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### **2014 Represented Universities**

Eastern Washington University  
La Sierra University  
California State University, San Bernardino  
University of New Mexico  
Utah Valley University  
Washington State University  
Whitworth University

# **RESEARCH CRITIQUE ABSTRACTS**



# FITNESS AND QUALITY OF LIFE TO FIBROMYALGIA

A critique of the work of Ayan et al. (2007), "Relationship between aerobic fitness and the quality of life in..."  
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## PURPOSE

Fibromyalgia is an incurable syndrome that causes muscle pain, fatigue, and sleep disturbance. The purpose of the reviewed study was to find a direct link between fitness levels and quality of life in females who have fibromyalgia (Ayan, Martin, Alvarez, Valencia, & Barrientos, 2007).

## METHODS

Twenty-nine women all belonging to the Fibromyalgia and Chronic Fatigue Association (ALEFAS) with an average age of 53±9 years and with an average body mass index (BMI) of 26 were tested. Each patient answered the Fibromyalgia Impact Questionnaire (FIQ) to assess quality of life 30 minutes before taking a Six-Minute Walk Test (6MWT). Based on the distance each participant walked or how much aerobic work was done, quality of life and heart rate (HR) altered and was analyzed at each distance. Analysis was carried out with ANOVA when the Bartlett's test results revealed normal distribution or the Kuskal-Willis non-parametric test when results did not.

## RESULTS & DISCUSSION

Based on the results, there was no correlation between the quality of life and distance walked. The average distance walked was 432.8 meters and the average FIQ score was 45.7 (see Table 1). There was also no correlation found between distance walked, BMI, height or weight. Physical fitness of women with fibromyalgia had no direct link with quality of life. There was no link because the FIQ only accounted for patients who suffered cardiorespiratory problems. Although exercise was a helpful way to rehabilitate those with fibromyalgia, its effects had no direct correlation with improvement of fibromyalgia based on the tests taken.

Average Values For All Measurements								
Test	HR1	HR2	FAT1	FAT2	DYS1	DYS2	6MWT	FIQ
Mean	85.9	102.6	3.0	4.1	2.0	3.3	432.7	47.5
(SD)	(12.7)	(12.1)	(2.6)	(3.2)	(2.0)	(2.2)	(61.2)	(18.9)
Range	66-113	82-131	0-8	0-10	0-7	0-8	282-568	0-73

Table 1. HR, dyspnoea (DYS), fatigue (FAT), 6MWT, and FIQ were tested.

## CRITIQUE

The study found that there was no link between fitness levels and quality of life. A strength of the study was the use of only females who have fibromyalgia which provided more conclusive data and less variables. A weakness of the study was the use of the Six-Minute Walk Test because it was more sensitive to patients who had cardiorespiratory sensitivities. Future studies should account for the Six-Minute Walk Test and its sensitivity to patients with bronchopathy or cardiopathy because the test measured cardiovascular adaptation to effort.

## REFERENCE

Ayan, C., Alonso-Cortes, B., Alvarez, M. J., Valencia, M., & Barrientos, M. J. (2007). Relationship between aerobic fitness and quality of life in female fibromyalgia patients. *Clinical Rehabilitation*, 21, 1109-1113.

# AGING DECREASES CELLULAR RESPONSE

A critique of the work of Morrison et al. (2005), "Aging reduces responsiveness to BSO and heat stress-induced..."  
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## PURPOSE

Aging may decrease an organism's ability to cope with oxidative stress such as heat because of the accumulation of damaged proteins and the reduction of antioxidants in the body. The purpose of the reviewed study was to analyze oxidative stress and overall cellular redox hemostasis on young and old male rats (Morrison, Coleman, Aunan, Walsh, Spitz, & Kregel, 2005).

## METHODS

Forty-Eight male rats in two age groups: young (six months) and old (24 months) participated in the study. There were 12 young and 12 old male rats treated with Buthionine sulfoximine (BSO) to reduce the concentration of liver glutathione (GSH). The rest of the young and old male rats were treated with saline (control group). Both groups were subjected to heat stress for 90 minutes. The liver tissues were collected and analyzed for different liver biological activities (see Table 1). Data was analyzed using analysis of variance (ANOVA) to determine differences among age groups and variations from the control.

Liver Biological Activities Investigated	
• Glutamate Cysteine Ligase (GCL)	• Catalase Activity (CA)
• Glutathione Activity (GSH)	• CuZn Superoxide Dismutase Activity (CuZn SDA)
• Glutathione Disulfide (GSSG)	

Table 1. Aged and young male rats' liver tissue was collected and used for different biological activity analyses.

## RESULTS & DISCUSSION

Liver tissue biological activities were analyzed for differences. Treatment with BSO caused a significant ( $P < 0.05$ ) decline in GCL activity, which appeared to affect liver GSH in young rats more than old rats. The young rats appeared to be more sensitive to cellular response than the old rats possibly due to more extensive depletion of GSH observed in young BSO-treated rats. The large fluctuations in antioxidant enzyme activity observed in this in vivo study also strongly suggested aged animals were lacking antioxidant enzyme activity.

## CRITIQUE

Compared to the young rats, the aged rats showed less cellular response to oxidative stress because there is a reduction in GSH influenced antioxidant enzyme activity. A strength of the study was that it was the first in vivo study to demonstrate the inhibition of GCL by BSO, which exhibited great variability of cells compared to in vitro experiments. A weakness of the study was that it lacked a control group of rats with no treatment before heat stress since both groups were treated with either BSO or saline. Future research should include lipid analysis to extend the scope of the study.

## REFERENCE

Morrison, J., Coleman, M., Aunan, E., Walsh, S., Spitz, D., & Kregel, K. (2005). Aging reduces responsiveness to BSO- and heat stress-induced perturbations of glutathione and antioxidant enzymes. *The American Physiological Society Journals*, 289, R1035-R1041.

# MOBILE APP TO COPE WITH POST-TRAUMATIC STRESS

A critique of the work of Kuhn et al. (2014), "Preliminary evaluation of PTSD coach, a smartphone app for ..."  
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## PURPOSE

Since the use of smartphones is expected to continue to grow in the future, mobile apps may potentially help mental health conditions such as post-traumatic stress disorder (PTSD). The purpose of the reviewed study was to evaluate the satisfaction with a mobile app, PTSD Coach, based on responses from a sample of veterans with PTSD (Kuhn, Greene, Hoffman, Nguyen, Wald, Schmidt et al., 2014).

## METHODS

Forty-five veterans with PTSD (34 men and 11 women) participated in the study. Participants were divided into smartphone owners, non-owners, and age groups. Non-owners were loaned an iPod Touch installed with PTSD Coach. Participants were exposed to the core features of the app for three days, then completed a self-report survey and participated in a 60-minute focus group about use and perceived value of the app. Survey data was summarized using descriptive analyses, Pearson correlations, and *t*-tests.

## RESULTS & DISCUSSION

The acceptability and perceived helpfulness of PTSD Coach as a self-management tool for veterans with PTSD was supported. The majority of participants (69-91%) indicated that they were moderately to extremely satisfied with the app, because it was convenient and easy accessible. The summary of the survey rating on helpfulness ranged from 2.27 to 2.91 (see Table 1). Both smartphone owners and non-owners had similar perceptions of PTSD Coach. Age did not relate to participants perceptions of the app. The focus group data provided evidence that PTSD Coach was helpful and educational.

### Summery of Self-reporting Survey Data

• Learn symptoms and treatments of PTSD	2.51
• Overcome the stigma of seeking mental health	2.27
• Enhancing knowledge of PTSD	2.91
• Track symptoms	2.80

Table 1. Forty-five veterans with PTSD rated survey items from 0-4 (not helpful to extremely helpful).

## CRITIQUE

Overall, the study showed participants were moderately to extremely satisfied with the mobile app. A strength of the study was that the entire experiment was quick to determine and evaluate feedback from participants. A weakness of the study was a small sample size, which may have resulted in insufficient power to detect actual differences between groups. Future research should include clinical assessed PTSD tests rather than only focusing on self-reporting to extend the scope of the study.

## REFERENCE

Kuhn, E., Greene, C., Hoffman, J., Nguyen, T., Wald, L., Schmdt, J., Ramsey, K., & Ruzek, J. (2014). Preliminary evaluation of PTSD coach, a smartphone app for post-traumatic stress symptoms. *Military Medicine*, 179(1), 12-18.

# AQUATIC TRAINING FOR MULTIPLE SCLEROSIS

A critique of the work of Kargarfard et al. (2012), "Effect of aquatic exercise training on fatigue and health..."  
A. H. Flint – [aflint14@my.whitworth.edu](mailto:aflint14@my.whitworth.edu) – Whitworth University

## PURPOSE

Participating in consistent and regular exercise may result in lowered levels of fatigue and higher levels of health-related quality of life for individuals with multiple sclerosis (MS). The purpose of the reviewed study was to examine the effectiveness of aquatic training for patients with multiple sclerosis (Kargarfard, Etemadifar, Baker, Mehrabi, & Hayatbakhsh, 2012).

## METHODS

In this study, 21 women with MS were randomly assigned to a control group or experimental group. Participants in the experimental group completed an aquatic exercise program (see Table 1). Both groups completed the Modified Fatigue Impact Scale (MFIS) and Multiple Sclerosis Quality of Life-54 (MSQOL-54) questionnaire at baseline, four weeks, and eight weeks. Independent samples *t*-tests were used to compare characteristics of the exercise and control groups at the onset of the study. A series of repeated-measures analysis of variance (ANOVA) assessed differences that occurred in the exercise group in relation to time.

Aquatic Exercise Training Program	
Duration	Session Details
-8 week program	-10 min. warm-up
-3 sessions per week	-40 min. exercise
	-10 min. cool-down

Table 1. Session intensity was prescribed at 50% to 75% maximal heart rate reserve.

Results After Completion of Eight Week Program		
Characteristics	Control	Exercise
MFIS - Overall	60.8 ± 9.0	32.3 ± 6.4
MSQOL-54 -Physical	44.2 ± 4.4	65.4 ± 6.6
MSQOL-54 -Mental	43.6 ± 8.9	70.2 ± 5.7

Table 2. Results posted include means and standard deviations recorded at the conclusion of the study.

## RESULTS & DISCUSSION

Means and standard deviations for MFIS and MSQOL-54 for both groups are shown (See Table 2). The MFIS – Overall score was 47% lower for the exercise group compared to the control group, and MSQOL-54 – Physical and Mental scores were 67% and 62% higher respectively. Reduction in MFIS scores and increase in MSQOL-54 scores could be attributed to the intervention of regular aquatic exercise over an eight week period. The findings suggest that the buoyant properties of water might have decreased the effects of gravity, and allowed individuals with MS to endure longer periods of physical activity.

## CRITIQUE

The intervention of regular aquatic exercise over eight weeks significantly improved participant's MSQOL-54 and MFIS scores. The extensive inclusion criteria for participants was a strength of the study design because it established a health baseline for all participants, and ensured their safety during the study. The fact that all participants were female may have limited the findings of the study. Future research should include male participants and land based training to examine what type of exercise is most effective for individuals with MS.

## REFERENCE

Kargarfard, M., Etemadifar, M., Baker, P., Mehrabi, M., & Hayatbakhsh, R. (2012). Effect of aquatic exercise training on fatigue and health-related quality of life in patients with multiple sclerosis. *Archives of Physical Medicine and Rehabilitation*, 93(10), 1701-1708.



# ENERGY EXPENDITURE AND AMPUTATION LEVEL

A critique of the work of Jeans et al. (2011), "Effect of amputation level on energy expenditure during..."  
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## PURPOSE

Lower-extremity amputations in the pediatric population may lead to an increase in oxygen cost (VO<sub>2</sub> cost), heart rate (HR), and a decrease in self-selected walking velocity during overground walking. Individuals may be affected differently depending on the location of their amputation. The purpose of the reviewed study was to determine how the location of amputation in children influenced VO<sub>2</sub> cost, HR, and self-selected speed of walking (Jeans, Richard, & Karol, 2011).

## METHODS

In this study, 66 children with an amputation, aged 4-19 years, participated in metabolic testing. Participants' amputations were classified as one of the following (see Table 1). Participants' HR was recorded over a 5-minute seated resting period. Next, participants walked for 10 minutes at a self-selected velocity around a 40-m loop. The following measurements were taken during the walking portion: VO<sub>2</sub> cost (ml/kg/m), HR (bpm), and self-selected walking velocity (m/min). Means of the five amputation types were compared using a one-way analysis of variance.

Participants	
Type of Amputation	#
<b>Unilateral</b>	
Syme Amputation (SA)	29
Trans tibial Amputation (TA)	13
Knee Disarticulation (KD)	14
Transfemoral Disarticulation (TD)	5
Hip Disarticulation (HD)	5

Table 1. Participants were classified as one of the above types of amputation.

Data From Resting State and 10 Minute Walk					
Amputation	SA	TA	KD	TD	HD
<b>Resting</b>					
HR	96±14	96±16	94±12	100±13	100±22
<b>Walking</b>					
VO <sub>2</sub> Cost	105±25	110±18	122±14	151±31	161±55
Velocity	95±13	97±8	92±10	80±13	72±14
HR	103±13	105±16	107±19	117±12	124±21

Table 2. Results posted included means and standard deviations recorded while resting and walking.

## RESULTS & DISCUSSION

Means and standard deviations for each amputation classification are shown in Table 2. When comparing VO<sub>2</sub> cost between amputation levels, TD and HD groups had a greater VO<sub>2</sub> cost than other amputation levels. Both the TD and HD groups recorded significantly slower walking velocities. When comparing SA and HD, HR was significantly higher in the HD group. A possible explanation for these findings was that an above the knee amputation decreased walking efficiency and thus required more energy and resulted in an elevated HR.

## CRITIQUE

The level of amputation in participants was shown to have an influence on VO<sub>2</sub> cost, walking velocity, and HR. The inclusion of five amputation levels and the diversity of data collected was a strength of the study. Participants choosing the velocity at which they walked may have influenced the findings of the study due to their personal preference and not their physical ability. Future research should control participants' walking velocity with the use of a treadmill.

## REFERENCE

Jeans, K., Browne, R., & Karol, L. (2011). Effect of amputation level on energy expenditure during overground walking by children with an amputation. *The Journal of Bone & Joint Surgery*, 93(10), 49-56.

# RESULTS OF RECOVERY SLEEP POST-RESTRICTION

A critique of the work of Pejovic et al. (2013), "Effects of recovery sleep after one work week of mild sleep..."  
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## PURPOSE

The effects of sleep restriction include increases in interleukin-6 levels (IL-6), subjective sleepiness levels (SS) and sleep latency (SL), as well as decrease psychomotor performance. The purpose of the reviewed study was to assess the effects of a recovery sleep period on IL-6, sleepiness, and performance after a five-day period of mild sleep restriction (Pejovic et al., 2013).

## METHODS

Sixteen men and 14 women (normal sleepers, ages 18-34) participated in a 13-day sleep experiment. The experiment was divided into three periods; four nights of eight hours sleep (Baseline), six nights of six hours sleep (Restricted), and three nights of 10 hours of sleep (Recovery). The schedule was designed to mimic the sleep pattern of a typical workweek. See Table 1 for administered tests. Data was analyzed using linear mixed effects models ( $p < 0.05$ ).

Tests Administered For Sleep Variables		Test Results For Differences Between Periods		
Test	Variable	Variable	Baseline-restricted	Baseline-recovery
Blood Sampling	IL-6 levels	IL-6 pg/mL	-0.90 ± 0.41	0.02 ± 0.34
Multiple Sleep Latency Test (MSLT)	Sleep latency (SL)	SL (min)	3.78 ± 0.91	-2.50 ± 0.90
Stanford Sleepiness Scale (SSS)	Subjective sleepiness	SS	-0.96 ± 0.18	0.24 ± 0.12
Psychomotor Vigilance Task	Performance			

Table 1. Testing was administered on the fourth, 10<sup>th</sup> and 13<sup>th</sup> days of the study for all sleep variables.

Table 2. Data present: Means ± standard error for difference of the mean between sleep periods for measured variables.

## RESULTS & DISCUSSION

The restricted period resulted in increased IL-6 levels, increased SS, decreased average daily sleep latency, and a decrease in all variables measuring performance (baseline:  $2.9 \pm 0.4$ , restricted:  $3.96 \pm 0.6$ ). After the recovery period, IL-6 levels returned to baseline level, and SS and average daily SL returned to a level below that of baseline. Performance levels did not improve significantly after recovery (recovery:  $4.3 \pm 0.6$ ), indicating that though sleepiness, fatigue, and IL-6 improved after the recovery period, it was not long enough to improve performance levels. See Table 2 for test results.

## CRITIQUE

The study showed that two days of increased sleep reverses most of the effects of a five-day sleep restriction, but not that of decreased performance. By using a focused sample group and by setting the subjects up to be their own controls, there was very little between-subject variation, and the power of the study was high. However, the study focused only on a narrow range of subjects, and so might not represent findings for the normal population. Future studies should include older subjects and variable recovery periods.

## REFERENCE

Pejovic, S., Basta, M., Vgontzas, A. N., Kritikou, I., Shaffer, M. L., Tsaousoglou, M., ... Chrousos, G. P. (2013) Effects of recovery sleep after one work week of mild sleep restriction on interleukin-6 and cortisol secretion and daytime sleepiness and performance. *American Journal of Physiology-Endocrinology and Metabolism*, 305, E890–E896. doi:10.1152/ajpendo.00301

# BRACING AFTER ACL RECONSTRUCTION SURGERY

A critique of the work of Dai et al. (2012), "Anterior cruciate ligament reconstruction in adolescent patients..."  
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## PURPOSE

Rates of re-injury after anterior cruciate ligament (ACL) reconstruction surgery are high in adolescents and the use of knee braces has been a proposed method of prevention. The purpose of the reviewed study was to investigate the effects of functional bracing on limb asymmetries in post-ACL reconstruction adolescents (Dai, Butler, Garrett, & Queen, 2012).

## METHODS

Twenty-three adolescent high school and college athletes that underwent ACL reconstruction surgery approximately six months prior to the study were allowed to participate. The participants underwent five trials of a 35° side-cutting task on both the surgical and nonsurgical legs with and without a knee brace. Segmental motion and ground-reaction forces were tracked using retro-reflective markers and embedded force plates. Repeated-measures analysis of variance and Tukey post hoc testing were used to determine significant differences between limbs.

## RESULTS & DISCUSSION

Bracing on the surgical limb increased the initial knee flexion velocity, prevented extension during ground contact, and decreased cutting speeds (see Table 1). Kinetic asymmetries between the surgical and nonsurgical limbs persisted in both the braced and nonbraced conditions. Bracing had no significant effect on ground-reaction force asymmetries between the surgical and nonsurgical limbs. The persistence of the kinetic asymmetries was possibly due to strength deficits, altered neuromuscular control, or cautious movements caused by fear of re-injury.

**Effect of Bracing on the Mean ± Standard Deviations of Kinetics for Surgical and Nonsurgical Limbs**

Kinetic Variables	Surgical Nonbraced	Nonsurgical Nonbraced	Surgical Braced	Nonsurgical Braced
Knee flexion velocity at initial contact (deg/sec)	-40.2 ± 168.0	41.6 ± 163.5	42.4 ± 108.4	55.9 ± 149.2
Impact vertical ground reaction force (weight)	2.6 ± 0.5	2.8 ± 0.6	2.5 ± 0.5	2.8 ± 0.6
Cutting Speed (m/sec)	3.6 ± 0.5	3.5 ± 0.5	3.5 ± 0.6	3.4 ± 0.5

Table 1. Knee flexion velocity, ground-reaction forces, and cutting speed were measured to examine how bracing affected asymmetries between the surgical and nonsurgical limbs.

## CRITIQUE

The kinetic asymmetries between the surgical and nonsurgical limbs persisted despite the use of functional knee braces. The use of both retro-reflective markers and embedded force plates ensured high accuracy for knee angle and ground-reaction force measurements. The study neglected to test subjects with different amounts of post-surgery recovery time, which may have limited the significance of the data. Future research should investigate whether asymmetries between limbs decrease after longer recovery times post-surgery.

## REFERENCE

Dai, B., Butler, R. J., Garrett, W. E., & Queen, R. M. (2012). Anterior cruciate ligament reconstruction in adolescent patients: Limb asymmetry and functional knee bracing. *The American Journal of Sports Medicine*, 40(12), 2756-2763.

# EFFECT OF SURFACE FRICTION ON ACL INJURY RISK

A critique of the work of Dowling et al. (2010), "Shoe-surface friction influences movement strategies during a..."  
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## PURPOSE

Most anterior cruciate ligament (ACL) injuries occur in non-contact situations. Specific biomechanical factors during foot-ground impact can predict ACL injury risk. The purpose of the reviewed study was to investigate the effect of shoe-surface friction on the biomechanical factors that lead to increased ACL injury risk (Dowling, Corazza, Chaudhari, & Andriacchi, 2010).

## METHODS

The study included 11 male and 11 female intramural level athletes, ages 20 to 26 years, who participated in sports with sidestep cutting maneuvers. The subjects underwent five trials of a 30° sidestep cutting task on their dominant legs on high and low friction surfaces. Full body kinematics were collected during the trials with a markerless motion capture system and force plates. Data was analyzed using paired 2-tailed Student *t*-tests.

## RESULTS & DISCUSSION

Changing the friction level of the cutting surface resulted in changes to the subjects' body kinematic strategies. The high friction surface caused several biomechanical changes associated with an increased risk for ACL injury. Subjects cutting on the high friction surface exhibited lower knee flexion angles, lower knee flexion moments, higher knee valgus moments, and centers of mass further from the cutting limbs (see Table 1). Changes in body kinematics between the high and low friction surfaces may have been due to the anticipation of the surface change or instinctual adaptations.

**Effects of Surface on Means ± Standard Deviations of Body Kinematics During Cutting Maneuvers**

Kinematic Variable	Low Friction Surface	High Friction Surface
Knee Flexion Angle (degrees)	23.38 ± 7.6	20.60 ± 8.3
Knee Flexion Moment (%Body Weight X Height)	5.80 ± 2.4	3.39 ± 1.6
Knee Valgus Moment (%Body Weight X Height)	1.10 ± 1.1	-0.10 ± 1.8
Medial Distance Center of Mass (%Height)	9.18 ± 2.0	10.42 ± 2.0

Table 1. Knee flexion angles, knee flexion moments, knee valgus moments, and the medial distance centers of mass were measured to examine the effect of surface friction on body kinematics.

## CRITIQUE

Cutting maneuvers on high friction surfaces exhibited more body kinematic strategies associated with an increased risk for ACL injury. The use of the markerless motion capture system and force plates strengthened the study by ensuring accurate body kinematic measurements during the cutting maneuvers. However, the study only tested two different surfaces and one type of athletic shoe, which may have limited the significance of the data. Future research should test the effects of several different athletic ground surfaces and different types of athletic footwear.

## REFERENCE

Dowling, A. V., Corazza, S., Chaudhari, A. M. W., & Andriacchi, T. P. (2010). Shoe-surface friction influences movement strategies during a sidestep cutting task: Implications for anterior cruciate ligament injury risk. *The American Journal of Sports Medicine*, 38(3), 478-485.

# ALERTNESS AFTER A NIGHT OF LIGHT DRINKING

A critique of the work by Kruisselbrink et al. (2006), "Physical and psychomotor functioning of females the..."  
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## PURPOSE

The acute and lasting effects of binge drinking alcohol are widely studied, known and include the loss of short-term memory, motor function and decision making. The purpose of the reviewed study was to test physical and psychomotor competency of college females after a night of non-binge beer drinking (Kruisselbrink, Martin, Megeney, Fowles, & Murphy, 2006).

## METHODS

Twelve college females (age  $22 \pm 2.8$  years), who consume several alcoholic drinks ( $5.71 \pm 1.97$ ) weekly ( $1.98 \pm .96$  days), were given controlled amounts of alcohol (see Table 1). Tests were conducted seven and a half hours after the last drink, at which blood alcohol volume reached zero. Severity of participants' hangover symptoms were measured with respect to grip strength, rate of perceived effort (RPE) for sub-maximal and maximal treadmill bouts, and timing and accuracy of responses to a series of multiple choice questions. Alcohol type, amount, timing of consumption, and pre-drinking meal were modeled after a night of North American low-moderate drinking standards. Test results were based on the zero beer control amount and analyzed using repeated measures analysis of variance with significance set at  $p \leq 0.05$ .

	Controlled Results			
	Zero Beers (0B)	Two Beers (2B)	Four Beers (4B)	Six Beers (6B)
Severity of Total Hangover Symptoms	3.83 ( $\pm 3.74$ )	7.08 ( $\pm 6.84$ )	7.25 ( $\pm 5.46$ )	14.25
Mean RPE of Maximal Treadmill Phase	17.7	17.1	17.9	17.4
Mean Psychomotor Response Errors	0.42	0.83	1.33	1.92

Table 1. Participants consumed each of the controlled conditions over four separate trials; beers were 11.5 oz. each at 5% alcohol by weight, spaced by 30 and 40 minute intervals.

## RESULTS & DISCUSSION

All groups report a significant increase of hangover symptom severity, RPE on the maximal exhaustion treadmill stage, and psychomotor response errors in correlation to increased alcohol consumption (see Table 1). Grip strength, RPE of the sub-maximal treadmill bout and response time of the psychomotor test showed no significant difference in any of the control conditions.

## CRITIQUE

After a night of light to moderate drinking, college females experienced a minimal decrease in psychomotor capacity. A major strength of the study was including the rigorous treadmill test which measured the post-alcohol effects over multiple situations. The post-alcohol effects could have been further measured by including a short-term memory test. Additionally, with a small, restricted sample size, the study was limited in statistical significance. Future studies would benefit from a short-term memory assessment that modeled the work capacity of an entry level customer service position, as well increasing the cohort size, age range and drinking habits.

## REFERENCE

Kruisselbrink, D. L., Martin, K. L., Megeney, M., Fowles, J. R., & Murphy, R. J. L. (2006). Physical and psychomotor functioning of females the morning after consuming low to moderate quantities of beer. *Journal of Studies on Alcohol*, 67(3), 416-420.

# INTERVAL TRAINING AND ENERGY EXPENDITURE

A critique of the work of Paoli et al. (2012), “High-Intensity Interval Resistance Training (HIRT) influences...”  
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## PURPOSE

Lack of time is an inhibitor to physical activity. Research suggests that short periods of high-intensity interval resistance training (HIRT) may increase metabolic rate more than longer periods of traditional training (TT). The purpose of the reviewed study was to determine the effects of HIRT and TT on resting energy expenditure (REE) and respiratory ratio (RR; Paoli et al., 2012).

## METHODS

Seventeen active males (age 23-32) participated in the two-week cross-over study. Basal REE and RR were measured each morning and 22 hours after exercise sessions from maximal oxygen uptake values and blood lactate levels, respectively. The 30-min HIRT sessions required 10-12 repetitions separated by 20-sec rest intervals at 65-70% of subjects’ one repetition maximum (1-RM), with 2.5-min rest between sets. Hour-long TT sessions consisted of four sets of eight resistance exercises at 70-75% of each subject’s 1-RM. A one-way analysis of variance was used to determine the significance of measured REE and RR values, with *p* set at 0.05.

## RESULTS & DISCUSSION

Both training protocols produced significantly higher REE levels 22 hours post-exercise (see Table 1). The REE levels increased 23% post-HIRT, compared to a 5% increase post-TT. The HIRT produced high lactate levels in the blood and required large metabolic demands, which likely yielded the significant increase in REE post-HIRT over TT. The RR levels significantly decreased 22 hours post-HIRT but were not significant post-TT. The post-HIRT RR ( $0.798 \pm 0.01$ ) could suggest greater lipolysis throughout the day.

	Energy Expenditure Rates			
	TT (initial)	TT + 22 hours	HIRT (initial)	HIRT + 22 hours
REE	1901 ± 93	1999 ± 89	1910 ± 90	2362 ± 118
RR	0.826 ± 0.009	0.822 ± 0.008	0.827 ± 0.006	0.798 ± 0.01

Table 1. The rate ± standard deviations of Kcal/day burned before and 22 hours post training.

## CRITIQUE

The results of the study support the hypothesis that HIRT increases metabolism at a greater rate than TT does. The cross-over design employing HIRT-trained active males contributed to the strengths of the study. While useful for trained subjects, the HIRT protocol might be inapt or harmful for inactive, untrained individuals. One weakness of the study is that it assumes post-exercise oxygen consumption increases in order to replace oxygen debt after exercise—a theory contradicted by other research. Future studies could examine the physiological mechanisms behind increased metabolic rate and decreased RR after high intensity training.

## REFERENCE

Paoli, A., Moro, T., Marcolin, G., Neri, M., Bianco, A., Palma, A., & Grimaldi, K. (2012). High-Intensity Interval Resistance Training (HIRT) influences resting energy expenditure and respiratory ratio in non-dieting individuals. *Journal of Translational Medicine*, 10, 237. doi: 10.1186/1479-5876-10-237

# STUNT-RELATED INJURIES IN CHEERLEADING

A critique of the work of Shields et al. (2009), "Epidemiology of cheerleading stunt-related injuries in the..."  
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## PURPOSE

Cheerleading-related injuries have increased in severity with an increase in the complexity in this one-time basic sport. Unfortunately, cheerleading-related injuries tend to be underreported, thus resulting in few epidemiological studies. The purpose of the reviewed study was to describe the epidemiology of cheerleading stunt-related injuries (type of injury, mechanism of injury, type of stunt, etc.) sustained by cheerleaders in the United States (Shields, Fernandez, & Smith, 2009).

## METHODS

The 567 participants were current cheerleaders, 13-21 years-old, of both genders who were classified by level of competition: All-Star, college, high school, middle school, and recreation. Injury data was collected via the Cheerleading Reporting Information Online (RIO) surveillance tool over a one-year span (2006-2007). The data was analyzed with odd ratios, chi-squared analyses, Fisher tests, and a logistic regression.

## RESULTS & DISCUSSION

Overall, there were 338 stunt-related injuries of the total 567 injuries (60%). The most prominent injury reported was concussions at 96%. The collegiate level of cheerleading experienced the highest rate of injury among the classifications (see Table 1). A possible explanation of this finding was the high level of stunting difficulty associated with higher levels of competition.

Occurrence of Stunt-Related Injuries	
Collegiate	1.59
High School	0.59
All-Star	0.36
Recreation	0.41
Middle School	0.23

Table 1. Data above displays injuries per 1000 athlete-exposures, ranked from highest to lowest occurrence.

## CRITIQUE

The study provided more insight into the occurrence of stunt-related injuries in cheerleading and identified that injury rates varied based on the level of competition. A strength of the study was the classification of competition levels, as it allowed for a better comparison between the different levels. A weakness in the study was an injury type could be in multiple categories. In future studies, creating a categorization system for injuries would prevent this.

## REFERENCE

Shields, B. J., Fernandez, S. A., & Smith, G. A. (2009). Epidemiology of cheerleading stunt-related injuries in the United States. *Journal of Athletic Training, 44*(6), 586-594.

# WARM-UP PROTOCOLS FOR FLEXIBILITY AND POWER

A critique of the work of Tsolakis and Bogdanis (2012), “Acute effects of two different warm-up protocols...”  
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## PURPOSE

Long durations of static stretching before athletic performance have been shown to improve range of motion (ROM) yet decrease muscular power, while explosive warm-ups produce a contrasting effect. The purpose of the reviewed study was to compare the effects of two different warm-up protocols with altered durations of combined static stretching and explosive movements on subsequent lower limb power and hip ROM (Tsolakis & Bogdanis, 2013).

## METHODS

Hip ROM and counter movement jump (CMJ) performance was measured on 20 elite speed/power athletes (10 male, 10 female) using a goniometer and contact platform, respectively. The warm-up protocol consisted of either a short (SDS) or long (LDS) duration of lower limb static stretches followed by corresponding durations of tuck jumps. (See Table 1). Data were analyzed using a 3-way repeated measures Analysis of Variance.

Warm-up Protocol (SDS/LDS)
• 5 min Jog
• Static Stretches (15 sec/45 sec)
• Tuck Jumps (3x3/5x5)
• 8 min recovery

Table 1. Summary of experiment protocol and conditions.

## RESULTS & DISCUSSION

Data analysis indicates decreased CMJ performance by  $5.5 \pm 0.9\%$  ( $p < 0.01$ ) immediately after LDS with no significant change in CMJ after SDS. Counter movement jump performance for LDS remained decreased immediately after the tuck jumps by  $4.3 \pm 1.4\%$  ( $p = 0.01$ ), yet returned to baseline values 8 minutes after performing the tuck jumps. Hip ROM was increased by  $\sim 12.6\%$  under both conditions and remained elevated throughout the experiment procedure.

## CRITIQUE

Although both conditions produced similar gains in ROM only the longer duration of stretching decreased CMJ performance. These finding could benefit athletes looking to maximize ROM increases during warm-up while not impairing lower limb power. The small number of tuck jumps performed may not have induced enough of an effect to achieve CMJ values above baseline. Future studies should investigate what effect a short duration ( $\sim 15$  sec) of stretching combined with various conditions of tuck jumps have on CMJ performance and ROM.

## REFERENCE

Tsolakis, C., & Bogdanis, G.C. (2012). Acute effects of two different warm-up protocols on flexibility and lower limb explosive performance in male and female high level athletes. *Journal of Sports Science and Medicine*, 11(4), 669-675.



# HIPPOTHERAPY AND MUSCLE ACTIVITY IN CHILDREN

A critique of the work of Benda et al. (2003), "Improvements in muscle symmetry in children with cerebral..."  
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## PURPOSE

Hippotherapy is a special type of physical therapy that utilizes the natural movements of horse riding to improve posture, muscle balance, and overall function. The purpose of the reviewed study was to analyze specific muscle activity before and after hippotherapy sessions involving either a stationary barrel or a moving horse (Benda, McGibbon, & Grant, 2003).

## METHODS

Fifteen children (ages 4-12 years) with spastic cerebral palsy were randomly assigned to either a hippotherapy intervention (n=7) or a barrel control (n=8) group. Electromyography (EMG) data was collected at baseline during each of three different tasks (sitting, standing, and walking) and then again following the eight-minute treatment interventions. Mean EMG values were calculated for pre-test and post-test results and the muscle group with the greatest asymmetry was selected for comparison purposes. An independent sample *t*-test was used to analyze muscle asymmetry scores between pre-test and post-test performance.

## RESULTS & DISCUSSION

The hippotherapy group showed a significant improvement in EMG asymmetry scores from pretest to post-test when compared to the barrel control group (see Table 1). Muscle symmetry improvements were attributed to a decrease in activity for the overactive muscle group. A corresponding muscle activity increase in the contralateral side was the result of efforts to maintain balance. The hippotherapy group demonstrated significantly higher symmetry improvement due to the rhythmic and dynamic interaction required to maintain balance while astride the horse.

Percentage Change in EMG Asymmetry Scores	
Group	Percentage Improvement
Barrel	-12.8% ± 88.8
Horse	64% ± 28.3

Table 1. This table demonstrates that the higher the positive percentage change, the greater the symmetry improvement between right and left muscle groups.

## CRITIQUE

Eight minutes of hippotherapy did result in an overall improvement in muscle symmetry for children with spastic cerebral palsy. A strength of the study design was that the researchers took into account the varying size of the children and matched horse size accordingly in order to help control extraneous variables. A weakness was that the group assigned to the barrel appeared to have less overall muscle asymmetry prior to testing. Future studies should perform a series of hippotherapy sessions over a several week period to analyze the long term effects of therapy

## REFERENCE

Benda, W., McGibbon, N. H., & Grant, K. L. (2003). Improvements in muscle symmetry in children with cerebral palsy after equine-assisted therapy (hippotherapy). *The Journal of Alternative and Complementary Medicine*, 9(6), 817-825.

# INFANT PHYSICAL ACTIVITY AND BONE STRENGTH

A critique of the work of Litmanovitz et al. (2003), "Early physical activity intervention prevents decrease of..."  
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## PURPOSE

Very low birth weight (VLBW) infants are at high risk of osteopenia due to reduced accumulation of bone mass and increased bone nutrient needs. The purpose of the reviewed study was to analyze the effects of early exercise intervention on bone strength and bone turnover in VLBW infants (Litmanovitz, Dolfín, Friedland, Arnon, Regev, Shainkin-Kestenbaum et al., 2003).

## METHODS

Twenty-four newborn infants with a birth weight less than 1500 g were randomly assigned to either an exercise intervention or a control group. Bone density, cortical thickness, elasticity, and microarchitecture were measured by bone speed of sound (SOS) using quantitative ultrasound. Protocol for the exercise intervention group included passive resistance range-of-motion (ROM) exercises in the upper and lower extremities for five minutes, five times per week, for four weeks. Additionally, osteocyte activity was monitored by pre-test and post-test blood analysis of biochemical markers. A two-way repeated measure analysis of variance was used to compare the effects of the intervention on bone SOS.

## RESULTS & DISCUSSION

The bone SOS decreased significantly in the control group and remained stable in the exercise intervention group (see Table 1). Most therapeutic attempts to prevent osteopenia in VLBW infants have focused on nutrition-focused treatment with limited success. Prevention of bone SOS was attributed to the stimulatory effects of mechanical strain on bone formation and growth.

Change in Bone SOS (m/s)		
Group	Pre-test	Post-test
Control	2892.3 ± 29.5	2799.5 ± 25.5
Exercise	2825.0 ± 32.2	2827.0 ± 26.0

Table 1. Bone SOS decreased significantly in the control group but remained unchanged in the exercise group.

## CRITIQUE

An early intervention of a daily five-minute ROM passive resistance exercise program prevented postnatal decline of bone SOS in VLBW infants. A strength of the study design was that many extraneous variables were closely monitored, including analogous nutritional management for each infant. A weakness was that only SOS measurements were taken on the tibia bone with no regard to SOS data on other bones. A future research suggestion would be to perform varying lengths of physical activity to determine optimum intervention duration. Additionally, a follow-up bone analysis could be performed several months after the experiment to evaluate if the therapy resulted in improved bone density levels on a long-term basis.

## REFERENCE

Litmanovitz, I., Dolfín, T., Friedland, O., Arnon, S., Regev, R., Shainkin-Kestenbaum, R., et al. (2003). Early physical activity intervention prevents decrease of bone strength in very low birth weight infants. *American Academy of Pediatrics*, 112(1),15-19.

# EFFECTS OF ASPARTAME ON BRAIN FUNCTIONALITY

A critique of the work of Spiers et al. (1998), "Aspartame: neurophysiologic and neuropsychological evaluation..."  
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## PURPOSE

Consumers of aspartame have been known to report neurobehavioral symptoms. Theories suggest this is due to high phenylalanine (Phe) concentrations. The purpose of the reviewed study was to determine if neurophysiologic, behavioral, and cognitive function can be disordered by aspartame (Spiers, Sabounjian, Reiner, Myers, Wurtman & Schomer, 1998).

## METHODS

Forty-eight undergraduate and graduate students (age 18-35) were recruited and screened for medical and psychiatric disorders. A high (n=24) or low (n=24) treatment of aspartame, sucrose, or a placebo was given on two sets of acute and chronic days per month for four months. Same day physical examinations, blood sampling, electroencephalograms (EEG), and the Profile of Mood States (POMS) were used to assess acute and chronic effects. Data was analyzed with a series of univariate, multifactor analyses of variance (ANOVAs).

## RESULTS AND DISCUSSION

Low-dose (LOAP) and high-dose (HIAP) aspartame groups showed significant increases in blood Phe concentrations on acute test days compared to alternate treatments. High dose subjects showed greatest increases on chronic test days. Increases may have been due to concentrations of Phe in aspartame containing treatments. Differences in EEG and POMS results and physical symptoms between groups were not significant (see Table 1). This may have been due to relatively small dosages and lack of adverse Phe effects leading to lack of significant symptoms.

**Physical Symptom and POMS Results**

Symptom	Number of Reported Symptoms by Group				
	All	LOAP	HIAP	Sucrose	Placebo
Irritability	9	0	2	2	5
Cognition	6	1	0	2	3
Emotionality	5	0	0	3	2
Headache	40	11	4	14	11

Table 1. Physical and POMS symptoms were recorded.

## CRITIQUE

Consumption of aspartame may raise blood Phe levels but will not adversely affect neurophysiologic, behavioral or cognitive function. Strengths of the present study included a randomized, double-blind, placebo-controlled, crossover design and the use of a diverse set of tests to limit bias and monitor a wide variety of symptoms. A limitation of the study was the lack of attention to additional dietary influence, which ignored potential synergistic effects of nutrients on blood Phe levels. Future research should include monitored diets to determine the effects of nutrition on aspartame related symptoms.

## REFERENCE

Spiers, P. A., Sabounjian, L., Reiner, A. Myers, D.K., Wurtman, J., & Schomer, D. L. (1998). Aspartame: neuropsychologic and neurophysiologic evaluation of acute and chronic effects. *The American Journal of Clinical Nutrition*, 68 (3), 531-537.

# BIOMECHANICAL FEEDBACK: TUCK JUMP & RUNNING

A critique of the work of Stroube et al. (2013), “Effects of task-specific augmented feedback on deficit...”

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## PURPOSE

Female athletes have a greater tendency for anterior cruciate ligament (ACL) injuries due to biomechanical differences as compared to males. The purpose of the reviewed study was to identify if feedback during tuck jumps can correct biomechanical errors before, during, and after performance in order to help reduce risk of injury (Stroube et al., 2013).

## METHODS

Thirty-seven female soccer players (ages  $14.7 \pm 1.7$  yrs) participated in the study which compared tuck jump augmented feedback (AF) to a control group in treadmill running feedback. All participants used the same training protocol which placed an emphasis on hamstring and posterior chain strength. Testers analyzed three components of tuck jumps: plyometrics, foot position on landing, and knee and thigh motion. Participants performed ten second intervals of continuous tuck jumps, which were recorded on a Panasonic camera. Feedback given to the control group (CG) included critique on running mechanics. An analysis of variance was used in each group to assess biomechanical errors.

## RESULTS & DISCUSSION

The test for AF group showed an overall decrease of biomechanical errors of 23.6% while CG showed an overall decrease of 10.6% in biomechanical errors. A nonparametric confirmatory analysis confirmed a decrease in deficits at posttest in AF group,  $P = .001$ . The greatest improvements were shown in valgus knee position (VKP), feet not shoulder width apart (FSW), excessive ground contact noise (EGC), feet not parallel front to back (FNP) and foot timing not equal (FTE). The improved areas were large stabilizers in preventing injury which were each linked to improved core strength (see Table 1).

Biomechanical Deficits						
Variables	VKP	FSW	EGC	FNP	FTE	Overall
Percentages	35.7%	44.4%	71.4%	40.0%	40.0%	23.6%
Significance						$P=.001$

Table 1. The deficits recorded show the most improvement in biomechanical errors.

## CRITIQUE

The combination of biomechanical feedback during a tuck jump exercise greatly reduced risk factors that influence ACL injury. A strength of the study was that researchers included hamstring and posterior chain strength in the training protocol, which placed emphasis on injury prevention. The study conducted was limited to athletic individuals. Future studies should include core strength as a possible factor contributing to injury using both males and females.

## REFERENCE

Stroube, B. W., Myer, G. D., Brent, J. L., Ford, K. R., Heidt, R. S., Hewett, T. L. (2013). Effects of task-specific augmented feedback on deficit modification during performance of the tuck-jump exercise. *Journal of Sport Rehabilitation*, 22(1), 7-18.

# SHORT TERM STARVATION AND MINERAL INEQUITY

A critique of the work of Wojciak (2013), "Can short term starvation be a reason for mineral imbalance in ..."

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## PURPOSE

Some women drastically reduce their calorie intake in an attempt to lose weight. The purpose of the reviewed study was to determine if short-term starvation affected both the mineral concentrations and the body compositions in women (Wojciak, 2013).

## METHODS

A total of 46 women between 20 and 30 years old participated in the 48-day study. The women were measured for body mass, body mass index (BMI), and body fat. The women were then split into two research groups and were required to starve for several days each week. During starvation days, the women could not eat more than 300 kilocalories (kcal). Samples of the women's blood, urine, hair, and serum were taken each month for analysis of copper, zinc, calcium, and magnesium levels. Standard deviation and *t*-tests were utilized to determine group difference and statistical significance.

## RESULTS & DISCUSSION

The participants showed a minor decrease in both body mass, BMI, and body fat (see Table 1). Most of the differences in mineral concentration were observed in the hair and serum samples. Calcium levels did not significantly alter following the experiment. The two-day starvation group displayed significantly lower zinc levels compared to the one-day starvation group. However, magnesium and copper levels were significantly lower in both groups. The unrealistic emphasis that society places on body size was thought to be the main contributor to self-starvation in women, which in turn severely disrupted the intake of essential minerals and nutrients.

**Changes in Body Composition for Healthy Women during Self-Starvation**

	Body Mass (kgx2)	BMI (kg/m <sup>2</sup> )	Body Fat (%)
Before Experiment (One Day)	61.0	21.5	24.8
After Experiment (One Day)	59.0	20.6	24.6
Before Experiment (Two Days)	61.0	21.7	27.4
After Experiment (Two Days)	58.5	20.8	27.0

Table 1. Data compared differences in body composition of female participants from starvation of either one or two days per week.

## CRITIQUE

Although short-term starvation did not dramatically affect body shape, it could have been detrimental to mineral intake. One strength of the study was that this was the first major study done on short-term self-starvation. One limitation of the study was very few statistical tests were performed. This limitation restricted the amount of analysis performed on the data and lessened the amount of evidence to support the experimental results. Further research should examine the mineral intakes for long-term self-starvation to determine if the intakes continue to decrease.

## REFERENCE

Wojciak, Rafal W. (2013). Can short term starvation be a reason for mineral imbalance in healthy women? *Trace Elements & Electrolytes*, 31(1), 33-39.

# EFFECT OF COOLING VESTS ON TEMPERATURE

A critique of the work of Trbovich, et al. (2014), “Effect of a Cooling Vest on Core Temperature in Athletes...”  
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## PURPOSE

Due to impaired core temperature regulation, athletes with spinal cord injury (SCI) are more likely to experience exercise-induced hyperthermia (EIH) than able-bodied (AB) athletes. Various cooling devices have been tested, but in controlled laboratory settings. The purpose of the reviewed study was to assess the degree of EIH in those with and without SCI, and to test the effectiveness of the cooling vest (CV) in a sport-specific environment.

## METHODS

Seventeen SCI men, separated into tetraplegia (TP), high tetraplegia (HP), and low tetraplegia (LP) groups, and 19 AB men played either wheelchair basketball or wheelchair rugby both with and without a CV. Prior to exercise, participants swallowed an ingestible thermometer pill to measure core temperature (CT). Participants rested for 20-min, then proceeded with 60-min of exercise. Core temperature was recorded at baseline then at 15-min intervals. Difference scores were computed using the change in CT from baseline to 30-min and baseline to 60-min. An analysis of variation with one between-subject factor and one within-subject factor was conducted for each set of scores.

## RESULTS & DISCUSSION

Changes in CT are shown in Table 1. Though all participants experienced EIH as defined by CT max >37.8°C, and 83% of TPs approached CT >40°C, which defines heat stroke for the AB population, no one terminated participation or showed symptoms of heat-related illness. Difference scores from baseline to 30-min ( $p = .041$ ) and baseline to 60-min ( $p = .004$ ) showed significant effects due to group. However, the cooling vests showed no significant effects on temperature.

	Changes in Core Temperatures							
	TP/NV	TP/V	HP/NV	HP/V	LP/NV	LP/V	AB/NV	AB/V
30 Min	0.4 (1.2)	0.8 (0.6)	0.8 (0.7)	0.3 (0.9)	0.2 (0.7)	0.2 (0.4)	0.9 (0.6)	0.9 (0.6)
60 Min	1.0 (0.8)	1.1 (0.8)	0.4 (1.1)	0.3 (0.7)	0.4 (0.5)	0.3 (0.4)	0.8 (1.0)	1.6 (1.2)

Table 1. Mean (SD) changes over time in core temperature for all groups with a cooling vest (V) and without a cooling vest (NV).

## CRITIQUE

Although temperature was found to be unaffected by a CV, it was shown that all athletes experienced EIH with no symptoms. The findings emphasize the need to educate athletes, especially those with SCI, about the risks of EIH. This is the largest study that examines the effect of a cooling intervention in a combined population of persons with tetraplegia and paraplegia in a field-based environment, which deserves merit. Future studies should establish a temperature that defines heat stroke in persons with SCI. Contrary to what was done, autonomic completeness of SCI, which may influence core temperature, should also be recorded.

## REFERENCE

Trbovich, M., Ortega, C., Schroeder, J., & Fredrickson, M. (2014). Effect of a Cooling Vest on Core Temperature in Athletes With and Without Spinal Cord Injury. *Top Spinal Cord Injury Rehabilitation, 20*(1), 70-80.

# PROTEIN BLEND HELPS MUSCLE PROTEIN SYNTHESIS

A critique of the work of Reidy et al. (2013), "Protein blend ingestion following resistance exercise promotes. . ." E. A. LaRue - elarue16@my.whitworth.edu - Whitworth University

## PURPOSE

Soy protein may be as useful as whey protein at promoting muscle protein synthesis. Many athletes use protein supplements after workouts to maximize this process. The purpose of the reviewed study was to compare the effectiveness of a blend of soy and dairy protein (PB) to whey protein (WP; Reidy, Walker, Dickinson, Gundermann, Drummond, Timmerman, et al., 2013).

## METHODS

In this study, 19 healthy participants (17 male, 2 female) aged 18-30 years, who did not exercise regularly, were selected. Ten participants were placed into the PB group and nine in the WP group. The participants consumed the protein drinks one hour after high-intensity leg resistance exercise (RE). Muscle biopsy tests were taken once before RE and then again 1, 3, and 5 hours after RE. Results were then analyzed with a *t*-test and ANCOVA of the variables, which indicated the difference between the fractional synthetic rate (FSR) of the PB and WP group.

## RESULTS & DISCUSSION

Overall, there was no significant difference between the FSR in the PB group or the WP group (see Table 1). The lack of a significant difference may have resulted from both PB and WP delivering almost the same amount of amino acid to the muscles. If both groups had the same amount of amino acid being delivered to their muscles, then the FSR would have been very similar. This similarity between the FSR for PB group and WP group meant that whey and soy protein both could have been effective in delivering amino acids to the muscles to prolong FSR.

Fractional Synthetic Rate Hour Before and After Exercise				
GROUP	Rest %/hr	0-2 %/ hr	2-4 %/hr	Entire 4 %/hr
PB	0.059	0.085	0.080	0.090
WP	0.059	0.079	0.070	0.085

Table 1. There was a slightly higher FSR (measured as %/hr) in PB group than the WP.

## CRITIQUE

The study found that there was no significant difference between protein from milk, soy, or whey in stimulating post-exercise muscle protein synthesis. A strength of the study was that researchers biopsied the muscles tissue multiple times, which allowed researchers to see the long term effects of the proteins. A weakness of the study was that it only looked at non-athletes. Future research should be done to see the long-term effects of the different kind of proteins in athletes. Further studies would allow for researchers to see if different proteins have different affects for athletes in various sports.

## REFERENCE

Reidy, P. T., Walker, D. K., Dickinson, J. M., Gundermann, D. M., Drummond, M. J., Timmerman, K. L., . . . Rasmussen, B. B. (2013). Protein blend ingestion following resistance exercise promotes human muscle protein synthesis. *The Journal of Nutrition*, 143, 410-416.

# RESISTANCE TRAINING FOR COLLEGE STUDENTS

A critique of the work of Barfield et al. (2012), "Format of basic instruction program resistance training classes..."  
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## PURPOSE

Modern resistance training classes have become popular among college students. The purpose of the reviewed study was to determine the effect of different forms of basic instruction program (BIP) resistance training classes on students' fitness levels over the course of a semester (Barfield, Channell, Pugh, Tuck, & Pendel, 2012).

## METHODS

Sixty college students (ages  $20 \pm 1$  year; 45 males and 15 females) were matched up by age, gender, and training experience, then dispersed into three different BIP resistance training classes (traditional, independent, or CrossFit). Body composition (body mass index; BMI), muscular power (standing long jump), and muscular endurance (pull-up, one minute squat, and YMCA bench press) were assessed. Subjects performed a pre-test and post-test to determine which classes showed the greatest improvements for each test using independent group analysis of variance.

## RESULTS & DISCUSSION

Mean scores differed significantly ( $p < .008$ ) by class format for two variables tested: muscular power and upper body muscular strength. Muscular power showed significant improvement among the participants in the traditional class (7.5% change). Participants from the traditional group also showed a significantly greater mean gain (18.1% change) for muscular strength. The traditional group was the only group with a lower BMI and > 5% improvement for all muscular fitness tests (see table 1).

Test	Fitness Variables Tested								
	Traditional			Independent			CrossFit		
	Pre-test	Post-test	%	Pre-test	Post-test	%	Pre-test	Post-test	%
BMI (kg/m )	24.30	24.08	-0.9	25.12	25.31	0.8	25.71	26.22	1.98
Standing Long Jump (cm)	199.60	214.60	7.5	195.60	194.70	-0.5	182.10	188.00	3.0
Bench Press (repetitions)	23.70	28.00	18.1	25.70	23.80	-7.4	22.55	24.25	7.5

Table 1. The variables represented showed significant mean differences from the pre to post-test scores between the classes over the course of the semester. %, Percent change

## CRITIQUE

Different forms of BIP resistance training affect certain aspects of fitness in college students. Participants in the traditional group showed the most significant improvements overall in the areas tested. There was a large testing battery in the study; however there was a wide range of training experience among the participants which could have affected the outcome of improvements without being directly related to the BIP class type. Future research should examine students that have the same amount of experience to further validate this study.

## REFERENCE

Barfield, J. P., Channell, B., Pugh, C., Tuck, M., & Pendel, D. (2012). Format of basic instruction program resistance training classes: effect on fitness change in college students. *The Physical Educator*, 69, 325-241.



# SHOD AND UNSHOD BACK SQUAT KINEMATICS

A critique of the work of Sato et al. (2013) "Comparison of back squat kinematics between barefoot..."

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## PURPOSE

Squatting barefoot may cause an increase in trunk flexion, deviating from the recommendations of the National Strength and Conditioning Association's (NSCA) squat position statement. The purpose of the reviewed study was to compare the back squat kinematics of two footwear conditions and analyze data with respect to the NSCA's position statement for proper squat technique. (Sato, Fortenbaugh, Hydock & Heise, 2013).

## METHODS

Twenty males and five females with five to seven years of resistance training experience performed 60% of their one-repetition maximum back squat. Motion analysis from a sagittal view was used to assess six different angles including three joint angles and three segmental angles. Each individual underwent one set of five repetitions of back squat wearing their own running shoes, and then wearing no shoes at all. Paired-sample t-tests were used to compare differences between footwear conditions.

## RESULTS & DISCUSSION

There were significant differences in trunk, thigh, shank, and knee angles between the footwear conditions (see Table 1). Hip and ankle peak flexion angles were nearly identical. Researchers' speculations suggests that subjects leaned forward to gain greater overall stability and did not go as deep in the squat during barefoot conditions. In regards to the NSCA's position statement for proper squat position: trunk and thigh alterations deviated away from the statement while the shank and knee angle shifted in favor of the statement.

Descriptive Statistics for Both Footwear Conditions			
Peak Angles (degree)	Running Shoes	Barefoot	Effect Size
• Trunk	50.72 ± 8.27	46.97 ± 9.87 *	.41
• Thigh	20.94 ± 10.19	24.42 ± 11.11 *	.33
• Shank	59.94 ± 5.54	62.75 ± 6.17 *	.51
• Knee	81.33 ± 13.70	88.32 ± 15.45 *	.48
• Hip	72.37 ± 13.85	71.87 ± 13.90	.04
• Ankle	99.40 ± 9.15	98.10 ± 9.02	.14

Table 1. Means ± standard deviations in degrees,  $P \leq .008$ , \* displaying significance

## CRITIQUE

Four out of the six joint angles investigated, were found significantly different between foot conditions due to body segment shifts to accommodate for the altered center of gravity (COG), which this article fails to address. A strength of the study was the motion analysis method, which could allow more electrodes to be applied and used to calculate the COG by segmental method. A future research suggestion would be to compare correlation of deviation from NSCA's position and injury risk. This could help conclude which foot condition is better for back squat.

## REFERENCE

Sato, K., Fortenbaugh, D., Hydock, D. S., & Heise, G. D. (2013). Comparison of back squat kinematics between barefoot and shoe conditions. *International Journal of Sports Science & Coaching*. (8)3. 571-578.

# EFFECT OF TENNIS ON THE BODY'S PERFORMANCE

A critique of the work of Ojala and Häkkinen (2013), "Effects of the tennis tournament on players' physical..."  
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## PURPOSE

Playing tennis, particularly during a competitive tournament, is physically and mentally demanding to an athlete's body and can produce physiological changes that can be detrimental to their physical performance. The purpose of the reviewed study was to measure changes of certain physiological and performance variables of tennis players over the course of a three-day tournament and the two following recovery days (Ojala & Häkkinen, 2013).

## METHODS

The study consisted of eight male national-level tennis players with a mean age of 23. The study was performed during the first tournament of the season and followed a six-week training period. Measurements of the players were taken before the match, twice during the match at 40 and 80 minutes, and four times after the match at 40 minute intervals. The physical performance tests used were a countermovement jump (CMJ) test, five meter run (5m), and standing 5-jump test. The study used the Holm-Bonferroni post hoc test to assess statistical differences between the matches at different time points during the tournament.

## RESULTS & DISCUSSION

There were no significant changes in CMJ, 5m, or 5-jump scores between the matches. However, the 5-jump and 5m were significantly lower following the first and second matches respectively (see Table 1). Serve speed decreased with each match and was significantly slower between the first and third matches. Overall the players underwent significant changes in their physical performance, indicating muscle soreness. One proposed cause of the decrease in physical performance was neuromuscular impairment due to failure of the central nervous system.

Physical Performance Tests

	Match 1		Match 2		Match 3	
	Pre-match	Post-match	Pre-match	Post-match	Pre-match	Post-match
5-jump (m)	12.67	12.48	12.49	12.48	12.53	12.50
5m (s)	1.04	1.08	1.04	1.09	1.06	1.08
Serve speed (km/h)	187.5	182.5	183.6	182.4	182.4	185.3

Table 1. Average physical performance markers were taken from all players before the start of each match.

## CRITIQUE

The study determined that the physical performance of the tennis players decreased over the course of the tournament and required several days to return to original levels due to muscle damage incurred during the tournament. A strength of the study was that it used high-level players who were accustomed to the stresses of a tennis tournament and able to prepare for it. A disadvantage of the study was that each match was exactly 120 minutes, eliminating the variability found in real tennis tournaments. Future studies should give the players a rest day between matches to simulate the actual recovery time found during professional tournaments.

## REFERENCE

Häkkinen, K., & Ojala, T. (2013). Effects of the tennis tournament on players' physical performance, hormonal responses, muscle damage and recovery. *Journal of Sports Science and Medicine*, 12(2), 240-248.

# FOOTWEAR EFFECTS ON FOOT MOTION

A critique of the work of Morio et al. (2009), “The influence of footwear on foot motion during walking...”  
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## PURPOSE

Footwear has been suggested to constrain the natural movement of the foot during running and walking activities. The purpose of the reviewed study was to observe the effect of footwear on forefoot to rearfoot motion while walking and running (Morio, Lake, Gueguen, Rao, & Baly, 2009).

## METHODS

Ten male subjects (ages 25 to 31) that were free from lower-limb injuries and wore a 43.5 (EU) shoe size, performed 10 trials of walking and running on a 15m pathway for three conditions. The three conditions included one barefoot condition and two different shod conditions. Identical sandals with two different midsole harnesses were used in the shod conditions. Multi-segment foot models were used to record the shoe sole and foot motion of each trial. Two-way analysis of variance and Tukey’s multiple comparison post-hoc test was used to analyze the two gait modes and three shod conditions

## RESULTS & DISCUSSION

Results found that footwear constrained natural foot motion. Sole torsion patterns were only similar to the foot patterns for the first 20% of the eversion/inversion motion. The results presented a restricted motion of the foot (see Table 1) possibly because sandals did not follow natural foot motion and therefore constrained sagittal motion. This could also be because the shoe was more constricting in the areas of the foot that moved in the frontal and horizontal planes.

**Degree of Foot Motions**

Conditions	Walk		Run	
	Barefoot	Shod	Barefoot	Shod
Horizontal Plane	4.8	6.8	6.9	9.1
Sagittal Plane	-2.6	-2.5	-3.4	-3.7
EV/INV	-98.1	-44	-317.9	-142.8

Table 1. Foot motion was recorded while walking and running on the 15m pathway.

## CRITIQUE

The footwear constricted the foot motions during the push-off phase in shod conditions compared to barefoot. A strength of the study was the variety of different planes the motion was tested in because it offered more information about foot restriction than in only one direction. A limitation of the study was that constriction from the shoes was not tested to determine whether or not they benefited the foot in motion. Further research should include an investigation to see if the constriction of foot motion benefits or hinders overall foot strength and stability.

## REFERENCE

Morio, C., Lake, M.J., Gueguen, N., Rao, G., & Baly, L. (2009). The influence of footwear on foot motion during walking and running. *Journal of Biomechanics*, 42(13), 2081-2088.

# TREATING CARPAL TUNNEL SYNDROME BY MASSAGE

A critique of the work of Madenci et al., (2012), "Reliability and efficacy of the new massage technique on the..."  
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## PURPOSE

The Madenci hand massage technique (MHMT) may increase grip strength (GS) in patients with carpal tunnel syndrome (CTS) without interfering with the traditional treatment of a wrist to hand resting splint. The purpose of the reviewed study was to evaluate the capability of the MHMT in decreasing pain, while increasing GS and median motor distal latency (mMDL) in patients with CTS (Madenci, Altindage, Koca, Yilmaz, & Gur, 2012).

## METHODS

Eighty patients diagnosed with CTS (four male, 76 female) with ages ranging from 31 to 65 were selected. The patients were divided into two groups of 40. Group I patients wore a splint and perform the MHMT. Group II patients only wore a splint. Electroneurophysiological (ENP) tests evaluated mMDL. Physician Global Assessment (MDPGA) and the Patient Global Assessment (PGA) evaluated pain. The Jamar Hand Dynamometer was used to evaluate GS. Student's t-test was used to analyze statistical data for intergroup comparison.

## RESULTS & DISCUSSION

Post treatment intergroup comparison (PTIC) found a significant difference in GS for both right and left hands ( $p < 0.042$  and  $p < 0.041$ , respectively). The PTIC of PGA and MDPGA found a significant difference  $p < 0.001$  in patient pain. Post treatment analyses of Group I found a significant difference in mMDL for right and left hands ( $p < 0.005$  and  $p < 0.002$ , respectively). However, PTIC of mMDL showed no significant difference  $p > 0.05$ . Data used for PTIC for GS, PGA, MDPGA, and mMDL is presented as means  $\pm$  standard deviation (see Table 1).

<u>Group Comparisons in Terms of PGA, MDPGA, GS and mMDL</u>				
	Group I		Group II	
	pre	post	pre	post
GS Right	25.4 $\pm$ 6.3	30.3 $\pm$ 5.2	25.7 $\pm$ 5.9	28.2 $\pm$ 3.2
GS Left	21.2 $\pm$ 3.2	26.9 $\pm$ 2.6	20.5 $\pm$ 3.3	24.1 $\pm$ 2.3
PGA	8.5 $\pm$ 1.1	2.3 $\pm$ 0.8	8.2 $\pm$ 1.2	4.1 $\pm$ 0.7
MDPGA	5.9 $\pm$ 0.8	1.2 $\pm$ 0.5	5.1 $\pm$ 0.9	2.7 $\pm$ 2.3
mMDL (Right)	4.2 $\pm$ 0.5	4.2 $\pm$ 0.5	4.4 $\pm$ 0.8	3.9 $\pm$ 0.9
mMDL (Left)	3.9 $\pm$ 0.7	3.9 $\pm$ 0.7	4.1 $\pm$ 0.7	3.9 $\pm$ 0.8

Table 1. The above data is the means  $\pm$  standard deviations used for PTIC.

## CRITIQUE

Data from PTIC suggested that the three minute MHMT improved GS and eased pain. Researchers performed thorough pretreatment evaluations to ensure patients were comparable. However, the study was limited by relying on patients to honestly report doing the MHMT. Madenci's team was the first to study the MHMT, so further studies are necessary. In future studies, researchers should observe subjects performing the MHMT to ensure participation.

## REFERENCE

Madenci, E., Altindag, O., Koca, I., Yilmaz, M., & Gur, A. (2012). Reliability and efficacy of the new massage technique on the treatment in the patients with carpal tunnel syndrome. *Rheumatology International*, 32(10), 3171-3179. doi:10.1007/s00296-011-2149-7

# THE EFFECTS OF PROTEIN ON BODY COMPOSITION

A critique of the work of Joy et al. (2013), "The effects of 8 weeks of whey or rice protein supplementation..."  
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## PURPOSE

At high doses, both animal and plant-based protein have the amount of leucine needed to enhance muscle protein synthesis (MPS). The purpose of the reviewed study was to compare an equal amount of rice protein (RP) against whey protein (WP) and the effects that they have on skeletal muscle hypertrophy, lean body mass, strength and power after eight weeks of resistance training (RT; Joy, Lowery, Wilson, Purpura, De Souza, Wilson et al., 2013).

## METHODS

The sample size of the study consisted of 24 college-aged (18-22 years) males. All of the males were closely related in age, body mass, strength, and RT experience. The 24 participants were separated into two different groups, with one group taking 48 grams of RP and the other group taking 48 grams of WP. Ultrasounds were used to determine muscle mass, x-rays determined body composition, and strength was measured at 0, 4, and 8 weeks. Resistance training was done three times a week over the course of eight weeks. Statistical significance was measured using an analysis of variance.

## RESULTS & DISCUSSION

The researchers found that there was no difference between the amounts of weight lifted by each group. Lean body mass increased significantly in both groups, body fat decreased in both groups as well, with the RP reducing by 2.2% and the WP by 0.7% (see Table 1). Overall, there was no extreme statistical difference between the two groups because the time interactions between the RP and WP groups were comparable on short-term recovery or training-induced adaptations.

Body Fat and Lean Body Mass of Rice and Whey Protein Subjects				
Kind of Protein	Before RP	After RP	Before WP	After WP
Body Fat (%)	17.8 +/- 6.0	15.6 +/- 4.9	16.3 +/- 5.1	15.6 +/- 4.9
Lean Body Mass (%)	58.5 +/- 5.5	61.0 +/- 5.6	59.6 +/- 5.2	62.8 +/- 5.2

Table 1. The statistics on body fat and lean body mass were taken before and after consumption of RP and WP.

## CRITIQUE

There was no statistical significant difference in taking either plant-based or animal-based protein on RT. Strengths of the study were that participants' diets were watched closely and each participants' body composition as well as exercise was similar to other participants this helps the results stay consistent between participants. A limitation of the study was the short duration of eight weeks because it did not provide enough data. Future research should include a longer duration and a control group. A control group would be a good way to measure if protein had a greater difference when paired with resistance training. A longer study may have provided more evidence on body fat and lean body mass paired with the different proteins.

## REFERENCE

Joy, J. M., Lowery, R. P., Wilson, J. M., Purpura, M., De Souza, E. O., Wilson, S. M. C., Kalman, D. S., Dudeck, J. E., & Jager, R. (2013). The effects of 8 weeks of whey or rice protein supplementation on body composition and exercise performance. *Nutrition Journal*, 12(86), 1-7.

# PAIN PERCEPTION IN SELF VERSUS OTHERS

A critique of the work of Ochsner et al. (2008), “Your pain or mine? Common and distinct neural systems...”  
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## PURPOSE

The neural activities of the anterior insula (AI) and dorsal anterior cingulate overlap during personal pain and when watching others in pain. However, this overlap is incomplete, suggesting that these pain-processing systems are differentiable. The purpose of the reviewed study was to determine the neural similarities and differences between experiencing pain and watching others in pain (Ochsner, Zaki, Hanelin, Ludlow, Knierim, Ramachandran et al., 2008).

## METHODS

Seven females and six males, aged 19-42 years, participated in this study. All participants fulfilled the Stanford University Medical School human subjects regulations. Participants underwent a self-pain condition where intense thermal stimuli were administered to their right distal lateral forearms. Stimulations were delivered by a Peltier probe and rated verbally by participants. An others-pain condition followed where participants watched 17 video clips of people injuring themselves in sports. Neural activity was monitored by functional magnetic resonance imaging (see Table 1). Differences and similarities between conditions were analyzed with paired sample *t*-tests and boxcar regressors.

**Major Monitored Regions of Neural Activation**

Anterior Insula	Premotor Cortex	Parietal Lobe	Precentral Gyrus	Amygdala
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Table 1. Activation maps and a Brain Imaging Toolbox were used to monitor regions of activity.

## RESULTS & DISCUSSION

Activations of the AI cortices, prefrontal cortex, and premotor cortex corresponded during both conditions. The self-pain condition produced higher activations in the superior temporal gyrus and midbrain. The others-pain condition produced higher activations in the medial parietal lobe, precentral gyrus, and medial prefrontal cortex. These findings suggested that brain activity both overlapped and had separate networks for pain. Researchers proposed this finding because both conditions activated the AI, but the self-pain condition activated nociceptive processing structures, whereas the others-pain condition activated mental state attribution structures.

## CRITIQUE

Neurological similarities and differences were expressed during the self-pain and others-pain conditions. A strength of the study was that word puzzles were given in between experimental conditions. This was beneficial because the word puzzles acted as a buffer and kept participants from mentally associating the trials together. A limitation of the study was that the participants' average age was 29.5 years, so the results did not extend to children or the elderly. Future research should include a cross-cultural study to determine if different cultural environments influence how the brain perceives pain.

## REFERENCE

Ochsner, K., Zaki, J., Hanelin, J., Ludlow, D., Knierim, K., Ramachandran, T., Glover, G., & Mackey, S. (2008). Your pain or mine? Common and distinct neural systems supporting the perception of pain in self and other. *Social Cognitive & Affective Neuroscience*, 3, 144-160.

# ADHD PREVENTS MEMORY CONSOLIDATION IN SLEEP

A critique of the work of Prehn-Kristensen et al. (2013), "Sleep promotes consolidation of emotional memory in..."  
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## PURPOSE

Sleep aids emotional memory consolidation in healthy children and adults because of the brain's oscillatory activities (OA) during slow wave sleep (SWS) and rapid eye movement (REM) sleep. Children with attention deficit hyperactivity disorder (ADHD) have imbalanced OA in their SWS and REM sleep. The purpose of the reviewed study was to compare the difference in sleep induced emotional memory consolidation (EMC) between children with ADHD to healthy children and adults (Prehn-Kristensen, Munz, Molzow, Wilhelm, Wiesner, & Baving, 2013).

## METHODS

Sixteen children with ADHD ages 9-12, 16 healthy children ages 9-12, and 20 healthy adults ages 20-26 participated in the study. All participants were male and did not have any sleeping disorders. Participants underwent a day condition where neutral and emotional images were viewed and scored in the morning, and then tested for recognition before bed. A night condition followed where the images were viewed and scored before bed, and then tested for recognition the next morning. Physiological signals were measured (see Table 1). Differences between and within groups were analyzed with an analysis of variance (ANOVA) test and a Fisher's  $z$ -test.

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### Physiological Signals Measured by a Polysomnographic (PSG) System

Electroencephalogram (EEG)	Electrooculogram (EOG)	Sub-mental Electromyogram (EMG)
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Table 1. An eight-channel PSG system recorded physiological signals for each participant.

## RESULTS & DISCUSSION

In both the day and night conditions, children with ADHD had lower target recognition scores for emotional pictures than healthy children and adults. An EEG detected irregular OA in children with ADHD during SWS and REM sleep. Healthy children and adults had strong OA during SWS and REM sleep. This finding suggested the necessity of strong OA for increased EMC during sleep. Researchers proposed this finding because of the observed relationship between poor OA and low EMC levels in children with ADHD, and strong OA and high EMC levels in healthy children and adults.

## CRITIQUE

Children with ADHD had lower EMC levels during sleep because of irregular OA. A strength of the study was that the experiment took place during the participants' normal schedules to prevent disrupting sleeping patterns. Another strength was that children and adults with sleeping disorders were excluded from the study because that could have affected the results. A limitation was that only males under the age of 26 were tested, so the results did not encompass females or the elderly. Future research should include a separate female study to determine if gender influences EMC during sleep.

## REFERENCE

Prehn-Kristensen, A., Munz, M., Molzow, I., Wilhelm, I., Wiesner, C. D., & Baving, L. (2013). Sleep promotes consolidation of emotional memory in healthy children but not in children with attention-deficit hyperactivity disorder. *PLOS ONE*, 8(5), 1-10.

# BLOW TO THE HEAD? DO SOME BLOW (MAYBE)!

A critique of the work of Yeung et al. (2013), "Effect of cocaine use on outcomes in traumatic brain injury."  
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## PURPOSE

More than 1.4 million people each year suffer from a traumatic brain injury (TBI), and 50,000 of those cases result in death. Theoretically, cocaine can help increase cerebral blood flow and protect the brain from ischemia. The purpose of the reviewed study was to determine whether TBI patients with positive cocaine metabolites had lower in-hospital mortality than those who did not (Yeung, Williams, & Bowling, 2013).

## METHODS

The trauma registry at Hurley Medical Centre was searched from 2006 to 2009 for all patients aged 15 to 55 years old who were admitted with minor to severe TBI's. A total of 741 patients who met the criteria and had drug screens performed at the time were included. A chi-squared test and both univariate and multivariate analyses were used to determine the differences in mortality between those who had positive cocaine metabolites and those who were negative.

## RESULTS & DISCUSSION

Both cocaine-positive and negative patients had low mortality rates overall; however, cocaine did not have a significant role in those results. Past studies found that cocaine had protective effects on the neurological system and cocaine-positive patients who had surgery within twenty-four hours of admittance had lower rates of cardiac complications. This showed that cocaine could have significant positive effects on other organ systems. The effects of cocaine may have been more pronounced in patients with moderate TBI's as mild injuries would heal anyway and severe TBI's may not benefit from pharmaceuticals. Unfortunately, there were too few patients with moderate TBI's to see the full potential benefits of cocaine (see Table 1).

**Data of Patients admitted with TBI**

	Cocaine-positive	Cocaine-negative
Number of patients	138 (18.6%)	603 (81.4%)
Mortality rate	1.4%	2.7%
Mild rating of TBI	89.1%	89.2%
Moderate rating of TBI	4.3%	3.8%

Table 1. Final data showed that cocaine does not have a significant association with low mortality rates.

## CRITIQUE

Cocaine was not found to significantly affect the mortality rates of patients admitted with TBI's. A strength of this study was the objective reasoning and thoughtfulness put into patient criteria and data analysis. A weakness was the reliance on past data from a database rather than actual clinical trials of the effects of cocaine. In the future, research should be done with actual patients with attention to dosages and a higher number of patients with moderate TBI's.

## REFERENCE

Yeung, J. T., Williams, J., & Bowling, W. M. (2013). Effect of cocaine use on outcomes in traumatic brain injury. *Journal of Emergencies, Trauma & Shock*, 6(3), 189-194.



# SUPERFICIAL DRY NEEDLING AND MYOFASCIAL PAIN

A critique of the work of Edwards and Knowles (2003), "Superficial dry needling and active stretching in the..."  
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## PURPOSE

Myofascial trigger points (TrPs) are a common source of musculoskeletal pain (see Table 1) caused by muscle overload. When palpated they can lead to increased local tenderness and referred pain. The purpose of the reviewed study was to test if superficial dry needling (SDN) with active stretching was more effective than stretching alone or with no treatment in deactivating TrPs and reducing myofascial pain (Edwards & Knowles, 2003).

Local pain	Active trigger point	Zone of reference
Taut muscular bands	Epiphenomena	Latent trigger

Table 1. Most common features related to TrPs.

Group	1			2			3		
	M1	M2	M3	M1	M2	M3	M1	M2	M3
<b>SFMPQ</b>	24	13	9.1	23	17	15	20	17	15
<b>PPT</b>	1.4	1.8	2.7	1.7	1.8	1.8	1.4	2.0	2.0

Table 2. Measurements were recorded for pain levels.

## METHODS

Forty subjects (male and female) over 18 years old with musculoskeletal pain over a five-month period were put into one of three groups. Group one (G1) received SDN and did active stretching, group two (G2) did just stretching, and group three (G3) had no treatment. Patient outcomes were measured using the Short Form McGill pain Questionnaire (SFMPQ) and the pressure pain threshold (PPT). Measurement took place at pre-intervention (M1), after three weeks of intervention (M2), and after a follow-up period of a further three weeks (M3), (see Table 2). Data was analyzed using a chi square test to detect differences between groups.

## RESULTS & DISCUSSION

The study found significantly improved scores for G1 compared to G2 and G3. Stretching muscles without prior deactivation of the TrP may have reduced pain but seemed to have minimal effect on TrP sensitivity. Thus patients benefited from SDN with stretch more than either stretching alone or no treatment. This was possibly due to the needle piercing the skin, which activated A-delta nerve fibers, which resulted in inhibition of muscular C-fibers conveying pain from the trigger points. Subsequent relaxation of the TrP's taut muscular band enabled the energy crisis at the motor end plate to resolve, thus restoring the affected muscle and deactivating the trigger point.

## CRITIQUE

Superficial dry needling followed by active stretching was more effective than stretching alone or no treatment in the management of myofascial pain caused by active TrPs. A strength of the study was assessing patient pain outcome measurements using the PPT form, which lead to accurate results when describing pain levels. A limitation was the minimal longevity of follow-ups, which limited the extent of the research. Future research should evaluate the effectiveness of SDN alone.

## REFERENCE

Edwards, J., & Knowles, N. (2003). Superficial dry needling and active stretching in the treatment of myofascial pain. *Acupuncture in Medicine: Journal of the British Acupuncture Society*, 21(3), 80-86.

# SHOCK WAVE THERAPY FOR MEDIAL TIBIAL STRESS

A critique of the work of Rompe et al. (2009), "Low-energy extracorporeal shock wave therapy as a treatment ..."  
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## PURPOSE

Shock wave therapy has been used successfully for the past three decades for managing a variety of musculoskeletal insertional disorders. The purpose of the reviewed study was to determine if low-energy shock wave therapy (SWT) was a safe and effective modality for the management of medial tibial stress syndrome (MTSS); (Rompe, Cacchio, Furia, & Maffulli, 2009).

## METHODS

The control group consisted of 26 women and 21 men (ages 18-54 years) with chronic MTSS. The treatment group consisted of 28 women and 19 men (ages 18-56 years) with chronic MTSS. Both groups performed an at home training program of exercises twice a day for 12 weeks. Additionally, the treatment group underwent low-energy SWT during weeks two, three, and four. The SWT treatment included 2000 shocks at a pressure of two and a half bars and a frequency of eight shocks per second. Degree of recovery was measured on a six-point Likert scale at one, four, and fifteen months from baseline. Statistical analysis was performed with a two-tailed *t*-test.

## RESULTS & DISCUSSION

The percentage of subjects with a Likert score of one or two was statistically greater ( $p < .001$ ) in the treatment group than in the control group (see Table 1). These results may have been because SWT was an effective treatment for numerous types of other insertional pain syndromes, and might have had the same effect on MTSS.

Likert Score Summary for Treatment and Control Groups					
		Likert Score			
Time From Baseline	Group	1= Completely Recovered	2= Much Improved	3= Somewhat Improved	4= Same
One Month	Treatment	5	9	17	16
	Control	-	6	8	33
Four Months	Treatment	11	19	14	3
	Control	-	14	29	4
Fifteen Months	Treatment	17	19	4	7
	Control	-	18	19	10

Table 1. The Likert scores of the treatment and control groups were compared at 1, 4, and 15 months from baseline.

## CRITIQUE

Shock wave therapy was found to be an effective treatment modality for MTSS. A strength of the study was that the treatment and control groups contained similar numbers of women and men with the same age ranges. This helped to eliminate the variables of age and gender. A limitation of the study was that it did not use imaging techniques to ensure each patient had the same condition of MTSS. Further research should include a placebo in order to eliminate the psychological component of receiving the therapy.

## REFERENCE

Rompe, J., Cacchio, A., Furia, J., & Maffulli, N. (2009). Low-energy extracorporeal shock wave therapy as a treatment for medial tibial stress syndrome. *The American Journal of Sports Medicine*, 38(1), 125-132.

# FOOT ORTHOSES IN LOWER LIMB INJURY PREVENTION

A critique of the work of Franklyn-Miller et al. (2010), "Foot orthoses in the prevention of injury in initial..."

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## PURPOSE

Foot orthoses have been commonly used devices in the treatment of overuse lower limb injuries. The purpose of the reviewed study was to determine if foot orthoses were effective in reducing overuse lower limb injury rates among an at-risk military population (Franklyn-Miller, Wilson, Bilzon, & McCrory, 2010).

## METHODS

Officer cadet trainees from the Britannia Royal Naval College were assessed using a plantar pressure plate to determine lower limb injury risk. Risk was evaluated by analyzing the plantar pressure data, which examined eight areas of the foot, including the medial heel, lateral heel, metatarsal heads and hallux. From this data, 400 cadets were deemed medium or high risk. A random integer generator split the 400 at risk cadets equally into two groups. One hundred and thirty six males and 64 females were placed in the control group, and 124 males and 76 females were placed in the treatment group. The control group received no intervention. The treatment group received custom-made D3D foot orthoses. Both groups were monitored over 18 months to determine rates of sustained injury. Statistical analysis was performed using a chi-square test.

## RESULTS & DISCUSSION

The treatment group sustained significantly less ( $p < 0.0001$ ) injuries than the control group (see Table 1). Consequently, the absolute risk reduction rate from the use of foot orthoses was 0.49. This result may have been due to the orthoses' corrective nature and their ability to alter gait, thereby improving biomechanics. Another possible reason was that the orthoses might have provided shock-absorption, which could have helped cushion and reduce stress in the lower limb.

Injury Comparison Results for Control and Treatment Groups						
Group	Number of Patients		Number of Injuries			Injury Rate: Hours Training
Control	Male	Female	Male	Female	Total	1:1600
	136	64	52	9	61	
Treatment	Male	Female	Male	Female	Total	1:4666
	124	76	16	5	21	

Table 1. The injury rates of the control and treatment groups were compared after 18 months.

## CRITIQUE

Foot orthoses significantly reduced rates of exercise-related lower limb injuries among at-risk cadets. A strength of the study was that both treatment and control groups consisted of cadets undergoing the same training, which helped to establish a highly controlled research setting with limited outside variables. A limitation of the study was that it did not include dummy orthotics for the control group, which could have provided an unwanted placebo effect in the treatment group. Further research should be performed on non-military populations in order to determine the effectiveness of foot orthoses in a wider variety of settings.

## REFERENCE

Franklyn-Miller, A., Wilson, C., Bilzon, J., & McCrory, P. (2010). Foot orthoses in the prevention of injury in initial military training. *The American Journal of Sports Medicine*, 39(1), 30-37.

# OUTCOMES OF PRENATAL TOBACCO EXPOSURE

A critique of the work of Espy et al. (2010), "Prenatal tobacco exposure: Developmental outcomes in the..."  
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## PURPOSE

Exposure to tobacco in the prenatal period has been shown to be associated with dose-dependent reductions in body length and head size. The purpose of the reviewed study was to study the impact prenatal tobacco exposure on the early development of regulatory processes during the first month of life (Espy, Fang, Johnson, Stopp & Wiebe, 2010).

## METHODS

Three hundred and four women and their infants were used in this study after meeting the specified criteria. Out of that 304, 143 infants were further classified as tobacco exposed and 161 as non-exposed. Tobacco exposure during pregnancy was determined at 16, 28, and 40 weeks via urine sampling and the DRI Cotinine Assay. The Neonatal Temperament Assessment (NTA) was used to measure emergent regulatory skills. The NTA was administered at 0.2 weeks, two weeks, and four weeks of age. In order to evaluate the impact of prenatal tobacco exposure on neonatal development a baseline growth model and a hierarchical linear model was used.

## RESULTS & DISCUSSION

While the tobacco exposed and the non-exposed group showed no difference in birth weight, there was a dose response relation within the exposed group. Cotinine in the maternal urine levels was found to be a predictor of birth weight. Heavier and persistent smoking resulted in lower birth weight and body length (see Table 1). In general, tobacco exposed infants displayed less attentive tracking behaviors to auditory and visual stimuli and orientation. Data was unclear if this was due to an effect of withdrawal or was unique to exposure related developmental vulnerability, although attention deficits did reflect the impact of nicotine withdrawal that occurred.

**Infant Growth Physical Parameters**

Physical parameters	Non-Exposed (M)	Exposed (M)	Non-Exposed (SD)	Exposed (SD)
Birth Weight (g)	3,420	3,428	438	448
Length (cm)	50.7	50.7	2.6	2.2
Head Circumference (cm)	34.3	34.2	2.1	1.5

Table 1. Mean scores (M) and standard deviations (SD) of birth weight, length, and head circumference were measured by group.

## CRITIQUE

This study found that, while tobacco exposure affected the birth weight and length of infants, it did not significantly affect irritability reactivity or differences in attention to visual and auditory stimuli. A strength of the study was its longitudinal design, allowing it to follow the impact of tobacco exposure through the first month of life. A limitation of the study was the amount of covariates, which provided confounds as the neonates may have been exposed to other factors which may have affected development. Future research should consider greater eligibility restrictions in order to further limit other exposures.

## REFERENCE

Espy, K., Fang, H., Johnson, C., Stopp, C., & Wiebe, S. (2010). Prenatal tobacco exposure: Developmental outcomes in the neonatal period. *Developmental Psychology*, 47(1), 153-169.

# EFFECTS OF HIGH-INTENSITY INTERVAL TRAINING

A critique of the work of Dunham and Harms (2011), “Effects of high-intensity interval training on pulmonary...”  
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## PURPOSE

The ideology of using endurance training (ET) to attain changes and improvements in performance, rehabilitation, and disease prevention has long been favored over other training methods. The purpose of the reviewed study was to determine if high intensity interval training (HIT) could improve pulmonary system function as well as ET (Dunham & Harms, 2011).

## METHODS

Eleven men and nine women who were active, non-smokers, and free of heart and pulmonary disease volunteered to participate. Subjects were split into two groups: an ET group and a HIT group for a four week training program. All participants went through pulmonary function tests, incremental maximum oxygen uptake tests ( $VO_{2max}$ ), and a five mile bike time trial to establish baseline figures. The ET group training sessions consisted of 45 minutes of constant load cycling at 60-70% of  $VO_{2max}$ . The HIT group performed five sets of one minute bouts of workload at 90% of  $VO_{2max}$  followed by three minutes of recovery cycling. A group versus time mixed analysis of variance (ANOVA) was used to determine differences in results for the different parameters being tested within the two training groups.

## RESULTS & DISCUSSION

Both the ET and HIT groups showed similar improvements in time trial tests,  $VO_{2max}$  measurements, and respiratory muscle strength (see Table 1). The HIT group showed significantly more improvement in inspiratory muscle strength and peak expiratory flow (PEF) compared to the ET group. There was no change in expiratory muscle strength in either group. While some of the results suggested that HIT would improve physical performance over ET, there is a possibility that one source of improvement was only from adaption to exercise training (regardless of the type).

	Changes in $VO_{2max}$ & PEF			
	Pre-Training		Post-Training	
	ET (n=7)	HIT (n=8)	ET (n=7)	HIT (n=8)
$VO_{2max}$ (liters/min)	2.24 ± 0.86	2.36 ± 0.56	2.37 ± 0.80	2.58 ± 0.58
PEF (liters/sec)	6.27 ± 2.13	6.14 ± 1.61	6.81 ± 2.58	7.87 ± 2.83

Table 1. The changes in measured  $VO_{2max}$  and PEF are summarized for each group.

## CRITIQUE

There was not a great difference in physical performance of a person who did HIT training from a person who did ET. A strength of the study was the in-depth pre-testing of subjects, which gave a wide range of variables to be compared to with post-training measurements of subjects. A limitation of the study was that the respiratory muscle fatigue of participants was not measured at all. Future studies should measure respiratory muscle fatigue levels pre- and post-training as it is an important measurement of performance.

## REFERENCE

Dunham, C., & Harms, C. A. (2012). Effects of high intensity interval training on pulmonary function. *European Journal of Applied Physiology*, 112(8), 3061-3068.

# WHOLE-BODY VIBRATION EFFECTS ON STRENGTH

A critique of the work of Mahieu et al. (2006), "Improving strength and postural control in young skiers..."  
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## PURPOSE

Research has shown that whole-body vibration (WBV) can increase muscular performance, strength, explosiveness, and postural control. The purpose of the reviewed study was to compare the effects of a WBV program and a standard but equivalent resistance (ER) training program (Mahieu, Witvrouw, Van de Voorde, Michilsens, Arbyn, & Van den Broecke, 2006).

## METHODS

Thirty-three young skiers, ranging from 9-15 years old, trained for six weeks using WBV or ER training. Two groups of children performed the same types of exercises; one group performed exercises on a vibration platform while the others performed exercises on the floor. Various tests were run in order to measure isokinetic muscle strength, explosive strength, and postural control (see Table 1). Data was analyzed by Kolmogorov-Smirnov tests and an independent *t* test.

Post-Training Tests			
	Isokinetic Strength	Explosive Strength	Postural Control
Tested Variable	<ul style="list-style-type: none"><li>• Plantar flexion/dorsiflexion torque</li><li>• Knee extension/flexion torque</li></ul>	<ul style="list-style-type: none"><li>• Explosive strength, agility and coordination</li></ul>	<ul style="list-style-type: none"><li>• Limits of stability</li><li>• Rhythmic weight shift</li></ul>
Test	<ul style="list-style-type: none"><li>• Flexion &amp; extension with dynamometer</li></ul>	<ul style="list-style-type: none"><li>• 30 cm high box test, lateral jumping</li></ul>	<ul style="list-style-type: none"><li>• Center of gravity shifting</li></ul>

Table 1. A series of tests determined if WBV training was more beneficial than ER training after a six-week intervention period.

## RESULTS & DISCUSSION

Results found more plantar-flexor strength at low speed ( $p < .001$ ), an increase in directional control values ( $p < .007$ ), and a greater increase in high box test performance ( $p < .001$ ) in the WBV group. In other tests, no significant differences were found between WBV and ER. The greater increases found in the WBV group might have been a result of the tonic vibration reflex, which stimulated the individual muscle fibers. Fast-twitch fibers, the basis for explosive strength, could have been promoted as a result of rapid activation of high-threshold motor units.

## CRITIQUE

Due to the vibration plate, there was an increase in fast-twitch fibers and explosive strength, which shows how WBV programs may be more beneficial than ER training. One strength of this study was the use of isolated strength measurements at the knee and the ankle, which allowed for legitimate findings on muscle development and structural stability. A limitation was that age range might have reduced the accuracy of this study, since some of the children might be more apt to muscle growth than others. Therefore, a recommendation for future studies would be to have a sample of children that are closer in age and body-type.

## REFERENCE

Mahieu, N. N., Witvrouw, E., Van de Voorde, D., Michilsens, D., Arbyn, V., & Van den Broecke, W. (2006). Improving strength and postural control in young skiers: Whole-body vibration versus equivalent resistance training. *Journal of Athletic Training, 41*(3), 286-293.

# LITERATURE REVIEW ABSTRACTS



# HYDRATION RESEARCH AND WEIGHT LOSS

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## ISSUE

Water composes the majority of the human body and is an underutilized diet component. It is indicated that a portion of the population may be chronically mildly dehydrated (Kleiner, 1999). Some research suggests that increased water consumption may contribute to weight loss. Water consumption in relation to weight loss has not been sufficiently researched to date and deserves future research attention (Armstrong, 2012; Boschmann, Steiniger J, Hille U, Tank J, Adams F, Sharma AM... Jordan J. 2003).

## OVERVIEW

Increasing water consumption in one's diet has a significant impact on metabolism, which therefore increases overall weight loss (Boschmann, 2003). In a study conducted by Boshmann et al., the amount of daily water consumption was increased above the FDA recommendation in an attempt to produce results. The traditional method for measuring fat composition has been anthropometric skin folds, which may produce inaccurate results (see table 1). Current research shows bioelectrical impedance is a superior method due to increased accuracy, rapidity, portability, reliability, and simple-to-operate methods for predicting total body weight and free fat mass compared with other traditional anthropometric techniques (Kushner, 1990).

DISADVANTAGES TO SKIN FOLD TESTING
- Only measure subcutaneous not visceral fat
- Inconsistency among people taking measurements
- Can be embarrassing for participants

Table 1. The inaccuracies of skin fold measurements make other measuring methods more useful.

## CONSIDERATION

Although studies examine the intake of water before meal consumption, there has not been sufficient evidence of increasing overall water consumption throughout the day. It is believed that the increased feeling of satiation throughout the day will lead to weight loss. There is a lack of research regarding duration and amount of water consumed.

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# VALUE OF VARIOUS EXERCISE RECOVERY METHODS

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## ISSUE

It is imperative for athletes to recover to top physical form as quickly as possible. Recovery modalities have gained anecdotal support, but many have not been validated by performance markers. Common recovery modalities include compression garments, and whole body cryotherapy (WBC). Far Infrared (FIR) exposure has also been evaluated as a recovery modality (see Table 1). Common evaluations examine baseline and post exercise muscle performance.

Independent and Dependent Variables	
Modalities Used/Study	Performance Markers Studied
WBC, FIR / (Hauswirth et al. 2011)	Maximal Voluntary Contraction (MVC)
Compression / (Davies et al. 2009)	Sprint, Agility, Countermovement jump
WBC / (Ascensão et al., 2011)	Jump, Sprint, MVC
Compression / (Byrne et al. 2010)	Jump, Countermovement Jump, MVC

Table 1: All studies commented on a different selection of performance markers.

## OVERVIEW

Strength ability of exerted muscles was measured to return at post one-hour WBC (Hauswirth, Bieuzen, Brisswalter, Filliard, Fournier, & Pournot, 2011) and post 24 hours (Ascensão, Leite, Magalhães, Magalhães, & Rebelo, 2011). Sprint and jump ability did not return to baseline at post 24 hours (Ascensão et al., 2011). The efficacy of compression garments on recovery varied between studies (Davies, Cooper, & Thompson, 2009; Byrne, Eston, & Jakeman, 2010). Muscle strength was restored at post 24 hours Far Infrared stimulation (Hauswirth et al., 2011).

## CONSIDERATIONS

The definition of “recovery” between studies was not consistent. All studies tested baseline performance, but the criteria for “recovered” status after post test varied. A strength of three studies was the use of a highly trained population with experience similar to athletes who are interested in recovery (Ascensão et al., 2010; Davies et al., 2009; Hauswirth et al., 2011). Byrne et al. (2010) did not use highly trained participants and thus the study may have been limited in regards to applying the results to athletes. Collectively, these studies suggest that both compression and cryotherapy may provide a degree of performance recovery post exercise. Future research should compare FIR, WBC, and compression garments while using highly trained athletes and a standardized definition of recovery.

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# BENEFITS OF PHYSICAL ACTIVITY ON DEPRESSION

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## ISSUE

Recent studies have found that physical activity (PA) can help prevent or decrease symptoms of depression. Studies support that vigorous exercise, leisure time physical activity (LTPA), and a lifetime of PA or PA through adolescence all reduce the onset and symptoms of adult depression.

## OVERVIEW

Vigorous PA was associated with reduced depressive symptoms more so than moderate PA, even when performed for shorter durations (Chen, Stevinson, Ku, Chang, & Chu, 2012; Wise, Adams-Campbell, Palmer, & Rosenberg, 2006). Participation in LTPA was more effective than non-leisure time physical activity (NLTPA) because it was less obligatory, more enjoyable, and provided social interaction which reduced the likelihood of depressive symptoms (Azevedo Da Silva et al., 2012; Chen et al., 2012; Wise et al., 2006). Persons who had a history of PA at younger ages were less likely to become depressed, especially if PA persisted into adulthood (Azevedo Da Silva et al., 2012; Chen et al., 2012; Jacka et al., 2011; Wise et al., 2006).

## CONSIDERATIONS

Adults across a variety of backgrounds were less likely to exhibit depressive symptoms if PA was regularly maintained. However, depression and PA measurements varied between studies (see Table 1). A limitation was some studies were retrospective (Chen et al., 2012; Jacka et al., 2011; Wise et al., 2006) and others self-reported (Azevedo Da Silva et al., 2012; Chen et al., 2012; Jacka et al., 2011; Wise et al., 2006), therefore all were subject to error and bias. A strength of the studies was potential demographic confounders were addressed such as age, gender, marital status, education, and occupation. The studies indicated LTPA done at high intensity throughout life reduces depressive symptoms. In the future, the use of longitudinal over retrospective studies and clinical diagnoses of depression over surveys might improve accuracy.

Assessment Types for Depression and Physical Activity		
Group	Depression Analysis	Physical Activity Analysis
London Civil Servants (35-55 yrs)	30 item general health survey	Average # hours/week moderate/vigorous PA
Taiwanese Older Adults (≥ 65 yrs)	10 item chinese modified 20 item CES-D	31 PA options, could choose up to 10
Geelong Osteoporosis Study of Australians (20-69 yrs)	Self-report based on DSM-IV	Light/moderate/hard/very hard PA
Black Women in US (21-69 yrs)	20 question CES-D	Self-report number of hours of PA

Table 1. Different survey methods were used by each group to analyze rates of PA and symptoms of depression.

## REFERENCES

- Azevedo Da Silva, M., Singh-Manoux, A., Brunner, E. J., Kaffashian, S., Shipley, M. J., Kivimaki, M., & Nabi, H. (2012). Bidirectional association between physical activity and symptoms of anxiety and depression: The whitehall ii study. *Eur J Epidemiol*, 7(27), 537-546.
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# EFFICACY OF PNF IN HEMIPLEGIC REHABILITATION

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## ISSUE

Proprioceptive neuromuscular facilitation (PNF) stretching is a technique commonly used in clinical environments to enhance muscle endurance and strength, joint range of motion, and neuromuscular control. However, the efficacy of PNF for treating lower extremity (LE) hemiplegia caused by a stroke as an alternative to conventional therapy is equivocal (Dickstein & Kawahira, 2004). Hemiplegic patients that participate in PNF make progress in symmetrical LE muscle activity during trunk stability exercises, gait normality, and functional gains in activities of daily living (ADL).

## OVERVIEW

A general evaluation of PNF effects on ambulatory status did not produce significant differences (Dickstein, Hocherman, Pillar, & Shaham, 1986), while specific evaluations observed improvements in gait cadence and speed (Wang, 1994) and a faster 10-meter walk time (Kawahira, Shimodozono, Ogata, & Tanaka, 2004) with PNF intervention; however, soleus and quadriceps muscles of the affected side developed significant electromyography (EMG) activity in training balance while reaching for an object (Kim, Kim, & Gong, 2011). Although Wang (1994) evaluated hemiplegia in patients not specific to strokes, cumulative PNF benefited those with both long and short term duration of paralysis (Kim et al., 2011). Activities of daily living require the ability to function during tasks such as dressing that necessitate strength, balance, locomotion, and coordination.

## CONSIDERATIONS

Different objective and functional tests were used in the studies (see Table 1). The studies took place over a six week intervention period, which limited outcomes of long-term effects of PNF on hemiplegia. The presented PNF research provided additional insight to its effect on LEs as opposed to previous research on upper extremity hemiplegia (Kim et al., 2011).

Neurophysiological therapy encouraged task implementation rather than movement in simple directions like most conventional therapies, which reinforced its use as a therapeutic approach in order to improve functional independence during ADL after a stroke. Utilization of objective tests like the Fugl-Meyer Assessment in future PNF research would produce quantitative data and help describe performance during functional activities.

Assessment of Hemiplegic Individuals		
• Brunnstrom stage of recovery from hemiplegia	• Functional Reach Test (FRT)	• Ankle and wrist range of motion
• Isokinetic dynamometer-knee flexion/extension	• Barthel Index of ADL	• Ambulatory status
• Muscle tone of LE	• EMG activity	• Foot tapping speed
	• 10-Meter Walk Test	

Table 1. These various objective and functional tests were used to evaluate LE and trunk improvements.

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# CORE STRENGTH AND LOWER EXTREMITY INJURY

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## ISSUE

Inability to control the position of the trunk over the pelvis and leg for optimal motor control (core stability) is correlated with kinetic chain injuries. Poor core stability could cause Lower Back Injury (LBI) and increased weakness and alteration of neuromuscular activation patterns. This weakness could lead to lower extremity injury (LEI) that is often mis-diagnosed. Dynamic Neuromuscular Stabilization (DNS) was considered an option to improve weakness patterns.

## OVERVIEW

Studies used numerous methods to test core stability in a preseason setting and track injury occurrences (Hides, Brown, Penfold, & Stanton, 2011; Wilkerson, Giles & Seibel, 2012). Experiments showed correlation between core instability and LEI (see Table 1). Results promoted more accurate diagnosis and prevention practices (Zazulak, Hewett, Reeves, Goldberg, & Cholewicki, 2007). A studied prevention and treatment option was DNS: a rehabilitative approach that increases balanced muscle strength and coordination through intra-abdominal pressure and regulation of the central nervous system (Frank, Kobesova, & Kolar, 2013).

Testing Methods and Injury Correlations		
Study	Method of Testing	Injury Correlation
Hides et al., 2011	Magnetic Resonance Imaging Electromyography	Decreased Multifidus size in all recorded injuries
Zazulak et al., 2007	4 isometric contractions of core	LEI risk 3x greater in players with below average core strength
Wilkerson et al., 2012	Trunk displacement in flexion, extension, and lateral bend	11 of 25 LEI sustained by athletes with increased displacement

Table 1. Experimenters used different methods, yet all studies showed increased injury risk from poor test results.

## CONSIDERATIONS

Health professionals agreed that core instability correlated strongly with LEI due to loss of proper motor function in the kinetic chain. It is implied that results alter the way professionals evaluate and diagnose LEI. Accurate data was acquired in regards to lumbopelvic muscle size and strength (Hides et al., 2011), mechanical force on the trunk, and its correlation with LEI (Zazulak et al., 2007). A possible solution for strengthening core muscles symmetrically and facilitating strong neurological control and balance is DNS (Frank et al., 2013). However, this technique has not been applied to studies that identified core strength and LEI correlation. Future researchers could test DNS effectiveness in regards to core stability and LEI occurrence.

## REFERENCES

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# THE EFFECTS OF EXERCISE ON MULTIPLE SCLEROSIS

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## ISSUE

Multiple Sclerosis (MS) is a chronic disease of the Central Nervous System which causes disability in young adults. Patients experience many different symptoms which often result in decreased physical activity and reduced mobility. Researchers have found that various types of exercise can improve muscle weakness, balance impairment, and fatigue in patients with MS.

## OVERVIEW

Muscle weakness in MS patients often results in walking difficulties. Exercises such as treadmill training and the combination of resistance training and Whole Body Vibrations (WBV) initially increased walking speed (Eftekhari, Mostahfezian, Etemadifar, & Zafari, 2012; van den Berg et al., 2006; see Table 1). However, only resistance training and WBV increased the maximal voluntary contractions in the muscles (Eftekhari et al., 2012). Pilates, aquatic training, and a combination of resistance training and WBV all documented significant increases in balance (Eftekhari et al., 2012; Marandi, Nejad, Shanazari, & Zolaktaf, 2013). The results indicated that fatigue was neither improved nor worsened by exercise (van den Berg et al., 2005).

Exercise and Areas of Improvement				
Type of Exercise	Walking Speed	Muscle Weakness	Balance	Fatigue
Resistance Training and WBV	Improved	Improved	Improved	No change
Pilates and Aquatic Training	No change	No change	Improved	No change
Treadmill Training	Improved	No change	No change	No change

Table 1. Improvement could be observed with each type of exercise.

## CONSIDERATIONS

The research supported the idea that exercise was effective for MS patients because it helped to slow down the rate of decline. The combination of resistance training and WBV resulted in the most improvement. The research targeted disabilities specifically caused by MS, however the number of patients was small and the studies only lasted a few weeks. Future studies should increase the number of patients and lengthen the duration of the study to determine if there could be prolongation before loss of effect. Overall, exercise should be implemented in the treatment plan of MS patients as it has been shown to temporarily improve mobility without consequence.

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# INCLUSION IN PHYSICAL EDUCATION

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## ISSUE

Integration of Adapted Physical Education (APE) and General Physical Education (GPE) is a controversial issue. Some parents of children with disabilities believe in GPE while some GPE teachers argue that it could add extra stress and work to their classes. According to Tripp, Rizzo, and Webbert (2007), inclusion is “an attitude, a value, a belief system, not just an action or set of actions”(p.32). Inclusion is believed to instill a sense of confidence in children with disabilities. In addition to beliefs and thoughts, children with disabilities are protected by the Individuals with Disabilities Education Act (IDEA). This law states that children with disabilities are entitled to a fair and equal education in the least restrictive environment.

	Pros	Cons
Teachers	Broadens teaching platform to include general and adapted lessons	May sloe lesson for explanation or corrections lesson due to extra t
Parents	Both students could form friendships and work on teamwork skills both students with and without disabilities	Students without disabilities may become bored or not reach standards due to the adapted lessons
Students without Disabilities	Become more familiar and comfortable working around students with disabilities	May become frustrated with the lace of the class and receive less active time
Students with Disabilities	Work with students without disabilities whom they wouldn't normally have the chance to interact with	May not receive enough individual attention/help with a skill

Table 1. Pros and Cons of Inclusive Physical Education

## OVERVIEW

Coates and Vickerman (2010) completed a study on the experiences of students with disabilities in GPE settings by surveying 65 children between the ages of 7 to 14 years. The authors concluded that students with disabilities had positive experiences when fully included in lessons and activities in addition to expressing feelings of acceptance. Numerous advocates of inclusion expressed that social benefits were obtained by students who participated in GPE settings. For example, Curtin and Clarke (2005) stated that inclusion allowed students to improve self-esteem and self-image by creating positive experiences with peers. Moreover, Butler and Hodge (2004) asserted that the social interactions of both students with and without disabilities experienced from inclusion in GPE settings were uplifting and created friendships and feelings of respect for others. Despite the benefits of including students with disabilities in GPE setting above, there are down side of inclusion effects. Some of the most common cons from critics of inclusion say that including children with disabilities could slow down activity time and possibly cause distractions (Curtin & Clarke, 2005). Another point brought up by many skeptics is that children with disabilities could face additional bullying if they could not perform a skill and therefore their overall mental health could be affected by inclusion (Hoover & Stenhjem, 2003).

## CONSIDERATIONS

In order to implement successful inclusion in GPE setting, physical education teachers, all students with and without disabilities, parents, and school administration should help to change the physical education cultures. GPE teachers may need more in-service training on different types of disabling conditions and instructional strategies (Tripp et. al., 2007). School administrator should create friendly inclusive environment for all students and provide on-going workshops for parents and all students.

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# EVIDENCE-BASED PRACTICE ADAPTED PHYSICAL EDUCATORS

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## ISSUE

Evidence-based practice (EBP) is a transdisciplinary approach that aims to promote accountability for the practitioners. In addition, evidence-based practice is a medical sciences movement that has begun to affect the behavioral and educational sciences. It aims to utilize the best research evidence in practice (Sackett, Rosenberg, Muir Gray, Haynes, & Richardson, 1996). Moreover, evidence-based practice that emphasizes research outcomes during decision making is important in the health and educational disciplines (Hutzler, 2011). Evidence-based practice is made possible through evidence-based research, which tries to synthesize scientific rigor of intervention effectiveness.

## OVERVIEW

Evidence-based practice has been described as a three-legged model (see Table 1; Haynes, Devereaux, & Guyatt 2002). The three legs included 1) a compilation of the best available research evidence provided by researchers, 2) input from practitioners who use their experiences to supplement research evidence, 3) contributions by service recipients who have their own insights from previous experiences, and who should ultimately approve the proposed method of instruction. In this regard, the research-based evidence fulfilled its potential to solve problems when practitioners appropriately implemented the evidence to make a decision (Balsor et al., 2000).

<b>Decision-Making Processes for EBP</b>
<ul style="list-style-type: none"><li>• Best available research evidence</li><li>• Practitioner's experience and expertise</li><li>• Service recipients' values and preferences</li></ul>

Table 1. The 3-step process may determine and integrate research evidence into practice.

## CONSIDERATIONS

EBP helped practitioners make decisions about their practice. In addition, EBP provided the practitioner with a sense of security that led him/her to consider it as an approach that integrates experience and comprehensive reviews of the latest research. Therefore, teachers can gain confidence in decision making and improve their critical-thinking skills by successfully implementing EBP.

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# PSYCHOBIOLOGICAL EFFECTS OF SLEEP DEPRIVATION

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## ISSUE

Adequate sleep is essential for all human beings in maintaining physical and mental wellness. Americans often receive less sleep than the recommended eight hours or more partially due to fast-paced lifestyles and other destructive lifestyle behaviors. This abstract demonstrates detrimental outcomes of prolonged sleep deprivation that are associated with brain function impediments, depression, and obesity.

## OVERVIEW

Sleep deprivation negatively affects memory and aging. Porter et al. (2012) discovered that a higher number of hippocampal genes were impaired by sleep deprivation than the aging process itself. This reveals how lack of sleep can prematurely age cognitive capabilities. Secondly, sleep deprivation can also cause psychological changes leading to long term depression. In 2011, Tadavarty et al. found that sleep-deprivation in rats induced an increase in the expression of the metabolic receptors GABAB-R1 and mGlu1aR, in the CA1 region of the hippocampus, which triggered long term depression. A third concern relates to sleep deprivation and the current obesity epidemic. Figure 1 suggests potential mechanisms, such as alteration of appetite hormones ghrelin and leptin leading to increased hunger, whereby sleep deprivation may negatively influence weight management and lead to obesity (Patel & Hu, 2008).

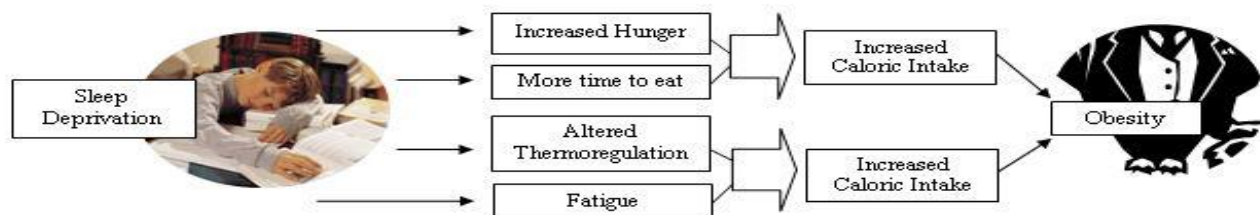


Figure 1. Potential mechanisms by which sleep deprivation can lead to obesity.

## CONSIDERATIONS

Sleep deprivation has a wide range of negative health impacts. Ongoing research suggests it may be a contributing factor to early aging, long term depression, and obesity. This review has important implications, especially for college students, due to academic pressures. They tend to stay up later than recommended by health practitioners. To achieve adequate sleep, people should reconsider their current lifestyle and determine what healthy behavior changes can be done to receive the recommended eight hour sleep duration, because setting sleep as a priority can greatly reduce individuals' risk of mental and physical issues.

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# CONCUSSION OCCURANCE IN YOUTH SPORTS

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## ISSUE

Younger athletes were at greater risk of frequently occurring concussions (Field, Collins, Lovell, & Maroon 2003). Highest rates for concussions occurred in soccer, ice hockey, and rugby (Guskiewicz, Weaver, Padua, & Garrett 2000). The first concussion usually did not result in significant impairment (Barth, Littlefield, & Cantu 2001). The purpose of this review was to address concussions in youth sports. A secondary purpose was to consider injury rate for concussion and “return-to-play” guidelines (Notebaert & Guskiewicz 2005).

## OVERVIEW

Symptoms of concussion included headache, poor balance, and dizziness. High school athletes were at highest risk (see Figure 1; Notebaert & Guskiewicz, 2005). After initial concussion, athletes were three times more likely to sustain additional concussions (Guskiewicz, et al., 2000). Self-report “return-to-play” guidelines were used to return athletes to play (see Table 1; Guskiewicz, et al., 2000; Barth, et al., 2001).

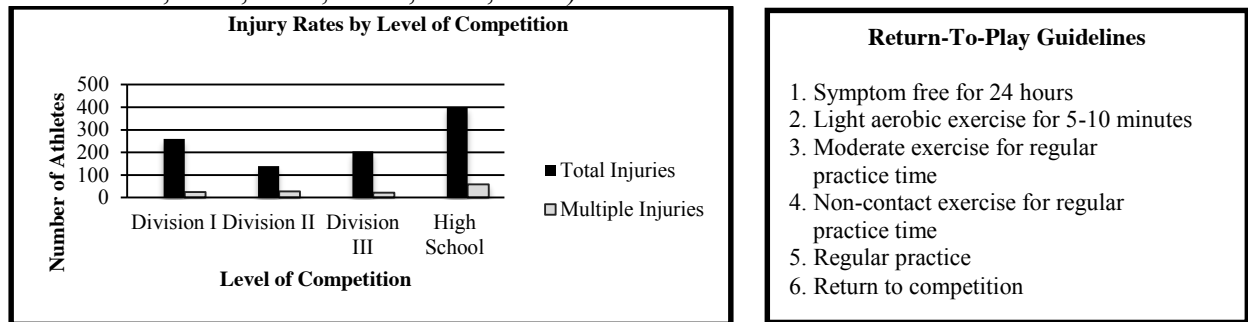


Figure 1. High school athletes were the most likely to sustain multiple injuries

Table 1. Return-to-play guidelines were used to

## CONSIDERATIONS

Many studies with concussion rates of high school athletes were reported in the literature (Guskiewicz, et al., 2000; Barth, et al., 2001; Field, et al., 2003; Notebaert, et al., 2005). The reports concerning concussion occurrence in youth sports was high. “Return-to-play” guidelines were inconsistently developed and inconsistently applied when returning athletes to play following concussion. Team physicians examined and cleared 62,816 high school players who sustained a concussion using current “return-to-play” procedures (Barth, et al., 2001; Field, et al., 2003). Among youth athletes, 34% suffered one concussion per career, while 20% sustained multiple concussions (Field, et al., 2003). Future research should include modification and consistency of administration of “return-to-play” policy.

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# PHYSICAL EDUCATION FOR STUDENTS WITH DISABILITIES

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## ISSUE

Federal law mandates that physical education be provided to students with disabilities and defines physical education as the development of physical and motor skills, fundamental motor skills and patterns (throwing, catching, walking, running, etc.), skills in aquatics, dance, and individual and group games and sports including intramural and lifetime sports” (Sherrill, 2004). Students with disabilities should be fully included in general physical education because it can promote a healthy lifestyle, skill acquisition and improvement, and positive social interaction. However, including students with disabilities to general physical education (GPE) class is still challenging issue.

## OVERVIEW

“According to U.S. Department of Health and Human Services, Physical inactivity is high among many children. In 2009, less than 25% of youth participated in at least sixty minutes of physical activity on any of the previous seven days”(2010). By providing students with disabilities the opportunity to interact with others in GPE, they will be able to engage in a more rigorous level of physical activity. In addition, the students with disabilities will have the opportunity to compete at a higher level as well. “According to The Parents Council on Physical Fitness and Sports Research Digest, it is reported that physical activity is 4.5 times lower for children and youth with disabilities than their peers without disabilities (Rimmer, 2008). By including the student with a disability into GPE with a non-disabled peer, the disabled student can learn about nutrition and exercise along with knowing the importance of daily physical activity. With the obesity epidemic in the youth of America being such an important issue, many general physical education courses are implementing a nutrition and exercise component into their curriculums. Therefore, students with disabilities should be fully included in GPE is because it can promote a healthy lifestyle.

## CONSIDERATIONS

In conclusion, if students with disabilities are placed in the general physical education class, they will be exposed to the pertinent information being disseminating in these courses. As a result, they will be better prepared to make healthy lifelong decisions about nutritious eating habits and a positive attitude about exercise.

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# KNEE ALIGNMENT AND OSTEOARTHRITIS

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## ISSUE

The purpose of this synthesis was to identify the importance of proper knee alignment in slowing the progression of osteoarthritis (OA) of the knee. Osteoarthritis is a major cause of disability affecting 20% of adults with prevalence increasing with age, with the knee often being affected (Jenkyn, Erhart, & Andriacchi, 2011). Malalignment put unnecessary strain on the joint, which caused a more rapid progression of OA (Teichtahl, Wluka, Janakiramanan, Davis, & Cicuttini, 2006).

## OVERVIEW

As alignment became more varus, the medial compartment joint space narrowing (MCN) became steadily increasingly more severe. Inversely, as the alignment became more valgus, the severity of the lateral (outer) compartment joint space narrowing (LCN) increased proportionately (see Table 1; Teichtahl, Wluka, & Cicuttini, 2008). The joint space narrowing was increased dramatically, directly proportional to the total mass of the individual (Moyer, Birmingham, Chesworth, Kean, & Griffin 2010). The annual change in knee alignment has been negatively associated with an annual change in the total patellar cartilage (Teichtahl et al., 2008).

**Narrowing of Medial and Lateral Compartments**

Knee Angle	1°	2°	3°	4°
MCN	2.10 - 1.40	1.20 - 0.60	0.70 - 0.30	0.40 - (-0.20)
LCN	0	0.00 - .150	0.10 - 0.30	0.75 - 1.45

Table 1. The MCN and LCN were directly proportional to the degree of the knee, and inverse of each other.

## CCONSIDERATIONS

It is important to start implementing corrective techniques, such as corrective shoes, to individuals suffering from, or at risk of OA (Jenkyn et al., 2011). Correcting proper knee alignment is a simple task for physical and occupational therapists and does not involve risky invasive surgery for the patients. Future studies should examine factors that influence proper knee alignment, such as Moyer et al. who was able to draw a correlation between increase of BMI and knee malalignment (Moyer et al., 2011).

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# AEROBIC TRAINING PROGRAM FOR FIBROMYALGIA

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## ISSUE

Fibromyalgia has been characterized by long-lasting, widespread, all encompassing pain, aching, fatigue, and stiffness in the muscles and connective tissues. Fibromyalgia was diagnosed with pain in 11 out of 18 pressure points scattered throughout the body. There is no cure for fibromyalgia however, symptoms can be managed with medicine and aerobic exercise regimens which have been shown to increase energy and decrease pain (Thomas & Blotman, 2010). Adherences to exercise programs are generally low in individuals with fibromyalgia (Newcomb, Koltyn, Morgan, & Cook, 2011).

## OVERVIEW

An aerobic exercise program for fibromyalgia patients should consist of land-based or water-based exercises with slight to moderate intensity two or three times per week (Hauser, 2010). Having one long workout regimen a day instead of multiple smaller ones increased adherence. However, results showed a statistical difference in favor of long bouts of exercise in distribution of pain, in a real world application; however, the increased adherence to the program would outweigh the difference (see Figure 1; Schachter, Busch, Peloso, & Sheppard, 2003). Patients following the preferred intensity exercise model had higher adherence to the programs and reported similar improvements with pain to patients in prescribed workouts (Newcomb et al., 2011).

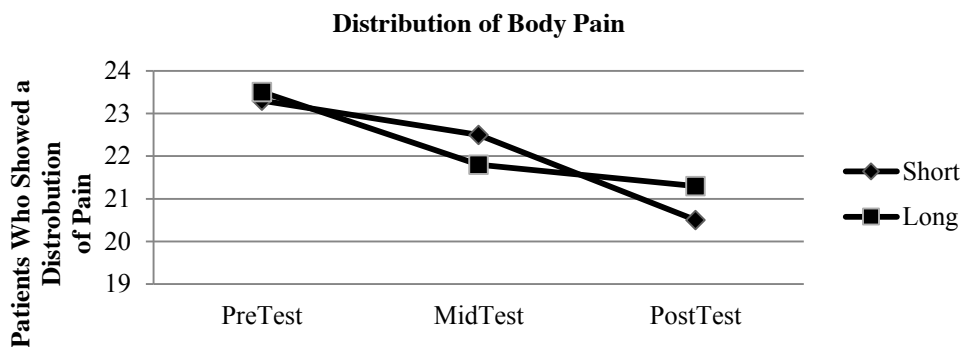


Figure 1. Patients going through one Long bout of exercise and multiple short bouts of exercise had similar rates of decrease of distribution of pain.

## CONSIDERATIONS

It has been shown that aerobic exercise has positive impacts on fibromyalgia. However, the cause is still idiopathic. Aerobic exercise should be tested against other forms of exercise programs to find the optimal program for pain management.

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# IMPORTANCE OF MOTIVATION IN REHABILITATION

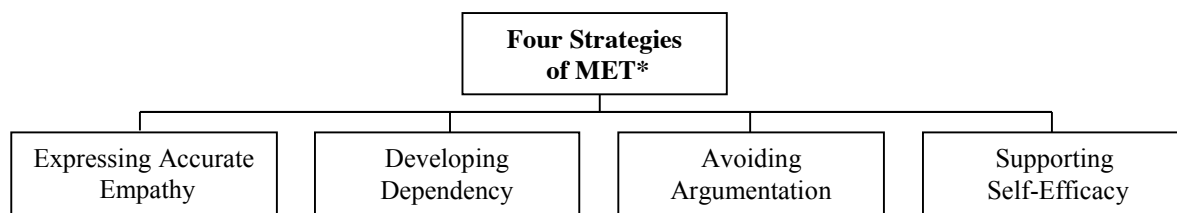
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## ISSUE

The purpose of this synthesis was to examine the importance of motivation in treating individuals in a rehabilitation setting. Rehabilitation professionals long suspected that a patient's motivation plays an important role in determining the outcome of therapy (Maclean & Pound, 2000). Intrinsic motivation was shown to be more effective and psychologically healthier for the patient than extrinsic motivation (Podlog & Eklund, 2005).

## OVERVIEW

Motivational Enhancement Therapy (MET) was shown to promote better longer lasting results both during and after rehabilitation (Vong, Chieng, Chan, & Chan, 2011). Individuals who went through a physical therapy program with MET increased proxy efficacy, working alliance, and treatment expectancy, along with an increase in lifting capacity and exercise compliance than individuals in physical therapy alone (Vong et al., 2011). Vong et al. (2011) established four principles to use in MET to aid patients (see Figure 1).



\*Adoption of the original work by Vong, Chieng, Chan, & Chan, 2011.

Figure 1. Four strategies for MET were defined for physical therapists to utilize to increase motivation in clients during therapy.

## CONSIDERATIONS

Future studies should focus on creative ways of utilizing different motivation techniques. Researchers worked together with patients to design a contract to follow a workout regimen that was autonomous in nature (Friedrich, Gittler, Arendsay, & Friedrich, 2005). By autonomously forming the contract, Friedrich et al. (2005) shifted subjects' perception of being 'forced' to exercise shifting the motivation from extrinsic to intrinsic in nature. This drastically improved both the psychological and physiological effects of the physical therapy program.

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# TREATING HEMIPARESIS IN STROKE VICTIMS

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## ISSUE

Persistent impairment of a limb movement (hemiparesis) is a common problem after traumatic brain injuries and cerebral vascular accidents (CVA; Sterr & Ferivogal, 2003). Constraint-induced movement therapy (CIMT) is a training program that uses a combination of immobilization of the non-affected limb and intensive training, using forced use therapy, of the affected limb to overcome the learned nonuse (Hammer, & Lindmark, 2009). The use of mass repetition acts as the primary vehicle to strengthen interneuron bonds in the sensorimotor area of the brain.

## OVERVIEW

Long-term alteration in brain growth and functions were caused by the rehabilitation. Magnetic stimulation was used to map cortical activity in CVA victims before and after CIMT. Findings showed significantly larger output area of the affected hemisphere (Liepert, Bauder, Miltner, Taub, & Weiller, 2000). Patients who received CIMT in the acute phase of recovery from a CVA performed higher on Action Research Arm Tests (ARAT) compared to an equal dose traditional therapy regime (see Figure 1 and Figure 2; Dromerick et al., 2009).

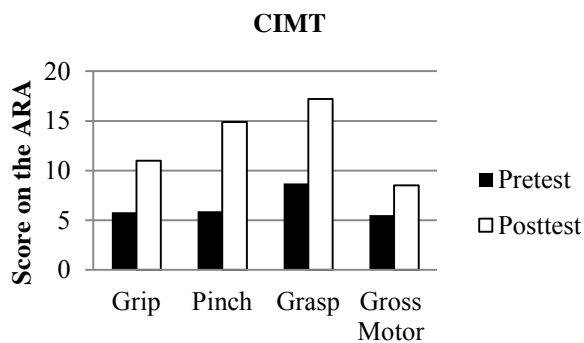


Figure 1. Pre vs post scores of CIMT group during acute recovery phase from CVA. There was a large statistical but significant correlation. Adapted from the original of Dromerick et al., 2000.

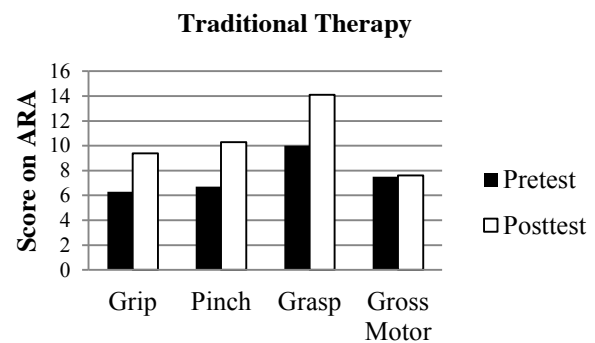


Figure 2. Pre vs post scores of Tradition therapy group during acute recovery phase from CVA. There was a small but significant correlation. Adapted from the original work of work Dromerick et al., 2000.

## CONSIDERATIONS

The effects of CIMT were beneficial but limited, lower body CIMT was ineffective, due to development of improper form from the binding of a leg. Future studies should look into therapy treatments capable of treating the lower body in combination with the upper body.

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# SUBACROMIAL IMPINGEMENT TREATMENT METHODS

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## ISSUE

Subacromial impingement syndrome (SIS), impingement of the rotator cuff tendons against the acromion, is a common cause of shoulder pain (Bernhardsson, Klintberg, & Wendt, 2010). Conservative treatment methods are offered as an alternative to surgical treatment for SIS. Treatment plans for patients with SIS may include stretching, strengthening, and taping.

## OVERVIEW

Stretching exercises have been effective when incorporated before (Morrison, Frogameni, & Woodworth, 1997) or during (Baskurt, Baskurt, Gelecek, & Ozkan, 2011; Bernhardsson et al., 2010) the strengthening phase of a treatment plan. Eccentric (Bernhardsson et al., 2010) and isotonic internal and external rotation exercises (Morrison et al., 1997) to strengthen various rotator cuff and scapular muscles were shown to decrease pain and increase function in patients with SIS (see Table 1). The use of scapular and thoracic taping to alter the posture of individuals with SIS did not significantly affect pain (Nyberg, Jonsson, & Sundelin, 2010).

**Eccentric Strengthening Pain and Function Scores**

	Baseline	Intervention	Change
Mean Pain (VAS 0-100 mm)	60.3	31.2	-29.1
Mean Function (0-30 points)	12.3	21.8	+9.5

Table 1. Eccentric strengthening combined with stretching significantly improved pain levels and function.

## CONSIDERATIONS

While the strengthening treatment programs targeted a variety of rotator cuff muscles, all studies strengthened the infraspinatus muscle (Baskurt et al., 2011; Bernhardsson et al., 2010; Morrison et al., 1997). The infraspinatus tendon was targeted because it is reportedly involved directly in SIS pain (Bernhardsson et al., 2010). The reviewed studies suggest that an effective treatment program for SIS involves a combination of stretching and strengthening of rotator cuff and scapular muscles. The findings on isotonic exercises and taping involved large patient populations, which strengthens the validity of the studies by providing data from a variety of patients. Due to a lack of follow-up within the studies, longitudinal data on pain after treatment was limited. Further research should include a longitudinal study of patients once they have completed the treatment program in order to determine the long-term effects of SIS treatment.

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# HIGH FRUCTOSE CORN SYRUP & THE ONSET OF GOUT

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## ISSUE

Current research shows that excess sugar in the American diet is taking a devastating toll on health. The most abused sweetener, high fructose corn syrup (HFCS), is in everyday products from soft drinks to salad dressings. Now there is evidence that HFCS is linked to acute arthritis, and more specifically gout (Choi, Willett, & Curhan, 2008), which affects almost one million Americans (Angelopoulos, Lowndes, Zukley, Melanson, Nguyen, Huffman, & Rippe, 2009).

## OVERVIEW

The United States sweetens its products with different types of HFCS. Of greatest concern is HFCS 55, which contains 55% fructose and 45% glucose and is used primarily in soft drinks. A waste product of fructose metabolism is uric acid. Excess uric acid in the blood is symptomatic of gout, a form of acute arthritis that causes severe pain and swelling in the joints. The doubling of the prevalence of gout over the past few decades (see Figure 1; Angelopoulos et al., 2009) coincides with a substantial increase in the consumption of HFCS products (see figure 2; Choi et al., 2008).

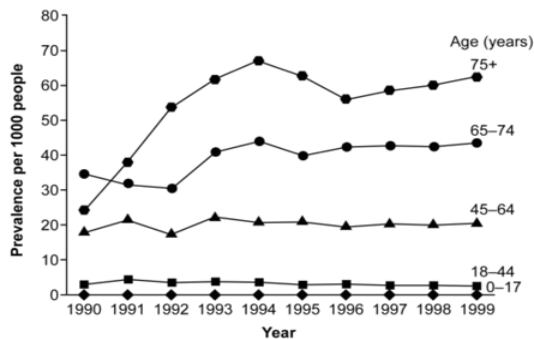


Figure 1. Rise in prevalence of patients with gout (Angelopoulos et al., 2009).

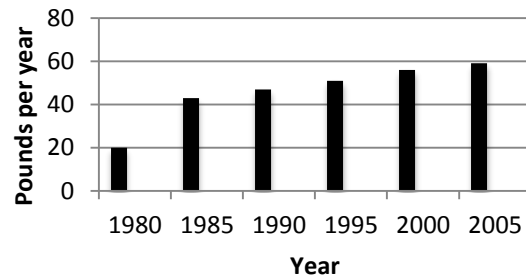


Figure 2. Consumption rate of HFCS (Choi et al., 2010).

Two major longitudinal studies on women (Choi, Willett, & Curhan, 2010) and men (Choi et al., 2008) had similar results. The daily consumption of two or more sugary drinks increased the risk of developing gout. High HFCS consumption may also contribute to hypertension, insulin resistance, obesity, and increased risk of breast and pancreatic cancers (Choi, et al. 2008).

## CONSIDERATIONS

Since fructose is metabolized differently than glucose, it is increasing the risk of several lifestyle diseases not the least of which is gout. In the last three decades, consumption per person, per year has almost tripled. Therefore it is prudent to reduce consumption of this dietary sweetener.

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# ORIGINAL RESEARCH ABSTRACTS



# EFFECTS OF MOVIE GENRES ON CYCLING PERFORMANCE AND PERCEIVED EXERTION

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## PURPOSE

Sedentary television viewing, that could be done while exercising, has been associated with serious health problems (Grontved & Hu, 2011). Annesi (2001) concluded that combined television and music distractions increased gym attendance, duration of exercise, and cardiorespiratory improvements. The purpose of the present study was to compare the effects of action, comedy, and drama movies on relative mean power (RMP), distance traveled (DT), energy expenditure (EE), and rating of perceived exertion (RPE) versus a control in healthy college-aged students. The research hypotheses for this study were that RPE would decrease while viewing any movie, the drama session would show decrease in all variables, and the action session would cause participants to work harder and produce higher RMP, DT, and EE values.

## METHODS

**Participants:** A convenience sample of sixteen healthy college-aged students volunteered for participation ( $n_{\text{male}} = 4$ ,  $n_{\text{female}} = 12$ ). All participants completed a health screening form prior to participation to check for recent injuries to lower extremities, illnesses within the past month, or any pre-diagnosed conditions. **Equipment:** Relative mean power and DT were measured on a Monark 828e cycle ergometer. Energy expenditure was measured on a TrueOne 2400 mobile metabolic cart. Rating of perceived exertion was measured on a Borg scale of 6-20. **Procedures:** Prior to testing, a familiarization session was conducted in which the researchers recorded the weight, height, self-selected intensity level, seat height, handlebar height, and handle bar angle of each participant. The study consisted of four, fifteen minute sessions where the participants watched either: an action movie, a comedy movie, a drama movie, or no movie. At the beginning and end of each session DT was recorded to calculate for the DT during the warm-up. Power was measured every minute and RPE every five minutes. Participants returned after at least twenty-four hours of rest for their next session. Full setup can be seen in Figure 1. **Statistics:** A repeated measures analysis of variance was used to investigate significant differences between movie genres for each dependent variable. Statistical significance was set at an alpha level of  $p \leq 0.05$ .

### Session Set-Up



Figure 1. Early sessions were conducted without a control box (left), while the majority of the sessions were conducted with a control box (right) to reduce distraction.

## RESULTS

Mean data for each session and dependent variable are summarized in Table 1. The multivariate variable results of the ANOVA comparison for RPE ( $p = 0.0673$ ), DT ( $p = 0.0559$ ), RMP ( $p = 0.795$ ), and EE ( $p = 0.901$ ) indicated no statistical differences. Pair-wise comparisons of DT ( $p =$

0.085 – 0.945), RMP ( $p = 0.114 – 0.974$ ), and EE ( $p = 0.354 – 0.863$ ) indicated that there were no significant differences. However, pair-wise comparisons of RPE indicated that there was a significant increase ( $p = 0.035$ ) between the action movie and the control. Pair-wise comparisons indicated no other differences in RPE ( $p > 0.05$ ). All dependent variables resulted in high beta values (RPE:  $\beta = 0.673$ ; DT:  $\beta = 0.559$ ; EE:  $\beta = 0.901$ ; RMP:  $\beta = 0.674$ ), which indicates an increased likelihood that the researchers committed a type two error. All research hypotheses were rejected.

**Mean Data and Standard Deviations for Movie and Control Conditions**

Variable	Condition			
	CONTROL	ACTION	COMEDY	DRAMA
RPE	11.3 ± 1.53	11.9 ± 1.38	11.5 ± 1.3	11.7 ± 1.6
DT (km)	6.3 ± 1.2	6.2 ± 1.0	6.0 ± 1.0	6.0 ± 1.1*
EE (kcal)	96.9 ± 26.0	101.1 ± 29.8*	97.9 ± 30.4	96.9 ± 32.4
RMP (W·kg <sup>-1</sup> )	1.3 ± 0.5	1.2 ± 0.4	1.2 ± 0.4	1.2 ± 0.4

Table 1. A \* indicates the omission of one participant from that data set.

## DISCUSSION

Previous studies did not indicate a significant difference in RPE using music as an exercise distraction method (Barwood, Weston, Thelwell & Page, 2009; Hutchinson & Karageorghis, 2013; Jarraya, Chtourou, Aloui, Hammouda, Chamari, Chaouachi, & Souissi, 2012). In this study, RPE was significantly increased during the action genre compared to a control, which may have been due to testing error or protocol differences. This study was limited by its small sample size and convenience sampling. Future research should study the effects of movies on trained athletes, longer movie sessions, and more controlled environments. The researchers of the present study found that participants were easily distracted by other noises and people in the testing area, so a more controlled testing space would be beneficial. Also, the high observed beta is likely attributed to the small sample size. A larger, more normalized, data set may produce different results. This study shows merit in the fact that it is one of the first to study the effects of movie genres on exercise performance and provides a foundation for future research in this area.

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# EFFECT OF MOTOR IMAGERY WITH LOCOMOTION ON THROWING ACCURACY IN COLLEGE STUDENTS

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## PURPOSE

Motor imagery (MI) is the mental rehearsal of an action without displaying over behavior (Louis, Collet, & Guillot, 2011). Motor imagery with locomotion may improve performance of a motor task (Guillot, Moschberger, & Collet, 2013). The purpose of this study was to compare the effect of MI with and without locomotion on throwing accuracy in recreationally active college students at Whitworth University. The Hypotheses were: 1) Both MI with locomotion and MI alone would produce significant improvement. 2) MI with locomotion would produce significant improvements compared to MI alone.

## METHODS

**Participants:** A convenience sample of 16 college aged students ( $20.75 \pm 0.93$  years) volunteered for participation ( $n_{\text{males}} = 8$ ,  $n_{\text{females}} = 8$ ). All participants were right hand dominant, non-varsity athletes, with no prior injuries, and were recreationally active (e.g.  $20 \text{ min } 3 \text{ d} \cdot \text{W}^{-1}$ ).  
**Equipment:** A lacrosse ball was thrown by participants at a tar paper target (90 cm X 120 cm). Blue chalk was used to cover the lacrosse ball, and a meter stick was used to measure radial error. A visualization script and as story by Ernest Hemingway were used for the different sessions. **Procedure:** The procedure took place in the University Recreation Center. Participants were given five warm up throws with a lacrosse ball. Participants then completed five minutes of an intermediate session. Intermediate sessions included an MI, MI plus locomotion, and control session. The three sessions were randomly ordered for each participant with the use of a random number generator. A minimum of 48 hours occurred between sessions. In the MI session a script was read to participants while they sat with closed eyes and visualized from a first person perspective. In the MI and locomotion session a script was read to participants as they performed the movements and visualized simultaneously. In the control session participants read A Clean Well-Lighted Place by Ernest Hemingway (1933) as a distraction. After the intermediate session the participants threw a lacrosse ball covered in blue chalk at a tar paper target (see Figure 1) ten times. The participants stood 6 m from the target which was centered 1.5 m above the ground. Researchers measured radial error from the center of the target to the closest edge of the chalk mark to the nearest 0.5 cm. (Chang et al., 2013; Klostermann, Kredel, & Hossner, 2013). Any chalk marks with a radial error greater than 40 cm were recorded as 40 cm radial error. The radial errors measured for the ten throws were averaged for each condition. **Statistical Analysis:** Means and standard deviations were utilized to describe the central tendency and variance for the measured dependent variable. A repeated measures ANOVA was used to determine significant differences between MI alone, MI with locomotion, and control conditions. Alpha ( $\alpha$ ) was set at  $p \leq 0.05$  to determine statistical significance for the repeated measures ANOVA.

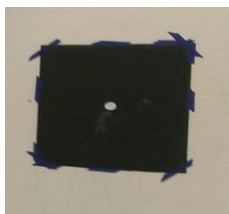


Figure 1. Participants threw a chalk covered lacrosse ball at a tar paper target.

## RESULTS

Descriptive statistics for each testing condition are shown in Table 1. The multivariate results of the ANOVA indicated no statistical difference in throwing accuracy ( $p = 0.34$ ). Pairwise comparisons of the three test conditions also showed no statistically significant differences ( $p = 0.19 - 0.60$ ). Both research hypotheses were false. There was a significant difference between session two and three which indicated a learning effect may have occurred (see Table 2).

Radial Error Across Conditions	
Condition	Mean and SD (cm)
Control	25.4 ± 6.8
MI	27.6 ± 5.8
MI with locomotion	26.2 ± 6.9

Table 1. Descriptive statistics for radial error are shown for each experimental condition.

Radial Error Across Sessions	
Session Number	Mean and SD (cm)
Session 1	26.8 ± 7.0
Session 2	27.8 ± 6.0
Session 3	24.5 ± 6.2

Table 2. Descriptive statistics for radial error are shown for each session according to order.

## DISCUSSION

The present study resulted in no significant performance improvement when MI was used, which was inconsistent with MI literature (Callow, Roberts, Hardy, Jiang, & Edwards, 2013; Hardy & Callow, 1999). A strength of the study was it was the first to investigate the effect of locomotion in addition to MI from a first person point of view on the accuracy of a throwing task. A limitation to the study was a 40 cm radial error cap may have decreased variance in radial error means between conditions when the measurements were taken on the targets. A second limitation may have been external distractions such as music and loud noises that possibly interfered with the concentration of the participants and decreased the efficiency of MI. Third, a small sample size made it difficult to infer results to the target population. Future researchers should increase the number of participants, the study should be conducted with minimal outside distractions, and researchers should increase the time between sessions to minimize the possibility of a learning effect.

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# CARDIORESPIRATORY AND CALORIC EXPENDITURE DIFFERENCES IN KETTLEBELL-SPECIFIC WORKOUTS

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## PURPOSE

Kettlebell (KB) training has become popular among recreationally active individuals and athletes as a way to gain functional strength and enhance cardiorespiratory endurance. The purpose of this study was to compare cardiorespiratory and lactate responses as well as caloric expenditure (CE) between different KB workouts. Previous descriptive studies involved only a few parameters, such as oxygen consumption ( $VO_2$ ) and rate of perceived exertion (RPE), for one particular workout (Falatic, 2011; Lake & Lauder, 2012; Schnettler, 2009; Skidmore, Jones, Blegen, & Matthew, 2012). The hypotheses were that both the continuous KB swing and the KB circuit workout would: 1) meet American College of Sports Medicine (ACSM) recommendations, and 2) elicit similar CE and cardiorespiratory responses.

## METHODS

**Participants:** Twenty-five recreationally active college-aged males ( $n = 8$ ) and females ( $n = 17$ ) completed both a KB swing and KB circuit workout. **Equipment:** Participants completed the predictive  $VO_{2max}$  test and warmed up on a Monark 328e cycle ergometer. Heart rate was measured using a Polar T31 chest strap monitor. Blood lactate (BLA) was measured using a Lactate Pro handheld lactate analyzer. Oxygen consumption was measured using a TrueOne 2400 mobile metabolic cart. An 8 or 16 kg Pro Grade Competition Kettlebell were used for both the KB protocols. **Procedures:** All participants attended a familiarization session, completed a predictive  $VO_{2max}$  test in accordance with the submaximal Young Men's Christian Association (YMCA) bike protocol, and learned correct KB technique for each maneuver prior to testing (see Figure 1). During the KB circuit testing session, participants performed one min of each of the following exercises consecutively: swing, deadlift, snatch, goblet squat, and clean and press. This was followed by two min of rest while a blood sample was collected before completion of another circuit set. For the KB swing testing session, participants performed a continuous, self-paced two-handed swing workout for 10 min. After five min, participants were allowed to rest for approximately two min while a blood sample was collected. In each testing session, heart rate (HR),  $VO_2$ , BLA, and CE were measured for the ten minute workout. **Statistics:** Paired  $t$ -tests (significance level  $p \leq 0.05$ ) were utilized to determine the existence of significant differences between KB workouts for  $VO_2$ ,  $\%VO_{2max}$ , HR,  $\%HR_{max}$ , BLA, and CE.



Figure 1. KB-specific maneuvers are demonstrated.

## RESULTS

Statistical differences were observed between KB swing and circuit workouts for all dependent variables (see Table 1). The circuit workout elicited higher cardiorespiratory, BLA, and CE responses ( $p = 0.00-0.001$ ) compared to the KB workout. Therefore, the null hypothesis was rejected. In addition, both the KB swing and circuit workouts met ACSM recommendations therefore the research hypothesis was accepted.

**Acute Responses of KB-Specific Workouts Descriptive Statistics Mean  $\pm$  SD**

	<b>KB Swings</b>	<b>Circuit</b>
<b>% VO<sub>2max</sub></b>	60.6 $\pm$ 15.5	68.0 $\pm$ 14.3*
<b>% HR<sub>max</sub></b>	74.6 $\pm$ 9.7	79.9 $\pm$ 9.2*
<b>BLA (mmol·L<sup>-1</sup>)</b>	4.1 $\pm$ 2.7	6.0 $\pm$ 2.8*
<b>CE (kcal)</b>	74.6 $\pm$ 28.0	82.1 $\pm$ 26.0 *

Table 1. The mean and standard deviations for cardiorespiratory, BLA, and CE parameters are represented from both workouts. \* Indicates significant difference between circuit and KB swings.

## DISCUSSION

Both the KB swing and circuit workouts met ACSM recommendations to improve cardiorespiratory endurance. Due to the utilization of more muscle mass and the increased production of metabolic waste, the circuit workout enhanced cardiorespiratory responses. The circuit workout required more upper extremity work during the snatch and clean and press maneuvers unlike the swing workout. Thus, the present study supported the idea that an enhanced cardiorespiratory response is typically elicited when upper body muscles were utilized (Schnettler, 2009). It was likely that the heightened BLA and CE levels were due quicker fatigue during the circuit workout due to the engagement of more muscle groups (Skidmore et al., 2012). A limitation of the study was that the frequency of KB swings was prescribed at a self-paced rate, which resulted in varying intensities across participants. A strength of the present study was that researchers observed BLA during a KB workout. Also, the observed statistical power was high, which indicated that the significant difference between the KB workouts was due to the experimental treatment and could be inferred to the target population. Future researchers should test whether a longer workout session could elicit similar results. Both KB workouts met ACSM standards to increase cardiorespiratory endurance, which indicate that both workouts are good models for exercise.

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# COMPARISON OF EXERCISE QUALITY BETWEEN DIFFERENT EXERGAMING PLATFORMS

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## PURPOSE

As media consumption rises among adolescents, the amount of time they spend being physically active decreases, contributing to childhood obesity. Average media consumption exceeds 7.5 hours per day among 8-18 year-olds (Rideout et al., 2010). In 2013, and for 4 of the last 5 years previous, childhood obesity was parent’s number one concern for their children (U-M C.S. Mott Chil. Hosp., 2013). Youth with an affinity for media may be interested in increasing their physical activity through exergames (video games incorporating physical activity in play). Bailey and McInnis (2011), found that several exergames provide greater exercise intensity than a 3 mile/hour walking pace. Because Xbox Kinect measures physical activity more accurately than Wii or PlayStation Move (Jensen and Becwar, 2012), we hypothesized that the Xbox would stimulate more physical activity in its players as less activity would correctly be rewarded less points. The null hypothesis is that no difference in energy expenditure or exercise intensity would be experienced during play of the Xbox Kinect or Wii. Despite the more effective movement tracking and assumed increase in physical activity that would stimulate, measurements were not made to assess play of the same game in different gaming platforms. Such comparisons were made in this study to determine if the same physical activity benefit would be achieved by play involving different platforms.

## METHODS

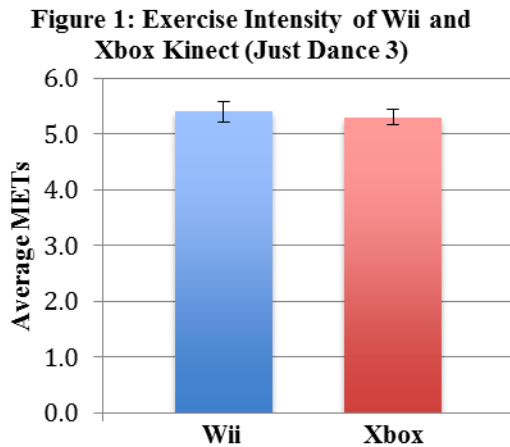
**Participants:** A sample of 51 participants ( $n_{\text{male}}= 31$ ,  $n_{\text{female}}= 20$ ), ages ranging from 17-40, voluntarily participated. **Equipment:** Subjects wore SenseWear armband accelerometers for physical activity monitoring. The video game, Just Dance 3, was played on both the Nintendo Wii and the Xbox 360 Kinect gaming consoles. **Procedures:** Twenty subjects, both male and female, played Just Dance 3 on the Wii, while 31 participants played the same game on the Xbox. Subjects were instructed on how to play the game before the trial began, and were allowed to pick different songs to dance to at the intensity level of their choice. Subjects played for 30 minutes. Perceived physical exertion was reported using Borg’s Rated Perceived Exertion (RPE) scale. The SenseWear Armbands measured energy expenditure (EE) (joules) and exercise intensity (MET: Metabolic Equivalent of Task). MET intensities were grouped as follows: 0-3 METs = Sedentary, 3-6 METs = Moderate, 6-9 METs = Vigorous, >9 METs = Very Vigorous. **Statistics:** Means were compared using a 2-tailed t-test with equal variance not assumed. Means were considered different if the alpha test yielded a p-value of less than 0.05.

**Table 1: Energy Expenditure Differenced Between Wii and Xbox Kinect**

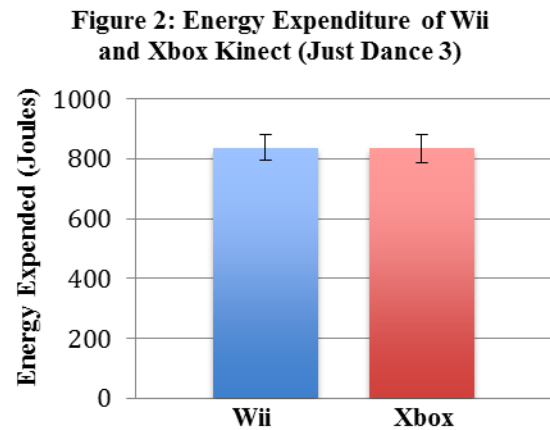
Console	EE (J)	Avg METs	Time at MET level (min)				RPE (6-20)
			< 3 METs	3-6 METs	6-9 METs	>9 METs	
Wii	837(±44)	5.4(±.19)	2.2(±.00021)	14.9(±.0011)	13.6(±.0012)	0.4(±.00020)	11.5(±.37)
Xbox	834(±48)	5.3(±.14)	3.5(±.00048)	14.2(±.00067)	12.9(±.00074)	0.2(±.00009)	12.2(±.45)
p-value	0.968	0.631	0.097	0.731	0.739	0.571	0.244

**Table 1:** Mean (±Standard Error) is calculated for a 30-minute workout. This data was calculated from subject play of Just Dance 3.





**Figure 1:** Mean ( $\pm$ Standard Error) MET level achieved during 30 minutes of Just Dance 3 play.



**Figure 2:** Mean ( $\pm$ Standard Error) energy expenditure achieved during 30 minutes of Just Dance 3 play.

## RESULTS

As shown in Table 1, game play produced similar energy expenditure and exercise intensity in both the Xbox and Wii groups. Figure 1 shows the difference in exercise intensity, and Figure 2 shows the difference in energy expenditure between the two platforms. Because there was no statistically-significant difference ( $p > 0.05$ ) between the Xbox and Wii trials, the null hypothesis that energy expenditure and exercise intensity between during play of Xbox Kinect or Wii are the same was accepted. Means and standard error are included in Table 1 and Figures 1 and 2.

## DISCUSSION

Previously, the Xbox Kinect platform proved superior at monitoring physical activity in its players compared to the Wii. It was hypothesized that being a better measurement device may make it better at stimulating greater physical activity in its players. While this may be the case in unmotivated players who prefer to make a small effort and earn as many points in the game as possible, the Wii was equally effective in eliciting exercise intensity and energy expenditure as the Xbox in motivated subjects. It appears that the interest level of individual players in playing a game plays a more important role in determining whether or not the individual put effort and enthusiasm into its play. This effort and enthusiasm of the player translates to the energy expenditure and exercise intensity they experience. The current study only included one game across two possible gaming consoles. Future research with a wide array of games available on multiple consoles would be needed to fully evaluate whether or not energy expenditure changes depending on how intrinsically interested the players are.

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# TEAM WORK FROM AN INTERDISCIPLINARY VIEW

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## PURPOSE

The purpose of these studies was to establish a global theme of increased cooperation that led to an exchange of knowledge with an increase in interdisciplinary work as exemplified by Klien (1996). Klien's theory predicted that as the complexity of the task increased, interactions between disciplines, it would create a greater interdisciplinary effect. In this paper, three studies were recorded; two studies were conducted, as a group to test the individual knowledge of young professionals in different fields of study. Study 1 (Ryan et al., 2012) as a part of the group of three studies, examined the Instrumental Interdisciplinary effect of Design after exposure to Kinesiology. Study 2 (St2) in the group of three studies, explored the development of the Epistemological Interdisciplinary effect, or Multidisciplinary (Horlick-Jones, 2004), of Interior Design (Design) students after cooperation with Kinesiology (Kines) consultants. Study 3 (St3) in the group of three studies, explored the baseline difference of the Transdisciplinary knowledge between Design and Kines students.

**Null Hypothesis St2:** There would be difference between pre- and post-Design Students interdisciplinary knowledge and awareness (considered in St2).

**Null Hypothesis St3:** There would be difference between Design and Kines students in interdisciplinary knowledge and awareness (considered in St3).

## METHODS

**Subjects.** Subjects used were female college students between the ages of 17 and 23 years, studying Interior Design or Kinesiology at a Division I – Research I University. Thirty four women (N=34) were used in this study, composed of Design (n<sub>Design</sub>=20) and Kines (n<sub>Kines</sub>=14) students. **Instrumentation.** Participants completed a 10 item, 5 point Likert scale on an Interdisciplinary Knowledge and Awareness Survey adapted from the Washington State University Community Based Learning Assessment (Brown, Gelmon, & Holland, 2008). Surveys were completed by both Design and Kines students prior to attendance at workshops (St2). The Design students completed the survey both before and after the experiment (St3).

**Procedures.** Students collaborated on a design project for a playscape natural environment for children's play. The design process consisted of three 1½ hour workshops held each Tuesday over three weeks, with a onetime observation of children's play from one group member per team. The interdisciplinary knowledge and awareness data was compiled on an excel spread sheet. A mean was calculated using individual subject item summaries. **Statistics.** Mean scores (M), standard deviations (SD), and a p-value was determined. A two tailed, type three, t-test was used to compare the pre and post experimental data for Design students (St2), and to compare the pre-pre experiment data between Design and Kines students (St3).

## RESULTS

For St2, the pre experimental group produced a mean score of 27.35 out of a possible 35 points on the confidence questionnaire. The post experiment group reported a mean score of 29.95 out of a possible 35 points. The p-value for this study was 0.0019 (see Table 1). For St3, Kines students reported mean score of 24.71 out of 35 points on the questionnaire. Design students recorded a mean score of 27.58 points. The p-value for this study was 0.0004 (see Table 2).

### Pre vs. Post Design Experiment Data

	n	M	SD	P-Value
pre	20	27.35	2.98	0.0019
post	20	29.95	1.73	

Table 1. Subjects reported a higher level of confidence after the experiment was completed.

### Kinesiology and Design

	n	M	SD	P-value
Kines	14	24.71	1.53	0.0004
Design	25	27.58	2.91	

Table 2. Design students recorded higher level of confidence in Interdisciplinary and Awareness than Kines students.

## DISCUSSION

Both the null hypotheses were rejected showing support for both multidisciplinary and transdisciplinary effects of cooperation. Students reported higher rates of interdisciplinary knowledge and awareness after a greater exposure to the other field.

In Ryan et al. (2012) Design students were tasked with designed a natural playscape for children. Two Kinesiology consultants provided a one hour presentation to Design students on motor activity during play. According to Klien (1996), the Ryan et al. (2012) experiment reflected instrumental interdisciplinary research.

In St2 the Design students showed an increase in knowledge and awareness after exposure to Kinesiology through the Kines consultant. The consultants provided the knowledge of human motor learning and activities to engage in appropriate development. The Design students compiled that information along with knowledge of buildings and structures. The exchange of ideas and theories in the respective fields, and a clear division of labor supported Horlick-Jones (2008) definition of multidisciplinary knowledge.

In St3, prior experience during early childhood, allowed the students to cooperate more efficiently and provided a base for the free exchange of information and ideas. This free exchange of ideas provided the foundation for future transdisciplinary work. The Design students' higher perceived interdisciplinary knowledge probably can be explained by greater exposure to the kinesiology field during early childhood play.

These findings support the Klien (1996) model. Early exposure to ideas increases interdisciplinary effect and complexity. In Ryan et al. (2012), Design students experienced a short exposure to the field of Kinesiology with limited cooperation. In St2, Design and Kines students worked cooperatively but separated tasks along professional lines. In St3, early exposure allowed participants to learn and understand the other discipline while maintain contact with the concepts of their own discipline.

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# DIFFERENCES BETWEEN PERCEIVED AND ACTUAL CARDIOVASCULAR DISEASE RISK IN COLLEGE

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## PURPOSE

Cardiovascular disease (CVD) was the leading killer in the U.S. in 2011 (Centers for Disease Control [CDC], 2011). Ogtontuya, Oum, Buckley, and Bonita (2013) reported that 40%-62% of the observed decline in CVD deaths could have been attributed to reduced CVD risk factors. Several studies have reported that 40% of the general middle-aged American population underestimated their CVD risk (Avis et al., 1989; Niknian, McKinlay, & Rakowski, 1989). Most of the current research has focused on CVD risk in middle-aged and elderly populations, which has led to a gap in information about college aged students and CVD risk. The purpose of this study was to compare perceived and actual CVD risk factors in a college aged student population. The research hypothesis was that participants would perceive that their CVD risk would be lower than their actual CVD risk.

## METHODS

**Participants:** A convenience sample of 75 male ( $n = 30$ ) and female ( $n = 45$ ) undergraduate students ( $20.0 \pm 1.0$  years;  $22.4 \pm 4.5$  kg/m<sup>2</sup>) volunteered for participation. No participants had known CVD, were on blood thinners, or had previous heart surgery. All participants were 18-22 years old, and were undergraduate students at Whitworth University, Gonzaga University, or Washington State University Riverpoint Campus. **Equipment:** The equipment used is included in Figure 1. **Procedures:** Participants attended one 20-minute session to obtain data. Participants were asked to complete the CVD risk and health survey. After completion of the survey, participants' blood pressure (BP) was recorded twice, 5-minutes apart, and then was averaged. Then, height and weight were measured and body mass index (BMI) was calculated. Upon completion of BMI measurements, waist circumference (WC) was measured below the most inferior rib. The tension caliper on the end of the measuring tape was used for consistency. Finally, participants' overall risk was calculated using the Framingham 30-year risk calculator. **Statistics:** A Related-Samples McNemar Test was used to investigate significant differences for each dependent variable. Statistical significance was set at an alpha level of  $p \leq 0.05$ .

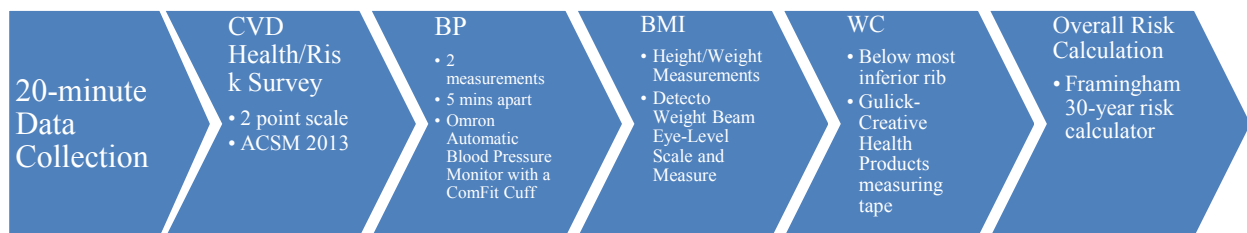


Figure 1. Equipment and order of procedures are summarized above.

## RESULTS

Descriptive statistics are displayed in Table 1. There were significant differences between perceived and actual overall CVD risk including 19-year-old participants ( $p = 0.004$ ) and excluding the 19-year-old participants ( $p = 0.041$ ), BP risk ( $p = 0.012$ ), and BP health ( $p = 0.000$ ). Thus, the research hypothesis was accepted for perceived and actual overall risk, BP risk, and BP health. There were no significant differences between perceived and actual BMI risk ( $p = 0.180$ ), BMI health ( $p = 0.508$ ), WC risk ( $p = 1.000$ ), and WC health ( $p = 0.289$ ). Therefore,

the research hypothesis was rejected for perceived and actual BMI risk, BMI health, WC risk, and WC health.

Descriptive Statistics		
Measurement	Mean and Standard Deviation	
	Males	Females
Overall Risk (%)	3.7 ± 1.5	1.5 ± 0.6
SBP (mmHg)	122.2 ± 13.0	116.8 ± 8.6
DBP (mmHg)	69.0 ± 6.8	68.3 ± 6.5
Weight (kg)	78.9 ± 13.3	61.2 ± 8.3
Height (cm)	181.6 ± 9.2	167.6 ± 6.0
BMI (kg/m <sup>2</sup> )	23.4 ± 4.5	22.7 ± 2.5
WC (cm)	82.0 ± 9.4	77.9 ± 5.7

Table 1. Descriptive statistics for each measurement were calculated.

## DISCUSSION

The overall CVD risk results of the present study were inconsistent with the results observed by Avis et al. (1989) and Niknian et al. (1989), potentially due to the age differential and small sample size of the present study. Harring, Montgomery, and Hardin (2010) reported that 28% of a college-aged sample had inaccurate BMI perceptions. In the present study, only 11% of participants had inaccurate BMI perceptions, possibly due to a large contingent of Health Science majors in the sample. The observed WC results were consistent with other means reported for the same age range (18-22 years old; Dobbelsteyn et al., 2001). The results possibly were due to better understanding of healthy WC values. Waist circumference is also an anthropometric measurement that may be more easily perceived, which could have affected the results. Significant differences appeared in both samples with and without 19-year-old participants. This is meaningful because the Framingham 30-year risk calculator is not recommended for use with individuals 19 years old or younger. This study had merit because early adulthood has been considered to be one of the healthiest periods of life; therefore little research has been conducted in examination of CVD risk factors for this age group. Limitations of the present study include a large contingent of the sample were Health Science majors, and only one testing session was used for data collection. Future research should utilize more known CVD risk factors to provide more data for risk assessment, schedule two testing sessions per participant to help mitigate the effects of confounding variables, and use random sampling techniques to obtain a more representative sample.

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