

International e-Conference on Kinesiology and Integrated Physiology, October 4-22, 2010

Keynote Presentation

Is exercise performance regulated or limited? Differences between the complex and catastrophic models of human exercise

Tim Noakes

Sports Science Institute of South Africa (South Africa)

Keynote Presentation

From the Lab to the Community: Applied Exercise Science from Switzerland

Boris Gojanovic

Visiting Scholar, Stanford Sports Medicine; Sports Medicine, Centre Hospitalier Universitaire Vaudois (CHUV) and Lausanne University (Switzerland)

Symposium

Current Trends in Exercise Immunology

Brain McFarlin, University of Houston (USA)

Symposium

Alternative Training Methodologies: Non-Conventional Training Applications to Accomplish Conventional Training Goals

Joel Krentz, University of Saskatchewan (Canada)

Scott Forbes, University of Alberta (Canada)

Jonathan Little, McMaster University (Canada)

Scott Mazzetti, Salisbury University (USA)

Symposium

Cytokines, Kinins and Physical Exercise: Aging and Obesity

Jonato Prestes, Catholic University of Brasília (Brazil)

Characterization of Respiratory and Muscular VO₂ Kinetics during Moderate Pseudo Random Binary Sequence Exercise

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INTRODUCTION

Commonly, there is no clear consensus about the distortion between respiratory (VO₂resp) and muscular VO₂ kinetics (VO₂musc). Especially, the venous blood volume, the venous oxygen stores and the perfusion rate determine the distortion and the time delay of VO₂resp.

At the onset of exercise or by altering work intensity, cardiac output will vary. Therefore, the time delay of the venous blood volume between exercising muscles and the lung (Vvmusc) will vary, too. In combination, the modified perfusion rate at muscular level influences the arteriovenous oxygen content difference. An exclusion of the first 20s, which reflects the cardiodynamic influences of VO₂resp, is a common used method, but neglects the complex interactions of the cardio-vascular parameters and will therefore not determine the VO₂musc.

The aim of this study is to characterize the differences between VO₂resp and VO₂musc by using a developed backward calculation method.

METHODS

23 volunteers (age: 27 ± 6 years; height: 176

± 9 cm; body mass: 72 ± 11 kg; VO₂peak: 3.9 ± 1.0 L min⁻¹) were subjected to randomized changes in workload (WL) on a cycle ergometer (30 W, 80 W, pseudo random binary sequence). Heart rate (HR) was measured beat-to-beat by ECG and stroke volume (SV) by impedance cardiography. VO₂resp was determined breath-by-breath.

For the backward calculation of VO₂musc a two compartment model comprising the exercising and non-exercising segments of the body was applied. Best fit of Vvmusc and perfusion rate of the non-exercising compartment (Q'rem) was assessed by an iterative method using the cross correlation functions (CCF) between WL and VO₂musc. Assessing the peak of the CCF between WL and VO₂musc (Mpeak) is based on a first order LTI system (linearity, time-invariance) and must fall on the declining part of the auto correlation function of WL. Higher peak values indicate faster system responses.

RESULTS

Vvmusc was calculated as 2.4 ± 0.6 L and Q'rem as 3.6 ± 1.9 L min⁻¹. The time delays to pass Vvmusc reached values between 20s to 26s during the pseudo random binary workload sequences (Fig. 1). A significant correlation between Rpeak (CCF between

WL and VO₂resp) and M_{peak} was found ($r=0.78$; $p<0.001$; $n=23$). In addition, significant differences of R_{peak} (0.34 ± 0.08) and M_{peak} (0.42 ± 0.08 ; $p<0.001$; $n=23$) were observed (Fig. 2).

DISCUSSION

The comparison between VO₂resp and VO₂musc illustrates that there are complex rather than trivial influences of the cardiovascular parameters. A simple negligence of the cardiodynamic influences seems not appropriate taking into account the different venous blood volumes, the varying perfusion rates and the dynamic time delays that occur during the transition phase. In conclusion, VO₂resp is a distorted version of VO₂musc.

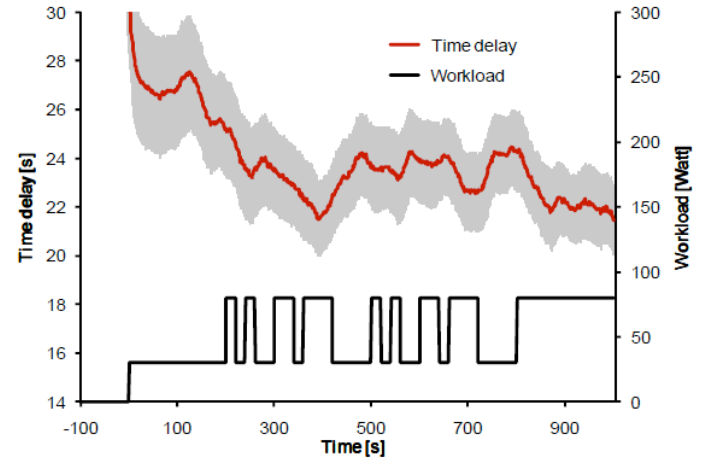


Fig. 1: Dynamic time delays (red) to pass $V_{v_{musc}}$ and workload pattern (black).

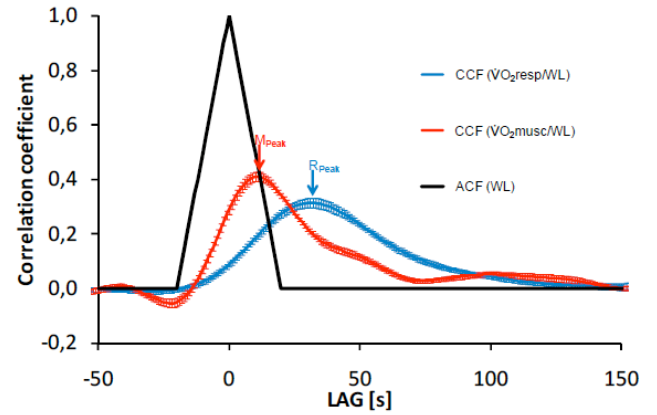


Fig. 2: Auto correlation function of workload (ACF; black) and cross correlation functions (CCF) of VO₂resp (blue) and VO₂musc (red). The amplitudes of R_{peak} and M_{peak} represent the kinetic responses. Higher values indicate faster system response.

Female and Male differences during Stability Ball Sitting and Arm Ergometry

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INTRODUCTION

This report is an extension of analysis from an earlier study¹ demonstrating that Stability Ball (B) sitting, when compared to Chair (C) sitting, elevates VO_2 10% to 16% without significantly elevating heart rate during sub-maximal arm ergometry.

This study expected that females (F) would respond differently than males (M) to arm ergometry with stability ball sitting for cardiopulmonary, metabolic, kinematics, and EMG indices at absolute levels of sub-maximal power output.

METHODS

Twelve F and 14 M apparently healthy young adults exercised twice—once sitting on B and once sitting on C (order randomized)—with a one hour break between. Participants exercised for four minutes at 15W, 30W, and 45W using a Monark ergometer. VO_2 , VCO_2 , and Ve were measured using a MAX-I system; heart rate (HR) by a Polar monitor; blood pressure by auscultation on the left arm (right arm kept cranking at $\frac{1}{2}$ the power output during measurement after all other indices were measured.); left rectus femoris, erector spinae, external oblique, and rectus

abdominis EMG were measured using a BioPac MP100 system; and right hip, knee, and shoulder angles were recorded using a Cannon Camcorder. Statistics: 3(power output) \times 2 (sitting mode) \times 2 (sex) ANOVAs for repeated measures with between-subjects were set for significance at $P < 0.05$ using SPSS (version 11.5).

RESULTS

ANOVAs indicated that there were no significant sex interactions with sitting mode and power output for VO_2 , Ve , and blood pressure and only a significant between-subjects sex effect for VO_2 ($P = 0.049$). However, there were significant sex-power output interaction ($P = 0.001$) and between-subjects sex effect ($P = 0.002$) for HR and significant sex-power output interaction for RER ($P = .043$) but no significant sitting mode interactions. In addition, all kinematics and most EMG levels had no significant sex interactions nor between-subjects effect; however, abdomen EMG activity had significant between-subjects sex effect only ($P = 0.023$) with F 29% to 33% higher than M.

DISCUSSION

In conclusion, females and males have some differences in response to sub-maximal arm ergometry but not in their response to differing sitting modes.

¹ Marks CRC, Czasak B, Terrell J. Sitting on a Stability Ball Elevates Oxygen Consumption During Arm Ergometry. *Med Sci Sports Exerc.* 2010;42(5)(suppl):S444.

TABLE 1. Female and Male values during arm ergometry with different sitting modes

Power Output:		<u>15W</u>	<u>30W</u>	<u>45W</u>
VO ₂ ml*min ⁻¹	F _B	507 ± 95	682 ± 86	911 ± 102
	F _C	433 ± 40	616 ± 82	834 ± 59
	M _B	592 ± 144	770 ± 144	952 ± 128
	M _C	517 ± 96	667 ± 110	890 ± 103
HR b* min ⁻¹	F _B	93 ± 15	105 ± 16	126 ± 18
	F _C	94 ± 14	108 ± 16	128 ± 22
	M _B	86 ± 10	93 ± 10	104 ± 12
	M _C	82 ± 11	90 ± 9	99 ± 11
RER	F	0.83 ± 0.05	0.87 ± 0.06	0.96 ± 0.07
<u>Combined B & C</u>		<u>0.83 ± 0.05</u>	<u>0.85 ± 0.06</u>	<u>0.90 ± 0.07</u>

Values are mean ± SD, B: stability ball, C: chair

Functional Outcome at Sea Level vs. Moderate Altitude (2500 m) in Race Walk

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Int J Exerc Sci 5(1) : S6-S7, 2010.

INTRODUCTION

Athletes of the Andean countries intermittently live train and have sports competitions at sea level (SL) vs. moderate altitude (M H) and must adapt to these changes, to achieve better performance.

However, the physiological mechanisms of adaptation (in situ) remains little studied.

Purpose to describe the interaction of cardiopulmonary variables (CPV) that giving light in the functional adaptations of training and competition, at SL and M. Alt (2500m).

METHODS

During training were studied 5 Olympics athletes three male (M) and two female (F) and one novel athlete (F) during competence of 10Km of race walk. All were inhabitants of Ecuadorian Andes: Age 22 ± 4 year; Weight 63 ± 5 kg and High 165 ± 4 cm. VE/VO_2 , O_2Pulse and stroke volume (SV) were obtained from a K4b² system. For the maximal speed (Max S) of race walk, the efficiency zones were identified by multiple lineal regressions (MLR). In each case the dependent variable was the speed and the

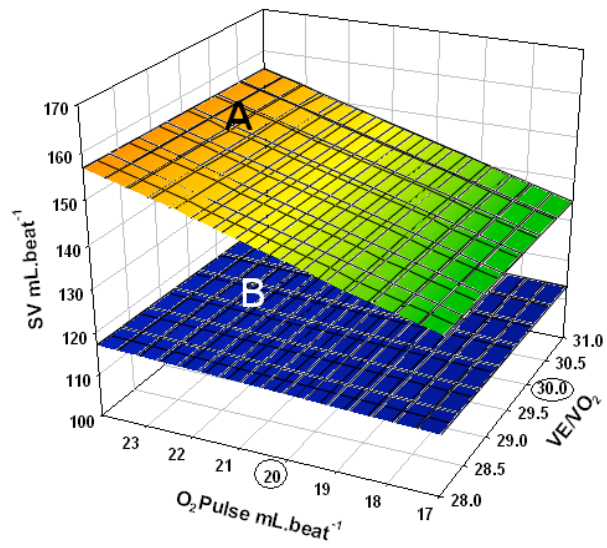
variable of weight was the distance of training or competence.

RESULTS

Max S (2.9 ± 1.2 m.sec⁻¹) at SL = $1.896 + 0.048 VE/VO_2 + 0.11 O_2Pulse - 0.017SV$ $R^2=0.40$ SEE=0.12; Max S = (3.2 ± 1.2 m.sec⁻¹) at M. Alt = $23.5 - 0.23 VE/VO_2 + 0.37 O_2Pulse - 0.18SV$ $R^2=0.69$ SEE=0.22. With data base of Max S at SL and M Alt smoothed planes were plotted according to $f = y_0 + a*x + b*y$ Fig. 1. The Efficient zone was identified for coordinates X (VE/VO_2) = 30 ± 0.5 ; Y (O_2Pulse) = 20 ± 2 . In Z the differences between SL vs. M Alt, are expressed by SV highest, at SL (plane A).

DISCUSSION

The results show that these athletes tolerate the stress barometer and the compensation mechanism achieved by training, is the modification of the stroke volume, without leaving the area of efficiency. During training and competence, these athletes are able to change significantly within the normal range, cardiovascular and respiratory variables in order to achieve the maximum performance.



Endothelial Dysfunction is Associated with Aerobic Capacity in Pre-hypertensive African Americans

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INTRODUCTION

According to the CDC, heart disease is the leading cause of death for both men and women in the United States and is astoundingly increased in the African American population. Oxidative status and antioxidant potentials appear to be significantly associated with a number of major cardiovascular risk factors including hypertension. Recently, investigators have examined the the role of oxidative stress in adults with pre-hypertension. Reliable, well-characterized biomarkers have been identified to quantify oxidative stress and inflammation in vivo. Regular physical activity seems to play an important preventative role in the development of cardiovascular diseases.

The purpose of this current study was to assess the oxidative and aerobic status of a population of sedentary pre-hypertensive middle-aged African Americans.

METHODS

Seventeen pre-hypertensive African Americans were assessed. Routine fasting blood chemistries were drawn to assess

blood lipids and fasting blood glucose along with urinalysis to rule out kidney dysfunction or disease. A stress echocardiogram was administered to screen for signs of cardiovascular disease. Each participant underwent a sub-maximal graded exercise test to quantify aerobic capacity. Markers of oxidative stress (8-isoprostane PGF_{2α}, TBARS), inflammation and predictors of CV events (CRP, VCAM-1) and anti-oxidants (NO, SOD) were measured.

RESULTS AND CONCLUSION

The present study examined the relationship between aerobic capacity and six of the most well-characterized indicators of endothelial function in a population of sedentary, middle-aged, pre-hypertensive African Americans who reside in an urban area. Our results showed aerobic capacity positively correlates with endothelial status.

The most significant finding was observed when analyzing oxidative and inflammatory markers to assess the status of the endothelium in relation to the participants' aerobic capacity ($p=.028$). This

relationship indicates that participants who were less aerobically fit had signs of greater endothelial dysfunction, suggesting they are at higher risk for a CV event.

This research was funded by NIH/NHLBI Grant RO1 HL085497 (PI, Michael Brown) and by NIH/NIA Grant KO1 AG019640 (PI, Michael Brown).

The Effects of Age and Repetitive Mechanical Loading on the Differential Expression of Localized Versus Systemic Whole Genome Gene Expression

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INTRODUCTION

Aging increases injury susceptibility and impairs skeletal muscle's ability to adapt to repetitive high-intensity mechanical, but little is understood of how interactions between systemic and local gene expression interact to impact adaptation or maladaptation following mechanical loading.

The purpose of the present study was to investigate the differences observed with respect to age in gene expression profiles between the systemic circulation and local tissue (tibialis anterior muscle) following chronic mechanical loading using stretch-shortening contractions (SSCs).

METHODS

The left dorsiflexor muscles of young (12 wks age, N = 8) and old (30 mo age, N = 8) male Fischer 344 x Brown Norway rats were exposed 3x/week for 4.5 weeks to a protocol of 80 maximum SSCs per exposure *in vivo*. Animals were sacrificed 24 hours after the last exposure and RNA was isolated from the blood leukocytes as well as a ~75mg portion of the tibialis anterior muscle from the left hindlimb. cRNA

samples were prepared and loaded onto Sentrix Rat-Ref12 Beadchips (Illumina, cat#BD-27-303) following standard protocols.

RESULTS

The genomic response from both the tissue and blood revealed numerous sets of genes that were being differentially regulated with regard to age. Within the tissue, we observed groups of genes that included early transcription regulators, cell cycle regulators, muscle regulatory factors (MRFs) and stress-responsive factors. Specifically, old rats exhibited an increased expression in genes associated with the stress-related response in comparison with young rats, while concurrently displaying a decreased expression in sets of genes associated with muscle growth and adaptation (increased muscle performance and hypertrophy) when compared with young counterparts. In contrast, groups of genes characterized in the blood revealed an increase in genes associated with oxidative stress, inflammation, and protein degradation in old rats. Conversely, genes associated with growth of normal cells and cell survival, as well as a host of ribosomal proteins were down-regulated in the old

rats compared to the young rats.

DISCUSSION

Understanding the connectivity between the sets of differentially regulated genes at both the systemic and local levels, specifically involved in regulating the adaptive/maladaptive response incurred following chronic mechanical loading and the effects of aging has immediate relevance for the development of new strategies that optimize muscle performance and muscle quality and increase quality of life in aging populations.

The Influence of Exercise Order on the Number of Repetitions, Perceived Exertion and Lactate Levels During Resistance Exercise in Adolescents

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ABSTRACT

The use of resistance training (RT) variables for different populations has been a target of scientific research in order to improve the applicability and prescription of RT. The objectives of the present study were: (1) To compare the effect of exercise order on lactate levels, (2) To compare the effect of exercise order on the ratings of perceived exertion (RPE) and (3) To compare the effect of exercise order on the total number of repetitions completed. Results revealed that for triceps extension, biceps Curl and chest press exercises the total number of repetitions was higher in the order SM-LG as compared with the inverse order. There was no statistically significant difference for RPE and a tendency ($p=0,051$) to higher lactate levels in the LG-SM order. Thus, more studies are necessary to improve the understanding of resistance training variables in this population, especially regarding the prescription and recommendation.

INTRODUCTION

Studies have been focusing in resistance training variables in order to improve prescription and scientific application in different populations.

Recent position stands have showed the recommendations of resistance training for health adults. However, there is a paucity of studies in children and adolescents, mainly regarding the recommendations for resistance training variables, such as exercise order (Faigenbaum, 2009).

Thus, the use of dependent variables to compare the effects of exercise order, such as lactate, RPE and repetitions, remains to be determined, consequently highlighting the need of additional research in this field.

The objectives of the present study were:

- 1) To compare the effect of exercise order on lactate levels.
- 2) To compare the effect of exercise order on the ratings of perceived exertion.
- 3) To compare the effect of exercise order on the total number of repetitions completed.

METHODS

Protocol

Twelve male adolescents (age: 15.7 ± 1.4 y, body mass: 64.2 ± 6.1 kg, height: 1.72 ± 0.04 , body fat percentage: 11.6 ± 9.6 %, GDTE: 3.8 ± 0.7 , PHDTE: 4.3 ± 0.8) were recruited. All individuals were healthy and without previous experience with resistance training.

Anthropometric evaluations were performed in the first day of familiarization to resistance training. Body mass, height, body fat percentage, triceps and subscapular skinfold thickness and Tanner stage of sexual maturation (Tanner, 1962) were collected. To calculate body fat percentage the equation of Slaughter et al. (1988) was used.

The Tanner stage of sexual maturation was performed by auto-evaluation by using figures and the scale of sexual maturation (Tanner, 1962). To avoid constraint, each adolescent got into the bathroom and performed the analysis by himself. After this, the analysis was put in a briefcase and delivered to the responsible researcher.

The order 1 started from small muscle groups to large muscle groups (SM-LG). The exercises for order 1 were: triceps extension, biceps curl, chest press and seated row. Order 2 was initiated from the large muscle groups to the small muscle groups (LG-SM), with the exact inverse order compared with order 1. All participants completed both exercise orders by performing 3 sets until voluntary exhaustion with a 10 repetitions maximal (10RM) load. Sets were separated by a 2' minutes passive rest interval and the number of repetitions was recorded for

each order. The RPE was verified by the OMNI scale immediately after the ending of each set for both orders. 25µl of blood was collected from lateral portion of indicator finger immediately after the protocol, 1' after exercise 1, 1' after exercise 3 and 10' after the protocol. The puncture was performed with a lancet (*Accu-check*) and lactate was determined by a portable lactate analyzer (*Accutrend Lactate - Roche*). The present study was approved by the Ethics Committee of Human Research from the Unieuro University Center n°049/2010 and all participants signed an informed consent according to Helsinki declaration.

Statistical Analysis

All data presented normal distribution. To compare the different exercise orders Anova for repeated measures with Fischer Post Hoc was adopted. To verify the differences in RPE the Wilcoxon test was used. A alpha levels of $p \leq 0.05$ was adopted (SPSS Inc).

RESULTS

Lactate

Results revealed that exercise order had no influence on lactate response. Although, there was a tendency to higher lactate levels for the large exercises order compared with small exercises order ($p = 0.51$, figure 1).

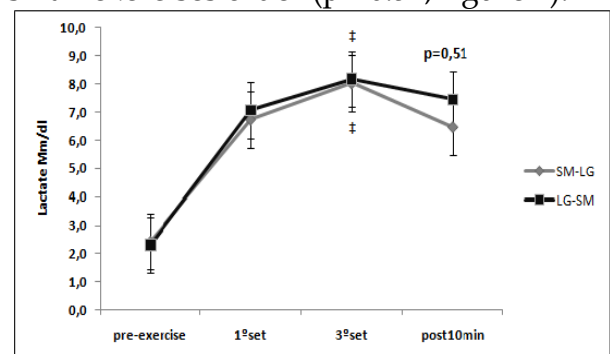


Figure 1. * = Significant difference from pre-exercise and 1st set on both orders.

RPE

There was no statistically significant difference for the RPE (OMNI) between exercise orders.

Repetitions

There were a higher number of repetitions completed in the SM-LG compared with A LG-SM order (table 1). However, there was no difference in the number of repetitions completed in the seated row exercise.

		TE	BC	CP	LR
SEQ SM-LG	First Set	10,6 \pm 1,7§	10,3 \pm 2,1§	6,0 \pm 2,5==£	7,4 \pm 2,3==
	Second Set	7,9 \pm 1,7‡	6,1 \pm 1,4‡	3,5 \pm 1,8€	5,8 \pm 2,6==
	Third Set	5,2 \pm 1,7	5,0 \pm 1,5£	2,8 \pm 1,5§	4,1 \pm 2,0§
	Total mean	8,0 \pm 1,4==	7,3 \pm 1,1==	4,1 \pm 1,2==	6,7 \pm 2,1
SEQ LG-SM	First Set	8,3 \pm 1,5	8,0 \pm 2,1	8,5 \pm 1,2	9,9 \pm 1,8
	Second Set	5,5 \pm 2,3	4,5 \pm 1,2	5,5 \pm 1,7	7,2 \pm 1,7
	Third Set	4,2 \pm 1,1	3,7 \pm 1,0	3,6 \pm 1,6	5,6 \pm 1,9
	Total mean	6,6 \pm 1,3	5,5 \pm 1,4	6,0 \pm 0,9	6,6 \pm 2,0

*SEQ SM-LG = small muscle group exercises to large muscle group exercises; SEQ LG-SM = large muscle group exercises to small muscle group exercises; TE = triceps extension; BC = biceps curl; CP = chest press; LR = low row.

§ = significant difference when compared to the first, second and third set of SEQ LG-SM; ‡ = significant difference when compared to the second and third set of SEQ LG-SM; == = significant difference when compared to the total mean of SEQ LG-SM; £ = significant difference when compared to the third set of SEQ LG-SM; = = significant difference when compared to the first set of SEQ LG-SM; € = significant difference when compared to the first and second set of SEQ LG-SM.

DISCUSSION

The main findings of the present study revealed that in the order of exercises initiating with small muscles groups a higher total number of repetitions can be completed compared with the order initiating with large muscle groups. The rating of perceived exertion was not affected by exercise order, corroborating with previously published studies in different populations. The exercise order initiating with small muscle groups can produce a higher total number of repetitions, without affecting RPE and lactate levels. Thus, it is possible that with

more repetitions an additional gain in motor learning and muscle strength may occur. More studies will be necessary to improve the understanding of the effect of exercise order on physiological, RPE and muscular variables.

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A New Kayakergometer Equipment: An Help for Trainers

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ABSTRACT

Several studies have showed that kayakergometer simulate precisely physiological requested of canoeing training. In our centre we had the possibility to test a prototype of a new kayakergometer (Riverrunner) which allows to value the power expressed with every single paddling, the advance velocity expressed in meter per second, the number of paddling and the heart rate. 15 athletes participated: they were put through an incremental test; in a different day athletes, were put through at a maximal test for a duration of 4 minutes and, after 20 minutes of rest, at a maximal test for 2 minutes. For each athlete we plotted changes of power and heart rate during the three tests. For each athlete we calculated in both 4 and 2 minutes test: maximal power for kg of weight; maximal absolute power; minimal power and fatigue index. The use of this prototype permitted trainers to supply a detailed vision of the capacities of a single athlete allowing to study a personalized training plan for filling deficiencies showed.

INTRODUCTION

Is very difficult to program training sessions for sports like kayak and canoeing during winter season.

In the last few years several studies (Van Somersen 2000, Van Someren 2002) have showed that kayakergometer simulate precisely physiological requested of canoeing training.

In our centre we had the possibility to test a prototype of a new kayakergometer (Riverrunner) which allows to value the power expressed with every single paddling, the advance velocity expressed in meter per second, the number of paddling and the heart rate.

We tested different high qualification athletes, who practise Kayak, canoeing and rafting, to an incremental test and to 2 maximal tests for a duration of 4 minutes and 2 minutes each every 2 months, in order to recognize deficiencies of each athlete, for personalizing training sessions.

METHODS

Participants

15 athletes participated: 5 who practise kayak, 5 canoeing and 5 rafting, Mean (SD) characteristics of participants were as follows: age 26,7 (11,6) years; height 178 (10,6); body mass 79,8 Kg (3,8).

Protocol

During the programmed rest week in the training sessions athletes were put through an incremental test increasing velocity every 30 seconds for measuring maximal aerobic velocity.

Data were analyzed with VAMEVAL programme (version 3 Charlet Sylvain).

In a different day athletes, after warming up, were put through a maximal test for a duration of 4 minutes and, after 20 minutes of rest, at a maximal test for 2 minutes.

RESULTS

For each athlete we plotted changes of power and heart rate during the three tests. For each athlete we calculated for the tests of 4 and 2 minutes:

maximal power for kg of weight
maximal power expressed for 5 seconds
minimal power expressed for 5 seconds
Fatigue index expressed by the formula

$$FI = \frac{\text{max power} - \text{min power}}{\text{max power}} \times 100$$

DISCUSSION

The observation of power curves trend in different tests permitted to point out those athletes who show:

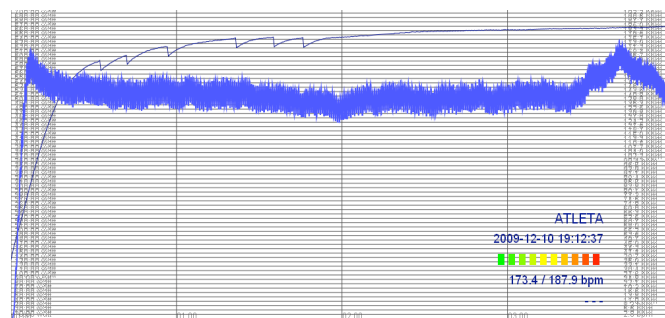
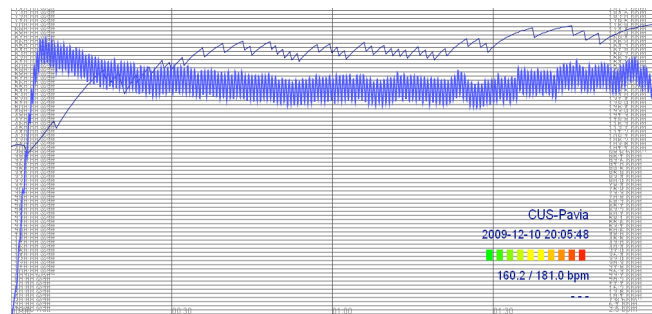
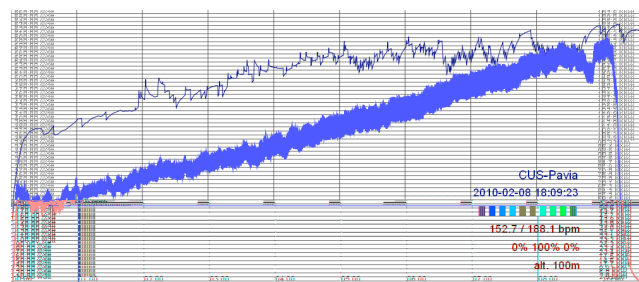
- 1) maximal absolute power deficiency
- 2) spare resistance capacity to an effort

The calculation of fatigue index permitted to point out those athletes with a big difference between maximal and minimal

power as a sign for resistance of deficiency power.

The contemporary observation of heart rate curve permitted to value a fall of preparation of the aerobic capacity for some athletes.

The use of this prototype permitted trainers to supply a detailed vision of the capacities of a single athlete allowing to study a personalized training plan for filling deficiencies showed.



Anaerobic Threshold Valuation in Ten Top National Kayakers : Comparison Between Direct and Indirect Methods

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ABSTRACT

Training results should be controlled in order to calibrate the training scheduled both on athlete's targets and on effective athlete's skills. Anaerobic threshold valuation can give important parameters for training sessions and competition planning. We compared anaerobic threshold informations, got in an indirect way through heart rate responses to incremental work rates and data obtained from a complete functional evaluation depending on Oxygen intake (VO₂), ventilation (VE) and blood lactate concentration. 10 national level kayakers took part for this study. Data collected showed in a statistically significant way ($p < 0,005$) that the heart rate threshold, evaluated on a base of linear regression with the work rate, can be assimilate to the heart rate threshold calculated on a base of the respiratory equivalent and of OBLA in Kayakers.

INTRODUCTION

Training results should be constantly controlled in order to calibrate the training scheduled both on athlete's targets and on effective athlete's skills. For this reasons is important that trainers have a specific test available, reproducible and easy to do.

Anaerobic threshold valuation can give important parameters for training sessions and competition planning. We compared anaerobic threshold informations, got in an indirect way through heart rate responses to incremental work rates and data obtained from a complete functional evaluation depending on Oxygen intake (VO₂), ventilation (VE) and blood lactate concentration (LA).

METHODS

Participants

10 national level athletes took part for this study, 18 ± 4 years old, with a body weight of $kg\ 77 \pm 8,5$, 5 who practice kayak and 5 who practice canoe.

Protocol

During the programmed rest week in the training sessions athletes were put trough an incremental test at the kayakergometer in which we increase velocity every 30 seconds for evaluating maximal aerobic velocity, maximal oxygen intake and the trend of ventilatory threshold.

Data for maximal aerobic velocity were analyzed with the VAMEVAL programme (version 3 Charlet Sylvain), while VO₂ max

and VE were collected by FITMATE equipment (by Cosmed company). On a different day, after warming up, athletes were put through a test for the evaluation of lactate threshold and the the onset of blood lactate accumulation (OBLA). The test consists first on a base lactate taking and then 5 steps of 5 minutes each separated by an interval of 30 seconds in which we take lactate levels.

We used Lactate pro equipment for measuring lactate levels.

Each step was calibrated on each athlete depending on heart rate values reached during the incremental test and specifically in this way:

1° step -6km/h (or -9 pulse/minute) depending on threshold velocity.

2° step -4 km/h (or -6 pulse/minute) depending on threshold velocity.

3°step -2 km/h (or -3 pulse/minute) depending on threshold velocity.

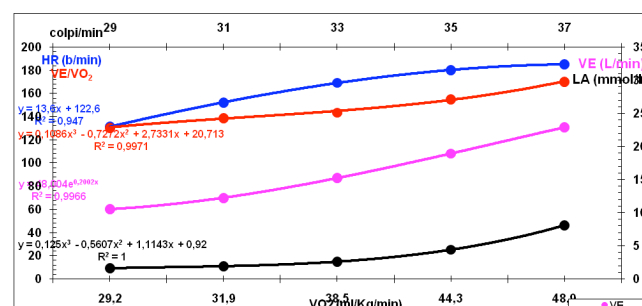
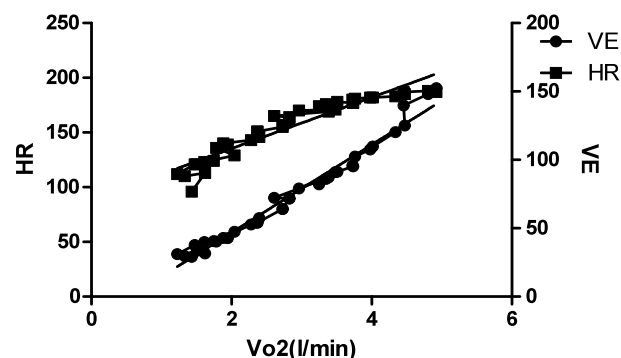
4°step threshold velocity or the same CF of threshold velocity.

5°step maximal

RESULTS

Data collected showed in a statistically significant way ($p < 0,005$) that heart rate threshold, evaluated on a base of linear

regression with the work rate, can be assimilate to the heart rate threshold calculated on a base of the respiratory equivalent and of OBLA in Kayakers and Canoeist.



DISCUSSION

The control of a correct training plan and performance need a quality system control which could be used by the trainer, reproducible and easy to do. We tried to suggest to our sport center technical staff a test for the evaluation of the aerobic threshold, that we consider extremely important for managing training sessions and competition both on Flat-water and Wild water specialties.

Winter Training Session in Kayak

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Int J Exerc Sci 5(1) : S19-S21, 2010.

ABSTRACT

This study wants to analyze cardiovascular and muscular fitness changes which occur during winter training sessions. Each athlete was put through an incremental test for testing the maximal aerobic velocity every 2 months (T0, T2, T4), a maximal test for a duration of 4 and 2 minutes and a maximal test with weights (1RM) every month (T0, T1, T2, T3, T4, T5). Differences between aerobic exercise on kayak ergometer and training on the water and between resistance training at T0 and T5 will be determined using one-way ANOVA ($p < 0.05$). The easiest method in order to value the preparation, although more generic, could be 1-RM test with resistance exercises well known and done.

INTRODUCTION

This study wants to analyze cardiovascular and muscular fitness changes which occur during winter training sessions.

Athletes trained since November 2009 (T0) to march 2010 (T5) with this method.

4 d \cdot wk⁻¹ resistance-training

4 d \cdot wk⁻¹ aerobic exercise on kayak-ergometer

3 d \cdot wk⁻¹ aerobic exercise on water

Each athlete was put through an incremental test for measuring the maximal aerobic velocity every 2 months (T0, T2, T4), a maximal test for a duration of 4 and 2 minutes and a maximal test with weights (1RM) every month (T0, T1, T2, T3, T4, T5).

METHODS

Participants

10 national level athletes took part for this study, 18 ± 4 years old, with a body weight of 77 ± 8.5 kg, 5 who practice kayak and 5 who practice canoe.

Protocol

Each athlete followed the training programme set in this way:

Resistance-training: 2 training sessions at 90% of 1-RM with the following exercises Bench Press, Seated Row, Lat Pull down, Bench pull up, Back extension and hyperextension, Abdominal.

2 training sessions at 70% of 1-RM with the following exercises Bench Press, Seated

Row, Lat Pull down, Bench pull up, Back extension and hyperextension, Abdominal.

Aerobic exercise on kayak-ergometer:

2 training sessions with repetition for a duration of 8 minutes.

2 training sessions with repetition for a duration of 4 minutes.

Aerobic exercise on water:

1 training session for aerobic capacity with a medium-low effort for long distance.

1 training session for aerobic power.

Athletes did incremental and maximal tests at T0 and T5 at the kayak-ergometer.

Incremental tests were done increasing velocity every 30 seconds in order to measure maximal aerobic velocity. Data were analyzed through VAMEVAL programme (Charlet and Sylvain version 3). After warming up athletes were put through a maximal test for a duration of 4 minutes and, after 30 minutes of rest, at a maximal test for 2 minutes for measuring maximal power for kg of weight maximal power expressed for 5 seconds minimal power expressed for 5 seconds and fatigue index.

Athletes monthly did a maximal tests at bench pull and bench press exercise evaluating 1-RM.

Statistical Analysis: Differences between aerobic exercise on kayak ergometer and training on the water and between resistance training at T0 and T5 will be determined using one-way ANOVA ($p < 0.05$).

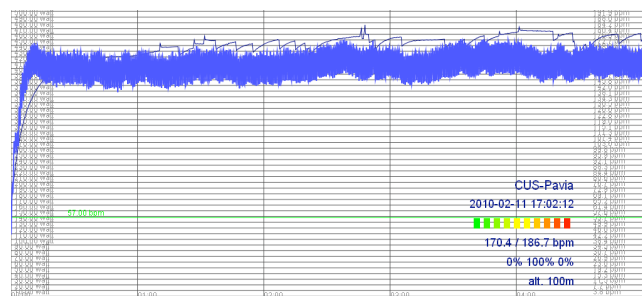
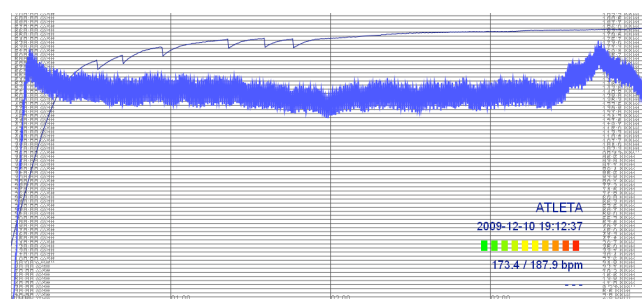
RESULTS

Maximal power tests (1-RM) showed the following variations:

Bench Pull up from 98 ± 20 to $114 \text{ kg} \pm 20$ with a increase of 16%.

Bench Press from $98 \text{ kg} \pm 20$ to $112 \text{ kg} \pm 17$ with an increase of 14%.

Kayak-ergometer tests showed an increase for maximal aerobic velocity with a stable cardiac frequency.



DISCUSSION

Correct training programme and execution control needs a control system of quality and quantity for the training done.

The easiest method in order to value the preparation, although more generic, could be 1-RM test with resistance exercises well known and done.

However we believe that the most sure test for testing the training done could be the one which use specifics muscle, although done at a simulator.

Does Standing-up On a Cycle-ergometer, At the Conclusion Of a GXT, Yield Cardiorespiratory Values Equivalent to Treadmill Testing? The Effect of Gender

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Int J Exerc Sci 5(1) : S22-S23, 2010.

INTRODUCTION

Graded exercise testing (GXT), using a cycle-ergometer (CE), offers safety/monitoring advantages over treadmill (TM) GXT, but CE-cardiorespiratory (CR) values, especially VO_{2max} , are frequently < TM-GXT CR values. If CE-GXT CR values could be increased, then CE v. TM CR comparisons (e.g. between modes, participants, and "predicted/normal") would be more valid/useful.

The primary purpose of this study was to determine if standing on a CE, towards the conclusion of a CE-GXT (Stand-CE), would increase Stand-CE-CR values = to TM-GXT CR values in recreationally-trained-aerobic males and females.

METHODS

A sample (N = 22), 11 males (24 ± 7.8 y, weight = 175 ± 25 lbs.) and 11 females (23 ± 8.5 y, weight = 133 ± 9 lbs.) participated. Participants completed three GXT (CR values measured by Medical Graphics CPX-D metabolic system) trials: one by TM (TM

= Quinton ST-55 and 12-lead EKG system) and two by MET-TM-matched (TM = Bruce protocol) CE-GXT trials (CE = Monark 828e) where initially-seated participants stood-up and pedaled after their RER was 1.0 (Stand-CE) or remained seated throughout GXT (Sit-CE). Lactate (LT = Accutrend analyzer) was obtained at RER = 1.0 and VO_{2max} . Data were analyzed (SPSS, version 17.0) by two-way ANOVA and ANCOVA (gender by trial, with repeated measures on trials and weight as covariate). The level of significance was $p < 0.05$ for all testing.

RESULTS

ANOVA demonstrated statistically significant differences by gender, but not trial, on $METS_{max}$ (Males TM = 14.3 ± 3.0 METS, Stand-CE = 13.0 ± 2.6 , Sit-CE = 13.0 ± 2.7 , females TM = 12.0 ± 1.9 , Stand-CE = 10.8 ± 1.9 , Sit-CE = 11.0 ± 2.1), but no differences on $HR@RER1.0$, HR_{max} , $LT@RER1.0$, $LT@VO_{2max}$ and RER_{max} . ANCOVA demonstrated significant differences by gender, but not trial, on VO_{2max} (males TM = 54.8 ± 10.5 ml/kg/min, Stand-CE = 49.9 ± 9.0 , Sit-CE =

51.3 \pm 9.6, females TM = 39.9 \pm 7.0, Stand-CE = 35.0 \pm 7.0, Sit-CE = 34.3 \pm 7.1), O₂-pulse (males TM = 21.6 \pm 3.4 ml/beat, Stand-CE = 20.3 \pm 2.3, Sit-CE = 20.5 \pm 2.7, females TM = 15.3 \pm 3.5, Stand-CE = 13.5 \pm 2.9, Sit-CE = 11.9 \pm 4.5), and VE_{max} (males TM = 131 \pm 18 l/min, Stand-CE = 120 \pm 17, Sit-CE = 129 \pm 30, females TM = 84 \pm 14, Stand-CE = 75 \pm 14, Sit-CE = 78 \pm 18). ANCOVA demonstrated a significant difference by gender and trial (TM > both CE) on VCO_{2max} (males TM = 4864 \pm 537 ml/min, Stand-CE = 4200 \pm 350, Sit-CE = 3995 \pm 729, females TM = 3102 \pm 588, Stand-CE = 2715 \pm 578, Sit-CE = 2833 \pm 552).

DISCUSSION

We are the first, to the best of our knowledge to use the Stand-CE-GXT technique and report, that Sit-CE and Stand-CE-GXT CR values are statistically = TM-GXT values in recreationally-trained-aerobic males and females. Differences in CR parameters were due to the effect of gender. Gender effects are likely probably related/caused by body composition mechanisms (e.g. muscle mass, hemoglobin, etc.) between males and females. These findings differ with others in that CE-CR values are usually statistically lower by trial (mode) than TM-CR values within gender. These encouraging findings suggest that in aerobically-trained individuals the CE might become the method of choice in GXT. This study was funded by Southern Arkansas University and complied with Helsinki Declaration of 1975 for protection of human participants.

Physiological Response to Low-intensity with Slow Movement Resistance Exercise in Collegiate Women

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Int J Exerc Sci 5(1) : S24-S26, 2010.

ABSTRACT

The aims of this study were 1) to examine physiological responses to the low-intensity resistance exercise with two different speeds and 2) to determine this training on muscular function. Fourteen female collegiate students (age: 20 to 22yr) with some moderate exercise regularly participated voluntarily. The subjects were divided into two groups. Seven subjects (6sec-group) performed following knee extension exercise regiment: the leg lifted the weight of 50% of 1RM in 3 s and lowered it in 3 s until the subjects could not maintain the right speed and form. Other subjects (10sec-group) exercised following the same menu of 6sec-group with the slower speed of movement (each in 5 s). Exercise regiment consisted of one set was performed three times a week for 6 weeks. To identify physiological response during exercise, this study examined systolic (Sys-BP) and diastolic (Dia-BP) blood pressure, heart rate (HR), heart rate-systolic pressure product (HR-BP pro), and SpO₂ before (pre-EX.) and during exercise (dur-EX.) . BP, HR and HR-BP pro in dur-EX were significantly higher as compared with those in pre-EX (p<0.001). SpO₂ was not changed. Subjects significantly increased 1RM (p<0.001), isometric muscle strength (p<0.05), and isokinetic muscular strength at 1.05 rad (60°) (p<0.05) after 6 weeks of the resistance exercise. The performances in both groups were not significantly increased. The result of this investigation suggests that 1) these slow-movement resistance exercises effect of the increase in muscular function and 2) the exercise speed did not affect the physiological response.

INTRODUCTION

Skeletal muscles respond to strong exercise stimuli with hypertrophy and gain in strength. In general, resistance exercise at middle-to-high intensity [70-80% of one-repetition maximum (1RM)] has been regarded as optimal for gaining muscular size and strength. It has been presented that high intensity resistance exercise elicits marked increase in both systolic and diastolic blood pressure while rise in heart

rate is less pronounced. Recent studies reported that a low intensity (less than 50% 1RM) with slow movement significantly increased muscular size and strength. Therefore, the purpose of this study were 1) to examine the heart rate and blood pressure responses to the low-intensity resistance exercise with the different movement speed and 2) to determine the effects these resistance trainings on muscular function.

METHODS

Fourteen female collegiate students (age: 20 to 22yr) with some moderate exercise regularly participated voluntarily in this study which was approved by the ethical committee of Osaka International University. The subjects were divided into two groups. Seven subjects (6sec-group) performed following knee extension exercise regiment in the seated position: the leg lifted the weight of 50% of 1RM in 3 s and lowered it in 3 s until the subjects could not maintain the right speed and form. Other subjects (10sec-group) exercised following the same menu of 6sec-group with the slower speed of movement (each in 5 s). The sports trainer during exercise supervised the subjects to repeat the movement at constant speed and frequency followed by metro norm. Exercise regiment in both groups consisted of one set was performed three times a week for 6 weeks. To identify physiological responses this study examined systolic (Sys-BP) and diastolic (Dia-BP) blood pressure, heart rates (HR), heart rate-systolic pressure product (HR-BP pro) and percutaneous oxygen saturation (SpO₂) during each resistance exercise. Subjects were tied on the exercise chair with the straps to minimize the mechanical affects on the upper body. Blood pressure from left radial artery was measured before and at 1 min of exercise by sport trainer who familiar with to use sphygmomanometry which was set at an adjustable table. SpO₂ and HR were recorded from the subject's point finger of the right hand by pulse spectrophotometry (DDG-3100, Nihon Kohden). Creatine kinase (CK) and perceived pain (PAIN) were measured to identify delayed onset muscle soreness (DOMS). Statistical analysis was calculated by SPSS.

Differences between two variables in the same group were examined with student's paired t-test. Condition differences were analyzed using one-way ANOVA. Statistical significance was set at $p < 0.05$.

RESULTS

There were no significant differences between two groups regarding 1RM of pre-training, the total exercise time of each exercise (almost 3 minutes), and the rate of the exercise intensity. 6sec-group and 10sec-group exercised with $50.5 \pm 3.2\%$ of 1RM for 25-30 repetitions and with $48.6 \pm 5.5\%$ of 1RM for 15-18 repetitions, respectively. Both groups significantly increased Sys-BP ($p < 0.05$), Dai-BP ($p < 0.05$), HR ($p < 0.05$) and HP-BP pro ($p < 0.05$) during the resistance exercise as compared with the pre-exercise (Table-1). These physiological measurements in 10sec-group were lower than those in 6sec-group, but there were no significant differences between two groups. The SpO₂ in both groups were not changed while exercising. CK and PAIN in both groups were not changed during the 7 days after the initial exercise. Both groups significantly increased circumference ($p < 0.05$), 1RM ($p < 0.001$), isometric muscle strength ($p < 0.05$), and isokinetic muscular strength at 1.05 rad (60°) ($p < 0.05$) after 6 weeks of the resistance exercise. The one-leg long jumping and double-leg long jumping, however, were not significantly increased during this study.

DISCUSSION

The main finding of this study was that both groups had significant increase in blood pressure and heart rate while exercising as compared with before

exercise. In the high intensity resistance exercise (70-80% of 1RM), Sys-BP remarkably increased up to 250mmHg. The mechanism of this slow and low-intensity resistance exercise is to decrease the blood flow in vein for the exercising muscle groups. This is a similar to KAATSU exercise which the subject wears the special belt on the proximal arms and/or legs to make vascular occlusion. In addition of this mechanism, it has been appeared that eccentric resistance exercise (ECC-Ex) greater gains increase in muscular strength and muscular size than concentric resistance exercise (CON-Ex). On the basis of this mechanism, it was that eccentric muscular contraction generated higher mechanical forces than concentric muscular contraction. ECC-Ex, however, induces DOMS after the initial exercise. In this study, the low-intensity with the slow movement minimize in stress on muscle, because CK and PAIN were not changed. Therefore, the result of this investigation suggests that 1) these slow-movement resistance exercises represent small physiological strains while exercising and 2) these slow-movement resistance exercises effect of the increase in muscle strength.

Table-1. Mean physiological responses before (pre) and during (dur) slow-movement resistance exercise (mean \pm SD)

		6sec-group	10sec-group
Sys-BP	pre	106.9 \pm 4.3mmHg	102.2 \pm 2.9mmHg
	dur	148.5 \pm 8.2mmHg	140.5 \pm 6.7mmHg
Dia-BP	pre	66.0 \pm 5.2mmHg	65.1 \pm 4.0mmHg
	dur	104.2 \pm 5.0mmHg	98.1 \pm 6.4mmHg
HR	pre	73.2 \pm 5.7bpm	70.7 \pm 4.2bpm
	dur	101.9 \pm 4.2bpm	92.4 \pm 1.9bpm
HR-BP pro	pre	750.61 \pm 1020.4bpm \cdot mmHg	6709.7 \pm 1319.5bpm \cdot mmHg
	dur	14308.8 \pm 1776.9bpm \cdot mmHg	11885.4 \pm 2163.0bpm \cdot mmHg
SpO2	pre	97.2 \pm 1.7%	97.8 \pm 1.0%
	dur	98.1 \pm 2.1%	97.2 \pm 1.7%

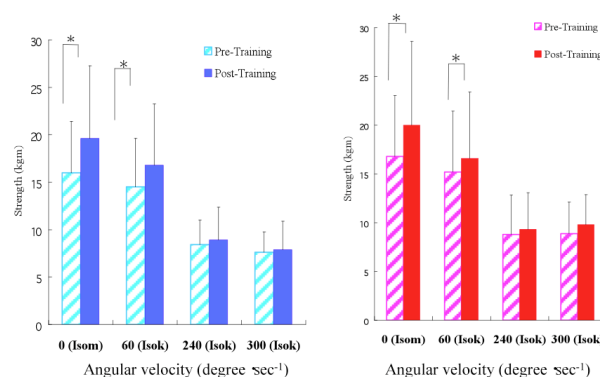


Figure-1. Changes in maximal isokinetic leg extensor strength before and after the 6 weeks of the resistance training. Slash-open bars show pre-training and solid bars show post-training. Values are means \pm SD. *:P<0.05 Pre- vs Post-Training (left 6sec-group, right 10sec-group)

Effects of Two Minutes Active Recovery on a “Booster” VO₂MAX Test Using Collegiate Female Distance Runners

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INTRODUCTION

Maximal aerobic capacity (VO₂max) tests typically end at the point of volitional exhaustion. However, previous research determined that concluding a maximal treadmill test with 2min active recovery and allowing averagely fit subjects to exercise a second time at the workload eliciting volitional exhaustion results in significantly greater VO₂ max values (1.4% mean increase). The potential effects of this testing sequence (2min recovery) on VO₂max treadmill tests has not been evaluated utilizing highly fit NCAA female distance runners.

The purpose was to examine changes in VO₂max values following 2min of active recovery at the conclusion of a treadmill GXT to volitional exhaustion.

METHODS

Twelve NCAA Division II female X-country runners completed a max treadmill GXT until reaching volitional exhaustion (MAX1). Immediately following 2min active recovery (at 0% grade & 2.5 mph),

each subject exercised to volitional exhaustion a second time (MAX2). MAX1 and MAX2 were compared using a paired T-test. Differences were considered significant at $p < 0.05$.

RESULTS

Significant differences ($p = 0.04$) occurred between MAX1 (50.4 ± 5.2 ml/kg/min) and MAX2 (51.5 ± 4.5 ml/kg/min). The mean change from MAX1 to MAX2 following 2min active recovery was +2.1% with individual values ranging from -4.1% to +9.2%. Also, 75% of the subjects benefited (+4.2% mean increase) from the booster test with individual increases of +0.5% up to +9.2%.

DISCUSSION

Mean results suggest that 2min active recovery allows significantly greater VO₂ max values to be achieved by highly fit individuals during treadmill testing, which supports previous “booster max” treadmill research. Future studies may be required to determine how fitness level, treadmill running experience, age, sport specificity,

or other variables might affect this exercise testing protocol.

Whole Body Vibration Training on Elite Athletes' Proprioception

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Int J Exerc Sci 5(1) : S29-S30, 2010.

INTRODUCTION

Whole Body Vibration (WBV) Training has been studied for the past 10 years with the aim of enhancing sport performance as well as injury recovery with mixed results. Studies have shown various positive effects on proprioception and balance mostly in elderly people or as part of neuro-vascular rehabilitation programs. The aim of this study was to investigate the influence of WBV training on elite athletes' proprioception.

METHODS

12 subjects (19-24 yrs \pm 2.5 yrs; 187.6 cm \pm 6.8 cm; lower limb length 104.6 cm \pm 5.0 cm) were recruited but only 9 completed the study which was a 6 week training program. Each athlete was asked to complete 3 workouts a week consisting of 3 times 2 minutes of WBV on the dominant leg with rest in between for a total of 12 minutes per session. Before and after tests were conducted to collect data for analysis. In the first outcome measure (laboratory) subjects were asked to stand on one foot, with eyes open on a force plate (Winpod, Medicauteurs©). Center of pressure (CoP) displacement (overall distance from footprint to CoP), CoP deviation (area under slope from footprint to

CoP) and CoP speed of displacement were measured on two horizontal planes (X=mediolateral Y=anteroposterior). The second test was a clinical, easy reproducible Star Excursion Balance Test (SEBT). Distances from footprint to standing leg in 3 different directions were measured.

Statistical analysis

A 2x2 ANOVA statistical analysis has been performed across the 4 conditions and the 3 different time fractions (T 0-10s, T 10-20s, T 20-30s) for the force plate test. The *p*-value was set at 0.05.

RESULTS

Three of the athletes were excluded, not having completed 90% of the sessions. No effect of training was observed for CoP displacement or Cop speed of displacement between trained and untrained legs. Both legs showed a similar increment in proprioception, with the sole difference between groups being the T 20-30s of the CoP Y deviation significantly improved (diminished) in the train leg (*p*=0.027).

DISCUSSION

WBV training has the potential to improve proprioception in elite volleyball players' dominant leg, as evidenced by the significant improvement in mediolateral stability (Deviation CoP Y T 20-30s). This improvement could be a result of reduced fatigue since it only occurs in the late phase of the proprioception trial (T 20-30s time fraction). The sample size is small, and further research should be done to see if the trend towards improvement in other aspects of proprioception can really be obtained by this novel form of exercise training. This is potentially important to improve the stability of the foot and ankle joints, which is of paramount importance in athletic activities involving jumping and landing on one foot, for better performance and prevention of injuries.

Effects of Caffeine on Fatigue and Peak Power on Division II Collegiate Male Wrestlers

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Int J Exerc Sci 5(1) : S31, 2010.

INTRODUCTION

The purpose of this study was to examine if there are any ergogenic effects of caffeine on peak power and fatigue index in college wrestlers.

METHODS

The subjects in this study were two 18-25 year old division II collegiate wrestlers at the University of Central Missouri. Each subject came in for a familiarization trial followed by two trials separated by at least seven days. In each trial the subject drank placebo or caffeine (6mg/kg total body weight) dissolved in water and waited 60 minutes. Subjects warmed up with light cycling at 100 watts for 5 minutes with 3-10 second sprints prior to performing a 30 second Wingate test on a Velotron bicycle. Load on the Wingate test was 10% of body weight resistance. Post Wingate test, participants had a thirty second rest followed by a rigorous five minute match-like exercise to mimic a wrestling match, followed by thirty more seconds of rest before a second Wingate test.

RESULTS

Caffeine ingestion produced a higher peak power measured in watts in both pre exercise $1311W \pm 235W$ (mean \pm standard deviation) and post exercise $1207W \pm 175W$ when compared to placebo $1257W \pm 141W$; $1110W \pm 320W$. This also resulted in a higher average between tests in caffeine $1259W \pm 205W$ compared to placebo $1184W \pm 231W$. Also, for both tests fatigue index was higher for caffeine (30.875 ± 3.29) than placebo 27.675 ± 2.93 (Watts/second \pm standard deviation).

Three of the athletes were excluded, not having completed 90% of the sessions. No effect of training was observed for CoP displacement or Cop speed of displacement between trained and untrained legs. Both legs showed a similar increment in proprioception, with the sole difference between groups being the T 20-30s of the CoP Y deviation significantly improved (diminished) in the train leg ($p=0.027$).

DISCUSSION

Although caffeine consumption produced a higher peak power, more subjects are needed to confirm this effect. In addition, higher peak power was associated with decreased fatigue index for the second Wingate test while placebo increased fatigue index.

Allometric Scaling and Conventional Methods to Compare VO₂peak in Obese and Lean Boys

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Int J Exerc Sci 5(1) : S32-S33, 2010.

INTRODUCTION

Maximal oxygen uptake (VO_{2max}) is an important variable for aerobic exercise prescription. The literature suggests that when the VO_{2max} is expressed relative to body mass (ml·kg⁻¹·min⁻¹), the aerobic capacity of individuals with a lower body mass is overestimated, whereas individuals with a higher body mass is underestimated. This allometric scaling method has been used since increases in VO₂ and body mass are not directly proportional. In this case, the use of allometric scaling may attenuate such problem.

This study aims to compare the peak oxygen uptake of obese boys (OB) with lean boys (LB) using conventional and allometric methods.

METHODS

Thirty physically active pre-pubescent boys were classified as OB (n=15; age= 9.4±1.1 years; body mass= 48.1±8.3 kg; BMI= 24.9 ± 3 kg·m⁻² and % fat= 46.4±14.3) and LB (n=15; (age= 9.1 ± 1.1 years; body mass= 30.3±4.7 kg; BMI= 16.1 ± 1.1 kg·m⁻² and % fat= 15.7±3.6) according to their body mass indexes (CDC, 2000), % body fat (Lohman,

1987) and triceps skinfold (Must, 1991). Peak oxygen uptake was measured in a cycle ergometer (ErgoFit 167, Spain) using the McMaster protocol and indirect calorimetry with an open circuit equipment (O₂ and CO₂ analyzer Medgraphics, model CPX/D, breath by breath method, USA). The test was interrupted when the boys met two of the following criteria: VO₂ plateau, HR > 200 bpm, RER > 1.15, RPE > 19, inability to maintain pace of 60 rpm, exhaustion despite verbal encouragement by researchers. An allometric exponent for OB and LB was calculated as: LogVO_{2peak} = log a + b log body mass, where “a” is a proportionality coefficient and “b” is the allometric expoent. The allometric exponent found for this sample was 0.50 and allometric VO_{2peak} was expressed in ml·kg^{-0.50}·min⁻¹. All data were processed in software SPSS 18.0 for Windows. Shapiro-Wilk’s test was used to check the normality of data and Levene’s test to check the normality of data variance. Independent t-test was employed to compare groups and data were expressed as mean ± standard deviation. Differences were considered significant when p<0.05.

RESULTS

The table below shows the results of $\text{VO}_{2\text{peak}}$ (mean \pm SD) expressed in absolute value, relative to body mass, and using the allometric exponent in each group.

$\text{VO}_{2\text{peak}}$	Lean Boys	Obese Boys
Absolute ($\text{ml}\cdot\text{min}^{-1}$)	1327 ± 221	$1618 \pm 292^*$
Relative to body mass ($\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$)	43.1 ± 6.2	$34 \pm 5.8^*$
Allometric exponent ($\text{ml}\cdot\text{kg}^{-0.50}\cdot\text{min}^{-1}$)	232 ± 7.9	240 ± 9.3

The Pearson correlation coefficient (r) between the absolute $\text{VO}_{2\text{peak}}$ and body mass was 0.692 ($p < 0.001$). The r between relative $\text{VO}_{2\text{peak}}$ and body mass was -0.691 ($p < 0.001$); while the r between allometric $\text{VO}_{2\text{peak}}$ and body mass was lower (-0.165, $p = 0.384$).

DISCUSSION

$\text{VO}_{2\text{peak}}$ corrected by body mass overestimated the values in LB by 21%, and underestimated them by 24.3% in OB. The allometric VO_2 was the form of expression of $\text{VO}_{2\text{peak}}$ which showed less effect of body mass. This suggests that allometry is an effective way to normalize $\text{VO}_{2\text{peak}}$ when comparing boys of different body mass.

The study was supported by CAPES and CNPq.

Influence of Power Output and Cadence on the Pedaling Technique of Cyclists and Triathletes

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Int J Exerc Sci 5(1) : S34-S37, 2010.

ABSTRACT

The aim of this study was to compare the pedaling technique of cyclists, triathletes and non-athletes. Twelve cyclists, eleven triathletes, and twelve non-athletes participated in the study. All subjects performed a maximal incremental cycling test up to exhaustion and a constant load test with varying power output and cadence. Right pedal force was measured and pedaling technique was analyzed by the overall pedal force index of effectiveness (IE). The IE was similar between cyclists and triathletes. However, non-athletes had an overall lower IE compared to triathletes in all conditions, but only in three conditions of power output and cadence compared to cyclists. Although we expected the IE to be higher in cyclists compared to triathletes, we cannot ascertain the reason for this IE similarity between these athletes.

INTRODUCTION

The ratio between the force applied on the pedal that is perpendicular to the crank (effective force - EF) and the total force applied on the pedal surface (resultant force - RF) has been used to analyze the overall force effectiveness (index of effectiveness - IE). The IE provides information about the pedaling technique (1) which has been observed to differ between cyclists and non-cyclists (2) and between cyclists and triathletes (3). However, it is not clear how these groups change their technique at their individual exercise intensities. Therefore, the aim of this study was to compare the IE of cyclists, triathletes and non-athletes at different cadences and power output.

METHODS

Subjects

Twelve cyclists, eleven triathletes, and twelve non-athletes volunteered to participate in the study. Information about age and physical characteristics is provided in Table I.

Protocol

On the first evaluation session, participants performed an incremental cycling test to exhaustion using their own bicycles mounted on a cycle trainer (Computrainer, ProLab 3D, Racermate Inc., Seattle, WA, USA) to determine maximal power output (PO_{max}) power output at ventilatory threshold 2 (PO at VT2), and at ventilatory threshold 1 (PO at VT1). Non-athletes used a road bicycle with saddle and handlebars position adapted to their body dimensions. All participants warmed up for 10 minutes at 150 W before starting the test. The initial load was 100 W with increments of 25

Table I. Anthropometrical and performance characteristics of the subjects (mean \pm sd).

	Age (years)	Body mass (kg)	Height (cm)	PO _{max} (W)	PO (W) VT2	PO (W) VT1
Cyclists	28.4 \pm 6.6	70.8 \pm 7.1	177.3 \pm 9.7	375.0 \pm 36.9	308.3 \pm 51.5	237.5 \pm 45.9
Triathletes	29.0 \pm 8.3	77.1 \pm 9.9	180.5 \pm 7.3	386.4 \pm 46.6	315.9 \pm 43.7	197.7 \pm 58.6
Non-Athletes	24.7 \pm 3.7	71.6 \pm 8.2	175.1 \pm 5.1	281.3 \pm 50.1*	208.3 \pm 41.7*	143.8 \pm 44.1*

*Significant difference between groups of non-athletes to cyclists and triathletes (p < 0,05).

W·min⁻¹ (4) and pedaling cadence controlled at 90 rpm for all subjects (6). After two to five days, participants returned to the laboratory to perform 1 minute trials with controlled pedaling cadence (90 rpm) at their PO_{max} obtained in the incremental test and sub maximal workload and cadence combinations (randomly selected): PO at VT2 and cadences of 90 rpm and 70 rpm; PO at VT1 and cadences of 90 rpm and 70 rpm. All five trials were conducted after two minutes of rest. Normal and shear forces on the right pedal were measured by a pedal dynamometer (3). Force signals were amplified (MSC6, Entran Ltd., UK) and digitized using a 16-channel A-D board (Dataq Instruments Inc., Akron, USA). Pedal angle was measured using a potentiometer (Spectrol Model 357) and a reed switch triggered the position of the crank with respect to the bike frame. Analog data was acquired using WINDAQ software (Dataq Instruments Inc., USA) with a sampling frequency of 600 Hz per channel. Normal and shear forces were converted to the effective component to calculate the overall IE, which was based on the ratio between the angular impulse of

the EF by the linear impulse of the RF (1). Data analysis was conducted offline using custom made scripts written in Matlab (MathWorks Inc., USA).

Statistical analysis

Tests of Shapiro-Wilk (normality), Mauchly (sphericity) and Multivariable ANOVA model were conducted with between-group comparison to test the hypothesis that cyclists, triathletes and non-athletes are different in terms of IE (with Bonferroni corrections). SPSS 13.0 was employed with Type I and Type II errors set at 5 and 80%, respectively.

RESULTS

The index of effectiveness (IE) was similar between cyclists and triathletes. However, non-athletes had lower IE at all conditions of PO and cadence compared to triathletes and at three conditions compared to cyclists (Table II).

Table II: Index effectiveness (IE) comparison between groups in different levels of PO and cadence.

IE	PO _{max}	VT2-90rpm	VT2-70rpm	VT1-90rpm	VT1-70rpm
Cyclists	48.6 ± 9.7	47.5 ± 11.7	54.7 ± 12.4	44.5 ± 10.6	51.9 ± 13.0
Triathletes	54.1 ± 7.4	51.4 ± 10.1	56.5 ± 6.5	47.2 ± 11.2	52.1 ± 7.5
Non-Athletes	44.1 ± 5.4*	40.2 ± 6.9*	45.3 ± 5.8*#	34.6 ± 4.2*#	39.6 ± 5.0*#

Significant difference in the group of the non-athletes to * triathletes and # cyclists, respectively ($p < 0.05$ and estimated power > 0.8).

DISCUSSION

The lack of difference between cyclists and triathletes is conflicting to previous reports (3) but similar to previous comparison between cyclists and non-cyclists (5). The possible increase in force effectiveness previously observed for non-cyclists riding close to their maximal PO (6) may explain why cyclists and non-athletes showed similar IE at PO_{max} and VT2-90rpm. The higher ability to apply force on the pedal was only evident for cyclists when those rode at lower pedalling cadence (70 rpm), which is in agreement to previous results (3, 7). Further comparison of EF and RF among the three groups may shed light on the differences between these groups for different pedalling cadences and intensity levels.

Pedaling technique as determined by the IE is not different between cyclists and triathletes of similar performance level when riding at similar intensity levels. Non-athletes appear to improve their technique and achieve similar results of trained cyclists, mainly when riding at their PO_{max}.

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Correlated Decreases in Bilateral Grip Forces with Fatigue: A Pilot Study on Repetitive Submaximal Perceived Force Exertion

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ABSTRACT

We measured grip forces repetitively exerted in bilateral simultaneous (BS) manner without any visual feedback system. 22 healthy right-handed male subjects exerted BS grip forces at a subjectively estimated 30% of their maximal voluntary contraction (MVC). The ratios of measured bilateral grip force to the MVCs decreased with fatigue development and showed a high correlation. These results suggest that brain signals may be equally-divided and transmitted to both sides of the body in BS force exertion.

INTRODUCTION

Many researches have been studied on fatiguing muscle force exertions performed repetitively or continually at specific intensity with a visual feedback system. However, few have been studied on those without any visual or auditory feedback system. The purpose of the present study is to investigate grip forces repetitively exerted in BS manner at subjectively estimated submaximal effort. We hypothesized that the bilateral grip forces would decrease with fatigue and that the grips of both limbs would significantly differ due to an absence of the visual feedback system.

METHODS

Participants

We recruited 22 healthy right-handed men (mean age \pm standard deviation (SD) was

24.1 \pm 2.1 years; range 22-31 years) for this study. All subjects were free of neurological and cardiac disorders. They had no previous experience with the experimental bilateral task and were clearly informed the purpose of this experiment before their written consents were obtained. The local Institutional Review Board of the University of Tokyo approved the experimental protocol before the experiment was conducted.

Protocol

Subjects were seated in upright position and could exert grip force against a handgrip dynamometer (Takei Scientific Instruments Co., Ltd., Niigata, Japan) in each hand with their arms hanging at their sides in vertical position. Three days prior to the experimental trials, the MVC was determined based on two consecutive 5 s recordings. On the day of the experiment, all subjects primarily practiced a BS

handgrip task at 30% MVC with a visual feedback system. After a sufficient understanding of our experimental protocol, they conducted another BS handgrip task at subjectively estimated 30% MVC without any visual or auditory feedback system. A handgrip task lasted 60 s, during which 2-s grip and 1-s rest was repeated 20 times. Time-series data of bilateral grip force were simultaneously collected at 1-ms intervals.

Statistical Analysis

We calculated 20 forces exerted in each hand from the time-series data and, then, the ratio of each grip force to each subject's MVC. We computed a correlation between bilateral grip force ratio. To confirm a significant decrease in the force ratio, the ratio of both first and last 5 exertions were analyzed using a two-way ANOVA (2 x 2; hand (right or left) x when (first or last)) (R for Windows). A *P*-value of 0.05 was considered statistically significant.

RESULTS

The correlation between the bilateral force ratio was 0.83. The force ratios of the right-hand first, left-hand first, right-hand last, and left-hand last 5 handgrip exertions averaged 0.41 ± 0.10 , 0.39 ± 0.08 , 0.31 ± 0.07 , and 0.30 ± 0.06 , respectively. The ratio of the first grips were significantly larger than that of the last grips ($P < 0.05$) while the ratio of the right-hand grips did not significantly differ from but were slightly larger than that of the left-hand grips ($P = 0.055$).

DISCUSSION

As we hypothesized, the bilateral ratios of grip forces decreased. This result show that our handgrip task at subjectively estimated 30% MVC might induce fatigue. Contrary to our hypothesis, the bilateral force ratios highly correlated with each other despite the absence of any feedback system. These results suggest that brain signals may be equally-divided and transmitted to bilateral side of the body in BS force exertion. Supposedly, our handgrip task without a feedback system might constantly require a certain amount of brain signals but induce peripheral fatigue. The grip forces in this study may decrease due to a collapse of a balance between an amount of required brain signals and peripheral fatigue. We have shown that bilateral grip forces decreased with a high correlation despite the absence of visual feedback system as fatigue progressed. For further insight, we need measure EMG data or cerebral blood oxygenation using near infrared spectroscopy.

Induced Neuromechanical Changes in Response to Practicing with Weighted Vests Increases Countermovement Jump Height

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INTRODUCTION

Jumping with preloaded vest is proposed as a method of warm up that leads to an increase in the height of subsequent jumps. However, the biomechanical adaptations during loaded jumps are still unknown.

The aim of this study was to explore the adaptive changes in the biomechanics of the lower limb joints during loaded maximal jumping.

METHODS

Following a full set of warm-up jumps, healthy college students (10 male, 8 female, 64.4 ± 16.3 kg, 1.7 ± 0.809 m) were asked to perform 2 pre-test jumps with a loaded vest equal to 15% of their body mass. Following which, they performed 3 sets of 5 consecutive countermovement jumps (exercise set). This was followed by a post-test where the subject again jumped twice. The jumps of pre and post exercise set were compared. Kinetic and kinematic data were collected for 12 defined body segments. Subjects would be excluded from the study if they had any history of ankle sprain or any type of neuromuscular disorder.

RESULTS

A significant increase in weighted jump height in males was observed during the posttest (28.45 vs. 26.48 cm, p -value $< .01$), an effect not seen in the females (18.9 vs. 18.5 cm, p -value $< .01$). This is consistent with the findings of Komi et al. (1977), who observed that during both drop jumps and counter movement jumps, males have better performances than women. Males also demonstrated significant increases in peak hip and knee angle, while females showed no significant changes in joint kinematics and kinetics. We also observed a significant increase in hip joint power and a decrease in ankle joint power.

DISCUSSION

Increased range of motion in the knee and hip as well as a shift in joint power from distal to proximal joints may be the underlying strategy that resulted in increased post-test jump height. Perhaps, the lack of change in joint power and range of motion in females prevented them from increasing the jump height. One possible mechanistic explanation is a difference in joint and tendon stiffness between genders, which Komi et al. (1978) have suggested

previously. From a practical perspective, these findings suggested that gender should play a role in the use of loaded jumping as a training procedure.

Successful 10-weeks Walking Program Among Female Students: Results Of A Randomized Controlled Trial

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ABSTRACT

Facing the worrying increase of chronic diseases in Gulf countries and the insufficient practice of physical activity, one of the first in Gulf countries, a randomized controlled trial consisting in a 10-weeks pedometer-based culturally-adapted physical activity program was conducted among 42 Female students (18-35 years old) at Al Ain, United Arab Emirates, in Spring 2009. An individual daily step goal was defined as the baseline daily steps' number plus 3 000 steps. Physical activity, anthropometric and laboratory parameters were assessed before and after the intervention. After 10 weeks, intervention group increased significantly its daily steps' number ($p=10^{-3}$) of more than 3 000 steps whereas no change was observed in controls. The difference in daily steps' number changes across groups was significant ($p=0.02$), even after adjustment for age, educational level of parents, baseline weight status and baseline daily steps' number. Regarding health outcomes, the difference of the changes from baseline between groups of all of them was not significant. This pedometer-based and culturally-adapted walking program which was designed was effective in promoting physical activity among female students even though no significant change of health outcomes was observed. Nevertheless, certainly, these results encourage policy makers to consider walking for public health purpose as an easy and simple tool to improve physical activity level.

INTRODUCTION

Even though health benefits of physical activity are recognized, most of people remain insufficiently active. Cross-cultural studies encouraging real world participants to improve their physical activity are needed, especially in Gulf countries, where the cardiovascular risk is particularly high and where culture and beliefs are tightly related to lifestyle.

METHODS

Sedentary female students ($n=42$), aged between 18 and 35 years, from the United Arab Emirates University at Al Ain, were enrolled in February-March 2009, to participate in a randomized controlled trial consisting in a 10-weeks pedometer-based culturally-adapted physical activity program with individual daily step goal defined as the baseline daily steps' number plus 3 000 steps.

Physical activity was measured by pedometer as primary end point and by the International Physical Activity Questionnaire. Anthropometry, blood

pressure at rest and biochemical parameters (Blood glucose, Triglycerides, HDL, LDL, Total Cholesterol and insulin) were assessed.

RESULTS

Control and intervention groups did not differ at baseline. The mean daily steps count was 8146.22 ± 3457.89 . Almost 40% of the participants were overweight or obese. After 10 weeks, intervention group increased significantly its daily steps' number ($p=10^{-3}$) of more than 3 000 steps whereas no change was observed in controls. The difference in daily steps' number changes across groups was significant ($p=0.02$), even after adjustment for age, educational level of parents, baseline weight status and baseline daily steps' number. In parallel, a significant difference in walking time's changes across groups ($p<10^{-2}$) was obtained. Regarding health outcomes, triglycerides level increased but in a lesser extent in intervention than in control group ($p<0.05$). A decrease of diastolic blood pressure was observed in intervention group ($p=0.03$), only. Finally, the difference of the changes from baseline between groups of all health outcomes was not significant.

DISCUSSION

To the authors' knowledge, such a trial was one of the first to have been conducted in the Gulf region. The pedometer-based and

culturally-adapted walking program which was designed is effective in promoting physical activity among female students. The lack of significant changes of health outcomes may be related to a too short intervention duration, the time needed to achieve the individual goal, a possible diet compensation although the follow-up of dietary habits through the program, the initial healthy profile of participants and a level of physical activity (time and intensity) which, even if increased, may not achieve the minimum amount which has been suggested to stimulate health benefits. But certainly, these results encourage policy makers to consider walking for public health purpose as an easy and simple tool to improve physical activity level.

Excess Post-Exercise Oxygen Consumption Duration is Significantly Greater in the Morning Compared to the Afternoon

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INTRODUCTION

Excess post-exercise consumption (EPOC) is the body's increased oxygen consumption during recovery after exercise and the usage of elevated amounts of oxygen (O₂) even though the muscles have stopped being used. The stored O₂ levels that were borrowed from the hemoglobin and myoglobin reserves at the start of exercise must be replenished post-exercise. EPOC is one of the most common methods for predicting exercise capacity. Previous research has focused on trained versus untrained (Chad & Quigley, 1991), modes of exercise (Lyons, *et al*, 2006), gender (Woo, *et al*, 2006), magnitude and duration (Maehlum, *et al*, 1986), and immune function (Peterson & Hoffman-Goetz, 2000). To our knowledge no previous research has focused on the effects of EPOC while comparing morning to afternoon bouts of exercise and the effect the time of day may cause on magnitude and duration. It is the purpose of the current study to examine the differences of duration and magnitude between morning and afternoon exercise sessions.

METHODS

Subjects

Four (1 male, 3 female) healthy, athletic-type college-age (ht = 171 ± 4.2 cm, wt = 70 ± 5.6 kg) subjects participated in this study. Upon arrival subjects height, weight, and resting heart rate (radial) were recorded. Subject was then fitted with a mask connected to a metabolic analysis system (Vacu-Med Minivista CPX, Ventura, CA USA; MET CART) that measured oxygen consumption while at rest. Subject remained at rest for 30 minutes and the average of the last ten minutes was recorded as their resting metabolic rate (RMR).

Procedure

Upon calculation of RMR the subject performed a series of 3 30-second Wingate (Monark 828E cycle ergometer, Monark Exercise-AB, VANSBRO, Sweden) trials with a 2-minute rest period between each bout. During each trial revolutions were recorded at 5-second intervals. After the third trial subjects received a rest period of 6.75 minutes before repeating the process over. After the 6th trial subjects were

reconnected to the MET CART and measurement of EPOC was recorded every minute until their 5-minute running average (5-AVG) was equal to RMR. Each subject performed this procedure once in the morning (6-8 am) and in the afternoon (12-4 pm).

Statistical Analysis

Duration was calculated using a 5-AVG. The first minute of the last 5-AVG calculated as being equal to RMR was recorded as Duration. The magnitude was calculated by taking the difference of RMR from EPOC each minute until reaching recorded duration. These figures were summed and the result was recorded as the magnitude. A paired t-test ($p \leq 0.05$) was used to compare duration and magnitude from morning to afternoon for each subject to determine if there was any difference.

RESULTS

Figures 1 and 2 show the differences between morning and afternoon duration and magnitude for all subjects. Preliminary results show statistical significance ($p = 0.007$) between morning and afternoon duration. There appeared to also be a difference for magnitude, but it was not significantly different ($p = 0.074$). In the afternoon both EPOC magnitude and duration were significantly decreased after exercise.

DISCUSSION

The purpose of the current study was to discover if any differences existed between morning and afternoon bouts of exercise on EPOC duration and magnitude. Our results show a significant difference for duration and only slightly less significant difference

for magnitude according to the time of the day in which exercise is undertaken. There is significant difference on measures of EPOC with regards to the time of day the measures are taken. We conclude that EPOC should be a measure taken in the morning, due to the depressed effect on measures afternoon bouts of exercise will render.

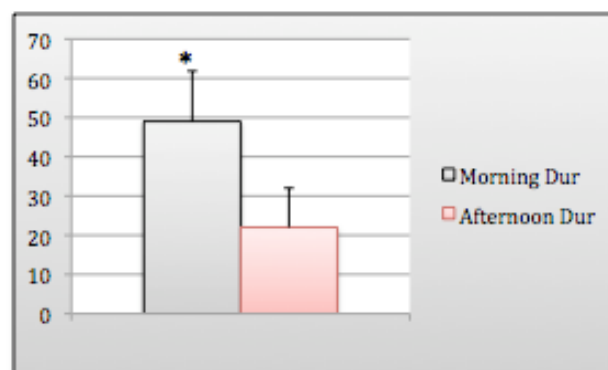


Figure 1. Comparison between morning (49 ± 12.84 min) and afternoon (22 ± 10.02 min) EPOC duration. * is significantly greater ($p=0.007$)

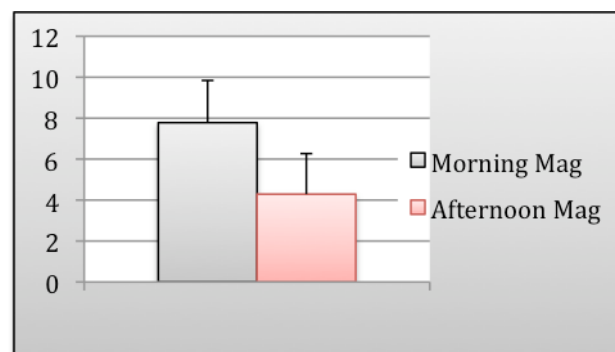


Figure 2. Comparison between morning (7.78 ± 2.06 L) and afternoon (4.29 ± 1.98 L) EPOC magnitude.

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Validation of Energy Expenditure on Commercial Treadmills: Is It Effective or Defective?

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ABSTRACT

The purpose of this study was to validate the accuracy of estimated energy expenditure (EE) on commercial treadmills. This study was performed with twenty five university students aged 20-32 yrs. Subjects conducted two tests. First test was performed with the indirect calorimetry to calculate EE at each speed on the basis of measured O₂ consumption and CO₂ production. Second test was conducted on commercial treadmills to estimate EE using body weight and the running speed. In both tests, initial speed was 3 mph with increases of 0.5 mph every two min up to 7 mph. For data analyses, paired t-test was performed using SPSS 13.0 (SPSS Inc., Chicago, IL). No significant difference found between two tests at any speed, however, estimated EE from commercial treadmill pattern showed difference over 10 % when speed went over 4 mph as compared to measured EE using indirect calorimetry. Commercial treadmills seem to overestimate EE at certain speed range even though it was not statistically significant due to small sample size. Results indicate estimation of EE should consider other than body weight and treadmill speed such as % body fat, the length of the stride and individual exercise economy.

INTRODUCTION

Numerous studies have documented the dramatic rise in obesity and overweight in both adults and children in USA. Commercial treadmills provide estimates of energy expenditure during exercise. The readout on cardio machine takes your weight and exercise intensity into account when estimating how many calories you burn while working out. But many factors can affect this number including weight, body composition, fitness level, environmental conditions.

The purpose of this study was to validate the accuracy of estimated energy expenditure (EE) on commercial treadmills.

METHODS

Total 25 subjects aged 20-32yr participated in this study. Each subjects conducted two tests. First test was performed with the indirect calorimetric to calculate EE at each speed on the basis of measured O₂ consumption and CO₂ production. Second test was conducted on commercial treadmills to estimate EE using body weight and the treadmill running speed. In both tests, initial speed was 3 mph with increases of 0.5 mph every two min up to 7

mph. For data analyses, paired t-test was performed using SPSS 13.0 (SPSS Inc., Chicago, IL).

RESULTS

No significant difference was found between two tests at any speed, however, estimated EE from commercial treadmill pattern showed difference over 10 % when speed went over 4 mph as compared to measured EE using indirect calorimetric.

DISCUSSION

Commercial treadmills seem to overestimate EE at speed range between 3 to 7 mph by 30-220 kcal/h even though it was not statistically significant due to small sample size.

Results indicate estimation of EE should consider other than body weight and running speed such as the length of the stride, fitness level, and individual exercise economy.

Since EE overestimation on commercial cardio machines may cause huge discrepancy between real and estimated EE in monthly or yearly period this discrepancy should be considered in long term weight management plan.

The Effects of Engaging in Table Tennis on Visuo-Spatial Working Memory in Elderly Adults: An Event-Related Potential Study

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ABSTRACT

Exercise has been suggested to play an important role in preventing or delaying brain aging. However, few studies have considered some confounding factors such as exercise style and gender. Accordingly, the purposes of the current study were to investigate (1) the effects of engaging in table tennis on elderly adults' visuo-spatial working memory, a function which is vulnerable to aging, and (2) the influence of gender on the relation between exercise and cognition. All of the participants performed in the normal range on the Mini Mental Status Exam (MMSE), and their levels of physical activity were evaluated by using the 7-Day Physical Activity Recall questionnaire. After the screening, electrophysiological and behavioral responses of the elderly adults (n=24; male=12) who were engaged in table tennis regularly were compared with their gender- and age-matched sedentary counterparts (n=24; male=12) on a non-delayed and 1.5 s delayed matching-to-sample task. Behavioral results indicated that the exercise group and male participants showed higher accuracy compared to their counterparts; however, the female exercise group showed faster reaction time when compared to the female control group. On the other hand, the ERP data showed that the exercise group exhibited larger P3 amplitude at both the encoding stage and response stage, but no significant difference was found in P3 latency at both stages. Thus, we conclude that elderly adults could have better behavioral and electrophysiological performance via engagement in table tennis. However, such benefits could be partially influenced by gender, a factor that should be considered in future studies.

INTRODUCTION

Extensive evidence has suggested that exercise or physical activity could improve brain functions in humans, particularly later in their lives. However, there are some studies that show inconsistent findings. Such inconsistencies could be due to one or several of the following reasons: (1) the benefits of exercise on cognition are selective depending on the difficulty or

characteristics of cognitive tasks; (2) different exercise styles benefit cognitive function via different facilitative mechanisms; (3) some cognitive functions or brain development is different across genders. In the present study, we chose visuo-spatial working memory as it is more vulnerable to aging than other cognitive functions. We also tested gender difference and its influence on the relation between cognitive functions and exercise. We

hypothesized that the effect of exercise on cognitive function in elderly adults could be seen by using a visuo-spatial working memory task, and the effect might be influenced by gender.

METHODS

Participants

Twenty-four participants (male=12) aged 65-69 years who were engaged in table tennis regularly and 24 gender- and age-matched sedentary controls were invited to the present study. They first took the Mini Mental Status Exam (MMSE) to ensure they were free of cognitive impairment, and then the levels of physical activity of the qualified participants (MMSE score > 24) were evaluated on the basis of the inquiry of the 7-Day Physical Activity Recall questionnaire.

Protocol

Both of the groups participated in a non-delayed and 1.5s delayed matching-to-sample task while the behavior and event-related potentials (ERP) indices were recorded simultaneously.

Statistical Analysis

A mixed design, factorial, and repeated-measures analysis of variance was conducted for the statistical analysis of separate behavioral performance (e.g., response time and response accuracy) and event-related potentials components. Significance was set at $p < 0.05$.

RESULTS

Our results indicated that the exercise group [$F(1,44) = 18.95$, $p < .001$, partial $\eta^2 = .301$] and male participants [$F(1,44) = 6.10$, $p = .017$, partial $\eta^2 = .122$] showed

higher accuracy compared to their counterparts. The RT data showed that no main effect of group or gender was observed, but an interaction between group x gender occurred [$F(1,44) = 6.10$, $p = .017$, partial $\eta^2 = .122$]. Post hoc t-test revealed that this interaction was due to fast RT in the female exercise group than the female control group [$t(22) = -2.42$, $p = .024$]. In terms of ERPs data, the exercise group exhibited larger P3 amplitude at both the encoding [$F(1,44) = 7.73$, $p = .008$, partial $\eta^2 = .149$] and response stages [$F(1,44) = 5.62$, $p = .022$, partial $\eta^2 = .113$]; however, no significant difference for P3 latency was found at both stages.

DISCUSSION

We concluded that the exercise group had better visuo-spatial working memory performance. The facilitating mechanisms might be that the exercise group could update spatial codes and executed response better via allocating more attentional resources. These findings demonstrated that better performance during a visuo-spatial working memory task could be observed in elderly adults who are regularly engaged in table tennis. The underlying mechanism is possibly that table tennis increases the efficiency in the brain, which is reflected in the electrophysiological measures. Nevertheless, the above results can be partially affected by gender. Thus, this issue is worth being further studied.

Moderate Exercise Induced Lymphocyte Apoptosis and Might Be Associated with Increased Level of Lactate

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Int J Exerc Sci 5(1) : S51-S52, 2010.

ABSTRACT

Purposes of this study were 1) to investigate changes in lymphocyte apoptosis following three runs at different intensities, 2) to examine the exercise intensity where lymphocyte apoptosis is significantly increased, and 3) to examine whether lymphocyte apoptosis was associated with level of lactate during the exercise. Twelve healthy untrained male subjects aged 18 to 26 (20.4 ± 0.57 , *Mean \pm SE*) were recruited. After $\text{VO}_{2\text{max}}$ test, each subject performed three treadmill runs at different intensities (60%, 70%, and 80% $\text{VO}_{2\text{max}}$) randomly. Blood samples were collected at rest (Pre), immediately after (Post), and 1 h following (1 h post) each run to analyze lymphocyte apoptotic index (AI) and level of lactate (LT). AI at Post following all three runs (11.6 ± 0.49 , 16.2 ± 0.41 , and 21.2 ± 0.67 : runs at 60%, 70%, and 80% $\text{VO}_{2\text{max}}$, respectively) were significantly greater as compared to Pre (6.7 ± 0.42 , 6.7 ± 0.41 , and 7.1 ± 0.43 : runs at 60%, 70% and 80% $\text{VO}_{2\text{max}}$ respectively, $p < .0001$) and Post LT (2.87 ± 0.37 , 4.66 ± 0.38 , and 7.33 ± 0.57 mmol/L: runs at 60%, 70%, and 80% $\text{VO}_{2\text{max}}$, respectively) were also significantly higher than Pre (1.49 ± 0.19 , 1.65 ± 0.18 , and 1.42 ± 0.13 mmol/L: runs at 60%, 70%, and 80% $\text{VO}_{2\text{max}}$, respectively, $p < .001$). AI and LT at post increased in dose dependent manner to exercise intensities. The strong positive relationship between AI and LT was detected ($r = .81$). Results from this study concluded that 60% of $\text{VO}_{2\text{max}}$ exercise can significantly increase lymphocyte apoptosis. In addition, this study suggested that increased level of lactate might be associated with lymphocyte apoptosis.

INTRODUCTION

Exercise, a well-known physiological stress factor, can induce lymphocyte apoptosis. However, specific exercise intensity at which lymphocyte apoptosis can be increased significantly was still controversial. In addition, an increasing number of studies have reported that increased level of lactate can induce apoptosis. However, it has not been examined that cumulated level of lactate during the exercise was also associated with lymphocyte apoptosis or not.

Purposes of this study were 1) to investigate changes in lymphocyte apoptosis following three runs at different intensities, 2) to examine the exercise intensity where lymphocyte apoptosis is significantly increased, and 3) to examine whether lymphocyte apoptosis was associated with level of lactate during the exercise.

METHODS

Twelve healthy untrained male subjects aged 18 to 26 (20.4 ± 0.57 , *Mean \pm SE*) and $\text{VO}_{2\text{max}}$ range 42.5 to 48.2 ml $\text{kg}^{-1} \text{min}^{-1}$

($46 \pm 56 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$) were recruited. After conducting $\text{VO}_{2\text{max}}$ test, each subjects performed three treadmill runs at different intensities (60%, 70%, and 80% $\text{VO}_{2\text{max}}$) randomly. Running distance for all three runs was equivalent to 30 min run at 70% $\text{VO}_{2\text{max}}$. The test day and time were identical for each subject and had one week interval among tests. Blood samples were collected at rest (Pre), immediately after (Post), and after 1 h following (1 h post) each run.

Lymphocyte apoptotic index (AI) was evaluated under a light microscope using oil objective lens (VWR International) after stained with May-Grünwald and Gimesa (Sigma-Aldrich Inc). Level of lactate (LT) was measured with an amperometric method using an enzymatic reaction by lactate analyzer (Arkary Inc.).

All data was presented as *means* \pm *SE*. Changes over three different running trials and times were analyzed using two way repeated measures ANOVA using SPSS software program (SPSS Inc., Chicago, IL, USA). $P < .05$ was inferred to be statistically significant. If significance was indicated, significant difference location was determined by performing *post hoc* test using Bonferroni correction. The Pearson's *r* was calculated to examine the relation between lymphocyte apoptosis and level of lactate.

RESULTS

Post AI at each running trials (11.6 ± 4.9 , 16.2 ± 4.1 , and $21.2 \pm 6.7\%$: 60%, 70%, and 80% $\text{VO}_{2\text{max}}$ respectively) were significantly increased than Pre (6.7 ± 4.2 , 6.7 ± 4.1 , and $7.1 \pm 4.3\%$: 60%, 70% and 80% $\text{VO}_{2\text{max}}$ respectively, $p < .0001$) and increased in dose

dependent manner to exercise intensities ($p < .0001$). Post LT at each running trials ($2.87 \pm .37$, $4.66 \pm .38$, and $7.33 \pm .57 \text{ mmol/L}$: 60%, 70%, and 80% $\text{VO}_{2\text{max}}$ respectively) were also significantly increased than Pre ($1.49 \pm .19$, $1.65 \pm .18$, and $1.42 \pm .13 \text{ mmol/L}$: 60%, 70%, and 80% $\text{VO}_{2\text{max}}$ respectively, $p < .001$) and increased in dose dependent manner to exercise intensities ($p < .0025$). The strong positive relationship between AI and LT was detected ($r = .81$).

DISCUSSION

Results from this study concluded that exercise at 60% of $\text{VO}_{2\text{max}}$ could increase lymphocyte apoptosis significantly. In addition, this study suggested that an increase in lymphocyte apoptosis might be associated with increased level of lactate in blood. Further study will be needed to investigate the mechanism linking increased level of lactate with an increase in lymphocyte apoptosis.

A Methodology for Determining Exercise-induced Changes of Fractalkine in Lymphocyte Subsets

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ABSTRACT

Fractalkine is an adhesion molecule that facilitates the migration of lymphocytes into non-lymphoid pools. To help explain the lymphocytopenia observed in the postexercise period, we describe here a simple finger-stick methodology that can be used to quantify CX₃CR1 membrane expression in lymphocyte subsets. Whole blood is incubated with an antibody panel for 30 min, and red blood cells are lysed prior to flow cytometric evaluation. We show here that it is possible to obtain measures of fractalkine expression on the cell membranes of lymphocyte subsets following a bout of exhaustive exercise.

INTRODUCTION

The normal immune response to intense exercise is to increase lymphocyte count significantly above resting values, followed by a decrease in the postexercise period. The lymphocytopenia that ensues following exercise has been explained as either due to cell death and removal of lymphocytes by apoptosis, or to selective migration out of the circulation. Recent unpublished work in our laboratory confirms findings that exercise does not induce significant levels of early-stage lymphocyte apoptosis. To explain the decrease in lymphocyte count following intense exercise, we decided to take a measure of migration in this cell type.

Fractalkine, or CX₃CR1 in humans, belongs to the CX₃C subfamily of chemokine receptors. In the soluble form, CX₃CR1 functions as a chemotactic receptor, but when expressed on the membrane acts as an adhesion molecule for movement into the non-lymphoid pools. We hypothesized that CX₃CR1 expression would be different in lymphocyte subsets given the variable nature of the immune functions carried out by these cells. Prior to obtaining a measure of this chemokine receptor in peripheral blood, we developed a simple methodology allowing us to assess the membrane surface expression of CX₃CR1 in lymphocyte subfractions. The purpose of this abstract is to set forth our methodology for determining exercise-induced changes in lymphocyte fractalkine expression.

Table 1. Antibody panel for the determination of exercise-induced CX₃CR1 expression in immune cell subfractions.

Tube 1	Tube 2	Tube 3
CX ₃ CR1 - FITC	CX ₃ CR1 - FITC	CX ₃ CR1 - FITC
Anti Human CD4 - PE	Anti Human CD8 - PE	Anti Human CD19 - PE

CD4 = Helper T lymphocytes, CD8 = Suppressor/cytotoxic T lymphocytes, CD19 = B lymphocytes, FITC = Fluorescein isothiocyanate, PE = Phycoerythrin.

METHODS

Protocol

Whole blood is obtained using Universal Precautions by sterilizing the fingertip and puncturing the tip with an automated lancet. A sample (30 mL) is collected into a heparanized capillary tube and 10 mL each is pipetted into microcentrifuge tubes containing an antibody panel according to table 1, and allowed to incubate at room temperature in the dark for 30 minutes. Following the incubation period, tubes are centrifuged at 3000 rpm for 10 minutes. After decanting, 300 mL Red Blood Cell Lysis Buffer is added and the tubes are thoroughly vortexed before being allowed to incubate at room temperature for 15 minutes. PBS (300 mL) is added and tubes are centrifuged again as described previous. Lastly, tubes are decanted, vortexed thoroughly, and 50 mL of binding buffer is added prior to analysis by flow cytometry.

RESULTS

For the purposes of this abstract, one healthy male performed intermittent treadmill runs (alternating runs of 30-sec at max running speed and at half max speed) to exhaustion. CX₃CR1 membrane expression is displayed in figure 1.

DISCUSSION

We have described here a simple methodology for determining postexercise fractalkine expression in lymphocyte subsets. Based on this single case study it appears that exhaustive exercise has a greater influence on the cytotoxic T lymphocyte subfraction than either the helper T, or the B-lymphocyte subsets. While further study is needed to quantify the cellular response involved with CX₃CR1 expression and its contribution to lymphocytopenia following exercise, this methodology represents a minimally invasive finger-stick procedure that may increase subject participation in these investigations.

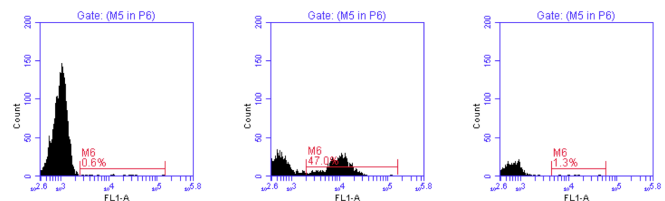


Figure 1. Left panel = CD4 lymphocytes, Middle panel = CD8 lymphocytes, and right panel = CD19 lymphocytes.

Repeated High-Intensity Anaerobic Bouts Influence Lymphocyte Migration but not Apoptosis

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ABSTRACT

Studies have shown significant changes in lymphocytes during continuous exercise, but little has been shown on the effect of repeated bouts. This study was designed to examine the effect of repeated anaerobic bouts on lymphocyte cell count, apoptosis, and migration. A series of six Wingate Anaerobic Cycle tests were performed with blood samples being attained before, immediately following, and after a designated recovery period in order to observe lymphocyte changes. Our results indicate there is a decrease in lymphocyte cell count after repeated bouts of exercise, and this is likely due to cell migration, not apoptosis.

INTRODUCTION

The immune system is one of the body's most fascinating features. It has the unique ability to protect humans from millions of pathogens, each of which possess the potential for infection and illness. Studies confirm that exercise induces considerable physiological changes in the immune system (1). One of these modulations is a change in lymphocytes and their subpopulations. Lymphocytes are white blood cells that help fight off pathogens by producing antibodies or killing pathogens directly. Studies employing continuous exercise have shown that with strenuous exercise, the cell counts of lymphocytes increase during exercise and go down in the period after the exercise bout has been ended (1).

Many athletic events require repetitive high intensity bouts of short duration. Little is

known about effects of repeated bouts of exercise on the immune system. The purpose of our study is to examine overall lymphocyte count, apoptosis, and migration of lymphocytes before, immediately after, and once returning to resting metabolic levels after repeated bouts of high-intensity anaerobic exercise.

METHODS

Three females and one male participated in the study (age = 26 ± 9 , ht = 171 ± 9 cm, wt = 71 ± 11 kg). Subjects were gathered at random and asked to sign a form of written consent that was approved by the institutional Human Subject Review Board. Participants were asked to sit quietly in a secluded room for 30 minutes without interruption to determine resting metabolic rate (RMR). RMR was calculated by taking the absolute average of the last 10 minutes. At this point, a series of Wingate Anaerobic

Cycle protocols were performed with a resistance of 0.075% of their body weight. Participants performed 2 sets of three bouts each, with 2-min between bouts and 6.75 min between sets. Prior to the end of the sixth and final Wingate bout, the face mask was secured and the subject was hooked up to the metabolic cart. Once the test was completed the subject was seated until RMR returned to resting.

Blood was obtained by finger-stick after the 30-min rest period (Pre), immediately following the final Wingate cycle bout (Post), and upon returning to the resting metabolic rate (Post Recovery). Whole blood was added to tubes containing an antibody cocktail containing markers for cell death (annexin V), cell migration (CX₃CR1), and cell phenotyping (CD4, CD8, or CD19). Samples were then incubated in a dark room for 30 minutes. They were then centrifuged for 10 minutes, decanted, and placed on the vortex for about 10 seconds. Then, red blood cell lysis buffer was added and again the tube was put on the vortex. The samples were then incubated for fifteen minutes and phosphate buffered saline was added to each sample. They were then centrifuged for ten minutes, decanted, and vortexed. The samples were then analyzed on the flow cytometer.

Data were analyzed using a one-way repeated measures ANOVA with significance accepted at $P \leq 0.05$. Post hoc analysis for main effects were determined using the Least Significant Difference option in SPSS.

RESULTS

Repeated anaerobic bouts increased the percentage of CX₃CR1 compared to rest and

postexercise recovery ($P = 0.01$, see figure 1). Overall lymphocyte count increase with exercise, and decreased following although there was not a statistical difference observed (Pre = 7995 ± 3832 , Post = 12609 ± 4765 , Post recovery = 8804 ± 2972 cells/10mL blood; $P = 0.12$). No difference in the percent of lymphocyte apoptosis was noted (Pre = $0.16 \pm 0.07\%$, Post = $0.15 \pm 0.10\%$, Post recovery = $0.17 \pm 0.06\%$; $P = 0.91$).

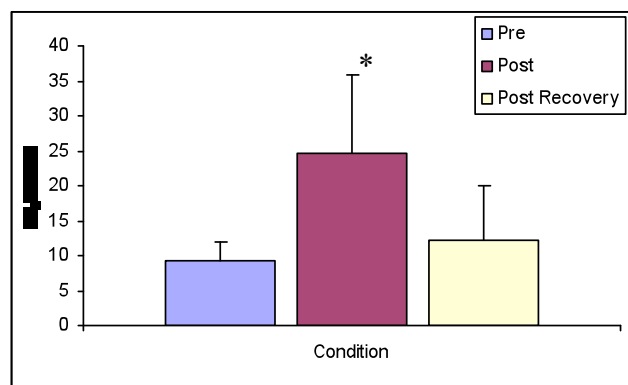


Figure 1. Lymphocyte membrane expression of CX₃CR1 before (Pre), after (Post), and following recovery (Post Recovery) in participants ($N = 4$) who completed repeated anaerobic cycle bouts. * indicates significantly greater than other conditions ($P = 0.01$).

DISCUSSION

Repeated bouts of anaerobic cycling has an effect on lymphocytes. The overall lymphocyte count increased following this type of exercise, but was not significant in our study. This is most likely to a small number of participants tested to date. The decrease in cell number following exercise has been explained as either due to an increase in cell death following exercise or the movement of these cells out of the blood stream. Our findings indicate that the observed lymphocytopenia is a result of cell

migration rather than apoptosis. Future investigations should incorporate a greater participant pool and can focus on the effect of repeated anaerobic exercise on lymphocyte subsets.

The Effect of Three Consecutive Days of Interval Runs to Exhaustion on Lymphocyte Migration in College-aged Males

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INTRODUCTION

Cells of the immune system have been shown to be modulated by exercise. The normal response in lymphocytes is that counts increase significantly following exercise and then decrease in the post exercise period to levels below resting values. One theory is that part of the reduction in observed cell number is due to the migration of lymphocyte cells out the blood stream into surrounding tissue.

Previous unpublished research from our laboratory found no significant increases in lymphocyte apoptosis, which is a type of programmed cell death, following a single treadmill run to exhaustion. One explanation for this finding may be that lymphocytes are not dying but are actually leaving the blood stream, thus reducing blood cell counts. Therefore, we hypothesized that highly intense interval runs would produce a modulatory response in fractalkine expression on lymphocyte membranes. The purpose of this investigation was to determine whether interval exercise bouts were a sufficient

stimulus to induce lymphocyte subset migration.

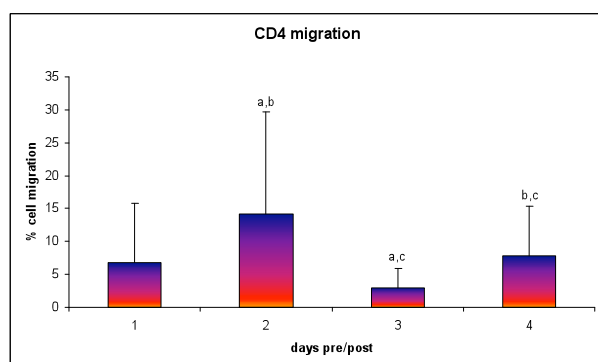
METHODS

Subjects were recruited from WKU student population, and 5 healthy college-aged males participated (age = 25 ± 3 , ht = 174.2 ± 8.6 , wt = 88.6 ± 13.5). Prior to the study, participants completed a health screening questionnaire and written informed consent. Both were approved by the institutional Human Subjects Review Board. Each participant reported to the laboratory on four separate days. On the first day a treadmill test was completed to determine maximal running speed and VO_{2max} (standardized 3-min warm-up, the test began at 6.2 mph and increased 0.6 mph every 2-min thereafter until maximal running speed and exhaustion were reached). The following week participants came three days in a row to complete an intermittent run to exhaustion (30 sec at max, and 30 sec at half of the maximal running speed). Blood was collected before exercise (PRE) and immediately following the treadmill bout (POST).

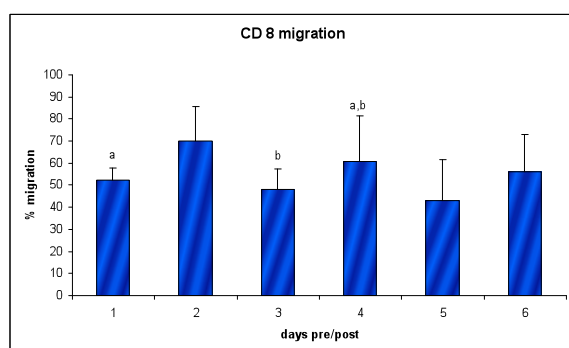
Whole blood was obtained using Universal Precautions, and was pipetted into an antibody cocktail containing CX₃CR1, and either CD4, CD8, or CD19. It incubated at room temperature in the dark for 30-min and then was centrifuged for 10 min. Red blood cell lysis buffer was added and after 15-min PBS was included. Samples were centrifuged for 10-min, decanted and analyzed on a flow cytometer.

Data were analyzed using a 1-way repeated measured ANOVA. Significance was accepted at $P \leq 0.05$.

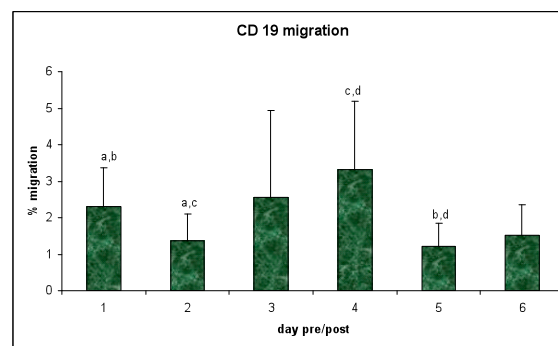
RESULTS



Test of between subjects effects for CD4 $p=0.021$. There was a significant difference between (a) day 2 post and day 3 pre exercise ($p=.043$), (b) day 2 post and day 3 post ($p=.052$), and (c) day 3 pre and day 3 post exercise ($p=.048$).



Test of between subjects effects for CD8 $p=0.001$. There was a significant difference between (a) day 1 pre and day 2 post exercise ($p=.001$), (b) day 2 pre and day 2 post ($p=.016$).



Test of between subjects effects for CD19 $p=0.000$. There was a significant difference between (a) day 1 pre and day 1 post exercise ($p=.019$), (b) day 1 pre and day 3 pre ($p=.041$), (c) day 1 post and day 2 post exercise ($p=.033$), and (d) day 2 post and day 3 pre ($p=.038$).

We observed a general increase in cell migration on day 2 of the lymphocytes. There was also a decrease in cell migration for day 3 in all three types of lymphocytes. This may be because of the body's ability to adapt over time.

DISCUSSION

Repeated intense interval exercise appears to increase the migration of lymphocytes out of the blood stream. However, the body appears to adapt after two days by decreasing the migration of lymphocytes on day three.

The cytotoxic T cells (CD8+) were the most affected by the migration receptor, where helper T cells (CD4+) and B cells (CD19+) were not as affected with migration. Helper T and B cells work together to create cytokines and antibodies, while cytotoxic T cells kill foreign cells, which might help explain why they are on the move all the time. Perhaps with the increase in intensity of exercise the body prepares itself for an influx of foreign cells through airways and attacks for other cells kept at bay by the immune system.

The Effect of Consecutive Days of Interval Running to Exhaustion on Lymphocyte Subset Count in College-aged Males

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INTRODUCTION

Research has shown that exercise significantly affects the immune system. The normal response in lymphocyte count to continuous high intensity exercise is a large increase during exercise followed by a reduction in the rest period after exercise. Overall lymphocyte count is typically reported, but it is possible that sub fractions (i.e. helper T, suppressor T, and B cells) are affected differentially with exercise.

In addition, most athletic activities consist of bouts of variable levels of intensity. It is unusual for athletic competitions to be performed at the constant workload. Also, many team sports compete or practice at changing levels of intensities for consecutive days. Therefore, evaluation of interval bouts of exercise on the immune system is important. We hypothesized that lymphocyte counts would be affected by interval runs, and that subsets would also show a differential response to this kind of exercise. The purpose of this investigation was to determine the lymphocyte subset response to interval runs to exhaustion on three consecutive days.

METHODS

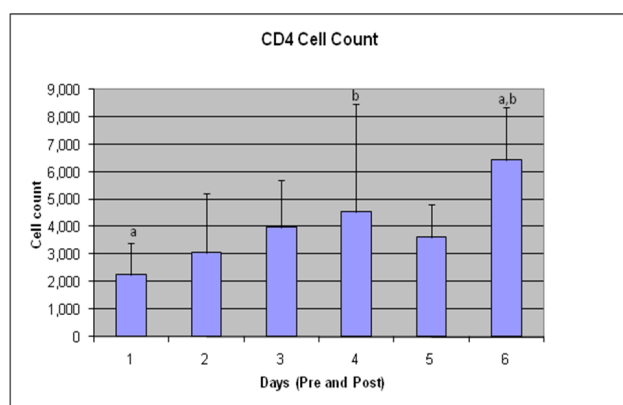
Five healthy college-aged males participated (age = 25 ± 3 , ht = 174.2 ± 8.6 , wt = 88.6 ± 13.5). Prior to participating in the study, subjects completed a health screening questionnaire and written informed consent form that was approved by the institutional Human Subjects Review Board. Each subject reported to the laboratory on four occasions. During the first session a treadmill test was completed to determine maximal running speed and VO_{2max} . Following a standardized 3-min warm-up, the test began at 6.2 mph and increased 0.6 mph every 2-min thereafter until maximal running speed and exhaustion were reached.

One week later subjects reported to the laboratory on three consecutive days to complete interval runs to exhaustion (30 sec at max, and 30 sec at half of the maximal running speed). Blood was collected before exercise (PRE) and immediately following the treadmill bout (POST).

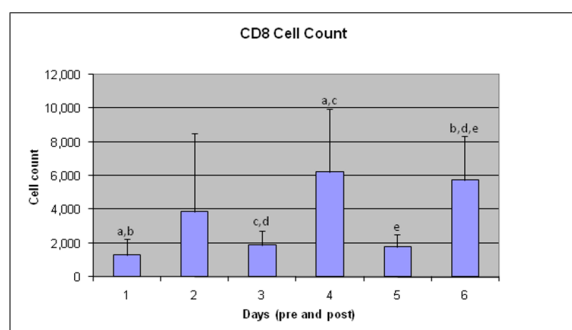
Whole blood was obtained using Universal Precautions, and was pipetted into an

antibody cocktail containing CD4, CD8, CD19, and CD45RA. It was allowed to incubate at room temperature in the dark for 30-min and then centrifuged for 10 min. After decanting, red blood cell lysis buffer was added and the solution was allowed to incubate at room temperature for 15-min. PBS was included to stop the lysis reaction, and the tubes were again centrifuged for 10-min. Following this, the sample was decanted and analyzed on a flow cytometer. Data were analyzed using a 1-way repeated measured ANOVA. Significance was accepted at $P \leq 0.05$.

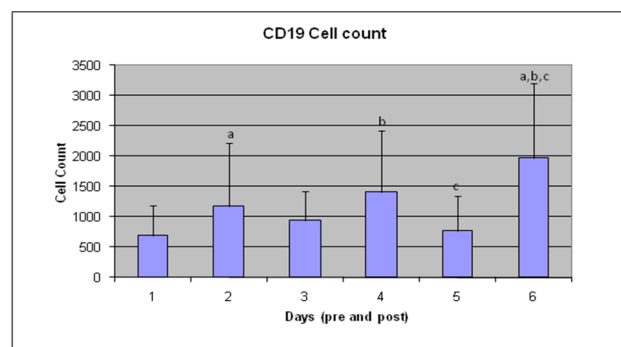
RESULTS



Pairwise comparison for CD4. Significant difference seen between (a) day 1 pre and day 3 post ($p=0.044$), (b) day 2 post and day 3 post ($p=0.020$).



Pairwise comparison for CD8. Significant difference seen between (a) day 1 pre and day 2 post ($p=0.043$), (b) day 1 pre and day 3 post ($p=0.007$), (c) day 2 pre and day 2 post ($p=0.032$), (d) day 2 pre and day 3 post ($p=0.026$), (e) day 3 pre and day 3 post ($p=0.041$).



Pairwise comparison for CD19. Significant difference seen between (a) day 1 post and day 3 post ($p=0.024$), (b) day 2 post and day 3 post ($p=0.010$), (c) day 3 pre and day 3 post ($p=0.009$).

DISCUSSION

The purpose of this investigation was to determine if three consecutive days of interval runs had an effect on immune cell count. Repeated intense interval exercise does appear to increase the overall cell count in the blood following each session. CD19 appears to be influenced earlier (after day 1) while the greatest response in T lymphocytes (CD4 and CD8) is found following the third day. It is possible that the stress of three consecutive days of intense exercise provides a signal that persists in inducing these cell volume changes. Future studies should assess potential mediators such as elevated humoral (stress hormones), and or cellular factors (cytokines).

Three Consecutive Days of Interval Runs to Exhaustion Significantly Increases CD19 Lymphocyte Apoptosis in College-aged Individuals

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Int J Exerc Sci 5(1) : S62-S63, 2010.

INTRODUCTION

Exercise has been shown to have an effect on the cells of the immune system. In particular, lymphocyte count increases significantly following exercise and then decreases in the postexercise period to levels below resting values. It has been suggested that part of the reduction in observed cell number is due to the induction of cell death (apoptosis) in these cells.

Previous unpublished research from our laboratory found no significant increases in lymphocyte apoptosis following a single treadmill run to exhaustion. The explanation for this finding may be that participants were only at a maximal level of exercise for one to two minutes at the most. Hsu et al. found that three consecutive days of treadmill running at 85% of the VO_{2max} was sufficient to induce increased levels of lymphocyte apoptosis (200?). Therefore, we hypothesized that three consecutive days of highly intense interval runs would produce a similar response. The purpose of this investigation was to determine whether

running at 30-sec intervals of maximal running speed and half-maximal speed to exhaustion on three consecutive days was a sufficient stimulus to induce apoptosis in lymphocyte subsets.

METHODS

Ten healthy college-aged individuals participated (male $N = 5$, female $N = 5$). Prior to participating in the study, subjects completed a health screening questionnaire and written informed consent form that was approved by the institutional Human Subjects Review Board. Each subject reported to the laboratory on four occasions. During the first session a treadmill test was completed to determine maximal running speed and VO_{2max} . Following a standardized 3-min warm-up, the test began at 6.2 mph and increased 0.6 mph every 2-min thereafter until maximal running speed and exhaustion were reached.

One week later subjects reported to the laboratory on three consecutive days to complete interval runs to exhaustion (30 sec

at max, and 30 sec at half of the maximal running speed). Blood was collected before exercise (PRE) and immediately following the treadmill bout (POST).

Whole blood was obtained using Universal Precautions, and 10 mL was pipetted into an antibody cocktail containing annexin V, CD45RA, and either CD4, CD8, or CD19. It was allowed to incubate at room temperature in the dark for 30-min and then centrifuged for 10 min. After decanting, red blood cell lysis buffer was added and the solution was allowed to incubate at room temperature for 15-min. PBS was included to stop the lysis reaction, and the tubes were again centrifuged for 10-min. Following this, the sample was decanted and analyzed on a flow cytometer.

Data were analyzed using a 1-way repeated measured ANOVA. Significance was accepted at $P \leq 0.05$.

RESULTS

CD19 was the only lymphocyte subset to show significant changes in apoptosis following high intensity interval exercises ($P=0.016$, see figure 1). Significant increases were observed after day one ($P=0.046$) and following the exercise bout on day 3 ($P=0.007$). While the number of apoptotic cells increased with exercise each day in CD4 and CD8 lymphocytes, these were not significant (CD4 $P=0.309$, CD8 $P=0.283$).

DISCUSSION

The purpose of this investigation was to determine if the combination of intensity, duration, and frequency was sufficient to induce cell apoptosis in specific subsets. We

found that the only subset significantly altered was the CD19, or B lymphocyte subfraction. No differences were noted for the T lymphocyte subsets (CD4 and CD8).

It is possible that the factors that increase with exercise (i.e. catecholamines, hydrogen ion, lactate, etc.) influence the B cell population differently than T lymphocytes. Future studies should investigate potential differences in membrane receptors for these factors to more fully explain the findings observed in the present study.

Increases in CD19 cell death following high intense exercise may have important consequences for the immune system. As these cells work to secrete antibodies, it is possible that humoral immunity could be compromised for a period following exercise. Future investigations should assess the time period at which an individual may be at an increased risk due to B cell immunosuppression.

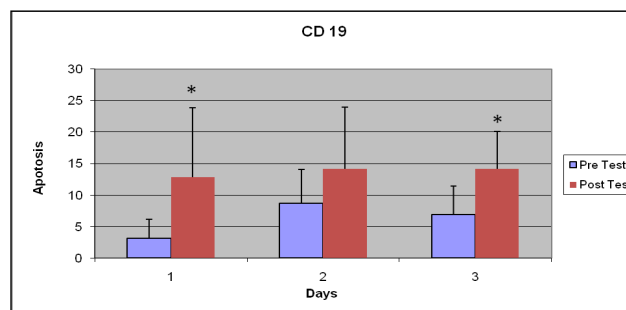


Figure 1. Annexin V binding to CD19 lymphocytes with three consecutive days of high intensity interval running to exhaustion. * denotes a significant difference compared to resting value on that day.

Interval Runs on Three Consecutive Days Affects Naïve T Migration but not Cell Count or Apoptosis

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Int J Exerc Sci 5(1) : S64-S65, 2010.

INTRODUCTION

Research has shown that maximal exercise has a significant effect on cells of the immune system. Maximal exercise is affected by two lymphocyte subfractions, helper T and cytotoxic T cells. Helper T cells are specific to CD3+/CD4+ phenotype, and cytotoxic T cells are specific to CD3+/CD8+ phenotype. Helper T cells are imperative to the function of the immune system, and protect against numerous pathogens. Cytotoxic T cells are known as killer T cells, and destroy infected cells. When naïve T cells come into contact with newly found pathogens, they create an immune response. After the disease or newly encountered pathogens are eliminated, a segment of the T cell population, which was engaged by the disease, forms a group of memory cells and act in response to the disease if it returns.

Research on the naïve T cell response is important because these cells allow the body to build immunity with new challenges. By increasing immune system strength, the body's reaction may improve in response to foreign pathogens. The

purpose of this study was to investigate naïve T cell responses to interval runs to exertion on a treadmill for three consecutive days.

METHODS

Subjects

Five female subjects were recruited to participate in this investigation. The subjects were college age ranging from 18 to 25. The Institutional Review Board on Human Subjects approved the study and informed consent was obtained prior to participation.

Procedures

Subjects were brought into the lab for an initial treadmill test to determine maximal running speed. At least one week following the initial test, the subjects returned for three consecutive days to perform a 21 stage treadmill protocol. The subjects performed at their maximum running speed for 30 seconds followed by 30 seconds at half of their maximum speed until the 21 stages were complete. Blood samples were obtained pre and post exercise.

Antibody panels with annexin V, CX3CR1, CD45RA, CD4, CD8, and CD19 were prepared to mix with the blood samples. Ten μL of whole blood were placed into microcentrifuge tubes with appropriate antibody panels and mixed thoroughly. Samples were then incubated at room temperature for 30 minutes in a dark room. After incubation the samples were centrifuged for 10 minutes, decanted in a smooth motion and vortexed. RBC lysis buffer was added and the solution was incubated again for an additional 15 minutes. Following incubation, Phosphate Buffered Saline was added. The solution was then centrifuged for an additional 10 minutes. Completed samples were then analyzed using the flow cytometer. A backflush was completed between samples to ensure purity.

Data Analysis

Data was collected and analyzed using SPSS version 17.0. A One way repeated ANOVA was used to evaluate the data. Significance was accepted at the $P < 0.05$ level.

RESULTS

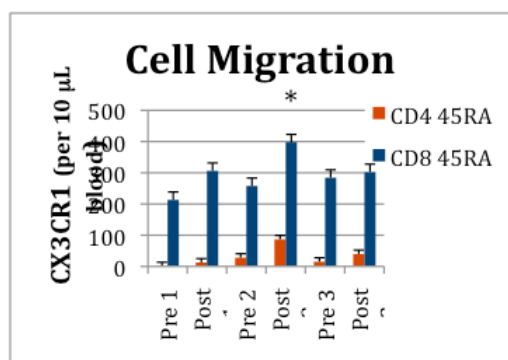


Figure 1. There was a significant difference noted between Pre 1 and Post 2 testing sessions for CD8/CD45RA cells. * significance $P=0.035$.

A significant amount of cell migration was noted ($P = 0.035$). Figure 1 shows the cell

migration between each pre and post testing session.

The mean cell counts and apoptosis values are shown in the table below. No significance was noted for count ($P=0.053$), or apoptosis ($P=0.46$).

	Pre 1	Post 2	Pre 2	Post 2	Pre 3	Post 3
Cell Count (per 10 μL blood)	1087 \pm 84	946 \pm 851	2134 \pm 149 4	964 \pm 859	1409 \pm 700	2626 \pm 632
Apoptosis (per 10 μL blood)	.67 \pm 0.8	1.50 \pm 2.1	1.17 \pm 1.9	1.00 \pm 1.2	0.33 \pm 0.5	1.00 \pm 1

DISCUSSION

The purpose of this investigation was to determine if high intensity interval runs on consecutive days had an effect on naïve T cells. Specifically, we were interested in cell count, cell death, and cell migration. Our results show that of these factors the only significant influence was on the migration of naïve lymphocytes.

Regarding migration, there was little influence on helper T cells, however cytotoxic T cell migration receptors increased significantly following the second day of treadmill testing. While the implications of this finding have yet to be determined, it is possible that the migration of naïve cytotoxic lymphocytes could have an effect on an individual's immune status following exercise of this nature. It is interesting to note that exhaustive intermittent exercise had no effect on naïve cell count or apoptosis. This may mean that the naïve cellular population is less responsive to this type of physiological challenge compared to mature lymphocytes. Future investigations should focus on underlying mechanisms.

The Relationship of Balance and Joint Proprioception in Older Adults

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ABSTRACT

The relationship of self-reported and performance-based balance and joint proprioception assessed at the hip, the knee, and the ankle concurrently has not been systematically studied. The aim of this study was to determine if a relationship exists between joint proprioception and balance in older adults. Subjects completed the Activities-Specific Balance Confidence (ABC) Scale, the Berg Balance Scale (BBS), and joint proprioception testing at the hip, knee, and ankle. Joint proprioception was assessed by digital video analysis using dedicated software (Dartfish 5.0). The ABC scale and BBS scores were correlated to the hip, knee, and ankle average error measurements using Pearson's r . The average error was determined to be the difference in a joint specific reference angle and the subject's ability to reproduce that reference angle without visual input. *Results:* As age increased, performance on the most difficult BBS tasks (#12-14) declined ($r = .38$, $p = .044$). Subjects reporting higher balance confidence on the ABC scale also scored higher on the BBS ($r = .83$, $p = .0001$). Finally, the greater the deviation from the reference angle for the knee, the greater the performance on the BBS ($r = .41$, $p = .024$). This data provides evidence that balance and joint proprioception of the knee are related. However, we were surprised to find that more error in proprioception was related to better balance. High confidence in balance is a good predictor of how a subject will perform on a balance assessment. We also confirmed that age increases, balance performance decreases.

INTRODUCTION

Balance has been shown to decrease with age, possibly a result of decreased joint proprioception [1,7,14]. Repetitive stress on the joints of the body can result in proprioceptive impairment leading to balance deficiency [9]. Interjoint coordination is essential in activities requiring high levels of balance. Fear of falling significantly influences a person's balance confidence, the confidence in the ability to maintain balance while performing activities of daily living [8]. Individuals reporting a fear of falling perform less adequately in balance

activities than those who do not have this fear [4,7]. This study is the first to assess joint proprioception of the hip, knee, and ankle simultaneously. The purpose of this study is to determine whether a relationship exists between ankle, knee, and hip proprioception and balance in older adults.

METHODS

Participants

30 subjects (65+ yrs) consented to procedures and expectations of the study. Approval from the Institutional Review Board was obtained before collecting data.

Protocol

Subjects completed the Activities-Specific Balance Confidence Scale (ABC), an individual's self-confidence in performing a specific activity [4]. Second, participants completed the Berg Balance Scale (BBS), a 14-item tool used to objectively measure balance activities using a rubric to score each item on a scale of 0-4 points [5]. Third, patients completed the proprioception joint assessment. The ankle, knee, and hip joints were assessed by the Dartfish Video Imaging program (Dartfish TeamPro 5.0, Fribourg, Switzerland), which quantified the various joint angles during proprioception tasks. For ankle proprioception, the subject sat on a table edge, and the knee was placed at a neutral angle by asking the participant to relax the leg as fully as possible. With a goniometer, the administrator passively dorsiflexed the ankle to 90 degrees for 5 seconds and the ankle was returned to neutral position. Then the subject was asked to actively return the ankle to 90 degrees and hold for 5 seconds. The angle to which the subject returned the ankle joint was termed the estimated angle. This same assessment was repeated for the knee at 45 degrees of flexion and the hip at 30 degrees of flexion. Differences between the target angle and the estimated angle for the three trials of each of the three joints were computed. These three differences were averaged together to form the average error (AE) between the target angle and the estimated angle for each joint tested.

Statistical Analysis

The AE value obtained for each joint was used when correlating proprioception angles with the balance scores to determine if there was a correlation between joint angle proprioception and balance (Statistica

8.0, Tulsa, OK.). Significance was set at 0.05.

RESULTS

As age increased, performance on the most difficult BBS tasks declined (Fig.1). Subjects reporting higher balance confidence on the ABC scale also scored higher on the BBS (Fig.2). Finally, the greater the deviation from the reference angle for the knee, the greater the performance on the BBS ($r=0.41$, $p=.024$).

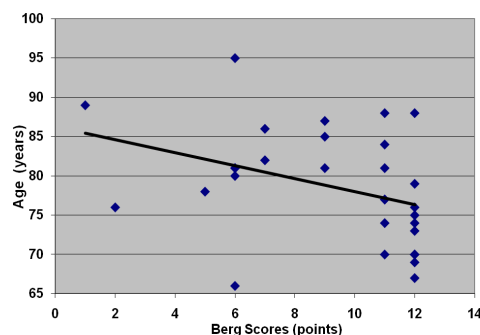


Figure 1. Berg Balance Scores on questions 12-14 correlated with age showed an inverse correlation ($r=0.38$, $p=.044$).

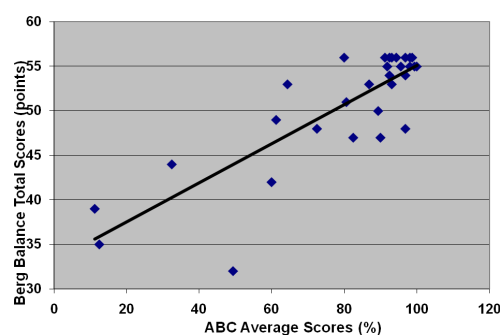


Figure 2. Berg Balance total scores in relationship with ABC Scale average percentages showed a positive relationship ($r=0.83$, $p<0.0001$).

DISCUSSION

Self-reported balance confidence is a good predictor of performance on a balance assessment. There was a negative correlation found between age and Berg

Balance questions 12-14 with older age associated with worse performance. This study found that as the average error from the target angle increased on the knee, participants scored better on the BBS. This unexpected relationship may be due to the methods for determining proprioception were more dynamic balance, whereas the BBS measures mostly static balance. Therefore, arthritis and other injuries in the knee may affect dynamic balance, but the subjects could be adapting to these problems and still performing functionally on static balance. The results of this study show that as older adults increase their balance confidence, they will score higher on balance assessments. Therefore, it may be beneficial to increase a person's balance confidence to assist with performance of more activities on the balance assessment without fear of falling. For further research, it would be beneficial to test another balance assessment that is more challenging for this population, because most of the subjects scored in the low risk category for the BBS. In conclusion, the hypothesis that there is a correlation between joint proprioception and balance was shown for the knee, but instead of a positive correlation as expected, it was a negative correlation.

Kinesiotaping®: Effects on Impact Acceleration and Plantar Pressure During Walking

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Int J Exerc Sci 5(1) : S69-S70, 2010.

INTRODUCTION

The analysis of the plantar pressure standard allows to determine excessive plantar pressures that could be indicative of an injury risk. The effects of the neuromuscular bandage “Low dye” in minimizing plantar pressures have been reported [bibliografia], however the effects of the neuromuscular bandage called Kinesiotaping®, more elastic and less compressive, have not yet been analyzed.

The objectives of this study are to analyse the effect of Kinesiotaping® during walking, specifically in 2 muscular groups: *Peroneii* and *Triceps surae*, by means of the plantar pressure standard and the acceleration registered on the tibia.

METHODS

29 healthy subjects: 12 men and 17 women (24.83 ± 3.51 years old, 1.70 ± 0.09 m y 66.2 ± 14 Kg) took part in the study. Kinesio® Tex Gold™ was applied to the muscular groups: a) *Peroneii* (right leg), and b) *Triceps surae* (left leg). Plantar pressures on both

feet were analysed using instrumented insoles (Biofoot/IBV 2001®). Each subject walked randomly, with or without Kinesiotaping®, 5 minutes at 0.73m/s (V1), and other 5 minutes at 1.3m/s (v2) on a treadmill. An uniaxial accelerometer (10G) was attached to the right leg of the subjects.

RESULTS

No significant effect of the Kinesiotaping® was found on the analysed plantar pressure parameters, as expected velocity effects were found. There was a slight increase in the foot-floor contact time during walking as well as a slight increase in the registered acceleration ($p < 0.001$). However, this was very low in scale: 3.9 and 0.6 % for V1 and V2, respectively.

DISCUSSION

The use of Kinesiotaping® applied to 2 muscular groups: *Peroneii* and *Triceps surae* had no significant effect on the analysed plantar pressure parameters. A slight increase in the foot-floor contact time with the application of the Kinesiotaping®

regardless the speed is observed when the bandage is applied. The increase in tibial acceleration with the application of the Kinesiotaping® reflects an increase in the impact during walking. However, the low magnitude of this increase, especially at the higher speed (0.6%), indicates that even though it is significant, its functional relevance is probably negligible.

Does Strain/Counter-Strain Increase Range-of-Motion in the Glenohumeral Joint With External or Internal Rotation as Determined by the Apley Scratch Test Among Collegiate Athletes?

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Int J Exerc Sci 5(1) : S71, 2010.

INTRODUCTION

This study was implemented to see if the manual therapy strain counter/strain (SCS) could increase Range Of Motion (ROM) in the GlenoHumeral Joint (GHJ) of the shoulder. Consider the analogy of a jewelry chain. When there is a kink in the chain, rather than pulling them apart, the kink is best released by first bringing the two ends of the chain toward each other. SCS works by bringing the origin and insertion of a muscle into approximation until a Position of Comfort (POC) is reached. Holding the POC for 90 seconds resets the muscle spindles and the muscle relaxes.

METHODS

Twenty collegiate athletes were used in this study. The treatment group used SCS as an intervention while the control group used resistance band exercises. The maximum increase in ROM was measured. First, the subjects were tested pre/post-intervention using the Apley Scratch Test (AST) to measure overall ROM. Second, the shoulder with the least pre-test ROM was used in the intervention. Finally, the post-test ROM was recorded. The AST places the

arm/shoulder into specific positions that involve multiple articulations and muscles of the GHJ.

RESULTS

Combined male and female subjects for the treatment group did not show a significant increase in ROM. ($p\text{-value}=0.128>0.05$). Due to unexpected anomalies in measurements, the data for the Researcher #2 Control Only Group (R2COG) and Researcher #2 Only Minus Outlier Group (R2OMOG) was reconfigured so that measurement anomalies would not impact the results.

DISCUSSION

The R2COG and R2MOG group data did show significant improvement over control (R2COG, $p\text{-value}=0.0374<0.05$), (R2MOG, $p\text{-value}=0.0108<0.05$). This initial study represents a foundation for similar studies that utilize SCS for athletic performance, rehabilitation, and the treatment of biomechanical dysfunction.

Thoracic Outlet Syndrome : Case Report

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Int J Exerc Sci 5(1) : S72-S74, 2010.

ABSTRACT

Thoracic Outlet Syndrome (TOS) is "a set of symptoms that may exist due to compression on the brachial plexus and on subclavian vessels in the region of the thoracic outlet". We use for our study a 23 years old kayaker, male, with a training program divided in winter and spring-summer session. The winter training session consists of five resistance sessions associated to one aerobic training session on kayak-ergometer or on water. The spring-summer session consists of two parts: aerobic training sessions on water and one resistance training session per week at 90% 1-RM. During spring aerobic training session the athlete feels fatigue to the upper limb during muscular effort requiring long time for recovering. On examination appear symmetrical and normal sized upper limbs with a mild bilateral triceps hypotrophy and a scalene muscle hypertrophy. Blood test values and instrumental examination (X-ray column, MRN cervical and electromyography) are normal an interesting result was obtained using dynamic phlebography assessed during Adson's manoeuvre. The Vascular Surgeon diagnosed TOS. Considering not very useful a conservative therapy we decided to put the athlete through a scalenectomy approached by supraclavicular route. After a period of rest the athlete was recommended to carry out a recovering specific training in order to gain muscular tone. Currently, after 18 months about to surgery, athlete regained muscular tone and muscle upper limbs weakness is completely regressed.

INTRODUCTION

According to Rodd and Stevenson definition (1966) Thoracic Outlet Syndrome (TOS) is "a set of symptoms that may exist due to compression on the brachial plexus and on subclavian vessels in the region of the thoracic outlet". It is possible to define three different TOS forms according to symptoms: Neurologic TOS is defined by pain, paraesthesia, loss of dexterity, muscle weakness and muscle spasm in neck and scapula region. Arterial TOS is defined by

cold, pallor, early fatigue, muscle weakness, pain in the upper extremity and inability to maintain one limb in the overhead position. Venous TOS is characterized by swelling stiffness, a feeling of heaviness and pain.

We use for our study a 23 years old kayaker, male, with a training program divided in winter and spring-summer session. The winter training session consists of five resistance sessions: two of them at 90% 1-RM, two at 70% 1-RM and one at 50% 1-RM with bench press, bench pull, lat

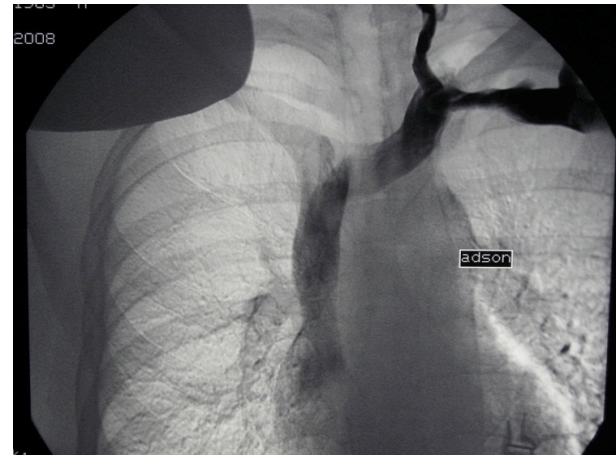
and pulley associated to one aerobic training session on kayak-ergometer or on water, depending on weather conditions. The spring-summer session consists of two parts: aerobic training sessions on water and one resistance training session per week at 90% 1-RM.

During spring aerobic training session the athlete feels fatigue to the upper limb during muscular effort requiring long time for recovering. On examination appear symmetrical and normal sized upper limbs with a mild bilateral triceps ipotrophy and a scalene muscle hypertrophy. Isoseismic pulses. PA 120/70 mmHg bilaterally, normal skin and appendages. Blood test values and instrumental examination (X-ray column, MRN cervical and electromyography) are normal except a slight rise of CK probably due to previous training sessions.



An interesting result was obtained using dynamic phlebography assessed during Adson's manoeuvre.

Considering instrumental examination results and Athlete's symptoms we were able to rule out as a diagnose cervical hernia, a moto-neuron disease or a



neuromuscular disorder; the Vascular Surgeon diagnosed TOS. Considering not very useful a conservative therapy based on medications such as muscle relaxants, tranquilizers, anti-inflammatory drugs or physical therapy program, we decided to put the athlete through a scalenectomy approached by supraclavicular route : an horizontal incision is made parallel and one fingerbreadth above the clavicle, extending from the sterno-cleido-mastoid muscle (SCM) to the anterior border of the trapezius. After platysma incision, the clavicular head of SCM is either retracted medially or incised and then repaired at the end of operation. The supraclavicular pad of fat, of varying bulk, is dissected from below upward; the omo-hyoid muscle is incised; the cervical transverse vessels may be ligated. One reaches the plane of the anterior scalene muscle; the phrenic nerve coursing obliquely on the surface of the muscle must be protected in order to perform the anterior scalenectomy. Optimally, the muscle is excised in toto from its insertion on the 1st rib to its attachments on the cervical tranverse processes. The subclavian artery and BP are exposed; BP elements are neurolyzed, ie individualized and placed on Penrose drains; any compressing element is released: cervical rib, elongated C7

transverse process, fascial band; as much of the medial portion of the middle scalene as possible should be resected.

Other operative approaches are transaxillary first rib resection (TAR) and posterior subscapular approach. After a period of rest the athlete was recommended to carry out a recovering specific training in order to gain muscular tone. Currently, after 18 months about to surgery, athlete regained muscular tone and muscle upper limbs weakness is completely regressed.

DISCUSSION

The TOS can be caused by congenital scalene hypertrophy or by an abnormal hypertrophy induced by an incorrect training technique. Aerobic training on water or on kayak-ergometer is not considered because cyclic and constantly monitored by a technician. We consider that an incorrect training technique on lat and pulley, engaging Scalene and cleido sterno mastoid, caused the hypertrophy that induced TOS.

Lactate Tolerance Test in Kayaker

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Int J Exerc Sci 5(1) : S75-S77, 2010.

ABSTRACT

This study wants to compare the physiological response to an exercise at Kayakergometer and one on the water. 10 national level athletes took part for this study. They were put through an incremental test at the beginning of the training session and at the end of that period, in order to estimate differences of lactate tolerance induced by specific training at kayak ergometer. The tests will be repeated on the water in order to estimate differences by specific training in this conditions. Compared to literature (1,2) we think that this study corroborates the similarities of the physiological stimulation both on kayakergometer and on water.

INTRODUCTION

This study wants to compare the physiological response to an exercise at Kayakergometer and one on the water. 10 national level athletes took part for this study. They were put through an incremental test at the beginning of the training session and at the end of that period, in order to estimate differences of lactate tolerance induced by specific training at kayakergometer.

The tests will be repeated on the water in order to estimate differences by specific training in this conditions.

METHODS

Participants

5 Kayakers and 5 canoeist of high qualification took part for this study, they

were 18 ± 4 years old, with a body mass of $77 \pm 8,5, 5$.

Protocol

These athletes were put through an incremental test in January with an increase of velocity every 30 seconds for considering the maximal aerobic velocity.

Data have been analyzed through VAMEVAL programme (Charlet Sylvain version 3) and was measured the heart rate at the anaerobic threshold.

2 days later athletes, after warming up, were put through a test which consists first on taking the basal blood lactate, and then 5 steps for a duration of 5 minutes each (with an interval of 30 seconds between one and another) during which we took blood lactate levels.

We used Lactate pro equipment for measuring blood lactate.

Each step is determined for each athlete relating to his heart rate reached during the incremental test and specifically in this way:

1° step -6km/h (or -9 pulse/minute) relating to threshold velocity.

2° step -4 km/h (or -6 pulse/minute) relating to threshold velocity.

3°step -2 km/h (or -3 pulse/minute) relating to threshold velocity.

4°step threshold velocity or the same CF of threshold velocity.

5°step maximal

During the first training session athletes were put through 1 training per week in order to stimulate muscle tampon system with the following training scheduled:

PAGAIERGOMETRO : 14-16 serie del programma sottoindicato

- 4 minuti al 70% della velocità aerobica massimale
- 1 minuti recupero
- 4 minuti oltre il 2-3% della velocità di soglia anaerobica
- 2 minuti recupero

In spring these test will be repeated on the river. The training on the water scheduled:

BARCA: 2 serie che prevedono 4 ripetizioni del programma di allenamento seguente con 8 minuti di pausa tra le serie

- 45 secondi oltre il 2-3% della velocità di soglia anaerobica
- 15 secondi di recupero

- 30 secondi oltre il 2-3% della velocità di soglia anaerobica
- 30 secondi di recupero
- 15 secondi oltre il 2-3% della velocità di soglia anaerobica
- 3 minuti di recupero

Statistical Analysis

Differences between exercise on kayak ergometer and training on the water will be determined using one-way ANOVA ($P < 0.05$).

RESULTS

Compared to literature (1,2) we think that this study corroborates the similarities of the physiological stimulation both on kayakergometer and on water.

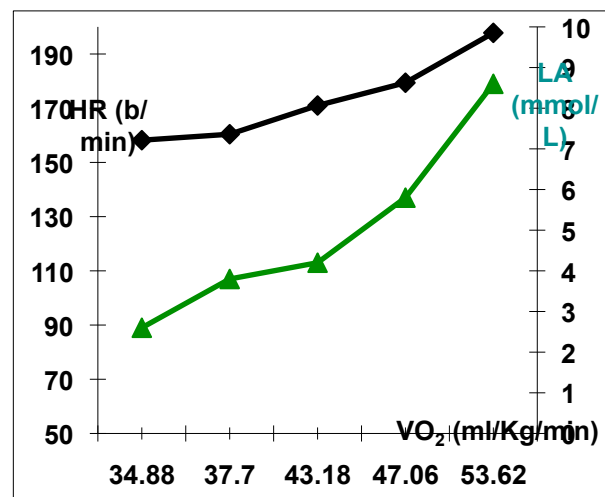


Fig.1 Before training on Kayak ergometer

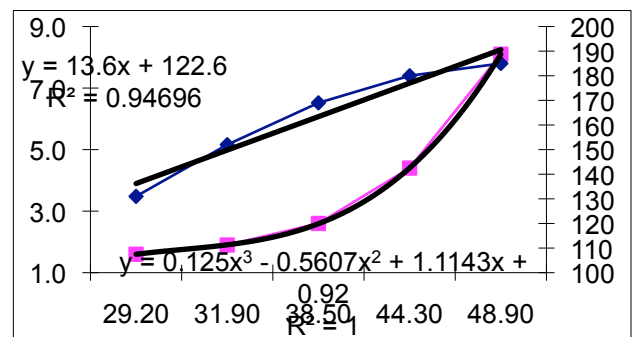


Fig.2 Post training on kayak ergometer

DISCUSSION

Because of problems with water in the river we haven't been able to repeat the experiment yet, in order to control if the suggested training is able to modify the tolerance lactate curve and if there is evidence, after specific training, of differences between the curves on kayakergometer and on the water.

We believe that we could finish this work when the river will be in good condition again and to be able to present our results for the poster presentation.

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The Effect of a Group-Mediated Cognitive-Behavioral Intervention on Dietary Choices of a Phase IV Cardiac Rehabilitation Program

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Int J Exerc Sci 5(1) : S78, 2010.

INTRODUCTION

The purpose of this investigation was to determine the effect of group-mediated cognitive behavioral interventions (GMCB) in cardiac rehabilitation on modifying behavior and diet in cardiac patients.

METHODS

Twenty-two subjects, aged 45-85 years, who were either at risk or had documented evidence of cardiovascular disease, participated in the study. The subjects were randomly divided into two groups: the treatment group (N=11; 64.2 yrs) and control group (N=11; 64 yrs), with both participating in the aerobic and strength training portion of the phase IV cardiac rehabilitation program. In addition, the treatment group attended weekly GMCB intervention sessions for 12-weeks, with active learning principles focusing on behavior modification and changing attitudes towards health. Over a 3-month period, each group completed a MEDFICTS (MF) food frequency questionnaire, 3-day

dietary recall, and MedGem (MG) resting energy expenditure (REE) testing.

RESULTS

The treatment group had significantly higher fat percent of total kilocalories, and cholesterol intake at baseline in comparison to the control group. There were no significant differences between groups for post-study data ($p < .05$). For the treatment group, significant correlations existed between MF values and weight, and both fat and saturated fat with daily attendance ($p < .05$). A significant correlation was also found in both groups in relation to the MG REE and predicted REE ($p < .05$).

DISCUSSION

Therefore, weekly cognitive-behavioral intervention sessions positively influenced nutritional choices and dietary behaviors of cardiac rehabilitation participants.

Comparison of Functional and Cardiovascular Capacity Between Elderly and Young Sedentary Women

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Int J Exerc Sci 5(1) : S79-S81, 2010.

ABSTRACT

Aging and/or sedentarism are associated with a significant decline in functional and cardiovascular capacity between elderly and young individuals. Thus, the aim of the present study was: to evaluate the functional capacity of elderly women (G_{olders}) and to compare their results with young women (G_{youngers}), both sedentary. Elderly women exhibited a lower cardiovascular capacity measured by the six minutes walk test as compared with young sedentary women ($p < 0.01$). These results were the same for the functional capacity tests ($p < 0.01$). These data serve as an alert for elderly sedentary regarding the negative effects of sedentarism associated with aging on the functional and cardiovascular capacity. Thus, elderly women should be strongly advised to practice regular exercise in order to maintain their health.

INTRODUCTION

Aging and/or sedentarism can induce an important decline in cardiovascular and functional capacity in elderly and young individuals.

Considering these limitations promoted by aging and sedentarism, without the cardioprotector effect of physical exercise older individuals can become dependent to perform simple daily living activities, compromising their quality of life and increasing the risk of mortality (Myers, 2002). Thus, the aim of the present study was: (1) to evaluate the functional capacity of elderly women (G_{olders}) and to compare their results with young women (G_{youngers}),

both sedentary, and (2) to evaluate the submaximal cardiovascular capacity with a six minutes walk test ($T_{6\text{walk}}$) in elderly women (G_{olders}) and to compare their results with young women (G_{youngers}).

METHODS

Protocol

After a selection process of 53 elderly and 20 young women 10 G_{olders} (67 ± 5 y; BMI: $26 \text{ Kg/m}^2 \pm 3$) and 10 G_{youngers} (32 ± 5 y; BMI: $24 \text{ Kg/m}^2 \pm 3$) were recruited. The following exclusion criteria were adopted: missing medical physical fitness evaluation, systolic and diastolic blood pressure $> 140/90 \text{ mmHg}$, respectively, cardiovascular, metabolic, neuromuscular and/or cognitive

Table 01. Data are means (\pm SD).

Aerobic test	G _{older} (n= 10)	G _{younger} (n=10)
T6 _{walk} (m)	496 \pm 49	654 \pm 41 *
Borg CR - 10	4 \pm 2	6 \pm 1
HR pre	71 \pm 13	78 \pm 16
HR post	106 \pm 22	114 \pm 25

Legend: HT pre = heart rate pre-exercise; HT post = heart rate post-exercise; T6_{walk} (m) = test 6 minutes walking * p = < 0,01.

problems that would limit their participation in the tests. To determine functional capacity the following tests were selected: 1) sit and stand for 30", 2) unilateral elbow flexion with 2kg dumbbell; 3) agility (Timed Up and Go); and 4) static balance with visual restriction. Submaximal cardiovascular capacity was determined by the six minutes walk test T6_{walk} (ATS - AMERICAN THORACIC SOCIETY, 2002). Additionally, heart rate (Oximeter: NONIN, Medical, Inc. EUA. 9500) and the ratings of perceived exertion (Borg CR 10) were measured.

The present study was approved by the Ethics Committee of Human Research from the Unieuro University Center n°049/2010 and all participants signed an informed consent according to Helsinki declaration.

Statistical Analysis

Statistical analysis was performed by the Student's t-test for independent samples with alpha level set at $p \leq 0.05$ (SPSS Inc).

RESULTS

Data from all functional tests indicated that sedentary elderly women exhibited inferior results as compared with young women ($p < 0.01$, table 1).

Similarly, older women also presented an inferior cardiovascular capacity as compared with young women ($p < 0.01$, table 2).

DISCUSSION

The main results of the present study revealed that elderly sedentary women present a lower functional and cardiovascular capacity than young sedentary women. Thus, elderly women should be strongly advised to practice regular exercise in order to avoid the deleterious effects of sedentarism and aging. Exercise programs and the development of facilities can encourage this population to exercise and to improve their functional and cardiovascular capacity (ACSM, 2009).

Table 02. Data are means (\pm SD)

Functional tests	G _{older} (n= 10)	G _{younger} (n=10)
Chair sit up 30 sec. (repetitions)	16 \pm 4	24 \pm 4*
Unilateral arm curl 30 sec. (repetitions)	20 \pm 2	24 \pm 3*
Agility	6,3 \pm 7	5,3 \pm 4*
Unilateral balance (sec.)	3 \pm 2	15 \pm 8*

Legend: cm = centimetres; m = metre; sec. = seconds *p < 0,01

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Comparing Muscle Strength of Elderly and Sedentary Women

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ABSTRACT

Aging process is associated with significant declines in muscle mass and muscle strength. Thus, muscle strength is an important component of physical fitness that is strongly affected by aging and inactivity. The objectives of the present study were: (1) to evaluate muscle strength of elderly women (G_{olders}) and (2) to compare the results of muscle strength between young (G_{youngers}) and elderly women, both sedentary. Elderly women presented significant lower strength levels than young women ($p < 0.01$). In conclusion, aging associated with sedentarism accelerates muscle strength loss and should be prevented with resistance training practice.

INTRODUCTION

Between physical fitness components, muscle strength has an great importance to functional capacity of elderly individuals and its decrease is associated with increased mortality (Metter, 2002).

It has been showed that the natural decrease in muscle strength observed during aging affects the performance of daily living activities and quality of life in older people.

Thus, the objectives of the present study were:

1) To evaluate muscle strength in elderly women (G_{olders}).

2) To compare their muscle strength with young women (G_{youngers}).

METHODS

Protocol

After a selection process of 53 elderly and 20 young women 10 G_{olders} (67 ± 5 y; BMI: $26 \text{ Kg/m}^2 \pm 3$) and 10 G_{youngers} (32 ± 5 y; BMI: $24 \text{ Kg/m}^2 \pm 3$) were recruited. The following exclusion criteria were adopted: missing medical physical fitness evaluation, systolic and diastolic blood pressure $> 140/90 \text{ mmHg}$, respectively, cardiovascular, metabolic, neuromuscular and/or cognitive problems that would limit their participation in the tests. Muscle strength was evaluated by the following isometric strength tests: manual prehension, lumbar traction, knee curl (hamstrings) and knee extension (quadriceps).

The present study was approved by the Ethics Committee of Human Research from the Unieuro University Center n°049/2010 and all participants signed an informed consent according to Helsinki declaration.

Statistical Analysis

Statistical analysis was performed by the Student's t-test for independent samples with alpha level set at $p \leq 0.05$ (SPSS Inc).

RESULTS

In all muscle strength tests elderly women presented inferior results as compared with young sedentary women ($p < 0.01$, table 1).

Table 01. Data are means (\pm SD).

Strength muscle tests	Elderly (n = 10)	Younger (n = 10)
MVIC quadriceps (kgs)	24 \pm 3	34 \pm 7 *
MVIC hamstrings (kgs)	8 \pm 1	14 \pm 3 *
MVIC grip strength (kgs)	19 \pm 2	26 \pm 4 *
MVIC lower back (kgs)	44 \pm 8	63 \pm 13 *

Legend: kgf = kilograms strength * $p < 0,01$.

DISCUSSION

The main findings of the present study revealed that sedentary elderly women present lower muscle isometric strength than young sedentary women. These results highlight the importance of physical exercise for elderly women, especially resistance training, which improves functional capacity in elderly women and attenuate the degenerative processes of aging. Government should stimulate the construction of resistance training facilities and invest more founding in research designed to investigate aging, improving health care of older people.

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Effects of Exercise Sequence on Strength, Speed, and Agility During Resistance Training

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INTRODUCTION

Manipulating variables in a training program (i.e. sets, reps, lifts, sequence, etc.) is designed to maximize strength and power performance (Pearson et al., 2000). Due to the complexity of designing resistance-training programs, changing one variable could potentially set an athletic team apart from others in performance.

The purpose of this study was to investigate if one exercise sequence outperformed another by comparing pre to post difference between the groups.

METHODS

This study compares two specific types of exercise sequences: traditional, which performs the prescribed exercises in a traditional or blocked manner (by completing every set of an exercise before moving to the next), and circuit, which performs the prescribed exercises in a circuit or alternating manner (by completing the first set of each prescribed exercise, then going to the second set of

each exercise.) Thirty-nine adolescent athletes from two separate high school football teams completed identical six-week resistance-training programs with the only difference being the sequence of the exercises. Each group tested pre-and post-intervention on hang clean, bench press, squat, 40-yard dash, and a 5-10-5 drill. A strength index was used to measure overall strength gained by dividing the sum of the three lifts by total body weight.

RESULTS

The results indicated that the only significant difference between groups occurred with hang clean. Significant gains in strength were made by both, circuit and traditional sequences, when comparing each exercise independently pre-to post-intervention.

DISCUSSION

These results suggest that if strength gains are desired, then either a circuit or traditional style of exercise sequence will work equally well.

Examination of Nutritional Patterns for College Students at Western

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ABSTRACT

The aim of this pilot study was to examine the nutritional patterns of female college students at Western Kentucky University. The sample consisted of 16 female students aged 18 to 30. Dietary assessment was measured over a two-month period using a self-report intake of food on a food log and a questionnaire based upon the food pyramid from the U.S. Department of Agriculture. A one-on-one intervention strategy was conducted between investigators and participants after the initial food log was completed. The results of the study show that the dietary habits of these women were positive. Participants demonstrated positive changes in their portion sizes within the food groups. The findings of the study support the need for appropriate interventions to improve the dietary intake of college age women.

INTRODUCTION

Obesity is a growing problem within the United States, especially among young adults. With the industrialized food industries flourishing so well, it is no hidden secret that an increase in the portion sizes of many food items has resulted in this problem over the years (LioRET, Volatier, Lafay, Touvier, & Maire, 2009, p.382). Koszewski and Kuo (1996), report that unhealthy eating behaviors are predominant among college women who are also susceptible to poor eating habits (p. 1286). Healthy People 2010 indicate that the "adoption by young adults of healthful food intake patterns in line with the U.S. Dietary Guidelines is an essential foundation for chronic disease prevention and maintenance of a healthy lifestyle" (Huang, Song, Schemmel, & Hoerr, 1994, p. 1144). Therefore, the objective of this study is to identify the nutritional consumption of

college female students at Western Kentucky University?

METHODS

A total of 16 female students participated in the study of which 94% were full-time and 6% was part-time. The sample was 94% Caucasian and 6% Asian. The ages ranged from 18-30. Sixty-six percent of the full-time students ate at a campus restaurant at least once a week. The one part-time participant never ate at a campus restaurant. Each participant completed a food intake questionnaire of their eating habits that was compiled from the *Fred Hutchinson Cancer Research Center* and the *Institute for Clinical and Translational Science at the University of Iowa* websites. Additionally, a 3-day food intake log was completed for two week days and a weekend day. USDA nutrition software was used to evaluate the intake.

Nutritional consultations were given to discuss participant's eating habits. At the conclusion of the consultation, each was given information packets on healthy eating. Weekly blogs were posted sharing tips on health and wellness. Weekly reminders to read the blog were sent via emails. At the conclusion of two months, another 3-day food log was completed as well as a 10 question post-survey. Descriptive statistics was used to analyze the data to identify any changes in eating behaviors of the participants. Additionally, a t-test was conducted to identify statistical significances.

RESULTS

Table 1. Descriptive Statistics for Food Log 1 (L1) and Food Log 2 (L2) (n=16)

FOOD GROUPS	L1 MEAN	L2 MEAN	L1 SD	L2 SD
Fruits	2.4	3.1	3.1	3.5
Vegetables	3.9	4.6	2.6	4.3
Grains	8.5	8.9	4.1	3.8
Meats/Beans	5.5	4.4	2.6	2.2
Dairy	3.7	2.8	2.1	2.0
Fat	8.8	7.3	4.5	3.8

Table 2. T-TEST of Differences Between L1 and L2

FOOD GROUPS	df	t
Fruits	30	0.59
Vegetables	30	0.55
Grains	30	0.28
Meats/Beans	30	1.29
Dairy	30	1.24
Fat	30	1.01

Overall, there was no statistical significance between L1 and L2. However, the analysis demonstrates that the participants showed positive changes in their intake within each food groups.

DISCUSSION

The literature on the nutritional patterns of college women is scant. Anderson, Freeman, Stead, Wrieden, and Barton (2008) state the USDA food pyramid can be an effective tool for nutritional planning because it helps individuals to recognize how much to eat in terms of portion sizes (p.375). Of the intervention strategies conducted in the study, 60% of the participants stated they benefitted from the food log, and 40% benefitted from the nutritional consultation. Overall, 80% of the participants stated they benefitted from the study because they were more aware of what they were consuming. Having more time for intervention strategies may have resulted in finding more significant differences in portion sizes. An additional study could look at over-all caloric intake and nutritional content for this population. Having a small focus group composed would offer a representative sample of the student population.

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Is The Exercise Guideline For Fat Loss Accurate?

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ABSTRACT

Exercise guidelines recommend low intensity and long duration exercise to lose body fat. However, indirect evidence indicates that moderate or moderate high intensity might be better in weight management. The purpose of this study was to investigate the exercise intensity maximizing fat loss in terms of percent max heart rate (MHR). Forty-two females aged 19-23 yrs were recruited from TAMIU. Participants performed a progressive treadmill exercise in which initial speed was three mile per hour (mph), and it was increased by 0.5 mph every two minutes until heart rate reached 90% MHR. Heart rate was detected at the end of every progressive stage. Optimal exercise intensity maximizing fat loss (fat oxidation) was between 65 to 80 percent MHR, which is higher than exercise guidelines provide. Optimal exercise intensity for females having a lower percent of body fat was between 70 and 80% MHR at a speed of 4.5 mph; however, for other females having higher percent of body fat was between 65 and 70% MHR at a speed of 3 mph. The results of this study suggest different exercise intensity guideline should be provided for the females whose percent body fat is under 30%.

INTRODUCTION

Throughout the years, preoccupation with self-image, especially physical appearance, has increased considerably; nowadays, people worry more about how they look, how overweight they are, or how fit they appear.

Recent study indicates that body composition changes are affected by the intensity of exercise training with high intensity exercise training more effectively for reducing total abdominal fat, subcutaneous abdominal fat and abdominal visceral fat in obese women (Irving et al., 2008).

Sedlock et al. (2010) reported that the higher exercise intensity was, the more excess energy expenditure required during recovery period.

It is plausible that increased carbohydrate metabolism during high intensity exercise reduces carbohydrate turn over into fat (Brooks et al., 2005).

However, there is a lot of controversy in which guidelines should we follow to obtain our ideal figure.

METHODS

Forty two females aged 19-23 years were recruited from Texas A&M International University.

Height, weight, body mass index, and % body fat with skinfold caliper were measured.

Participants performed a progressive treadmill exercise in which initial speed was three mile per hour (mph), and it was increased by 0.5 mph every two minutes until heart rate reached 90% MHR.

Heart rate was measured at the end of every progressive stage.

RESULTS

Optimal exercise intensity maximizing fat loss was between 65 to 80 percent MHR, which is higher than exercise guidelines provide.

Optimal exercise intensity for females having a lower percent of body fat (less than 30%) was between 70% and 80% MHR at a speed of 4.5 mph; however, for other females having higher percent of body fat was between 65 and 70% MHR at a speed of 3 mph.

CONCLUSION

The results of this study suggest that different exercise intensity guideline should be provided for the females whose percent body fat is less than 30%.

As a result, exercise guidelines that promote diverse exercise intensity that are used by various health centers and departments; do not give us an accurate outcome, which people follow to hopefully obtain their goal of an ideal body.

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