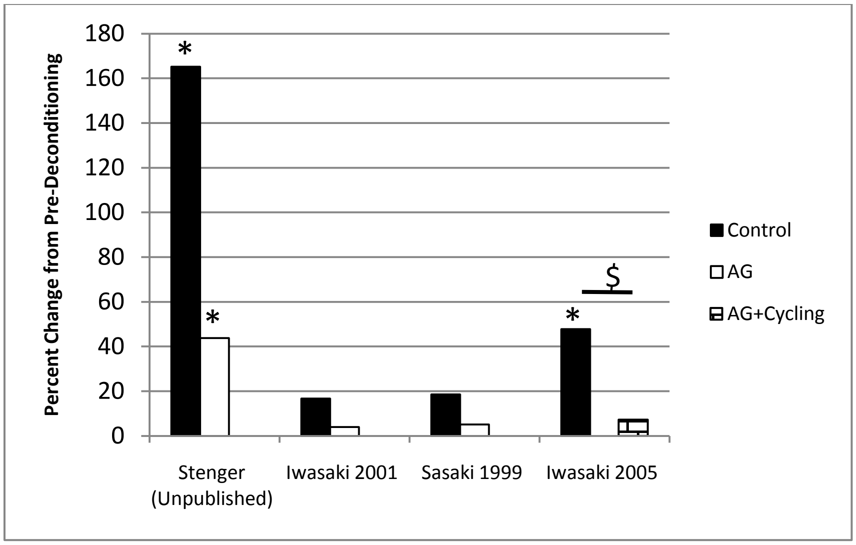


Figure 27. High frequency / low frequency heart rate. * p<0.05 vs. pre-bed rest, $ p<0.05 group effect

TPR, which is closely related to cardiac output and mean arterial pressure, is shown in Figure 28. The only study to prevent an increase in TPR is Shibata et al. 2010 with the countermeasure of cycling combined with Dextran infusion. As TPR is calculated from cardiac output, the large increase in the treatment group of Sun et al. 2002 is likely a result of the study's cardiac output data, which is discussed above.

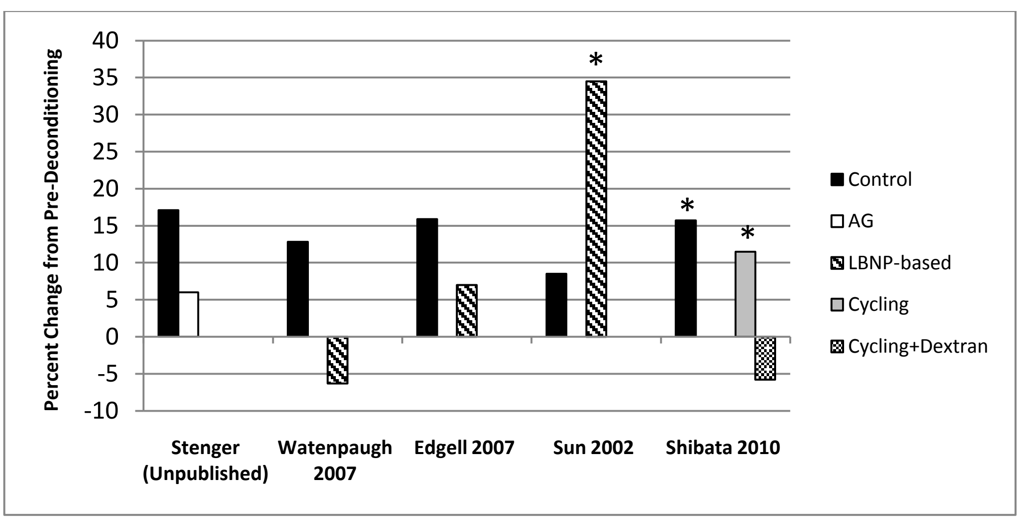


Figure 28. Total Peripheral Resistance. * p<0.05 vs. pre-bed rest.

Dissections of arteries were performed in some animal studies. CSA of the anterior tibial artery is shown in Figure 29 and the CSA of anterior tibial artery media thickness is shown in Figure 30. In both measurements the countermeasures of head-up tilt for four hours or standing for two hours daily mitigated the decreases in CSA.

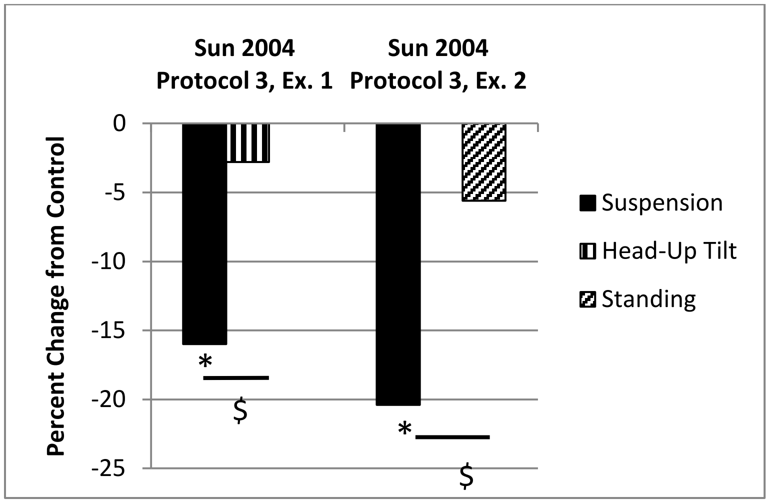


Figure 29. CSA of anterior tibial artery. * p<0.05 vs. control, $ p<0.05 group effect

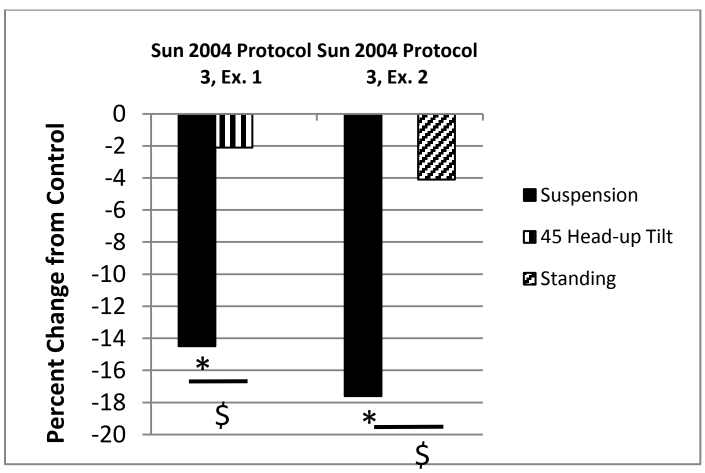


Figure 30. CSA of the media thickness of the anterior tibial artery. * p<0.05 vs. control, $ p<0.05 group effect

The treatment effect (see 3.0 Methods) for resting heart rate is shown in Figure 31A for AG countermeasures and in Figure 31B for traditional countermeasures. In general, resting heart rate increased with bed rest in the control group and was roughly maintained in the treatment group, which results in a negative treatment effect. Linear regression analyses yielded a non-significant slope in both instances.

The resting heart rate treatment effect is shown as box plots in Figure 32 for the different countermeasure groups. The outlier (denoted by an '*') in the traditional countermeasure group was the Suzuki et al. 1994 study, which had moderate cycling as the countermeasure. In the LBNP with treadmill group, the Lee et al. 2007 and Lee 2009 studies, which used monozygotic twins as subjects, both had a large treatment effect of –19 beats per minute. All countermeasure groups in Figure 32 were effective as countermeasures ($p<0.05$). The treatment effect of the AG group was not significantly different from the traditional countermeasure group. Despite appearances, the AG group was also not significantly different from the LBNP with treadmill group ($p=0.142$).

The original heart rate data from the studies is shown as percent change graphs in Figure 33A for AG studies and Figure 33B for traditional countermeasure studies.

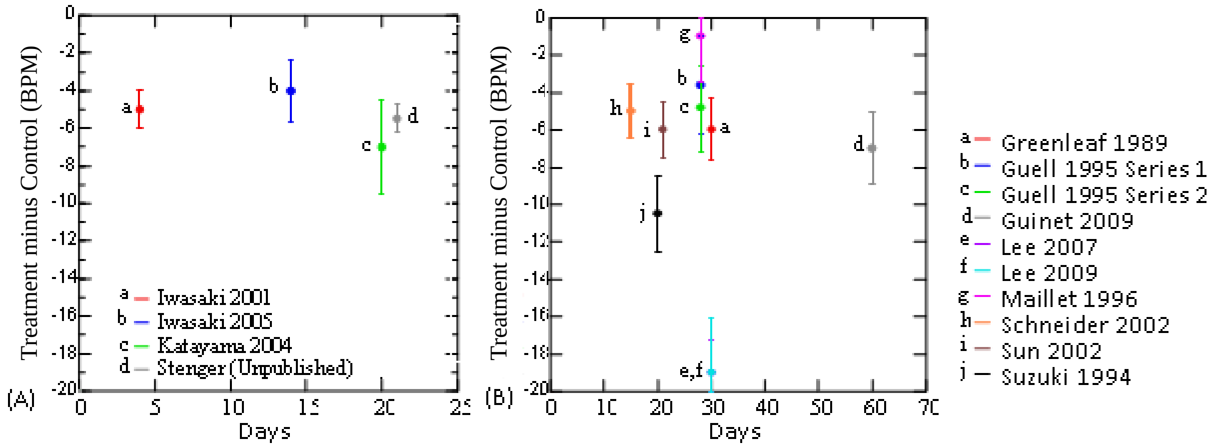


Figure 31. Resting heart rate treatment effect for AG studies (A) and traditional countermeasure studies (B) plotted over time

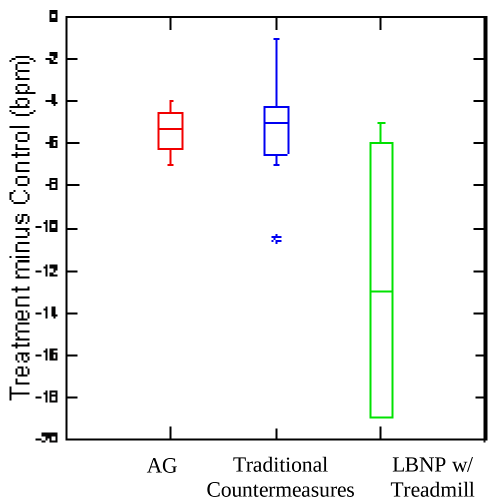
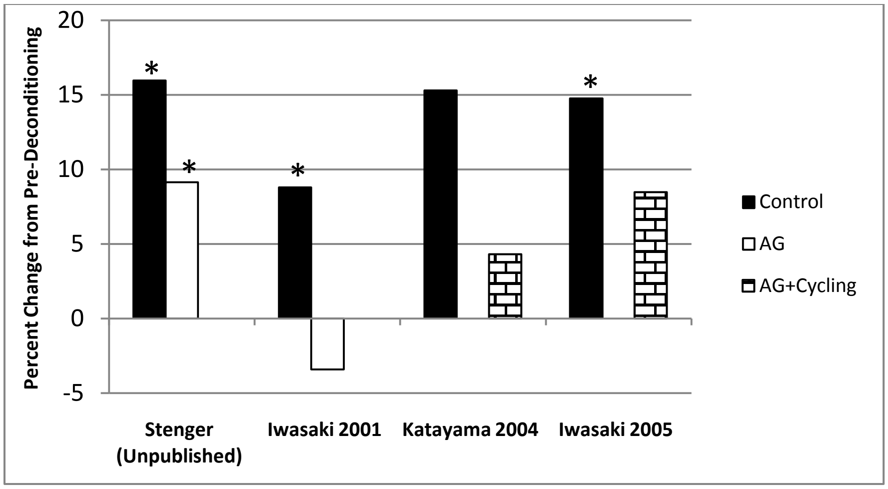
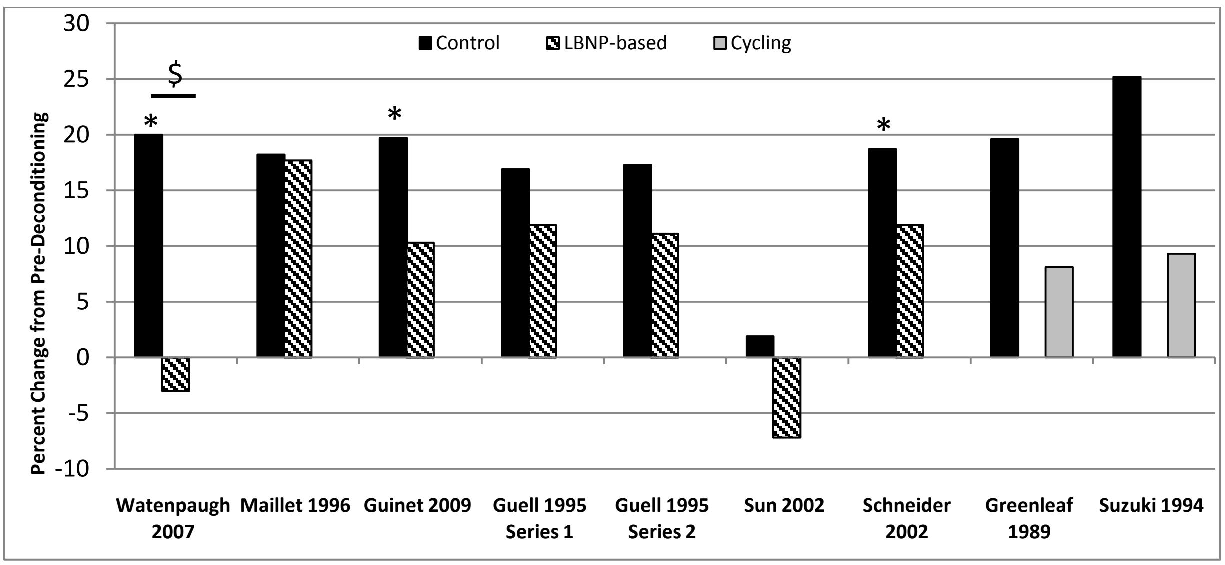


Figure 32. Collapsed treatment effect for resting heart rate and grouped by countermeasure.

(A)





(B)

Figure 33. Resting heart rate for AG studies (A) and traditional countermeasure studies (B). *p<0.05 vs. pre-bed rest, $ p<0.05 group effect

The VO_2 max treatment effect is shown in Figure 34A for AG and in Figure 34B for traditional countermeasures. VO_2 max was degraded in the control groups during deconditioning while VO_2 max was roughly maintained in the treatment groups; this results in mostly positive values for the VO2 max treatment effect. Although treatment effect appears to increase with study duration, this trend was not significant by linear regression analyses.

A time-independent box plot of the VO_2 max treatment effect is shown in Figure 35 for the different countermeasure groups. All countermeasure groups were effective, that is, all groups were significantly different from zero ($p<0.05$). The AG group was not significantly different from either the traditional countermeasures group or the LBNP with treadmill group. Note that the outlier in the AG countermeasure group was the Katayama et al. 2004 study, which coupled AG with intensive cycling. In addition, the upper whisker of the traditional countermeasures group was from the Greenleaf et al. 1989 study, which used only intensive cycling as the countermeasure.

The original VO_2 max data from the studies is shown as percent change graphs in Figure 36.

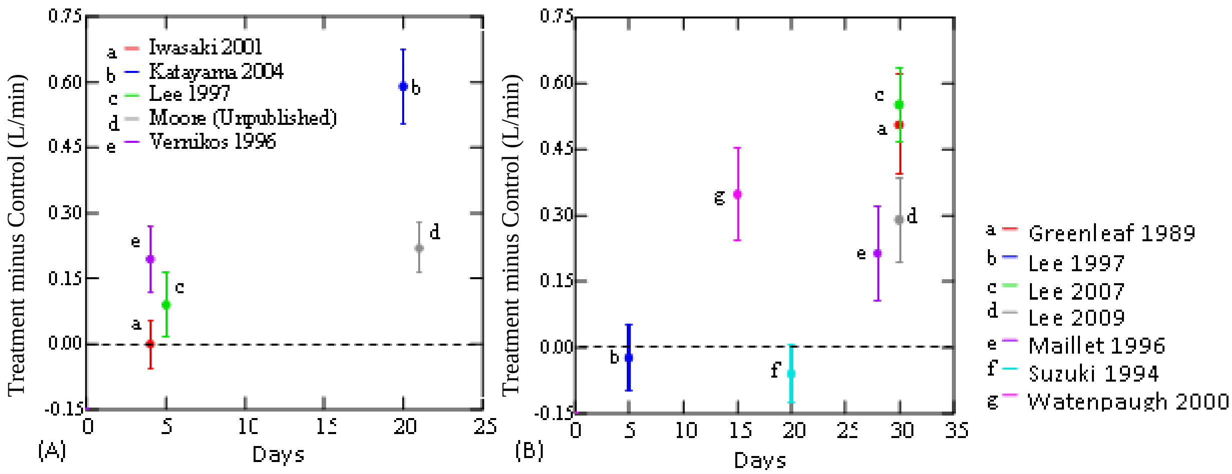


Figure 34. VO_2 max treatment effect for AG studies (A) and traditional countermeasure studies (B) plotted over time

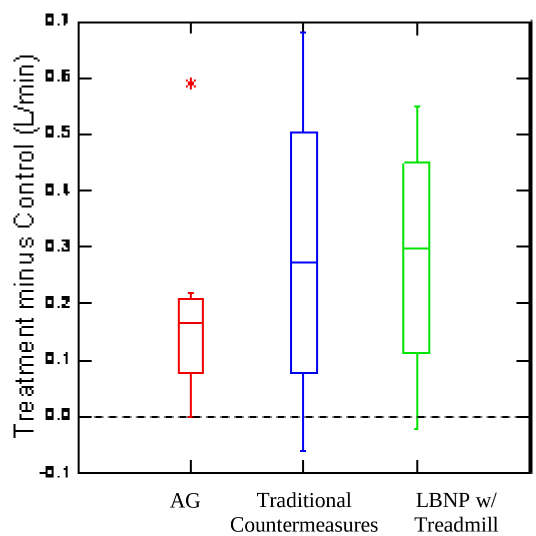
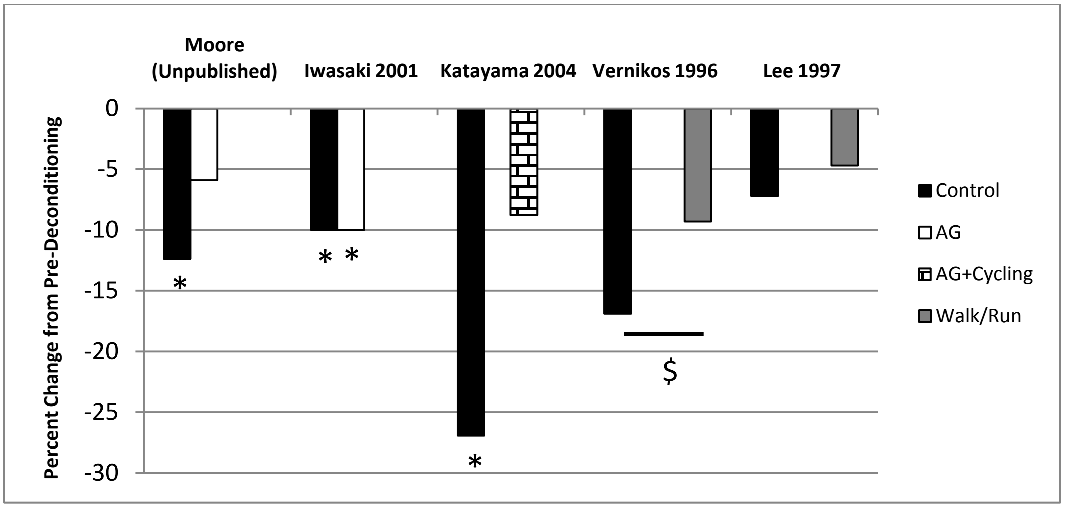
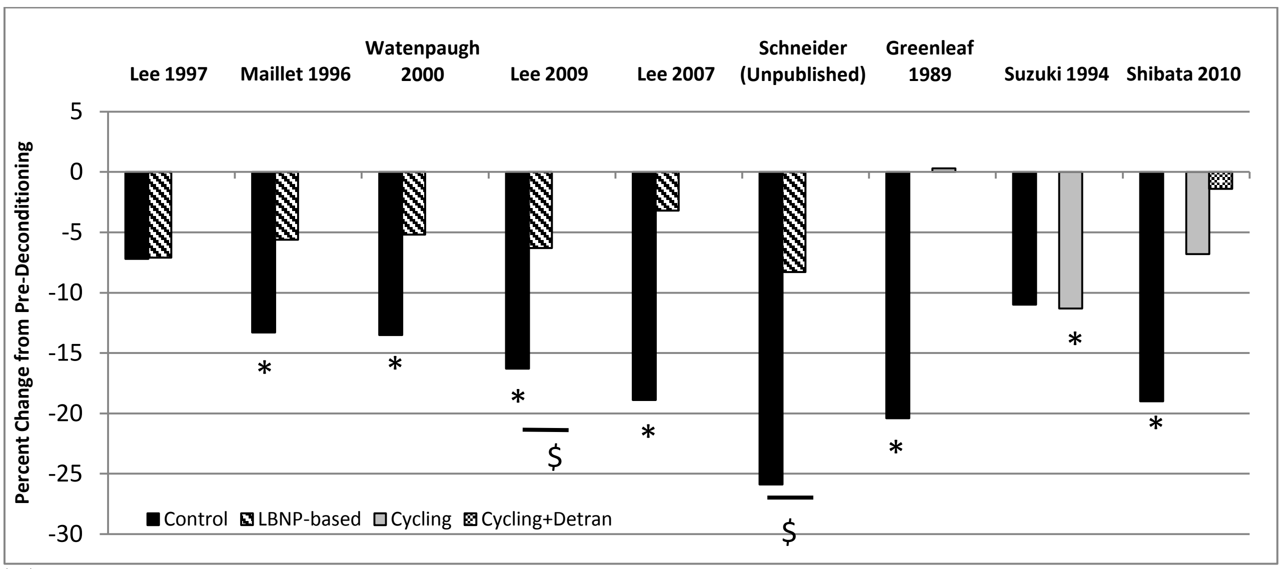


Figure 35. Collapsed treatment effect for VO_2 max and grouped by countermeasure



(A)



(B)

Figure 36. VO_2 max for AG studies (A) and traditional countermeasure studies (B). *p<0.05 vs. pre-bed rest, $ p<0.05 group effect

Exercise time to exhaustion is shown in Figure 37 and all of the countermeasures that used this measurement completely prevented the exercise time decrement with their respective treatment protocols.

Minute ventilation is shown in Figure 38 and only the AG coupled with cycling (Katayama et al. 2004) and the LBNP with vertical treadmill (Lee et al. 2007) prevented the its decrease. Respiratory exchange ratio (RER) is shown in Figure 39 and although the treatment group was found to be significantly different than the control group in Lee et al. 2007, it still decreased significantly from pre-bed rest.

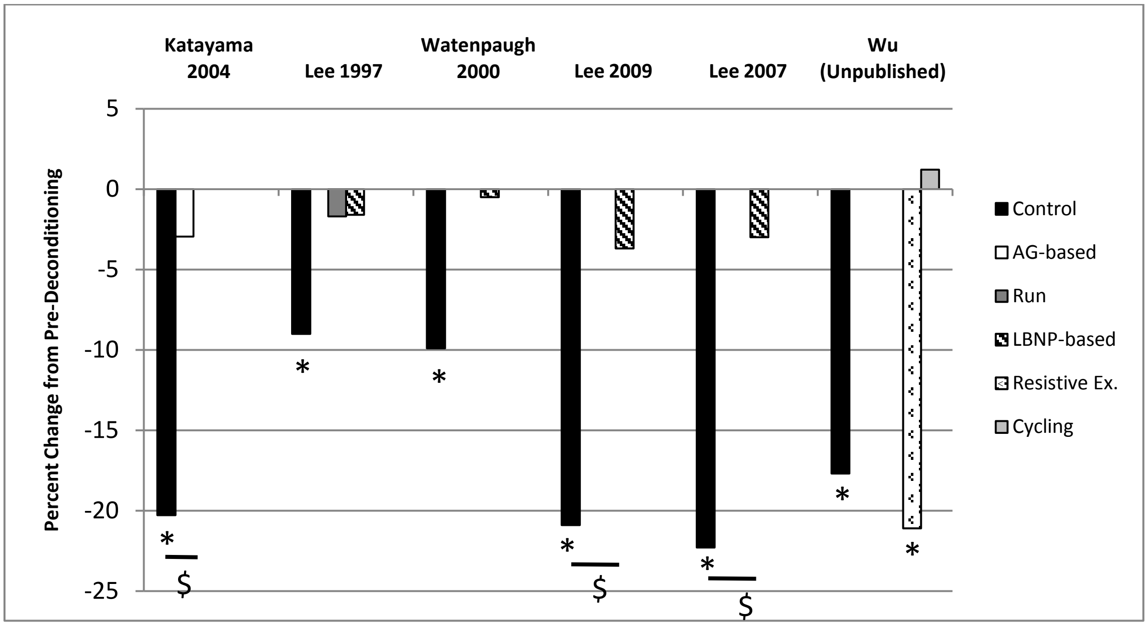


Figure 37. Exercise time to exhaustion. * p<0.05 vs. pre-bed rest, $ p<0.05 group effect

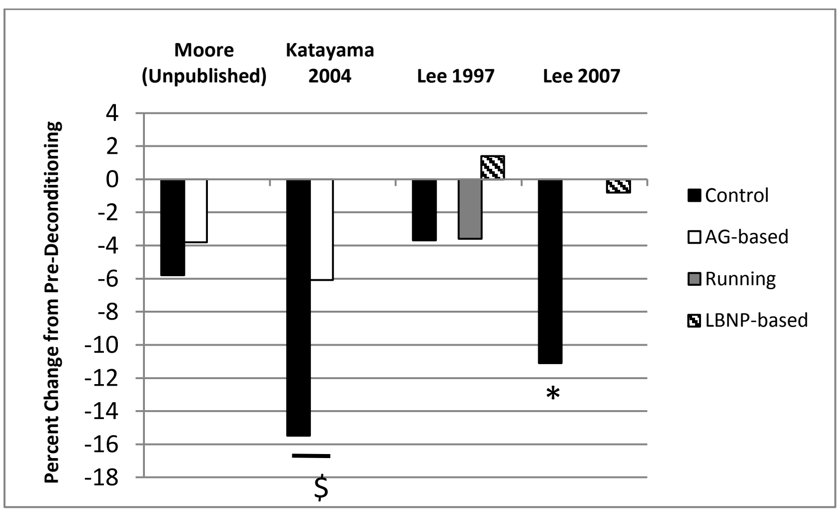


Figure 38. Minute ventilation, Ve. * p<0.05 vs. pre-bed rest, $ p<0.05 group effect

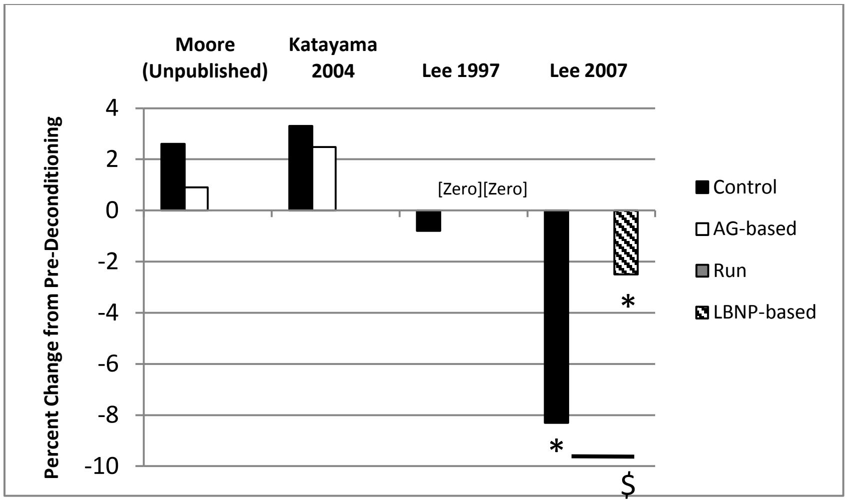


Figure 39. Respiratory exchange ratio. * p<0.05 vs. pre-bed rest, $ p<0.05 group effect

4.2 Muscle Results

Changes in soleus fiber dimensions are shown in Figure 40. Fibers in the AG study (Caiozzo et al. 2009) were not stained to determine fiber type, thus the percent change represents all fiber types. The resistive exercise study, on the other hand, did stain for fiber types and type I fibers are shown in the percent change bars for Trappe et al. 2008. Further evidence with AG-like protocols in animals is shown in Figure 41. Standing for 40 minutes per day in four increments (Widrick et al. 1996) or walking 20 meters per minute at 30% grade for ten minutes per day and progressively increasing duration to 90 minutes per day (Graham et al. 1989a) were successful in lessening type I CSA atrophy; however, the treatment group still deconditioned significantly versus control. Walking for 40 minutes per day at a slower speed (5 meters per minute) and a lower incline (19%) (Hauschka et al. 1988) did not maintain soleus fiber CSA.

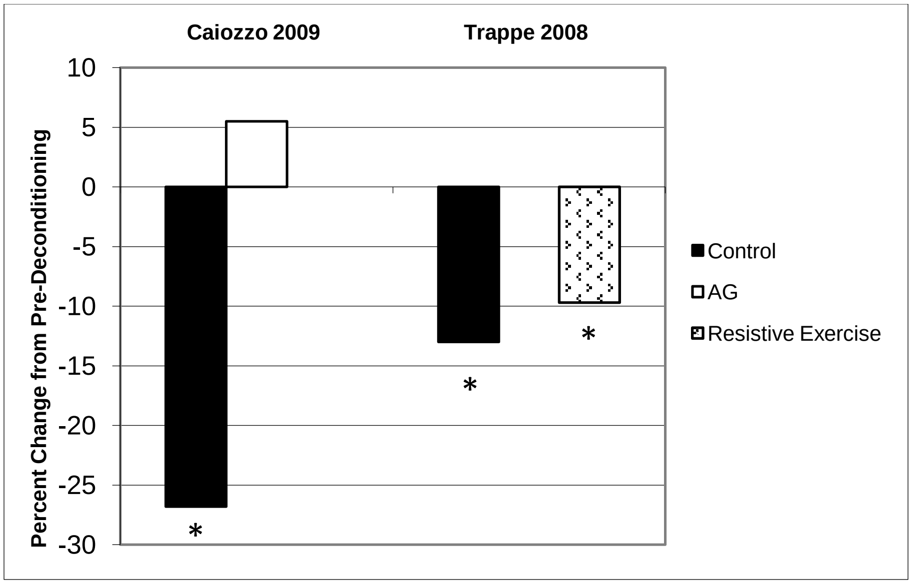


Figure 40. Soleus fiber cross-sectional area (Caiozzo et al. 2009) and soleus type I fiber diameter (Trappe et al. 2008). * p<0.05 vs. pre-bed rest.

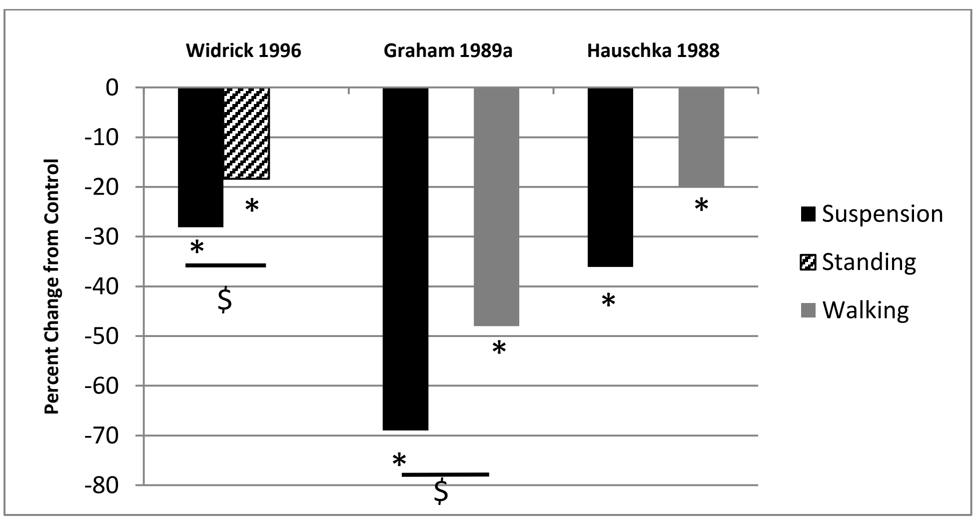


Figure 41. Animal soleus type I fiber cross-sectional area. * p<0.05 vs. pre-bed rest, $ p<0.05 group effect

Figure 42A illustrates the changes in vastus lateralis fiber dimensions. As in Figure 40, the AG study (Caiozzo et al. 2009) represents the average fiber CSA for all fiber types while the resistive exercise studies represent only the change in diameter of type IIa fibers. All resistive countermeasures – Trappe et al. 2007 (alternating squats and LBNP w/ treadmill), Bamman et al. 1998 (squats), and Trappe et al. 2004 (squats) – successfully maintained type IIa fiber diameter.

It is curious to note that Trappe et al. 2004 study did not show significant deconditioning of the control group despite its 90-day duration. No variations in either deconditioning or biopsy protocols between studies are noted in the published literature. Figure 42B shows the change in type IIa/IIx fiber CSA of the VL in rhesus monkeys. Spinning the monkeys at $1.2G_z$ for 5-20 minutes per day, five days a week maintained VL type IIa/IIx CSA.

Knee extensor (the vasti group and rectus femoris) muscle volume is shown in Figure 43. No change was seen in the AG study, although all resistive countermeasures successfully maintained muscle volume.

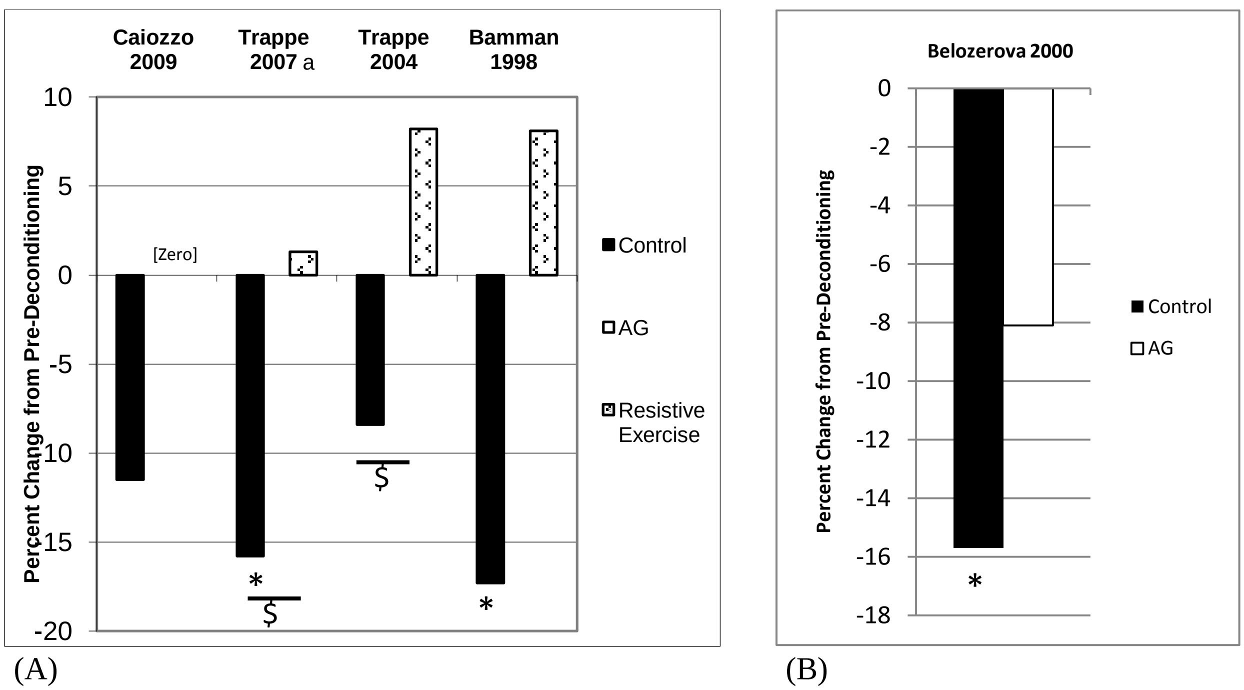


Figure 42. Vastus lateralis fiber CSA or diameter in humans (A) and rhesus monkeys (B). * $p<0.05$ vs. pre-bed rest, $ $p<0.05$ group effect

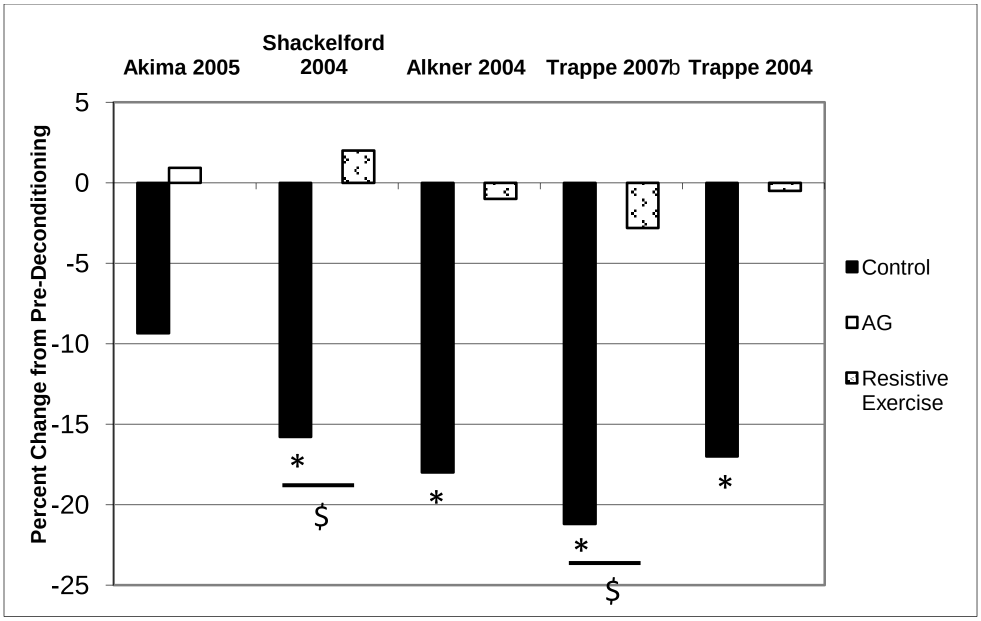
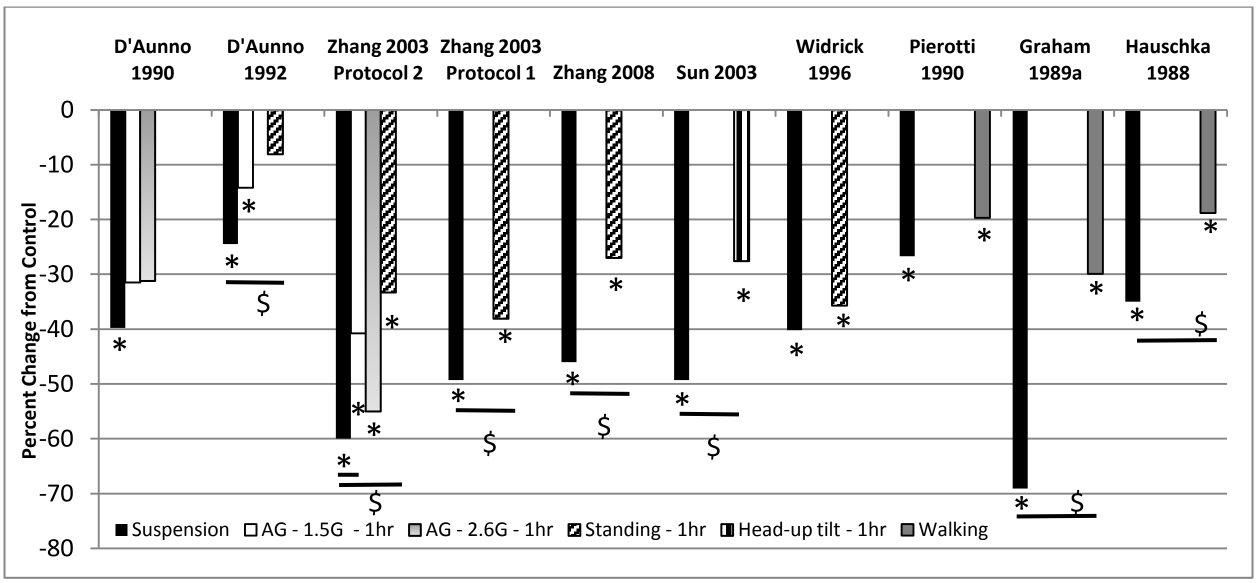
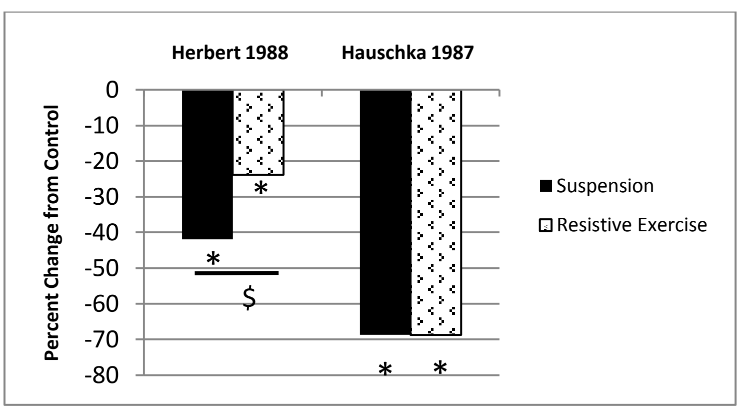


Figure 43. Muscle volume of the knee extensors. * p<0.05 vs. pre-bed rest, $ p<0.05 group effect

Whole muscle volume measurements are rarely performed for the plantar flexors in humans. Only one of the analyzed studies (Shackelford et al. 2004) performed a calf muscle volume measurement and both treatment and control groups deconditioned significantly versus pre-bed rest, although the treatment group was significantly different than the control group (not shown). Animal (rat) studies, on the other hand, have largely concentrated on studying the plantar flexors. Soleus wet weight is shown in Figure 44A using AG / AG analog countermeasures and is shown in Figure 44B using traditional-like countermeasures. Centrifugation of the rats at $1.5G_x$ for one hour per day maintained soleus wet weight in D'Aunno et al. 1990, but did not maintain treatment groups of the other two AG ($1.5G_x$) studies. Rats spun at a higher G-level of $2.6G_x$ did not have increased salutary effects on soleus wet weight. In fact, $2.6G_x$ decreased the effectiveness of centrifugation in Zhang et al. 2003 Protocol 2. The source responsible for this counter-intuitive phenomenon is not understood (Zhang, personal comm. 2009), although some investigators have suggested it might be due to the rats sitting in their cages at higher G-levels (Caiozzo, personal comm. 2009). Unfortunately, visualization of the rats during centrifugation was not performed in any study. Standing for one hour per day was effective at lessening the decrement of soleus wet weight in all studies except for the Widrick et al. 1996 study, which had rats standing for only 40 minutes per day. Head-up tilt to 45° effectively reduced deconditioning, while walking (on an incline) was effective for two of the studies but not Pierotti et al. 1990. The differences between protocols of Pierotti et al. 1990 (not effective) and Hauschka et al. 1988 (effective) are worth noting. In fact, the only difference (including deconditioning paradigm, study duration, and treatment protocol) between these two studies is the treatment of walking 12 meters/minute in Pierotti et al. 1990 while only walking at a rate of 5 meters/minute in Haschka et al. 1988. The underlying mechanism for why the less strenuous protocol is more effective is unknown. For traditional countermeasure analogues, climbing a grid at 85° was an effective countermeasure (Figure 44B, Herbert et al. 1988) while dropping the rats from 58 cm was not effective (Hauschka et al. 1987).



(A)



(B)

Figure 44. Soleus wet weight for AG / AG analog countermeasures (A) and traditional countermeasures (B). * p<0.05 vs. control, $ p<0.05 group effect

The wet weight of animal gastrocnemius muscle (also a plantar flexor) is shown in Figure 45. None of the countermeasures were successful and even centrifugation at 2.6G_x was significantly worse than the suspension group, perhaps for same reason as previously discussed.

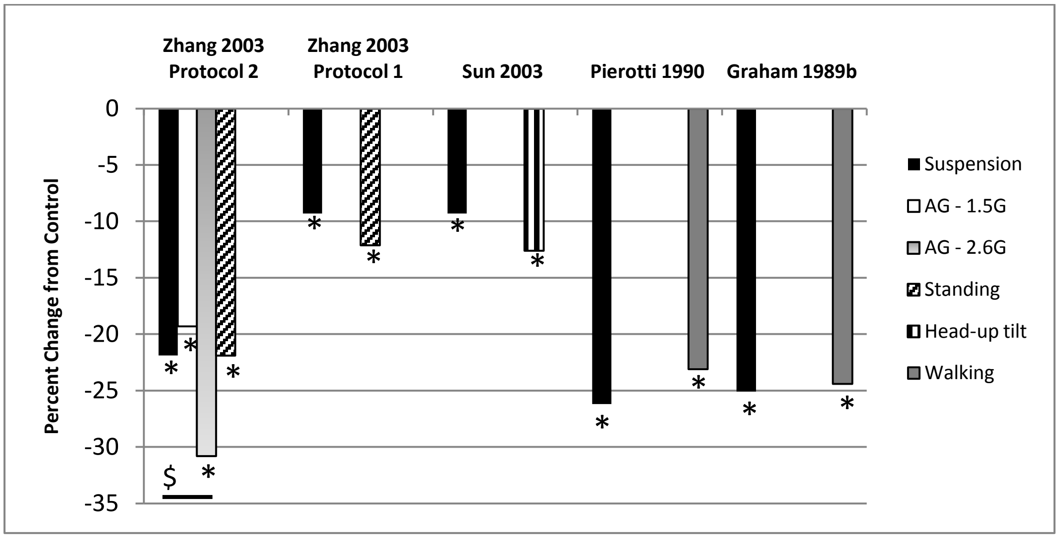


Figure 45. Gastrocnemius wet weight for AG / AG analog countermeasures. * p<0.05 vs. control, $ p<0.05 group effect

Knee extensor maximum voluntary contraction of humans is shown in Figure 46. Protocols consisting of squats were successful in maintaining knee extensor MVC, and Wu et al. (Unpublished) actually increased MVC compared to pre-bed rest. The control groups of the shorter duration studies of Akima et al. 2005, Suzuki et al. 1994, and Wu et al. (Unpublished) (20, 20, and 30 days, respectively) did not significantly change post- versus pre-bed rest whereas the control group of the 90-day duration study of Trappe et al. 2004 did decondition significantly.

Peak force, P_o, of the soleus muscle was measured in situ in AG analog animal studies (Figure 47A) and in humans (Figure 47B). Alternating days of LBNP with a vertical treadmill and squats / calf presses (Trappe et al. 2004) was not an effective countermeasure for soleus Po; however, an intensive resistive exercise regiment was effective (Koryak et al. 1997). Both standing and walking protocols were effective at lessening the decrement in P_o in animals.

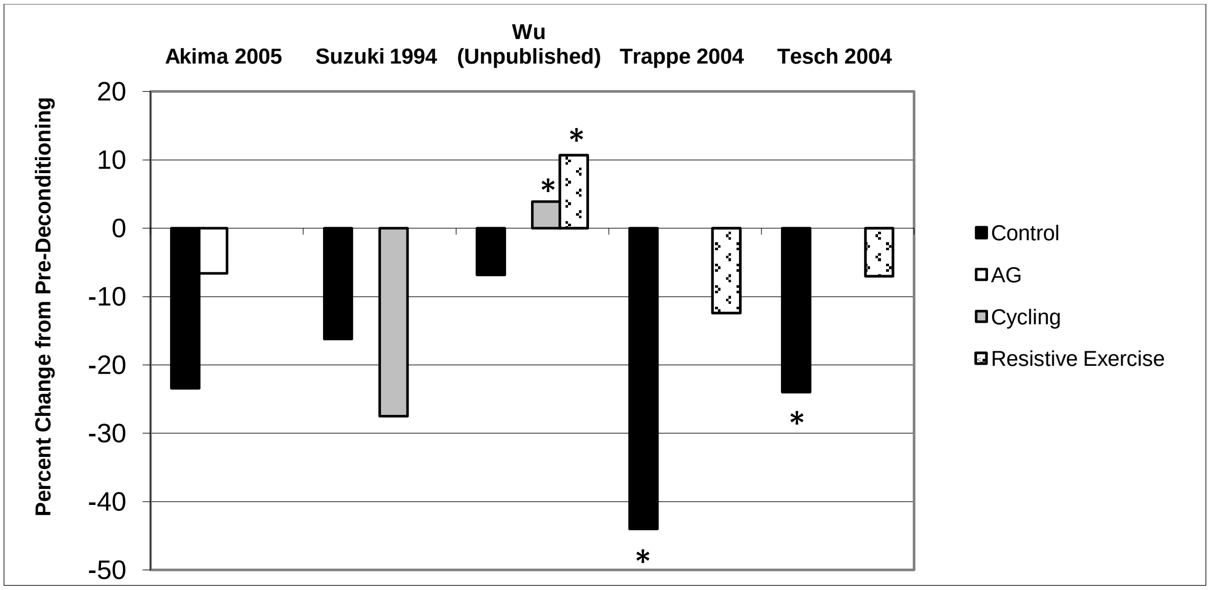


Figure 46. Knee extensor maximum voluntary contraction. * p<0.05 vs. pre-bed rest

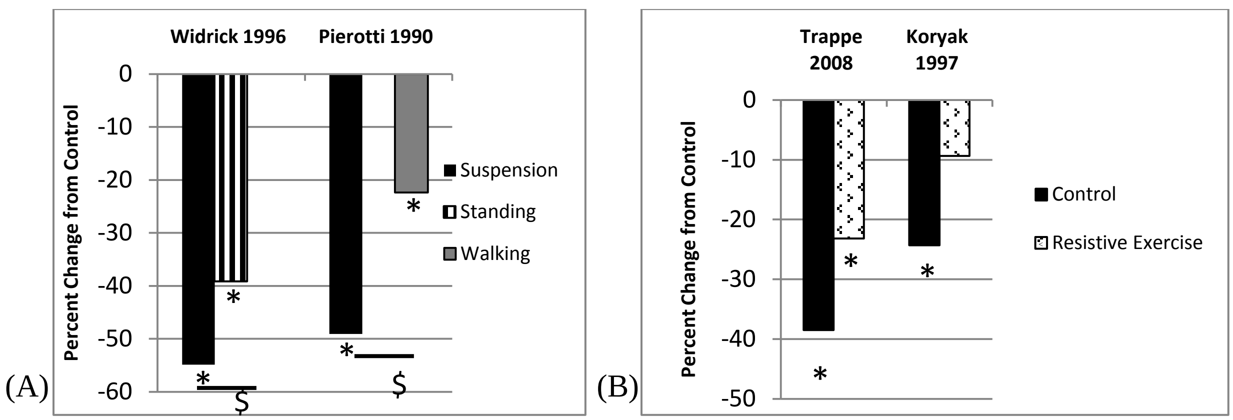


Figure 47. Peak force, P_o, of the soleus muscle in animals (A) and humans (B). * p<0.05 vs. control, $ p<0.05 group effect

4.3 Bone Results

The most definitive measurement to gauge bone loss is bone mineral density itself. BMD measurements for various lower limb sights are shown in Figure 48. Only one human, AG study has examined BMD and unfortunately, no significant results were observed. The 119-day duration resistive exercise study (Shackelford et al. 2004) was successful in preventing BMD loss in the trochanter and total hip, and increased BMD in the lumbar spine. These results are likely due to the extremely intensive exercise regime that was characteristic of the study. No significant results were observed in arguably the most important weight-bearing region of the lower body – the femoral hip.

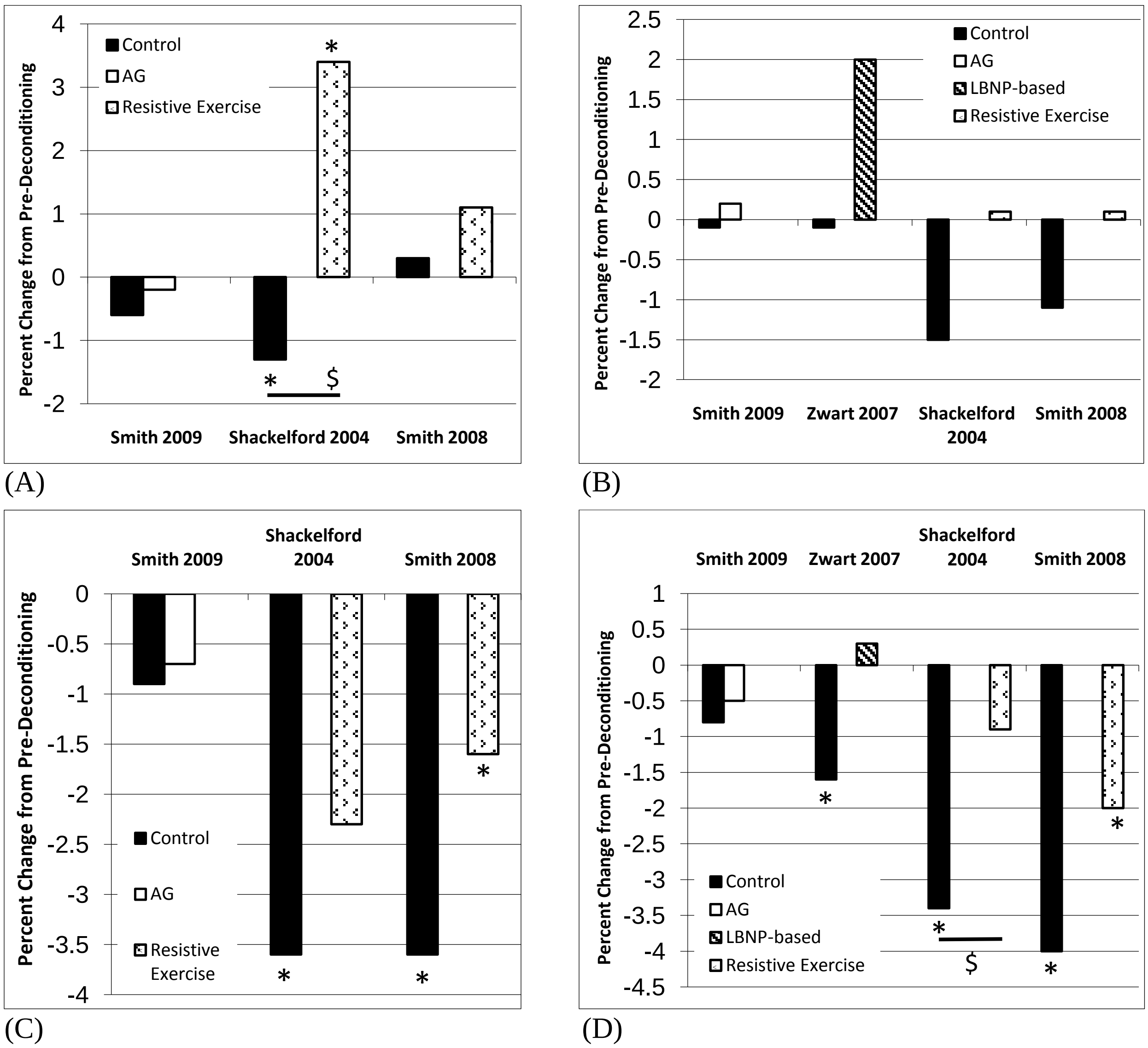


Figure 48. Bone mineral density in the lumbar spine (A), femoral neck (B), trochanter (C), and total hip (D). * p<0.05 vs. pre-bed rest, $ p<0.05 group effect

Because bone measurements are scarce in humans, data from animals is an important supplement. Rat femur density is shown in Figure 49, while femur maximum load and elastic load from mechanical testing is shown in Figure 50A and B, respectively. Standing or head-up tilt to 45 degrees for one hour were effective countermeasures for femur density. AG at $1.5G_x$

for one hour was also an effective countermeasure though the treatment group still had significantly less density than the control group. Similar to the muscle results of rats, centrifugation at $2.6G_x$ for one hour had worse results than centrifugation at $1.5G_x$ for the same period. All animal countermeasures had a significant benefit to maximum load except head-up tilt, while all countermeasures had a significant benefit to elastic load except standing.

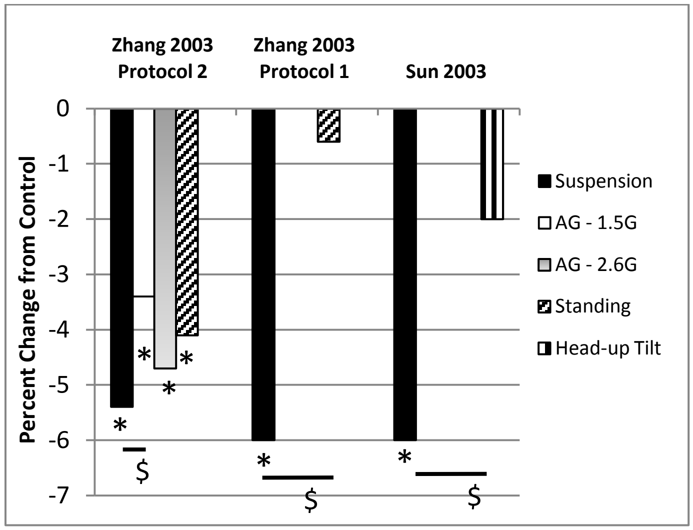
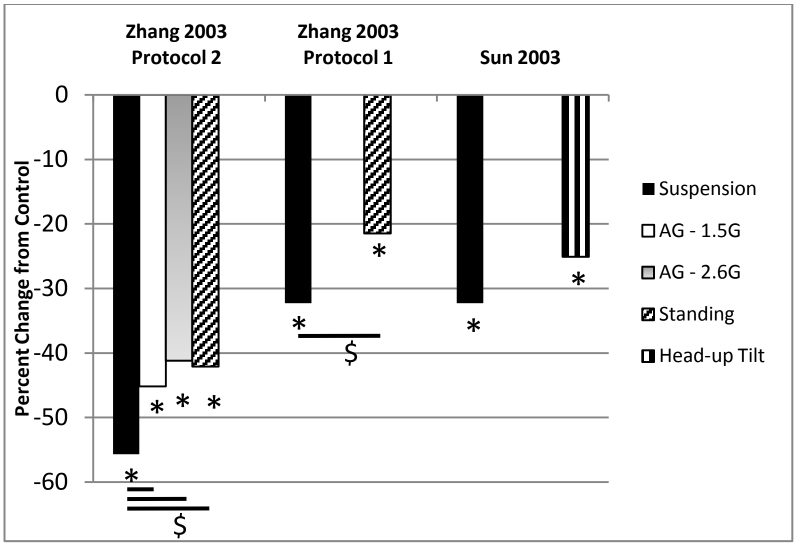
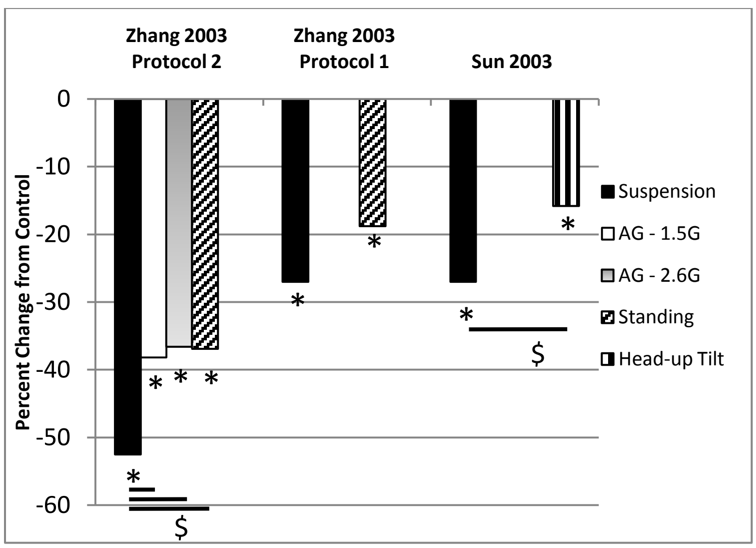


Figure 49. Animal (rat) femur density. * p<0.05 vs. control, $ p<0.05 group effect



(A)



(B)

Figure 50. Animal (rat) femur maximum load (A) and elastic load (B). * p<0.05 vs. control, $ p<0.05 group effect

Parathyroid hormone (PTH) is shown in Figure 51 while urinary calcium and serum calcium are shown in Figure 52A and B, respectively. PTH plays an important role in regulating serum calcium; thus, with lower serum calcium levels, PTH would be expected to increase. Also, an increased PTH level would be expected to increase calcium absorption in the intestines and kidney. These effects can be seen primarily in the Shackelford et al. 2004 study in Figure 51 and Figure 52. The opposite trend is observed in the same figures with the Smith et al. 2003 study.

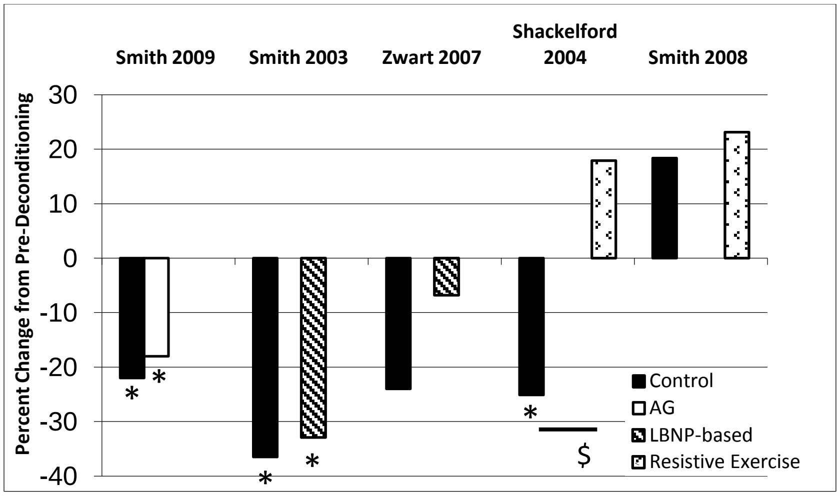
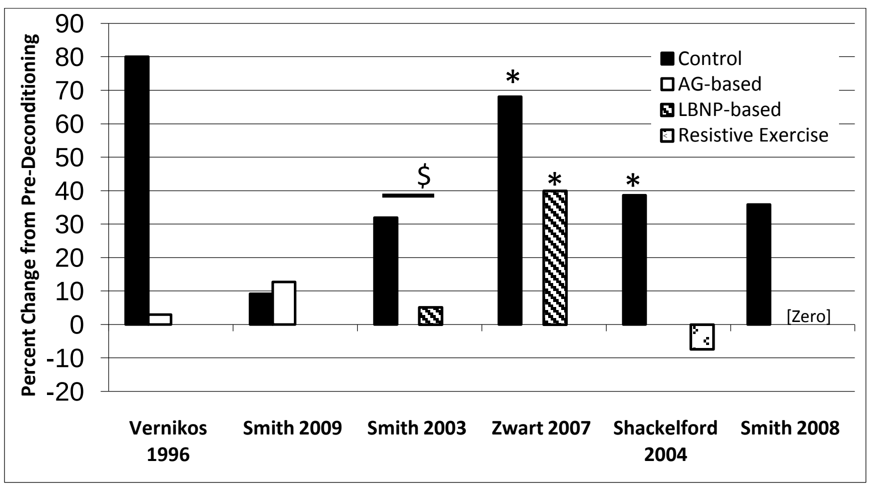
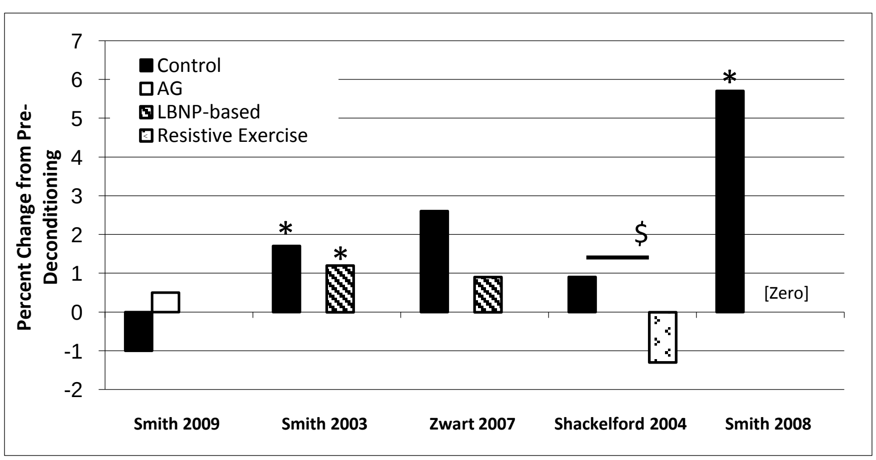


Figure 51. Parathyroid hormone. * p<0.05 vs. pre-bed rest, $ p<0.05 group effect



(A)



(B)

Figure 52. Calcium in the urine (A) and serum (B). * p<0.05 vs. pre-bed rest, $ p<0.05 group effect

Bone resorption markers are shown in Figure 53. All markers are increased after bed rest and most are increased significantly in every study. Countermeasures seem to have very little impact on any resorption marker; only LBNP with a vertical treadmill was effective at lessening the increase in NTX and deoxypyridinoline (Smith et al. 2003). Interestingly, this same protocol was effective for male twins (Smith et al. 2003), but was ineffective for female twins (Zwart et al. 2007) in 30 days of bed rest.

Bone formation markers (Figure 54) – although 25(OH)-Vitamin D and 1,25(OH)-Vitamin D are indirect measures of formation as they affect how much dietary calcium is absorbed – are much more variable than resorption markers. The active form of Vitamin D, 1,25(OH)-Vitamin D, was generally depressed in all studies (Figure 54B), although it was significantly different from the control group in Shackelford et al. 2004. Subjects in this study took a 400IU supplement of Vitamin D, which, when coupled with exercise, could explain this salutary effect. This effect could also have ultimately influenced the direct markers of bone formation, osteocalcin (Figure 54C) and BSAP (Figure 54D).

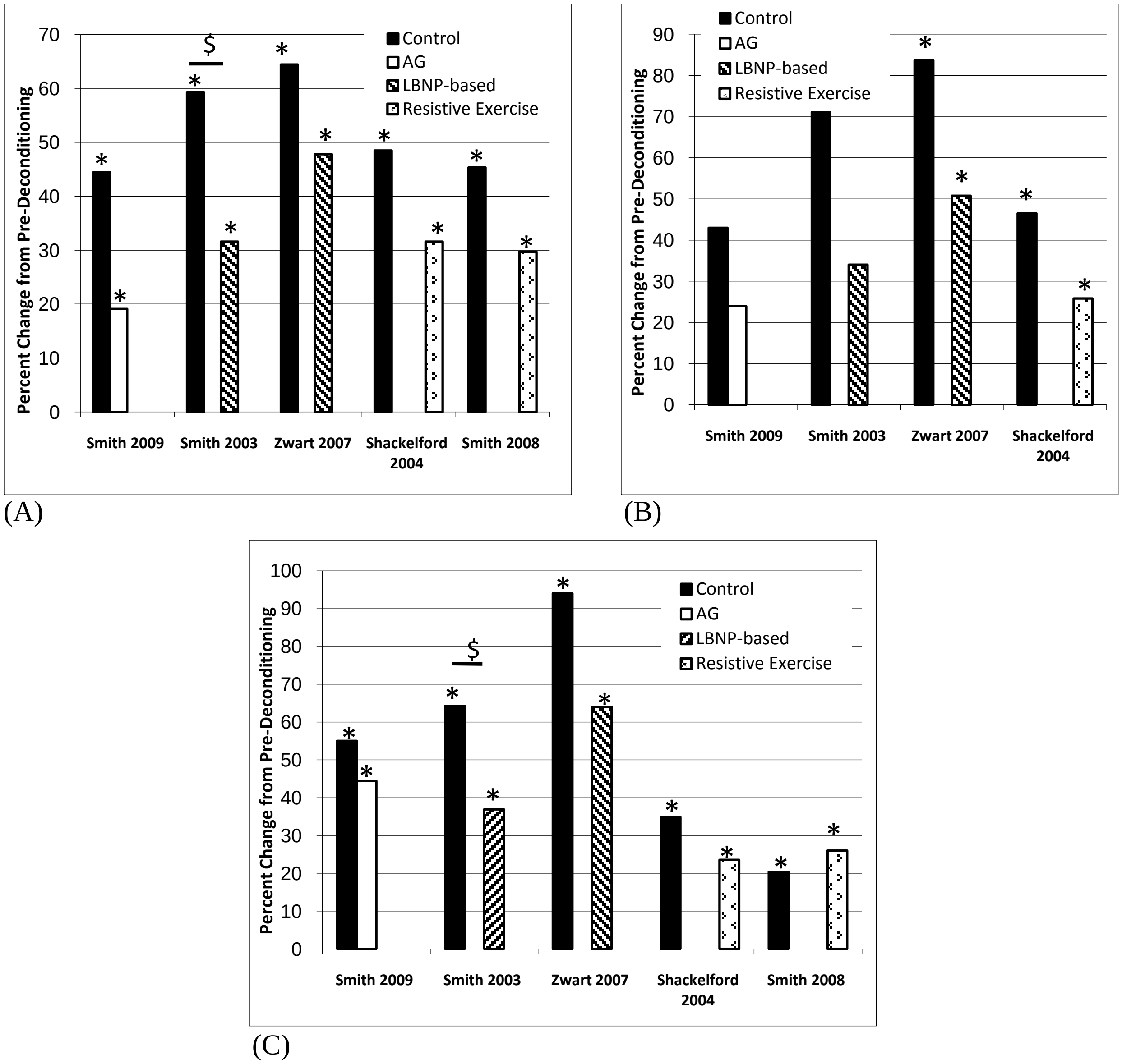


Figure 53. Bone resorption markers. (A) n-telopeptide crosslink; (B) Pyridinoline crosslink; (C) Deoxypyridinoline. * p<0.05 vs. pre-bed rest, $ p<0.05 group effect

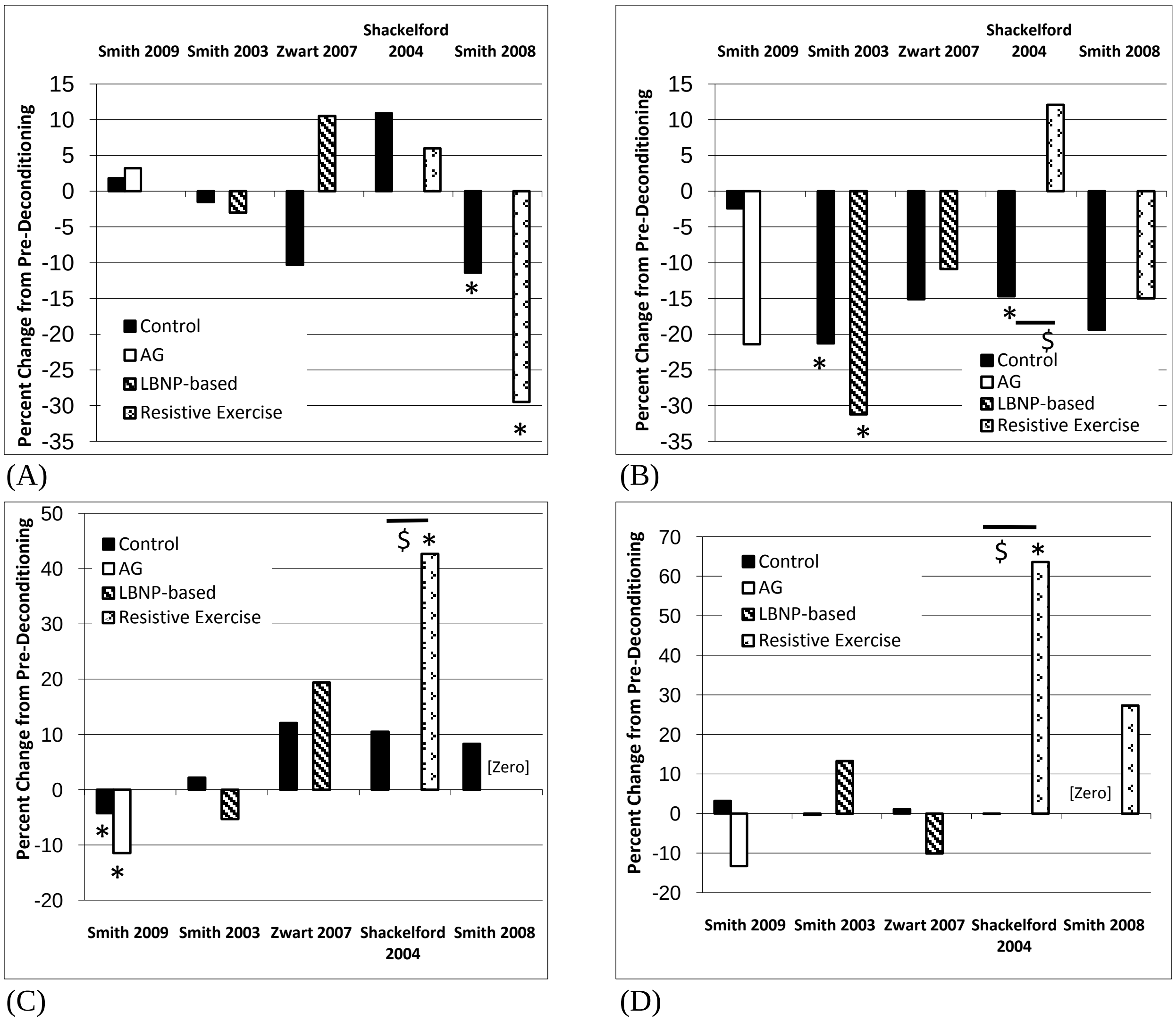


Figure 54. Bone formation markers. (A) 25(OH)-Vitamin D; (B) 1,25(OH)-Vitamin D; (C) Osteocalcin; (D) Bone Specific Alkaline Phosphate. * p<0.05 vs. pre-bed rest, $ p<0.05 group effect

5.0 Discussion

As with any meta-analyses, vast differences between study protocols exist in the literature. An important consideration that must be realized when comparing different countermeasure groups is the variation in intent of treatment protocol. For example, the Shackelford et al. 2004 study showed salutary effects of a resistive exercise paradigm in almost all bone measurements studied in this analysis. However, the protocol for this study was created specifically to counteract bone deconditioning. In contrast, the AG study (Smith et al. 2009) was a part of a larger pilot study at UTMB (Paloski et al. Unpublished), which was the first of its kind to study the effects of AG across all physiological systems. As such, the aim of the protocol was not to benefit any specific physiological system, but rather the aim was to have a starting point from which to base future protocols.

Another important difference between studies that must be noted is the wide range of protocol durations. This tends to not be an issue with the cardiovascular system, which has a deconditioning timescale on the order of days (Buckey 2006, Vernikos 1996); however, it could be very important in interpreting bone studies, and, to a lesser extent, skeletal muscle studies. Recent studies have shown that long-duration deconditioning exposures (i.e. on the order of at least eight weeks) are necessary for changes in BMD to become apparent (Pavy Le Traon et al. 2007, Spector et al. 2009). This point is illustrated in the Shackelford et al. 2004 study, which was 17-weeks in duration. During this timeframe, the control group exhibited significant deconditioning in many bone measurements. In comparison, the AG study spanned only a 3-week period, in which the control group showed no significant deviation from pre-bed rest means in any bone parameter studied.

One limitation of the current meta-analysis lies in the calculation of the variance associated with the treatment effect variable, which was performed for VO_2 max and resting heart rate. Specifically, Eq. 1, which was used to calculate the post minus pre-bed rest variance, is the general equation to find the difference of the variance for two independent samples. However, the variance of the post minus pre-bed rest averages is strongly related because they are the same people. As a result, the treatment effect variance is uncertain. Individual subject data, which is not published, is needed in order to make an accurate calculation. Although attempts have been made by the authors to obtain such data, it has nevertheless been slow to come to fruition. As a result, the statistics associated with the VO_2 max and resting heart rate parameters are not concrete, but rather a rough estimate.

Finally, a few AG, bed rest studies exist that were not included in this study because their measured physiological parameters were not the same as those currently analyzed. To the author's knowledge, the studies White et al. 1965, Shulzhenko et al. 1977, Shulzhenko et al. 1980, and Symons et al. 2009 combined with Table 2 represent the complete human AG deconditioning literature.

5.1 Cardiovascular Results

Comparatively, many more studies were found for the cardiovascular system than the musculo-skeletal system, which is perhaps due to muscle and bone only recently emerging into the countermeasure spotlight. One of the most persistently measured parameters to gauge cardiovascular deconditioning and the efficacy of countermeasures is orthostatic tolerance time under cardiac stress, which is an integrated performance measure that depends on hydration status, vascular status, and the integrity of the sympathetic nervous system. Although this is a gross measurement, it is useful because it serves to elucidate the overall cardiovascular state. The results of this study have shown that an AG-based countermeasure is effective at maintaining orthostatic tolerance, whereas traditional countermeasures have had limited effectiveness. One confounding variable in this measurement, however, is the fact that some investigations have a preset time limit for the cardiovascular test, while other investigations will continue the stress until presyncope occurs. For instance, consider a stress test (e.g. head-up tilt to 80°) with a time limit of 10 minutes. A subject in the treatment group might pass the test in both pre- and post-bed rest; however, had the test continued to presyncope, true tolerance time might be 17 minutes pre-bed rest and 12 minutes post-bed rest. This true decrement in tolerance might be significant and is not observed in the time-limited tests. However, this nuance does not completely negate results from studies that performed time-limited tolerance tests. If the control group shows a significant decrement in tolerance time from pre- to post-bed rest whereas the countermeasure group does not, a salutary effect of the countermeasure is seen; however, the entire story is not quite told.

Other measurements have been taken and have been presented that characterize the cardiovascular system to a finer detail than orthostatic tolerance time. Plasma volume is an important parameter to orthostatic tolerance that strongly affects stroke volume and cardiac output. However, it has been shown that merely supplanting the loss of plasma volume does not counteract orthostatic tolerance. Thus, plasma volume is not a direct indicator of orthostatic intolerance, though it might serve as a triggering mechanism for further dysfunction (Platts et al. 2009). Plasma volume seems to be maintained with an exercising countermeasure; AG alone was not effective at counteracting its loss. However, AG coupled with cycling as well as several traditional countermeasures were effective in maintaining plasma volume.

Vascular status is a slightly more difficult parameter to measure and in humans, it is primarily measured as total peripheral resistance. As expected, TPR increases after deconditioning due to increased vasoconstriction because the heart tries to maintain systemic blood pressure with lower plasma volume. None of the countermeasure groups were effective at maintaining TPR except the Shibata et al. 2010 study where the cycling plus Dextran group maintained TPR whereas pure cycling significantly increased from pre-bed rest. Dextran was administered only at the end of the bed-rest as a fluid loading measure. Its effect on TPR is expected as restoring plasma volume would cause a measure of vasodilation and thus reduce TPR. Vascular status can also be assessed by arterial dissection in animals. The AG analog of standing for two hours was an effective countermeasure in preserving CSA of the anterior tibial artery and CSA of its media thickness.

Finally, spectral analysis of the heart is beneficial to assess sympathetic and parasympathetic levels. Unfortunately, these measurements have been confined to AG studies and have yet to be used in traditional countermeasure studies. While both pure AG and AG coupled with cycling maintained parasympathetic activity from a depressed level, only AG coupled with cycling successfully maintained sympathetic activity. Autonomic responses of the heart are important in understanding its capability, although other factors such as its atrophy and distensibility play an important role in its function and ultimately have some impact on orthostatic tolerance. The latter two measurements are not routinely performed in deconditioning studies. A crucial sympathetic response – the baroreflex – is also not traditionally measured in deconditioning studies although its integrity is indirectly measured with orthostatic tolerance time. Only an AG-based countermeasure or LBNP are capable of stimulating the baroreflex in deconditioning and thus maintaining its effectiveness.

Exercise capacity is the second facet of the cardiovascular system that must be maintained. This analysis has shown that an AG-based countermeasure is as effective as traditional countermeasures in measurements of VO_2 max, minute ventilation, and exercise time to exhaustion. Specifically, both pure AG and AG coupled with cycling were effective at maintaining the former two measurements, while only AG coupled with cycling studies have measured exercise time to exhaustion and have consequently maintained this parameter.

5.2 Muscle Results

Only two bed rest studies exist that have examined AG as a countermeasure to human skeletal muscle deconditioning. AG alone (Caiozzo et al. 2009) significantly attenuated the decrease in soleus CSA, possibly because of ad lib calf presses that subjects were instructed to perform to maintain the muscle pump during centrifugation. No similar benefit was observed for any AG study for all other muscle measurements as the control groups did not degrade significantly from pre-deconditioning. It is important to note that most of the traditional countermeasure studies that examine muscle are of a longer duration (35-119 days) than the AG studies (20 and 21 days) (Table 2 and Table 5). Owing to slow adaptation time constants, evaluation of the skeletal muscle effects may require longer duration AG studies, especially with regards to knee extensor muscle volume and MVC.

Animal studies are useful in this instance because of the lack of data in human studies. Standing or walking of rats significantly lessened the soleus type I fiber CSA and soleus peak force. In addition, pure AG or standing maintained the soleus wet weight; however, none of the countermeasures maintained the gastrocnemius wet weight. Most of the rat studies have concentrated on the soleus muscle. While this is advantageous because human studies have mostly analyzed the quadriceps, which results in little overlap, rat studies should also examine effects of countermeasures on the quadriceps so common measures between animal and human can be compared.

Primates, such as Rhesus monkeys, are especially useful because their bipedal nature closely links their physiology with homo sapiens. Belozerova et al. 2000 found that pure AG maintained fast-twitch vastus lateralis CSA. In another AG study analyzing Rhesus monkeys, Korolkov et al. 2001 found that extracellular fluid, interstitial fluid, and blood flow to the medial gastocnemius was maintained with centrifugation.

Finally, no human, bed rest, AG study has examined the quality of muscle fibers after deconditioning (i.e. CSA and distribution by fiber type), while this has been performed in many of the traditional countermeasure studies. These measurements can be used to assess the degree of slow-to-fast fiber transition as well as peak force and shortening velocity of the fiber. Future AG studies should analyze global muscle parameters (e.g. muscle volume, MVC, endurance, etc.) as well as individual muscle fibers by fiber type in order to better understand any salutary effects of centrifugation on skeletal muscle. In sum, AG has shown some salutary effects on muscle as seen in human and animal studies; however, additional AG bed rest studies are much needed in order to have a consensus on the efficacy of AG in preventing skeletal muscle deconditioning.

5.3 Bone Results

Like the skeletal muscle studies, AG bed rest studies that analyze bone are very few in number; the Smith et al. 2009 study is the only comprehensive AG bone study. Like previously mentioned, study duration is important to note in analyzing the results. The AG study was only 21 days whereas the traditional countermeasure studies were of much longer duration [30 days (Zwart et al. 2007) to 117 days (Shackelford et al. 2004)]. As a result, no significant BMD results were seen in the AG study and only few were present in the traditional countermeasure studies.

Again, animal studies are very beneficial in supplementing human bone data. Generally, AG was effective at maintaining animal density and strength of the femur, although relatively few intermittent AG studies have been performed on animals. Because of the close physiological ties primates have to humans, primates such as the Rhesus monkey should be utilized in future AG studies.

Urinary and serum calcium are two markers of calcium balance that are commonly studied. For these parameters, dietary calcium plays an important role and can bias results if calcium intake is different between studies. However, for all studies analyzed, calcium intake was 1±0.1 g/day. For urinary calcium, only the Smith et al. 2003 and Shackelford et al. 2004 studies show a benefit with traditional countermeasures. The Shackelford et al. 2004 and Smith et al. 2008 studies both significantly reduced the increase in serum calcium. No conclusions can be made for any other study. It is interesting to note that as part of the Shackelford et al. 2004 study protocol, all subjects were required to take a daily vitamin pill, which contained a 400IU vitamin D dose. This vitamin D supplement may have had additional salutary effects on urinary and serum calcium levels when coupled with exercise.

Daily activities in $1G_z$ result in high loading of the lower skeleton, especially the hip and lumbar spine. Resistive exercise countermeasures have incorporated high loading of the lower skeleton through the use of supine squats. However, no comparable loads were attained in the AG protocols discussed thus far (pure AG and AG coupled with cycling). Proof-of-concept studies without human deconditioning have been performed that compare squats during centrifugation to upright squats and have found that squats during centrifugation can provide high foot forces that are analogous to squats in 1G (Yang et al. 2007a). In addition to providing high loading for bone, AG squats might also be beneficial for the skeletal muscle as previously discussed.

A countermeasure for bone deconditioning remains elusive. Unfortunately, due to the shortage of AG bed rest studies that have examined bone and due to the relatively short duration of those AG studies, few conclusions can be made regarding its efficacy as a countermeasure for bone deconditioning. Future AG studies should be designed specifically to evaluate its potential to protect bone deconditioning.

5.4 Vestibular Motivations for Artificial Gravity

Maintaining any dysfunction that might be associated with the vestibular system or measuring any deleterious effects AG might have on the vestibular system has not been the focus of AG studies. The comprehensive AG study performed at UTMB was the first ground-based study to analyze neurovestibular effects of AG. This study found that AG did not impact balance control or ocular counter-rolling, which affects posture, compared to the control group (Paloski et al. Unpublished). In the same study, error in subjective visual vertical was significantly different from zero in the treatment group and not different in the control group; however, this effect was short-lived.

Another important function of the vestibular system that has only recently emerged into the forefront of vestibular research is the vestibulosympathetic reflex (VSR), which is enacted by otolith stimulation (Yates and Miller 1994). VSR in humans has been found to be a mediator of cardiovascular stress (Dyckman et al. 2007, Saunder et al. 2008) and to even have shorter response latency than the baroreflex (Kaufman et al. 2002 and Voustianiouk et al. 2006). The latter finding indicates that the VSR could be the first line-of-defense to cardiovascular stress and thus could play a vital role in maintaining astronaut orthostatic tolerance. Little is known about the sympathetic response to spaceflight, especially with regard to the VSR, though any deconditioning of the VSR might act an instigator to additional reflexes responsible for orthostatic tolerance. AG may be a suitable countermeasure to protect the integrity of the VSR. Anecdotal evidence of the efficacy of AG is given in a study that analyzed the hemodynamic responses from the four centrifuged astronauts against the two non-rotated astronauts of the Neurolab mission (Moore et al. 2005). This study found that one of the non-rotated astronauts exhibited signs that were indicative of orthostatic intolerance (although none of the astronauts became presyncopal during the tilt test), which suggests that AG stimulation of the VSR and baroreflex was a successful countermeasure. Although this evidence is extremely circumstantial, it nevertheless represents the only space-based evidence that AG assisted in mitigating orthostatic intolerance. As research continues on the VSR, its role in triggering the first sympathetic response to cardiovascular stress is paramount; if there continues a drive to address orthostatic intolerance post-spaceflight, it must also address the VSR and any associated deconditioning. Artificial gravity is the only space-tested countermeasure that can not only stimulate the vestibular apparatus, but can also stimulate the otoliths in the appropriate manner to elicit a vestibulosympathetic reflex.

5.5 Nutritional Aspects

Some studies have been performed that have examined nutrition as a countermeasure (e.g. the WISE-2005 campaign as noted in Guinet et al. 2009, Trappe et al. 2007a, 2007b, 2008, and Smith et al. 2008). Based on the WISE-2005 study, a nutritional countermeasure alone was not effective in protecting most of the physiological measurements of the cardiovascular or musculo-skeletal systems. However, ensuring nutritional parameters are maintained in daily diet is critical for countermeasure effectiveness. For example, daily intake of calcium must be maintained at 1.0 g/day to help prevent exaggerated bone loss. Also, a 400 IU Vitamin D supplement seems to exhibit salutary effects when combined with intensive resistive exercise. While nutrition alone appears to not be an effective countermeasure, providing adequate nutrition will create a strong foundation that with a concomitant countermeasure may have increased salutary effects than with a countermeasure alone.

5.6 Implementation of Artificial Gravity in Space

While this study has analyzed the scientific motivations for continuing AG research, there exist several issues with its implementation in exploration-class spaceflight that warrant separate trade-based studies. Despite implementation issues being a rather large topic, a few of these issues are highlighted here for reference. One issue that arises with an AG-based countermeasure is vibration; however, this can be solved by a vibration isolation system similar to that found on the current ISS countermeasure devices. Other, perhaps more challenging, factors for AG in exploration-class spaceflight is the extremely limited mass and power, if any, that will be available to support a centrifuge. A space centrifuge will have to be designed with little mass, which can possibly be accomplished by using only a lightweight frame for the centrifuge. Power can be minimized by having a centrifuge that is powered by human cycling. This type of centrifuge (a ‘Space Cycle’) has been developed and tested at the University of California, Irvine (Yang et al. 2007b).

5.7 A Comprehensive Artificial Gravity Protocol

While the questions of 'how much?', 'how long?', and 'how often?' still persist with regards to a comprehensive AG protocol, an attempt is made to address these questions through the present analysis. Table 7 lists all of the measurements that were analyzed in this study. The columns represent different AG modalities: pure AG, AG coupled with cycling, standing, and running upright. Only the protocols that were effective for each measurement are listed. Red cells indicates the protocol was ineffective, blue cells indicate that no significance was associated with either control or treatment group (i.e. the protocol might be effective, but is unclear as control did not significantly change), and grey cells indicate that the measurement has not been performed with the protocol. If more than one study was effective for a given protocol type (e.g. two pure AG studies were effective at a measurement), the table was populated with the protocol that was either 1) the lowest G-level or 2) the lowest exposure time per day.

Table 7. Comprehensive results of AG studies for the different physiological systems. Red cells – ineffective protocol, blue – effectiveness could not be determined, grey – protocol not attempted.

	Species	Measurement	Pure AG			AG w/cycling				Standing	Running	
			G-level (feet)	Duration (min)	Days	G-level (feet)	Duration (min)	Cycling intensity	Days	Duration (min)	Duration (min)	Intensity
Cardiovascular	Human	Orthostatic Tolerance Time	2.5	60	every	Iwasaki	30	60W	alt.			
		Plasma Volume				Iwasaki	30	60W	alt.	240	240	3mph
		Hematocrit	Iwasaki	60	every						30	40-90%VO2 max
		Stroke Volume				1 to 5	40	60W for 20 minutes / 40-80% VO2max for 20 minutes	alt.			
		Cardiac Output										
		High Freqency Heart Rate	Iwasaki	60	every	Iwasaki	30	60W	alt.			
		High Frequency / Low Frequency Heart Rate				Iwasaki	30	60W	alt.			
		Total Peripheral Resistance										
		Resting Heart Rate	Iwasaki	60	every	Iwasaki	30	60W	alt.			
		Maximum Rate of Oxygen Uptake	2.5	60	every	1 to 5	40	60W for 20 minutes / 40-80% VO2max for 20 minutes	alt.	240	120	3mph
		Exercise Time to Exhaustion				1 to 5	40	60W for 20 minutes / 40-80% VO2max for 20 minutes	alt.		30	40-90%VO2 max
		Minute Ventilation				1 to 5	40	60W for 20 minutes / 40-80% VO2max for 20 minutes	alt.			
		Respiratory Exchange Ratio										
	Rat	CSA of anterior tibial artery								120		
		CSA of media thickness of anterior tibial artery								120		
Muscle	Human	Soleus Fiber CSA	2.5	60	every							
		Vastus Lateralis Fiber CSA										
		Muscle Volume of Knee Extensors										
		Knee Extensor MVC										
	Monkey	Vastus Lateralis Fiber CSA	1.2	5 to 20	every							
	Rat	Soleus Type I Fiber CSA								40	10 to 90	0.75 mph
		Soleus Wet Weight	1.5	60	every					60	40	0.2 mph
		Gastrocnemius Wet Weight										
		Soleus Peak Force								40	40	0.45 mph
Bone	Human	Lumbar Spine BMD										
		Femoral Neck BMD										
		Trochanter BMD										
		Total Hip BMD										
		PTH										
		Urinary Calcium										
		Serum Calcium										
		NTX										
		Pyridinoline crosslink										
		Deoxypyridinoline										
		25(OH)-Vitamin D										
		1,25(OH)-Vitamin D										
		Osteocalcin										
		BSAP										
	Rat	Femur Density	1.5	60	every					60		
		Femur Maximum Load	1.5	60	every					60		
		Femur Elastic Load	1.5	60	every							

As seen in the table and discussed previously, AG coupled with cycling is effective for many of the cardiovascular parameters, including orthostatic tolerance time and VO_2 max. The minimum duration and minimum intensity protocol that works is specifically two 20 minute sessions of: 1) centrifugation at 0.8-1.4 G_z at the heart (2.9-5.0 G_z at the feet), which is based on individual tolerance to centrifugation, coupled with cycling at a constant 60W, and 2) centrifugation at 0.3 G_z at the heart (1.0 G_z at the feet) coupled with cycling at variable levels based on pre-bed rest VO_2max (2 min. at 40% VO_2max, 3 min. at 60%, 2 min. at 40%, 3 min. at 70%, 2 min. at 40%, 3 min. at 80%, 2 min. at 40%, and 3 min. at 80%). This protocol was effective with alternating days of treatment.

As mentioned earlier, little musculo-skeletal data exists for AG. Soleus fiber CSA was preserved with 60 minutes of 2.5 G_z and calf presses. If animal data can be interpreted synonymously with human data, 60 minutes of standing or centrifugation at 1.5 G_z protects soleus muscle characteristics, vastus lateralis fiber CSA, and femur density and strength. Moreover, squats and calf presses have been the primary effectors at preserving leg muscle characteristics in traditional countermeasure studies and to some extent bone. Squats have been successfully performed in AG training studies without adverse effects from coriolis forces or motion sickness (Duda 2007, Yang et al. 2007b). In addition, high intensity squats have been performed in a training study and have shown similar foot forces and EMG activity with squats during centrifugation versus standing upright (Yang et al. 2007a). For these reasons, a comprehensive AG protocol should consist of squats and calf presses to maintain the musculo-skeletal system. Adopting the protocol used by many traditional countermeasure studies seems to be a logical starting choice. Specifically, squats and calf presses are performed every other day and consist of four sets of seven maximal repetition squats followed by four sets of 14 maximal repetition calf presses. By combining the AG squat and cycling protocol, a two day cycle alternating aerobic and resistive exercise is created and shown in Table 8.

Table 8. A hypothetical AG protocol that might counteract deconditioning of all physiological systems.

	Duration	G-level (at feet)	Subject #1	Subject #2
Day 1	20	2.9-5.0	Cycling at 60W	4x14 calf presses
	20	2.5	Cycling at 40W	Passive
	20	1.0	Graded Cycling based on VO2 max	4x7 squats
Day 2	20	2.9-5.0	4x14 calf presses	Cycling at 60W
	20	2.5	Passive	Cycling at 40W
	20	1.0	4x7 squats	Graded Cycling based on VO2 max

This protocol could easily be accommodated by a human-powered, two arm centrifuge. The subject performing aerobic exercise would supply power to the centrifuge, while the other subject would perform resistive exercise. In the event that squats in 1 G_z do not supply the correct intensity, cables could be added to the centrifuge to increase resistance (Duda 2007). This protocol could be the starting point in the continuing search for a comprehensive protocol. In addition, before reambulation, subjects should perform fluid loading to augment the salutary effects of this countermeasure regime.

5.8 Future Work on Artificial Gravity

Several avenues exist for future research of artificial gravity as a spaceflight countermeasure. As Table 7 shows, the paucity of data found with the musculo-skeletal system reflects the amount of AG research still to be performed. Ground-based studies must be performed to address these gaps in the musculo-skeletal system. Moreover, parametric studies should be performed to systematically address those persisting questions of ‘how much?’, ‘how long?’, and ‘how often?’. However, such studies must not lose sight of the multi-system benefits of AG by examining only one system at a time. Instead, such studies should investigate comprehensive protocols with experts from all the target systems playing roles in the study.

Such a multi-system, multi-investigator approach is the only manner in which to gauge the true effectiveness of an AG protocol.

As mentioned in the beginning of the discussion section, many confounding variables arose from the varying protocols of deconditioning itself. Differences were observed in all aspects of the deconditioning protocol, including deconditioning paradigm, daily nutritional content and supplements (if any) used, fluid intake, etc. Standardizing the deconditioning protocols should be the first step in future research – either AG or traditional countermeasures – as it will allow for a more compatible assessment across various studies.

Admittedly, deconditioning studies are extremely expensive, especially given that studies needed for AG should be of a very long duration (eight weeks) to observe musculo-skeletal changes. However, a pilot study for bone could be performed for very low cost. Bone is chosen because it is the system that arguably lacks the most useful AG data and it is the constraint for having a long duration deconditioning study. To demonstrate the salutary effect of AG on bone, a training study could be devised where ambulatory subjects are rotated three times per week. Because squats have proven to be beneficial for bone maintenance, AG could be coupled with squats, and the intensity of the squat exercise would be determined in the same manner as the comprehensive AG protocol in 5.7. BMD measurements of the lower limbs and biological bone markers would be taken before and after six months of training. Calcium supplements could be administered as needed by monitoring nutritional intake. If AG coupled with squats increases BMD after six months of training, this relatively inexpensive study might perhaps provide the motivation for a larger deconditioning study.

Although ground-based studies will ultimately be the medium for determining a comprehensive AG protocol, a centrifuge in space might provide the impetus for further ground-based research. At present, there exist two possibilities for introducing a centrifuge to the ISS. EADS-Astrium in Europe is working on a centrifuge design for an eventual proposal to the European Space Agency (ESA). This centrifuge could be placed in either the Multi-Purpose Logistics Module (MPLM) or the Automated Transfer Vehicle (ATV). The other possibility is a proposal to the Japanese Aerospace Exploration Agency (JAXA) for a low up-mass centrifuge to be placed in the ISS (Iwase, personal comm. 2009). If either of these two efforts succeeds, it will mark the first time a human centrifuge will be in space and will have been built specifically to counteract cardiovascular and musculo-skeletal deconditioning. Any positive results from this space centrifuge would surely spur subsequent ground-based research.

6.0 Conclusion

In the state of global waning of funding for artificial gravity research, this analysis has attempted to quantify the scientific evidence for an AG countermeasure to spaceflight deconditioning by examining its effectiveness in ground-based studies to the effectiveness of more traditional countermeasures. In reviewing both human and animal literature, AG, especially AG coupled with cycling, was determined to be as effective as traditional countermeasures for the cardiovascular system. AG and AG analogue studies (e.g. standing) with animals provided some measure of protection against deconditioning of the musculo-skeletal system; however, this phenomenon was not present in human studies due to their paucity as well as their short-duration. Based on the AG literature, motivations for an AG countermeasure in spaceflight were discussed and a hypothetical comprehensive AG protocol was derived.

While it may ultimately be a large-radius, continually-rotating centrifuge that will become spacecraft architecture, its manifestation might not be realized until far into the future based on current NASA ideology and technical direction. As exploration-class missions will be planned and developed in the interim, an improvement must be made upon the current countermeasures in order to prevent deleterious deconditioning of humans. Artificial gravity could be such an improvement as it is the countermeasure that addresses the root cause of the deconditioning phenomenon instead of treating its end-effects system-by-system as do the current countermeasures. As this analysis has shown, there exists substantial rationale to continue research on an AG-based countermeasure to prevent spaceflight deconditioning of all physiological systems.

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Appendix A: World Centrifuges

The tables below list the known human (Table A1) and animal (Table A2) centrifuges located around the world. The human centrifuges are limited to those that supply a G_z acceleration and that are short-radius since those were the focus of the present study. Only animal centrifuges that have been used in deconditioning studies are shown. Operational details – to the extent that they are known – are presented.

Table A1. Human short-radius centrifuges.

Name	Location	Radius (m)	Number of Arms	Mode	Additional Capabilities	Max. G (at feet)
Short-Arm Centrifuge	UTMB, Galveston, USA	3	2	Bed		3.5
Artificial Gravity Sleeper	MIT, Cambridge, USA	2	1	Bed	Cycling / Squats	2
Human Powered Centrifuge	NASA Ames, USA	2	2	Bed	Cycling	5
Space Cycle	University of California, Irvine, USA	1 to 2	2	Gondola / Swinging arm	Cycling / Squats	5
Artificial Gravity Simulator	Baylor College of Medicine, Houston, USA	2	4	Bed		3
Self-Powered Short-Arm Human Centrifuge	Fourth Military Medical University, Xi' An, China	2	2	Bed	Cycling	4
Short-Radius Human Centrifuge	Aichi Medical University (was Nagoya University), Aichi Prefecture, Japan	2	1	Bed	Cycling	5
Short-Arm Human Centrifuge	Nihon University, Nishi-Funibashi, Japan	1.8	1	Gondola		3
Short-Radius Centrifuge	IBMP, Moscow, Russia	2		Bed	Cycling	2
Human Centrifuge "ASEA"	IBMP, Moscow, Russia	7.25	1	Bed		12
ESA Short-Arm Centrifuge	MEDES, Toulouse, France	2.9	4	bed/chair		3.5
Short-Arm Centrifuge	DLR, Cologne, Germany	2.9	4	bed/chair		3.5

Table A2. Animal centrifuges.

Name	Location	Radius (m)	Number of Arms	Mode	Max. G (at feet)	Species
Rat Centrifuge	UTMB, Galveston, USA	0.9	1	Gondola		Rats
Centrifuge I and II	University of California, Davis, USA	3	1		4.5	Rats / Chickens / Monkeys
Rat Centrifuge	Fourth Military Medical University, Xi' An, China	1	1	Bed		Rats
Centrifuge "CF-4"	IBMP, Moscow, Russia	4	2	Bed	10	Monkeys
Centrifuge "CF-KB-365"	IBMP, Moscow, Russia	1.34	1	Gondola	2	Rats

Appendix B: Master Database

This appendix includes the master spreadsheet that was populated in compiling countermeasure data. In the master spreadsheet, a few parameters, such as treatment applied, deconditioning paradigm, species, and protocol specifics are coded. Table B1 below shows the key for species, while Table B2 shows the key for deconditioning paradigm, and Table B3 is the key for treatment (or countermeasure) applied. If two treatments are applied, their treatments codes are summed and entered into the master database. For instance, the LBNP with a vertical treadmill countermeasure will have the code 260 (LBNP: 256 plus treadmill: 4). Table B4 shows the master database itself.

Table B1. Key to species code

Code	Species
0	Humans
1	Rhesus Monkeys
2	Sprague-Dawley Rats
3	Wistar Rats
4	Fisher 334 Rats

Table B2. Key to deconditioning paradigm code

Code	Deconditioning
0	None
1	5 Head Down Bed Rest
2	6 Head Down Bed Rest
3	10 Head Down Bed Rest
4	0 Head Down Bed Rest
5	Dry Immersion
6	Wet Immersion
7	Unilateral Lower Limb Suspension
8	Tail Suspension
9	Weightlessness

Table B3. Key to Treatment code

Code	Treatment
0	None
1	Artificial Gravity
2	Cycle Ergometer
4	Treadmill
8	Standing Upright
16	Walking Upright
32	Water / Salt Supplement
64	Squat
128	Heel Raises / Calf Press
256	Lower Body Negative Pressure
512	Head-Up Tilt
1024	Isokinetic Exercise
2048	Nutrition
4096	Pamidronate
8192	Combined resistive exercise
16384	Isometric
32768	Arm Press
65536	Dropped
131072	Stair Stepper
262144	Parathyroid Harmone
524288	Climbing
1048576	Beta-Blockers
2097152	Leptin
4194304	1,25-D
8388608	EB1089
16777216	Testosterone
33554432	Nandrolone Decanoate

Table B4. Master database for countermeasure studies

Study	Author	Species	Days	Deconditioning	Treatment	Radius	G-level at feet	G-level at heart	Duration (min)	Freq. of Treatment	Protocol Specifics	Group	Female in Group	Male in Group	Description	Description	Description	Percent Change	Pre- vs Post- Sig	Group Sig
1	Caiozzo 2009	0	21	2	0							CON	0	7	Muscle Strength	Knee Flexors		-3		
1	Caiozzo 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Muscle Strength	Knee Flexors		-6		
1	Caiozzo 2009	0	21	2	0							CON	0	7	Muscle Strength	Plantar Flexor		-7		
1	Caiozzo 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Muscle Strength	Plantar Flexor		7		
1	Caiozzo 2009	0	21	2	0							CON	0	7	Myofiber Cross Sectional Area	Vastus Lateralis		-11.5		
1	Caiozzo 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Myofiber Cross Sectional Area	Vastus Lateralis		0		
1	Caiozzo 2009	0	21	2	0							CON	0	7	Myofiber Cross Sectional Area	Soleus		-26.8	1	
1	Caiozzo 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Myofiber Cross Sectional Area	Soleus		5.5		
1	Caiozzo 2009	0	21	2	0							CON	0	7	Total RNA Concentration	Vastus Lateralis		5.9		
1	Caiozzo 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Total RNA Concentration	Vastus Lateralis		-5.2		
1	Caiozzo 2009	0	21	2	0							CON	0	7	Total RNA Concentration	Soleus		-5		
1	Caiozzo 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Total RNA Concentration	Soleus		5.8		
1	Caiozzo 2009	0	21	2	0							CON	0	7	Total MHC mRNA levels	Vastus Lateralis		-27	1	
1	Caiozzo 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Total MHC mRNA levels	Vastus Lateralis		-33	1	
1	Caiozzo 2009	0	21	2	0							CON	0	7	Total MHC mRNA levels	Soleus		-40	1	
1	Caiozzo 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Total MHC mRNA levels	Soleus		-16.7		
1	Caiozzo 2009	0	21	2	0							CON	0	7	Actin Levels	Vastus Lateralis		-33	1	
1	Caiozzo 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Actin Levels	Vastus Lateralis		-22.4		
1	Caiozzo 2009	0	21	2	0							CON	0	7	Actin Levels	Soleus		-15.6		
1	Caiozzo 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Actin Levels	Soleus		-6.2		
1	Caiozzo 2009	0	21	2	0							CON	0	7	Myostatin Levels	Vastus Lateralis		14.3		
1	Caiozzo 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Myostatin Levels	Vastus Lateralis		-9.7		
1	Caiozzo 2009	0	21	2	0							CON	0	7	Myostatin Levels	Soleus		56.1		
1	Caiozzo 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Myostatin Levels	Soleus		17.1		
1	Caiozzo 2009	0	21	2	0							CON	0	7	Atrogin Levels	Vastus Lateralis		42.7		
1	Caiozzo 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Atrogin Levels	Vastus Lateralis		11.1		
1	Caiozzo 2009	0	21	2	0							CON	0	7	Atrogin Levels	Soleus		13.6		
1	Caiozzo 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Atrogin Levels	Soleus		-31.3		
1	Caiozzo 2009	0	21	2	0							CON	0	7	Type I MHC mRNA Levels	Vastus Lateralis		-25		
1	Caiozzo 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Type I MHC mRNA Levels	Vastus Lateralis		-5		
1	Caiozzo 2009	0	21	2	0							CON	0	7	Type I MHC mRNA Levels	Soleus		-43	1	
1	Caiozzo 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Type I MHC mRNA Levels	Soleus		-23		
1	Caiozzo 2009	0	21	2	0							CON	0	7	Type IIa MHC mRNA Levels	Vastus Lateralis		-7.1		
1	Caiozzo 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Type IIa MHC mRNA Levels	Vastus Lateralis		-22.7		
1	Caiozzo 2009	0	21	2	0							CON	0	7	Type IIa MHC mRNA Levels	Soleus		-21.1		
1	Caiozzo 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Type IIa MHC mRNA Levels	Soleus		-26.8		
1	Caiozzo 2009	0	21	2	0							CON	0	7	Type IIxMHC mRNA Levels	Vastus Lateralis		29		
1	Caiozzo 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Type IIxMHC mRNA Levels	Vastus Lateralis		68.6	1	
1	Caiozzo 2009	0	21	2	0							CON	0	7	Type IIxMHC mRNA Levels	Soleus		236	1	
1	Caiozzo 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Type IIxMHC mRNA Levels	Soleus		246	1	
2	Symons 2009	0	21	2	0							CON	0	7	Fractional Synthesis Rate	Vastus Lateralis		-48.5	1	
2	Symons 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Fractional Synthesis Rate	Vastus Lateralis		-14		
2	Symons 2009	0	21	2	0							CON	0	7	Fractional Synthesis Rate	Soleus		-22		
2	Symons 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Fractional Synthesis Rate	Soleus		-9		
2	Symons 2009	0	21	2	0							CON	0	7	Fractional Breakdown Rate	Vastus Lateralis		-17		
2	Symons 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Fractional Breakdown Rate	Vastus Lateralis		-10		
2	Symons 2009	0	21	2	0							CON	0	7	Fractional Breakdown Rate	Soleus		1		
2	Symons 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Fractional Breakdown Rate	Soleus		-23		
3	Akima 2005	0	20	2	0							CON	0	5	Muscle Volume	Knee Extensor		-9.4		
3	Akima 2005	0	20	2	3	2	2.9-5; 1	0.8-1.4; 0.3	40	Every other day	cycle@60W for 20min, then profile based on VO2max	AG	0	5	Muscle Volume	Knee Extensor		0.9		
3	Akima 2005	0	20	2	0							CON	0	5	Muscle Volume	Rectus Femoris		-11.8		
3	Akima 2005	0	20	2	3	2	2.9-5; 1	0.8-1.4; 0.3	40	Every other day	cycle@60W for 20min, then profile based on VO2max	AG	0	5	Muscle Volume	Rectus Femoris		8.1		
3	Akima 2005	0	20	2	0							CON	0	5	Muscle Volume	Vastus Lateralis		-8.1	1	
3	Akima 2005	0	20	2	3	2	2.9-5; 1	0.8-1.4; 0.3	40	Every other day	cycle@60W for 20min, then profile based on VO2max	AG	0	5	Muscle Volume	Vastus Lateralis		4.3		
3	Akima 2005	0	20	2	0							CON	0	5	Muscle Volume	Vastus Intermedius		-11.3	1	

3	Akima 2005	0	20	2	3	2	2.9-5; 1	0.8-1.4; 0.3	40	Every other day	cycle@60W for 20min, then profile based on VO2max	AG	0	5	Muscle Volume	Vastus Intermedius		-0.6		
3	Akima 2005	0	20	2	0							CON	0	5	Muscle Volume	Vastus Medialis		-7.8	1	
3	Akima 2005	0	20	2	3	2	2.9-5; 1	0.8-1.4; 0.3	40	Every other day	cycle@60W for 20min, then profile based on VO2max	AG	0	5	Muscle Volume	Vastus Medialis		-3.7		
3	Akima 2005	0	20	2	0							CON	0	5	Muscle Volume	Knee Flexors		-7.5		
3	Akima 2005	0	20	2	3	2	2.9-5; 1	0.8-1.4; 0.3	40	Every other day	cycle@60W for 20min, then profile based on VO2max	AG	0	5	Muscle Volume	Knee Flexors		-6.4		
3	Akima 2005	0	20	2	0							CON	0	5	Muscle Volume	Adductors		-7.0		
3	Akima 2005	0	20	2	3	2	2.9-5; 1	0.8-1.4; 0.3	40	Every other day	cycle@60W for 20min, then profile based on VO2max	AG	0	5	Muscle Volume	Adductors		1.4		
3	Akima 2005	0	20	2	0							CON	0	5	Muscle Volume	Total		-8.5	1	
3	Akima 2005	0	20	2	3	2	2.9-5; 1	0.8-1.4; 0.3	40	Every other day	cycle@60W for 20min, then profile based on VO2max	AG	0	5	Muscle Volume	Total		-0.7		
3	Akima 2005	0	20	2	0							CON	0	5	Maximum Voluntary Contraction (MVC)	Knee Extensor		-23.4		
3	Akima 2005	0	20	2	3	2	2.9-5; 1	0.8-1.4; 0.3	40	Every other day	cycle@60W for 20min, then profile based on VO2max	AG	0	5	Maximum Voluntary Contraction (MVC)	Knee Extensor		-6.6		
3	Akima 2005	0	20	2	0							CON	0	5	MVC / Muscle Volume	Knee Extensor		-16.7		
3	Akima 2005	0	20	2	3	2	2.9-5; 1	0.8-1.4; 0.3	40	Every other day	cycle@60W for 20min, then profile based on VO2max	AG	0	5	MVC / Muscle Volume	Knee Extensor		-8.3		
3	Akima 2005	0	20	2	0							CON	0	5	EMG activity	Knee Extensor		-14.4		
3	Akima 2005	0	20	2	3	2	2.9-5; 1	0.8-1.4; 0.3	40	Every other day	cycle@60W for 20min, then profile based on VO2max	AG	0	5	EMG activity	Knee Extensor		-12.9	1	
3	Akima 2005	0	20	2	0							CON	0	5	mfMRI (T2) (% change pre- and post- exercise	Knee Extensor		1.0		
3	Akima 2005	0	20	2	3	2	2.9-5; 1	0.8-1.4; 0.3	40	Every other day	cycle@60W for 20min, then profile based on VO2max	AG	0	5	mfMRI (T2) (% change pre- and post- exercise	Knee Extensor		-26.9		
4	Moore (Unpublished)	0	21	2	0							CON	0	7	VO2 (L/min)	Max		-12.4	1	
4	Moore (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	VO2 (L/min)	Max		-5.9		
4	Moore (Unpublished)	0	21	2	0							CON	0	7	VCO2	Max		-9.8	1	
4	Moore (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	VCO2	Max		-4.9		
4	Moore (Unpublished)	0	21	2	0							CON	0	7	Ve (L/min)	Max		-5.8		
4	Moore (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Ve (L/min)	Max		-3.8		
4	Moore (Unpublished)	0	21	2	0							CON	0	7	Respiratory Exchange Ratio	Max		2.6		
4	Moore (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Respiratory Exchange Ratio	Max		0.9		
4	Moore (Unpublished)	0	21	2	0							CON	0	7	Heart Rate (beats/min)	Max		2.3		
4	Moore (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Heart Rate (beats/min)	Max		1		
4	Moore (Unpublished)	0	21	2	0							CON	0	7	VO2 (L/min)	Submaximal Exercise		-3.7		
4	Moore (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	VO2 (L/min)	Submaximal Exercise		2.3		
4	Moore (Unpublished)	0	21	2	0							CON	0	7	VCO2	Submaximal Exercise		1.2		
4	Moore (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	VCO2	Submaximal Exercise		7.9		
4	Moore (Unpublished)	0	21	2	0							CON	0	7	Ve (L/min)	Submaximal Exercise		9.7		
4	Moore (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Ve (L/min)	Submaximal Exercise		12.7		
4	Moore (Unpublished)	0	21	2	0							CON	0	7	Respiratory Exchange Ratio	Submaximal Exercise		5.4	1	
4	Moore (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Respiratory Exchange Ratio	Submaximal Exercise		5.5	1	
4	Moore (Unpublished)	0	21	2	0							CON	0	7	Heart Rate (beats/min)	Submaximal Exercise		10.8	1	
4	Moore (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Heart Rate (beats/min)	Submaximal Exercise		8.3	1	
5	Stenger (Unpublished)	0	21	2	0							CON	0	7	Tolerance Time	80 Head-Up Tilt		-46.37		
5	Stenger (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Tolerance Time	80 Head-Up Tilt		-21.20		1
5	Stenger (Unpublished)	0	21	2	0							CON	0	7	Anti-G Score					

5	Stenger (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Anti-G Score					
5	Stenger (Unpublished)	0	21	2	0							CON	0	7	Plasme Volume (mL)	Resting		-8.51	1	
5	Stenger (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Plasme Volume (mL)	Resting		-6.25	1	
5	Stenger (Unpublished)	0	21	2	0							CON	0	7	Systolic Blood Pressure (mmHg)	Resting		4.92		
5	Stenger (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Systolic Blood Pressure (mmHg)	Resting		3.36		
5	Stenger (Unpublished)	0	21	2	0							CON	0	7	Diastolic Blood Pressure (mmHg)	Resting		4.48		
5	Stenger (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Diastolic Blood Pressure (mmHg)	Resting		4.55		
5	Stenger (Unpublished)	0	21	2	0							CON	0	7	Total Peripheral Resistance	Resting		17.09		
5	Stenger (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Total Peripheral Resistance	Resting		5.99		
5	Stenger (Unpublished)	0	21	2	0							CON	0	7	Heart Rate (beats/min)	Resting		15.95	1	
5	Stenger (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Heart Rate (beats/min)	Resting		9.13	1	
5	Stenger (Unpublished)	0	21	2	0							CON	0	7	Stroke Volume (mL)	Resting		-12.20	1	
5	Stenger (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Stroke Volume (mL)	Resting		-11.19	1	
5	Stenger (Unpublished)	0	21	2	0							CON	0	7	Cardiac Output	Resting		-5.45		
5	Stenger (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Cardiac Output	Resting		-3.85		
5	Stenger (Unpublished)	0	21	2	0							CON	0	7	Low Frequency (LF) BP	Resting		63.16	1	
5	Stenger (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Low Frequency (LF) BP	Resting		86.67	1	
5	Stenger (Unpublished)	0	21	2	0							CON	0	7	High Frequency (HF) BP	Resting		-10.00		
5	Stenger (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	High Frequency (HF) BP	Resting		-14.29		
5	Stenger (Unpublished)	0	21	2	0							CON	0	7	Low Frequency (LF) Heart Rate	Resting		64.54		
5	Stenger (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Low Frequency (LF) Heart Rate	Resting		19.80		
5	Stenger (Unpublished)	0	21	2	0							CON	0	7	High Frequency (HF) Heart Rate	Resting		-58.62		
5	Stenger (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	High Frequency (HF) Heart Rate	Resting		-20.55		
5	Stenger (Unpublished)	0	21	2	0							CON	0	7	HF parasympathetic activity (PNS) (HF/(HF+LF))	Resting		-51.11	1	
5	Stenger (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	HF parasympathetic activity (PNS) (HF/(HF+LF))	Resting		-19.05	1	
5	Stenger (Unpublished)	0	21	2	0							CON	0	7	HF sympathetic activity (SNS) (LF/HF)	Resting		165.22	1	
5	Stenger (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	HF sympathetic activity (SNS) (LF/HF)	Resting		43.75	1	
5	Stenger (Unpublished)	0	21	2	0							CON	0	7	Delta SBP	80 Head-Up Tilt		-120.00		
5	Stenger (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Delta SBP	80 Head-Up Tilt		-71.43		
5	Stenger (Unpublished)	0	21	2	0							CON	0	7	Delta DBP	80 Head-Up Tilt		-28.57		
5	Stenger (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Delta DBP	80 Head-Up Tilt		-22.22		
5	Stenger (Unpublished)	0	21	2	0							CON	0	7	Delta Total peripheral resistance	80 Head-Up Tilt		-6.25		
5	Stenger (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Delta Total peripheral resistance	80 Head-Up Tilt		0.00		
5	Stenger (Unpublished)	0	21	2	0							CON	0	7	Delta Heart rate	80 Head-Up Tilt		58.33	1	
5	Stenger (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Delta Heart rate	80 Head-Up Tilt		76.90	1	
5	Stenger (Unpublished)	0	21	2	0							CON	0	7	Delta Stroke volume	80 Head-Up Tilt		3.13	1	
5	Stenger (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Delta Stroke volume	80 Head-Up Tilt		-2.92	1	

5	Stenger (Unpublished)	0	21	2	0							CON	0	7	Delta Cardiac output	80 Head-Up Tilt		0.00		
5	Stenger (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Delta Cardiac output	80 Head-Up Tilt		-10.53		
5	Stenger (Unpublished)	0	21	2	0							CON	0	7	Delta Low Frequency (LF) BP	80 Head-Up Tilt		-39.39		
5	Stenger (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Delta Low Frequency (LF) BP	80 Head-Up Tilt		69.57		
5	Stenger (Unpublished)	0	21	2	0							CON	0	7	Delta High frequency (HF) BP	80 Head-Up Tilt		-66.67		
5	Stenger (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Delta High frequency (HF) BP	80 Head-Up Tilt		0.00		
5	Stenger (Unpublished)	0	21	2	0							CON	0	7	Delta LF HR	80 Head-Up Tilt		-96.51		
5	Stenger (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Delta LF HR	80 Head-Up Tilt		29.13		
5	Stenger (Unpublished)	0	21	2	0							CON	0	7	Delta HF HR	80 Head-Up Tilt		-69.23		
5	Stenger (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Delta HF HR	80 Head-Up Tilt		71.43		
5	Stenger (Unpublished)	0	21	2	0							CON	0	7	Delta HF parasympathetic activity	80 Head-Up Tilt		-65.38	1	
5	Stenger (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Delta HF parasympathetic activity	80 Head-Up Tilt		-13.04	1	
5	Stenger (Unpublished)	0	21	2	0							CON	0	7	Delta HF sympathetic activity	80 Head-Up Tilt		-60.00		
5	Stenger (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Delta HF sympathetic activity	80 Head-Up Tilt		27.78		
5	Stenger (Unpublished)	0	21	2	0							CON	0	7	Left Ventricular Diameter systole (cm)			-4.06		
5	Stenger (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Left Ventricular Diameter systole (cm)			-9.35		
5	Stenger (Unpublished)	0	21	2	0							CON	0	7	Left Ventricular Diameter diastole (cm)			-4.35		
5	Stenger (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Left Ventricular Diameter diastole (cm)			-9.18		
5	Stenger (Unpublished)	0	21	2	0							CON	0	7	Mitral E wave velocity (cm/sec)			-18.49		
5	Stenger (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Mitral E wave velocity (cm/sec)			-13.69		
5	Stenger (Unpublished)	0	21	2	0							CON	0	7	Isovolumic Relaxation time (msec)			16.46		
5	Stenger (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Isovolumic Relaxation time (msec)			7.82		
5	Stenger (Unpublished)	0	21	2	0							CON	0	7	Left ventricular mass (g)			-3.08		
5	Stenger (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Left ventricular mass (g)			3.89		
5	Stenger (Unpublished)	0	21	2	0							CON	0	7	Mitral E to A wave ratio			-23.95		
5	Stenger (Unpublished)	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Mitral E to A wave ratio			-7.04		
6	Katayama 2004	0	20	2	0							CON	0	5	VO2 (L/min)	Resting		0		
6	Katayama 2004	0	20	2	3	2	2.9-5; 1	0.8-1.4; 0.3	40	Every other day	cycle@60W for 20min, then profile based on VO2max	AG	0	5	VO2 (L/min)	Resting		3.7037037		
6	Katayama 2004	0	20	2	0							CON	0	5	VCO2	Resting		0		
6	Katayama 2004	0	20	2	3	2	2.9-5; 1	0.8-1.4; 0.3	40	Every other day	cycle@60W for 20min, then profile based on VO2max	AG	0	5	VCO2	Resting		4.34782609		
6	Katayama 2004	0	20	2	0							CON	0	5	Ve (L/min)	Resting		12.6315789		
6	Katayama 2004	0	20	2	3	2	2.9-5; 1	0.8-1.4; 0.3	40	Every other day	cycle@60W for 20min, then profile based on VO2max	AG	0	5	Ve (L/min)	Resting		9.09090909		
6	Katayama 2004	0	20	2	0							CON	0	5	Respiratory Exchange Ratio	Resting		0		
6	Katayama 2004	0	20	2	3	2	2.9-5; 1	0.8-1.4; 0.3	40	Every other day	cycle@60W for 20min, then profile based on VO2max	AG	0	5	Respiratory Exchange Ratio	Resting		1.17647059		
6	Katayama 2004	0	20	2	0							CON	0	5	Heart Rate (beats/min)	Resting		15.2905199		
6	Katayama 2004	0	20	2	3	2	2.9-5; 1	0.8-1.4; 0.3	40	Every other day	cycle@60W for 20min, then profile based on VO2max	AG	0	5	Heart Rate (beats/min)	Resting		4.31654676		
6	Katayama 2004	0	20	2	0							CON	0	5	Systolic Blood Pressure (mmHg)	Resting		-1.8612521		
6	Katayama 2004	0	20	2	3	2	2.9-5; 1	0.8-1.4; 0.3	40	Every other day	cycle@60W for 20min, then profile based on VO2max	AG	0	5	Systolic Blood Pressure (mmHg)	Resting		2.02286719		
6	Katayama 2004	0	20	2	0							CON	0	5	Diastolic Blood Pressure (mmHg)	Resting		1.13798009		
6	Katayama 2004	0	20	2	3	2	2.9-5; 1	0.8-1.4; 0.3	40	Every other day	cycle@60W for 20min, then profile based on VO2max	AG	0	5	Diastolic Blood Pressure (mmHg)	Resting		-3.0136986		

6	Katayama 2004	0	20	2	0							CON	0	5	Stroke Volume (mL)	Resting		-27.628032	1	
6	Katayama 2004	0	20	2	3	2	2.9-5; 1	0.8-1.4; 0.3	40	Every other day	cycle@60W for 20min, then profile based on VO2max	AG	0	5	Stroke Volume (mL)	Resting		-4.4534413		1
6	Katayama 2004	0	20	2	0							CON	0	5	Cardiac Output	Resting		-14.893617		
6	Katayama 2004	0	20	2	3	2	2.9-5; 1	0.8-1.4; 0.3	40	Every other day	cycle@60W for 20min, then profile based on VO2max	AG	0	5	Cardiac Output	Resting		-5.5555556		
6	Katayama 2004	0	20	2	0							CON	0	5	VO2 (L/min)	Submaximal Exercise		-5		
6	Katayama 2004	0	20	2	3	2	2.9-5; 1	0.8-1.4; 0.3	40	Every other day	cycle@60W for 20min, then profile based on VO2max	AG	0	5	VO2 (L/min)	Submaximal Exercise		-2.5		
6	Katayama 2004	0	20	2	0							CON	0	5	VCO2	Submaximal Exercise		6		
6	Katayama 2004	0	20	2	3	2	2.9-5; 1	0.8-1.4; 0.3	40	Every other day	cycle@60W for 20min, then profile based on VO2max	AG	0	5	VCO2	Submaximal Exercise		-5		
6	Katayama 2004	0	20	2	0							CON	0	5	Ve (L/min)	Submaximal Exercise		15	1	
6	Katayama 2004	0	20	2	3	2	2.9-5; 1	0.8-1.4; 0.3	40	Every other day	cycle@60W for 20min, then profile based on VO2max	AG	0	5	Ve (L/min)	Submaximal Exercise		-5		
6	Katayama 2004	0	20	2	0							CON	0	5	Respiratory Exchange Ratio	Submaximal Exercise		20	1	
6	Katayama 2004	0	20	2	3	2	2.9-5; 1	0.8-1.4; 0.3	40	Every other day	cycle@60W for 20min, then profile based on VO2max	AG	0	5	Respiratory Exchange Ratio	Submaximal Exercise		-3		
6	Katayama 2004	0	20	2	0							CON	0	5	Heart Rate (beats/min)	Submaximal Exercise		20	1	
6	Katayama 2004	0	20	2	3	2	2.9-5; 1	0.8-1.4; 0.3	40	Every other day	cycle@60W for 20min, then profile based on VO2max	AG	0	5	Heart Rate (beats/min)	Submaximal Exercise		5		
6	Katayama 2004	0	20	2	0							CON	0	5	Systolic Blood Pressure (mmHg)	Submaximal Exercise		7		
6	Katayama 2004	0	20	2	3	2	2.9-5; 1	0.8-1.4; 0.3	40	Every other day	cycle@60W for 20min, then profile based on VO2max	AG	0	5	Systolic Blood Pressure (mmHg)	Submaximal Exercise		-5		
6	Katayama 2004	0	20	2	0							CON	0	5	Diastolic Blood Pressure (mmHg)	Submaximal Exercise		3		
6	Katayama 2004	0	20	2	3	2	2.9-5; 1	0.8-1.4; 0.3	40	Every other day	cycle@60W for 20min, then profile based on VO2max	AG	0	5	Diastolic Blood Pressure (mmHg)	Submaximal Exercise		0		
6	Katayama 2004	0	20	2	0							CON	0	5	Stroke Volume (mL)	Submaximal Exercise		-15	1	
6	Katayama 2004	0	20	2	3	2	2.9-5; 1	0.8-1.4; 0.3	40	Every other day	cycle@60W for 20min, then profile based on VO2max	AG	0	5	Stroke Volume (mL)	Submaximal Exercise		-3		
6	Katayama 2004	0	20	2	0							CON	0	5	Cardiac Output	Submaximal Exercise		9		
6	Katayama 2004	0	20	2	3	2	2.9-5; 1	0.8-1.4; 0.3	40	Every other day	cycle@60W for 20min, then profile based on VO2max	AG	0	5	Cardiac Output	Submaximal Exercise		0		
6	Katayama 2004	0	20	2	0							CON	0	5	VO2 (L/min)	Max		-26.923077	1	
6	Katayama 2004	0	20	2	3	2	2.9-5; 1	0.8-1.4; 0.3	40	Every other day	cycle@60W for 20min, then profile based on VO2max	AG	0	5	VO2 (L/min)	Max		-8.7719298		
6	Katayama 2004	0	20	2	0							CON	0	5	VO2 (L/min)	Max		-25.957447	1	
6	Katayama 2004	0	20	2	3	2	2.9-5; 1	0.8-1.4; 0.3	40	Every other day	cycle@60W for 20min, then profile based on VO2max	AG	0	5	VO2 (L/min)	Max		-7.966457		
6	Katayama 2004	0	20	2	0							CON	0	5	VCO2	Max		-24.668435	1	
6	Katayama 2004	0	20	2	3	2	2.9-5; 1	0.8-1.4; 0.3	40	Every other day	cycle@60W for 20min, then profile based on VO2max	AG	0	5	VCO2	Max		-6.3953488		1
6	Katayama 2004	0	20	2	0							CON	0	5	Ve (L/min)	Max		-15.47619		
6	Katayama 2004	0	20	2	3	2	2.9-5; 1	0.8-1.4; 0.3	40	Every other day	cycle@60W for 20min, then profile based on VO2max	AG	0	5	Ve (L/min)	Max		-6.0921248		1
6	Katayama 2004	0	20	2	0							CON	0	5	Respiratory Exchange Ratio	Max		3.30578512		
6	Katayama 2004	0	20	2	3	2	2.9-5; 1	0.8-1.4; 0.3	40	Every other day	cycle@60W for 20min, then profile based on VO2max	AG	0	5	Respiratory Exchange Ratio	Max		2.47933884		
6	Katayama 2004	0	20	2	0							CON	0	5	Heart Rate (beats/min)	Max		1.16525424		
6	Katayama 2004	0	20	2	3	2	2.9-5; 1	0.8-1.4; 0.3	40	Every other day	cycle@60W for 20min, then profile based on VO2max	AG	0	5	Heart Rate (beats/min)	Max		1.42566191		
6	Katayama 2004	0	20	2	0							CON	0	5	Exercise Time	Max		-20.27027	1	
6	Katayama 2004	0	20	2	3	2	2.9-5; 1	0.8-1.4; 0.3	40	Every other day	cycle@60W for 20min, then profile based on VO2max	AG	0	5	Exercise Time	Max		-2.962963		1
7	Iwasaki 2005	0	14	2	0							CON	0	6	Heart Rate (beats/min)	Resting		14.7540984	1	
7	Iwasaki 2005	0	14	2	3	2		1.2	30	~Every other day	Cycle at constant intensity of 60W, (n=4)	AG	0	6	Heart Rate (beats/min)	Resting		8.47457627		
7	Iwasaki 2005	0	14	2	0							CON	0	6	R-R Interval	Resting		-13.875124	1	
7	Iwasaki 2005	0	14	2	3	2		1.2	30	~Every other day	Cycle at constant intensity of 60W, (n=4)	AG	0	6	R-R Interval	Resting		-8.097561		
7	Iwasaki 2005	0	14	2	0							CON	0	6	Systolic Blood Pressure (mmHg)	Resting		0.80645161		
7	Iwasaki 2005	0	14	2	3	2		1.2	30	~Every other day	Cycle at constant intensity of 60W, (n=4)	AG	0	6	Systolic Blood Pressure (mmHg)	Resting		0		
7	Iwasaki 2005	0	14	2	0							CON	0	6	Diastolic Blood Pressure (mmHg)	Resting		4.28571429		
7	Iwasaki 2005	0	14	2	3	2		1.2	30	~Every other day	Cycle at constant intensity of 60W, (n=4)	AG	0	6	Diastolic Blood Pressure (mmHg)	Resting		-2.8571429		
7	Iwasaki 2005	0	14	2	0							CON	0	6	Respiratory Rate	Resting		0		
7	Iwasaki 2005	0	14	2	3	2		1.2	30	~Every other day	Cycle at constant intensity of 60W, (n=4)	AG	0	6	Respiratory Rate	Resting		6.25		
7	Iwasaki 2005	0	14	2	0							CON	0	6	End Tidal CO2	Resting		-4.8780488		

7	Iwasaki 2005	0	14	2	3	2		1.2	30	~Every other day	Cycle at constant intensity of 60W, (n=4)	AG	0	6	End Tidal CO2	Resting		0		
7	Iwasaki 2005	0	14	2	0							CON	0	6	Low Frequency (LF) Heart Rate	Resting		-43.823147		
7	Iwasaki 2005	0	14	2	3	2		1.2	30	~Every other day	Cycle at constant intensity of 60W, (n=4)	AG	0	6	Low Frequency (LF) Heart Rate	Resting		-37.751561		
7	Iwasaki 2005	0	14	2	0							CON	0	6	High Frequency (HF) Heart Rate	Resting		-64.980159	1	
7	Iwasaki 2005	0	14	2	3	2		1.2	30	~Every other day	Cycle at constant intensity of 60W, (n=4)	AG	0	6	High Frequency (HF) Heart Rate	Resting		-33.217391		
7	Iwasaki 2005	0	14	2	0							CON	0	6	HF sympathetic activty (SNS) (LF/HF)	Resting		47.7272727	1	
7	Iwasaki 2005	0	14	2	3	2		1.2	30	~Every other day	Cycle at constant intensity of 60W, (n=4)	AG	0	6	HF sympathetic activty (SNS) (LF/HF)	Resting		7.1942446		1
7	Iwasaki 2005	0	14	2	0							CON	0	6	Low Frequency (LF) BP	Resting		-27.419355		
7	Iwasaki 2005	0	14	2	3	2		1.2	30	~Every other day	Cycle at constant intensity of 60W, (n=4)	AG	0	6	Low Frequency (LF) BP	Resting		-24.528302		
7	Iwasaki 2005	0	14	2	0							CON	0	6	High Frequency (HF) BP	Resting		-14.285714		
7	Iwasaki 2005	0	14	2	3	2		1.2	30	~Every other day	Cycle at constant intensity of 60W, (n=4)	AG	0	6	High Frequency (HF) BP	Resting		-8.3333333		
7	Iwasaki 2005	0	14	2	0							CON	0	6	Coherence-LF (unit)	Resting		1.72413793		
7	Iwasaki 2005	0	14	2	3	2		1.2	30	~Every other day	Cycle at constant intensity of 60W, (n=4)	AG	0	6	Coherence-LF (unit)	Resting		-14.285714		
7	Iwasaki 2005	0	14	2	0							CON	0	6	Coherence-HF (unit)	Resting		-8.0645161		
7	Iwasaki 2005	0	14	2	3	2		1.2	30	~Every other day	Cycle at constant intensity of 60W, (n=4)	AG	0	6	Coherence-HF (unit)	Resting		-8.0645161		
7	Iwasaki 2005	0	14	2	0							CON	0	6	Phase-LF (radian)	Resting		11.1111111		
7	Iwasaki 2005	0	14	2	3	2		1.2	30	~Every other day	Cycle at constant intensity of 60W, (n=4)	AG	0	6	Phase-LF (radian)	Resting		1.00719424		
7	Iwasaki 2005	0	14	2	0							CON	0	6	Phase-HF (radian)	Resting		0		
7	Iwasaki 2005	0	14	2	3	2		1.2	30	~Every other day	Cycle at constant intensity of 60W, (n=4)	AG	0	6	Phase-HF (radian)	Resting		-3.7383178		
7	Iwasaki 2005	0	14	2	0							CON	0	6	Gain-LF (ms/mmHg)	Resting		-14.83871		
7	Iwasaki 2005	0	14	2	3	2		1.2	30	~Every other day	Cycle at constant intensity of 60W, (n=4)	AG	0	6	Gain-LF (ms/mmHg)	Resting		-9.0322581		
7	Iwasaki 2005	0	14	2	0							CON	0	6	Gain-HF (ms/mmHg)	Resting		-33.789954	1	
7	Iwasaki 2005	0	14	2	3	2		1.2	30	~Every other day	Cycle at constant intensity of 60W, (n=4)	AG	0	6	Gain-HF (ms/mmHg)	Resting		-13.488372		
7	Iwasaki 2005	0	14	2	0							CON	0	6	Baroflex gain by sequence analysis (m/mmHg)	Resting		-37.5	1	
7	Iwasaki 2005	0	14	2	3	2		1.2	30	~Every other day	Cycle at constant intensity of 60W, (n=4)	AG	0	6	Baroflex gain by sequence analysis (m/mmHg)	Resting		-24.623116		
7	Iwasaki 2005	0	14	2	0							CON	0	6	Plasme Volume (mL)	Resting		-16.2		
7	Iwasaki 2005	0	14	2	3	2		1.2	30	~Every other day	Cycle at constant intensity of 60W, (n=4)	AG	0	6	Plasme Volume (mL)	Resting		-6.8		1
7	Iwasaki 2005	0	14	2	0							CON	0	6	Deoxypyridinoline	Resting		72		
7	Iwasaki 2005	0	14	2	3	2		1.2	30	~Every other day	Cycle at constant intensity of 60W, (n=4)	AG	0	6	Deoxypyridinoline	Resting		22.9		
8	Iwase 2005	0	14	2	0							CON	0	6	Plasme Volume (mL)	Resting		-16.4		
8	Iwase 2005	0	14	2	3	2		1.2	30	~Every other day	Cycle at constant intensity of 60W, (n=4)	AG	0	6	Plasme Volume (mL)	Resting		-5		1
8	Iwase 2005	0	14	2	0							CON	0	6	Anti-G Score	Resting		11.9521912		
8	Iwase 2005	0	14	2	3	2		1.2	30	~Every other day	Cycle at constant intensity of 60W, (n=4)	AG	0	6	Anti-G Score	Resting		34.4295992	1	
8	Iwase 2005	0	14	2	0							CON	0	6	Tolerance Time			10.3		
8	Iwase 2005	0	14	2	3	2		1.2	30	~Every other day	Cycle at constant intensity of 60W, (n=4)	AG	0	6	Tolerance Time			26.3	1	
8	Iwase 2005	0	14	2	0							CON	0	6	Heart Rate (beats/min)	Resting		14.1065831		
8	Iwase 2005	0	14	2	3	2		1.2	30	~Every other day	Cycle at constant intensity of 60W, (n=4)	AG	0	6	Heart Rate (beats/min)	Resting		9.3442623		1
8	Iwase 2005	0	14	2	0							CON	0	6	Systolic Blood Pressure (mmHg)	Resting		3.05676856		
8	Iwase 2005	0	14	2	3	2		1.2	30	~Every other day	Cycle at constant intensity of 60W, (n=4)	AG	0	6	Systolic Blood Pressure (mmHg)	Resting		3.80779692		
8	Iwase 2005	0	14	2	0							CON	0	6	Diastolic Blood Pressure (mmHg)	Resting		1.2145749		
8	Iwase 2005	0	14	2	3	2		1.2	30	~Every other day	Cycle at constant intensity of 60W, (n=4)	AG	0	6	Diastolic Blood Pressure (mmHg)	Resting		2.65363128		
8	Iwase 2005	0	14	2	0							CON	0	6	Stroke Volume (mL)	Resting		-8.0357143		
8	Iwase 2005	0	14	2	3	2		1.2	30	~Every other day	Cycle at constant intensity of 60W, (n=4)	AG	0	6	Stroke Volume (mL)	Resting		-10.485934		
8	Iwase 2005	0	14	2	0							CON	0	6	Plasma Angiotensin II	Resting		143.333333	1	
8	Iwase 2005	0	14	2	3	2		1.2	30	~Every other day	Cycle at constant intensity of 60W, (n=4)	AG	0	6	Plasma Angiotensin II	Resting		-4.5454545		

8	Iwase 2005	0	14	2	0							CON	0	6	MSNA Burst Rate	Resting		21.4285714		
8	Iwase 2005	0	14	2	3	2		1.2	30	~Every other day	Cycle at constant intensity of 60W, (n=4)	AG	0	6	MSNA Burst Rate	Resting		-11.764706		
8	Iwase 2005	0	14	2	0							CON	0	6	Delta MSNA	30 Head-Up Tilt		-43.986448		
8	Iwase 2005	0	14	2	3	2		1.2	30	~Every other day	Cycle at constant intensity of 60W, (n=4)	AG	0	6	Delta MSNA	30 Head-Up Tilt		-59.455916		
8	Iwase 2005	0	14	2	0							CON	0	6	Delta Heart rate	30 Head-Up Tilt		18.4210526		
8	Iwase 2005	0	14	2	3	2		1.2	30	~Every other day	Cycle at constant intensity of 60W, (n=4)	AG	0	6	Delta Heart rate	30 Head-Up Tilt		-10.377358		1
8	Iwase 2005	0	14	2	0							CON	0	6	Delta Angiotensin II	30 Head-Up Tilt				
8	Iwase 2005	0	14	2	3	2		1.2	30	~Every other day	Cycle at constant intensity of 60W, (n=4)	AG	0	6	Delta Angiotensin II	30 Head-Up Tilt				
9	Iwasaki 2001	0	4	2	0							CON	0	10	Heart Rate (beats/min)	Resting		8.8	1	
9	Iwasaki 2001	0	4	2	1			2	30	Twice /		AG	0	10	Heart Rate (beats/min)	Resting		-3.4		
9	Iwasaki 2001	0	4	2	0							CON	0	10	High Frequency (HF) Heart Rate			-50	1	
9	Iwasaki 2001	0	4	2	1			2	30	Twice / day		AG	0	10	High Frequency (HF) Heart Rate			13.6		
9	Iwasaki 2001	0	4	2	0							CON	0	10	HF sympathetic activity (SNS) (LF/HF)	Resting		16.7		
9	Iwasaki 2001	0	4	2	1			2	30	Twice / day		AG	0	10	HF sympathetic activity (SNS) (LF/HF)	Resting		4		
9	Iwasaki 2001	0	4	2	0							CON	0	10	Low Frequency (LF) BP	Resting		-60	1	
9	Iwasaki 2001	0	4	2	1			2	30	Twice /		AG	0	10	Low Frequency (LF) BP	Resting		52.8	1	
9	Iwasaki 2001	0	4	2	0							CON	0	10	Hematocrit			11.6	1	
9	Iwasaki 2001	0	4	2	1			2	30	Twice /		AG	0	10	Hematocrit			4.4		
9	Iwasaki 2001	0	4	2	0							CON	0	10	VO2 (L/min)	Max		-10	1	
9	Iwasaki 2001	0	4	2	1			2	30	Twice /		AG	0	10	VO2 (L/min)	Max		-10	1	
10	Vernikos 1996	0	4	2	0							CON	0	9	Tolerance Time	60 Head-Up Tilt		-50	1	
10	Vernikos 1996	0	4	2	8				15	8 times / day		STD2	0	9	Tolerance Time	60 Head-Up Tilt		-25		
10	Vernikos 1996	0	4	2	8				15	16 times / day		STD4	0	9	Tolerance Time	60 Head-Up Tilt		-11.1		
10	Vernikos 1996	0	4	2	16				15	8 times / day	3mph	WLK2	0	9	Tolerance Time	60 Head-Up Tilt		-17.333333	1	
10	Vernikos 1996	0	4	2	16				15	16 times / day	3mph	WLK4	0	9	Tolerance Time	60 Head-Up Tilt		-28.534704	1	
10	Vernikos 1996	0	4	2	0							CON	0	9	Delta Heart rate	60 Head-Up Tilt		125	1	
10	Vernikos 1996	0	4	2	8				15	8 times / day		STD2	0	9	Delta Heart rate	60 Head-Up Tilt		62.5	1	
10	Vernikos 1996	0	4	2	8				15	16 times / day		STD4	0	9	Delta Heart rate	60 Head-Up Tilt		56.2	1	
10	Vernikos 1996	0	4	2	16				15	8 times / day	3mph	WLK2	0	9	Delta Heart rate	60 Head-Up Tilt		62.5	1	
10	Vernikos 1996	0	4	2	16				15	16 times / day	3mph	WLK4	0	9	Delta Heart rate	60 Head-Up Tilt		56.2	1	
10	Vernikos 1996	0	4	2	0							CON	0	9	Delta Mean Arterial Pressure	60 Head-Up Tilt		0		
10	Vernikos 1996	0	4	2	8				15	8 times / day		STD2	0	9	Delta Mean Arterial Pressure	60 Head-Up Tilt		0		
10	Vernikos 1996	0	4	2	8				15	16 times / day		STD4	0	9	Delta Mean Arterial Pressure	60 Head-Up Tilt		0		
10	Vernikos 1996	0	4	2	16				15	8 times / day	3mph	WLK2	0	9	Delta Mean Arterial Pressure	60 Head-Up Tilt		0		
10	Vernikos 1996	0	4	2	16				15	16 times / day	3mph	WLK4	0	9	Delta Mean Arterial Pressure	60 Head-Up Tilt		0		
10	Vernikos 1996	0	4	2	0							CON	0	9	VO2 (L/min)	Max		-16.9		
10	Vernikos 1996	0	4	2	8				15	8 times / day		STD2	0	9	VO2 (L/min)	Max		-14		
10	Vernikos 1996	0	4	2	8				15	16 times / day		STD4	0	9	VO2 (L/min)	Max		-11.5		1
10	Vernikos 1996	0	4	2	16				15	8 times / day	3mph	WLK2	0	9	VO2 (L/min)	Max		-9		1
10	Vernikos 1996	0	4	2	16				15	16 times / day	3mph	WLK4	0	9	VO2 (L/min)	Max		-9.3		1
10	Vernikos 1996	0	4	2	0							CON	0	9	Plasme Volume (mL)	Resting		-10.5		
10	Vernikos 1996	0	4	2	8				15	8 times / day		STD2	0	9	Plasme Volume (mL)	Resting		-11.8		
10	Vernikos 1996	0	4	2	8				15	16 times / day		STD4	0	9	Plasme Volume (mL)	Resting		-5.2		1
10	Vernikos 1996	0	4	2	16				15	8 times / day	3mph	WLK2	0	9	Plasme Volume (mL)	Resting		-11		
10	Vernikos 1996	0	4	2	16				15	16 times / day	3mph	WLK4	0	9	Plasme Volume (mL)	Resting		-3.7		1
10	Vernikos 1996	0	4	2	0							CON	0	9	Calcium	Urinary		80		

10	Vernikos 1996	0	4	2	8				15	8 times / day		STD2	0	9	Calcium	Urinary		30		
10	Vernikos 1996	0	4	2	8				15	16 times / day		STD4	0	9	Calcium	Urinary		35		
10	Vernikos 1996	0	4	2	16				15	8 times / day	3mph	WLK2	0	9	Calcium	Urinary		5		
10	Vernikos 1996	0	4	2	16				15	16 times / day	3mph	WLK4	0	9	Calcium	Urinary		3		
11	Vil-Viliams 1980	0	3	5	0							CON	0	6	Tolerance Time	3Gz Overload (measurement before and last minute)		-11.111111		
11	Vil-Viliams 1980	0	3	5	1	1.74	0.8		60	Twice / day		0.8AG(2x)	0	6	Tolerance Time	3Gz Overload (measurement before and last minute)		-14.503817		
11	Vil-Viliams 1980	0	3	5	1	1.74	1.2		60	Twice / day		1.2AG(2x)	0	6	Tolerance Time	3Gz Overload (measurement before and last minute)		-4.1666667		
11	Vil-Viliams 1980	0	3	5	1	1.74	1.6		60	Twice / day		1.6AG(2x)	0	4	Tolerance Time	3Gz Overload (measurement before and last minute)		-11.524164		
11	Vil-Viliams 1980	0	3	5	0							CON	0	6	Tolerance Time	3Gz Overload (measurement before and last minute)		-40.84507		
11	Vil-Viliams 1980	0	3	5	1	1.74	0.8		40	Thrice / day		0.8AG(3x)	0	5	Tolerance Time	3Gz Overload (measurement before and last minute)		-21.95122		
11	Vil-Viliams 1980	0	3	5	1	1.74	1.2		40	Thrice / day		1.2AG(3x)	0	6	Tolerance Time	3Gz Overload (measurement before and last minute)		-7.9136691		
11	Vil-Viliams 1980	0	3	5	1	1.74	1.6		40	Thrice / day		1.6AG(3x)	0	5	Tolerance Time	3Gz Overload (measurement before and last minute)		-0.3344482		1
11	Vil-Viliams 1980	0	3	5	0							CON	0	6	Anti-G Score					
11	Vil-Viliams 1980	0	3	5	1	1.74	1.6		40	Thrice / day		1.6AG(3x)	0	5	Anti-G Score					
11	Vil-Viliams 1980	0	3	5	0							CON	0	18	Delta Heart rate	3Gz Overload (measurement before and last minute)		100		
11	Vil-Viliams 1980	0	3	5	1	1.74	0.8		40, 60	Twice or Thrice/ day		0.8AG	0	11	Delta Heart rate	3Gz Overload (measurement before and last minute)		115		
11	Vil-Viliams 1980	0	3	5	1	1.74	1.2		40, 60	Twice or Thrice/ day		1.2AG	0	12	Delta Heart rate	3Gz Overload (measurement before and last minute)		117		
11	Vil-Viliams 1980	0	3	5	1	1.74	1.6		40, 60	Twice or Thrice/ day		1.6AG	0	9	Delta Heart rate	3Gz Overload (measurement before and last minute)		120		
11	Vil-Viliams 1980	0	3	5	0							CON	0	18	Delta Photoplethysmographic (PPG)	3Gz Overload (measurement before and last minute)		-77		
11	Vil-Viliams 1980	0	3	5	1	1.74	0.8		40, 60	Twice or Thrice/ day		0.8AG	0	11	Delta Photoplethysmographic (PPG)	3Gz Overload (measurement before and last minute)		-60		
11	Vil-Viliams 1980	0	3	5	1	1.74	1.2		40, 60	Twice or Thrice/ day		1.2AG	0	12	Delta Photoplethysmographic (PPG)	3Gz Overload (measurement before and last minute)		-56		
11	Vil-Viliams 1980	0	3	5	1	1.74	1.6		40, 60	Twice or Thrice/ day		1.6AG	0	9	Delta Photoplethysmographic (PPG)	3Gz Overload (measurement before and last minute)		-42		
11	Vil-Viliams 1980	0	3	5	0							CON	0	18	Delta Blood Pressure	3Gz Overload (measurement before and last minute)		-82		
11	Vil-Viliams 1980	0	3	5	1	1.74	0.8		40, 60	Twice or Thrice/ day		0.8AG	0	11	Delta Blood Pressure	3Gz Overload (measurement before and last minute)		-52		
11	Vil-Viliams 1980	0	3	5	1	1.74	1.2		40, 60	Twice or Thrice/ day		1.2AG	0	12	Delta Blood Pressure	3Gz Overload (measurement before and last minute)		-64		
11	Vil-Viliams 1980	0	3	5	1	1.74	1.6		40, 60	Twice or Thrice/ day		1.6AG	0	9	Delta Blood Pressure	3Gz Overload (measurement before and last minute)		-42		
11	Vil-Viliams 1980	0	3	5	0							CON	0	18	Delta Heart rate	3Gz Overload (measurement before and after)		34		

11	Vil-Viliams 1980	0	3	5	1	1.74	0.8, 1.2, 1.6		40, 60	Twice or Thrice/ day		AG	0	32	Delta Heart rate	3Gz Overload (measurement before and after)		30		
11	Vil-Viliams 1980	0	3	5	0							CON	0	18	Delta Systollic Volume	3Gz Overload (measurement before and after)		-22		
11	Vil-Viliams 1980	0	3	5	1	1.74	0.8, 1.2, 1.6		40, 60	Twice or Thrice/ day		AG	0	32	Delta Systollic Volume	3Gz Overload (measurement before and after)		-5		
11	Vil-Viliams 1980	0	3	5	0							CON	0	18	Delta Cardiac output	3Gz Overload (measurement before and after)		4		
11	Vil-Viliams 1980	0	3	5	1	1.74	0.8, 1.2, 1.6		40, 60	Twice or Thrice/ day		AG	0	32	Delta Cardiac output	3Gz Overload (measurement before and after)		20		
12	Shulzhenko 1977	0	56	6	1		0.6-0.9		90	Daily for 7 days	Protocol: Day 1-7 Centrifugation; 8-21 Immersion only; 22-28 Centrifuge + water/salt; 29-35 Immersion only; 36-40 Exercise (bungee cords 2340kg total on legs, ab, arms); 41-47 Immersion only; 48-52 Centrifugation +Exercise; 53-54 Immersion only; 55-56 All three	AG	0	2	Heart Rate (beats/min)	Resting		44.5		
12	Shulzhenko 1977	0	56	6	64					Daily for 5 days	Protocol: Day 1-7 Centrifugation; 8-21 Immersion only; 22-28 Centrifuge + water/salt; 29-35 Immersion only; 36-40 Exercise (bungee cords 2340kg total on legs, ab, arms); 41-47 Immersion only; 48-52 Centrifugation +Exercise; 53-54 Immersion only; 55-56 All three	BRE	0	2	Heart Rate (beats/min)	Resting		15.5		
12	Shulzhenko 1977	0	56	6	65		0.6-0.10		90	Daily for 5 days	Protocol: Day 1-7 Centrifugation; 8-21 Immersion only; 22-28 Centrifuge + water/salt; 29-35 Immersion only; 36-40 Exercise (bungee cords 2340kg total on legs, ab, arms); 41-47 Immersion only; 48-52 Centrifugation +Exercise; 53-54 Immersion only; 55-56 All three	AG+BRE	0	2	Heart Rate (beats/min)	Resting		82		
12	Shulzhenko 1977	0	56	6	0						Protocol: Day 1-7 Centrifugation; 8-21 Immersion only; 22-28 Centrifuge + water/salt; 29-35 Immersion only; 36-40 Exercise (bungee cords 2340kg total on legs, ab, arms); 41-47 Immersion only; 48-52 Centrifugation +Exercise; 53-54 Immersion only; 55-56 All three	CON	0	2	Total Renal Excretion			11.1		
12	Shulzhenko 1977	0	56	6	1		0.6-0.9		90	Daily for 7 days	Protocol: Day 1-7 Centrifugation; 8-21 Immersion only; 22-28 Centrifuge + water/salt; 29-35 Immersion only; 36-40 Exercise (bungee cords 2340kg total on legs, ab, arms); 41-47 Immersion only; 48-52 Centrifugation +Exercise; 53-54 Immersion only; 55-56 All three	AG	0	2	Total Renal Excretion			-25.2		
12	Shulzhenko 1977	0	56	6	33		0.6-0.10		90	Daily for 5 days	Protocol: Day 1-7 Centrifugation; 8-21 Immersion only; 22-28 Centrifuge + water/salt; 29-35 Immersion only; 36-40 Exercise (bungee cords 2340kg total on legs, ab, arms); 41-47 Immersion only; 48-52 Centrifugation +Exercise; 53-54 Immersion only; 55-56 All three	AGNaCl	0	2	Total Renal Excretion			-74.1		
12	Shulzhenko 1977	0	56	6	1		0.6-0.9		90	Daily for 7 days	Protocol: Day 1-7 Centrifugation; 8-21 Immersion only; 22-28 Centrifuge + water/salt; 29-35 Immersion only; 36-40 Exercise (bungee cords 2340kg total on legs, ab, arms); 41-47 Immersion only; 48-52 Centrifugation +Exercise; 53-54 Immersion only; 55-56 All three	AG	0	2	Total Renal Excretion of Creatinine			-9		
12	Shulzhenko 1977	0	56	6	1		0.6-0.9		90	Daily for 7 days	Protocol: Day 1-7 Centrifugation; 8-21 Immersion only; 22-28 Centrifuge + water/salt; 29-35 Immersion only; 36-40 Exercise (bungee cords 2340kg total on legs, ab, arms); 41-47 Immersion only; 48-52 Centrifugation +Exercise; 53-54 Immersion only; 55-56 All three	AG	0	2	Total Renal Excretion of Sodium			-25.5		
12	Shulzhenko 1977	0	56	6	1		0.6-0.9		90	Daily for 7 days	Protocol: Day 1-7 Centrifugation; 8-21 Immersion only; 22-28 Centrifuge + water/salt; 29-35 Immersion only; 36-40 Exercise (bungee cords 2340kg total on legs, ab, arms); 41-47 Immersion only; 48-52 Centrifugation +Exercise; 53-54 Immersion only; 55-56 All three	AG	0	2	Total Renal Excretion of Potassium			-20		
12	Shulzhenko 1977	0	56	6	1		0.6-0.9		90	Daily for 7 days	Protocol: Day 1-7 Centrifugation; 8-21 Immersion only; 22-28 Centrifuge + water/salt; 29-35 Immersion only; 36-40 Exercise (bungee cords 2340kg total on legs, ab, arms); 41-47 Immersion only; 48-52 Centrifugation +Exercise; 53-54 Immersion only; 55-56 All three	AG	0	2	Total Renal Excretion of Calcium			-9.7		

13	Shulzhenko 1979	0	3	6	0							CON	0	6	Tolerance Time	3Gz Overload (measurement before and last minute)		-29		
13	Shulzhenko 1979	0	3	6	1	2	0.8		40	3 times / day		0.8AG	0	6	Tolerance Time	3Gz Overload (measurement before and last minute)		-18		
13	Shulzhenko 1979	0	3	6	1	2	1.2		40	3 times / day		1.2AG	0	5	Tolerance Time	3Gz Overload (measurement before and last minute)		-7.3		
13	Shulzhenko 1979	0	3	6	1	2	1.6		40	3 times / day		1.6AG	0	5	Tolerance Time	3Gz Overload (measurement before and last minute)		-1		
13	Shulzhenko 1979	0	3	6	0							CON	0	6	Plasme Volume (mL)			-20		
13	Shulzhenko 1979	0	3	6	1	2	0.8		40	3 times / day		0.8AG	0	6	Plasme Volume (mL)			-17.9		
13	Shulzhenko 1979	0	3	6	1	2	1.2		40	3 times / day		1.2AG	0	5	Plasme Volume (mL)			-14.4		
13	Shulzhenko 1979	0	3	6	1	2	1.6		40	3 times / day		1.6AG	0	5	Plasme Volume (mL)			-14.9		
13	Shulzhenko 1979	0	3	6	0							CON	0	6	Fluid Balance					
13	Shulzhenko 1979	0	3	6	1	2	0.8		40	3 times / day		0.8AG	0	6	Fluid Balance			-23.5		
13	Shulzhenko 1979	0	3	6	1	2	1.2		40	3 times / day		1.2AG	0	5	Fluid Balance			-59.5		
13	Shulzhenko 1979	0	3	6	1	2	1.6		40	3 times / day		1.6AG	0	5	Fluid Balance			-52		
14	Grigoriev 1979	0	13	5	0							CON	0	5	Sodium Concentration in Serum			2.8		
14	Grigoriev 1979	0	13	5	1	7.25	0.6-2		60-90	Daily after day 8		AG	0	5	Sodium Concentration in Serum			0		
14	Grigoriev 1979	0	13	5	0							CON	0	5	Potassium Concentration in Serum			-15.2	1	
14	Grigoriev 1979	0	13	5	1	7.25	0.6-2		60-90	Daily after day 8		AG	0	5	Potassium Concentration in Serum			-4.4		
14	Grigoriev 1979	0	13	5	0							CON	0	5	Calcium Concentration in Serum			16.6		
14	Grigoriev 1979	0	13	5	1	7.25	0.6-2		60-90	Daily after day 8		AG	0	5	Calcium Concentration in Serum			10.4		
14	Grigoriev 1979	0	13	5	0							CON	0	5	Magnesium Concentration in Serum			19.2		
14	Grigoriev 1979	0	13	5	1	7.25	0.6-2		60-90	Daily after day 8		AG	0	5	Magnesium Concentration in Serum			13.5		
14	Grigoriev 1979	0	13	5	0							CON	0	5	Osmolarity			1.7		
14	Grigoriev 1979	0	13	5	1	7.25	0.6-2		60-90	Daily after day 8		AG	0	5	Osmolarity			-0.6		
14	Grigoriev 1979	0	13	5	0							CON	0	5	Total Renal Excretion			36	1	
14	Grigoriev 1979	0	13	5	1	7.25	0.6-2		60-90	Daily after day 8		AG	0	5	Total Renal Excretion			14.2		
14	Grigoriev 1979	0	13	5	0							CON	0	5	Total Renal Excretion of Osmotically Active Substances			20.6	1	
14	Grigoriev 1979	0	13	5	1	7.25	0.6-2		60-90	Daily after day 8		AG	0	5	Total Renal Excretion of Osmotically Active Substances			7.1		
14	Grigoriev 1979	0	13	5	0							CON	0	5	Total Renal Excretion of Sodium			31.4	1	
14	Grigoriev 1979	0	13	5	1	7.25	0.6-2		60-90	Daily after day 8		AG	0	5	Total Renal Excretion of Sodium			0		
14	Grigoriev 1979	0	13	5	0							CON	0	5	Total Renal Excretion of Potassium			69.5	1	
14	Grigoriev 1979	0	13	5	1	7.25	0.6-2		60-90	Daily after day 8		AG	0	5	Total Renal Excretion of Potassium			44.6		
14	Grigoriev 1979	0	13	5	0							CON	0	5	Total Renal Excretion of Calcium			37.2	1	
14	Grigoriev 1979	0	13	5	1	7.25	0.6-2		60-90	Daily after day 8		AG	0	5	Total Renal Excretion of Calcium			29.2		
14	Grigoriev 1979	0	13	5	0							CON	0	5	Total Renal Excretion of Magnesium			38.9	1	
14	Grigoriev 1979	0	13	5	1	7.25	0.6-2		60-90	Daily after day 8		AG	0	5	Total Renal Excretion of Magnesium			13.2		
15	Shulzhenko 1980	0	3	5	0							CON	0	10	Total Renal Excretion			39.4	1	
15	Shulzhenko 1980	0	3	5	1	2	1.2,1.6		30	Twice /	15 min @ 1.2, 15 min @ 1.6	AG	0	10	Total Renal Excretion			22.8	1	1
15	Shulzhenko 1980	0	3	5	0							CON	0	10	Total Renal Excretion of Sodium			18.8		

15	Shulzhenko 1980	0	3	5	1	2	1.2,1.6		30	Twice / day	15 min @ 1.2, 15 min @ 1.6	AG	0	10	Total Renal Excretion of Sodium			-0.2		
15	Shulzhenko 1980	0	3	5	0							CON	0	10	Total Renal Excretion of Potassium			14.1		
15	Shulzhenko 1980	0	3	5	1	2	1.2,1.6		30	Twice / day	15 min @ 1.2, 15 min @ 1.6	AG	0	10	Total Renal Excretion of Potassium			0		
15	Shulzhenko 1980	0	3	5	0							CON	0	10	Sodium / Potassium			6.9	1	
15	Shulzhenko 1980	0	3	5	1	2	1.2,1.6		30	Twice /	15 min @ 1.2, 15 min @ 1.6	AG	0	10	Sodium / Potassium			2.3		
16	Vil-Viliams 1980	0	28	5	0							CON	0	4	Tolerance Time	3Gz Overload (measurement before and last minute)		-56.3		
16	Vil-Viliams 1980	0	28	5	3	1.74	0.8, 1.2, 1.6		60	Twice / day	Day 1-8, 15, 22 - immersion, Day 9-14 - SAC, Day 16-21 cycling @600kgf/min 10 min then 10 rest for 60 min twice/day, Day 23-28 SACwith cycling	AG+CYC	0	4	Tolerance Time	3Gz Overload (measurement before and last minute)		-8.3		
16	Vil-Viliams 1980	0	28	5	0							CON	0	4	Anti-G Score					
16	Vil-Viliams 1980	0	28	5	3	1.74	0.8, 1.2, 1.6		60	Twice / day	Day 1-8, 15, 22 - immersion, Day 9-14 - SAC, Day 16-21 cycling @600kgf/min 10 min then 10 rest for 60 min twice/day, Day 23-28 SACwith cycling	AG+CYC	0	4	Anti-G Score					
17	Sasaki 1999	0	4	2	0							BR	0	4	R-R Interval	Resting		-5.96	1	
17	Sasaki 1999	0	4	2	1	1.8		2	30	Twice /		AG	0	8	R-R Interval	Resting		2.22		1
17	Sasaki 1999	0	4	2	0							BR	0	4	High Frequency (HF) Heart Rate	Resting		-46.3	1	
17	Sasaki 1999	0	4	2	1	1.8		2	30	Twice / day		AG	0	8	High Frequency (HF) Heart Rate	Resting		5.08		1
17	Sasaki 1999	0	4	2	0							BR	0	4	HF sympathetic activity (SNS) (LF/HF)	Resting		18.5		
17	Sasaki 1999	0	4	2	1	1.8		2	30	Twice / day		AG	0	8	HF sympathetic activity (SNS) (LF/HF)	Resting		5.17		
17	Sasaki 1999	0	4	2	0							BR	0	4	Baroflex gain by sequence analysis (m/mmHg)	Resting		-30.9	1	
17	Sasaki 1999	0	4	2	1	1.8		2	30	Twice / day		AG	0	8	Baroflex gain by sequence analysis (m/mmHg)	Resting		10.6		1
19	Smith 2009	0	21	2	0							CON	0	7	25(OH)-vitamin D	Serum		1.8		
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	25(OH)-vitamin D	Serum		3.2		
19	Smith 2009	0	21	2	0							CON	0	7	1,25(OH)-vitamin D	Serum		-2.4		
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	1,25(OH)-vitamin D	Serum		-21.4		
19	Smith 2009	0	21	2	0							CON	0	7	Parathyroid Hormone (intact molecule)	Serum		-22	1	
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Parathyroid Hormone (intact molecule)	Serum		-18	1	
19	Smith 2009	0	21	2	0							CON	0	7	Ionized Calcium	Serum		0.8		
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Ionized Calcium	Serum		0		
19	Smith 2009	0	21	2	0							CON	0	7	Calcium	Serum		-1		
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Calcium	Serum		0.5		
19	Smith 2009	0	21	2	0							CON	0	7	Calcium	Urinary		9.2		
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Calcium	Urinary		12.7		
19	Smith 2009	0	21	2	0							CON	0	7	n-telopeptide	Urinary		44.4	1	
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	n-telopeptide	Urinary		19.1	1	
19	Smith 2009	0	21	2	0							CON	0	7	c-telopeptide	Serum		33.3	1	
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	c-telopeptide	Serum		22.2	1	
19	Smith 2009	0	21	2	0							CON	0	7	Helical Peptide	Urinary		54.5	1	
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Helical Peptide	Urinary		42.4	1	
19	Smith 2009	0	21	2	0							CON	0	7	Deoxypyridinoline	Urinary		55	1	
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Deoxypyridinoline	Urinary		44.4	1	
19	Smith 2009	0	21	2	0							CON	0	7	Pyridinium cosslink	Urinary		43		
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Pyridinium cosslink	Urinary		23.9		
19	Smith 2009	0	21	2	0							CON	0	7	Bone specific alkaline phosphate	Serum		3.2		
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Bone specific alkaline phosphate	Serum		-13.3		
19	Smith 2009	0	21	2	0							CON	0	7	Total Alkaline Phosphatase	Serum		9.8		
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Total Alkaline Phosphatase	Serum		-3.3		
19	Smith 2009	0	21	2	0							CON	0	7	Procollagen type 1 N propeptide	Serum		-3.4		
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Procollagen type 1 N propeptide	Serum		-11.8		
19	Smith 2009	0	21	2	0							CON	0	7	Osteocalcin	Serum		-4.3	1	
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Osteocalcin	Serum		-11.5	1	
19	Smith 2009	0	21	2	0							CON	0	7	Osteoprotegerin	Serum		0		
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Osteoprotegerin	Serum		2.3		
19	Smith 2009	0	21	2	0							CON	0	7	Tartrate-resistant acid phosphatase	Serum		16.7	1	
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Tartrate-resistant acid phosphatase	Serum		15.6	1	

19	Smith 2009	0	21	2	0							CON	0	7	Bone Mineral Content	Whole Body		-1.1		
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Bone Mineral Content	Whole Body		-0.7		
19	Smith 2009	0	21	2	0							CON	0	7	Bone Mineral Density	Whole Body		-0.3		
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Bone Mineral Density	Whole Body		0		
19	Smith 2009	0	21	2	0							CON	0	7	Bone Mineral Density	Pelvis		-1.1		
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Bone Mineral Density	Pelvis		-0.6		
19	Smith 2009	0	21	2	0							CON	0	7	Bone Mineral Density	Calcaneus		0.6		
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Bone Mineral Density	Calcaneus		-0.1		
19	Smith 2009	0	21	2	0							CON	0	7	Bone Mineral Density	Spine		-0.6		
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Bone Mineral Density	Spine		-0.2		
19	Smith 2009	0	21	2	0							CON	0	7	Bone Mineral Density	Trochanter		-0.9		
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Bone Mineral Density	Trochanter		-0.7		
19	Smith 2009	0	21	2	0							CON	0	7	Bone Mineral Density	Femoral Neck		-0.1		
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Bone Mineral Density	Femoral Neck		0.2		
19	Smith 2009	0	21	2	0							CON	0	7	Bone Mineral Density	Total Hip		-0.8		
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Bone Mineral Density	Total Hip		-0.5		
19	Smith 2009	0	21	2	0							CON	0	7	Bone Mineral Density	Tibia Epiphysis (5% from ankle)		0.8		
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Bone Mineral Density	Tibia Epiphysis (5% from ankle)		0		
19	Smith 2009	0	21	2	0							CON	0	7	Cortical Density	Tibia Epiphysis (5% from ankle)		1.2		
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Cortical Density	Tibia Epiphysis (5% from ankle)		0		
19	Smith 2009	0	21	2	0							CON	0	7	Trabecular Density	Tibia Epiphysis (5% from ankle)		-0.4		
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Trabecular Density	Tibia Epiphysis (5% from ankle)		-0.4		
19	Smith 2009	0	21	2	0							CON	0	7	Polar Strength-strain Index	Tibia Epiphysis (5% from ankle)		1.6		
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Polar Strength-strain Index	Tibia Epiphysis (5% from ankle)		0.1		
19	Smith 2009	0	21	2	0							CON	0	7	Bone Mineral Density	Tibia Shaft (50% from ankle)		-0.3		
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Bone Mineral Density	Tibia Shaft (50% from ankle)		0		
19	Smith 2009	0	21	2	0							CON	0	7	Cortical Density	Tibia Shaft (50% from ankle)		-0.6		
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Cortical Density	Tibia Shaft (50% from ankle)		0.3		
19	Smith 2009	0	21	2	0							CON	0	7	Trabecular Density	Tibia Shaft (50% from ankle)		0.8		
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Trabecular Density	Tibia Shaft (50% from ankle)		-0.4		
19	Smith 2009	0	21	2	0							CON	0	7	Polar Strength-strain Index	Tibia Shaft (50% from ankle)		0.3		
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Polar Strength-strain Index	Tibia Shaft (50% from ankle)		-0.2		
19	Smith 2009	0	21	2	0							CON	0	7	Bone Mineral Density	Tibia Proximal #1 (insertion of patellar)		0.3		
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Bone Mineral Density	Tibia Proximal #1 (insertion of patellar)		0		
19	Smith 2009	0	21	2	0							CON	0	7	Cortical Density	Tibia Proximal #1 (insertion of patellar)		-0.2		
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Cortical Density	Tibia Proximal #1 (insertion of patellar)		0.4		
19	Smith 2009	0	21	2	0							CON	0	7	Trabecular Density	Tibia Proximal #1 (insertion of patellar)		1.2		
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Trabecular Density	Tibia Proximal #1 (insertion of patellar)		-1.2		
19	Smith 2009	0	21	2	0							CON	0	7	Polar Strength-strain Index	Tibia Proximal #1 (insertion of patellar)		-1		
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Polar Strength-strain Index	Tibia Proximal #1 (insertion of patellar)		1.5		
19	Smith 2009	0	21	2	0							CON	0	7	Bone Mineral Density	Tibia Proximal #2 (insertion of patellar)		0		
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Bone Mineral Density	Tibia Proximal #2 (insertion of patellar)		0.3		
19	Smith 2009	0	21	2	0							CON	0	7	Cortical Density	Tibia Proximal #2 (insertion of patellar)		-0.2		
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Cortical Density	Tibia Proximal #2 (insertion of patellar)		0.2		
19	Smith 2009	0	21	2	0							CON	0	7	Trabecular Density	Tibia Proximal #2 (insertion of patellar)		0		

19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Trabecular Density	Tibia Proximal #2 (insertion of patellar)		0		
19	Smith 2009	0	21	2	0							CON	0	7	Polar Strength-strain Index	Tibia Proximal #2 (insertion of patellar)		-1.4		
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Polar Strength-strain Index	Tibia Proximal #2 (insertion of patellar)		0.2		
19	Smith 2009	0	21	2	0							CON	0	7	Bone Mineral Density	Tibia Proximal #3 (insertion of patellar)		0.7		
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Bone Mineral Density	Tibia Proximal #3 (insertion of patellar)		0		
19	Smith 2009	0	21	2	0							CON	0	7	Cortical Density	Tibia Proximal #3 (insertion of patellar)		0.8		
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Cortical Density	Tibia Proximal #3 (insertion of patellar)		0		
19	Smith 2009	0	21	2	0							CON	0	7	Trabecular Density	Tibia Proximal #3 (insertion of patellar)		0		
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Trabecular Density	Tibia Proximal #3 (insertion of patellar)		0		
19	Smith 2009	0	21	2	0							CON	0	7	Polar Strength-strain Index	Tibia Proximal #3 (insertion of patellar)		0.3		
19	Smith 2009	0	21	2	1	3	2.5	1	60	Daily		AG	0	8	Polar Strength-strain Index	Tibia Proximal #3 (insertion of patellar)		1.9		
20	Greenleaf 1989	0	30	2	0							CON	0	5	Tolerance Time	60 Head-Up Tilt		-34.7	1	
20	Greenleaf 1989	0	30	2	2				30	Twice daily / 5 days per week	7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40% (supine ergometer)	CYC	0	7	Tolerance Time	60 Head-Up Tilt		-19	1	
20	Greenleaf 1989	0	30	2	1024				30	Twice daily / 5 days per week	5 min warm-up, 5 peak knee flexions and extensions (90° arc) in 10s and rested remaining 50s. Repeat 10 times, 4min cooling down, repeat with other leg	ISK	0	7	Tolerance Time	60 Head-Up Tilt		-43.3	1	
20	Greenleaf 1989	0	30	2	0							CON	0	5	Anti-G Score					
20	Greenleaf 1989	0	30	2	2				30	Twice daily / 5 days per week	7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40% (supine ergometer)	CYC	0	7	Anti-G Score					
20	Greenleaf 1989	0	30	2	1024				30	Twice daily / 5 days per week	5 min warm-up, 5 peak knee flexions and extensions (90° arc) in 10s and rested remaining 50s. Repeat 10 times, 4min cooling down, repeat with other leg	ISK	0	7	Anti-G Score					
20	Greenleaf 1989	0	30	2	0							CON	0	5	Delta Heart rate	60 Head-Up Tilt		156.2	1	
20	Greenleaf 1989	0	30	2	2				30	Twice daily / 5 days per week	7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40% (supine ergometer)	CYC	0	7	Delta Heart rate	60 Head-Up Tilt		150	1	
20	Greenleaf 1989	0	30	2	1024				30	Twice daily / 5 days per week	5 min warm-up, 5 peak knee flexions and extensions (90° arc) in 10s and rested remaining 50s. Repeat 10 times, 4min cooling down, repeat with other leg	ISK	0	7	Delta Heart rate	60 Head-Up Tilt		142.1	1	
20	Greenleaf 1989	0	30	2	0							CON	0	5	Delta SBP	60 Head-Up Tilt		#DIV/0!		
20	Greenleaf 1989	0	30	2	2				30	Twice daily / 5 days per week	7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40% (supine ergometer)	CYC	0	7	Delta SBP	60 Head-Up Tilt		0		
20	Greenleaf 1989	0	30	2	1024				30	Twice daily / 5 days per week	5 min warm-up, 5 peak knee flexions and extensions (90° arc) in 10s and rested remaining 50s. Repeat 10 times, 4min cooling down, repeat with other leg	ISK	0	7	Delta SBP	60 Head-Up Tilt		125		
20	Greenleaf 1989	0	30	2	0							CON	0	5	Delta DBP	60 Head-Up Tilt		122.2		
20	Greenleaf 1989	0	30	2	2				30	Twice daily / 5 days per week	7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40% (supine ergometer)	CYC	0	7	Delta DBP	60 Head-Up Tilt		125		
20	Greenleaf 1989	0	30	2	1024				30	Twice daily / 5 days per week	5 min warm-up, 5 peak knee flexions and extensions (90° arc) in 10s and rested remaining 50s. Repeat 10 times, 4min cooling down, repeat with other leg	ISK	0	7	Delta DBP	60 Head-Up Tilt		-16.6		
20	Greenleaf 1989	0	30	2	0							CON	0	5	Plasme Volume (mL)			-17.3	1	
20	Greenleaf 1989	0	30	2	2				30	Twice daily / 5 days per week	7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40% (supine ergometer)	CYC	0	7	Plasme Volume (mL)			-4.4		
20	Greenleaf 1989	0	30	2	1024				30	Twice daily / 5 days per week	5 min warm-up, 5 peak knee flexions and extensions (90° arc) in 10s and rested remaining 50s. Repeat 10 times, 4min cooling down, repeat with other leg	ISK	0	7	Plasme Volume (mL)			-18.4	1	
20	Greenleaf 1989	0	30	2	0							CON	0	5	VO2 (L/min)	Max		-20.4	1	
20	Greenleaf 1989	0	30	2	2				30	Twice daily / 5 days per week	7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40% (supine ergometer)	CYC	0	7	VO2 (L/min)	Max		0.3		
20	Greenleaf 1989	0	30	2	1024				30	Twice daily / 5 days per week	5 min warm-up, 5 peak knee flexions and extensions (90° arc) in 10s and rested remaining 50s. Repeat 10 times, 4min cooling down, repeat with other leg	ISK	0	7	VO2 (L/min)	Max		-10.4	1	
20	Greenleaf 1989	0	30	2	0							CON	0	5	Red Blood Cell Volume			-11.1	1	
20	Greenleaf 1989	0	30	2	2				30	Twice daily / 5 days per week	7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40% (supine ergometer)	CYC	0	7	Red Blood Cell Volume			-7.6		

20	Greenleaf 1989	0	30	2	1024				30	Twice daily / 5 days per week	5 min warm-up, 5 peak knee flexions and extensions (90° arc) in 10s and rested remaining 50s. Repeat 10 times, 4min cooling down, repeat with other leg	ISK	0	7	Red Blood Cell Volume			-17.2	1	
20	Greenleaf 1989	0	30	2	0							CON	0	5	Total Blood Volume			-12.6		
20	Greenleaf 1989	0	30	2	2				30	Twice daily / 5 days per week	7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40% (supine ergometer)	CYC	0	7	Total Blood Volume			-3		
20	Greenleaf 1989	0	30	2	1024				30	Twice daily / 5 days per week	5 min warm-up, 5 peak knee flexions and extensions (90° arc) in 10s and rested remaining 50s. Repeat 10 times, 4min cooling down, repeat with other leg	ISK	0	7	Total Blood Volume			-17.7	1	
20	Greenleaf 1989	0	30	2	0							CON	0	5	Heart Rate (beats/min)	Resting		19.6		
20	Greenleaf 1989	0	30	2	2				30	Twice daily / 5 days per week	7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40% (supine ergometer)	CYC	0	7	Heart Rate (beats/min)	Resting		8.1		
20	Greenleaf 1989	0	30	2	1024				30	Twice daily / 5 days per week	5 min warm-up, 5 peak knee flexions and extensions (90° arc) in 10s and rested remaining 50s. Repeat 10 times, 4min cooling down, repeat with other leg	ISK	0	7	Heart Rate (beats/min)	Resting		13.2		
21	Lee 2009	0	30	2	0							CON	7	0	Exercise Time	Max		-20.9	1	1
21	Lee 2009	0	30	2	260				45	Daily / 6 days per week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	7	0	Exercise Time	Max		-3.7		
21	Lee 2009	0	30	2	0							CON	7	0	Peak Treadmill Grade			-100	1	1
21	Lee 2009	0	30	2	260				45	Daily / 6 days per week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	7	0	Peak Treadmill Grade			-6.6		
21	Lee 2009	0	30	2	0							CON	7	0	VO2 (L/min)	Max		-16.3	1	1
21	Lee 2009	0	30	2	260				45	Daily / 6 days per week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	7	0	VO2 (L/min)	Max		-6.3		
21	Lee 2009	0	30	2	0							CON	7	0	Sprint Time			35	1	1
21	Lee 2009	0	30	2	260				45	Daily / 6 days per week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	7	0	Sprint Time			9		
21	Lee 2009	0	30	2	0							CON	7	0	Sprint Speed			-24	1	1
21	Lee 2009	0	30	2	260				45	Daily / 6 days per week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	7	0	Sprint Speed			-8		
21	Lee 2009	0	30	2	0							CON	7	0	Plasme Volume (mL)			-3.1		
21	Lee 2009	0	30	2	260				45	Daily / 6 days per week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	7	0	Plasme Volume (mL)			-2.6		
21	Lee 2009	0	30	2	0							CON	7	0	Body Mass			-0.6		1
21	Lee 2009	0	30	2	260				45	Daily / 6 days per week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	7	0	Body Mass			1		
21	Lee 2009	0	30	2	0							CON	7	0	Lean Tissue			-0.7		1
21	Lee 2009	0	30	2	260				45	Daily / 6 days per week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	7	0	Lean Tissue			1.8	1	
21	Lee 2009	0	30	2	0							CON	7	0	Fat Mass			7.9	1	1
21	Lee 2009	0	30	2	260				45	Daily / 6 days per week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	7	0	Fat Mass			4.6		
21	Lee 2009	0	30	2	0							CON	7	0	Body Fat			7.1	1	

21	Lee 2009	0	30	2	260				45	Daily / 6 days per week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	7	0	Body Fat			3.7		
21	Lee 2009	0	30	2	0							CON	7	0	Heart Rate (beats/min)	Resting		24.3	1	
21	Lee 2009	0	30	2	260				45	Daily / 6 days per week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	7	0	Heart Rate (beats/min)	Resting		0		
22	Watenpaugh 2000	0	15	2	0							CON	0	8	Exercise Time	Max		-9.9	1	
22	Watenpaugh 2000	0	15	2	260				40	Daily	LBNP at ~1 body weight. 40 min exercisewith LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	0	8	Exercise Time	Max		-0.5		
22	Watenpaugh 2000	0	15	2	0							CON	0	8	VO2 (L/min)	Max		-13.5	1	
22	Watenpaugh 2000	0	15	2	260				40	Daily	LBNP at ~1 body weight. 40 min exercisewith LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3	LBNP	0	8	VO2 (L/min)	Max		-5.2		
22	Watenpaugh 2000	0	15	2	0							CON	0	8	Sprint Time					
22	Watenpaugh 2000	0	15	2	260				40	Daily	LBNP at ~1 body weight. 40 min exercisewith LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	0	8	Sprint Time					
22	Watenpaugh 2000	0	15	2	0							CON	0	8	Sprint Speed			-16.3	1	
22	Watenpaugh 2000	0	15	2	260				40	Daily	LBNP at ~1 body weight. 40 min exercisewith LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	0	8	Sprint Speed			-4.5		
22	Watenpaugh 2000	0	15	2	0							CON	0	8	Muscle Strength	Plantar Flexor		-7		
22	Watenpaugh 2000	0	15	2	260				40	Daily	LBNP at ~1 body weight. 40 min exercisewith LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3	LBNP	0	8	Muscle Strength	Plantar Flexor		2.1		
22	Watenpaugh 2000	0	15	2	0							CON	0	8	Hematocrit			6.5	1	
22	Watenpaugh 2000	0	15	2	260				40	Daily	LBNP at ~1 body weight. 40 min exercisewith LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3	LBNP	0	8	Hematocrit			0.5		
22	Watenpaugh 2000	0	15	2	0							CON	0	8	Plasme Volume (mL)			-13.7		
22	Watenpaugh 2000	0	15	2	260				40	Daily	LBNP at ~1 body weight. 40 min exercisewith LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3	LBNP	0	8	Plasme Volume (mL)			-5.6		
22	Watenpaugh 2000	0	15	2	0							CON	0	8	Total Blood Volume			-10.5		
22	Watenpaugh 2000	0	15	2	260				40	Daily	LBNP at ~1 body weight. 40 min exercisewith LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3	LBNP	0	8	Total Blood Volume			-4.4		
22	Watenpaugh 2000	0	15	2	0							CON	0	8	Erythrocyte Volume			-4.4		
22	Watenpaugh 2000	0	15	2	260				40	Daily	LBNP at ~1 body weight. 40 min exercisewith LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3	LBNP	0	8	Erythrocyte Volume			-1.9		
23	Lee 1997	0	5	2	0						7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40%, 5 min @40%	CON	0	8	VO2 (L/min)	Max		-7.2		
23	Lee 1997	0	5	2	16				30	Daily	7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40%, 5 min @40%	Upex	0	8	VO2 (L/min)	Max		-4.7		

23	Lee 1997	0	5	2	260				30	Daily	7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40%, 5 min @40%	LBNP	0	8	VO2 (L/min)	Max		-7.1		
23	Lee 1997	0	5	2	0						7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40%, 5 min @40%	CON	0	8	Heart Rate (beats/min)	Max		0		
23	Lee 1997	0	5	2	16				30	Daily	7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40%, 5 min @40%	Upex	0	8	Heart Rate (beats/min)	Max		0		
23	Lee 1997	0	5	2	260				30	Daily	7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40%, 5 min @40%	LBNP	0	8	Heart Rate (beats/min)	Max		1		
23	Lee 1997	0	5	2	0						7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40%, 5 min @40%	CON	0	8	Respiratory Exchange Ratio	Max		-0.8		
23	Lee 1997	0	5	2	16				30	Daily	7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40%, 5 min @40%	Upex	0	8	Respiratory Exchange Ratio	Max		0		
23	Lee 1997	0	5	2	260				30	Daily	7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40%, 5 min @40%	LBNP	0	8	Respiratory Exchange Ratio	Max		0		
23	Lee 1997	0	5	2	0						7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40%, 5 min @40%	CON	0	8	Ve (L/min)	Max		-3.7		
23	Lee 1997	0	5	2	16				30	Daily	7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40%, 5 min @40%	Upex	0	8	Ve (L/min)	Max		-3.6		
23	Lee 1997	0	5	2	260				30	Daily	7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40%, 5 min @40%	LBNP	0	8	Ve (L/min)	Max		1.4		
23	Lee 1997	0	5	2	0						7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40%, 5 min @40%	CON	0	8	Exercise Time	Max		-9	1	
23	Lee 1997	0	5	2	16				30	Daily	7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40%, 5 min @40%	Upex	0	8	Exercise Time	Max		-1.7		
23	Lee 1997	0	5	2	260				30	Daily	7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40%, 5 min @40%	LBNP	0	8	Exercise Time	Max		-1.6		
23	Lee 1997	0	5	2	0						7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40%, 5 min @40%	CON	0	8	Plasme Volume (mL)			-16.2	1	
23	Lee 1997	0	5	2	16				30	Daily	7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40%, 5 min @40%	Upex	0	8	Plasme Volume (mL)			-9.5	1	
23	Lee 1997	0	5	2	260				30	Daily	7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40%, 5 min @40%	LBNP	0	8	Plasme Volume (mL)			-3.6		
23	Lee 1997	0	5	2	0						7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40%, 5 min @40%	CON	0	8	Hemoglobin			11.4	1	
23	Lee 1997	0	5	2	16				30	Daily	7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40%, 5 min @40%	Upex	0	8	Hemoglobin			6.6		
23	Lee 1997	0	5	2	260				30	Daily	7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40%, 5 min @40%	LBNP	0	8	Hemoglobin			2.1		
23	Lee 1997	0	5	2	0						7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40%, 5 min @40%	CON	0	8	Hematocrit			11.3	1	
23	Lee 1997	0	5	2	16				30	Daily	7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40%, 5 min @40%	Upex	0	8	Hematocrit			5.9		
23	Lee 1997	0	5	2	260				30	Daily	7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40%, 5 min @40%	LBNP	0	8	Hematocrit			5.7		
24	Watenpaugh 2007	0	30	2	0							CON	7	8	Tolerance Time	60 Head-Up Tilt with graded LBNP		-34	1	
24	Watenpaugh 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	7	8	Tolerance Time	60 Head-Up Tilt with graded LBNP		-13	1	1
24	Watenpaugh 2007	0	30	2	0							CON	7	8	Anti-G Score					

24	Watenpaugh 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	7	8	Anti-G Score					
24	Watenpaugh 2007	0	30	2	0							CON	7	8	Stroke Volume (mL)	Resting		-13	1	
24	Watenpaugh 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	7	8	Stroke Volume (mL)	Resting		7.3		
24	Watenpaugh 2007	0	30	2	0							CON	7	8	Stroke Volume (mL)	60 Head-Up Tilt		-28	1	
24	Watenpaugh 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	7	8	Stroke Volume (mL)	60 Head-Up Tilt				
24	Watenpaugh 2007	0	30	2	0							CON	7	8	Heart Rate (beats/min)	Resting		20	1	
24	Watenpaugh 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	7	8	Heart Rate (beats/min)	Resting		-3		1
24	Watenpaugh 2007	0	30	2	0							CON	7	8	Heart Rate (beats/min)	Max			1	
24	Watenpaugh 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	7	8	Heart Rate (beats/min)	Max				1
24	Watenpaugh 2007	0	30	2	0							CON	7	8	Cardiac Output	Resting		0		
24	Watenpaugh 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	7	8	Cardiac Output	Resting		3.9		
24	Watenpaugh 2007	0	30	2	0							CON	7	8	Cardiac Output	60 Head-Up Tilt				
24	Watenpaugh 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	7	8	Cardiac Output	60 Head-Up Tilt				
24	Watenpaugh 2007	0	30	2	0							CON	7	8	Total Peripheral Resistance	Resting		12.8		
24	Watenpaugh 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	7	8	Total Peripheral Resistance	Resting		-6.3		
24	Watenpaugh 2007	0	30	2	0							CON	7	8	Total Peripheral Resistance	60 Head-Up Tilt				
24	Watenpaugh 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	7	8	Total Peripheral Resistance	60 Head-Up Tilt				
24	Watenpaugh 2007	0	30	2	0							CON	7	8	Mean Arterial Pressure	Resting				
24	Watenpaugh 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	7	8	Mean Arterial Pressure	Resting				
24	Watenpaugh 2007	0	30	2	0							CON	7	8	Mean Arterial Pressure	60 Head-Up Tilt				
24	Watenpaugh 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	7	8	Mean Arterial Pressure	60 Head-Up Tilt				
24	Watenpaugh 2007	0	30	2	0							CON	7	8	Cerebral Vascular Resistance	Resting				
24	Watenpaugh 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	7	8	Cerebral Vascular Resistance	Resting				
24	Watenpaugh 2007	0	30	2	0							CON	7	8	Cerebral Vascular Resistance	60 Head-Up Tilt				

24	Watenpaugh 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	7	8	Cerebral Vascular Resistance	60 Head-Up Tilt				
25	Suzuki 1994	0	20	4	0							CON	0	6	VO2 (L/min)	Max		-11		
25	Suzuki 1994	0	20	4	2				60	Daily	50W (~40%VO2max)	CYC	0	3	VO2 (L/min)	Max		-11.3	1	
25	Suzuki 1994	0	20	4	0							CON	0	6	Maximum Voluntary Contraction (MVC)	Knee Extensor		-16.2		
25	Suzuki 1994	0	20	4	2				60	Daily	50W (~40%VO2max)	CYC	0	3	Maximum Voluntary Contraction (MVC)	Knee Extensor		-27.5		
25	Suzuki 1994	0	20	4	0							CON	0	6	Heart Rate (beats/min)	Resting		25.2		
25	Suzuki 1994	0	20	4	2				60	Daily	50W (~40%VO2max)	CYC	0	3	Heart Rate (beats/min)	Resting		9.3		
25	Suzuki 1994	0	20	4	0							CON	0	6	Systolic Blood Pressure (mmHg)	Resting		-11.3		
25	Suzuki 1994	0	20	4	2				60	Daily	50W (~40%VO2max)	CYC	0	3	Systolic Blood Pressure (mmHg)	Resting		-16.8		
25	Suzuki 1994	0	20	4	0							CON	0	6	Diastolic Blood Pressure (mmHg)	Resting		-16		
25	Suzuki 1994	0	20	4	2				60	Daily	50W (~40%VO2max)	CYC	0	3	Diastolic Blood Pressure (mmHg)	Resting		-23.7		
25	Suzuki 1994	0	20	4	0							CON	0	6	Stroke Volume (mL)	Resting		-27.7		
25	Suzuki 1994	0	20	4	2				60	Daily	50W (~40%VO2max)	CYC	0	3	Stroke Volume (mL)	Resting		-20.2		
25	Suzuki 1994	0	20	4	0							CON	0	6	Cardiac Output	Resting		-9.4		
25	Suzuki 1994	0	20	4	2				60	Daily	50W (~40%VO2max)	CYC	0	3	Cardiac Output	Resting		-15.1		
26	Smith 2003	0	30	2	0							CON	0	8	Calcium	Serum		1.7	1	
26	Smith 2003	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	0	8	Calcium	Serum		1.2	1	
26	Smith 2003	0	30	2	0							CON	0	8	25(OH)-vitamin D	Serum		-1.5		
26	Smith 2003	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	0	8	25(OH)-vitamin D	Serum		-3		
26	Smith 2003	0	30	2	0							CON	0	8	1,25(OH)-vitamin D	Serum		-21.3	1	
26	Smith 2003	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	0	8	1,25(OH)-vitamin D	Serum		-31.2	1	
26	Smith 2003	0	30	2	0							CON	0	8	Parathyroid Hormone (intact molecule)	Serum		-36.5	1	
26	Smith 2003	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	0	8	Parathyroid Hormone (intact molecule)	Serum		-32.9	1	
26	Smith 2003	0	30	2	0							CON	0	8	Bone specific alkaline phosphate	Serum		-0.4		
26	Smith 2003	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	0	8	Bone specific alkaline phosphate	Serum		13.3		
26	Smith 2003	0	30	2	0							CON	0	8	Alkaline Phosphate	Serum		5.1		
26	Smith 2003	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	0	8	Alkaline Phosphate	Serum		5.3		
26	Smith 2003	0	30	2	0							CON	0	8	Osteocalcin	Serum		2.2		
26	Smith 2003	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	0	8	Osteocalcin	Serum		-5.3		
26	Smith 2003	0	30	2	0							CON	0	8	Calcium	Urinary		31.9	1	
26	Smith 2003	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	0	8	Calcium	Urinary		5.2		1

26	Smith 2003	0	30	2	0							CON	0	8	n-telopeptide	Urinary		59.3	1	
26	Smith 2003	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	0	8	n-telopeptide	Urinary		31.6	1	1
26	Smith 2003	0	30	2	0							CON	0	8	Pyridinium cosslink	Urinary		71.1		
26	Smith 2003	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	0	8	Pyridinium cosslink	Urinary		34		
26	Smith 2003	0	30	2	0							CON	0	8	Deoxypyridinoline	Urinary		64.3	1	
26	Smith 2003	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	0	8	Deoxypyridinoline	Urinary		36.9	1	1
26	Smith 2003	0	30	2	0							CON	0	8	Creatinine	Urinary		13.6		
26	Smith 2003	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	0	8	Creatinine	Urinary		9		
26	Smith 2003	0	30	2	0							CON	0	8	Urinary Volume	Urinary		5.7		
26	Smith 2003	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	LBNP	0	8	Urinary Volume	Urinary		-6.2		
28	Rittweger 2005	0	90	2	0							CON	0	9	Muscle Cross Section Area	Calf		-25.6		
28	Rittweger 2005	0	90	2	192					Every third day	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	9	Muscle Cross Section Area	Calf		-17.3		p<0.05 vs. BR and
28	Rittweger 2005	0	90	2	4096					Once	On C-14, infused 60mg dose of drug dissolved in 500mL 0.9% saline over 3hr	PMD	0	7	Muscle Cross Section Area	Calf		-25.6		
28	Rittweger 2005	0	90	2	0							CON	0	9	Muscle Cross Section Area	Forearm		-6.4		
28	Rittweger 2005	0	90	2	192					Every third day	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	9	Muscle Cross Section Area	Forearm		-7.6		
28	Rittweger 2005	0	90	2	4096					Once	On C-14, infused 60mg dose of drug dissolved in 500mL 0.9% saline over 3hr	PMD	0	7	Muscle Cross Section Area	Forearm		-7.7		
28	Rittweger 2005	0	90	2	0							CON	0	9	Bone Mineral Content	Tibia Epiphysis (4% from ankle)		-6		
28	Rittweger 2005	0	90	2	192					Every third day	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	9	Bone Mineral Content	Tibia Epiphysis (4% from ankle)		-2.8		
28	Rittweger 2005	0	90	2	4096					Once	On C-14, infused 60mg dose of drug dissolved in 500mL 0.9% saline over 3hr	PMD	0	7	Bone Mineral Content	Tibia Epiphysis (4% from ankle)		-3.6		
28	Rittweger 2005	0	90	2	0							CON	0	9	Bone Mineral Content	Tibia Metaphysis (14% from ankle)		-1		
28	Rittweger 2005	0	90	2	192					Every third day	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	9	Bone Mineral Content	Tibia Metaphysis (14% from ankle)		-0.9		
28	Rittweger 2005	0	90	2	4096					Once	On C-14, infused 60mg dose of drug dissolved in 500mL 0.9% saline over 3hr	PMD	0	7	Bone Mineral Content	Tibia Metaphysis (14% from ankle)		-0.7		
28	Rittweger 2005	0	90	2	0							CON	0	9	Bone Mineral Content	Tibia Shaft (33% from ankle)		-2		p<0.05 vs. BRE
28	Rittweger 2005	0	90	2	192					Every third day	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	9	Bone Mineral Content	Tibia Shaft (33% from ankle)		-0.7		
28	Rittweger 2005	0	90	2	4096					Once	On C-14, infused 60mg dose of drug dissolved in 500mL 0.9% saline over 3hr	PMD	0	7	Bone Mineral Content	Tibia Shaft (33% from ankle)		-0.5		
28	Rittweger 2005	0	90	2	0							CON	0	9	Bone Mineral Content	Tibia Shaft (66% from ankle)		-1.6		p<0.05 vs. BRE
28	Rittweger 2005	0	90	2	192					Every third day	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	9	Bone Mineral Content	Tibia Shaft (66% from ankle)		-0.9		
28	Rittweger 2005	0	90	2	4096					Once	On C-14, infused 60mg dose of drug dissolved in 500mL 0.9% saline over 3hr	PMD	0	7	Bone Mineral Content	Tibia Shaft (66% from ankle)		-0.5		
28	Rittweger 2005	0	90	2	0							CON	0	9	Bone Mineral Content	Distal Radius		-0.6		
28	Rittweger 2005	0	90	2	192					Every third day	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	9	Bone Mineral Content	Distal Radius		-0.7		

28	Rittweger 2005	0	90	2	4096					Once	On C-14, infused 60mg dose of drug dissolved in 500mL 0.9% saline over 3hr	PMD	0	7	Bone Mineral Content	Distal Radius		-0.3		
28	Rittweger 2005	0	90	2	0							CON	0	9	Bone Mineral Content	Radius Shaft (60% from wrist)		-0.4		
28	Rittweger 2005	0	90	2	192					Every third day	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	9	Bone Mineral Content	Radius Shaft (60% from wrist)		-0.4		
28	Rittweger 2005	0	90	2	4096					Once	On C-14, infused 60mg dose of drug dissolved in 500mL 0.9% saline over 3hr	PMD	0	7	Bone Mineral Content	Radius Shaft (60% from wrist)		-0.2		
29	Zwart 2007	0	30	2	0							CON	7	0	Calcium	Urinary		68.1	1	
29	Zwart 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	7	0	Calcium	Urinary		40	1	
29	Zwart 2007	0	30	2	0							CON	7	0	n-telopeptide	Urinary		64.4	1	
29	Zwart 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	7	0	n-telopeptide	Urinary		47.8	1	
29	Zwart 2007	0	30	2	0							CON	7	0	Pyridinium cosslink	Urinary		83.8	1	
29	Zwart 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	7	0	Pyridinium cosslink	Urinary		50.8	1	
29	Zwart 2007	0	30	2	0							CON	7	0	Deoxypyridinoline	Urinary		94	1	
29	Zwart 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	7	0	Deoxypyridinoline	Urinary		64	1	
29	Zwart 2007	0	30	2	0							CON	7	0	Helical Peptide	Urinary		81.3	1	
29	Zwart 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	7	0	Helical Peptide	Urinary		9.3	1	1
29	Zwart 2007	0	30	2	0							CON	7	0	Creatinine	Urinary		19	1	
29	Zwart 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	7	0	Creatinine	Urinary		26.1	1	
29	Zwart 2007	0	30	2	0							CON	7	0	Phosphorous	Urinary		69	1	
29	Zwart 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	7	0	Phosphorous	Urinary		65.8	1	
29	Zwart 2007	0	30	2	0							CON	7	0	Calcium	Serum		2.6		
29	Zwart 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	7	0	Calcium	Serum		0.9		
29	Zwart 2007	0	30	2	0							CON	7	0	25(OH)-vitamin D	Serum		-10.3		
29	Zwart 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	7	0	25(OH)-vitamin D	Serum		10.5		
29	Zwart 2007	0	30	2	0							CON	7	0	1,25(OH)-vitamin D	Serum		-15.1		
29	Zwart 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	7	0	1,25(OH)-vitamin D	Serum		-10.9		
29	Zwart 2007	0	30	2	0							CON	7	0	Parathyroid Hormone (intact molecule)	Serum		-24		

29	Zwart 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	7	0	Parathyroid Hormone (intact molecule)	Serum		-6.8		
29	Zwart 2007	0	30	2	0							CON	7	0	Bone specific alkaline phosphate	Serum		1.1		
29	Zwart 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	7	0	Bone specific alkaline phosphate	Serum		-10.1		
29	Zwart 2007	0	30	2	0							CON	7	0	Alkaline Phosphate	Serum		0		
29	Zwart 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	7	0	Alkaline Phosphate	Serum		-8.5		
29	Zwart 2007	0	30	2	0							CON	7	0	Osteocalcin	Serum		12.1		
29	Zwart 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	7	0	Osteocalcin	Serum		19.4		
29	Zwart 2007	0	30	2	0							CON	7	0	Bone Mineral Density	Whole Body		0.3		
29	Zwart 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	7	0	Bone Mineral Density	Whole Body		-0.1		
29	Zwart 2007	0	30	2	0							CON	7	0	Bone Mineral Density	Legs		-0.4		
29	Zwart 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	7	0	Bone Mineral Density	Legs		-0.5		
29	Zwart 2007	0	30	2	0							CON	7	0	Bone Mineral Density	Femoral Neck		-0.1		
29	Zwart 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	7	0	Bone Mineral Density	Femoral Neck		2		
29	Zwart 2007	0	30	2	0							CON	7	0	Bone Mineral Density	Femoral Shaft		-2	1	
29	Zwart 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	7	0	Bone Mineral Density	Femoral Shaft		0.5		
29	Zwart 2007	0	30	2	0							CON	7	0	Bone Mineral Density	Total Hip		-1.6	1	
29	Zwart 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	7	0	Bone Mineral Density	Total Hip		0.3		
30	Shackelford 2004	0	119	4	0							CON	5	13	Bone Mineral Density	Spine		-1.3	1	
30	Shackelford 2004	0	119	4	8192					6 days/ week		BRE	4	5	Bone Mineral Density	Spine		3.4	1	1
30	Shackelford 2004	0	119	4	0							CON	5	13	Bone Mineral Density	Femoral Neck		-1.5		
30	Shackelford 2004	0	119	4	8192					6 days/ week		BRE	4	5	Bone Mineral Density	Femoral Neck		0.1		
30	Shackelford 2004	0	119	4	0							CON	5	13	Bone Mineral Density	Trochanter		-3.6	1	
30	Shackelford 2004	0	119	4	8192					6 days/ week		BRE	4	5	Bone Mineral Density	Trochanter		-2.3		
30	Shackelford 2004	0	119	4	0							CON	5	13	Bone Mineral Density	Total Hip		-3.4	1	
30	Shackelford 2004	0	119	4	8192					6 days/ week		BRE	4	5	Bone Mineral Density	Total Hip		-0.9		1
30	Shackelford 2004	0	119	4	0							CON	5	13	Bone Mineral Density	Calcaneus		-9.2	1	
30	Shackelford 2004	0	119	4	8192					6 days/ week		BRE	4	5	Bone Mineral Density	Calcaneus		1.2		1
30	Shackelford 2004	0	119	4	0							CON	5	13	Bone Mineral Density	Distal Radius		0		
30	Shackelford 2004	0	119	4	8192					6 days/ week		BRE	4	5	Bone Mineral Density	Distal Radius		-1		
30	Shackelford 2004	0	119	4	0							CON	5	13	Bone Mineral Density	Proximal Radius		-0.2		
30	Shackelford 2004	0	119	4	8192					6 days/ week		BRE	4	5	Bone Mineral Density	Proximal Radius		0.2		

30	Shackelford 2004	0	119	4	0							CON	5	13	Bone Mineral Density	Whole Body		-0.7	1	
30	Shackelford 2004	0	119	4	8192					6 days/ week		BRE	4	5	Bone Mineral Density	Whole Body		0.1		1
30	Shackelford 2004	0	119	4	0							CON	5	13	Bone Mineral Density	Pelvis		-3.3	1	
30	Shackelford 2004	0	119	4	8192					6 days/ week		BRE	4	5	Bone Mineral Density	Pelvis		-0.5		1
30	Shackelford 2004	0	119	4	0							CON	5	13	Bone Mineral Density	Legs		-1.8	1	
30	Shackelford 2004	0	119	4	8192					6 days/ week		BRE	4	5	Bone Mineral Density	Legs		-0.8		
30	Shackelford 2004	0	119	4	0							CON	5	13	Bone Mineral Density	Arms		-0.6		
30	Shackelford 2004	0	119	4	8192					6 days/ week		BRE	4	5	Bone Mineral Density	Arms		-0.5		
30	Shackelford 2004	0	119	4	0							CON	5	13	Calcium	Urinary		38.6	1	
30	Shackelford 2004	0	119	4	8192					6 days/ week		BRE	4	5	Calcium	Urinary		-7.4		
30	Shackelford 2004	0	119	4	0							CON	5	13	n-telopeptide	Urinary		48.5	1	
30	Shackelford 2004	0	119	4	8192					6 days/ week		BRE	4	5	n-telopeptide	Urinary		31.6	1	
30	Shackelford 2004	0	119	4	0							CON	5	13	Pyridinium cosslink	Urinary		46.5	1	
30	Shackelford 2004	0	119	4	8192					6 days/ week		BRE	4	5	Pyridinium cosslink	Urinary		25.8	1	
30	Shackelford 2004	0	119	4	0							CON	5	13	Deoxypyridinoline	Urinary		34.9	1	
30	Shackelford 2004	0	119	4	8192					6 days/ week		BRE	4	5	Deoxypyridinoline	Urinary		23.5	1	
30	Shackelford 2004	0	119	4	0							CON	5	13	Alkaline Phosphate	Serum		4.9		
30	Shackelford 2004	0	119	4	8192					6 days/ week		BRE	4	5	Alkaline Phosphate	Serum		31.4	1	1
30	Shackelford 2004	0	119	4	0							CON	5	13	Bone specific alkaline phosphate	Serum		-0.1		
30	Shackelford 2004	0	119	4	8192					6 days/ week		BRE	4	5	Bone specific alkaline phosphate	Serum		63.6	1	1
30	Shackelford 2004	0	119	4	0							CON	5	13	Osteocalcin	Serum		10.5		
30	Shackelford 2004	0	119	4	8192					6 days/ week		BRE	4	5	Osteocalcin	Serum		42.7	1	1
30	Shackelford 2004	0	119	4	0							CON	5	13	1,25(OH)-vitamin D	Serum		-14.7	1	
30	Shackelford 2004	0	119	4	8192					6 days/ week		BRE	4	5	1,25(OH)-vitamin D	Serum		12.1		1
30	Shackelford 2004	0	119	4	0							CON	5	13	25(OH)-vitamin D	Serum		10.9		
30	Shackelford 2004	0	119	4	8192					6 days/ week		BRE	4	5	25(OH)-vitamin D	Serum		6		
30	Shackelford 2004	0	119	4	0							CON	5	13	Parathyroid Hormone (mid-molecule)	Serum		-5.2		
30	Shackelford 2004	0	119	4	8192					6 days/ week		BRE	4	5	Parathyroid Hormone (mid-molecule)	Serum		-2.4		
30	Shackelford 2004	0	119	4	0							CON	5	13	Parathyroid Hormone (intact molecule)	Serum		-25.1	1	
30	Shackelford 2004	0	119	4	8192					6 days/ week		BRE	4	5	Parathyroid Hormone (intact molecule)	Serum		17.9		1
30	Shackelford 2004	0	119	4	0							CON	5	13	Calcium	Serum		0.9		
30	Shackelford 2004	0	119	4	8192					6 days/ week		BRE	4	5	Calcium	Serum		-1.3		1
30	Shackelford 2004	0	119	4	0							CON	5	13	Ionized Calcium	Serum		1.1	1	
30	Shackelford 2004	0	119	4	8192					6 days/ week		BRE	4	5	Ionized Calcium	Serum		-0.8		1
30	Shackelford 2004	0	119	4	0							CON	5	13	Calcium	Fecal		19.5	1	
30	Shackelford 2004	0	119	4	8192					6 days/ week		BRE	4	5	Calcium	Fecal		0.8		
30	Shackelford 2004	0	119	4	0							CON	5	13	Muscle Volume	Posterior Back		-5.6		
30	Shackelford 2004	0	119	4	8192					6 days/ week		BRE	4	5	Muscle Volume	Posterior Back		1.6		
30	Shackelford 2004	0	119	4	0							CON	5	13	Muscle Volume	Psoas Back		7.2	1	
30	Shackelford 2004	0	119	4	8192					6 days/ week		BRE	4	5	Muscle Volume	Psoas Back		16.4	1	
30	Shackelford 2004	0	119	4	0							CON	5	13	Muscle Volume	Soleus		-29.3	1	
30	Shackelford 2004	0	119	4	8192					6 days/ week		BRE	4	5	Muscle Volume	Soleus		-9.7	1	1
30	Shackelford 2004	0	119	4	0							CON	5	13	Muscle Volume	Gastrocnemius		-28.1	1	
30	Shackelford 2004	0	119	4	8192					6 days/ week		BRE	4	5	Muscle Volume	Gastrocnemius		-6.6	1	1
30	Shackelford 2004	0	119	4	0							CON	5	13	Muscle Volume	Calf		-22.9	1	
30	Shackelford 2004	0	119	4	8192					6 days/ week		BRE	4	5	Muscle Volume	Calf		-7.3	1	1
30	Shackelford 2004	0	119	4	0							CON	5	13	Muscle Volume	Sartorius		-7.5	1	

30	Shackelford 2004	0	119	4	8192					6 days/ week		BRE	4	5	Muscle Volume	Sartorius		3.1		1
30	Shackelford 2004	0	119	4	0							CON	5	13	Muscle Volume	Knee Extensor		-15.8	1	
30	Shackelford 2004	0	119	4	8192					6 days/ week		BRE	4	5	Muscle Volume	Knee Extensor		2		1
30	Shackelford 2004	0	119	4	0							CON	5	13	Muscle Volume	Hamstrings		-13.2	1	
30	Shackelford 2004	0	119	4	8192					6 days/ week		BRE	4	5	Muscle Volume	Hamstrings		-8.3		1
30	Shackelford 2004	0	119	4	0							CON	5	13	Muscle Volume	Adductors		-8.6	1	
30	Shackelford 2004	0	119	4	8192					6 days/ week		BRE	4	5	Muscle Volume	Adductors		-3.1		
30	Shackelford 2004	0	119	4	0							CON	5	13	Muscle Volume	Thigh		-13.2	1	
30	Shackelford 2004	0	119	4	8192					6 days/ week		BRE	4	5	Muscle Volume	Thigh		-2.1		1
31	Lee 2007	0	30	2	0							CON	0	8	VO2 (L/min)	Max		-18.9	1	
31	Lee 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	0	8	VO2 (L/min)	Max		-3.2		1
31	Lee 2007	0	30	2	0							CON	0	8	Heart Rate (beats/min)	Max				
31	Lee 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	0	8	Heart Rate (beats/min)	Max			1	
31	Lee 2007	0	30	2	0							CON	0	8	Respiratory Exchange Ratio	Max		-8.3	1	
31	Lee 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	0	8	Respiratory Exchange Ratio	Max		-2.5	1	1
31	Lee 2007	0	30	2	0							CON	0	8	Ve (L/min)	Max		-11.1	1	
31	Lee 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	0	8	Ve (L/min)	Max		-0.8		
31	Lee 2007	0	30	2	0							CON	0	8	Exercise Time	Max		-22.3	1	
31	Lee 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	0	8	Exercise Time	Max		-3		1
31	Lee 2007	0	30	2	0							CON	0	8	VO2 (L/min)	Submaximal Exercise				
31	Lee 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	0	8	VO2 (L/min)	Submaximal Exercise				
31	Lee 2007	0	30	2	0							CON	0	8	Heart Rate (beats/min)	Submaximal Exercise		20	1	
31	Lee 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	0	8	Heart Rate (beats/min)	Submaximal Exercise				1
31	Lee 2007	0	30	2	0							CON	0	8	Respiratory Exchange Ratio	Submaximal Exercise				
31	Lee 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	0	8	Respiratory Exchange Ratio	Submaximal Exercise				
31	Lee 2007	0	30	2	0							CON	0	8	Ve (L/min)	Submaximal Exercise				
31	Lee 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	0	8	Ve (L/min)	Submaximal Exercise				
31	Lee 2007	0	30	2	0							CON	0	8	VO2 (L/min)	Submaximal Exercise				
31	Lee 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	0	8	VO2 (L/min)	Submaximal Exercise				

31	Lee 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	0	8	Heart Rate (beats/min)	Submaximal Exercise				1
31	Lee 2007	0	30	2	0							CON	0	8	Respiratory Exchange Ratio	Submaximal Exercise				
31	Lee 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	0	8	Respiratory Exchange Ratio	Submaximal Exercise				1
31	Lee 2007	0	30	2	0							CON	0	8	Ve (L/min)	Submaximal Exercise		18	1	
31	Lee 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	0	8	Ve (L/min)	Submaximal Exercise				1
31	Lee 2007	0	30	2	0							CON	0	8	VO2 (L/min)	Submaximal Exercise				
31	Lee 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	0	8	VO2 (L/min)	Submaximal Exercise				
31	Lee 2007	0	30	2	0							CON	0	8	Heart Rate (beats/min)	Submaximal Exercise		9	1	
31	Lee 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	0	8	Heart Rate (beats/min)	Submaximal Exercise				1
31	Lee 2007	0	30	2	0							CON	0	8	Respiratory Exchange Ratio	Submaximal Exercise			1	
31	Lee 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	0	8	Respiratory Exchange Ratio	Submaximal Exercise				1
31	Lee 2007	0	30	2	0							CON	0	8	Ve (L/min)	Submaximal Exercise		23	1	
31	Lee 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	0	8	Ve (L/min)	Submaximal Exercise				1
31	Lee 2007	0	30	2	0							CON	0	8	Sprint Time	Max		24	1	
31	Lee 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	0	8	Sprint Time	Max		8		
31	Lee 2007	0	30	2	0							CON	0	8	Heart Rate (beats/min)	Resting		20.5	1	
31	Lee 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	0	8	Heart Rate (beats/min)	Resting		-5.6		1
31	Lee 2007	0	30	2	0							CON	0	8	Heart Rate (beats/min)	Resting		43.4	1	
31	Lee 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	0	8	Heart Rate (beats/min)	Resting		7.1		1
31	Lee 2007	0	30	2	0							CON	0	8	Plasme Volume (mL)			-13.3	1	
31	Lee 2007	0	30	2	260				45	6 days/ week	LBNP at 1 body weight. 40 min exercisewith LBNP, then 5 min resting LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	0	8	Plasme Volume (mL)			-4		
32	Maillet 1996	0	28	2	0							CON	0	6	Tolerance Time	60 Head-Up Tilt		-14.2		
32	Maillet 1996	0	28	2	1280				20	6 days/ week	LBNP - 15min @ 30mmHg daily on BR16,18,20,22-28; RE - knee extension - 4s3r @ 50% max torque, 3s2r @ 80-90% max torque, 1s1r @ max torque; isometric exerc - (3-5s) @ 90, 120, 150 knee joint angle	BRE	0	6	Tolerance Time	60 Head-Up Tilt		15.8		
32	Maillet 1996	0	28	2	0							CON	0	6	Anti-G Score					

32	Maillet 1996	0	28	2	1280				20	6 days/ week	LBNP - 15min @ 30mmHg daily on BR16,18,20,22-28; RE - knee extension - 4s3r @ 50% max torque, 3s2r @ 80-90% max torque, 1s1r @ max torque; isometric exerc - (3-5s) @ 90, 120, 150 knee joint angle	BRE	0	6	Anti-G Score					
32	Maillet 1996	0	28	2	0							CON	0	6	Hematocrit	Serum		1.6		
32	Maillet 1996	0	28	2	1280				20	6 days/ week	LBNP - 15min @ 30mmHg daily on BR16,18,20,22-28; RE - knee extension - 4s3r @ 50% max torque, 3s2r @ 80-90% max torque, 1s1r @ max torque; isometric exerc - (3-5s) @ 90, 120, 150 knee joint angle	BRE	0	6	Hematocrit	Serum		1.6		
32	Maillet 1996	0	28	2	0							CON	0	6	Sodium Concentration in Serum	Serum		1.4		
32	Maillet 1996	0	28	2	1280				20	6 days/ week	LBNP - 15min @ 30mmHg daily on BR16,18,20,22-28; RE - knee extension - 4s3r @ 50% max torque, 3s2r @ 80-90% max torque, 1s1r @ max torque; isometric exerc - (3-5s) @ 90, 120, 150 knee joint angle	BRE	0	6	Sodium Concentration in Serum	Serum		-0.7		
32	Maillet 1996	0	28	2	0							CON	0	6	Creatinine	Serum		4.3		
32	Maillet 1996	0	28	2	1280				20	6 days/ week	LBNP - 15min @ 30mmHg daily on BR16,18,20,22-28; RE - knee extension - 4s3r @ 50% max torque, 3s2r @ 80-90% max torque, 1s1r @ max torque; isometric exerc - (3-5s) @ 90, 120, 150 knee joint angle	BRE	0	6	Creatinine	Serum		1		
32	Maillet 1996	0	28	2	0							CON	0	6	Protein	Serum		2.3		
32	Maillet 1996	0	28	2	1280				20	6 days/ week	LBNP - 15min @ 30mmHg daily on BR16,18,20,22-28; RE - knee extension - 4s3r @ 50% max torque, 3s2r @ 80-90% max torque, 1s1r @ max torque; isometric exerc - (3-5s) @ 90, 120, 150 knee joint angle	BRE	0	6	Protein	Serum		-1.2		
32	Maillet 1996	0	28	2	0							CON	0	6	Plasme Volume (mL)	Serum		-11.2	1	
32	Maillet 1996	0	28	2	1280				20	6 days/ week	LBNP - 15min @ 30mmHg daily on BR16,18,20,22-28; RE - knee extension - 4s3r @ 50% max torque, 3s2r @ 80-90% max torque, 1s1r @ max torque; isometric exerc - (3-5s) @ 90, 120, 150 knee joint angle	BRE	0	6	Plasme Volume (mL)	Serum		-2.2		
32	Maillet 1996	0	28	2	0							CON	0	6	VO2 (L/min)	Max		-13.3	1	
32	Maillet 1996	0	28	2	1280				20	6 days/ week	LBNP - 15min @ 30mmHg daily on BR16,18,20,22-28; RE - knee extension - 4s3r @ 50% max torque, 3s2r @ 80-90% max torque, 1s1r @ max torque; isometric exerc - (3-5s) @ 90, 120, 150 knee joint angle	BRE	0	6	VO2 (L/min)	Max		-5.6		
32	Maillet 1996	0	28	2	0							CON	0	6	Heart Rate (beats/min)	Resting		18.2		
32	Maillet 1996	0	28	2	1280				20	6 days/ week	LBNP - 15min @ 30mmHg daily on BR16,18,20,22-28; RE - knee extension - 4s3r @ 50% max torque, 3s2r @ 80-90% max torque, 1s1r @ max torque; isometric exerc - (3-5s) @ 90, 120, 150 knee joint angle	BRE	0	6	Heart Rate (beats/min)	Resting		17.7		
32	Maillet 1996	0	28	2	0							CON	0	6	Diastolic Blood Pressure (mmHg)	Resting		8.6	1	
32	Maillet 1996	0	28	2	1280				20	6 days/ week	LBNP - 15min @ 30mmHg daily on BR16,18,20,22-28; RE - knee extension - 4s3r @ 50% max torque, 3s2r @ 80-90% max torque, 1s1r @ max torque; isometric exerc - (3-5s) @ 90, 120, 150 knee joint angle	BRE	0	6	Diastolic Blood Pressure (mmHg)	Resting		14.8	1	
32	Maillet 1996	0	28	2	0							CON	0	6	Atrial Natriuretic Peptide	Serum				
32	Maillet 1996	0	28	2	1280				20	6 days/ week	LBNP - 15min @ 30mmHg daily on BR16,18,20,22-28; RE - knee extension - 4s3r @ 50% max torque, 3s2r @ 80-90% max torque, 1s1r @ max torque; isometric exerc - (3-5s) @ 90, 120, 150 knee joint angle	BRE	0	6	Atrial Natriuretic Peptide	Serum				
32	Maillet 1996	0	28	2	0							CON	0	6	Plasma Renin Peptide	Serum		258.4	1	
32	Maillet 1996	0	28	2	1280				20	6 days/ week	LBNP - 15min @ 30mmHg daily on BR16,18,20,22-28; RE - knee extension - 4s3r @ 50% max torque, 3s2r @ 80-90% max torque, 1s1r @ max torque; isometric exerc - (3-5s) @ 90, 120, 150 knee joint angle	BRE	0	6	Plasma Renin Peptide	Serum		166.3	1	
32	Maillet 1996	0	28	2	0							CON	0	6	Aldosterone	Serum		148.5	1	
32	Maillet 1996	0	28	2	1280				20	6 days/ week	LBNP - 15min @ 30mmHg daily on BR16,18,20,22-28; RE - knee extension - 4s3r @ 50% max torque, 3s2r @ 80-90% max torque, 1s1r @ max torque; isometric exerc - (3-5s) @ 90, 120, 150 knee joint angle	BRE	0	6	Aldosterone	Serum		98.7	1	
32	Maillet 1996	0	28	2	0							CON	0	6	Norepinephrine	Serum				

32	Maillet 1996	0	28	2	1280				20	6 days/ week	LBNP - 15min @ 30mmHg daily on BR16,18,20,22-28; RE - knee extension - 4s3r @ 50% max torque, 3s2r @ 80-90% max torque, 1s1r @ max torque; isometric exerc - (3-5s) @ 90, 120, 150 knee joint angle	BRE	0	6	Norepinephrine	Serum				
32	Maillet 1996	0	28	2	0							CON	0	6	Epinephrine	Serum				
32	Maillet 1996	0	28	2	1280				20	6 days/ week	LBNP - 15min @ 30mmHg daily on BR16,18,20,22-28; RE - knee extension - 4s3r @ 50% max torque, 3s2r @ 80-90% max torque, 1s1r @ max torque; isometric exerc - (3-5s) @ 90, 120, 150 knee joint angle	BRE	0	6	Epinephrine	Serum				
32	Maillet 1996	0	28	2	0							CON	0	6	Total Renal Excretion of Sodium	Urinary		-30.3	1	
32	Maillet 1996	0	28	2	1280				20	6 days/ week	LBNP - 15min @ 30mmHg daily on BR16,18,20,22-28; RE - knee extension - 4s3r @ 50% max torque, 3s2r @ 80-90% max torque, 1s1r @ max torque; isometric exerc - (3-5s) @ 90, 120, 150 knee joint angle	BRE	0	6	Total Renal Excretion of Sodium	Urinary		-28.8		
32	Maillet 1996	0	28	2	0							CON	0	6	Total Renal Excretion of Potassium	Urinary				
32	Maillet 1996	0	28	2	1280				20	6 days/ week	LBNP - 15min @ 30mmHg daily on BR16,18,20,22-28; RE - knee extension - 4s3r @ 50% max torque, 3s2r @ 80-90% max torque, 1s1r @ max torque; isometric exerc - (3-5s) @ 90, 120, 150 knee joint angle	BRE	0	6	Total Renal Excretion of Potassium	Urinary				
32	Maillet 1996	0	28	2	0							CON	0	6	Total Renal Excretion of Creatinine	Urinary				
32	Maillet 1996	0	28	2	1280				20	6 days/ week	LBNP - 15min @ 30mmHg daily on BR16,18,20,22-28; RE - knee extension - 4s3r @ 50% max torque, 3s2r @ 80-90% max torque, 1s1r @ max torque; isometric exerc - (3-5s) @ 90, 120, 150 knee joint angle	BRE	0	6	Total Renal Excretion of Creatinine	Urinary				
32	Maillet 1996	0	28	2	0							CON	0	6	Atrial Natriuretic Peptide	Urinary				
32	Maillet 1996	0	28	2	1280				20	6 days/ week	LBNP - 15min @ 30mmHg daily on BR16,18,20,22-28; RE - knee extension - 4s3r @ 50% max torque, 3s2r @ 80-90% max torque, 1s1r @ max torque; isometric exerc - (3-5s) @ 90, 120, 150 knee joint angle	BRE	0	6	Atrial Natriuretic Peptide	Urinary				
32	Maillet 1996	0	28	2	0							CON	0	6	ADH	Urinary				
32	Maillet 1996	0	28	2	1280				20	6 days/ week	LBNP - 15min @ 30mmHg daily on BR16,18,20,22-28; RE - knee extension - 4s3r @ 50% max torque, 3s2r @ 80-90% max torque, 1s1r @ max torque; isometric exerc - (3-5s) @ 90, 120, 150 knee joint angle	BRE	0	6	ADH	Urinary				
32	Maillet 1996	0	28	2	0							CON	0	6	c GMP	Urinary				
32	Maillet 1996	0	28	2	1280				20	6 days/ week	LBNP - 15min @ 30mmHg daily on BR16,18,20,22-28; RE - knee extension - 4s3r @ 50% max torque, 3s2r @ 80-90% max torque, 1s1r @ max torque; isometric exerc - (3-5s) @ 90, 120, 150 knee joint angle	BRE	0	6	c GMP	Urinary				
32	Maillet 1996	0	28	2	0							CON	0	6	Metanephrine	Urinary				
32	Maillet 1996	0	28	2	1280				20	6 days/ week	LBNP - 15min @ 30mmHg daily on BR16,18,20,22-28; RE - knee extension - 4s3r @ 50% max torque, 3s2r @ 80-90% max torque, 1s1r @ max torque; isometric exerc - (3-5s) @ 90, 120, 150 knee joint angle	BRE	0	6	Metanephrine	Urinary				
32	Maillet 1996	0	28	2	0							CON	0	6	Nometanephrine	Urinary				
32	Maillet 1996	0	28	2	1280				20	6 days/ week	LBNP - 15min @ 30mmHg daily on BR16,18,20,22-28; RE - knee extension - 4s3r @ 50% max torque, 3s2r @ 80-90% max torque, 1s1r @ max torque; isometric exerc - (3-5s) @ 90, 120, 150 knee joint angle	BRE	0	6	Nometanephrine	Urinary				
32	Maillet 1996	0	28	2	0							CON	0	6	MHPG Glucuronides	Urinary				
32	Maillet 1996	0	28	2	1280				20	6 days/ week	LBNP - 15min @ 30mmHg daily on BR16,18,20,22-28; RE - knee extension - 4s3r @ 50% max torque, 3s2r @ 80-90% max torque, 1s1r @ max torque; isometric exerc - (3-5s) @ 90, 120, 150 knee joint angle	BRE	0	6	MHPG Glucuronides	Urinary				
32	Maillet 1996	0	28	2	0							CON	0	6	MPHG Sulfates	Urinary				
32	Maillet 1996	0	28	2	1280				20	6 days/ week	LBNP - 15min @ 30mmHg daily on BR16,18,20,22-28; RE - knee extension - 4s3r @ 50% max torque, 3s2r @ 80-90% max torque, 1s1r @ max torque; isometric exerc - (3-5s) @ 90, 120, 150 knee joint angle	BRE	0	6	MPHG Sulfates	Urinary				
33	Greenleaf 1992	0	30	2	0							CON	0	5	Plasme Volume (mL)	Serum		-14.7	1	

33	Greenleaf 1992	0	30	2	2				30	Twice daily / 6 days per week	7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40% (supine ergometer)	ITE	0	7	Plasme Volume (mL)	Serum		-1.5		
33	Greenleaf 1992	0	30	2	1024				30	Twice daily / 6 days per week	5 min warm-up, 5 peak knee flexions and extensions (90° arc) in 10s and rested remaining 50s. Repeat 10 times, 4min cooling down, repeat with other leg	IKE	0	7	Plasme Volume (mL)	Serum		-16.8	1	
33	Greenleaf 1992	0	30	2	0							CON	0	5	Erythrocyte Volume	Serum		-10.3	1	
33	Greenleaf 1992	0	30	2	2				30	Twice daily / 6 days per week	7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40% (supine ergometer)	ITE	0	7	Erythrocyte Volume	Serum				
33	Greenleaf 1992	0	30	2	1024				30	Twice daily / 6 days per week	5 min warm-up, 5 peak knee flexions and extensions (90° arc) in 10s and rested remaining 50s. Repeat 10 times, 4min cooling down, repeat with other leg	IKE	0	7	Erythrocyte Volume	Serum		-17.2	1	
33	Greenleaf 1992	0	30	2	0							CON	0	5	Fluid Balance			72.5	1	
33	Greenleaf 1992	0	30	2	2				30	Twice daily / 6 days per week	7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40% (supine ergometer)	ITE	0	7	Fluid Balance			344.7	1	
33	Greenleaf 1992	0	30	2	1024				30	Twice daily / 6 days per week	5 min warm-up, 5 peak knee flexions and extensions (90° arc) in 10s and rested remaining 50s. Repeat 10 times, 4min cooling down, repeat with other leg	IKE	0	7	Fluid Balance			-170.7	1	
33	Greenleaf 1992	0	30	2	0							CON	0	5	Protein	Serum				
33	Greenleaf 1992	0	30	2	2				30	Twice daily / 6 days per week	7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40% (supine ergometer)	ITE	0	7	Protein	Serum				
33	Greenleaf 1992	0	30	2	1024				30	Twice daily / 6 days per week	5 min warm-up, 5 peak knee flexions and extensions (90° arc) in 10s and rested remaining 50s. Repeat 10 times, 4min cooling down, repeat with other leg	IKE	0	7	Protein	Serum				
33	Greenleaf 1992	0	30	2	0							CON	0	5	Osmolarity	Serum				
33	Greenleaf 1992	0	30	2	2				30	Twice daily / 6 days per week	7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40% (supine ergometer)	ITE	0	7	Osmolarity	Serum				
33	Greenleaf 1992	0	30	2	1024				30	Twice daily / 6 days per week	5 min warm-up, 5 peak knee flexions and extensions (90° arc) in 10s and rested remaining 50s. Repeat 10 times, 4min cooling down, repeat with other leg	IKE	0	7	Osmolarity	Serum				
33	Greenleaf 1992	0	30	2	0							CON	0	5	VO2 (L/min)	Max		-18.2	1	
33	Greenleaf 1992	0	30	2	2				30	Twice daily / 6 days per week	7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40% (supine ergometer)	ITE	0	7	VO2 (L/min)	Max		2.6		
33	Greenleaf 1992	0	30	2	1024				30	Twice daily / 6 days per week	5 min warm-up, 5 peak knee flexions and extensions (90° arc) in 10s and rested remaining 50s. Repeat 10 times, 4min cooling down, repeat with other leg	IKE	0	7	VO2 (L/min)	Max		-9.1	1	
33	Greenleaf 1992	0	30	2	0							CON	0	5	Energy Cost of Regime					
33	Greenleaf 1992	0	30	2	2				30	Twice daily / 6 days per week	7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40% (supine ergometer)	ITE	0	7	Energy Cost of Regime					
33	Greenleaf 1992	0	30	2	1024				30	Twice daily / 6 days per week	5 min warm-up, 5 peak knee flexions and extensions (90° arc) in 10s and rested remaining 50s. Repeat 10 times, 4min cooling down, repeat with other leg	IKE	0	7	Energy Cost of Regime					
34	Greenleaf 1983	0	14	2	0							CON	0	7	Muscle Strength	Handgrip		0		
34	Greenleaf 1983	0	14	2	2				30	Twice daily / everyday	60rpm @68% VO2max	ITE	0	7	Muscle Strength	Handgrip		-1		
34	Greenleaf 1983	0	14	2	16384				30	Twice daily / everyday	21% maximal leg extension force for 1min then 1min relax	IME	0	7	Muscle Strength	Handgrip		1		
34	Greenleaf 1983	0	14	2	0							CON	0	7	Muscle Endurance	Handgrip		-19.6	1	
34	Greenleaf 1983	0	14	2	2				30	Twice daily / everyday	60rpm @68% VO2max	ITE	0	7	Muscle Endurance	Handgrip		-7.5		
34	Greenleaf 1983	0	14	2	16384				30	Twice daily / everyday	21% maximal leg extension force for 1min then 1min relax	IME	0	7	Muscle Endurance	Handgrip		3.6		
34	Greenleaf 1983	0	14	2	0							CON	0	7	Systolic Blood Pressure (mmHg)	Max		-4.5		
34	Greenleaf 1983	0	14	2	2				30	Twice daily / everyday	60rpm @68% VO2max	ITE	0	7	Systolic Blood Pressure (mmHg)	Max		0.6		
34	Greenleaf 1983	0	14	2	16384				30	Twice daily / everyday	21% maximal leg extension force for 1min then 1min relax	IME	0	7	Systolic Blood Pressure (mmHg)	Max		0		
34	Greenleaf 1983	0	14	2	0							CON	0	7	Diastolic Blood Pressure (mmHg)	Max		0.8		
34	Greenleaf 1983	0	14	2	2				30	Twice daily / everyday	60rpm @68% VO2max	ITE	0	7	Diastolic Blood Pressure (mmHg)	Max		16.4		
34	Greenleaf 1983	0	14	2	16384				30	Twice daily / everyday	21% maximal leg extension force for 1min then 1min relax	IME	0	7	Diastolic Blood Pressure (mmHg)	Max		9.1		
36	Alkner 2004	0	90	2	0							CON	0	9	Muscle Volume	Knee Extensor		-18	1	
36	Alkner 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	8	Muscle Volume	Knee Extensor		-1		
36	Alkner 2004	0	90	2	0							CON	0	9	Muscle Volume	Vastii Group		-19	1	

36	Alkner 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	8	Muscle Volume	Vastii Group		0		
36	Alkner 2004	0	90	2	0							CON	0	9	Muscle Volume	Rectus Femoris		-9	1	
36	Alkner 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	8	Muscle Volume	Rectus Femoris		0		
36	Alkner 2004	0	90	2	0							CON	0	9	Muscle Volume	Plantar Flexor		-29	1	
36	Alkner 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	8	Muscle Volume	Plantar Flexor		-15	1	1
38	Tesch 2004	0	35	7	0							CON	4	7	Muscle Volume	Knee Extensor		-8.8	1	
38	Tesch 2004	0	35	7	192					Every third day	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	ULLSE	3	7	Muscle Volume	Knee Extensor		7.7	1	
38	Tesch 2004	0	35	7	0							CON	4	7	Muscle Volume	Plantar Flexor		-10.5	1	
38	Tesch 2004	0	35	7	192					Every third day	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	ULLSE	3	7	Muscle Volume	Plantar Flexor		-11.1	1	
38	Tesch 2004	0	35	7	0							CON	4	7	Muscle Volume	Vastus Lateralis		-9.3	1	
38	Tesch 2004	0	35	7	192					Every third day	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	ULLSE	3	7	Muscle Volume	Vastus Lateralis		6.2	1	
38	Tesch 2004	0	35	7	0							CON	4	7	Muscle Volume	Vastus Intermedius		-8.8	1	
38	Tesch 2004	0	35	7	192					Every third day	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	ULLSE	3	7	Muscle Volume	Vastus Intermedius		5.3	1	
38	Tesch 2004	0	35	7	0							CON	4	7	Muscle Volume	Vastus Medialis		-12.1	1	
38	Tesch 2004	0	35	7	192					Every third day	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	ULLSE	3	7	Muscle Volume	Vastus Medialis		9.3	1	
38	Tesch 2004	0	35	7	0							CON	4	7	Muscle Volume	Rectus Femoris		0		
38	Tesch 2004	0	35	7	192					Every third day	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	ULLSE	3	7	Muscle Volume	Rectus Femoris		16.7	1	
38	Tesch 2004	0	35	7	0							CON	4	7	Maximum Voluntary Contraction (MVC)	90 degrees knee		-24	1	
38	Tesch 2004	0	35	7	192					Every third day	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	ULLSE	3	7	Maximum Voluntary Contraction (MVC)	90 degrees knee		-7		
38	Tesch 2004	0	35	7	0							CON	4	7	Maximum Voluntary Contraction (MVC)	120 degrees knee		-26	1	
38	Tesch 2004	0	35	7	192					Every third day	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	ULLSE	3	7	Maximum Voluntary Contraction (MVC)	120 degrees knee		-8		
38	Tesch 2004	0	35	7	0							CON	4	7	Maximum Voluntary Contraction (MVC)	90 degrees calf		-32	1	
38	Tesch 2004	0	35	7	192					Every third day	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	ULLSE	3	7	Maximum Voluntary Contraction (MVC)	90 degrees calf		-12	1	1
39	Trappe 2008	0	60	2	0							CON	7	0	Diameter	MHC I	Soleus	-14.4	1	
39	Trappe 2008	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Diameter	MHC I	Soleus	-13	1	
39	Trappe 2008	0	60	2	452					RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Diameter	MHC I	Soleus	-9.7	1	
39	Trappe 2008	0	60	2	0							CON	7	0	Myofiber Cross Sectional Area	Total	Soleus	-24.7		
39	Trappe 2008	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Myofiber Cross Sectional Area	Total	Soleus			
39	Trappe 2008	0	60	2	452					RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Myofiber Cross Sectional Area	Total	Soleus	-8.5		
39	Trappe 2008	0	60	2	0							CON	7	0	Po, Peak force	MHC I	Soleus	-38.5	1	

39	Trappe 2008	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Po, Peak force	MHC I	Soleus	-28.3	1	
39	Trappe 2008	0	60	2	452					RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Po, Peak force	MHC I	Soleus	-23.2	1	1
39	Trappe 2008	0	60	2	0							CON	7	0	Po/CSA	MHC I	Soleus	-14.8	1	
39	Trappe 2008	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Po/CSA	MHC I	Soleus	-2.2		
39	Trappe 2008	0	60	2	452					RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Po/CSA	MHC I	Soleus	-10		
39	Trappe 2008	0	60	2	0							CON	7	0	Vo, shortening velocity	MHC I	Soleus	-7.2		
39	Trappe 2008	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Vo, shortening velocity	MHC I	Soleus	2.7		
39	Trappe 2008	0	60	2	452					RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Vo, shortening velocity	MHC I	Soleus	6.4		
39	Trappe 2008	0	60	2	0							CON	7	0	Vmax	MHC I	Soleus	4.3		
39	Trappe 2008	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Vmax	MHC I	Soleus	3.3		1
39	Trappe 2008	0	60	2	452					RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Vmax	MHC I	Soleus	26.1	1	
39	Trappe 2008	0	60	2	0							CON	7	0	Absolute Power	MHC I	Soleus	-39.1		
39	Trappe 2008	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Absolute Power	MHC I	Soleus	-29.8	1	
39	Trappe 2008	0	60	2	452					RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Absolute Power	MHC I	Soleus	-8		p<0.05 post and pre vs. BR post and pre / post
39	Trappe 2008	0	60	2	0							CON	7	0	Normalized Power	MHC I	Soleus	-16		
39	Trappe 2008	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Normalized Power	MHC I	Soleus	-3.6		
39	Trappe 2008	0	60	2	452					RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Normalized Power	MHC I	Soleus	11.1		
39	Trappe 2008	0	60	2	0							CON	7	0	Diameter	MHC I / IIa	Soleus	-10.5		
39	Trappe 2008	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Diameter	MHC I / IIa	Soleus			

39	Trappe 2008	0	60	2	452					RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Diameter	MHC I / IIa	Soleus	-2.1		
39	Trappe 2008	0	60	2	0							CON	7	0	Po, Peak force	MHC I / IIa	Soleus	-44.9		
39	Trappe 2008	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Po, Peak force	MHC I / IIa	Soleus			
39	Trappe 2008	0	60	2	452					RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Po, Peak force	MHC I / IIa	Soleus	-23.3		
39	Trappe 2008	0	60	2	0							CON	7	0	Po/CSA	MHC I / IIa	Soleus	-30.8		
39	Trappe 2008	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Po/CSA	MHC I / IIa	Soleus			
39	Trappe 2008	0	60	2	452					RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Po/CSA	MHC I / IIa	Soleus	-21.7		
39	Trappe 2008	0	60	2	0							CON	7	0	Vo, shortening velocity	MHC I / IIa	Soleus	-4		
39	Trappe 2008	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Vo, shortening velocity	MHC I / IIa	Soleus			
39	Trappe 2008	0	60	2	452					RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Vo, shortening velocity	MHC I / IIa	Soleus	41.6		
39	Trappe 2008	0	60	2	0							CON	7	0	Vmax	MHC I / IIa	Soleus	-30.2		
39	Trappe 2008	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Vmax	MHC I / IIa	Soleus			
39	Trappe 2008	0	60	2	452					RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Vmax	MHC I / IIa	Soleus	53.2		
39	Trappe 2008	0	60	2	0							CON	7	0	Absolute Power	MHC I / IIa	Soleus	-69.5		
39	Trappe 2008	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Absolute Power	MHC I / IIa	Soleus			
39	Trappe 2008	0	60	2	452					RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Absolute Power	MHC I / IIa	Soleus	-5.1		
39	Trappe 2008	0	60	2	0							CON	7	0	Normalized Power	MHC I / IIa	Soleus	-62.9		
39	Trappe 2008	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Normalized Power	MHC I / IIa	Soleus			
39	Trappe 2008	0	60	2	452					RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Normalized Power	MHC I / IIa	Soleus	-2.4		
39	Trappe 2008	0	60	2	0							CON	7	0	Diameter	MHC IIa	Soleus	-11		

39	Trappe 2008	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Diameter	MHC IIa	Soleus	-12		
39	Trappe 2008	0	60	2	452					RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Diameter	MHC IIa	Soleus	1.1		
39	Trappe 2008	0	60	2	0							CON	7	0	Po, Peak force	MHC IIa	Soleus	-21.5		
39	Trappe 2008	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Po, Peak force	MHC IIa	Soleus	-31.4		
39	Trappe 2008	0	60	2	452					RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Po, Peak force	MHC IIa	Soleus	8		
39	Trappe 2008	0	60	2	0							CON	7	0	Po/CSA	MHC IIa	Soleus	-1.6		
39	Trappe 2008	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Po/CSA	MHC IIa	Soleus	-7.2		
39	Trappe 2008	0	60	2	452					RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Po/CSA	MHC IIa	Soleus	4.8		
39	Trappe 2008	0	60	2	0							CON	7	0	Vo, shortening velocity	MHC IIa	Soleus	-8.5		
39	Trappe 2008	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Vo, shortening velocity	MHC IIa	Soleus	2.1		
39	Trappe 2008	0	60	2	452					RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Vo, shortening velocity	MHC IIa	Soleus	12.2		
39	Trappe 2008	0	60	2	0							CON	7	0	Vmax	MHC IIa	Soleus	1.8		
39	Trappe 2008	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Vmax	MHC IIa	Soleus	15.3		
39	Trappe 2008	0	60	2	452					RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Vmax	MHC IIa	Soleus	18.9		
39	Trappe 2008	0	60	2	0							CON	7	0	Absolute Power	MHC IIa	Soleus	-7.8		
39	Trappe 2008	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Absolute Power	MHC IIa	Soleus	-28.5		
39	Trappe 2008	0	60	2	452					RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Absolute Power	MHC IIa	Soleus	13.5		
39	Trappe 2008	0	60	2	0							CON	7	0	Normalized Power	MHC IIa	Soleus	11.4		
39	Trappe 2008	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Normalized Power	MHC IIa	Soleus	-11.6		
39	Trappe 2008	0	60	2	452					RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Normalized Power	MHC IIa	Soleus	13.1		

39	Trappe 2008	0	60	2	0							CON	7	0	Diameter	MHC IIa / IIx	Soleus	-6		
39	Trappe 2008	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Diameter	MHC IIa / IIx	Soleus			
39	Trappe 2008	0	60	2	452					RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Diameter	MHC IIa / IIx	Soleus	14.1		
39	Trappe 2008	0	60	2	0							CON	7	0	Po, Peak force	MHC IIa / IIx	Soleus	-18.1		
39	Trappe 2008	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Po, Peak force	MHC IIa / IIx	Soleus			
39	Trappe 2008	0	60	2	452					RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Po, Peak force	MHC IIa / IIx	Soleus	15.8		
39	Trappe 2008	0	60	2	0							CON	7	0	Po/CSA	MHC IIa / IIx	Soleus	-11.3		
39	Trappe 2008	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Po/CSA	MHC IIa / IIx	Soleus			
39	Trappe 2008	0	60	2	452					RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Po/CSA	MHC IIa / IIx	Soleus	-9.2		
39	Trappe 2008	0	60	2	0							CON	7	0	Vo, shortening velocity	MHC IIa / IIx	Soleus	14.6		
39	Trappe 2008	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Vo, shortening velocity	MHC IIa / IIx	Soleus			
39	Trappe 2008	0	60	2	452					RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Vo, shortening velocity	MHC IIa / IIx	Soleus	1.5		
39	Trappe 2008	0	60	2	0							CON	7	0	Vmax	MHC IIa / IIx	Soleus	69.2		
39	Trappe 2008	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Vmax	MHC IIa / IIx	Soleus			
39	Trappe 2008	0	60	2	452					RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Vmax	MHC IIa / IIx	Soleus	-11.8		
39	Trappe 2008	0	60	2	0							CON	7	0	Absolute Power	MHC IIa / IIx	Soleus	13.9		
39	Trappe 2008	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Absolute Power	MHC IIa / IIx	Soleus			
39	Trappe 2008	0	60	2	452					RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Absolute Power	MHC IIa / IIx	Soleus	-19.6		
39	Trappe 2008	0	60	2	0							CON	7	0	Normalized Power	MHC IIa / IIx	Soleus	29.4		
39	Trappe 2008	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Normalized Power	MHC IIa / IIx	Soleus			

39	Trappe 2008	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Normalized Power	MHC IIa / IIx	Soleus	-36.6		
40	Trappe 2007	0	60	2	0							CON	7	0	Diameter	MHC I	Vastus Lateralis	-13.5	1	
40	Trappe 2007	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Diameter	MHC I	Vastus Lateralis	-18.2	1	
40	Trappe 2007	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Diameter	MHC I	Vastus Lateralis	-1.2		1
40	Trappe 2007	0	60	2	0							CON	7	0	Po, Peak force	MHC I	Vastus Lateralis	-35.7	1	
40	Trappe 2007	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Po, Peak force	MHC I	Vastus Lateralis	-39.7	1	
40	Trappe 2007	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Po, Peak force	MHC I	Vastus Lateralis	-9.8		1
40	Trappe 2007	0	60	2	0							CON	7	0	Po/CSA	MHC I	Vastus Lateralis	-16.2	1	
40	Trappe 2007	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Po/CSA	MHC I	Vastus Lateralis	-6.9		
40	Trappe 2007	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Po/CSA	MHC I	Vastus Lateralis	-8.6		1
40	Trappe 2007	0	60	2	0							CON	7	0	Vo, shortening velocity	MHC I	Vastus Lateralis	-12.2		
40	Trappe 2007	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Vo, shortening velocity	MHC I	Vastus Lateralis	-4.8		
40	Trappe 2007	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Vo, shortening velocity	MHC I	Vastus Lateralis	1		
40	Trappe 2007	0	60	2	0							CON	7	0	Vmax	MHC I	Vastus Lateralis	-9.5		
40	Trappe 2007	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Vmax	MHC I	Vastus Lateralis	2.4		
40	Trappe 2007	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Vmax	MHC I	Vastus Lateralis	14.9		
40	Trappe 2007	0	60	2	0							CON	7	0	Absolute Power	MHC I	Vastus Lateralis	-41.2	1	
40	Trappe 2007	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Absolute Power	MHC I	Vastus Lateralis	-43.3	1	
40	Trappe 2007	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Absolute Power	MHC I	Vastus Lateralis	-2.1		1
40	Trappe 2007	0	60	2	0							CON	7	0	Normalized Power	MHC I	Vastus Lateralis	-20.8		

40	Trappe 2007	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Normalized Power	MHC I	Vastus Lateralis	-13.8		
40	Trappe 2007	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Normalized Power	MHC I	Vastus Lateralis	-3.7		
40	Trappe 2007	0	60	2	0							CON	7	0	Diameter	MHC I / IIa	Vastus Lateralis	-5.6		
40	Trappe 2007	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Diameter	MHC I / IIa	Vastus Lateralis	-12		
40	Trappe 2007	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Diameter	MHC I / IIa	Vastus Lateralis	-17.5		
40	Trappe 2007	0	60	2	0							CON	7	0	Po, Peak force	MHC I / IIa	Vastus Lateralis	-51.7		
40	Trappe 2007	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Po, Peak force	MHC I / IIa	Vastus Lateralis	-25		
40	Trappe 2007	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Po, Peak force	MHC I / IIa	Vastus Lateralis	-35.2		
40	Trappe 2007	0	60	2	0							CON	7	0	Po/CSA	MHC I / IIa	Vastus Lateralis	-44.2		
40	Trappe 2007	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Po/CSA	MHC I / IIa	Vastus Lateralis	1.9		
40	Trappe 2007	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Po/CSA	MHC I / IIa	Vastus Lateralis	-5.1		
40	Trappe 2007	0	60	2	0							CON	7	0	Vo, shortening velocity	MHC I / IIa	Vastus Lateralis	-23.8		
40	Trappe 2007	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Vo, shortening velocity	MHC I / IIa	Vastus Lateralis	-18.8		
40	Trappe 2007	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Vo, shortening velocity	MHC I / IIa	Vastus Lateralis	-22.3		
40	Trappe 2007	0	60	2	0							CON	7	0	Vmax	MHC I / IIa	Vastus Lateralis	-15.1		
40	Trappe 2007	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Vmax	MHC I / IIa	Vastus Lateralis	-12.4		
40	Trappe 2007	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Vmax	MHC I / IIa	Vastus Lateralis	1.2		
40	Trappe 2007	0	60	2	0							CON	7	0	Absolute Power	MHC I / IIa	Vastus Lateralis	-78.9		
40	Trappe 2007	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Absolute Power	MHC I / IIa	Vastus Lateralis	-53.8		
40	Trappe 2007	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Absolute Power	MHC I / IIa	Vastus Lateralis	-49.5		

40	Trappe 2007	0	60	2	0							CON	7	0	Normalized Power	MHC I / IIa	Vastus Lateralis	-74.6		
40	Trappe 2007	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Normalized Power	MHC I / IIa	Vastus Lateralis	-27.6		
40	Trappe 2007	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Normalized Power	MHC I / IIa	Vastus Lateralis	-23.5		
40	Trappe 2007	0	60	2	0							CON	7	0	Diameter	MHC IIa	Vastus Lateralis	-15.8	1	
40	Trappe 2007	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Diameter	MHC IIa	Vastus Lateralis	-20.5	1	
40	Trappe 2007	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Diameter	MHC IIa	Vastus Lateralis	1.3		1
40	Trappe 2007	0	60	2	0							CON	7	0	Myofiber Cross Sectional Area	Total	Vastus Lateralis	-31.6		
40	Trappe 2007	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Myofiber Cross Sectional Area	Total	Vastus Lateralis			
40	Trappe 2007	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Myofiber Cross Sectional Area	Total	Vastus Lateralis	-0.9		
40	Trappe 2007	0	60	2	0							CON	7	0	Po, Peak force	MHC IIa	Vastus Lateralis	-30.6		
40	Trappe 2007	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Po, Peak force	MHC IIa	Vastus Lateralis	-30		
40	Trappe 2007	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Po, Peak force	MHC IIa	Vastus Lateralis	4.3		
40	Trappe 2007	0	60	2	0							CON	7	0	Po/CSA	MHC IIa	Vastus Lateralis	-6.6		
40	Trappe 2007	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Po/CSA	MHC IIa	Vastus Lateralis	5.4		
40	Trappe 2007	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Po/CSA	MHC IIa	Vastus Lateralis	-2.5		
40	Trappe 2007	0	60	2	0							CON	7	0	Vo, shortening velocity	MHC IIa	Vastus Lateralis	-8.8		
40	Trappe 2007	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Vo, shortening velocity	MHC IIa	Vastus Lateralis	5		
40	Trappe 2007	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Vo, shortening velocity	MHC IIa	Vastus Lateralis	1.2		
40	Trappe 2007	0	60	2	0							CON	7	0	Vmax	MHC IIa	Vastus Lateralis	0		
40	Trappe 2007	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Vmax	MHC IIa	Vastus Lateralis	4.5		

40	Trappe 2007	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Vmax	MHC IIa	Vastus Lateralis	9.1		
40	Trappe 2007	0	60	2	0							CON	7	0	Absolute Power	MHC IIa	Vastus Lateralis	-27.8		
40	Trappe 2007	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Absolute Power	MHC IIa	Vastus Lateralis	-24.1		
40	Trappe 2007	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Absolute Power	MHC IIa	Vastus Lateralis	8.4		
40	Trappe 2007	0	60	2	0							CON	7	0	Normalized Power	MHC IIa	Vastus Lateralis	-3.1		
40	Trappe 2007	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Normalized Power	MHC IIa	Vastus Lateralis	16.9		
40	Trappe 2007	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Normalized Power	MHC IIa	Vastus Lateralis	-0.6		
40	Trappe 2007	0	60	2	0							CON	7	0	Diameter	MHC IIa / IIx	Vastus Lateralis	-9.1		
40	Trappe 2007	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Diameter	MHC IIa / IIx	Vastus Lateralis	6.8		
40	Trappe 2007	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Diameter	MHC IIa / IIx	Vastus Lateralis	4.6		
40	Trappe 2007	0	60	2	0							CON	7	0	Po, Peak force	MHC IIa / IIx	Vastus Lateralis	-25.5		
40	Trappe 2007	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Po, Peak force	MHC IIa / IIx	Vastus Lateralis	12.2		
40	Trappe 2007	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Po, Peak force	MHC IIa / IIx	Vastus Lateralis	1.7		
40	Trappe 2007	0	60	2	0							CON	7	0	Po/CSA	MHC IIa / IIx	Vastus Lateralis	-8.9		
40	Trappe 2007	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Po/CSA	MHC IIa / IIx	Vastus Lateralis	1.4		
40	Trappe 2007	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Po/CSA	MHC IIa / IIx	Vastus Lateralis	-1.8		
40	Trappe 2007	0	60	2	0							CON	7	0	Vo, shortening velocity	MHC IIa / IIx	Vastus Lateralis	-6.7		
40	Trappe 2007	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Vo, shortening velocity	MHC IIa / IIx	Vastus Lateralis	-13.8		
40	Trappe 2007	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Vo, shortening velocity	MHC IIa / IIx	Vastus Lateralis	-6.7		
40	Trappe 2007	0	60	2	0							CON	7	0	Vmax	MHC IIa / IIx	Vastus Lateralis	-5.6		

40	Trappe 2007	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Vmax	MHC IIa / IIx	Vastus Lateralis	-22.9		
40	Trappe 2007	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Vmax	MHC IIa / IIx	Vastus Lateralis	-7.1		
40	Trappe 2007	0	60	2	0							CON	7	0	Absolute Power	MHC IIa / IIx	Vastus Lateralis	-39.9		
40	Trappe 2007	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Absolute Power	MHC IIa / IIx	Vastus Lateralis	-14.5		
40	Trappe 2007	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Absolute Power	MHC IIa / IIx	Vastus Lateralis	-14.6		
40	Trappe 2007	0	60	2	0							CON	7	0	Normalized Power	MHC IIa / IIx	Vastus Lateralis	-22.9		
40	Trappe 2007	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Normalized Power	MHC IIa / IIx	Vastus Lateralis	-18.5		
40	Trappe 2007	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Normalized Power	MHC IIa / IIx	Vastus Lateralis	-16.3		
41	Trappe 2007	0	60	2	0							CON	7	0	Muscle Volume	Knee Extensor	Vastus Lateralis	-21.2	1	
41	Trappe 2007	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Muscle Volume	Knee Extensor	Vastus Lateralis	-24.1	1	1
41	Trappe 2007	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Muscle Volume	Knee Extensor	Vastus Lateralis	-2.8		1
41	Trappe 2007	0	60	2	0							CON	7	0	Muscle Volume	Plantar Flexor	Vastus Lateralis	-28.8	1	
41	Trappe 2007	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Muscle Volume	Plantar Flexor	Vastus Lateralis	-27.3	1	
41	Trappe 2007	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	6	0	Muscle Volume	Plantar Flexor	Vastus Lateralis	-7.3	1	1
42	Trappe 2004	0	90	2	0							CON	0	6	Muscle Volume	Knee Extensor	Vastus Lateralis	-17	1	
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Muscle Volume	Knee Extensor	Vastus Lateralis	-0.5		
42	Trappe 2004	0	90	2	0							CON	0	6	Maximum Voluntary Contraction (MVC)	Knee Extensor	Vastus Lateralis	-44	1	
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Maximum Voluntary Contraction (MVC)	Knee Extensor	Vastus Lateralis	-12.4		
42	Trappe 2004	0	90	2	0							CON	0	6	Concentric Peak Force	Knee Extensor	Vastus Lateralis	-40.5	1	
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Concentric Peak Force	Knee Extensor	Vastus Lateralis	1.1		
42	Trappe 2004	0	90	2	0							CON	0	6	Eccentric Peak Force	Knee Extensor	Vastus Lateralis	-36.2	1	
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Eccentric Peak Force	Knee Extensor	Vastus Lateralis	-9.4		
42	Trappe 2004	0	90	2	0							CON	0	6	Absolute Power	Knee Extensor	Vastus Lateralis	-48.2	1	
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Absolute Power	Knee Extensor	Vastus Lateralis	7.2		

42	Trappe 2004	0	90	2	0							CON	0	6	Diameter	MHC I	Vastus Lateralis	-15.4	1	
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Diameter	MHC I	Vastus Lateralis	4.6		
42	Trappe 2004	0	90	2	0							CON	0	6	Po, Peak force	MHC I	Vastus Lateralis	-47.7	1	
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Po, Peak force	MHC I	Vastus Lateralis	-19		
42	Trappe 2004	0	90	2	0							CON	0	6	Po/CSA	MHC I	Vastus Lateralis	-27.7	1	
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Po/CSA	MHC I	Vastus Lateralis	-20.2		
42	Trappe 2004	0	90	2	0							CON	0	6	Vo, shortening velocity	MHC I	Vastus Lateralis	-21.2	1	
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Vo, shortening velocity	MHC I	Vastus Lateralis	-0.8		
42	Trappe 2004	0	90	2	0							CON	0	6	Vmax	MHC I	Vastus Lateralis	-22.2	1	
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Vmax	MHC I	Vastus Lateralis	6		
42	Trappe 2004	0	90	2	0							CON	0	6	Absolute Power	MHC I	Vastus Lateralis	-55.2	1	
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Absolute Power	MHC I	Vastus Lateralis	-28.9	1	
42	Trappe 2004	0	90	2	0							CON	0	6	Normalized Power	MHC I	Vastus Lateralis	-40.7	1	
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Normalized Power	MHC I	Vastus Lateralis	-31.3	1	
42	Trappe 2004	0	90	2	0							CON	0	6	Diameter	MHC I / IIa	Vastus Lateralis	-14		
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Diameter	MHC I / IIa	Vastus Lateralis	-14.7		
42	Trappe 2004	0	90	2	0							CON	0	6	Po, Peak force	MHC I / IIa	Vastus Lateralis	-39.1		
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Po, Peak force	MHC I / IIa	Vastus Lateralis	-30.8		
42	Trappe 2004	0	90	2	0							CON	0	6	Po/CSA	MHC I / IIa	Vastus Lateralis	-17.5		
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Po/CSA	MHC I / IIa	Vastus Lateralis	-8.6		
42	Trappe 2004	0	90	2	0							CON	0	6	Vo, shortening velocity	MHC I / IIa	Vastus Lateralis	-23.5		
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Vo, shortening velocity	MHC I / IIa	Vastus Lateralis	-19.1		
42	Trappe 2004	0	90	2	0							CON	0	6	Vmax	MHC I / IIa	Vastus Lateralis	-53.1		
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Vmax	MHC I / IIa	Vastus Lateralis	-15.1		
42	Trappe 2004	0	90	2	0							CON	0	6	Absolute Power	MHC I / IIa	Vastus Lateralis	-59.1		
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Absolute Power	MHC I / IIa	Vastus Lateralis	-53.4		
42	Trappe 2004	0	90	2	0							CON	0	6	Normalized Power	MHC I / IIa	Vastus Lateralis	-37.2		
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Normalized Power	MHC I / IIa	Vastus Lateralis	-41.8		
42	Trappe 2004	0	90	2	0							CON	0	6	Diameter	MHC IIa	Vastus Lateralis	-8.4		
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Diameter	MHC IIa	Vastus Lateralis	8.2		1
42	Trappe 2004	0	90	2	0							CON	0	6	Myofiber Cross Sectional Area	Total	Vastus Lateralis	-23.2		
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Myofiber Cross Sectional Area	Total	Vastus Lateralis	13.7		
42	Trappe 2004	0	90	2	0							CON	0	6	Po, Peak force	MHC IIa	Vastus Lateralis	-25	1	
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Po, Peak force	MHC IIa	Vastus Lateralis	4.3		
42	Trappe 2004	0	90	2	0							CON	0	6	Po/CSA	MHC IIa	Vastus Lateralis	-12.9		
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Po/CSA	MHC IIa	Vastus Lateralis	-9.3		
42	Trappe 2004	0	90	2	0							CON	0	6	Vo, shortening velocity	MHC IIa	Vastus Lateralis	-5.8		

42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Vo, shortening velocity	MHC IIa	Vastus Lateralis	12.8		
42	Trappe 2004	0	90	2	0							CON	0	6	Vmax	MHC IIa	Vastus Lateralis	-32.6		
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Vmax	MHC IIa	Vastus Lateralis	7.2		
42	Trappe 2004	0	90	2	0							CON	0	6	Absolute Power	MHC IIa	Vastus Lateralis	-24.5		
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Absolute Power	MHC IIa	Vastus Lateralis	1		
42	Trappe 2004	0	90	2	0							CON	0	6	Normalized Power	MHC IIa	Vastus Lateralis	-13.5		
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Normalized Power	MHC IIa	Vastus Lateralis	-13.6		
42	Trappe 2004	0	90	2	0							CON	0	6	Diameter	MHC IIa / IIx	Vastus Lateralis	0		
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Diameter	MHC IIa / IIx	Vastus Lateralis	22.7		
42	Trappe 2004	0	90	2	0							CON	0	6	Po, Peak force	MHC IIa / IIx	Vastus Lateralis	-20.8		
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Po, Peak force	MHC IIa / IIx	Vastus Lateralis	-1.2		
42	Trappe 2004	0	90	2	0							CON	0	6	Po/CSA	MHC IIa / IIx	Vastus Lateralis	-33.5		
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Po/CSA	MHC IIa / IIx	Vastus Lateralis	-36.2		
42	Trappe 2004	0	90	2	0							CON	0	6	Vo, shortening velocity	MHC IIa / IIx	Vastus Lateralis	-10		
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Vo, shortening velocity	MHC IIa / IIx	Vastus Lateralis	-8.4		
42	Trappe 2004	0	90	2	0							CON	0	6	Vmax	MHC IIa / IIx	Vastus Lateralis	-15.6		
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Vmax	MHC IIa / IIx	Vastus Lateralis	-8.1		
42	Trappe 2004	0	90	2	0							CON	0	6	Absolute Power	MHC IIa / IIx	Vastus Lateralis	-45.1		
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Absolute Power	MHC IIa / IIx	Vastus Lateralis	2.9		
42	Trappe 2004	0	90	2	0							CON	0	6	Normalized Power	MHC IIa / IIx	Vastus Lateralis	-53		
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Normalized Power	MHC IIa / IIx	Vastus Lateralis	-34.9		
42	Trappe 2004	0	90	2	0							CON	0	6	Diameter	MHC I / IIa / IIx	Vastus Lateralis			
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Diameter	MHC I / IIa / IIx	Vastus Lateralis			
42	Trappe 2004	0	90	2	0							CON	0	6	Po, Peak force	MHC I / IIa / IIx	Vastus Lateralis			
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Po, Peak force	MHC I / IIa / IIx	Vastus Lateralis			
42	Trappe 2004	0	90	2	0							CON	0	6	Po/CSA	MHC I / IIa / IIx	Vastus Lateralis			
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Po/CSA	MHC I / IIa / IIx	Vastus Lateralis			
42	Trappe 2004	0	90	2	0							CON	0	6	Vo, shortening velocity	MHC I / IIa / IIx	Vastus Lateralis			
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Vo, shortening velocity	MHC I / IIa / IIx	Vastus Lateralis			
42	Trappe 2004	0	90	2	0							CON	0	6	Vmax	MHC I / IIa / IIx	Vastus Lateralis			
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Vmax	MHC I / IIa / IIx	Vastus Lateralis			
42	Trappe 2004	0	90	2	0							CON	0	6	Absolute Power	MHC I / IIa / IIx	Vastus Lateralis			
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Absolute Power	MHC I / IIa / IIx	Vastus Lateralis			
42	Trappe 2004	0	90	2	0							CON	0	6	Normalized Power	MHC I / IIa / IIx	Vastus Lateralis			
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Normalized Power	MHC I / IIa / IIx	Vastus Lateralis			
42	Trappe 2004	0	90	2	0							CON	0	6	Diameter	Single muscle fiber V.L. composition data	Vastus Lateralis	-9.9	1	
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Diameter	Single muscle fiber V.L. composition data	Vastus Lateralis	5.4		

42	Trappe 2004	0	90	2	0							CON	0	6	Po, Peak force	Single muscle fiber V.L. composition data	Vastus Lateralis	-36.6	1	
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Po, Peak force	Single muscle fiber V.L. composition data	Vastus Lateralis	4.3		
42	Trappe 2004	0	90	2	0							CON	0	6	Po/CSA	Single muscle fiber V.L. composition data	Vastus Lateralis	-21.1	1	
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Po/CSA	Single muscle fiber V.L. composition data	Vastus Lateralis	-14.7	1	
42	Trappe 2004	0	90	2	0							CON	0	6	Vo, shortening velocity	Single muscle fiber V.L. composition data	Vastus Lateralis	11.4		
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Vo, shortening velocity	Single muscle fiber V.L. composition data	Vastus Lateralis	11.6		
42	Trappe 2004	0	90	2	0							CON	0	6	Absolute Power	Single muscle fiber V.L. composition data	Vastus Lateralis	-22.9	1	
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Absolute Power	Single muscle fiber V.L. composition data	Vastus Lateralis	0.5		
42	Trappe 2004	0	90	2	0							CON	0	6	Normalized Power	Single muscle fiber V.L. composition data	Vastus Lateralis	-11.4		
42	Trappe 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	6	Normalized Power	Single muscle fiber V.L. composition data	Vastus Lateralis	-13.6		
44	Akima 2001	0	20	2	0							CON	0	10	Muscle Cross Section Area	Rectus Femoris		-4.8		1
44	Akima 2001	0	20	2	64					Twice / day	Morning - 3 sets of 10 reps leg press @ 90% maximal load. 1 min between sets. Afternoon - isotonic leg press @ 40% max load until volitional exhaustion	BRE	0	5	Muscle Cross Section Area	Rectus Femoris		-2.2		
44	Akima 2001	0	20	2	0							CON	0	10	Muscle Cross Section Area	Vastus Lateralis		-5.1	1	
44	Akima 2001	0	20	2	64					Twice / day	Morning - 3 sets of 10 reps leg press @ 90% maximal load. 1 min between sets. Afternoon - isotonic leg press @ 40% max load until volitional exhaustion	BRE	0	5	Muscle Cross Section Area	Vastus Lateralis		6.6		1
44	Akima 2001	0	20	2	0							CON	0	10	Muscle Cross Section Area	Vastus Intermedius		-9.8	1	
44	Akima 2001	0	20	2	64					Twice / day	Morning - 3 sets of 10 reps leg press @ 90% maximal load. 1 min between sets. Afternoon - isotonic leg press @ 40% max load until volitional exhaustion	BRE	0	5	Muscle Cross Section Area	Vastus Intermedius		11.6	1	1
44	Akima 2001	0	20	2	0							CON	0	10	Muscle Cross Section Area	Vastus Medialis		-8.9		
44	Akima 2001	0	20	2	64					Twice / day	Morning - 3 sets of 10 reps leg press @ 90% maximal load. 1 min between sets. Afternoon - isotonic leg press @ 40% max load until volitional exhaustion	BRE	0	5	Muscle Cross Section Area	Vastus Medialis		4.1		1
44	Akima 2001	0	20	2	0							CON	0	10	Muscle Cross Section Area	Knee Extensor		-7.1	1	
44	Akima 2001	0	20	2	64					Twice / day	Morning - 3 sets of 10 reps leg press @ 90% maximal load. 1 min between sets. Afternoon - isotonic leg press @ 40% max load until volitional exhaustion	BRE	0	5	Muscle Cross Section Area	Knee Extensor		6	1	1
44	Akima 2001	0	20	2	0							CON	0	10	Muscle Cross Section Area	Biceps Femoris Short Head		-2.9		
44	Akima 2001	0	20	2	64					Twice / day	Morning - 3 sets of 10 reps leg press @ 90% maximal load. 1 min between sets. Afternoon - isotonic leg press @ 40% max load until volitional exhaustion	BRE	0	5	Muscle Cross Section Area	Biceps Femoris Short Head		-4.6		
44	Akima 2001	0	20	2	0							CON	0	10	Muscle Cross Section Area	Biceps Femoris Long Head		-7.5	1	
44	Akima 2001	0	20	2	64					Twice / day	Morning - 3 sets of 10 reps leg press @ 90% maximal load. 1 min between sets. Afternoon - isotonic leg press @ 40% max load until volitional exhaustion	BRE	0	5	Muscle Cross Section Area	Biceps Femoris Long Head		1.4		1
44	Akima 2001	0	20	2	0							CON	0	10	Muscle Cross Section Area	Semitendinosus		-6.6		
44	Akima 2001	0	20	2	64					Twice / day	Morning - 3 sets of 10 reps leg press @ 90% maximal load. 1 min between sets. Afternoon - isotonic leg press @ 40% max load until volitional exhaustion	BRE	0	5	Muscle Cross Section Area	Semitendinosus		-5.9		
44	Akima 2001	0	20	2	0							CON	0	10	Muscle Cross Section Area	Semimembranosus		-12.1	1	
44	Akima 2001	0	20	2	64					Twice / day	Morning - 3 sets of 10 reps leg press @ 90% maximal load. 1 min between sets. Afternoon - isotonic leg press @ 40% max load until volitional exhaustion	BRE	0	5	Muscle Cross Section Area	Semimembranosus		-5.9		1
44	Akima 2001	0	20	2	0							CON	0	10	Muscle Cross Section Area	Sartorius		-8.8		

44	Akima 2001	0	20	2	64					Twice / day	Morning - 3 sets of 10 reps leg press @ 90% maximal load. 1 min between sets. Afternoon - isotonic leg press @ 40% max load until volitional exhaustion	BRE	0	5	Muscle Cross Section Area	Sartorius		-3.4		
44	Akima 2001	0	20	2	0							CON	0	10	Muscle Cross Section Area	Gracilis		-2.9		
44	Akima 2001	0	20	2	64					Twice / day	Morning - 3 sets of 10 reps leg press @ 90% maximal load. 1 min between sets. Afternoon - isotonic leg press @ 40% max load until volitional exhaustion	BRE	0	5	Muscle Cross Section Area	Gracilis		3.4		
44	Akima 2001	0	20	2	0							CON	0	10	Muscle Cross Section Area	Hamstrings		-8.8	1	
44	Akima 2001	0	20	2	64					Twice / day	Morning - 3 sets of 10 reps leg press @ 90% maximal load. 1 min between sets. Afternoon - isotonic leg press @ 40% max load until volitional exhaustion	BRE	0	5	Muscle Cross Section Area	Hamstrings		-3	1	
44	Akima 2001	0	20	2	0							CON	0	10	Muscle Cross Section Area	Gastrocnemius		-12.5	1	
44	Akima 2001	0	20	2	64					Twice / day	Morning - 3 sets of 10 reps leg press @ 90% maximal load. 1 min between sets. Afternoon - isotonic leg press @ 40% max load until volitional exhaustion	BRE	0	5	Muscle Cross Section Area	Gastrocnemius		-12.3	1	
44	Akima 2001	0	20	2	0							CON	0	10	Muscle Cross Section Area	Gastrocnemius		-12.2		
44	Akima 2001	0	20	2	64					Twice / day	Morning - 3 sets of 10 reps leg press @ 90% maximal load. 1 min between sets. Afternoon - isotonic leg press @ 40% max load until volitional exhaustion	BRE	0	5	Muscle Cross Section Area	Gastrocnemius		-16.8	1	
44	Akima 2001	0	20	2	0							CON	0	10	Muscle Cross Section Area	Soleus		-12.2	1	
44	Akima 2001	0	20	2	64					Twice / day	Morning - 3 sets of 10 reps leg press @ 90% maximal load. 1 min between sets. Afternoon - isotonic leg press @ 40% max load until volitional exhaustion	BRE	0	5	Muscle Cross Section Area	Soleus		-9.8	1	
44	Akima 2001	0	20	2	0							CON	0	10	Muscle Cross Section Area	Plantar Flexor		-12.4	1	
44	Akima 2001	0	20	2	64					Twice / day	Morning - 3 sets of 10 reps leg press @ 90% maximal load. 1 min between sets. Afternoon - isotonic leg press @ 40% max load until volitional exhaustion	BRE	0	5	Muscle Cross Section Area	Plantar Flexor		-12.2	1	
44	Akima 2001	0	20	2	0							CON	0	10	Muscle Cross Section Area	Tibialis Anterior		-0.8		1
44	Akima 2001	0	20	2	64					Twice / day	Morning - 3 sets of 10 reps leg press @ 90% maximal load. 1 min between sets. Afternoon - isotonic leg press @ 40% max load until volitional exhaustion	BRE	0	5	Muscle Cross Section Area	Tibialis Anterior		-9.4		
45	Bamman 1998	0	14	2	0							CON	0	8	Myofiber Cross Sectional Area	MHC I	Vastus Lateralis	-14.6	1	
45	Bamman 1998	0	14	2	64					Every other day	Warmup - 10-12 repititions @ ~67% previous repitition maximum (RM). 5 sets of 8 reps @ 80-85% of 1 RM	BRE	0	8	Myofiber Cross Sectional Area	MHC I	Vastus Lateralis	-2.2		
45	Bamman 1998	0	14	2	0							CON	0	8	Myofiber distribution %	MHC I	Vastus Lateralis	7.6		
45	Bamman 1998	0	14	2	64					Every other day	Warmup - 10-12 repititions @ ~67% previous repitition maximum (RM). 5 sets of 8 reps @ 80-85% of 1 RM	BRE	0	8	Myofiber distribution %	MHC I	Vastus Lateralis	8.9		
45	Bamman 1998	0	14	2	0							CON	0	8	MHC distribution %	MHC I	Vastus Lateralis	-2.5		
45	Bamman 1998	0	14	2	64					Every other day	Warmup - 10-12 repititions @ ~67% previous repitition maximum (RM). 5 sets of 8 reps @ 80-85% of 1 RM	BRE	0	8	MHC distribution %	MHC I	Vastus Lateralis	8.6		
45	Bamman 1998	0	14	2	0							CON	0	8	Myofiber Cross Sectional Area	MHC IIa	Vastus Lateralis	-17.3	1	
45	Bamman 1998	0	14	2	64					Every other day	Warmup - 10-12 repititions @ ~67% previous repitition maximum (RM). 5 sets of 8 reps @ 80-85% of 1 RM	BRE	0	8	Myofiber Cross Sectional Area	MHC IIa	Vastus Lateralis	8.1		
45	Bamman 1998	0	14	2	0							CON	0	8	Myofiber distribution %	MHC IIa	Vastus Lateralis	-6.2		
45	Bamman 1998	0	14	2	64					Every other day	Warmup - 10-12 repititions @ ~67% previous repitition maximum (RM). 5 sets of 8 reps @ 80-85% of 1 RM	BRE	0	8	Myofiber distribution %	MHC IIa	Vastus Lateralis	8.1		
45	Bamman 1998	0	14	2	0							CON	0	8	MHC distribution %	MHC IIa	Vastus Lateralis	-12.8		
45	Bamman 1998	0	14	2	64					Every other day	Warmup - 10-12 repititions @ ~67% previous repitition maximum (RM). 5 sets of 8 reps @ 80-85% of 1 RM	BRE	0	8	MHC distribution %	MHC IIa	Vastus Lateralis	-4.6		
45	Bamman 1998	0	14	2	0							CON	0	8	Myofiber distribution %	MHC IIx	Vastus Lateralis	21.4		
45	Bamman 1998	0	14	2	64					Every other day	Warmup - 10-12 repititions @ ~67% previous repitition maximum (RM). 5 sets of 8 reps @ 80-85% of 1 RM	BRE	0	8	Myofiber distribution %	MHC IIx	Vastus Lateralis	-83.6	1	
45	Bamman 1998	0	14	2	0							CON	0	8	MHC distribution %	MHC IIx	Vastus Lateralis	36.5		
45	Bamman 1998	0	14	2	64					Every other day	Warmup - 10-12 repititions @ ~67% previous repitition maximum (RM). 5 sets of 8 reps @ 80-85% of 1 RM	BRE	0	8	MHC distribution %	MHC IIx	Vastus Lateralis	-5.7		
45	Bamman 1998	0	14	2	0							CON	0	8	Myofiber Cross Sectional Area	Total		-22.8		

45	Bamman 1998	0	14	2	64					Every other day	Warmup - 10-12 repititions @ ~67% previous repitition maximum (RM). 5 sets of 8 reps @ 80-85% of 1 RM	BRE	0	8	Myofiber Cross Sectional Area	Total		4.7		
46	Koryak 1997	0	120	2	0							CON	4	0	Pt, Isometric max twitch force	Plantar Flexor		-18.7	1	
46	Koryak 1997	0	120	2	32832					4 day cycle	First day - force-velocity regime (70% force-velocity exercise, 15% velocity and force requiring exercise). Second day - velocity regime (70% velocity requiring exercise, 15% force and force-velocity exercise). Third day - force regime (70% force exercise, 15% velocit and force-velocity requiring exercise). Fourth day rest. Repeat	BRE	4	0	Pt, Isometric max twitch force	Plantar Flexor		-13.5	1	
46	Koryak 1997	0	120	2	0							CON	4	0	Maximum Voluntary Contraction (MVC)	Plantar Flexor		-36.1	1	
46	Koryak 1997	0	120	2	32832					4 day cycle	First day - force-velocity regime (70% force-velocity exercise, 15% velocity and force requiring exercise). Second day - velocity regime (70% velocity requiring exercise, 15% force and force-velocity exercise). Third day - force regime (70% force exercise, 15% velocit and force-velocity requiring exercise). Fourth day rest. Repeat	BRE	4	0	Maximum Voluntary Contraction (MVC)	Plantar Flexor		-3		
46	Koryak 1997	0	120	2	0							CON	4	0	Po, Peak force	Plantar Flexor		-24.3	1	
46	Koryak 1997	0	120	2	32832					4 day cycle	First day - force-velocity regime (70% force-velocity exercise, 15% velocity and force requiring exercise). Second day - velocity regime (70% velocity requiring exercise, 15% force and force-velocity exercise). Third day - force regime (70% force exercise, 15% velocit and force-velocity requiring exercise). Fourth day rest. Repeat	BRE	4	0	Po, Peak force	Plantar Flexor		-9.4		
46	Koryak 1997	0	120	2	0							CON	4	0	Force deficiency (difference b/t Po and MVC)	Plantar Flexor		29.7	1	
46	Koryak 1997	0	120	2	32832					4 day cycle	First day - force-velocity regime (70% force-velocity exercise, 15% velocity and force requiring exercise). Second day - velocity regime (70% velocity requiring exercise, 15% force and force-velocity exercise). Third day - force regime (70% force exercise, 15% velocit and force-velocity requiring exercise). Fourth day rest. Repeat	BRE	4	0	Force deficiency (difference b/t Po and MVC)	Plantar Flexor		-9.9	1	
46	Koryak 1997	0	120	2	0							CON	4	0	Time to peak tension	Plantar Flexor		13.5		
46	Koryak 1997	0	120	2	32832					4 day cycle	First day - force-velocity regime (70% force-velocity exercise, 15% velocity and force requiring exercise). Second day - velocity regime (70% velocity requiring exercise, 15% force and force-velocity exercise). Third day - force regime (70% force exercise, 15% velocit and force-velocity requiring exercise). Fourth day rest. Repeat	BRE	4	0	Time to peak tension	Plantar Flexor		-3.4		
46	Koryak 1997	0	120	2	0							CON	4	0	Half relaxation time	Plantar Flexor		-17	1	
46	Koryak 1997	0	120	2	32832					4 day cycle	First day - force-velocity regime (70% force-velocity exercise, 15% velocity and force requiring exercise). Second day - velocity regime (70% velocity requiring exercise, 15% force and force-velocity exercise). Third day - force regime (70% force exercise, 15% velocit and force-velocity requiring exercise). Fourth day rest. Repeat	BRE	4	0	Half relaxation time	Plantar Flexor		-7.3	1	
46	Koryak 1997	0	120	2	0							CON	4	0	Total contraction time	Plantar Flexor		-16.3	1	
46	Koryak 1997	0	120	2	32832					4 day cycle	First day - force-velocity regime (70% force-velocity exercise, 15% velocity and force requiring exercise). Second day - velocity regime (70% velocity requiring exercise, 15% force and force-velocity exercise). Third day - force regime (70% force exercise, 15% velocit and force-velocity requiring exercise). Fourth day rest. Repeat	BRE	4	0	Total contraction time	Plantar Flexor		-19.2	1	
47	Akima 2003	0	20	2	0							CON	0	6	Muscle Cross Section Area	Plantar Flexor		-11.6	1	
47	Akima 2003	0	20	2	64					Twice / day	Morning - 5 sets of 10 reps leg press @ 70% maximal isometric force. 1 min between sets. Afternoon - plantar flexion training - 5 sets of 10 reps @ 70% max isometric force. 1 min between sets.	BRE	0	6	Muscle Cross Section Area	Plantar Flexor		-2.4		
47	Akima 2003	0	20	2	0							CON	0	6	Maximum Voluntary Contraction (MVC)	Plantar Flexor		-9.2		
47	Akima 2003	0	20	2	64					Twice / day	Morning - 5 sets of 10 reps leg press @ 70% maximal isometric force. 1 min between sets. Afternoon - plantar flexion training - 5 sets of 10 reps @ 70% max isometric force. 1 min between sets.	BRE	0	6	Maximum Voluntary Contraction (MVC)	Plantar Flexor		0.7		
47	Akima 2003	0	20	2	0							CON	0	6	Delta in Exercise induced T2	Gastrocnemius		54.7	1	

47	Akima 2003	0	20	2	64					Twice / day	Morning - 5 sets of 10 reps leg press @ 70% maximal isometric force. 1 min between sets. Afternoon - plantar flexion training - 5 sets of 10 reps @ 70% max isometric force. 1 min between sets.	BRE	0	6	Delta in Exercise induced T2	Gastrocnemius		7.2		
47	Akima 2003	0	20	2	0							CON	0	6	Delta in Exercise induced T2	Gastrocnemius		78.7	1	
47	Akima 2003	0	20	2	64					Twice / day	Morning - 5 sets of 10 reps leg press @ 70% maximal isometric force. 1 min between sets. Afternoon - plantar flexion training - 5 sets of 10 reps @ 70% max isometric force. 1 min between sets.	BRE	0	6	Delta in Exercise induced T2	Gastrocnemius		-3.8		
47	Akima 2003	0	20	2	0							CON	0	6	Delta in Exercise induced T2	Soleus		50	1	
47	Akima 2003	0	20	2	64					Twice / day	Morning - 5 sets of 10 reps leg press @ 70% maximal isometric force. 1 min between sets. Afternoon - plantar flexion training - 5 sets of 10 reps @ 70% max isometric force. 1 min between sets.	BRE	0	6	Delta in Exercise induced T2	Soleus		-7.6		
47	Akima 2003	0	20	2	0							CON	0	6	Delta in Exercise induced T2	Tibialis Anterior		200		
47	Akima 2003	0	20	2	64					Twice / day	Morning - 5 sets of 10 reps leg press @ 70% maximal isometric force. 1 min between sets. Afternoon - plantar flexion training - 5 sets of 10 reps @ 70% max isometric force. 1 min between sets.	BRE	0	6	Delta in Exercise induced T2	Tibialis Anterior		-66.6		
47	Akima 2003	0	20	2	0							CON	0	6	Delta in Exercise induced T2	Libia Marrow		25		
47	Akima 2003	0	20	2	64					Twice / day	Morning - 5 sets of 10 reps leg press @ 70% maximal isometric force. 1 min between sets. Afternoon - plantar flexion training - 5 sets of 10 reps @ 70% max isometric force. 1 min between sets.	BRE	0	6	Delta in Exercise induced T2	Libia Marrow		74.9		
49	Guinet 2009	0	60	2	0							CON	8	0	Tolerance Time	80 Head-Up Tilt		-50	1	
49	Guinet 2009	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	8	0	Tolerance Time	80 Head-Up Tilt		-35	1	
49	Guinet 2009	0	60	2	0							CON	8	0	Heart Rate (beats/min)	Resting		19.7	1	
49	Guinet 2009	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	8	0	Heart Rate (beats/min)	Resting		10.3		
50	Schneider (Unpublished)	0	60	2	0							CON	8	0	VO2 (L/min)	Max		-25.9		
50	Schneider (Unpublished)	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	VO2 (L/min)	Max		-27.2		
50	Schneider (Unpublished)	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	8	0	VO2 (L/min)	Max		-8.3		1
51	Smith 2008	0	60	2	0							CON	8	0	Parathyroid Hormone (intact molecule)	Serum		18.4		
51	Smith 2008	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	8	0	Parathyroid Hormone (intact molecule)	Serum		23.1		
51	Smith 2008	0	60	2	0							CON	8	0	1,25(OH)-vitamin D	Serum		-19.4		
51	Smith 2008	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	8	0	1,25(OH)-vitamin D	Serum		-15		
51	Smith 2008	0	60	2	0							CON	8	0	25(OH)-vitamin D	Serum		-11.4	1	
51	Smith 2008	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	8	0	25(OH)-vitamin D	Serum		-29.5	1	
51	Smith 2008	0	60	2	0							CON	8	0	Calcium	Serum		5.7	1	

51	Smith 2008	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	8	0	Calcium	Serum		0	1	
51	Smith 2008	0	60	2	0							CON	8	0	Calcium	Urinary		35.9		
51	Smith 2008	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	8	0	Calcium	Urinary		0		
51	Smith 2008	0	60	2	0							CON	8	0	Total Alkaline Phosphatase	Serum		8.5		
51	Smith 2008	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	8	0	Total Alkaline Phosphatase	Serum		24	1	
51	Smith 2008	0	60	2	0							CON	8	0	Bone specific alkaline phosphate	Serum		0		
51	Smith 2008	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	8	0	Bone specific alkaline phosphate	Serum		27.3		
51	Smith 2008	0	60	2	0							CON	8	0	Osteocalcin	Serum		8.3		
51	Smith 2008	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	8	0	Osteocalcin	Serum		0		
51	Smith 2008	0	60	2	0							CON	8	0	Procollagen type 1 N propeptide	Serum		-5.5		
51	Smith 2008	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	8	0	Procollagen type 1 N propeptide	Serum		32.5	1	
51	Smith 2008	0	60	2	0							CON	8	0	n-telopeptide	Urinary		45.3	1	
51	Smith 2008	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	8	0	n-telopeptide	Urinary		29.7	1	
51	Smith 2008	0	60	2	0							CON	8	0	c-telopeptide	Urinary		75.6	1	
51	Smith 2008	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	8	0	c-telopeptide	Urinary		40.6	1	
51	Smith 2008	0	60	2	0							CON	8	0	Helical Peptide	Urinary		72.8	1	
51	Smith 2008	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	8	0	Helical Peptide	Urinary		51.3	1	
51	Smith 2008	0	60	2	0							CON	8	0	Deoxypyridinoline	Urinary		20.4	1	
51	Smith 2008	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	8	0	Deoxypyridinoline	Urinary		26	1	
51	Smith 2008	0	60	2	0							CON	8	0	Tartrate-resistant acid phosphatase	Serum		34.9	1	

51	Smith 2008	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	8	0	Tartrate-resistant acid phosphatase	Serum		29.9	1	
51	Smith 2008	0	60	2	0							CON	8	0	Bone Mineral Density	Trochanter		-3.6	1	
51	Smith 2008	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	8	0	Bone Mineral Density	Trochanter		-1.6	1	
51	Smith 2008	0	60	2	0							CON	8	0	Bone Mineral Density	Total Hip		-4	1	
51	Smith 2008	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	8	0	Bone Mineral Density	Total Hip		-2	1	
51	Smith 2008	0	60	2	0							CON	8	0	Bone Mineral Density	Legs		-1.3	1	
51	Smith 2008	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	8	0	Bone Mineral Density	Legs		-0.3	1	1
51	Smith 2008	0	60	2	0							CON	8	0	Bone Mineral Density	Femoral Neck		-1.1		
51	Smith 2008	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	8	0	Bone Mineral Density	Femoral Neck		0.1		
51	Smith 2008	0	60	2	0							CON	8	0	Bone Mineral Density	Spine		0.3		
51	Smith 2008	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	8	0	Bone Mineral Density	Spine		1.1		
53	Edgell 2007	0	60	2	0							CON	8	0	Mean Arterial Pressure	Resting		-1.7		
53	Edgell 2007	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Mean Arterial Pressure	Resting		-5.8		
53	Edgell 2007	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	8	0	Mean Arterial Pressure	Resting		0.7		
53	Edgell 2007	0	60	2	0							CON	8	0	Stroke Volume (mL)	Resting		-16.7		
53	Edgell 2007	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Stroke Volume (mL)	Resting		-12.7		
53	Edgell 2007	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	8	0	Stroke Volume (mL)	Resting		-0.2		
53	Edgell 2007	0	60	2	0							CON	8	0	Cardiac Output	Resting		-6.7		
53	Edgell 2007	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Cardiac Output	Resting		-1.7		
53	Edgell 2007	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	8	0	Cardiac Output	Resting		-2.4		
53	Edgell 2007	0	60	2	0							CON	8	0	Total Peripheral Resistance	Resting		15.9		

53	Edgell 2007	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Total Peripheral Resistance	Resting		-8.7		
53	Edgell 2007	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	8	0	Total Peripheral Resistance	Resting		7		
53	Edgell 2007	0	60	2	0							CON	8	0	Leg Vascular Resistance	Resting		-48.8		
53	Edgell 2007	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Leg Vascular Resistance	Resting		-29		
53	Edgell 2007	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	8	0	Leg Vascular Resistance	Resting		23		
53	Edgell 2007	0	60	2	0							CON	8	0	Cerebral Vascular Resistance	Resting		3.5		
53	Edgell 2007	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Cerebral Vascular Resistance	Resting		12.2		
53	Edgell 2007	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	8	0	Cerebral Vascular Resistance	Resting		-3.8		
53	Edgell 2007	0	60	2	0							CON	8	0	Epinephrine	Resting		74.7		
53	Edgell 2007	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Epinephrine	Resting		13.8		
53	Edgell 2007	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	8	0	Epinephrine	Resting		-30.7		
53	Edgell 2007	0	60	2	0							CON	8	0	Norepinephrine	Resting		18		
53	Edgell 2007	0	60	2	2048						1.45g/kg BW/day protein, 3.6g/day free leucine, 1.8g/day free valine, 1.8g/day free isoleucine (total protein intake was ~1.6g/kg BW/day whereas other two groups were 1.0g/kg BW/day	BRN	8	0	Norepinephrine	Resting		0.7		
53	Edgell 2007	0	60	2	452				50	RE: every third day, LBNP 2-4 times / wk	RE: 4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device. LBNP: 40 min on vertical treadmill (40-80% Pre-BR VO2max) (~180 steps/min) 10 min LBNP at 52+-3mmHg (~1 body wt.)	BRE	8	0	Norepinephrine	Resting		-16.6		
54	Greenleaf 1989b	0	30	2	0							CON	0	5	VO2 (L/min)	Max		-20.5	1	
54	Greenleaf 1989b	0	30	2	2				30	Twice daily / 5 days per week	7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40% (supine ergometer)	ITE	0	7	VO2 (L/min)	Max		0.3		
54	Greenleaf 1989b	0	30	2	1024				30	Twice daily / 5 days per week	5 min warm-up, 5 peak knee flexions and extensions (90° arc) in 10s and rested remaining 50s. Repeat 10 times, 4min cooling down, repeat with other leg	IKE	0	7	VO2 (L/min)	Max		-10.5	1	
54	Greenleaf 1989b	0	30	2	0							CON	0	5	Heart Rate (beats/min)	Max		-1.6		
54	Greenleaf 1989b	0	30	2	2				30	Twice daily / 5 days per week	7 min @ 40% VO2max, then 2 min @ 60,70,80,90,80% VO2max each separated by 2 min @ 40% (supine ergometer)	ITE	0	7	Heart Rate (beats/min)	Max		8.8	1	
54	Greenleaf 1989b	0	30	2	1024				30	Twice daily / 5 days per week	5 min warm-up, 5 peak knee flexions and extensions (90° arc) in 10s and rested remaining 50s. Repeat 10 times, 4min cooling down, repeat with other leg	IKE	0	7	Heart Rate (beats/min)	Max		4.8		
55	Belin de Chantemele 2004	0	90	2	0							CON	0	9	Tolerance Time	80 Head-Up Tilt		-17.8		
55	Belin de Chantemele 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	9	Tolerance Time	80 Head-Up Tilt		-17.2		
55	Belin de Chantemele 2004	0	90	2	0							CON	0	9	Muscle Volume	Calf		-17.4	1	

55	Belin de Chantemele 2004	0	90	2	192					Every third day from day 5	4 sets of 7 supine squat reps and 4 sets of 14 calf press reps. 2 min in between sets and 5 min between exercises. Used a flywheel device	BRE	0	9	Muscle Volume	Calf		-14.7	1	
56	Hughson 1994	0	28	2	0							CON	0	6	R-R Interval	Resting		-14.1		
56	Hughson 1994	0	28	2	17666					RE: ~20min 6 days/wk from day 7 LBNP: 15 min on day 16, 18, 20, 22-28	RE: cycling 15 min @ 25W, max isometric contraction for 5s, submax isom contraction for 30s, three reps max isokinetic contraction @ 30/s, seven reps max isok @ 180/s. Sets varyied each day: one set day, four set day, three set day. LBNP: -40mmHg	BRE	0	6	R-R Interval	Resting		-15.5		
56	Hughson 1994	0	28	2	0							CON	0	6	Systolic Blood Pressure (mmHg)	Resting		-3.6	1	
56	Hughson 1994	0	28	2	17666					RE: ~20min 6 days/wk from day 7 LBNP: 15 min on day 16, 18, 20, 22-28	RE: cycling 15 min @ 25W, max isometric contraction for 5s, submax isom contraction for 30s, three reps max isokinetic contraction @ 30/s, seven reps max isok @ 180/s. Sets varyied each day: one set day, four set day, three set day. LBNP: -40mmHg	BRE	0	6	Systolic Blood Pressure (mmHg)	Resting		5.8	1	
56	Hughson 1994	0	28	2	0							CON	0	6	Plasme Volume (mL)	Resting		-2.2		
56	Hughson 1994	0	28	2	17666					RE: ~20min 6 days/wk from day 7 LBNP: 15 min on day 16, 18, 20, 22-28	RE: cycling 15 min @ 25W, max isometric contraction for 5s, submax isom contraction for 30s, three reps max isokinetic contraction @ 30/s, seven reps max isok @ 180/s. Sets varyied each day: one set day, four set day, three set day. LBNP: -40mmHg	BRE	0	6	Plasme Volume (mL)	Resting		-11.2	1	
56	Hughson 1994	0	28	2	0							CON	0	6	Norepinephrine	Resting		30.9		
56	Hughson 1994	0	28	2	17666					RE: ~20min 6 days/wk from day 7 LBNP: 15 min on day 16, 18, 20, 22-28	RE: cycling 15 min @ 25W, max isometric contraction for 5s, submax isom contraction for 30s, three reps max isokinetic contraction @ 30/s, seven reps max isok @ 180/s. Sets varyied each day: one set day, four set day, three set day. LBNP: -40mmHg	BRE	0	6	Norepinephrine	Resting		18		
56	Hughson 1994	0	28	2	0							CON	0	6	Epinephrine	Resting		17.1		
56	Hughson 1994	0	28	2	17666					RE: ~20min 6 days/wk from day 7 LBNP: 15 min on day 16, 18, 20, 22-28	RE: cycling 15 min @ 25W, max isometric contraction for 5s, submax isom contraction for 30s, three reps max isokinetic contraction @ 30/s, seven reps max isok @ 180/s. Sets varyied each day: one set day, four set day, three set day. LBNP: -40mmHg	BRE	0	6	Epinephrine	Resting		1.3		
57	Guell 1995 Series 1	0	28	2	0							CON	0	5	Heart Rate (beats/min)	Resting		16.9		
57	Guell 1995 Series 1	0	28	2	256				20	3 times/day for 3 weeks, 4/day for 4 days of last week, 6/day last	-28mmHg	LBNP	0	5	Heart Rate (beats/min)	Resting		11.9		
57	Guell 1995 Series 1	0	28	2	0							CON	0	5	Mean Arterial Pressure	Resting		5.8		
57	Guell 1995 Series 1	0	28	2	256				20	3 times/day for 3 weeks, 4/day for 4 days of last week, 6/day last	-28mmHg	LBNP	0	5	Mean Arterial Pressure	Resting		5.1		
58	Guell 1995 Series 2	0	28	2	0							Con	0	6	Heart Rate (beats/min)	Resting		17.3		
58	Guell 1995 Series 2	0	28	2	320				30		No CM first week, Exercise last 3 weeks, LBNP (15min@-28mmHg) every other day third week and every day last week	BRE	0	6	Heart Rate (beats/min)	Resting		11.1		

58	Guell 1995 Series 2	0	28	2	0							Con	0	6	Mean Arterial Pressure	Resting		-0.6		
58	Guell 1995 Series 2	0	28	2	320				30		No CM first week, Exercise last 3 weeks, LBNP (15min@-28mmHg) every other day third week and every day last week	BRE	0	6	Mean Arterial Pressure	Resting		4.1		
59	Sun 2002	0	21	2	0							CON	0	6	Systolic Blood Pressure (mmHg)	Resting		-5.3		
59	Sun 2002	0	21	2	256				60	Daily from Day 15-21	-30mmHg in a Chinese LBNP suit	LBNP	0	6	Systolic Blood Pressure (mmHg)	Resting		0.7		
59	Sun 2002	0	21	2	0							CON	0	6	Diastolic Blood Pressure (mmHg)	Resting		-14		
59	Sun 2002	0	21	2	256				60	Daily from Day 15-21	-30mmHg in a Chinese LBNP suit	LBNP	0	6	Diastolic Blood Pressure (mmHg)	Resting		-9.9	1	
59	Sun 2002	0	21	2	0							CON	0	6	Mean Arterial Pressure	Resting		-11.1		
59	Sun 2002	0	21	2	256				60	Daily from Day 15-21	-30mmHg in a Chinese LBNP suit	LBNP	0	6	Mean Arterial Pressure	Resting		-5.3		
59	Sun 2002	0	21	2	0							CON	0	6	Heart Rate (beats/min)	Resting		1.9		
59	Sun 2002	0	21	2	256				60	Daily from Day 15-21	-30mmHg in a Chinese LBNP suit	LBNP	0	6	Heart Rate (beats/min)	Resting		-7.2		
59	Sun 2002	0	21	2	0							CON	0	6	Cardiac Output	Resting		-9.9		
59	Sun 2002	0	21	2	256				60	Daily from Day 15-21	-30mmHg in a Chinese LBNP suit	LBNP	0	6	Cardiac Output	Resting		-27	1	
59	Sun 2002	0	21	2	0							CON	0	6	Total Peripheral Resistance	Resting		8.5		
59	Sun 2002	0	21	2	256				60	Daily from Day 15-21	-30mmHg in a Chinese LBNP suit	LBNP	0	6	Total Peripheral Resistance	Resting		34.5	1	
59	Sun 2002	0	21	2	0							CON	0	6	Stroke Volume (mL)	Resting		-7.2		
59	Sun 2002	0	21	2	256				60	Daily from Day 15-21	-30mmHg in a Chinese LBNP suit	LBNP	0	6	Stroke Volume (mL)	Resting		-13.4		
60	Schneider 2002	0	15	2	0							CON	0	7	Hematocrit	Resting		6.5	1	
60	Schneider 2002	0	15	2	260				40	Daily	LBNP at ~1 body weight. 40 min exercisewith LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	0	7	Hematocrit	Resting		0.5		
60	Schneider 2002	0	15	2	0							CON	0	7	Tolerance Time	Resting		-38.3	1	
60	Schneider 2002	0	15	2	260				40	Daily	LBNP at ~1 body weight. 40 min exercisewith LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	0	7	Tolerance Time	Resting		-42.9	1	
60	Schneider 2002	0	15	2	0							CON	0	7	Heart Rate (beats/min)	Resting		18.7	1	
60	Schneider 2002	0	15	2	260				40	Daily	LBNP at ~1 body weight. 40 min exercisewith LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	0	7	Heart Rate (beats/min)	Resting		11.9		
60	Schneider 2002	0	15	2	0							CON	0	7	Systolic Blood Pressure (mmHg)	Resting				
60	Schneider 2002	0	15	2	260				40	Daily	LBNP at ~1 body weight. 40 min exercisewith LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	0	7	Systolic Blood Pressure (mmHg)	Resting				
60	Schneider 2002	0	15	2	0							CON	0	7	Diastolic Blood Pressure (mmHg)	Resting				
60	Schneider 2002	0	15	2	260				40	Daily	LBNP at ~1 body weight. 40 min exercisewith LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	0	7	Diastolic Blood Pressure (mmHg)	Resting				
60	Schneider 2002	0	15	2	0							CON	0	7	Mean Arterial Pressure	Resting				
60	Schneider 2002	0	15	2	260				40	Daily	LBNP at ~1 body weight. 40 min exercisewith LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	0	7	Mean Arterial Pressure	Resting				
60	Schneider 2002	0	15	2	0							CON	0	7	Pulse Pressure	Resting				
60	Schneider 2002	0	15	2	260				40	Daily	LBNP at ~1 body weight. 40 min exercisewith LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	0	7	Pulse Pressure	Resting				
60	Schneider 2002	0	15	2	0							CON	0	7	Norepinephrine	Resting				

60	Schneider 2002	0	15	2	260				40	Daily	LBNP at ~1 body weight. 40 min exercisewith LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	0	7	Norepinephrine	Resting				
60	Schneider 2002	0	15	2	0							CON	0	7	Epinephrine	Resting				
60	Schneider 2002	0	15	2	260				40	Daily	LBNP at ~1 body weight. 40 min exercisewith LBNP. 7min @ 40% Pre-BR VO2max, 3 @ 60%, 2 @ 40%, 3 @ 70%, 2 @ 50%, 3 @ 80%, 2 @60%, 3 @ 80%, 2 @ 50%, 3 @70%, 2 @ 40%, 3 @60%, 5 @ 40%	BRE	0	7	Epinephrine	Resting				
61	Wu (Unpublished)	0	30	2	0							CON	0	5	Tolerance Time	75 Head-Up Tilt		-57.6	1	
61	Wu (Unpublished)	0	30	2	2				20	5 days / 1 rest	first two cycles - 5 sets of 5 reps for squat and 10 reps for calf press 60-70% max |||| remaining 3 cycles - 5 sets of 10 reps for squats and 15 reps for calf press 60-80% max	BRE	0	5	Tolerance Time	75 Head-Up Tilt		-34.7		
61	Wu (Unpublished)	0	30	2	192				30	5 days / 1 rest	7min @50% VO2max, 2@60, 2%50, 2@70, 2@50, 2@80, 2@50, 2@90, 2@50, 2@80, 3@50, 2@30	CYC	0	5	Tolerance Time	75 Head-Up Tilt		-36.4		
61	Wu (Unpublished)	0	30	2	0							CON	0	5	Exercise Time	Max		-17.7	1	
61	Wu (Unpublished)	0	30	2	2				20	5 days / 1 rest	first two cycles - 5 sets of 5 reps for squat and 10 reps for calf press 60-70% max |||| remaining 3 cycles - 5 sets of 10 reps for squats and 15 reps for calf press 60-80% max	BRE	0	5	Exercise Time	Max		-21.1	1	
61	Wu (Unpublished)	0	30	2	192				30	5 days / 1 rest	7min @50% VO2max, 2@60, 2%50, 2@70, 2@50, 2@80, 2@50, 2@90, 2@50, 2@80, 3@50, 2@30	CYC	0	5	Exercise Time	Max		1.2		
61	Wu (Unpublished)	0	30	2	0							CON	0	5	Muscle Strength	90 degrees knee		-6.81		
61	Wu (Unpublished)	0	30	2	2				20	5 days / 1 rest	first two cycles - 5 sets of 5 reps for squat and 10 reps for calf press 60-70% max |||| remaining 3 cycles - 5 sets of 10 reps for squats and 15 reps for calf press 60-80% max	BRE	0	5	Muscle Strength	90 degrees knee		10.7	1	
61	Wu (Unpublished)	0	30	2	192				30	5 days / 1 rest	7min @50% VO2max, 2@60, 2%50, 2@70, 2@50, 2@80, 2@50, 2@90, 2@50, 2@80, 3@50, 2@30	CYC	0	5	Muscle Strength	90 degrees knee		3.88	1	
62	Shibata 2010	0	18	2	32						Dextran 40 infusion on day 14	CON	1	6	Tolerance Time	graded LBNP		-25	1	
62	Shibata 2010	0	18	2	2				30	3 / day / daily	75% max HR	CYC	1	6	Tolerance Time	graded LBNP		-43	1	
62	Shibata 2010	0	18	2	34				30	3 / day / daily	75% max HR, Dextran 40 infusion on day 14	CYC+DEX	1	6	Tolerance Time	graded LBNP		-1.5		
62	Shibata 2010	0	18	2	32						Dextran 40 infusion on day 14	CON	1	6	VO2 (L/min)	Max		-19	1	
62	Shibata 2010	0	18	2	2				30	3 / day / daily	75% max HR	CYC	1	6	VO2 (L/min)	Max		-6.8		
62	Shibata 2010	0	18	2	34				30	3 / day / daily	75% max HR, Dextran 40 infusion on day 14	CYC+DEX	1	6	VO2 (L/min)	Max		-1.4		
62	Shibata 2010	0	18	2	32						Dextran 40 infusion on day 14	CON	1	6	Plasme Volume (mL)	Resting		-8.8	1	
62	Shibata 2010	0	18	2	2				30	3 / day / daily	75% max HR	CYC	1	6	Plasme Volume (mL)	Resting		-4.5	1	
62	Shibata 2010	0	18	2	32						Dextran 40 infusion on day 14	CON	1	6	Stroke Volume (mL)	Resting		-15.8	1	
62	Shibata 2010	0	18	2	32						Dextran 40 infusion on day 14	CON	1	6	Stroke Volume (mL)	Resting		5.4		
62	Shibata 2010	0	18	2	2				30	3 / day / daily	75% max HR	CYC	1	6	Stroke Volume (mL)	Resting		-4.1		1
62	Shibata 2010	0	18	2	34				30	3 / day / daily	75% max HR, Dextran 40 infusion on day 14	CYC+DEX	1	6	Stroke Volume (mL)	Resting		6.1		
62	Shibata 2010	0	18	2	32						Dextran 40 infusion on day 14	CON	1	6	Cardiac Output	Resting		-11.5	1	
62	Shibata 2010	0	18	2	32						Dextran 40 infusion on day 14	CON	1	6	Cardiac Output	Resting		11.8	1	
62	Shibata 2010	0	18	2	2				30	3 / day / daily	75% max HR	CYC	1	6	Cardiac Output	Resting		-5.6		
62	Shibata 2010	0	18	2	34				30	3 / day / daily	75% max HR, Dextran 40 infusion on day 14	CYC+DEX	1	6	Cardiac Output	Resting		8.6		
62	Shibata 2010	0	18	2	32						Dextran 40 infusion on day 14	CON	1	6	Mean Arterial Pressure	Resting		0.4		
62	Shibata 2010	0	18	2	32						Dextran 40 infusion on day 14	CON	1	6	Mean Arterial Pressure	Resting		3.3		
62	Shibata 2010	0	18	2	2				30	3 / day / daily	75% max HR	CYC	1	6	Mean Arterial Pressure	Resting		3.4		
62	Shibata 2010	0	18	2	34				30	3 / day / daily	75% max HR, Dextran 40 infusion on day 14	CYC+DEX	1	6	Mean Arterial Pressure	Resting		-0.7		
62	Shibata 2010	0	18	2	32						Dextran 40 infusion on day 14	CON	1	6	Total Peripheral Resistance	Resting		15.7	1	
62	Shibata 2010	0	18	2	32						Dextran 40 infusion on day 14	CON	1	6	Total Peripheral Resistance	Resting		-6.8	1	
62	Shibata 2010	0	18	2	2				30	3 / day / daily	75% max HR	CYC	1	6	Total Peripheral Resistance	Resting		11.5	1	
62	Shibata 2010	0	18	2	34				30	3 / day / daily	75% max HR, Dextran 40 infusion on day 14	CYC+DEX	1	6	Total Peripheral Resistance	Resting		-5.8		
81	Zhang 2003 Protocol 1	2	28	0	0							CON	0	7	Wet Weight	Whole Body				
81	Zhang 2003 Protocol 1	2	28	8	0							SUS	0	7	Wet Weight	Whole Body		20		

81	Zhang 2003 Protocol 1	2	28	8	8				60	Daily		SUS+STD1	0	7	Wet Weight	Whole Body		10.3		p<0.05 vs CON
81	Zhang 2003 Protocol 1	2	28	8	8				120	Daily		SUS+STD2	0	7	Wet Weight	Whole Body		16.4		
81	Zhang 2003 Protocol 1	2	28	8	8				240	Daily		SUS+STD4	0	7	Wet Weight	Whole Body		11.7		p<0.05 vs CON
81	Zhang 2003 Protocol 1	2	28	0	0							CON	0	7	Wet Weight	Adrenal Gland				
81	Zhang 2003 Protocol 1	2	28	8	0							SUS	0	7	Wet Weight	Adrenal Gland		-56.4		p<0.01 vs CON
81	Zhang 2003 Protocol 1	2	28	8	8				60	Daily		SUS+STD1	0	7	Wet Weight	Adrenal Gland		-53		p<0.01 vs CON
81	Zhang 2003 Protocol 1	2	28	8	8				120	Daily		SUS+STD2	0	7	Wet Weight	Adrenal Gland		-53.7		p<0.01 vs CON
81	Zhang 2003 Protocol 1	2	28	8	8				240	Daily		SUS+STD4	0	7	Wet Weight	Adrenal Gland		-61.2		p<0.01 vs CON
81	Zhang 2003 Protocol 1	2	28	0	0							CON	0	7	Wet Weight	Left Testis				
81	Zhang 2003 Protocol 1	2	28	8	0							SUS	0	7	Wet Weight	Left Testis		-12		
81	Zhang 2003 Protocol 1	2	28	8	8				60	Daily		SUS+STD1	0	7	Wet Weight	Left Testis		-20		
81	Zhang 2003 Protocol 1	2	28	8	8				120	Daily		SUS+STD2	0	7	Wet Weight	Left Testis		-24		
81	Zhang 2003 Protocol 1	2	28	8	8				240	Daily		SUS+STD4	0	7	Wet Weight	Left Testis		-20		
81	Zhang 2003 Protocol 1	2	28	0	0							CON	0	7	Wet Weight	Soleus				
81	Zhang 2003 Protocol 1	2	28	8	0							SUS	0	7	Wet Weight	Soleus		-49.3		p<0.01 vs CON
81	Zhang 2003 Protocol 1	2	28	8	8				60	Daily		SUS+STD1	0	7	Wet Weight	Soleus		-38.1		p<0.01 vs CON p<0.01 vs. SUS
81	Zhang 2003 Protocol 1	2	28	8	8				120	Daily		SUS+STD2	0	7	Wet Weight	Soleus		-27.6		p<0.01 vs CON p<0.01 vs. SUS
81	Zhang 2003 Protocol 1	2	28	8	8				240	Daily		SUS+STD4	0	7	Wet Weight	Soleus		-11.8		p<0.01 vs. SUS
81	Zhang 2003 Protocol 1	2	28	0	0							CON	0	7	Wet Weight	Gastrocnemius	Medial			
81	Zhang 2003 Protocol 1	2	28	8	0							SUS	0	7	Wet Weight	Gastrocnemius	Medial	-9.3		p<0.05 vs CON
81	Zhang 2003 Protocol 1	2	28	8	8				60	Daily		SUS+STD1	0	7	Wet Weight	Gastrocnemius	Medial	-12.1		p<0.05 vs CON
81	Zhang 2003 Protocol 1	2	28	8	8				120	Daily		SUS+STD2	0	7	Wet Weight	Gastrocnemius	Medial	-12.6		p<0.05 vs CON
81	Zhang 2003 Protocol 1	2	28	8	8				240	Daily		SUS+STD4	0	7	Wet Weight	Gastrocnemius	Medial	-6		
81	Zhang 2003 Protocol 1	2	28	0	0							CON	0	7	Wet Weight	Gastrocnemius	Lateral			
81	Zhang 2003 Protocol 1	2	28	8	0							SUS	0	7	Wet Weight	Gastrocnemius	Lateral	-19.5		p<0.01 vs CON
81	Zhang 2003 Protocol 1	2	28	8	8				60	Daily		SUS+STD1	0	7	Wet Weight	Gastrocnemius	Lateral	-20.7		p<0.01 vs CON
81	Zhang 2003 Protocol 1	2	28	8	8				120	Daily		SUS+STD2	0	7	Wet Weight	Gastrocnemius	Lateral	-16.7		p<0.01 vs CON
81	Zhang 2003 Protocol 1	2	28	8	8				240	Daily		SUS+STD4	0	7	Wet Weight	Gastrocnemius	Lateral	-15.9		p<0.01 vs CON
81	Zhang 2003 Protocol 1	2	28	0	0							CON	0	7	Wet Weight	Extensor Digitorum Longus				
81	Zhang 2003 Protocol 1	2	28	8	0							SUS	0	7	Wet Weight	Extensor Digitorum Longus		-10.5		p<0.05 vs CON
81	Zhang 2003 Protocol 1	2	28	8	8				60	Daily		SUS+STD1	0	7	Wet Weight	Extensor Digitorum Longus		-11.6		p<0.05 vs CON
81	Zhang 2003 Protocol 1	2	28	8	8				120	Daily		SUS+STD2	0	7	Wet Weight	Extensor Digitorum Longus		-13.4		p<0.01 vs CON
81	Zhang 2003 Protocol 1	2	28	8	8				240	Daily		SUS+STD4	0	7	Wet Weight	Extensor Digitorum Longus		-11.1		p<0.01 vs CON
81	Zhang 2003 Protocol 1	2	28	0	0							CON	0	7	Wet Weight	Femur				
81	Zhang 2003 Protocol 1	2	28	8	0							SUS	0	7	Wet Weight	Femur		-10.4		p<0.01 vs CON

81	Zhang 2003 Protocol 1	2	28	8	8				60	Daily		SUS+S TD1	0	7	Wet Weight	Femur		-3.9		p<0.01 vs SUS
81	Zhang 2003 Protocol 1	2	28	8	8				120	Daily		SUS+S TD2	0	7	Wet Weight	Femur		-5.1		
81	Zhang 2003 Protocol 1	2	28	8	8				240	Daily		SUS+S TD4	0	7	Wet Weight	Femur		-6.4		
81	Zhang 2003 Protocol 1	2	28	0	0							CON	0	7	Dry Weight	Femur				
81	Zhang 2003 Protocol 1	2	28	8	0							SUS	0	7	Dry Weight	Femur		-15		p<0.01 vs CON
81	Zhang 2003 Protocol 1	2	28	8	8				60	Daily		SUS+S TD1	0	7	Dry Weight	Femur		-10.6		p<0.01 vs CON
81	Zhang 2003 Protocol 1	2	28	8	8				120	Daily		SUS+S TD2	0	7	Dry Weight	Femur		-10		p<0.01 vs CON p<0.05 vs. SUS
81	Zhang 2003 Protocol 1	2	28	8	8				240	Daily		SUS+S TD4	0	7	Dry Weight	Femur		-11.6		p<0.01 vs CON
81	Zhang 2003 Protocol 1	2	28	0	0							CON	0	7	Density	Femur				
81	Zhang 2003 Protocol 1	2	28	8	0							SUS	0	7	Density	Femur		-6		p<0.01 vs CON
81	Zhang 2003 Protocol 1	2	28	8	8				60	Daily		SUS+S TD1	0	7	Density	Femur		-0.6		p<0.01 vs. SUS
81	Zhang 2003 Protocol 1	2	28	8	8				120	Daily		SUS+S TD2	0	7	Density	Femur		-1.3		p<0.01 vs. SUS
81	Zhang 2003 Protocol 1	2	28	8	8				240	Daily		SUS+S TD4	0	7	Density	Femur		-1.3		p<0.01 vs. SUS
81	Zhang 2003 Protocol 1	2	28	0	0							CON	0	7	Elastic Load	Femur				
81	Zhang 2003 Protocol 1	2	28	8	0							SUS	0	7	Elastic Load	Femur		-27		p<0.01 vs CON
81	Zhang 2003 Protocol 1	2	28	8	8				60	Daily		SUS+S TD1	0	7	Elastic Load	Femur		-18.8		p<0.01 vs CON
81	Zhang 2003 Protocol 1	2	28	8	8				120	Daily		SUS+S TD2	0	7	Elastic Load	Femur		-9		p<0.01 vs. SUS
81	Zhang 2003 Protocol 1	2	28	8	8				240	Daily		SUS+S TD4	0	7	Elastic Load	Femur		-12		p<0.05 vs CON p<0.01 vs. SUS
81	Zhang 2003 Protocol 1	2	28	0	0							CON	0	7	Maximum Load	Femur				
81	Zhang 2003 Protocol 1	2	28	8	0							SUS	0	7	Maximum Load	Femur		-32.3		p<0.01 vs CON
81	Zhang 2003 Protocol 1	2	28	8	8				60	Daily		SUS+S TD1	0	7	Maximum Load	Femur		-21.5		p<0.01 vs CON p<0.05 vs. SUS
81	Zhang 2003 Protocol 1	2	28	8	8				120	Daily		SUS+S TD2	0	7	Maximum Load	Femur		-15.4		p<0.01 vs CON p<0.01 vs. SUS
81	Zhang 2003 Protocol 1	2	28	8	8				240	Daily		SUS+S TD4	0	7	Maximum Load	Femur		-14.2		p<0.01 vs CON p<0.01 vs. SUS
81	Zhang 2003 Protocol 1	2	28	0	0							CON	0	7	Bending Rigidity Coefficient	Femur				
81	Zhang 2003 Protocol 1	2	28	8	0							SUS	0	7	Bending Rigidity Coefficient	Femur		-30.9		p<0.01 vs CON
81	Zhang 2003 Protocol 1	2	28	8	8				60	Daily		SUS+S TD1	0	7	Bending Rigidity Coefficient	Femur		-15.4		
81	Zhang 2003 Protocol 1	2	28	8	8				120	Daily		SUS+S TD2	0	7	Bending Rigidity Coefficient	Femur		-19.3		p<0.01 vs CON
81	Zhang 2003 Protocol 1	2	28	8	8				240	Daily		SUS+S TD4	0	7	Bending Rigidity Coefficient	Femur		-18.6		p<0.01 vs CON
82	Zhang 2003 Protocol 2	2	28	0	0							CON	0	6	Wet Weight	Whole Body				
82	Zhang 2003 Protocol 2	2	28	8	0							SUS	0	6	Wet Weight	Whole Body		5.1		

82	Zhang 2003 Protocol 2	2	28	8	8				60	Daily		SUS+STD1	0	6	Wet Weight	Whole Body		-11.7		p<0.01 vs CON
82	Zhang 2003 Protocol 2	2	28	8	1		1.5	1.5	60	Daily		SUS+CEN1.5	0	6	Wet Weight	Whole Body		-6.2		p<0.01 vs CON
82	Zhang 2003 Protocol 2	2	28	8	1		2.6	2.6	60	Daily		SUS+CEN2.6	0	6	Wet Weight	Whole Body		-19		p<0.01 vs CON
82	Zhang 2003 Protocol 2	2	28	0	0							CON	0	6	Wet Weight	Adrenal Gland				
82	Zhang 2003 Protocol 2	2	28	8	0							SUS	0	6	Wet Weight	Adrenal Gland		-65.2		p<0.01 vs CON
82	Zhang 2003 Protocol 2	2	28	8	8				60	Daily		SUS+STD1	0	6	Wet Weight	Adrenal Gland		-63.1		p<0.01 vs CON
82	Zhang 2003 Protocol 2	2	28	8	1		1.5	1.5	60	Daily		SUS+CEN1.5	0	6	Wet Weight	Adrenal Gland		-68		p<0.01 vs CON
82	Zhang 2003 Protocol 2	2	28	8	1		2.6	2.6	60	Daily		SUS+CEN2.6	0	6	Wet Weight	Adrenal Gland		-67.3		p<0.01 vs CON
82	Zhang 2003 Protocol 2	2	28	0	0							CON	0	6	Wet Weight	Left Testis				
82	Zhang 2003 Protocol 2	2	28	8	0							SUS	0	6	Wet Weight	Left Testis		15.7		
82	Zhang 2003 Protocol 2	2	28	8	8				60	Daily		SUS+STD1	0	6	Wet Weight	Left Testis		36.8		
82	Zhang 2003 Protocol 2	2	28	8	1		1.5	1.5	60	Daily		SUS+CEN1.5	0	6	Wet Weight	Left Testis		26.3		
82	Zhang 2003 Protocol 2	2	28	8	1		2.6	2.6	60	Daily		SUS+CEN2.6	0	6	Wet Weight	Left Testis		10.5		
82	Zhang 2003 Protocol 2	2	28	0	0							CON	0	6	Wet Weight	Soleus				
82	Zhang 2003 Protocol 2	2	28	8	0							SUS	0	6	Wet Weight	Soleus		-60		p<0.01 vs CON
82	Zhang 2003 Protocol 2	2	28	8	8				60	Daily		SUS+STD1	0	6	Wet Weight	Soleus		-33.3		p<0.01 vs CON p<0.01 vs. SUS
82	Zhang 2003 Protocol 2	2	28	8	1		1.5	1.5	60	Daily		SUS+CEN1.5	0	6	Wet Weight	Soleus		-40.8		p<0.01 vs CON p<0.01 vs. SUS
82	Zhang 2003 Protocol 2	2	28	8	1		2.6	2.6	60	Daily		SUS+CEN2.6	0	6	Wet Weight	Soleus		-55		p<0.01 vs CON
82	Zhang 2003 Protocol 2	2	28	0	0							CON	0	6	Wet Weight	Gastrocnemius	Medial			
82	Zhang 2003 Protocol 2	2	28	8	0							SUS	0	6	Wet Weight	Gastrocnemius	Medial	-21.9		p<0.01 vs CON
82	Zhang 2003 Protocol 2	2	28	8	8				60	Daily		SUS+STD1	0	6	Wet Weight	Gastrocnemius	Medial	-21.9		p<0.01 vs CON
82	Zhang 2003 Protocol 2	2	28	8	1		1.5	1.5	60	Daily		SUS+CEN1.5	0	6	Wet Weight	Gastrocnemius	Medial	-19.3		p<0.01 vs CON
82	Zhang 2003 Protocol 2	2	28	8	1		2.6	2.6	60	Daily		SUS+CEN2.6	0	6	Wet Weight	Gastrocnemius	Medial	-30.8		p<0.01 vs CON p<0.01 vs. SUS
82	Zhang 2003 Protocol 2	2	28	0	0							CON	0	6	Wet Weight	Gastrocnemius	Lateral			
82	Zhang 2003 Protocol 2	2	28	8	0							SUS	0	6	Wet Weight	Gastrocnemius	Lateral	-26.3		p<0.01 vs CON
82	Zhang 2003 Protocol 2	2	28	8	8				60	Daily		SUS+STD1	0	6	Wet Weight	Gastrocnemius	Lateral	-32.5		p<0.01 vs CON p<0.01 vs. SUS
82	Zhang 2003 Protocol 2	2	28	8	1		1.5	1.5	60	Daily		SUS+CEN1.5	0	6	Wet Weight	Gastrocnemius	Lateral	-28.4		p<0.01 vs CON
82	Zhang 2003 Protocol 2	2	28	8	1		2.6	2.6	60	Daily		SUS+CEN2.6	0	6	Wet Weight	Gastrocnemius	Lateral	-34.8		p<0.01 vs CON p<0.01 vs. SUS
82	Zhang 2003 Protocol 2	2	28	0	0							CON	0	6	Wet Weight	Extensor Digitorum Longus				
82	Zhang 2003 Protocol 2	2	28	8	0							SUS	0	6	Wet Weight	Extensor Digitorum Longus		-10.4		p<0.05 vs CON
82	Zhang 2003 Protocol 2	2	28	8	8				60	Daily		SUS+STD1	0	6	Wet Weight	Extensor Digitorum Longus		-17.4		p<0.01 vs CON p<0.05 vs. SUS

82	Zhang 2003 Protocol 2	2	28	8	1		1.5	1.5	60	Daily		SUS+CEN1.5	0	6	Wet Weight	Extensor Digitorum Longus		-11.1		p<0.05 vs CON
82	Zhang 2003 Protocol 2	2	28	8	1		2.6	2.6	60	Daily		SUS+CEN2.6	0	6	Wet Weight	Extensor Digitorum Longus		-22.3		p<0.01 vs CON p<0.05 vs. SUS
82	Zhang 2003 Protocol 2	2	28	0	0							CON	0	6	Wet Weight	Femur				
82	Zhang 2003 Protocol 2	2	28	8	0							SUS	0	6	Wet Weight	Femur		-13.3		p<0.01 vs CON
82	Zhang 2003 Protocol 2	2	28	8	8				60	Daily		SUS+STD1	0	6	Wet Weight	Femur		-12.3		p<0.01 vs CON
82	Zhang 2003 Protocol 2	2	28	8	1		1.5	1.5	60	Daily		SUS+CEN1.5	0	6	Wet Weight	Femur		-10		p<0.01 vs CON
82	Zhang 2003 Protocol 2	2	28	8	1		2.6	2.6	60	Daily		SUS+CEN2.6	0	6	Wet Weight	Femur		-16.8		p<0.01 vs CON
82	Zhang 2003 Protocol 2	2	28	0	0							CON	0	6	Dry Weight	Femur				
82	Zhang 2003 Protocol 2	2	28	8	0							SUS	0	6	Dry Weight	Femur		-21.8		p<0.01 vs CON
82	Zhang 2003 Protocol 2	2	28	8	8				60	Daily		SUS+STD1	0	6	Dry Weight	Femur		-18.3		p<0.01 vs CON
82	Zhang 2003 Protocol 2	2	28	8	1		1.5	1.5	60	Daily		SUS+CEN1.5	0	6	Dry Weight	Femur		-16.2		p<0.01 vs CON p<0.05 vs. SUS
82	Zhang 2003 Protocol 2	2	28	8	1		2.6	2.6	60	Daily		SUS+CEN2.6	0	6	Dry Weight	Femur		-21.8		p<0.01 vs CON
82	Zhang 2003 Protocol 2	2	28	0	0							CON	0	6	Density	Femur				
82	Zhang 2003 Protocol 2	2	28	8	0							SUS	0	6	Density	Femur		-5.4		p<0.01 vs CON
82	Zhang 2003 Protocol 2	2	28	8	8				60	Daily		SUS+STD1	0	6	Density	Femur		-4.1		p<0.01 vs CON
82	Zhang 2003 Protocol 2	2	28	8	1		1.5	1.5	60	Daily		SUS+CEN1.5	0	6	Density	Femur		-3.4		p<0.01 vs CON p<0.05 vs. SUS
82	Zhang 2003 Protocol 2	2	28	8	1		2.6	2.6	60	Daily		SUS+CEN2.6	0	6	Density	Femur		-4.7		p<0.01 vs CON
82	Zhang 2003 Protocol 2	2	28	0	0							CON	0	6	Elastic Load	Femur				
82	Zhang 2003 Protocol 2	2	28	8	0							SUS	0	6	Elastic Load	Femur		-52.5		p<0.01 vs CON
82	Zhang 2003 Protocol 2	2	28	8	8				60	Daily		SUS+STD1	0	6	Elastic Load	Femur		-36.9		p<0.01 vs CON p<0.05 vs. SUS
82	Zhang 2003 Protocol 2	2	28	8	1		1.5	1.5	60	Daily		SUS+CEN1.5	0	6	Elastic Load	Femur		-38.2		p<0.01 vs CON p<0.05 vs. SUS
82	Zhang 2003 Protocol 2	2	28	8	1		2.6	2.6	60	Daily		SUS+CEN2.6	0	6	Elastic Load	Femur		-36.6		p<0.01 vs CON p<0.01 vs. SUS
82	Zhang 2003 Protocol 2	2	28	0	0							CON	0	6	Maximum Load	Femur				
82	Zhang 2003 Protocol 2	2	28	8	0							SUS	0	6	Maximum Load	Femur		-55.7		p<0.01 vs CON
82	Zhang 2003 Protocol 2	2	28	8	8				60	Daily		SUS+STD1	0	6	Maximum Load	Femur		-42.1		p<0.01 vs CON p<0.05 vs. SUS
82	Zhang 2003 Protocol 2	2	28	8	1		1.5	1.5	60	Daily		SUS+CEN1.5	0	6	Maximum Load	Femur		-45.2		p<0.01 vs CON p<0.05 vs. SUS
82	Zhang 2003 Protocol 2	2	28	8	1		2.6	2.6	60	Daily		SUS+CEN2.6	0	6	Maximum Load	Femur		-41.2		p<0.01 vs CON p<0.01 vs. SUS
82	Zhang 2003 Protocol 2	2	28	0	0							CON	0	6	Bending Rigidity Coefficient	Femur				

82	Zhang 2003 Protocol 2	2	28	8	0							SUS	0	6	Bending Rigidity Coefficient	Femur		-60.1		p<0.01 vs CON
82	Zhang 2003 Protocol 2	2	28	8	8				60	Daily		SUS+STD1	0	6	Bending Rigidity Coefficient	Femur		-43.4		p<0.01 vs CON p<0.05 vs. SUS
82	Zhang 2003 Protocol 2	2	28	8	1		1.5	1.5	60	Daily		SUS+CEN1.5	0	6	Bending Rigidity Coefficient	Femur		-49.7		p<0.01 vs CON
82	Zhang 2003 Protocol 2	2	28	8	1		2.6	2.6	60	Daily		SUS+CEN2.6	0	6	Bending Rigidity Coefficient	Femur		-48.4		p<0.01 vs CON
83	Zhang 2003 Protocol 3	2	28	0	0							CON	0	10	Muscle Cross Section Area	Papillary				
83	Zhang 2003 Protocol 3	2	28	8	0							SUS	0	10	Muscle Cross Section Area	Papillary		-4.9		
83	Zhang 2003 Protocol 3	2	28	8	8				1	Daily		SUS+STD1	0	10	Muscle Cross Section Area	Papillary		0		
83	Zhang 2003 Protocol 3	2	28	8	8				2	Daily		SUS+STD2	0	10	Muscle Cross Section Area	Papillary		-2.4		
83	Zhang 2003 Protocol 3	2	28	8	8				4	Daily		SUS+STD4	0	10	Muscle Cross Section Area	Papillary		-3.7		
84	Zhang 2008	2	28	0	0							CON	0	8	Wet Weight	Whole Body				
84	Zhang 2008	2	28	8	0							SUS	0	8	Wet Weight	Whole Body		-76.5		
84	Zhang 2008	2	28	8	8				60	Daily		SUS+STD1	0	8	Wet Weight	Whole Body		-68.5		
84	Zhang 2008	2	28	0	0							CON	0	8	Wet Weight	Soleus				
84	Zhang 2008	2	28	8	0							SUS	0	8	Wet Weight	Soleus		-46		p<0.01 vs. CON
84	Zhang 2008	2	28	8	8				60	Daily		SUS+STD1	0	8	Wet Weight	Soleus		-27		p<0.01 vs. CON p<0.05 vs. SUS
84	Zhang 2008	2	28	0	0							CON	0	8	Length	Tibia				
84	Zhang 2008	2	28	8	0							SUS	0	8	Length	Tibia		-1.9		
84	Zhang 2008	2	28	8	8				60	Daily		SUS+STD1	0	8	Length	Tibia		-3.2		
84	Zhang 2008	2	28	0	0							CON	0	8	Systolic Blood Pressure (mmHg)	Resting				
84	Zhang 2008	2	28	8	0							SUS	0	8	Systolic Blood Pressure (mmHg)	Resting		8.5		p<0.01 vs. CON
84	Zhang 2008	2	28	8	8				60	Daily		SUS+STD1	0	8	Systolic Blood Pressure (mmHg)	Resting		4.4		p<0.05 vs. SUS
84	Zhang 2008	2	28	0	0							CON	0	8	Diastolic Blood Pressure (mmHg)	Resting				
84	Zhang 2008	2	28	8	0							SUS	0	8	Diastolic Blood Pressure (mmHg)	Resting		11.7		p<0.01 vs. CON
84	Zhang 2008	2	28	8	8				60	Daily		SUS+STD1	0	8	Diastolic Blood Pressure (mmHg)	Resting		8		
84	Zhang 2008	2	28	0	0							CON	0	8	Heart Rate (beats/min)	Resting				
84	Zhang 2008	2	28	8	0							SUS	0	8	Heart Rate (beats/min)	Resting		5		p<0.05 vs. CON
84	Zhang 2008	2	28	8	8				60	Daily		SUS+STD1	0	8	Heart Rate (beats/min)	Resting		4.1		p<0.05 vs. CON
84	Zhang 2008	2	28	0	0							CON	0	8	Total Power Heart Rate	Resting				
84	Zhang 2008	2	28	8	0							SUS	0	8	Total Power Heart Rate	Resting		195.7		p<0.01 vs. CON
84	Zhang 2008	2	28	8	8				60	Daily		SUS+STD1	0	8	Total Power Heart Rate	Resting		197.4		p<0.01 vs. CON
84	Zhang 2008	2	28	0	0							CON	0	8	Low Frequency (LF) Heart Rate	Resting				
84	Zhang 2008	2	28	8	0							SUS	0	8	Low Frequency (LF) Heart Rate	Resting		246.8		p<0.05 vs. CON
84	Zhang 2008	2	28	8	8				60	Daily		SUS+STD1	0	8	Low Frequency (LF) Heart Rate	Resting		128.1		p<0.05 vs. CON
84	Zhang 2008	2	28	0	0							CON	0	8	High Frequency (HF) Heart Rate	Resting				
84	Zhang 2008	2	28	8	0							SUS	0	8	High Frequency (HF) Heart Rate	Resting		126.2		
84	Zhang 2008	2	28	8	8				60	Daily		SUS+STD1	0	8	High Frequency (HF) Heart Rate	Resting		63.9		
84	Zhang 2008	2	28	0	0							CON	0	8	HF sympathetic activity (SNS) (LF/HF)	Resting				
84	Zhang 2008	2	28	8	0							SUS	0	8	HF sympathetic activity (SNS) (LF/HF)	Resting		-16.6		

84	Zhang 2008	2	28	8	8				60	Daily		SUS+STD1	0	8	HF sympathetic activity (SNS) (LF/HF)	Resting		0		
84	Zhang 2008	2	28	0	0							CON	0	8	SBP Total Power	Resting				
84	Zhang 2008	2	28	8	0							SUS	0	8	SBP Total Power	Resting		12.7		
84	Zhang 2008	2	28	8	8				60	Daily		SUS+STD1	0	8	SBP Total Power	Resting		12		
84	Zhang 2008	2	28	0	0							CON	0	8	Low Frequency (LF) BP	Resting				
84	Zhang 2008	2	28	8	0							SUS	0	8	Low Frequency (LF) BP	Resting		35.8		
84	Zhang 2008	2	28	8	8				60	Daily		SUS+STD1	0	8	Low Frequency (LF) BP	Resting		35.8		
84	Zhang 2008	2	28	0	0							CON	0	8	High Frequency (HF) BP	Resting				
84	Zhang 2008	2	28	8	0							SUS	0	8	High Frequency (HF) BP	Resting		-64.5		
84	Zhang 2008	2	28	8	8				60	Daily		SUS+STD1	0	8	High Frequency (HF) BP	Resting		-70.9		
85	Sun 2003	2	28	0	0							CON	0	7	Wet Weight	Soleus				
85	Sun 2003	2	28	8	0							SUS	0	7	Wet Weight	Soleus		-49.3		p<0.05 vs. CON
85	Sun 2003	2	28	8	512				120	Daily	45 degrees	HUT2	0	7	Wet Weight	Soleus		-27.6		p<0.05 vs. CON p<0.05 vs. SUS
85	Sun 2003	2	28	8	512				240	Daily	45 degrees	HUT4	0	7	Wet Weight	Soleus		-11.8		p<0.05 vs. SUS p<0.05 vs. SUS+HUT2
85	Sun 2003	2	28	0	0							CON	0	7	Relative Weight	Soleus				
85	Sun 2003	2	28	8	0							SUS	0	7	Relative Weight	Soleus		-45		p<0.05 vs. CON
85	Sun 2003	2	28	8	512				120	Daily	45 degrees	HUT2	0	7	Relative Weight	Soleus		-17.5		p<0.05 vs. CON p<0.05 vs. SUS
85	Sun 2003	2	28	8	512				240	Daily	45 degrees	HUT4	0	7	Relative Weight	Soleus		4.9		p<0.05 vs. SUS p<0.05 vs. SUS+HUT2
85	Sun 2003	2	28	0	0							CON	0	7	Wet Weight	Gastrocnemius	Medial			
85	Sun 2003	2	28	8	0							SUS	0	7	Wet Weight	Gastrocnemius	Medial	-9.3		p<0.05 vs. CON
85	Sun 2003	2	28	8	512				120	Daily	45 degrees	HUT2	0	7	Wet Weight	Gastrocnemius	Medial	-12.6		p<0.05 vs. CON
85	Sun 2003	2	28	8	512				240	Daily	45 degrees	HUT4	0	7	Wet Weight	Gastrocnemius	Medial	-6		
85	Sun 2003	2	28	0	0							CON	0	7	Relative Weight	Gastrocnemius	Medial			
85	Sun 2003	2	28	8	0							SUS	0	7	Relative Weight	Gastrocnemius	Medial	-7.3		p<0.05 vs. CON
85	Sun 2003	2	28	8	512				120	Daily	45 degrees	HUT2	0	7	Relative Weight	Gastrocnemius	Medial	-7.3		p<0.05 vs. CON
85	Sun 2003	2	28	8	512				240	Daily	45 degrees	HUT4	0	7	Relative Weight	Gastrocnemius	Medial	2.8		p<0.05 vs. SUS
85	Sun 2003	2	28	0	0							CON	0	7	Wet Weight	Gastrocnemius	Lateral			
85	Sun 2003	2	28	8	0							SUS	0	7	Wet Weight	Gastrocnemius	Lateral	-19.5		p<0.05 vs. CON
85	Sun 2003	2	28	8	512				120	Daily	45 degrees	HUT2	0	7	Wet Weight	Gastrocnemius	Lateral	-16.7		p<0.05 vs. CON
85	Sun 2003	2	28	8	512				240	Daily	45 degrees	HUT4	0	7	Wet Weight	Gastrocnemius	Lateral	-15.9		p<0.05 vs. CON
85	Sun 2003	2	28	0	0							CON	0	7	Relative Weight	Gastrocnemius	Lateral			
85	Sun 2003	2	28	8	0							SUS	0	7	Relative Weight	Gastrocnemius	Lateral	-18.1		p<0.05 vs. CON
85	Sun 2003	2	28	8	512				120	Daily	45 degrees	HUT2	0	7	Relative Weight	Gastrocnemius	Lateral	-13		p<0.05 vs. CON
85	Sun 2003	2	28	8	512				240	Daily	45 degrees	HUT4	0	7	Relative Weight	Gastrocnemius	Lateral	-8		p<0.05 vs. SUS
85	Sun 2003	2	28	0	0							CON	0	7	Wet Weight	Extensor Digitorum Longus				
85	Sun 2003	2	28	8	0							SUS	0	7	Wet Weight	Extensor Digitorum Longus		-10.5		p<0.05 vs. CON
85	Sun 2003	2	28	8	512				120	Daily	45 degrees	HUT2	0	7	Wet Weight	Extensor Digitorum Longus		-13.4		p<0.05 vs. CON

85	Sun 2003	2	28	8	512				240	Daily	45 degrees	HUT4	0	7	Wet Weight	Extensor Digitorum Longus		-11.1		$p<0.05$ vs. CON
85	Sun 2003	2	28	0	0							CON	0	7	Relative Weight	Extensor Digitorum Longus				
85	Sun 2003	2	28	8	0							SUS	0	7	Relative Weight	Extensor Digitorum Longus		-10.2		$p<0.05$ vs. CON
85	Sun 2003	2	28	8	512				120	Daily	45 degrees	HUT2	0	7	Relative Weight	Extensor Digitorum Longus		-10.2		$p<0.05$ vs. CON
85	Sun 2003	2	28	8	512				240	Daily	45 degrees	HUT4	0	7	Relative Weight	Extensor Digitorum Longus		-4		$p<0.05$ vs. SUS
85	Sun 2003	2	28	0	0							CON	0	7	Wet Weight	Femur				
85	Sun 2003	2	28	8	0							SUS	0	7	Wet Weight	Femur		-10.4		$p<0.05$ vs. CON
85	Sun 2003	2	28	8	512				120	Daily	45 degrees	HUT2	0	7	Wet Weight	Femur		-7.5		$p<0.05$ vs. CON
85	Sun 2003	2	28	8	512				240	Daily	45 degrees	HUT4	0	7	Wet Weight	Femur		-10.8		$p<0.05$ vs. CON
85	Sun 2003	2	28	0	0							CON	0	7	Dry Weight	Femur				
85	Sun 2003	2	28	8	0							SUS	0	7	Dry Weight	Femur		-15		$p<0.05$ vs. CON
85	Sun 2003	2	28	8	512				120	Daily	45 degrees	HUT2	0	7	Dry Weight	Femur		-14.1		$p<0.05$ vs. CON
85	Sun 2003	2	28	8	512				240	Daily	45 degrees	HUT4	0	7	Dry Weight	Femur		-16.5		$p<0.05$ vs. CON
85	Sun 2003	2	28	0	0							CON	0	7	Ash Weight	Femur				
85	Sun 2003	2	28	8	0							SUS	0	7	Ash Weight	Femur		-27.4		$p<0.05$ vs. CON
85	Sun 2003	2	28	8	512				120	Daily	45 degrees	HUT2	0	7	Ash Weight	Femur		-23.3		$p<0.05$ vs. CON
85	Sun 2003	2	28	8	512				240	Daily	45 degrees	HUT4	0	7	Ash Weight	Femur		-27.1		$p<0.05$ vs. CON
85	Sun 2003	2	28	0	0							CON	0	7	Density	Femur				
85	Sun 2003	2	28	8	0							SUS	0	7	Density	Femur		-6		$p<0.05$ vs. CON
85	Sun 2003	2	28	8	512				120	Daily	45 degrees	HUT2	0	7	Density	Femur		-2		$p<0.05$ vs. SUS
85	Sun 2003	2	28	8	512				240	Daily	45 degrees	HUT4	0	7	Density	Femur		-2		$p<0.05$ vs. CON $p<0.05$ vs. SUS
85	Sun 2003	2	28	0	0							CON	0	7	Bone Mineral Density	Femur				
85	Sun 2003	2	28	8	0							SUS	0	7	Bone Mineral Density	Femur		-29.2		$p<0.05$ vs. CON
85	Sun 2003	2	28	8	512				120	Daily	45 degrees	HUT2	0	7	Bone Mineral Density	Femur		-23.9		$p<0.05$ vs. CON
85	Sun 2003	2	28	8	512				240	Daily	45 degrees	HUT4	0	7	Bone Mineral Density	Femur		-25		$p<0.05$ vs. CON
85	Sun 2003	2	28	0	0							CON	0	7	Elastic Load	Femur				
85	Sun 2003	2	28	8	0							SUS	0	7	Elastic Load	Femur		-27		$p<0.05$ vs. CON
85	Sun 2003	2	28	8	512				120	Daily	45 degrees	HUT2	0	7	Elastic Load	Femur		-15.8		$p<0.05$ vs. CON $p<0.05$ vs. SUS
85	Sun 2003	2	28	8	512				240	Daily	45 degrees	HUT4	0	7	Elastic Load	Femur		-12.3		$p<0.05$ vs. CON $p<0.05$ vs. SUS
85	Sun 2003	2	28	0	0							CON	0	7	Maximum Load	Femur				
85	Sun 2003	2	28	8	0							SUS	0	7	Maximum Load	Femur		-32.3		$p<0.05$ vs. CON
85	Sun 2003	2	28	8	512				120	Daily	45 degrees	HUT2	0	7	Maximum Load	Femur		-25.1		$p<0.05$ vs. CON
85	Sun 2003	2	28	8	512				240	Daily	45 degrees	HUT4	0	7	Maximum Load	Femur		-21.2		$p<0.05$ vs. CON $p<0.05$ vs. SUS
85	Sun 2003	2	28	0	0							CON	0	7	Bending Rigidity Coefficient	Femur				
85	Sun 2003	2	28	8	0							SUS	0	7	Bending Rigidity Coefficient	Femur		-30.9		$p<0.05$ vs. CON
85	Sun 2003	2	28	8	512				120	Daily	45 degrees	HUT2	0	7	Bending Rigidity Coefficient	Femur		-24.2		$p<0.05$ vs. CON
85	Sun 2003	2	28	8	512				240	Daily	45 degrees	HUT4	0	7	Bending Rigidity Coefficient	Femur		-20.4		$p<0.05$ vs. CON

86	Sun 2004 Protocol 1	2	28	0	0							CON	0	7	Wet Weight	Whole Body		26.2		
86	Sun 2004 Protocol 1	2	28	8	0							SUS	0	7	Wet Weight	Whole Body		20.1		
86	Sun 2004 Protocol 1	2	28	8	8				60	Daily		STD1	0	7	Wet Weight	Whole Body		13.5		p<0.05 vs. CON
86	Sun 2004 Protocol 1	2	28	8	8				120	Daily		STD2	0	7	Wet Weight	Whole Body		15.3		
86	Sun 2004 Protocol 1	2	28	8	8				240	Daily		STD4	0	7	Wet Weight	Whole Body		12.6		p<0.05 vs. CON
86	Sun 2004 Protocol 1	2	28	8	512				120	Daily	45 degrees	HUT2	0	7	Wet Weight	Whole Body		10.9		p<0.01 vs. CON
86	Sun 2004 Protocol 1	2	28	8	512				240	Daily	45 degrees	HUT4	0	7	Wet Weight	Whole Body		2.7		p<0.01 vs. CON
86	Sun 2004 Protocol 1	2	28	0	0							CON	0	7	Contractile Response (100mM)	Basilar Artery				
86	Sun 2004 Protocol 1	2	28	8	0							SUS	0	7	Contractile Response (100mM)	Basilar Artery		42.9		
86	Sun 2004 Protocol 1	2	28	8	8				60	Daily		STD1	0	7	Contractile Response (100mM)	Basilar Artery		2		p<0.05 vs. SUS
86	Sun 2004 Protocol 1	2	28	8	8				120	Daily		STD2	0	7	Contractile Response (100mM)	Basilar Artery		12.2		p<0.05 vs. SUS
86	Sun 2004 Protocol 1	2	28	8	8				240	Daily		STD4	0	7	Contractile Response (100mM)	Basilar Artery		3.1		p<0.05 vs. SUS
86	Sun 2004 Protocol 1	2	28	8	512				120	Daily	45 degrees	HUT2	0	7	Contractile Response (100mM)	Basilar Artery		12.2		p<0.05 vs. SUS
86	Sun 2004 Protocol 1	2	28	8	512				240	Daily	45 degrees	HUT4	0	7	Contractile Response (100mM)	Basilar Artery		0		p<0.05 vs. SUS
86	Sun 2004 Protocol 1	2	28	0	0							CON	0	7	Contractile Response (100mM)	Femoral Artery				
86	Sun 2004 Protocol 1	2	28	8	0							SUS	0	7	Contractile Response (100mM)	Femoral Artery		-20		
86	Sun 2004 Protocol 1	2	28	8	8				60	Daily		STD1	0	7	Contractile Response (100mM)	Femoral Artery		7.4		p<0.05 vs. SUS
86	Sun 2004 Protocol 1	2	28	8	8				120	Daily		STD2	0	7	Contractile Response (100mM)	Femoral Artery		-2.9		p<0.05 vs. SUS
86	Sun 2004 Protocol 1	2	28	8	8				240	Daily		STD4	0	7	Contractile Response (100mM)	Femoral Artery		10.3		p<0.05 vs. SUS
86	Sun 2004 Protocol 1	2	28	8	512				120	Daily	45 degrees	HUT2	0	7	Contractile Response (100mM)	Femoral Artery		-2.9		p<0.05 vs. SUS
86	Sun 2004 Protocol 1	2	28	8	512				240	Daily	45 degrees	HUT4	0	7	Contractile Response (100mM)	Femoral Artery		8.6		p<0.05 vs. SUS
87	Sun 2004 Protocol 2	2	28	0	0							COn	0	6	Wet Weight	Whole Body		53.1		
87	Sun 2004 Protocol 2	2	28	8	0							SUS	0	6	Wet Weight	Whole Body		47.2		
87	Sun 2004 Protocol 2	2	28	8	512				240	Daily	45 degrees	HUT4	0	6	Wet Weight	Whole Body		47.6		
87	Sun 2004 Protocol 2	2	28	0	0							COn	0	6	Media Thickness	Basilar Artery				
87	Sun 2004 Protocol 2	2	28	8	0							SUS	0	6	Media Thickness	Basilar Artery		52.9		p<0.01 vs. CON
87	Sun 2004 Protocol 2	2	28	8	512				240	Daily	45 degrees	HUT4	0	6	Media Thickness	Basilar Artery		8.9		p<0.01 vs. SUS
87	Sun 2004 Protocol 2	2	28	0	0							COn	0	6	Cross Sectional Area	Basilar Artery				
87	Sun 2004 Protocol 2	2	28	8	0							SUS	0	6	Cross Sectional Area	Basilar Artery		17.4		p<0.01 vs. CON
87	Sun 2004 Protocol 2	2	28	8	512				240	Daily	45 degrees	HUT4	0	6	Cross Sectional Area	Basilar Artery		-10.3		p<0.01 vs. SUS
87	Sun 2004 Protocol 2	2	28	0	0							COn	0	6	Intraluminal Diameter	Basilar Artery				
87	Sun 2004 Protocol 2	2	28	8	0							SUS	0	6	Intraluminal Diameter	Basilar Artery				
87	Sun 2004 Protocol 2	2	28	8	512				240	Daily	45 degrees	HUT4	0	6	Intraluminal Diameter	Basilar Artery				
87	Sun 2004 Protocol 2	2	28	0	0							COn	0	6	Cross Sectional Area of Smooth Cells	Basilar Artery				
87	Sun 2004 Protocol 2	2	28	8	0							SUS	0	6	Cross Sectional Area of Smooth Cells	Basilar Artery		13.9		
87	Sun 2004 Protocol 2	2	28	8	512				240	Daily	45 degrees	HUT4	0	6	Cross Sectional Area of Smooth Cells	Basilar Artery		6.9		
87	Sun 2004 Protocol 2	2	28	0	0							COn	0	6	Number of Smooth Cells	Basilar Artery				

87	Sun 2004 Protocol 2	2	28	8	0							SUS	0	6	Number of Smooth Cells	Basilar Artery		40.4		p<0.01 vs. CON
87	Sun 2004 Protocol 2	2	28	8	512				240	Daily	45 degrees	HUT4	0	6	Number of Smooth Cells	Basilar Artery		4.7		p<0.01 vs. SUS
87	Sun 2004 Protocol 2	2	28	0	0							COn	0	6	Media Thickness	Anterior Tibial Artery				
87	Sun 2004 Protocol 2	2	28	8	0							SUS	0	6	Media Thickness	Anterior Tibial Artery		-18.8		p<0.01 vs. CON
87	Sun 2004 Protocol 2	2	28	8	512				240	Daily	45 degrees	HUT4	0	6	Media Thickness	Anterior Tibial Artery		2.4		p<0.01 vs. SUS
87	Sun 2004 Protocol 2	2	28	0	0							COn	0	6	Cross Sectional Area	Anterior Tibial Artery				
87	Sun 2004 Protocol 2	2	28	8	0							SUS	0	6	Cross Sectional Area	Anterior Tibial Artery		-14.8		p<0.05 vs. CON
87	Sun 2004 Protocol 2	2	28	8	512				240	Daily	45 degrees	HUT4	0	6	Cross Sectional Area	Anterior Tibial Artery		4.5		p<0.01 vs. SUS
87	Sun 2004 Protocol 2	2	28	0	0							COn	0	6	Intraluminal Diameter	Anterior Tibial Artery				
87	Sun 2004 Protocol 2	2	28	8	0							SUS	0	6	Intraluminal Diameter	Anterior Tibial Artery		8.4		
87	Sun 2004 Protocol 2	2	28	8	512				240	Daily	45 degrees	HUT4	0	6	Intraluminal Diameter	Anterior Tibial Artery		12.2		
87	Sun 2004 Protocol 2	2	28	0	0							COn	0	6	Cross Sectional Area of Smooth Cells	Anterior Tibial Artery				
87	Sun 2004 Protocol 2	2	28	8	0							SUS	0	6	Cross Sectional Area of Smooth Cells	Anterior Tibial Artery		-3.3		
87	Sun 2004 Protocol 2	2	28	8	512				240	Daily	45 degrees	HUT4	0	6	Cross Sectional Area of Smooth Cells	Anterior Tibial Artery		2		
87	Sun 2004 Protocol 2	2	28	0	0							COn	0	6	Number of Smooth Cells	Anterior Tibial Artery				
87	Sun 2004 Protocol 2	2	28	8	0							SUS	0	6	Number of Smooth Cells	Anterior Tibial Artery		-19.4		p<0.05 vs. CON
87	Sun 2004 Protocol 2	2	28	8	512				240	Daily	45 degrees	HUT4	0	6	Number of Smooth Cells	Anterior Tibial Artery		0		p<0.05 vs. SUS
88	Sun 2004 Protocol 3, Ex. 1	2	28	0	0							COn	0	5	Media Thickness	Basilar Artery				
88	Sun 2004 Protocol 3, Ex. 1	2	28	8	0							SUS	0	5	Media Thickness	Basilar Artery		17.7		p<0.05 vs. CON
88	Sun 2004 Protocol 3, Ex. 1	2	28	8	8				60	Daily		HUT4	0	5	Media Thickness	Basilar Artery		-2		p<0.05 vs. SUS
88	Sun 2004 Protocol 3, Ex. 1	2	28	0	0							COn	0	5	Cross Sectional Area	Basilar Artery				
88	Sun 2004 Protocol 3, Ex. 1	2	28	8	0							SUS	0	5	Cross Sectional Area	Basilar Artery		16.8		p<0.05 vs. CON
88	Sun 2004 Protocol 3, Ex. 1	2	28	8	8				60	Daily		HUT4	0	5	Cross Sectional Area	Basilar Artery		-2.1		p<0.05 vs. SUS
88	Sun 2004 Protocol 3, Ex. 1	2	28	0	0							COn	0	5	Intraluminal Diameter	Basilar Artery				
88	Sun 2004 Protocol 3, Ex. 1	2	28	8	0							SUS	0	5	Intraluminal Diameter	Basilar Artery		-0.4		
88	Sun 2004 Protocol 3, Ex. 1	2	28	8	8				60	Daily		HUT4	0	5	Intraluminal Diameter	Basilar Artery		-0.2		
88	Sun 2004 Protocol 3, Ex. 1	2	28	0	0							COn	0	5	Cross Sectional Area of Smooth Cells	Basilar Artery				
88	Sun 2004 Protocol 3, Ex. 1	2	28	8	0							SUS	0	5	Cross Sectional Area of Smooth Cells	Basilar Artery		-0.6		
88	Sun 2004 Protocol 3, Ex. 1	2	28	8	8				60	Daily		HUT4	0	5	Cross Sectional Area of Smooth Cells	Basilar Artery		0.6		
88	Sun 2004 Protocol 3, Ex. 1	2	28	0	0							COn	0	5	Number of Smooth Cells	Basilar Artery				
88	Sun 2004 Protocol 3, Ex. 1	2	28	8	0							SUS	0	5	Number of Smooth Cells	Basilar Artery		15.9		p<0.05 vs. CON
88	Sun 2004 Protocol 3, Ex. 1	2	28	8	8				60	Daily		HUT4	0	5	Number of Smooth Cells	Basilar Artery		-4.5		p<0.05 vs. SUS
88	Sun 2004 Protocol 3, Ex. 1	2	28	0	0							COn	0	5	Media Thickness	Anterior Tibial Artery				
88	Sun 2004 Protocol 3, Ex. 1	2	28	8	0							SUS	0	5	Media Thickness	Anterior Tibial Artery		-14.5		p<0.05 vs. CON
88	Sun 2004 Protocol 3, Ex. 1	2	28	8	8				60	Daily		HUT4	0	5	Media Thickness	Anterior Tibial Artery		-2.1		p<0.05 vs. SUS
88	Sun 2004 Protocol 3, Ex. 1	2	28	0	0							COn	0	5	Cross Sectional Area	Anterior Tibial Artery				
88	Sun 2004 Protocol 3, Ex. 1	2	28	8	0							SUS	0	5	Cross Sectional Area	Anterior Tibial Artery		-16		p<0.05 vs. CON

88	Sun 2004 Protocol 3, Ex. 1	2	28	8	8				60	Daily		HUT4	0	5	Cross Sectional Area	Anterior Tibial Artery		-2.8		p<0.05 vs. SUS
88	Sun 2004 Protocol 3, Ex. 1	2	28	0	0							COn	0	5	Intraluminal Diameter	Anterior Tibial Artery				
88	Sun 2004 Protocol 3, Ex. 1	2	28	8	0							SUS	0	5	Intraluminal Diameter	Anterior Tibial Artery		0		
88	Sun 2004 Protocol 3, Ex. 1	2	28	8	8				60	Daily		HUT4	0	5	Intraluminal Diameter	Anterior Tibial Artery		-0.3		
88	Sun 2004 Protocol 3, Ex. 1	2	28	0	0							COn	0	5	Cross Sectional Area of Smooth Cells	Anterior Tibial Artery				
88	Sun 2004 Protocol 3, Ex. 1	2	28	8	0							SUS	0	5	Cross Sectional Area of Smooth Cells	Anterior Tibial Artery		4.6		
88	Sun 2004 Protocol 3, Ex. 1	2	28	8	8				60	Daily		HUT4	0	5	Cross Sectional Area of Smooth Cells	Anterior Tibial Artery		1.5		
88	Sun 2004 Protocol 3, Ex. 1	2	28	0	0							COn	0	5	Number of Smooth Cells	Anterior Tibial Artery				
88	Sun 2004 Protocol 3, Ex. 1	2	28	8	0							SUS	0	5	Number of Smooth Cells	Anterior Tibial Artery		-16		p<0.05 vs. CON
88	Sun 2004 Protocol 3, Ex. 1	2	28	8	8				60	Daily		HUT4	0	5	Number of Smooth Cells	Anterior Tibial Artery		-2.6		p<0.05 vs. SUS
89	Sun 2004 Protocol 3, Ex. 2	2	28	0	0							CON	0	7	Media Thickness	Basilar Artery				
89	Sun 2004 Protocol 3, Ex. 2	2	28	0	8				120	Daily		CON2	0	7	Media Thickness	Basilar Artery		-5.6		
89	Sun 2004 Protocol 3, Ex. 2	2	28	8	0							SUS	0	7	Media Thickness	Basilar Artery		28.6		p<0.05 vs. CON p<0.05 vs.
89	Sun 2004 Protocol 3, Ex. 2	2	28	8	8				120	Daily		STD2	0	7	Media Thickness	Basilar Artery		3.9		p<0.05 vs. SUS
89	Sun 2004 Protocol 3, Ex. 2	2	28	0	0							CON	0	7	Cross Sectional Area	Basilar Artery				
89	Sun 2004 Protocol 3, Ex. 2	2	28	0	8				120	Daily		CON2	0	7	Cross Sectional Area	Basilar Artery		-4.9		
89	Sun 2004 Protocol 3, Ex. 2	2	28	8	0							SUS	0	7	Cross Sectional Area	Basilar Artery		33		p<0.05 vs. CON p<0.05 vs.
89	Sun 2004 Protocol 3, Ex. 2	2	28	8	8				120	Daily		STD2	0	7	Cross Sectional Area	Basilar Artery		4.9		p<0.05 vs. SUS
89	Sun 2004 Protocol 3, Ex. 2	2	28	0	0							CON	0	7	Intraluminal Diameter	Basilar Artery				
89	Sun 2004 Protocol 3, Ex. 2	2	28	0	8				120	Daily		CON2	0	7	Intraluminal Diameter	Basilar Artery		0.9		
89	Sun 2004 Protocol 3, Ex. 2	2	28	8	0							SUS	0	7	Intraluminal Diameter	Basilar Artery		1.2		
89	Sun 2004 Protocol 3, Ex. 2	2	28	8	8				120	Daily		STD2	0	7	Intraluminal Diameter	Basilar Artery		0.4		
89	Sun 2004 Protocol 3, Ex. 2	2	28	0	0							CON	0	7	Media Thickness	Anterior Tibial Artery				
89	Sun 2004 Protocol 3, Ex. 2	2	28	0	8				120	Daily		CON2	0	7	Media Thickness	Anterior Tibial Artery		-1.9		
89	Sun 2004 Protocol 3, Ex. 2	2	28	8	0							SUS	0	7	Media Thickness	Anterior Tibial Artery		-17.6		p<0.05 vs. CON p<0.05 vs.
89	Sun 2004 Protocol 3, Ex. 2	2	28	8	8				120	Daily		STD2	0	7	Media Thickness	Anterior Tibial Artery		-4.1		p<0.05 vs. SUS
89	Sun 2004 Protocol 3, Ex. 2	2	28	0	0							CON	0	7	Cross Sectional Area	Anterior Tibial Artery				
89	Sun 2004 Protocol 3, Ex. 2	2	28	0	8				120	Daily		CON2	0	7	Cross Sectional Area	Anterior Tibial Artery		-1.8		
89	Sun 2004 Protocol 3, Ex. 2	2	28	8	0							SUS	0	7	Cross Sectional Area	Anterior Tibial Artery		-20.4		p<0.05 vs. CON p<0.05 vs.
89	Sun 2004 Protocol 3, Ex. 2	2	28	8	8				120	Daily		STD2	0	7	Cross Sectional Area	Anterior Tibial Artery		-5.6		p<0.05 vs. SUS
89	Sun 2004 Protocol 3, Ex. 2	2	28	0	0							CON	0	7	Intraluminal Diameter	Anterior Tibial Artery				
89	Sun 2004 Protocol 3, Ex. 2	2	28	0	8				120	Daily		CON2	0	7	Intraluminal Diameter	Anterior Tibial Artery		0.5		
89	Sun 2004 Protocol 3, Ex. 2	2	28	8	0							SUS	0	7	Intraluminal Diameter	Anterior Tibial Artery		-1.9		

89	Sun 2004 Protocol 3, Ex. 2	2	28	8	8				120	Daily		STD2	0	7	Intraluminal Diameter	Anterior Tibial Artery		-0.9		
90	Korolkov 2001	1	28	1	0							CON	0	6	VO2 (L/min)			-16.1		
90	Korolkov 2001	1	28	1	1		1.2-1.6		30	2-3 or 4-5 per week	1.2G 2-3 times/week or 1.2, 1.4, 1.6 4-5 times per week	AG	0	6	VO2 (L/min)			-6.7		
90	Korolkov 2001	1	28	1	0							CON	0	6	Energy Cost of Regime			-20		
90	Korolkov 2001	1	28	1	1		1.2-1.6		30	2-3 or 4-5 per week	1.2G 2-3 times/week or 1.2, 1.4, 1.6 4-5 times per week	AG	0	6	Energy Cost of Regime			-14.3		
90	Korolkov 2001	1	28	1	0							CON	0	6	Volume of Body Fluids			-5		
90	Korolkov 2001	1	28	1	1		1.2-1.6		30	2-3 or 4-5 per week	1.2G 2-3 times/week or 1.2, 1.4, 1.6 4-5 times per week	AG	0	6	Volume of Body Fluids			-5		
90	Korolkov 2001	1	28	1	0							CON	0	6	Intracellular Fluid			-4		
90	Korolkov 2001	1	28	1	1		1.2-1.6		30	2-3 or 4-5 per week	1.2G 2-3 times/week or 1.2, 1.4, 1.6 4-5 times per week	AG	0	6	Intracellular Fluid			-4		
90	Korolkov 2001	1	28	1	0							CON	0	6	Plasme Volume (mL)			-6		
90	Korolkov 2001	1	28	1	1		1.2-1.6		30	2-3 or 4-5 per week	1.2G 2-3 times/week or 1.2, 1.4, 1.6 4-5 times per week	AG	0	6	Plasme Volume (mL)			-7		
90	Korolkov 2001	1	28	1	0							CON	0	6	Extracellular Fluid			-11		
90	Korolkov 2001	1	28	1	1		1.2-1.6		30	2-3 or 4-5 per week	1.2G 2-3 times/week or 1.2, 1.4, 1.6 4-5 times per week	AG	0	6	Extracellular Fluid			-6.5		1
90	Korolkov 2001	1	28	1	0							CON	0	6	Interstitial Fluid			-11.5		
90	Korolkov 2001	1	28	1	1		1.2-1.6		30	2-3 or 4-5 per week	1.2G 2-3 times/week or 1.2, 1.4, 1.6 4-5 times per week	AG	0	6	Interstitial Fluid			-6.5		1
90	Korolkov 2001	1	28	1	0							CON	0	6	Blood Flow	Gastrocnemius	Medial	-40		
90	Korolkov 2001	1	28	1	1		1.2-1.6		30	2-3 or 4-5 per week	1.2G 2-3 times/week or 1.2, 1.4, 1.6 4-5 times per week	AG	0	6	Blood Flow	Gastrocnemius	Medial	-19		1
91	Gurovsky 1980	3	18.5	0	0							CON	0	20	Wet Weight			43.3		
91	Gurovsky 1980	3	18.5	9	0							ug	0	20	Wet Weight			33.2		
91	Gurovsky 1980	3	18.5	9	1	0.32	1	1		Continuous		ug+AG	0	10	Wet Weight			29.7		
91	Gurovsky 1980	3	18.5	9	0							ug	0	20	Ve (L/min)			lower		
91	Gurovsky 1980	3	18.5	9	1	0.32	1	1		Continuous		ug+AG	0	10	Ve (L/min)			lower		
91	Gurovsky 1980	3	18.5	0	0							CON	0	20	Total Renal Excretion of Potassium					
91	Gurovsky 1980	3	18.5	9	0							ug	0	20	Total Renal Excretion of Potassium			53		
91	Gurovsky 1980	3	18.5	9	1	0.32	1	1		Continuous		ug+AG	0	10	Total Renal Excretion of Potassium			14.9		
91	Gurovsky 1980	3	18.5	9	0							ug	0	20	Functioning Capillaries			lower		
91	Gurovsky 1980	3	18.5	9	1	0.32	1	1		Continuous		ug+AG	0	10	Functioning Capillaries			lower		
91	Gurovsky 1980	3	18.5	0	0							CON	0	20	Hemoglobin					
91	Gurovsky 1980	3	18.5	9	0							ug	0	20	Hemoglobin			17.6		
91	Gurovsky 1980	3	18.5	9	1	0.32	1	1		Continuous		ug+AG	0	10	Hemoglobin			13		
91	Gurovsky 1980	3	18.5	0	0							CON	0	20	Red Blood Cell Volume					
91	Gurovsky 1980	3	18.5	9	0							ug	0	20	Red Blood Cell Volume			20		
91	Gurovsky 1980	3	18.5	9	1	0.32	1	1		Continuous		ug+AG	0	10	Red Blood Cell Volume			13.8		
91	Gurovsky 1980	3	18.5	0	0							CON	0	20	Hematocrit					
91	Gurovsky 1980	3	18.5	9	0							ug	0	20	Hematocrit			2		
91	Gurovsky 1980	3	18.5	9	1	0.32	1	1		Continuous		ug+AG	0	10	Hematocrit			-4.1		
91	Gurovsky 1980	3	18.5	0	0							CON	0	20	Reticulocytes					
91	Gurovsky 1980	3	18.5	9	0							ug	0	20	Reticulocytes			-13.3		
91	Gurovsky 1980	3	18.5	9	1	0.32	1	1		Continuous		ug+AG	0	10	Reticulocytes			15		
91	Gurovsky 1980	3	18.5	0	0							CON	0	20	Leucocytes					
91	Gurovsky 1980	3	18.5	9	0							ug	0	20	Leucocytes			-27.1		
91	Gurovsky 1980	3	18.5	9	1	0.32	1	1		Continuous		ug+AG	0	10	Leucocytes			0		
91	Gurovsky 1980	3	18.5	0	0							CON	0	20	Segmentonuclear Neutrophilis					
91	Gurovsky 1980	3	18.5	9	0							ug	0	20	Segmentonuclear Neutrophilis			181.2		
91	Gurovsky 1980	3	18.5	9	1	0.32	1	1		Continuous		ug+AG	0	10	Segmentonuclear Neutrophilis			37.5		
91	Gurovsky 1980	3	18.5	0	0							CON	0	20	Lymphocytes					
91	Gurovsky 1980	3	18.5	9	0							ug	0	20	Lymphocytes			-36.7		
91	Gurovsky 1980	3	18.5	9	1	0.32	1	1		Continuous		ug+AG	0	10	Lymphocytes			-7.5		
91	Gurovsky 1980	3	18.5	0	0							CON	0	20	Eosinophils					
91	Gurovsky 1980	3	18.5	9	0							ug	0	20	Eosinophils			-69.2		
91	Gurovsky 1980	3	18.5	9	1	0.32	1	1		Continuous		ug+AG	0	10	Eosinophils			-53.8		
91	Gurovsky 1980	3	18.5	9	0							ug	0	20	Sarcoplasmatic Proteins			increase		
91	Gurovsky 1980	3	18.5	9	1	0.32	1	1		Continuous		ug+AG	0	10	Sarcoplasmatic Proteins			no change		
91	Gurovsky 1980	3	18.5	9	0							ug	0	20	ATPase activity of Myosin	Myocardial		arge decrease		
91	Gurovsky 1980	3	18.5	9	1	0.32	1	1		Continuous		ug+AG	0	10	ATPase activity of Myosin	Myocardial		mall decrease		
93	Belozerova 2000	1	30	3	0							CON	0	6	Myofiber Cross Sectional Area	MHC I	Vastus Lateralis	-26.4	1	
93	Belozerova 2000	1	30	3	1			1.2	20-May	5 days/week		AG	0	5	Myofiber Cross Sectional Area	MHC I	Vastus Lateralis	-16.7	1	
93	Belozerova 2000	1	30	3	0							CON	0	6	Myofiber Cross Sectional Area	MHC IIa / IIx		-15.7	1	

93	Belozerova 2000	1	30	3	1			1.2	20-May	5 days/week		AG	0	5	Myofiber Cross Sectional Area	MHC IIa / IIx		-8.1		
93	Belozerova 2000	1	30	3	0							CON	0	6	Area % Connective Tussue Compartment			113	1	
93	Belozerova 2000	1	30	3	1			1.2	20-May	5 days/week		AG	0	5	Area % Connective Tussue Compartment			36		
93	Belozerova 2000	1	30	3	0							CON	0	6	Capillary per fiber ratio			-9.5		
93	Belozerova 2000	1	30	3	1			1.2	20-May	5 days/week		AG	0	5	Capillary per fiber ratio			-9		
93	Belozerova 2000	1	30	3	0							CON	0	6	capillary density			12.6		
93	Belozerova 2000	1	30	3	1			1.2	20-May	5 days/week		AG	0	5	capillary density			-3.7		
93	Belozerova 2000	1	30	3	0							CON	0	6	Succinate Dehydrogenase	MHC I		-2.6		
93	Belozerova 2000	1	30	3	1			1.2	20-May	5 days/week		AG	0	5	Succinate Dehydrogenase	MHC I		22.2	1	
93	Belozerova 2000	1	30	3	0							CON	0	6	Muscle weight-to-body ratio	MHC IIa / IIx		9.9		
93	Belozerova 2000	1	30	3	1			1.2	20-May	5 days/week		AG	0	5	Muscle weight-to-body ratio	MHC IIa / IIx		28.5	1	
95	D'Aunno 1990	2	7	0	0							BAS	7	0	Wet Weight	Soleus				
95	D'Aunno 1990	2	7	0	0							CON	8	0	Wet Weight	Soleus				
95	D'Aunno 1990	2	7	8	0							SUS	12	0	Wet Weight	Soleus		-39.8	1	
95	D'Aunno 1990	2	7	8	1	1.6	1.5	1.5	60	Daily		AG1.5	8	0	Wet Weight	Soleus		-31.5		
95	D'Aunno 1990	2	7	8	1	1.6	1.5	1.5	120	Daily		AG1.5	8	0	Wet Weight	Soleus		-27.3		1
95	D'Aunno 1990	2	7	8	1	1.6	2.6	2.6	60	Daily		AG2.6	6	0	Wet Weight	Soleus		-31.2		
95	D'Aunno 1990	2	7	8	1	1.6	2.6	2.6	120	Daily		AG2.6	7	0	Wet Weight	Soleus		-29.9		1
95	D'Aunno 1990	2	7	8	8				120	Daily		STD2	6	0	Wet Weight	Soleus		-25.1		1
95	D'Aunno 1990	2	7	0	0							BAS	7	0	Sarcoplasmatic Proteins	Soleus				
95	D'Aunno 1990	2	7	0	0							CON	8	0	Sarcoplasmatic Proteins	Soleus				
95	D'Aunno 1990	2	7	8	0							SUS	12	0	Sarcoplasmatic Proteins	Soleus		-37.1	1	
95	D'Aunno 1990	2	7	8	1	1.6	1.5	1.5	60	Daily		AG1.5	8	0	Sarcoplasmatic Proteins	Soleus		-32		
95	D'Aunno 1990	2	7	8	1	1.6	1.5	1.5	120	Daily		AG1.5	8	0	Sarcoplasmatic Proteins	Soleus		-26.9		
95	D'Aunno 1990	2	7	8	1	1.6	2.6	2.6	60	Daily		AG2.6	6	0	Sarcoplasmatic Proteins	Soleus		-23		
95	D'Aunno 1990	2	7	8	1	1.6	2.6	2.6	120	Daily		AG2.6	7	0	Sarcoplasmatic Proteins	Soleus		-39.7		
95	D'Aunno 1990	2	7	8	8				120	Daily		STD2	6	0	Sarcoplasmatic Proteins	Soleus		-30.7		
95	D'Aunno 1990	2	7	0	0							BAS	7	0	Muscle weight-to-body ratio	Soleus				
95	D'Aunno 1990	2	7	0	0							CON	8	0	Muscle weight-to-body ratio	Soleus				
95	D'Aunno 1990	2	7	8	0							SUS	12	0	Muscle weight-to-body ratio	Soleus		-23.5	1	
95	D'Aunno 1990	2	7	8	1	1.6	1.5	1.5	60	Daily		AG1.5	8	0	Muscle weight-to-body ratio	Soleus		-21.5		
95	D'Aunno 1990	2	7	8	1	1.6	1.5	1.5	120	Daily		AG1.5	8	0	Muscle weight-to-body ratio	Soleus		-18.6		
95	D'Aunno 1990	2	7	8	1	1.6	2.6	2.6	60	Daily		AG2.6	6	0	Muscle weight-to-body ratio	Soleus		-21.5		
95	D'Aunno 1990	2	7	8	1	1.6	2.6	2.6	120	Daily		AG2.6	7	0	Muscle weight-to-body ratio	Soleus		-17.6		
95	D'Aunno 1990	2	7	8	8				120	Daily		STD2	6	0	Muscle weight-to-body ratio	Soleus		-15.6		
95	D'Aunno 1990	2	7	0	0							BAS	7	0	Wet Weight	Whole Body				
95	D'Aunno 1990	2	7	0	0							CON	8	0	Wet Weight	Whole Body				
95	D'Aunno 1990	2	7	8	0							SUS	12	0	Wet Weight	Whole Body		-13.3		
95	D'Aunno 1990	2	7	8	1	1.6	1.5	1.5	60	Daily		AG1.5	8	0	Wet Weight	Whole Body		-12.3		
95	D'Aunno 1990	2	7	8	1	1.6	1.5	1.5	120	Daily		AG1.5	8	0	Wet Weight	Whole Body		-11		
95	D'Aunno 1990	2	7	8	1	1.6	2.6	2.6	60	Daily		AG2.6	6	0	Wet Weight	Whole Body		-11.7		
95	D'Aunno 1990	2	7	8	1	1.6	2.6	2.6	120	Daily		AG2.6	7	0	Wet Weight	Whole Body		-14		
95	D'Aunno 1990	2	7	8	8				120	Daily		STD2	6	0	Wet Weight	Whole Body		-10.7		
95	D'Aunno 1990	2	7	0	0							CON	8	0	Food Intake					
95	D'Aunno 1990	2	7	8	0							SUS	12	0	Food Intake			-6.1		
95	D'Aunno 1990	2	7	8	1	1.6	1.5	1.5	60	Daily		AG1.5	8	0	Food Intake			-17.4		
95	D'Aunno 1990	2	7	8	1	1.6	1.5	1.5	120	Daily		AG1.5	8	0	Food Intake			-5.1		
95	D'Aunno 1990	2	7	8	1	1.6	2.6	2.6	60	Daily		AG2.6	6	0	Food Intake			-7.6		
95	D'Aunno 1990	2	7	8	1	1.6	2.6	2.6	120	Daily		AG2.6	7	0	Food Intake			-22		
95	D'Aunno 1990	2	7	8	8				120	Daily		STD2	6	0	Food Intake			-2.5		
96	D'Aunno 1992	2	7	0	0							BAS	8	0	Wet Weight	Soleus				
96	D'Aunno 1992	2	7	0	0							CON	7	0	Wet Weight	Soleus				
96	D'Aunno 1992	2	7	8	0							SUS	6	0	Wet Weight	Soleus		-24.5		p<0.05 vs CONS
96	D'Aunno 1992	2	7	8	8				15	4/day daily		STD1	9	0	Wet Weight	Soleus		-8.1		p<0.05 vs SUS
96	D'Aunno 1992	2	7	8	1	1.6	1.2	1.2	15	4/day daily		AG1.6	5	0	Wet Weight	Soleus		-14.2		p<0.05 vs CONS
96	D'Aunno 1992	2	7	0	0							BAS	8	0	Relative Sarcoplasmic protein	Soleus				
96	D'Aunno 1992	2	7	0	0							CON	7	0	Relative Sarcoplasmic protein	Soleus				
96	D'Aunno 1992	2	7	8	0							SUS	6	0	Relative Sarcoplasmic protein	Soleus		8.5		
96	D'Aunno 1992	2	7	8	8				15	4/day daily		STD1	9	0	Relative Sarcoplasmic protein	Soleus		25.7		
96	D'Aunno 1992	2	7	8	1	1.6	1.2	1.2	15	4/day daily		AG1.6	5	0	Relative Sarcoplasmic protein	Soleus		0.5		
96	D'Aunno 1992	2	7	0	0							BAS	8	0	Sarcoplasmatic Proteins	Soleus				
96	D'Aunno 1992	2	7	0	0							CON	7	0	Sarcoplasmatic Proteins	Soleus				
96	D'Aunno 1992	2	7	8	0							SUS	6	0	Sarcoplasmatic Proteins	Soleus		-22.6		
96	D'Aunno 1992	2	7	8	8				15	4/day daily		STD1	9	0	Sarcoplasmatic Proteins	Soleus		5.6		

96	D'Aunno 1992	2	7	8	1	1.6	1.2	1.2	15	4/day daily		AG1.6	5	0	Sarcoplasmatic Proteins	Soleus		-20.7		
96	D'Aunno 1992	2	7	0	0							BAS	8	0	Muscle weight-to-body ratio	Soleus				
96	D'Aunno 1992	2	7	0	0							CON	7	0	Muscle weight-to-body ratio	Soleus				
96	D'Aunno 1992	2	7	8	0							SUS	6	0	Muscle weight-to-body ratio	Soleus		-11.6		p<0.05 vs CONS
96	D'Aunno 1992	2	7	8	8				15	4/day daily		STD1	9	0	Muscle weight-to-body ratio	Soleus		2.1		p<0.05 vs SUS
96	D'Aunno 1992	2	7	8	1	1.6	1.2	1.2	15	4/day daily		AG1.6	5	0	Muscle weight-to-body ratio	Soleus		-2.4		
96	D'Aunno 1992	2	7	0	0							BAS	8	0	Wet Weight	Whole Body				
96	D'Aunno 1992	2	7	0	0							CON	7	0	Wet Weight	Whole Body				
96	D'Aunno 1992	2	7	8	0							SUS	6	0	Wet Weight	Whole Body		-17.2		p<0.05 vs CON
96	D'Aunno 1992	2	7	8	8				15	4/day daily		STD1	9	0	Wet Weight	Whole Body		-13		p<0.05 vs CON
96	D'Aunno 1992	2	7	8	1	1.6	1.2	1.2	15	4/day daily		AG1.6	5	0	Wet Weight	Whole Body		-14.6		p<0.05 vs CON
96	D'Aunno 1992	2	7	0	0							BAS	8	0	Wet Weight	Plantar Flexor				
96	D'Aunno 1992	2	7	0	0							CON	7	0	Wet Weight	Plantar Flexor				
96	D'Aunno 1992	2	7	8	0							SUS	6	0	Wet Weight	Plantar Flexor		-23		p<0.05 vs CON
96	D'Aunno 1992	2	7	8	8				15	4/day daily		STD1	9	0	Wet Weight	Plantar Flexor		-14.5		p<0.05 vs CON
96	D'Aunno 1992	2	7	8	1	1.6	1.2	1.2	15	4/day daily		AG1.6	5	0	Wet Weight	Plantar Flexor		-21.5		p<0.05 vs CON
96	D'Aunno 1992	2	7	0	0							BAS	8	0	Wet Weight	Adrenal Gland				
96	D'Aunno 1992	2	7	0	0							CON	7	0	Wet Weight	Adrenal Gland				
96	D'Aunno 1992	2	7	8	0							SUS	6	0	Wet Weight	Adrenal Gland		8.7		
96	D'Aunno 1992	2	7	8	8				15	4/day daily		STD1	9	0	Wet Weight	Adrenal Gland		24		
96	D'Aunno 1992	2	7	8	1	1.6	1.2	1.2	15	4/day daily		AG1.6	5	0	Wet Weight	Adrenal Gland		20.6		
96	D'Aunno 1992	2	7	0	0							CON	7	0	Food Intake					
96	D'Aunno 1992	2	7	8	0							SUS	6	0	Food Intake			-25		
96	D'Aunno 1992	2	7	8	8				15	4/day daily		STD1	9	0	Food Intake			0		
96	D'Aunno 1992	2	7	8	1	1.6	1.2	1.2	15	4/day daily		AG1.6	5	0	Food Intake			-15		
113	Wimalawansa 1999	4	14	0	0							BAS	0	10	#N/A					
113	Wimalawansa 1999	4	14	0	0							CON	0	10	#N/A					
113	Wimalawansa 1999	4	14	8	0							SUS	0	10	#N/A					
113	Wimalawansa 1999	4	14	8	262144					Daily	80µg/kg/day	PTH80	0	10	#N/A					
97	Thomason 1987	2	28	0	0							CON	25	0	Wet Weight	Soleus	slow twitch			
97	Thomason 1987	2	28	8	0							SUS	31	0	Wet Weight	Soleus	slow twitch			p<0.05 vs CON
97	Thomason 1987	2	28	8	8				120	Daily		STD2	6	0	Wet Weight	Soleus	slow twitch			p<0.05 vs CON and SUS
97	Thomason 1987	2	28	8	8				240	Daily		STD4	7	0	Wet Weight	Soleus	slow twitch			p<0.05 vs CON and SUS
97	Thomason 1987	2	28	8	16				90	Daily	20m/min @ 30% grade	SUS+WLK	8	0	Wet Weight	Soleus	slow twitch			p<0.05 vs CON and SUS
97	Thomason 1987	2	28	0	0							CON	25	0	Wet Weight	Adductors	slow twitch			
97	Thomason 1987	2	28	8	0							SUS	31	0	Wet Weight	Adductors	slow twitch			p<0.05 vs CON
97	Thomason 1987	2	28	8	8				120	Daily		STD2	6	0	Wet Weight	Adductors	slow twitch			p<0.05 vs CON and SUS
97	Thomason 1987	2	28	8	8				240	Daily		STD4	7	0	Wet Weight	Adductors	slow twitch			p<0.05 vs CON and SUS
97	Thomason 1987	2	28	8	16				90	Daily	20m/min @ 30% grade	SUS+WLK	8	0	Wet Weight	Adductors	slow twitch			p<0.05 vs CON and SUS
97	Thomason 1987	2	28	0	0							CON	25	0	Wet Weight	Vastus Intermedius	slow twitch			
97	Thomason 1987	2	28	8	0							SUS	31	0	Wet Weight	Vastus Intermedius	slow twitch			p<0.05 vs CON
97	Thomason 1987	2	28	8	8				120	Daily		STD2	6	0	Wet Weight	Vastus Intermedius	slow twitch			p<0.05 vs CON
97	Thomason 1987	2	28	8	8				240	Daily		STD4	7	0	Wet Weight	Vastus Intermedius	slow twitch			p<0.05 vs CON
97	Thomason 1987	2	28	8	16				90	Daily	20m/min @ 30% grade	SUS+WLK	8	0	Wet Weight	Vastus Intermedius	slow twitch			p<0.05 vs CON and SUS

97	Thomason 1987	2	28	0	0							CON	25	0	Wet Weight	Plantaris	fast twitch			
97	Thomason 1987	2	28	8	0							SUS	31	0	Wet Weight	Plantaris	fast twitch			p<0.05 vs CON
97	Thomason 1987	2	28	8	8				120	Daily		STD2	6	0	Wet Weight	Plantaris	fast twitch			p<0.05 vs CON and SUS
97	Thomason 1987	2	28	8	8				240	Daily		STD4	7	0	Wet Weight	Plantaris	fast twitch			p<0.05 vs CON and SUS
97	Thomason 1987	2	28	8	16				90	Daily	20m/min @ 30% grade	SUS+WLK	8	0	Wet Weight	Plantaris	fast twitch			p<0.05 vs CON
97	Thomason 1987	2	28	0	0							CON	25	0	Wet Weight	Tibialis Anterior	fast twitch			
97	Thomason 1987	2	28	8	0							SUS	31	0	Wet Weight	Tibialis Anterior	fast twitch			p<0.05 vs CON
97	Thomason 1987	2	28	8	8				120	Daily		STD2	6	0	Wet Weight	Tibialis Anterior	fast twitch			p<0.05 vs CON
97	Thomason 1987	2	28	8	8				240	Daily		STD4	7	0	Wet Weight	Tibialis Anterior	fast twitch			p<0.05 vs CON
97	Thomason 1987	2	28	8	16				90	Daily	20m/min @ 30% grade	SUS+WLK	8	0	Wet Weight	Tibialis Anterior	fast twitch			p<0.05 vs CON and SUS
97	Thomason 1987	2	28	0	0							CON	25	0	Wet Weight	Vastus Lateralis	fast twitch			
97	Thomason 1987	2	28	8	0							SUS	31	0	Wet Weight	Vastus Lateralis	fast twitch			p<0.05 vs CON
97	Thomason 1987	2	28	8	8				120	Daily		STD2	6	0	Wet Weight	Vastus Lateralis	fast twitch			p<0.05 vs CON and SUS
97	Thomason 1987	2	28	8	8				240	Daily		STD4	7	0	Wet Weight	Vastus Lateralis	fast twitch			p<0.05 vs CON and SUS
97	Thomason 1987	2	28	8	16				90	Daily	20m/min @ 30% grade	SUS+WLK	8	0	Wet Weight	Vastus Lateralis	fast twitch			p<0.05 vs CON
97	Thomason 1987	2	28	0	0							CON	25	0	Wet Weight	Whole Body				
97	Thomason 1987	2	28	8	0							SUS	31	0	Wet Weight	Whole Body				p<0.05 vs CON
97	Thomason 1987	2	28	8	8				120	Daily		STD2	6	0	Wet Weight	Whole Body				p<0.05 vs CON
97	Thomason 1987	2	28	8	8				240	Daily		STD4	7	0	Wet Weight	Whole Body				p<0.05 vs CON
97	Thomason 1987	2	28	8	16				90	Daily	20m/min @ 30% grade	SUS+WLK	8	0	Wet Weight	Whole Body				
97	Thomason 1987	2	28	0	0							CON	25	0	Wet Weight	Heart				
97	Thomason 1987	2	28	8	0							SUS	31	0	Wet Weight	Heart				
97	Thomason 1987	2	28	8	8				120	Daily		STD2	6	0	Wet Weight	Heart				
97	Thomason 1987	2	28	8	8				240	Daily		STD4	7	0	Wet Weight	Heart				
97	Thomason 1987	2	28	8	16				90	Daily	20m/min @ 30% grade	SUS+WLK	8	0	Wet Weight	Heart				p<0.05 vs CON
97	Thomason 1987	2	28	0	0							CON	25	0	Wet Weight	Adrenal Gland				
97	Thomason 1987	2	28	8	0							SUS	31	0	Wet Weight	Adrenal Gland				
97	Thomason 1987	2	28	8	8				120	Daily		STD2	6	0	Wet Weight	Adrenal Gland				
97	Thomason 1987	2	28	8	8				240	Daily		STD4	7	0	Wet Weight	Adrenal Gland				
97	Thomason 1987	2	28	8	16				90	Daily	20m/min @ 30% grade	SUS+WLK	8	0	Wet Weight	Adrenal Gland				p<0.05 vs CON and SUS
97	Thomason 1987	2	28	0	0							CON	25	0	Protein	Soleus	myofibril			
97	Thomason 1987	2	28	8	0							SUS	31	0	Protein	Soleus	myofibril			p<0.05 vs CON
97	Thomason 1987	2	28	8	8				120	Daily		STD2	6	0	Protein	Soleus	myofibril			p<0.05 vs CON and SUS
97	Thomason 1987	2	28	8	8				240	Daily		STD4	7	0	Protein	Soleus	myofibril			p<0.05 vs CON and SUS
97	Thomason 1987	2	28	8	16				90	Daily	20m/min @ 30% grade	SUS+WLK	8	0	Protein	Soleus	myofibril			p<0.05 vs CON and SUS
97	Thomason 1987	2	28	0	0							CON	25	0	Protein	Soleus	myofibril -			
97	Thomason 1987	2	28	8	0							SUS	31	0	Protein	Soleus	myofibril - relative			p<0.05 vs CON
97	Thomason 1987	2	28	8	8				120	Daily		STD2	6	0	Protein	Soleus	myofibril - relative			p<0.05 vs CON
97	Thomason 1987	2	28	8	8				240	Daily		STD4	7	0	Protein	Soleus	myofibril - relative			p<0.05 vs CON and SUS

97	Thomason 1987	2	28	8	16				90	Daily	20m/min @ 30% grade	SUS+WLK	8	0	Protein	Soleus	myofibril - relative			p<0.05 vs CON
97	Thomason 1987	2	28	0	0							CON	25	0	Relative ATPase activity of Myosin	Soleus				
97	Thomason 1987	2	28	8	0							SUS	31	0	Relative ATPase activity of Myosin	Soleus				p<0.05 vs CON
97	Thomason 1987	2	28	8	8				120	Daily		STD2	6	0	Relative ATPase activity of Myosin	Soleus				p<0.05 vs CON
97	Thomason 1987	2	28	8	8				240	Daily		STD4	7	0	Relative ATPase activity of Myosin	Soleus				p<0.05 vs CON
97	Thomason 1987	2	28	8	16				90	Daily	20m/min @ 30% grade	SUS+WLK	8	0	Relative ATPase activity of Myosin	Soleus				p<0.05 vs CON
97	Thomason 1987	2	28	0	0							CON	25	0	Myosin Isoform Content	Soleus	slow twitch			
97	Thomason 1987	2	28	8	0							SUS	31	0	Myosin Isoform Content	Soleus	slow twitch			p<0.05 vs CON
97	Thomason 1987	2	28	8	8				120	Daily		STD2	6	0	Myosin Isoform Content	Soleus	slow twitch			p<0.05 vs CON
97	Thomason 1987	2	28	8	8				240	Daily		STD4	7	0	Myosin Isoform Content	Soleus	slow twitch			p<0.05 vs CON and SUS
97	Thomason 1987	2	28	8	16				90	Daily	20m/min @ 30% grade	SUS+WLK	8	0	Myosin Isoform Content	Soleus	slow twitch			p<0.05 vs CON and SUS
97	Thomason 1987	2	28	0	0							CON	25	0	Myosin Isoform Content	Soleus	fast twitch			
97	Thomason 1987	2	28	8	0							SUS	31	0	Myosin Isoform Content	Soleus	fast twitch			
97	Thomason 1987	2	28	8	8				120	Daily		STD2	6	0	Myosin Isoform Content	Soleus	fast twitch			
97	Thomason 1987	2	28	8	8				240	Daily		STD4	7	0	Myosin Isoform Content	Soleus	fast twitch			
97	Thomason 1987	2	28	8	16				90	Daily	20m/min @ 30% grade	SUS+WLK	8	0	Myosin Isoform Content	Soleus	fast twitch			
98	Widrick 1996	2	14	0	0							CON	0	7	Wet Weight	Soleus				
98	Widrick 1996	2	14	8	0							SUS	0	7	Wet Weight	Soleus		-40.2		p<0.05 vs CON
98	Widrick 1996	2	14	8	8				10	4 / day		STD	0	7	Wet Weight	Soleus		-35.7		p<0.05 vs CON
98	Widrick 1996	2	14	0	0							CON	0	7	Relative Weight	Soleus				
98	Widrick 1996	2	14	8	0							SUS	0	7	Relative Weight	Soleus		-45		p<0.05 vs CON
98	Widrick 1996	2	14	8	8				10	4 / day		STD	0	7	Relative Weight	Soleus		-35.2		p<0.05 vs CON and SUS
98	Widrick 1996	2	14	0	0							CON	0	7	Myofiber Cross Sectional Area	Soleus				
98	Widrick 1996	2	14	8	0							SUS	0	7	Myofiber Cross Sectional Area	Soleus		-28.1		p<0.05 vs CON
98	Widrick 1996	2	14	8	8				10	4 / day		STD	0	7	Myofiber Cross Sectional Area	Soleus		-18.3		p<0.05 vs CON and SUS
98	Widrick 1996	2	14	0	0							CON	0	7	Po, Peak force	MHC I	Soleus			
98	Widrick 1996	2	14	8	0							SUS	0	7	Po, Peak force	MHC I	Soleus	-54.9		p<0.05 vs CON
98	Widrick 1996	2	14	8	8				10	4 / day		STD	0	7	Po, Peak force	MHC I	Soleus	-39.2		p<0.05 vs CON and SUS
98	Widrick 1996	2	14	0	0							CON	0	7	Peak Tension	Soleus				
98	Widrick 1996	2	14	8	0							SUS	0	7	Peak Tension	Soleus		-16.1		p<0.05 vs CON
98	Widrick 1996	2	14	8	8				10	4 / day		STD	0	7	Peak Tension	Soleus		-10		p<0.05 vs CON
98	Widrick 1996	2	14	0	0							CON	0	7	Peak Elastic Modulus (Eo)	Soleus				
98	Widrick 1996	2	14	8	0							SUS	0	7	Peak Elastic Modulus (Eo)	Soleus		-40.6		p<0.05 vs CON
98	Widrick 1996	2	14	8	8				10	4 / day		STD	0	7	Peak Elastic Modulus (Eo)	Soleus		-31.1		p<0.05 vs CON
98	Widrick 1996	2	14	0	0							CON	0	7	Po / Eo	Soleus				
98	Widrick 1996	2	14	8	0							SUS	0	7	Po / Eo	Soleus		40		p<0.05 vs CON
98	Widrick 1996	2	14	8	8				10	4 / day		STD	0	7	Po / Eo	Soleus		26.6		p<0.05 vs CON
98	Widrick 1996	2	14	0	0							CON	0	7	Vo, shortening velocity	Soleus				
98	Widrick 1996	2	14	8	0							SUS	0	7	Vo, shortening velocity	Soleus		33.3		p<0.05 vs CON
98	Widrick 1996	2	14	8	8				10	4 / day		STD	0	7	Vo, shortening velocity	Soleus		17		p<0.05 vs CON and SUS

101	Pierotti 1990	2	7	0	0							CON	0	7	Wet Weight	Whole Body				
101	Pierotti 1990	2	7	8	0							SUS	0	9	Wet Weight	Whole Body		-8.8		p<0.05 vs. CON
101	Pierotti 1990	2	7	8	16				10	4 / day	12m/min @ 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	8	Wet Weight	Whole Body		-13.4		p<0.05 vs. CON
101	Pierotti 1990	2	7	0	0							CON	0	7	Wet Weight	Soleus				
101	Pierotti 1990	2	7	8	0							SUS	0	9	Wet Weight	Soleus		-26.7		p<0.05 vs. CON
101	Pierotti 1990	2	7	8	16				10	4 / day	12m/min @ 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	8	Wet Weight	Soleus		-19.7		p<0.05 vs. CON
101	Pierotti 1990	2	7	0	0							CON	0	7	Relative Weight	Soleus				
101	Pierotti 1990	2	7	8	0							SUS	0	9	Relative Weight	Soleus		-21.2		p<0.05 vs. CON
101	Pierotti 1990	2	7	8	16				10	4 / day	12m/min @ 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	8	Relative Weight	Soleus		-8.5		
101	Pierotti 1990	2	7	0	0							CON	0	7	Total contraction time	Soleus				
101	Pierotti 1990	2	7	8	0							SUS	0	9	Total contraction time	Soleus		-24.7		p<0.05 vs. CON
101	Pierotti 1990	2	7	8	16				10	4 / day	12m/min @ 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	8	Total contraction time	Soleus		-13.1		p<0.05 vs. CON p<0.05 vs. HS
101	Pierotti 1990	2	7	0	0							CON	0	7	Half relaxation time	Soleus				
101	Pierotti 1990	2	7	8	0							SUS	0	9	Half relaxation time	Soleus		2.7		
101	Pierotti 1990	2	7	8	16				10	4 / day	12m/min @ 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	8	Half relaxation time	Soleus		-5.7		
101	Pierotti 1990	2	7	0	0							CON	0	7	Pt, Isometric max twitch force	Soleus				
101	Pierotti 1990	2	7	8	0							SUS	0	9	Pt, Isometric max twitch force	Soleus		-41.8		p<0.05 vs. CON
101	Pierotti 1990	2	7	8	16				10	4 / day	12m/min @ 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	8	Pt, Isometric max twitch force	Soleus		-17.7		p<0.05 vs. CON p<0.05 vs. HS
101	Pierotti 1990	2	7	0	0							CON	0	7	Po, Peak force	Soleus				
101	Pierotti 1990	2	7	8	0							SUS	0	9	Po, Peak force	Soleus		-49.1		p<0.05 vs. CON
101	Pierotti 1990	2	7	8	16				10	4 / day	12m/min @ 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	8	Po, Peak force	Soleus		-22.4		p<0.05 vs. CON p<0.05 vs. HS
101	Pierotti 1990	2	7	0	0							CON	0	7	Pt / Po	Soleus				
101	Pierotti 1990	2	7	8	0							SUS	0	9	Pt / Po	Soleus		17.3		p<0.05 vs. CON
101	Pierotti 1990	2	7	8	16				10	4 / day	12m/min @ 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	8	Pt / Po	Soleus		8.6		
101	Pierotti 1990	2	7	0	0							CON	0	7	Po / Muscle Weight	Soleus				
101	Pierotti 1990	2	7	8	0							SUS	0	9	Po / Muscle Weight	Soleus		-30.5		p<0.05 vs. CON
101	Pierotti 1990	2	7	8	16				10	4 / day	12m/min @ 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	8	Po / Muscle Weight	Soleus		-2.7		p<0.05 vs. HS
101	Pierotti 1990	2	7	0	0							CON	0	7	Vo, shortening velocity	Soleus				
101	Pierotti 1990	2	7	8	0							SUS	0	9	Vo, shortening velocity	Soleus		4		
101	Pierotti 1990	2	7	8	16				10	4 / day	12m/min @ 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	8	Vo, shortening velocity	Soleus		10.2		
101	Pierotti 1990	2	7	0	0							CON	0	7	Fatigue Index	Soleus				
101	Pierotti 1990	2	7	8	0							SUS	0	9	Fatigue Index	Soleus		0		
101	Pierotti 1990	2	7	8	16				10	4 / day	12m/min @ 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	8	Fatigue Index	Soleus		-1		
101	Pierotti 1990	2	7	0	0							CON	0	7	Wet Weight	Gastrocnemius	Medial			
101	Pierotti 1990	2	7	8	0							SUS	0	9	Wet Weight	Gastrocnemius	Medial	-26.2		p<0.05 vs. CON
101	Pierotti 1990	2	7	8	16				10	4 / day	12m/min @ 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	8	Wet Weight	Gastrocnemius	Medial	-23.1		p<0.05 vs. CON
101	Pierotti 1990	2	7	0	0							CON	0	7	Relative Weight	Gastrocnemius	Medial			
101	Pierotti 1990	2	7	8	0							SUS	0	9	Relative Weight	Gastrocnemius	Medial	-18.6		p<0.05 vs. CON
101	Pierotti 1990	2	7	8	16				10	4 / day	12m/min @ 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	8	Relative Weight	Gastrocnemius	Medial	-10.3		p<0.05 vs. CON
101	Pierotti 1990	2	7	0	0							CON	0	7	Total contraction time	Gastrocnemius	Medial			
101	Pierotti 1990	2	7	8	0							SUS	0	9	Total contraction time	Gastrocnemius	Medial	-1.5		
101	Pierotti 1990	2	7	8	16				10	4 / day	12m/min @ 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	8	Total contraction time	Gastrocnemius	Medial	0.5		
101	Pierotti 1990	2	7	0	0							CON	0	7	Half relaxation time	Gastrocnemius	Medial			
101	Pierotti 1990	2	7	8	0							SUS	0	9	Half relaxation time	Gastrocnemius	Medial	-4.9		

101	Pierotti 1990	2	7	8	16				10	4 / day	12m/min @ 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	8	Half relaxation time	Gastrocnemius	Medial	-1.6		
101	Pierotti 1990	2	7	0	0							CON	0	7	Pt, Isometric max twitch force	Gastrocnemius	Medial			
101	Pierotti 1990	2	7	8	0							SUS	0	9	Pt, Isometric max twitch force	Gastrocnemius	Medial	-1.5		
101	Pierotti 1990	2	7	8	16				10	4 / day	12m/min @ 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	8	Pt, Isometric max twitch force	Gastrocnemius	Medial	0		
101	Pierotti 1990	2	7	0	0							CON	0	7	Po, Peak force	Gastrocnemius	Medial			
101	Pierotti 1990	2	7	8	0							SUS	0	9	Po, Peak force	Gastrocnemius	Medial	-19.7		p<0.05 vs. CON
101	Pierotti 1990	2	7	8	16				10	4 / day	12m/min @ 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	8	Po, Peak force	Gastrocnemius	Medial	-11.1		
101	Pierotti 1990	2	7	0	0							CON	0	7	Pt / Po	Gastrocnemius	Medial			
101	Pierotti 1990	2	7	8	0							SUS	0	9	Pt / Po	Gastrocnemius	Medial	21.4		p<0.05 vs. CON
101	Pierotti 1990	2	7	8	16				10	4 / day	12m/min @ 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	8	Pt / Po	Gastrocnemius	Medial	7.1		
101	Pierotti 1990	2	7	0	0							CON	0	7	Po / Muscle Weight	Gastrocnemius	Medial			
101	Pierotti 1990	2	7	8	0							SUS	0	9	Po / Muscle Weight	Gastrocnemius	Medial	8.8		
101	Pierotti 1990	2	7	8	16				10	4 / day	12m/min @ 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	8	Po / Muscle Weight	Gastrocnemius	Medial	15.3		p<0.05 vs. CON
101	Pierotti 1990	2	7	0	0							CON	0	7	Vo, shortening velocity	Gastrocnemius	Medial			
101	Pierotti 1990	2	7	8	0							SUS	0	9	Vo, shortening velocity	Gastrocnemius	Medial	-3		
101	Pierotti 1990	2	7	8	16				10	4 / day	12m/min @ 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	8	Vo, shortening velocity	Gastrocnemius	Medial	-6.4		
101	Pierotti 1990	2	7	0	0							CON	0	7	Fatigue Index	Gastrocnemius	Medial			
101	Pierotti 1990	2	7	8	0							SUS	0	9	Fatigue Index	Gastrocnemius	Medial	-5.1		
101	Pierotti 1990	2	7	8	16				10	4 / day	12m/min @ 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	8	Fatigue Index	Gastrocnemius	Medial	0		
102	Graham 1989a	2	28	0	0							CON	7	0	Wet Weight	Soleus				
102	Graham 1989a	2	28	8	0							SUS	7	0	Wet Weight	Soleus		-69.1		p<0.05 vs. CON
102	Graham 1989a	2	28	8	16				10 to 90	Daily	started at 10min/day, increased by 5min/day until 1hr/day, then increased by 10min/day until 90min/day. Speed was 20m/min at 30% grade	SUS+WLK	7	0	Wet Weight	Soleus		-29.9		p<0.05 vs. CON p<0.05 vs. HS
102	Graham 1989a	2	28	0	0							CON	7	0	Wet Weight	Adrenal Gland				
102	Graham 1989a	2	28	8	0							SUS	7	0	Wet Weight	Adrenal Gland		5		
102	Graham 1989a	2	28	8	16				10 to 90	Daily	started at 10min/day, increased by 5min/day until 1hr/day, then increased by 10min/day until 90min/day. Speed was 20m/min at 30% grade	SUS+WLK	7	0	Wet Weight	Adrenal Gland		51.8		p<0.05 vs. CON p<0.05 vs. HS
102	Graham 1989a	2	28	0	0							CON	7	0	Myofiber distribution %	Soleus	fast twitch			
102	Graham 1989a	2	28	8	0							SUS	7	0	Myofiber distribution %	Soleus	fast twitch	90		
102	Graham 1989a	2	28	8	16				10 to 90	Daily	started at 10min/day, increased by 5min/day until 1hr/day, then increased by 10min/day until 90min/day. Speed was 20m/min at 30% grade	SUS+WLK	7	0	Myofiber distribution %	Soleus	fast twitch	70		
102	Graham 1989a	2	28	0	0							CON	7	0	Myofiber Cross Sectional Area	Soleus	slow twitch			
102	Graham 1989a	2	28	8	0							SUS	7	0	Myofiber Cross Sectional Area	Soleus	slow twitch	-69		p<0.05 vs. CON
102	Graham 1989a	2	28	8	16				10 to 90	Daily	started at 10min/day, increased by 5min/day until 1hr/day, then increased by 10min/day until 90min/day. Speed was 20m/min at 30% grade	SUS+WLK	7	0	Myofiber Cross Sectional Area	Soleus	slow twitch	-48		p<0.05 vs. CON p<0.05 vs. HS
102	Graham 1989a	2	28	0	0							CON	7	0	Myofiber Cross Sectional Area	Soleus	fast twitch			
102	Graham 1989a	2	28	8	0							SUS	7	0	Myofiber Cross Sectional Area	Soleus	fast twitch	-46		p<0.05 vs. CON
102	Graham 1989a	2	28	8	16				10 to 90	Daily	started at 10min/day, increased by 5min/day until 1hr/day, then increased by 10min/day until 90min/day. Speed was 20m/min at 30% grade	SUS+WLK	7	0	Myofiber Cross Sectional Area	Soleus	fast twitch	-18		p<0.05 vs. CON p<0.05 vs. HS
102	Graham 1989a	2	28	0	0							CON	7	0	Succinate Dehydrogenase	Soleus	slow twitch			
102	Graham 1989a	2	28	8	0							SUS	7	0	Succinate Dehydrogenase	Soleus	slow twitch	40.2		
102	Graham 1989a	2	28	8	16				10 to 90	Daily	started at 10min/day, increased by 5min/day until 1hr/day, then increased by 10min/day until 90min/day. Speed was 20m/min at 30% grade	SUS+WLK	7	0	Succinate Dehydrogenase	Soleus	slow twitch	39.7		
102	Graham 1989a	2	28	0	0							CON	7	0	Succinate Dehydrogenase	Soleus	fast twitch			
102	Graham 1989a	2	28	8	0							SUS	7	0	Succinate Dehydrogenase	Soleus	fast twitch	11.3		
102	Graham 1989a	2	28	8	16				10 to 90	Daily	started at 10min/day, increased by 5min/day until 1hr/day, then increased by 10min/day until 90min/day. Speed was 20m/min at 30% grade	SUS+WLK	7	0	Succinate Dehydrogenase	Soleus	fast twitch	19.5		
102	Graham 1989a	2	28	0	0							CON	7	0	Integrated Succinate Dehydrogenase (ISDH)	Soleus	slow twitch			

102	Graham 1989a	2	28	8	0							SUS	7	0	Integrated Succinate Dehydrogenase (ISDH)	Soleus	slow twitch	-55.9		
102	Graham 1989a	2	28	8	16				10 to 90	Daily	started at 10min/day, increased by 5min/day until 1hr/day, then increased by 10min/day until 90min/day. Speed was 20m/min at 30% grade	SUS+WLK	7	0	Integrated Succinate Dehydrogenase (ISDH)	Soleus	slow twitch	-26.4		
102	Graham 1989a	2	28	0	0							CON	7	0	Integrated Succinate Dehydrogenase (ISDH)	Soleus	fast twitch			
102	Graham 1989a	2	28	8	0							SUS	7	0	Integrated Succinate Dehydrogenase (ISDH)	Soleus	fast twitch	-37.8		
102	Graham 1989a	2	28	8	16				10 to 90	Daily	started at 10min/day, increased by 5min/day until 1hr/day, then increased by 10min/day until 90min/day. Speed was 20m/min at 30% grade	SUS+WLK	7	0	Integrated Succinate Dehydrogenase (ISDH)	Soleus	fast twitch	2.5		
103	Hauschka 1988	2	7	0	0							CON	0	10	Wet Weight	Adrenal Gland				
103	Hauschka 1988	2	7	8	0							SUS	0	11	Wet Weight	Adrenal Gland		6.8		
103	Hauschka 1988	2	7	8	16				10	4 / day	Walked 5m/min at 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	12	Wet Weight	Adrenal Gland		-4.5		
103	Hauschka 1988	2	7	0	0							CON	0	10	Length	Tibia				
103	Hauschka 1988	2	7	8	0							SUS	0	11	Length	Tibia		-1.5		
103	Hauschka 1988	2	7	8	16				10	4 / day	Walked 5m/min at 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	12	Length	Tibia		-1.8		
103	Hauschka 1988	2	7	0	0							CON	0	10	Length	Femur				
103	Hauschka 1988	2	7	8	0							SUS	0	11	Length	Femur		-0.8		
103	Hauschka 1988	2	7	8	16				10	4 / day	Walked 5m/min at 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	12	Length	Femur		-0.2		
103	Hauschka 1988	2	7	0	0							CON	0	10	Wet Weight	Soleus				
103	Hauschka 1988	2	7	8	0							SUS	0	11	Wet Weight	Soleus		-35		p<0.05 vs. CON
103	Hauschka 1988	2	7	8	16				10	4 / day	Walked 5m/min at 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	12	Wet Weight	Soleus		-18.8		p<0.05 vs. CON p<0.05 vs. HS
103	Hauschka 1988	2	7	0	0							CON	0	10	Relative Weight	Soleus				
103	Hauschka 1988	2	7	8	0							SUS	0	11	Relative Weight	Soleus		-27.5		p<0.05 vs. CON
103	Hauschka 1988	2	7	8	16				10	4 / day	Walked 5m/min at 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	12	Relative Weight	Soleus		-7.5		p<0.05 vs. HS
103	Hauschka 1988	2	7	0	0							CON	0	10	Myofiber distribution %	Soleus	fast twitch			
103	Hauschka 1988	2	7	8	0							SUS	0	11	Myofiber distribution %	Soleus	fast twitch	-2.7		
103	Hauschka 1988	2	7	8	16				10	4 / day	Walked 5m/min at 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	12	Myofiber distribution %	Soleus	fast twitch	2.7		
103	Hauschka 1988	2	7	0	0							CON	0	10	Succinate Dehydrogenase	Soleus	slow twitch			
103	Hauschka 1988	2	7	8	0							SUS	0	11	Succinate Dehydrogenase	Soleus	slow twitch	9.7		
103	Hauschka 1988	2	7	8	16				10	4 / day	Walked 5m/min at 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	12	Succinate Dehydrogenase	Soleus	slow twitch	-8.7		
103	Hauschka 1988	2	7	0	0							CON	0	10	Succinate Dehydrogenase	Soleus	fast twitch			
103	Hauschka 1988	2	7	8	0							SUS	0	11	Succinate Dehydrogenase	Soleus	fast twitch	26.6		
103	Hauschka 1988	2	7	8	16				10	4 / day	Walked 5m/min at 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	12	Succinate Dehydrogenase	Soleus	fast twitch	5.7		
103	Hauschka 1988	2	7	0	0							CON	0	10	Integrated Succinate Dehydrogenase (ISDH)	Soleus	slow twitch			
103	Hauschka 1988	2	7	8	0							SUS	0	11	Integrated Succinate Dehydrogenase (ISDH)	Soleus	slow twitch	-28.1		
103	Hauschka 1988	2	7	8	16				10	4 / day	Walked 5m/min at 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	12	Integrated Succinate Dehydrogenase (ISDH)	Soleus	slow twitch	-24.5		
103	Hauschka 1988	2	7	0	0							CON	0	10	Integrated Succinate Dehydrogenase (ISDH)	Soleus	fast twitch			
103	Hauschka 1988	2	7	8	0							SUS	0	11	Integrated Succinate Dehydrogenase (ISDH)	Soleus	fast twitch	-14.5		
103	Hauschka 1988	2	7	8	16				10	4 / day	Walked 5m/min at 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	12	Integrated Succinate Dehydrogenase (ISDH)	Soleus	fast twitch	-5.1		
103	Hauschka 1988	2	7	0	0							CON	0	10	Myofiber Cross Sectional Area	Soleus	slow twitch			
103	Hauschka 1988	2	7	8	0							SUS	0	11	Myofiber Cross Sectional Area	Soleus	slow twitch	-36.1		p<0.05 vs. CON
103	Hauschka 1988	2	7	8	16				10	4 / day	Walked 5m/min at 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	12	Myofiber Cross Sectional Area	Soleus	slow twitch	-20		p<0.05 vs. CON
103	Hauschka 1988	2	7	0	0							CON	0	10	Myofiber Cross Sectional Area	Soleus	fast twitch			
103	Hauschka 1988	2	7	8	0							SUS	0	11	Myofiber Cross Sectional Area	Soleus	fast twitch	-33.5		p<0.05 vs. CON
103	Hauschka 1988	2	7	8	16				10	4 / day	Walked 5m/min at 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	12	Myofiber Cross Sectional Area	Soleus	fast twitch	-12.1		p<0.05 vs. SUS
104	Graham 1989b	2	7	0	0							CON	0	10	Wet Weight	Gastrocnemius	Medial			
104	Graham 1989b	2	7	8	0							SUS	0	11	Wet Weight	Gastrocnemius	Medial	-25.1		p<0.05 vs. CON

104	Graham 1989b	2	7	8	16				10	4 / day	Walked 5m/min at 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	12	Wet Weight	Gastrocnemius	Medial	-24.4		p<0.05 vs. CON
104	Graham 1989b	2	7	0	0							CON	0	10	Relative Weight	Gastrocnemius	Medial			
104	Graham 1989b	2	7	8	0							SUS	0	11	Relative Weight	Gastrocnemius	Medial	-16.9		p<0.05 vs. CON
104	Graham 1989b	2	7	8	16				10	4 / day	Walked 5m/min at 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	12	Relative Weight	Gastrocnemius	Medial	-13.3		p<0.05 vs. CON
104	Graham 1989b	2	7	0	0							CON	0	10	Myofiber distribution %	Gastrocnemius	Superficial Dark			
104	Graham 1989b	2	7	8	0							SUS	0	11	Myofiber distribution %	Gastrocnemius	Superficial Dark	0		
104	Graham 1989b	2	7	8	16				10	4 / day	Walked 5m/min at 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	12	Myofiber distribution %	Gastrocnemius	Superficial Dark	0		
104	Graham 1989b	2	7	0	0							CON	0	10	Myofiber distribution %	Gastrocnemius	Deep Dark			
104	Graham 1989b	2	7	8	0							SUS	0	11	Myofiber distribution %	Gastrocnemius	Deep Dark	-1.3		
104	Graham 1989b	2	7	8	16				10	4 / day	Walked 5m/min at 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	12	Myofiber distribution %	Gastrocnemius	Deep Dark	-5		
104	Graham 1989b	2	7	0	0							CON	0	10	Myofiber Cross Sectional Area	Gastrocnemius	Deep Light			
104	Graham 1989b	2	7	8	0							SUS	0	11	Myofiber Cross Sectional Area	Gastrocnemius	Deep Light			
104	Graham 1989b	2	7	8	16				10	4 / day	Walked 5m/min at 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	12	Myofiber Cross Sectional Area	Gastrocnemius	Deep Light			
104	Graham 1989b	2	7	0	0							CON	0	10	Myofiber Cross Sectional Area	Gastrocnemius	Deep Dark			
104	Graham 1989b	2	7	8	0							SUS	0	11	Myofiber Cross Sectional Area	Gastrocnemius	Deep Dark			
104	Graham 1989b	2	7	8	16				10	4 / day	Walked 5m/min at 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	12	Myofiber Cross Sectional Area	Gastrocnemius	Deep Dark			
104	Graham 1989b	2	7	0	0							CON	0	10	Myofiber Cross Sectional Area	Gastrocnemius	Superficial Dark			
104	Graham 1989b	2	7	8	0							SUS	0	11	Myofiber Cross Sectional Area	Gastrocnemius	Superficial Dark			
104	Graham 1989b	2	7	8	16				10	4 / day	Walked 5m/min at 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	12	Myofiber Cross Sectional Area	Gastrocnemius	Superficial Dark			
104	Graham 1989b	2	7	0	0							CON	0	10	Succinate Dehydrogenase	Gastrocnemius	Deep Light			
104	Graham 1989b	2	7	8	0							SUS	0	11	Succinate Dehydrogenase	Gastrocnemius	Deep Light			
104	Graham 1989b	2	7	8	16				10	4 / day	Walked 5m/min at 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	12	Succinate Dehydrogenase	Gastrocnemius	Deep Light			
104	Graham 1989b	2	7	0	0							CON	0	10	Succinate Dehydrogenase	Gastrocnemius	Deep Dark			
104	Graham 1989b	2	7	8	0							SUS	0	11	Succinate Dehydrogenase	Gastrocnemius	Deep Dark			
104	Graham 1989b	2	7	8	16				10	4 / day	Walked 5m/min at 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	12	Succinate Dehydrogenase	Gastrocnemius	Deep Dark			
104	Graham 1989b	2	7	0	0							CON	0	10	Succinate Dehydrogenase	Gastrocnemius	Superficial Dark			
104	Graham 1989b	2	7	8	0							SUS	0	11	Succinate Dehydrogenase	Gastrocnemius	Superficial Dark			
104	Graham 1989b	2	7	8	16				10	4 / day	Walked 5m/min at 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	12	Succinate Dehydrogenase	Gastrocnemius	Superficial Dark			
104	Graham 1989b	2	7	0	0							CON	0	10	Integrated Succinate Dehydrogenase (ISDH)	Gastrocnemius	Deep Light			
104	Graham 1989b	2	7	8	0							SUS	0	11	Integrated Succinate Dehydrogenase (ISDH)	Gastrocnemius	Deep Light			
104	Graham 1989b	2	7	8	16				10	4 / day	Walked 5m/min at 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	12	Integrated Succinate Dehydrogenase (ISDH)	Gastrocnemius	Deep Light			
104	Graham 1989b	2	7	0	0							CON	0	10	Integrated Succinate Dehydrogenase (ISDH)	Gastrocnemius	Deep Dark			
104	Graham 1989b	2	7	8	0							SUS	0	11	Integrated Succinate Dehydrogenase (ISDH)	Gastrocnemius	Deep Dark			
104	Graham 1989b	2	7	8	16				10	4 / day	Walked 5m/min at 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	12	Integrated Succinate Dehydrogenase (ISDH)	Gastrocnemius	Deep Dark			
104	Graham 1989b	2	7	0	0							CON	0	10	Integrated Succinate Dehydrogenase (ISDH)	Gastrocnemius	Superficial Dark			
104	Graham 1989b	2	7	8	0							SUS	0	11	Integrated Succinate Dehydrogenase (ISDH)	Gastrocnemius	Superficial Dark			
104	Graham 1989b	2	7	8	16				10	4 / day	Walked 5m/min at 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	12	Integrated Succinate Dehydrogenase (ISDH)	Gastrocnemius	Superficial Dark			
104	Graham 1989b	2	7	0	0							CON	0	10	a-glycerophosphate Dehydrogenase (GDP)	Gastrocnemius	Deep Light			
104	Graham 1989b	2	7	8	0							SUS	0	11	a-glycerophosphate Dehydrogenase (GDP)	Gastrocnemius	Deep Light			
104	Graham 1989b	2	7	8	16				10	4 / day	Walked 5m/min at 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	12	a-glycerophosphate Dehydrogenase (GDP)	Gastrocnemius	Deep Light			
104	Graham 1989b	2	7	0	0							CON	0	10	a-glycerophosphate Dehydrogenase (GDP)	Gastrocnemius	Deep Dark			
104	Graham 1989b	2	7	8	0							SUS	0	11	a-glycerophosphate Dehydrogenase (GDP)	Gastrocnemius	Deep Dark			

104	Graham 1989b	2	7	8	16				10	4 / day	Walked 5m/min at 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	12	a-glycerophosphate Dehydrogenase (GDP)	Gastrocnemius	Deep Dark			
104	Graham 1989b	2	7	0	0							CON	0	10	a-glycerophosphate Dehydrogenase (GDP)	Gastrocnemius	Superficial Dark			
104	Graham 1989b	2	7	8	0							SUS	0	11	a-glycerophosphate Dehydrogenase (GDP)	Gastrocnemius	Superficial Dark			
104	Graham 1989b	2	7	8	16				10	4 / day	Walked 5m/min at 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	12	a-glycerophosphate Dehydrogenase (GDP)	Gastrocnemius	Superficial Dark			
104	Graham 1989b	2	7	0	0							CON	0	10	Integrated a-glycerophosphate Dehydrogenase (IGDP)	Gastrocnemius	Deep Light			
104	Graham 1989b	2	7	8	0							SUS	0	11	Integrated a-glycerophosphate Dehydrogenase (IGDP)	Gastrocnemius	Deep Light			
104	Graham 1989b	2	7	8	16				10	4 / day	Walked 5m/min at 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	12	Integrated a-glycerophosphate Dehydrogenase (IGDP)	Gastrocnemius	Deep Light			
104	Graham 1989b	2	7	0	0							CON	0	10	Integrated a-glycerophosphate Dehydrogenase (IGDP)	Gastrocnemius	Deep Dark			
104	Graham 1989b	2	7	8	0							SUS	0	11	Integrated a-glycerophosphate Dehydrogenase (IGDP)	Gastrocnemius	Deep Dark			
104	Graham 1989b	2	7	8	16				10	4 / day	Walked 5m/min at 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	12	Integrated a-glycerophosphate Dehydrogenase (IGDP)	Gastrocnemius	Deep Dark			
104	Graham 1989b	2	7	0	0							CON	0	10	Integrated a-glycerophosphate Dehydrogenase (IGDP)	Gastrocnemius	Superficial Dark			
104	Graham 1989b	2	7	8	0							SUS	0	11	Integrated a-glycerophosphate Dehydrogenase (IGDP)	Gastrocnemius	Superficial Dark			
104	Graham 1989b	2	7	8	16				10	4 / day	Walked 5m/min at 19% grade on treadmill (Tail cast weighed 15g and provided extra loading on treadmill)	SUS+WLK	0	12	Integrated a-glycerophosphate Dehydrogenase (IGDP)	Gastrocnemius	Superficial Dark			
105	Herbert 1988	2	7	0	0							CON	0	7	Wet Weight	Adrenal Gland				
105	Herbert 1988	2	7	8	0							SUS	0	7	Wet Weight	Adrenal Gland		-4.1		
105	Herbert 1988	2	7	8	524288				1.5	4 / day	Climbed 1-m grid inclined to 85° for 8 reps. Rats carried a load equal to 75% body weight strapped to tail cast	SUS+CLB	0	8	Wet Weight	Adrenal Gland		4.1		
105	Herbert 1988	2	7	0	0							CON	0	7	Length	Tibia				
105	Herbert 1988	2	7	8	0							SUS	0	7	Length	Tibia		-1		
105	Herbert 1988	2	7	8	524288				1.5	4 / day	Climbed 1-m grid inclined to 85° for 8 reps. Rats carried a load equal to 75% body weight strapped to tail cast	SUS+CLB	0	8	Length	Tibia		-1.3		
105	Herbert 1988	2	7	0	0							CON	0	7	Wet Weight	Soleus				
105	Herbert 1988	2	7	8	0							SUS	0	7	Wet Weight	Soleus		-41.9		p<0.05 vs. CON
105	Herbert 1988	2	7	8	524288				1.5	4 / day	Climbed 1-m grid inclined to 85° for 8 reps. Rats carried a load equal to 75% body weight strapped to tail cast	SUS+CLB	0	8	Wet Weight	Soleus		-23.8		p<0.05 vs. CON p<0.05 vs. SUS
105	Herbert 1988	2	7	0	0							CON	0	7	Relative Weight	Soleus				
105	Herbert 1988	2	7	8	0							SUS	0	7	Relative Weight	Soleus		-32.8		p<0.05 vs. CON
105	Herbert 1988	2	7	8	524288				1.5	4 / day	Climbed 1-m grid inclined to 85° for 8 reps. Rats carried a load equal to 75% body weight strapped to tail cast	SUS+CLB	0	8	Relative Weight	Soleus		-8.5		p<0.05 vs. CON p<0.05 vs. SUS
105	Herbert 1988	2	7	0	0							CON	0	7	Po / Muscle Weight	Soleus				
105	Herbert 1988	2	7	8	0							SUS	0	7	Po / Muscle Weight	Soleus		-4.1		
105	Herbert 1988	2	7	8	524288				1.5	4 / day	Climbed 1-m grid inclined to 85° for 8 reps. Rats carried a load equal to 75% body weight strapped to tail cast	SUS+CLB	0	8	Po / Muscle Weight	Soleus		-4.9		
105	Herbert 1988	2	7	0	0							CON	0	7	Wet / Dry Weight	Soleus				
105	Herbert 1988	2	7	8	0							SUS	0	7	Wet / Dry Weight	Soleus		-6.2		
105	Herbert 1988	2	7	8	524288				1.5	4 / day	Climbed 1-m grid inclined to 85° for 8 reps. Rats carried a load equal to 75% body weight strapped to tail cast	SUS+CLB	0	8	Wet / Dry Weight	Soleus		-2.5		
105	Herbert 1988	2	7	0	0							CON	0	7	Relative Sarcoplasmic protein	Soleus				
105	Herbert 1988	2	7	8	0							SUS	0	7	Relative Sarcoplasmic protein	Soleus		-11.8		
105	Herbert 1988	2	7	8	524288				1.5	4 / day	Climbed 1-m grid inclined to 85° for 8 reps. Rats carried a load equal to 75% body weight strapped to tail cast	SUS+CLB	0	8	Relative Sarcoplasmic protein	Soleus		-14.6		
105	Herbert 1988	2	7	0	0							CON	0	7	Total contraction time	Soleus				
105	Herbert 1988	2	7	8	0							SUS	0	7	Total contraction time	Soleus		-12.3		p<0.05 vs. CON
105	Herbert 1988	2	7	8	524288				1.5	4 / day	Climbed 1-m grid inclined to 85° for 8 reps. Rats carried a load equal to 75% body weight strapped to tail cast	SUS+CLB	0	8	Total contraction time	Soleus		-20		p<0.05 vs. CON
105	Herbert 1988	2	7	0	0							CON	0	7	Half relaxation time	Soleus				
105	Herbert 1988	2	7	8	0							SUS	0	7	Half relaxation time	Soleus		-4.8		
105	Herbert 1988	2	7	8	524288				1.5	4 / day	Climbed 1-m grid inclined to 85° for 8 reps. Rats carried a load equal to 75% body weight strapped to tail cast	SUS+CLB	0	8	Half relaxation time	Soleus		-24.3		p<0.05 vs. CON p<0.05 vs. SUS

105	Herbert 1988	2	7	0	0							CON	0	7	Pt, Isometric max twitch force	Soleus				
105	Herbert 1988	2	7	8	0							SUS	0	7	Pt, Isometric max twitch force	Soleus		-34.2		p<0.05 vs. CON
105	Herbert 1988	2	7	8	524288				1.5	4 / day	Climbed 1-m grid inclined to 85° for 8 reps. Rats carried a load equal to 75% body weight strapped to tail cast	SUS+CLB	0	8	Pt, Isometric max twitch force	Soleus		-26.3		p<0.05 vs. CON
105	Herbert 1988	2	7	0	0							CON	0	7	Po, Peak force	Soleus				
105	Herbert 1988	2	7	8	0							SUS	0	7	Po, Peak force	Soleus		-44.1		p<0.05 vs. CON
105	Herbert 1988	2	7	8	524288				1.5	4 / day	Climbed 1-m grid inclined to 85° for 8 reps. Rats carried a load equal to 75% body weight strapped to tail cast	SUS+CLB	0	8	Po, Peak force	Soleus		-26.9		p<0.05 vs. CON p<0.05 vs. SUS
105	Herbert 1988	2	7	0	0							CON	0	7	Pt / Po	Soleus				
105	Herbert 1988	2	7	8	0							SUS	0	7	Pt / Po	Soleus		17.3		
105	Herbert 1988	2	7	8	524288				1.5	4 / day	Climbed 1-m grid inclined to 85° for 8 reps. Rats carried a load equal to 75% body weight strapped to tail cast	SUS+CLB	0	8	Pt / Po	Soleus		0		
105	Herbert 1988	2	7	0	0							CON	0	7	P20 / Po (Max Tension at 20Hz / Po)	Soleus				
105	Herbert 1988	2	7	8	0							SUS	0	7	P20 / Po (Max Tension at 20Hz / Po)	Soleus		-15		p<0.05 vs. CON
105	Herbert 1988	2	7	8	524288				1.5	4 / day	Climbed 1-m grid inclined to 85° for 8 reps. Rats carried a load equal to 75% body weight strapped to tail cast	SUS+CLB	0	8	P20 / Po (Max Tension at 20Hz / Po)	Soleus		-20.5		p<0.05 vs. CON
105	Herbert 1988	2	7	0	0							CON	0	7	Vo, shortening velocity	Soleus				
105	Herbert 1988	2	7	8	0							SUS	0	7	Vo, shortening velocity	Soleus		13.3		
105	Herbert 1988	2	7	8	524288				1.5	4 / day	Climbed 1-m grid inclined to 85° for 8 reps. Rats carried a load equal to 75% body weight strapped to tail cast	SUS+CLB	0	8	Vo, shortening velocity	Soleus		6.6		
105	Herbert 1988	2	7	0	0							CON	0	7	Fatigue Index	Soleus				
105	Herbert 1988	2	7	8	0							SUS	0	7	Fatigue Index	Soleus		-2		
105	Herbert 1988	2	7	8	524288				1.5	4 / day	Climbed 1-m grid inclined to 85° for 8 reps. Rats carried a load equal to 75% body weight strapped to tail cast	SUS+CLB	0	8	Fatigue Index	Soleus		-1		
105	Herbert 1988	2	7	0	0							CON	0	7	Wet Weight	Gastrocnemius	Medial			
105	Herbert 1988	2	7	8	0							SUS	0	7	Wet Weight	Gastrocnemius	Medial	-28.1		p<0.05 vs. CON
105	Herbert 1988	2	7	8	524288				1.5	4 / day	Climbed 1-m grid inclined to 85° for 8 reps. Rats carried a load equal to 75% body weight strapped to tail cast	SUS+CLB	0	8	Wet Weight	Gastrocnemius	Medial	-25.8		p<0.05 vs. CON
105	Herbert 1988	2	7	0	0							CON	0	7	Relative Weight	Gastrocnemius	Medial			
105	Herbert 1988	2	7	8	0							SUS	0	7	Relative Weight	Gastrocnemius	Medial	-17.4		p<0.05 vs. CON
105	Herbert 1988	2	7	8	524288				1.5	4 / day	Climbed 1-m grid inclined to 85° for 8 reps. Rats carried a load equal to 75% body weight strapped to tail cast	SUS+CLB	0	8	Relative Weight	Gastrocnemius	Medial	-11.3		p<0.05 vs. CON
105	Herbert 1988	2	7	0	0							CON	0	7	Po / Muscle Weight	Gastrocnemius	Medial			
105	Herbert 1988	2	7	8	0							SUS	0	7	Po / Muscle Weight	Gastrocnemius	Medial	7.1		
105	Herbert 1988	2	7	8	524288				1.5	4 / day	Climbed 1-m grid inclined to 85° for 8 reps. Rats carried a load equal to 75% body weight strapped to tail cast	SUS+CLB	0	8	Po / Muscle Weight	Gastrocnemius	Medial	13.6		p<0.05 vs. CON
105	Herbert 1988	2	7	0	0							CON	0	7	Wet / Dry Weight	Gastrocnemius	Medial			
105	Herbert 1988	2	7	8	0							SUS	0	7	Wet / Dry Weight	Gastrocnemius	Medial	-4.1		
105	Herbert 1988	2	7	8	524288				1.5	4 / day	Climbed 1-m grid inclined to 85° for 8 reps. Rats carried a load equal to 75% body weight strapped to tail cast	SUS+CLB	0	8	Wet / Dry Weight	Gastrocnemius	Medial	-6		p<0.05 vs. CON
105	Herbert 1988	2	7	0	0							CON	0	7	Relative Sarcoplasmic protein	Gastrocnemius	Medial			
105	Herbert 1988	2	7	8	0							SUS	0	7	Relative Sarcoplasmic protein	Gastrocnemius	Medial	5.4		
105	Herbert 1988	2	7	8	524288				1.5	4 / day	Climbed 1-m grid inclined to 85° for 8 reps. Rats carried a load equal to 75% body weight strapped to tail cast	SUS+CLB	0	8	Relative Sarcoplasmic protein	Gastrocnemius	Medial	0		
105	Herbert 1988	2	7	0	0							CON	0	7	Total contraction time	Gastrocnemius	Medial			
105	Herbert 1988	2	7	8	0							SUS	0	7	Total contraction time	Gastrocnemius	Medial	-9.1		
105	Herbert 1988	2	7	8	524288				1.5	4 / day	Climbed 1-m grid inclined to 85° for 8 reps. Rats carried a load equal to 75% body weight strapped to tail cast	SUS+CLB	0	8	Total contraction time	Gastrocnemius	Medial	-6		
105	Herbert 1988	2	7	0	0							CON	0	7	Half relaxation time	Gastrocnemius	Medial			
105	Herbert 1988	2	7	8	0							SUS	0	7	Half relaxation time	Gastrocnemius	Medial	-7.6		
105	Herbert 1988	2	7	8	524288				1.5	4 / day	Climbed 1-m grid inclined to 85° for 8 reps. Rats carried a load equal to 75% body weight strapped to tail cast	SUS+CLB	0	8	Half relaxation time	Gastrocnemius	Medial	-5.1		
105	Herbert 1988	2	7	0	0							CON	0	7	Pt, Isometric max twitch force	Gastrocnemius	Medial			
105	Herbert 1988	2	7	8	0							SUS	0	7	Pt, Isometric max twitch force	Gastrocnemius	Medial	-15.9		

105	Herbert 1988	2	7	8	524288				1.5	4 / day	Climbed 1-m grid inclined to 85° for 8 reps. Rats carried a load equal to 75% body weight strapped to tail cast	SUS+CLB	0	8	Pt, Isometric max twitch force	Gastrocnemius	Medial	-6.8		
105	Herbert 1988	2	7	0	0							CON	0	7	Po, Peak force	Gastrocnemius	Medial			
105	Herbert 1988	2	7	8	0							SUS	0	7	Po, Peak force	Gastrocnemius	Medial	-23		$p<0.05$ vs. CON
105	Herbert 1988	2	7	8	524288				1.5	4 / day	Climbed 1-m grid inclined to 85° for 8 reps. Rats carried a load equal to 75% body weight strapped to tail cast	SUS+CLB	0	8	Po, Peak force	Gastrocnemius	Medial	-15.7		$p<0.05$ vs. CON
105	Herbert 1988	2	7	0	0							CON	0	7	Pt / Po	Gastrocnemius	Medial			
105	Herbert 1988	2	7	8	0							SUS	0	7	Pt / Po	Gastrocnemius	Medial	5.5		
105	Herbert 1988	2	7	8	524288				1.5	4 / day	Climbed 1-m grid inclined to 85° for 8 reps. Rats carried a load equal to 75% body weight strapped to tail cast	SUS+CLB	0	8	Pt / Po	Gastrocnemius	Medial	5.5		
105	Herbert 1988	2	7	0	0							CON	0	7	P20 / Po (Max Tension at 20Hz / Po)	Gastrocnemius	Medial			
105	Herbert 1988	2	7	8	0							SUS	0	7	P20 / Po (Max Tension at 20Hz / Po)	Gastrocnemius	Medial	-4.3		
105	Herbert 1988	2	7	8	524288				1.5	4 / day	Climbed 1-m grid inclined to 85° for 8 reps. Rats carried a load equal to 75% body weight strapped to tail cast	SUS+CLB	0	8	P20 / Po (Max Tension at 20Hz / Po)	Gastrocnemius	Medial	2.1		
105	Herbert 1988	2	7	0	0							CON	0	7	Vo, shortening velocity	Gastrocnemius	Medial			
105	Herbert 1988	2	7	8	0							SUS	0	7	Vo, shortening velocity	Gastrocnemius	Medial	-6		
105	Herbert 1988	2	7	8	524288				1.5	4 / day	Climbed 1-m grid inclined to 85° for 8 reps. Rats carried a load equal to 75% body weight strapped to tail cast	SUS+CLB	0	8	Vo, shortening velocity	Gastrocnemius	Medial	-7.2		
105	Herbert 1988	2	7	0	0							CON	0	7	Fatigue Index	Gastrocnemius	Medial			
105	Herbert 1988	2	7	8	0							SUS	0	7	Fatigue Index	Gastrocnemius	Medial	11.1		
105	Herbert 1988	2	7	8	524288				1.5	4 / day	Climbed 1-m grid inclined to 85° for 8 reps. Rats carried a load equal to 75% body weight strapped to tail cast	SUS+CLB	0	8	Fatigue Index	Gastrocnemius	Medial	11.1		
106	Hauschka 1987	2	28	0	0							CON	7	0	Wet Weight	Whole Body				
106	Hauschka 1987	2	28	8	0							SUS	8	0	Wet Weight	Whole Body		-1.4		
106	Hauschka 1987	2	28	8	65536					10 / day	Rats dropped from 58cm angled at 45° so HL absorbed majority of force	SUS+DRP	5	0	Wet Weight	Whole Body		-17.7		
106	Hauschka 1987	2	28	0	0							CON	7	0	Wet Weight	Soleus				
106	Hauschka 1987	2	28	8	0							SUS	8	0	Wet Weight	Soleus		-68.7		$p<0.05$ vs. CON
106	Hauschka 1987	2	28	8	65536					10 / day	Rats dropped from 58cm angled at 45° so HL absorbed majority of force	SUS+DRP	5	0	Wet Weight	Soleus		-68.7		$p<0.05$ vs. CON
106	Hauschka 1987	2	28	0	0							CON	7	0	Myofiber distribution %	Soleus	fast twitch			
106	Hauschka 1987	2	28	8	0							SUS	8	0	Myofiber distribution %	Soleus	fast twitch	30.7		$p<0.05$ vs. CON
106	Hauschka 1987	2	28	8	65536					10 / day	Rats dropped from 58cm angled at 45° so HL absorbed majority of force	SUS+DRP	5	0	Myofiber distribution %	Soleus	fast twitch	65.3		$p<0.05$ vs. CON
106	Hauschka 1987	2	28	0	0							CON	7	0	Succinate Dehydrogenase	Soleus	slow twitch			
106	Hauschka 1987	2	28	8	0							SUS	8	0	Succinate Dehydrogenase	Soleus	slow twitch	26.6		$p<0.05$ vs. CON
106	Hauschka 1987	2	28	8	65536					10 / day	Rats dropped from 58cm angled at 45° so HL absorbed majority of force	SUS+DRP	5	0	Succinate Dehydrogenase	Soleus	slow twitch	78		$p<0.05$ vs. CON $p<0.05$ vs. SUS
106	Hauschka 1987	2	28	0	0							CON	7	0	a-glycerophosphate Dehydrogenase (GDP)	Soleus	slow twitch			
106	Hauschka 1987	2	28	8	0							SUS	8	0	a-glycerophosphate Dehydrogenase (GDP)	Soleus	slow twitch	113		$p<0.05$ vs. CON
106	Hauschka 1987	2	28	8	65536					10 / day	Rats dropped from 58cm angled at 45° so HL absorbed majority of force	SUS+DRP	5	0	a-glycerophosphate Dehydrogenase (GDP)	Soleus	slow twitch	82.4		$p<0.05$ vs. CON
106	Hauschka 1987	2	28	0	0							CON	7	0	Myofiber Cross Sectional Area	Soleus	slow twitch			
106	Hauschka 1987	2	28	8	0							SUS	8	0	Myofiber Cross Sectional Area	Soleus	slow twitch	-67.3		$p<0.05$ vs. CON
106	Hauschka 1987	2	28	8	65536					10 / day	Rats dropped from 58cm angled at 45° so HL absorbed majority of force	SUS+DRP	5	0	Myofiber Cross Sectional Area	Soleus	slow twitch	-74		$p<0.05$ vs. CON $p<0.05$ vs. SUS
106	Hauschka 1987	2	28	0	0							CON	7	0	SDH / GDP	Soleus	slow twitch			
106	Hauschka 1987	2	28	8	0							SUS	8	0	SDH / GDP	Soleus	slow twitch	-43.6		$p<0.05$ vs. CON
106	Hauschka 1987	2	28	8	65536					10 / day	Rats dropped from 58cm angled at 45° so HL absorbed majority of force	SUS+DRP	5	0	SDH / GDP	Soleus	slow twitch	-54.6		$p<0.05$ vs. CON
106	Hauschka 1987	2	28	0	0							CON	7	0	Succinate Dehydrogenase	Soleus	fast twitch			
106	Hauschka 1987	2	28	8	0							SUS	8	0	Succinate Dehydrogenase	Soleus	fast twitch	-11.2		$p<0.05$ vs. CON

106	Hauschka 1987	2	28	8	65536					10 / day	Rats dropped from 58cm angled at 45° so HL absorbed majority of force	SUS+DRP	5	0	Succinate Dehydrogenase	Soleus	fast twitch	29.7		p<0.05 vs. CON p<0.05 vs. SUS
106	Hauschka 1987	2	28	0	0							CON	7	0	a-glycerophosphate Dehydrogenase (GDP)	Soleus	fast twitch			
106	Hauschka 1987	2	28	8	0							SUS	8	0	a-glycerophosphate Dehydrogenase (GDP)	Soleus	fast twitch	128.3		p<0.05 vs. CON
106	Hauschka 1987	2	28	8	65536					10 / day	Rats dropped from 58cm angled at 45° so HL absorbed majority of force	SUS+DRP	5	0	a-glycerophosphate Dehydrogenase (GDP)	Soleus	fast twitch	182		p<0.05 vs. CON p<0.05 vs. SUS
106	Hauschka 1987	2	28	0	0							CON	7	0	Myofiber Cross Sectional Area	Soleus	fast twitch			
106	Hauschka 1987	2	28	8	0							SUS	8	0	Myofiber Cross Sectional Area	Soleus	fast twitch	-50.3		p<0.05 vs. CON
106	Hauschka 1987	2	28	8	65536					10 / day	Rats dropped from 58cm angled at 45° so HL absorbed majority of force	SUS+DRP	5	0	Myofiber Cross Sectional Area	Soleus	fast twitch	-53.2		p<0.05 vs. CON
106	Hauschka 1987	2	28	0	0							CON	7	0	SDH / GDP	Soleus	fast twitch			
106	Hauschka 1987	2	28	8	0							SUS	8	0	SDH / GDP	Soleus	fast twitch	-57.1		p<0.05 vs. CON
106	Hauschka 1987	2	28	8	65536					10 / day	Rats dropped from 58cm angled at 45° so HL absorbed majority of force	SUS+DRP	5	0	SDH / GDP	Soleus	fast twitch	-69.5		p<0.05 vs. CON
107	Haddad 2006	2	6	0	0							CON	7	0	Wet Weight	Gastrocnemius	Medial			
107	Haddad 2006	2	6	8	0							SUS	7	0	Wet Weight	Gastrocnemius	Medial	-20		p<0.05 vs. CON
107	Haddad 2006	2	6	8	16384				27	Days 1, 2, 4, 5,	electrodes placed in R. leg of anesthetized rat. 4 sets of contractions of 10 reps against a footplate to produce maximal isometric tension	SUS+ISM	7	0	Wet Weight	Gastrocnemius	Medial	-12.5		p<0.05 vs. CON p<0.05 vs. SUS
107	Haddad 2006	2	6	0	0							CON	7	0	Relative Weight	Gastrocnemius	Medial			
107	Haddad 2006	2	6	8	0							SUS	7	0	Relative Weight	Gastrocnemius	Medial	-11		p<0.05 vs. CON
107	Haddad 2006	2	6	8	16384				27	Days 1, 2, 4, 5,	electrodes placed in R. leg of anesthetized rat. 4 sets of contractions of 10 reps against a footplate to produce maximal isometric tension	SUS+ISM	7	0	Relative Weight	Gastrocnemius	Medial	-4		
107	Haddad 2006	2	6	0	0							CON	7	0	Protein	Gastrocnemius	Medial			
107	Haddad 2006	2	6	8	0							SUS	7	0	Protein	Gastrocnemius	Medial	5		
107	Haddad 2006	2	6	8	16384				27	Days 1, 2, 4, 5,	electrodes placed in R. leg of anesthetized rat. 4 sets of contractions of 10 reps against a footplate to produce maximal isometric tension	SUS+ISM	7	0	Protein	Gastrocnemius	Medial	12.7		p<0.05 vs. SUS
107	Haddad 2006	2	6	0	0							CON	7	0	Myofibril Concentration	Gastrocnemius	Medial			
107	Haddad 2006	2	6	8	0							SUS	7	0	Myofibril Concentration	Gastrocnemius	Medial	-5		
107	Haddad 2006	2	6	8	16384				27	Days 1, 2, 4, 5,	electrodes placed in R. leg of anesthetized rat. 4 sets of contractions of 10 reps against a footplate to produce maximal isometric tension	SUS+ISM	7	0	Myofibril Concentration	Gastrocnemius	Medial	-10		
107	Haddad 2006	2	6	0	0							CON	7	0	Myofibril Content	Gastrocnemius	Medial			
107	Haddad 2006	2	6	8	0							SUS	7	0	Myofibril Content	Gastrocnemius	Medial	-16		p<0.05 vs. CON
107	Haddad 2006	2	6	8	16384				27	Days 1, 2, 4, 5,	electrodes placed in R. leg of anesthetized rat. 4 sets of contractions of 10 reps against a footplate to produce maximal isometric tension	SUS+ISM	7	0	Myofibril Content	Gastrocnemius	Medial	-14		p<0.05 vs. CON
107	Haddad 2006	2	6	0	0							CON	7	0	Total RNA Concentration	Gastrocnemius	Medial			
107	Haddad 2006	2	6	8	0							SUS	7	0	Total RNA Concentration	Gastrocnemius	Medial	-24		p<0.05 vs. CON
107	Haddad 2006	2	6	8	16384				27	Days 1, 2, 4, 5,	electrodes placed in R. leg of anesthetized rat. 4 sets of contractions of 10 reps against a footplate to produce maximal isometric tension	SUS+ISM	7	0	Total RNA Concentration	Gastrocnemius	Medial	0		p<0.05 vs. SUS
107	Haddad 2006	2	6	0	0							CON	7	0	Myostatin Levels	Gastrocnemius	Medial			
107	Haddad 2006	2	6	8	0							SUS	7	0	Myostatin Levels	Gastrocnemius	Medial	400		p<0.05 vs. CON
107	Haddad 2006	2	6	8	16384				27	Days 1, 2, 4, 5,	electrodes placed in R. leg of anesthetized rat. 4 sets of contractions of 10 reps against a footplate to produce maximal isometric tension	SUS+ISM	7	0	Myostatin Levels	Gastrocnemius	Medial	7		p<0.05 vs. SUS
107	Haddad 2006	2	6	0	0							CON	7	0	Atrogin Levels	Gastrocnemius	Medial			
107	Haddad 2006	2	6	8	0							SUS	7	0	Atrogin Levels	Gastrocnemius	Medial	230		p<0.05 vs. CON
107	Haddad 2006	2	6	8	16384				27	Days 1, 2, 4, 5,	electrodes placed in R. leg of anesthetized rat. 4 sets of contractions of 10 reps against a footplate to produce maximal isometric tension	SUS+ISM	7	0	Atrogin Levels	Gastrocnemius	Medial	26		
107	Haddad 2006	2	6	0	0							CON	7	0	MURF-1 mRNA	Gastrocnemius	Medial			
107	Haddad 2006	2	6	8	0							SUS	7	0	MURF-1 mRNA	Gastrocnemius	Medial	140		p<0.05 vs. CON

107	Haddad 2006	2	6	8	16384				27	Days 1, 2, 4, 5,	electrodes placed in R. leg of anesthetized rat. 4 sets of contractions of 10 reps against a footplate to produce maximal isometric tension	SUS+ISM	7	0	MURF-1 mRNA	Gastrocnemius	Medial	23		
108	Baek 2009	2	28	0	0							CON	0	10	Marrow Area	Tibia		0		
108	Baek 2009	2	28	8	0							SUS	0	12	Marrow Area	Tibia		7.4		
108	Baek 2009	2	28	0	1048576					Daily	250 ug/kg/hr	CONBB	0	10	Marrow Area	Tibia		0		
108	Baek 2009	2	28	8	1048576					Daily	250 ug/kg/hr	SUSBB	0	12	Marrow Area	Tibia		2.9		
108	Baek 2009	2	28	0	2097152					Daily	0.35 mg/kg/d	CONLE	0	10	Marrow Area	Tibia		-4.6		
108	Baek 2009	2	28	8	2097152					Daily	0.35 mg/kg/d	SUSLE	0	12	Marrow Area	Tibia		-4.9		
108	Baek 2009	2	28	0	0							CON	0	10	Cortical Shell Area	Tibia		1.1		
108	Baek 2009	2	28	8	0							SUS	0	12	Cortical Shell Area	Tibia		-14.8		p<0.05 vs. PRE
108	Baek 2009	2	28	0	1048576					Daily	250 ug/kg/hr	CONBB	0	10	Cortical Shell Area	Tibia		-2.5		
108	Baek 2009	2	28	8	1048576					Daily	250 ug/kg/hr	SUSBB	0	12	Cortical Shell Area	Tibia		-16.8		p<0.05 vs. PRE
108	Baek 2009	2	28	0	2097152					Daily	0.35 mg/kg/d	CONLE	0	10	Cortical Shell Area	Tibia		-4.8		
108	Baek 2009	2	28	8	2097152					Daily	0.35 mg/kg/d	SUSLEP	0	12	Cortical Shell Area	Tibia		-12.1		p<0.05 vs. PRE
108	Baek 2009	2	28	0	0							CON	0	10	Total Area	Tibia		0.4		
108	Baek 2009	2	28	8	0							SUS	0	12	Total Area	Tibia		-2		
108	Baek 2009	2	28	0	1048576					Daily	250 ug/kg/hr	CONBB	0	10	Total Area	Tibia		-1.1		
108	Baek 2009	2	28	8	1048576					Daily	250 ug/kg/hr	SUSBB	0	12	Total Area	Tibia		-2.5		
108	Baek 2009	2	28	0	2097152					Daily	0.35 mg/kg/d	CONLE	0	10	Total Area	Tibia		-5.1		
108	Baek 2009	2	28	8	2097152					Daily	0.35 mg/kg/d	SUSLE	0	12	Total Area	Tibia		-7.9		
110	Fluckey 2002	2	28	0	0							CON	0	4	Wet Weight	Soleus				
110	Fluckey 2002	2	28	8	0							SUS	0	5	Wet Weight	Soleus				p<0.05 vs. CON
110	Fluckey 2002	2	28	8	64					3 times / week	2 sets of a maximum of 25 reps (or point of failure)	SUSEX	0	5	Wet Weight	Soleus				p<0.05 vs. CON p<0.05 vs. SUS
110	Fluckey 2002	2	28	0	0							CON	0	4	Fractional Synthesis Rate					
110	Fluckey 2002	2	28	8	0							SUS	0	5	Fractional Synthesis Rate					p<0.05 vs. CON
110	Fluckey 2002	2	28	8	64					3 times / week	2 sets of a maximum of 25 reps (or point of failure)	SUSEX	0	5	Fractional Synthesis Rate					p<0.05 vs. SUS
110	Fluckey 2002	2	28	0	0							CON	0	4	Bone Mineral Density	Distal Femur				
110	Fluckey 2002	2	28	8	0							SUS	0	5	Bone Mineral Density	Distal Femur		-7.7		p<0.05 vs. CON
110	Fluckey 2002	2	28	8	64					3 times / week	2 sets of a maximum of 25 reps (or point of failure)	SUSEX	0	5	Bone Mineral Density	Distal Femur				
110	Fluckey 2002	2	28	0	0							CON	0	4	Bone Mineral Density	Mid-shaft Femur				
110	Fluckey 2002	2	28	8	0							SUS	0	5	Bone Mineral Density	Mid-shaft Femur				
110	Fluckey 2002	2	28	8	64					3 times / week	2 sets of a maximum of 25 reps (or point of failure)	SUSEX	0	5	Bone Mineral Density	Mid-shaft Femur				