

Mid-Atlantic Regional Chapter  
of the  
American College of Sports Medicine  
(MARC-ACSM)

38<sup>th</sup> Annual Scientific Meeting - 2015

Abstract Booklet  
Clinical Case Studies and Research Abstracts

Friday, November 6, 2015  
and  
Saturday, November 7, 2015

Sheraton Harrisburg-Hershey Hotel  
Harrisburg, PA

# **2015 Annual Meeting**

## **Clinical Case Studies**

## **Wrist Pain in a Non-athletic Individual**

*Adae Amoako MD, Drexel University Sports Medicine*

*George Pujalte, MD*

**HISTORY:** 42-year-old, right-handed Caucasian male who presented to the medical orthopedics clinic with left wrist pain. Pain was aggravated by lifting things, shuffling cards, and taking trash bag out of the trash can. He reported occasional clicking and catching. He denied history of trauma, injury, or fall. He also denied numbness or tingling sensation, swelling, or redness.

**PHYSICAL EXAMINATION:** Examination of the left wrist showed limited extension compared to the right. There was clicking with flexion and extension of the wrist on the dorsal aspect. Mild tenderness was noticed over the distal radioulnar joint. There was ulnar and radial deviation on provocation. Anatomic snuffbox was non-tender. Neurovascular exam was intact.

### **DIFFERENTIAL DIAGNOSIS:**

Kienbock's disease (avascular necrosis of the lunate bone)

Scapholunate instability

Scaphoid fractured

Quervain's tenosynovitis

Carpometacarpal osteoarthritis.

### **TESTS AND RESULTS:**

4-view x-rays of the left wrist

--Mild radiocarpal and scapho-trapezium-trapezoid (ST-T) osteoarthritis

--Subchondral cysts seen in the lunate and scaphoid with no obvious fractures

Magnetic resonance imaging (MRI) of left wrist

--Abnormal T1 hypodense signal involving the proximal pole of the scaphoid

--Articular collapse proximally of the scaphoid with marked irregularity of the overlying cartilage

### **FINAL/WORKING DIAGNOSIS:**

Preiser's Disease (Idiopathic avascular necrosis of the scaphoid)

### **TREATMENT AND OUTCOMES:**

Initially put in wrist brace with diclofenac topical gel for pain control.

Corticosteroid steroid injection under fluoroscopy.

Pedicle bone graft reconstruction of the proximal pole of the left scaphoid and intercompartmental supra-retinacular artery vascularization.

Post-surgery thumb spica cast with the interphalangeal joint free for 6 weeks.

6 weeks post-surgery, patient able to make composite fist with his left hand.

18 weeks post op, patient was moving wrist with no pain.

## **Hip Pain in a Male High School Runner**

*Craig Betchart MD, University of Rochester*

*Sponsor, Mark Mirabelli MD*

**HISTORY:** This is a case of a 16yo male cross country runner who presented to the sports medicine clinic with a chief complaint of right hip and thigh pain. The pain had been present for about 2 weeks, interfered with his running, and progressed to the point where it was painful to walk. He has no significant past medical history. He is a non-smoker, non-drinking, and non-drug user. Family hx is only significant for breast cancer in his grandmother.

**PHYSICAL EXAMINATION:** Normal gait, no pain to palpation, no erythema, no swelling. He experienced pain with hip flexion, that was located in the anterior groin and radiated to the thigh. Full ROM, full strength. FABER and FADIR reproduced the thigh pain. He refused to jump on the right leg, stating it would hurt.

**DIFFERENTIAL DIAGNOSIS:** Prior to MRI: stress fracture, labral tear, FAI, tumor. Following MRI: eosinophilic granuloma, osteoid osteoma, osteomyelitis (bacterial, fungal, tubercular), Ewing sarcoma, osteosarcoma, lymphoma, multiple myeloma, metastasis, skeletal syphilis, Brodie abscess, chondroblastoma, giant cell tumor.

**TESTS AND RESULTS:** CBC, CMP, CRP, were normal. Xray at the initial visit was negative. There was concern for a stress fracture, so he was sent for an MRI. The MRI showed a well circumscribed 1cmx2cm T2 enhancing lesion in the proximal femur. He was sent to pediatric orthopedic surgery for bone biopsy. Frozen section at biopsy was negative for malignancy, and was read as "myxoid lesion." The remainder of the lesion was curretted, and a bone graft was placed. The tissue was sent for pathology and cultures. Pathology reported as acute on chronic inflammation consistent with osteomyelitis, but cultures and stains were negative.

**FINAL/WORKING DIAGNOSIS:** Aseptic Osteomyelitis.

**TREATMENT AND OUTCOMES:** The definitive treatment was surgery. The patient recovered well after surgery. No antibiotics were given due to negative culture data. He began a graduated running program at 6 weeks, and was running pain free at 12 weeks.

## **Acute Patella Subluxation in Crossfit Athlete, Not So Fast**

*Richard Davis DO, Geisinger Sports Medicine*

*Sponsor: Matthew McElroy DO*

**HISTORY:** A 30 CRNA active crossfit athlete sustained a right knee twisting/patella subluxation when she was doing a clean and jerk at a crossfit gym. She felt as though her patella displaced laterally and then her knee gave out. Her patella spontaneously reduced after she extended her knee. She went to the community ED later that day where her x-rays were negative; she was placed in a knee immobilizer and followed up with the sports medicine clinic 2 days later for follow-up.

**PHYSICAL EXAMINATION:** Right knee: TTP over suprapatellar region, 2+effusion, 3/5 extension of right knee, ligamentous structures difficult to evaluate due to guarding. Pain with forced flexion, otherwise NVI distally, compartments soft.

**DIFFERENTIAL DIAGNOSIS:** Patella instability, ACL tear, PCL tear, osteochondral defect, meniscal injury, quad tendon rupture, patella tendon rupture.

**TESTS AND RESULTS:** X-ray shows good maintenance of patellofemoral and tibiofemoral joint spaces. Decision to get MRI was made considering she had tense effusion and was a female of child bearing age. MRI shows torn ACL, tear of posterior horn of medial meniscus extending to superior articular surface, vertical tear of lateral meniscus extending to superior articular surface, 13mm full-thickness cartilage loss overlying medial femoral condyle, 5mm region of full thickness cartilage loss overlying lateral femoral condyle.

**FINAL/WORKING DIAGNOSIS:** ACL tear, medial and lateral meniscal tears with articular cartilage injury.

**TREATMENTS AND OUTCOMES:** Evaluated by Orthopedic Sports Surgeon who decided on 2 weeks of rehab and she worked on maintaining range of motion and quadriceps strengthening. She then underwent successful surgery with ACL reconstruction, medial/posteromedial reconstruction, allograft for ACL reconstruction and microfracture of medial femoral condyle.

## **Elbow Injury-Football**

*Abbie Kelley DO, York Hospital Sports*

*Sponsor: Mark Lavallee MD*

**HISTORY:** 15 y.o. male football quarterback with complaint of right medial elbow pain after throwing a football at practice 5 days ago. Patient states that he heard a pop and was unable to throw the football after the injury. He denies any pain or previous injury to the elbow. Immediately following the injury, the patient describes a significant amount of pain and swelling. He treated the medial elbow with ice and compression, which did improve the swelling. He continues to complain of pain and inability to throw the football. He denies any numbness or tingling of the forearm, hand, or fingers.

**PHYSICAL EXAMINATION:** Inspection of right elbow reveals some fullness over the medial aspect. No ecchymosis noted. Tender to palpation over the medial epicondyle. Lacks 20 degrees of extension. Flexion is about 110 degrees. Strength in flexion and extension of the elbow is full, 5/5. Slight weakness with pronation of the hand. 5/5 strength in supination of the hand. 5/5 strength in wrist extension. Weakness in wrist flexion. Neurovascularly intact. No ulnar nerve subluxation. Negative ulnar nerve Tinel's test. Discomfort with valgus stress testing and milking maneuver, but no definitive laxity.

**DIFFERENTIAL DIAGNOSIS:** 1. Ulnar Collateral Ligament Sprain, 2. Ulnar Collateral Ligament Tear, 3. Medial Epicondyle Apophysitis, 4. Strain of the flexor-pronator mass 5. Elbow Dislocation 6. Ulnar Nerve Subluxation, 7. Medial Epicondylar apophyseal fracture

**TEST AND RESULTS:** X-ray of the right elbow reveals an avulsion fracture of the medial epicondylar apophysis.

**FINAL/WORKING DIAGNOSIS:** Avulsion Fracture of the medial epicondylar apophysis, Salter-Harris 1.

**TREATMENT AND OUTCOMES:** Patient was placed in a sling for 2 weeks and told to wean out of the sling, only to use for comfort thereafter. Tylenol was used for pain as needed. Pt followed up 1 month after the injury, at which time the patient was completely pain free and range of motion improved. Repeat x-ray of the right elbow showed healing of the medial epicondylar fracture. Sling was discontinued and patient was told to follow up in 1 month. He was instructed NOT to participate in any type of throwing sport for at least 3 months time. If, at that point, patient is still pain free, he will start physical therapy and gradual return to play/throw protocol.

## Shoulder Injury – Recreational Bowler

*James F. Kelley MD and Adae Amoako MD, Penn State Hershey Family Medicine Residency*

*Sponsor: Jessica Butts MD*

**HISTORY:** 59-year-old gentleman presented to his primary care office with a complaint of left shoulder pain. He reported that he had thrown a snowball at a family member, when he felt a “pop” in his shoulder, followed by pain. The pain was an aching quality and intermittent, located on the lateral aspect of his shoulder. There was no impact on his arm’s range of motion. It initially responded to warm and cold compresses, but the pain worsened and he soon had difficulty putting his coat on. He used non-steroidal anti-inflammatories with moderate reduction of pain. While he had no history of acute shoulder injury or surgery in the past, the patient has been a recreational bowler for thirty years, and reported long standing discomfort with range of motion in his left shoulder for years. The patient was diagnosed with a rotator cuff injury, prescribed a prescription strength dose non-steroidal anti-inflammatory, and referred to physical therapy. Patient returned to clinic after four days of treatment due to developing ecchymosis over his anterior arm. Patient had allergies to antibiotics, but no known NSAID allergies.

**PHYSICAL EXAMINATION:** On initial exam: He had tenderness on palpation of his lateral left shoulder. He was documented as having 5/5 strength. Empty Can and Lift-Off Test were positive. On subsequent exam tenderness was localized in the bicipital groove and nonblanching ecchymosis was noted on the distal half of his left bicep. The gross appearance of his biceps was asymmetric, with left bicep larger than the right. He had 5/5 upper extremity testing, except for 4/5 strength on left arm flexion, abduction, internal and external rotation, left elbow flexion and left wrist supination. He had a positive Yergason’s and Speed’s test on left side.

**DIFFERENTIAL DIAGNOSIS:** 1. Rotator Cuff Muscle tear 2. Labrum tear 3. Subluxation of the shoulder 4. Subacromial impingement 5. Bicipital tendonitis or tear 6. Acromioclavicular joint disorders 7. Glenohumeral arthritis 8. Cervical radiculopathy with radiation to the shoulder 9. Gallbladder inflammation 10. Rheumatologic conditions 11. Paget Schroeter Syndrome (Upper extremity DVT due to exertion)

**TESTS AND RESULTS:** D-dimer to screen for DVT was negative.

**FINAL/WORKING DIAGNOSIS:** Proximal rupture of Biceps Long Head tendon, likely secondary to tendon remodeling caused by long standing supraspinatus inflammation from bowling.

**TREATMENT AND OUTCOMES:** 1. Initiated physical therapy 2. NSAIDs as needed for pain. 3. Began with external rotation resistance exercises and shoulder flexion. 4. Advanced to bicep curls, brachioradialis curls, and triceps extensions with light weights. 5. Progressed to shoulder rows and lateral pull downs. 6. After two months of physical therapy, patient reported 0/10 pain with passive range of shoulder motion. 7. After six physical therapy visits he was discharged with a home exercise routine, and has not complained of shoulder pain to his primary care physician in follow up visits.

## **Knee Injury – Fall**

*Michael Kraft MD, Cristiana Care Health System Sports Medicine Fellowship*

*Sponsor: Bradley Sandella DO*

**HISTORY:** A 50 year old female sustained a lower leg injury while running. She tripped on an uneven piece of sidewalk, felt a pop, and fell. At that time she went to the local hospital and she was found to have a left fibular head fracture, she was placed in a knee immobilizer, walking boot, and given oxycodone. She was seen in our clinic for follow-up 10 days later. At that time she was complaining of numbness/tingling as well as weakness in her foot and toes. She reported that she was unable to bear weight and unable to move her foot. The patient had no prior history of lower extremity injuries.

**PHYSICAL EXAMINATION:** Left lower leg – knee - positive swelling and ecchymosis about the left lateral leg, tender to palpation over lateral joint line and fibular head. Knee decreased ROM secondary to pain. Positive varus stress test, equivocal Lachman's, positive posterior drawer. Strength – difficult to assess in knee secondary to pain.

Foot limited ROM with no dorsiflexion. Strength in foot – 3/5 plantarflexion, 0/5 dorsiflexion. Sensation – no tactile sensation over dorsum of foot. Dorsalis pedis 2+, skin warm

**DIFFERENTIAL DIAGNOSIS:** 1.) fibular head fracture with peroneal nerve injury 2.) PCL and LCL tear

**TESTS AND RESULTS:** 1.) Left knee x-ray – comminuted avulsion fracture of proximal fibula 2.) MRI without contrast left knee – (a.) Acute avulsion fracture of the lateral tibial rim cortex with subjacent reactive marrow edema and avulsion of the lateral capsular ligament suggestive of a Segond fracture. At least high-grade partial tearing at the femoral attachment of the ACL. (b.) Acute avulsion fracture of the fibular head tip with the dominant fragment displaced 2.3 cm superiorly. Full-thickness tear of the fibular collateral ligament with a large hematoma. (c.) Nondisplaced trabecular fracture of the anterolateral medial femoral condyle with extensive reactive marrow edema. (d.) The peroneal nerve is thickened and edematous compatible with nerve injury, no evidence of complete transection of the nerve.

**FINAL/WORKING DIAGNOSIS:** ACL tear with proximal fibular head fracture and peroneal nerve injury

**TREATMENT AND OUTCOMES:** 1.) ACL reconstruction with allograft, LCL and posterolateral collateral ligament repairs and peroneal nerve neurolysis. 2.) A course of physical therapy. 3.) Patient's pain improved but foot drop persisted at 5 month follow-up. 3.) Referred to fracture liaison of the strong bones program for the fragility fracture.

## **Bilateral Lower Extremity Cramping in a Lacrosse Player**

*Jill Kropa MD, Thomas Jefferson University Primary Care Sports Medicine*

*Sponsor: Sunny Gupta DO*

**HISTORY:** A 19-year old female collegiate lacrosse player presented to the outpatient office for evaluation of bilateral lower extremity cramping during running exercises. She described it as a tightening of her calf and thigh muscles to the point of being “rock hard.” These muscles were very sore the day following activity. This had occurred on countless occasions in the past few competitive seasons. She had already been worked up with blood work, all of which was negative for abnormalities. She was on an extensive fluid and electrolyte regimen but did not see any improvement in frequency or intensity of these episodes. While at college she had also participated in three months of dedicated physical therapy including Graston and soft tissue techniques again with no progress.

**PHYSICAL EXAMINATION:** Examination in the office revealed a well-developed, age appropriate female. She had full range of motion of her neck, back, hip, and ankle. She had full knee flexion and extension but lacked 30 degrees of extension when the hip was flexed to 90 degrees. She had 5/5 bilateral strength of hip flexion, knee extension, knee flexion, ankle dorsi- and plantar flexion. She had 2+ distal pulses bilaterally. Sensation to light touch was intact and equal in her bilateral lower extremities. Bilateral hip exam produced no pain with log roll. FABER and FADIR testing were negative. She had no tenderness at the hip joint, greater trochanter, pubic symphysis, or ASIS. Bilateral knee exam revealed no ligamentous laxity, tenderness to palpation or bony deformities. She had negative Lachman, McMurray, anterior and posterior drawer testing as well as negative valgus and varus stress testing. Her bilateral calves revealed no edema, erythema, ecchymosis or warmth. She was non-tender to palpation over this musculature.

**DIFFERENTIAL DIAGNOSIS:** 1. Exertional Compartment Syndrome 2. Electrolyte abnormality 3. Metabolic disorder such as glycogen storage disease 4. Popliteal artery entrapment 5. Lymphatic obstruction

**TESTS AND RESULTS:** Exertional Compartment testing: Negative bilaterally for increase in compartment pressures after running on a track. Dynamic Arterial Duplex Scan with maneuvers: Positive for Popliteal Artery Entrapment bilaterally.

**FINAL/WORKING DIAGNOSIS:** Bilateral Popliteal Artery Entrapment

**TREATMENT AND OUTCOMES:** Referred for further evaluation with a vascular surgeon.

## **Bilateral Ankle Injury – Non-traumatic**

*Duron A. Lee MD, Pennsylvania State University  
Primary Care Sports Medicine Fellowship-State College  
Sponsor: Peter H. Seidenberg MD*

**HISTORY:** A 59-year-old Caucasian male with an 80-pack-year history of tobacco abuse and COPD reports mild bilateral posterior ankle discomfort while changing the battery in the bottom of his boat. The following day, he notes an acute onset of posterior left ankle pain followed by pain in the posterior right ankle associated with significant gait impairment. He denies any precipitating injury or event. Weeks prior, he reports being treated for an acute COPD exacerbation with several medications. At the time of evaluation, 9 weeks had past from the initial onset of ankle discomfort.

**PHYSICAL EXAMINATION:** The patient was alert, oriented and in no acute distress. Lower extremity skin was warm and dry without rashes or lesions. There was decreased sensation to light touch in bilateral S1 nerve root distributions. Bilateral gastrocnemius muscles were without masses or tenderness. There was a small, tender palpable defect appreciated in both Achilles tendons approximately 5 cm proximal to their insertion onto the calcaneus. Thompson testing while lying supine was equivocal with slight toe flexion. There was 5/5 strength in both tibialis anterior and EHL muscles and decreased strength in bilateral gastroc-soleus muscles. Distal pulses were intact with brisk capillary refill.

**DIFFERENTIAL DIAGNOSIS:** 1) Achilles tendonitis 2) Gastrocnemius muscle tear

**TEST & RESULTS:** Sports ultrasonography demonstrated evidence of extensive tendinosis and complete tendon rupture bilaterally.

**FINAL/WORKING DIAGNOSIS:** Bilateral acute Achilles tendon rupture

**TREATMENT & OUTCOMES:** Static and dynamic ultrasound evaluation demonstrated complete discontinuity of both Achilles tendons at the area of tenderness and palpable defect. Interval monthly sports ultrasonography over 3 months showed progressive bridging of the defects with increased scar formation and fiber realignment, representing tendon healing. These morphological changes corresponded directly with improved clinical symptoms and functional capacity. Musculoskeletal ultrasonography can play an important role in the assessment and evaluation of healing during non-operative management of Achilles tendon ruptures.

## Acute Abdominal Injury in a Collegiate Hockey Player

Jayson R Loeffert DO, Pennsylvania State University

Primary Care Sports Medicine Fellowship-Hershey

Sponsors: Matthew Silvis MD, Cayce Onks DO, Shawn Phillips MD

**HISTORY:** 19yo male, collegiate ice hockey player, suffered an abdominal injury in a game. Hit into the boards by another player. This occurred at his team's bench, and he had to be helped over the boards. He was then moved to the locker room for evaluation. He was pale, diaphoretic, and complained of acute left upper quadrant pain. Pain was 7/10, sharp, radiating to his left shoulder. He was transferred to the local ED for further evaluation, due to concern for intra-abdominal trauma.

### PHYSICAL EXAMINATION:

**Vital Sign:** Pulse 74-84, BP 92-137/ 51-68, RR 18-20, PO2 100#

**General:** awake, alert, NAD

**HEENT:** head and facial bones nontender, EOMI, PERRLA, TM intact without fluid/blood, no blood in mouth/nares, mucous membranes moist

**Neck:** nontender, no stepoffs/crepitus, trachea midline

**Heart:** regular rate and rhythm, no murmurs

**Lungs:** clear bilaterally, chest wall nontender, no wheezing/rales

**Abdomen:** soft, tender to palpation at left upper quadrant, nondistended, +BS, no guarding, or rigidity.

**Extremities:** pulse/motor/sensory grossly intact

**Neuro:** alert/oriented, no focal deficits, CN 2-12 intact

**Skin:** no rashes/erythema/ecchymosis over abdomen

### DIFFERENTIAL DIAGNOSIS:

Splenic laceration/ contusion

Abdominal wall strain

Bowel rupture

Injury to pancreas

Injury to stomach

Rib Fracture, contusion

### TESTS AND RESULTS:

CBC, CMP, and Lipase normal. **CT chest/abdomen** - Small sub centimeter splenic contusion involving the lower pole. No other traumatic injury identified. Thickening of the bowel, appreciated by general surgery, questionable significance, concerning for possible laceration.

### FINAL/WORKING DIAGNOSIS:

Small bowel laceration

### TREATMENT AND OUTCOME:

Following initial studies and evaluation, he was observed overnight, due to pain and possible spleen injury. Overnight, pt was seen to have increased heart rate, pain, and WBC. He was taken for exploratory laparotomy which revealed a small bowel perforation. This was surgically repaired. No other injury, including that to the spleen, could be appreciated. Pt remained in the hospital for 6 days, which were uneventful, then discharged home. One month later, he was seen in follow up by trauma. His exam was unremarkable. He was held from hockey for the remainder of the season. He was otherwise released to full activity and cleared to participate in next year's hockey season.

## An unusual hip injury in a male soccer player

**HISTORY:** A 15-year-old male high school soccer player presented for evaluation after injuring his left hip during a soccer game three days prior to presentation. He was turning for the ball, planted his left foot with an extended knee and felt a posterior force into his hip. He stated that: "It felt like my hip popped out of place." He experienced acute onset of posterior left hip pain. He was unable to continue playing secondary to the pain. He denied any radiation, distal paresthesias, or weakness at the time or since. He rested over the weekend, took ibuprofen and applied ice, and reported significant improvement of symptoms upon presentation. On presentation, he had mild pain at the left lower buttock region.

**PHYSICAL EXAMINATION:** Examination of the bilateral hips revealed no gross deformity or ecchymosis. Range of motion at the bilateral hips was restricted in internal and external rotation, but equal bilaterally and painless. There was no tenderness to palpation over the left greater trochanter, external hip rotators, left proximal hamstring, or ischial tuberosity. Strength was 5/5 in hip flexion, extension, abduction, and adduction bilaterally without reproduction of pain. There was no tenderness to palpation over the lumbosacral region. Patellar reflexes were 2+ bilaterally. Babinski's was downgoing. Sensation was intact to light touch and equal bilaterally. Gait was normal.

**DIFFERENTIAL DIAGNOSIS:**

Proximal hamstring injury  
External hip rotator strain  
Referred lumbosacral pain  
Sacroiliac joint dysfunction  
Pelvic ring fracture

**TESTS AND RESULTS:** At the initial evaluation, we suspected an extra-articular source of discomfort. Given the drastic improvement of symptoms in the first three days after injury and lack of significant physical exam findings, we decided to treat conservatively with anti-inflammatories as needed and rehabilitation with gradual return-to-play as tolerated. The patient and his mother were given strict instructions to call or return with worsening or persistent symptoms. He returned to light conditioning and practice without significant increase in his pain. After successfully completing a regulation game, however, he noted slight worsening of his pain. After a discussion with his mother, an MRI was ordered. The MRI of the left hip revealed a transverse, non-displaced posterior acetabular fracture.

**FINAL/WORKING DIAGNOSIS:** Traumatic, low-velocity posterior acetabular fracture

**TREATMENT AND OUTCOME:** He subsequently was given crutches and made toe touch weight bearing. He will follow-up in four weeks to reassess.

## **Groin Pain - Collegiate Soccer Player**

*Ariel Nassim MD Drexel University Sports Medicine*

*Sponsor: Thomas Trojian MD*

**HISTORY:** Patient is a 21 year old men's collegiate soccer player presenting with complaints of left groin pain. He states the pain began 4 months prior to presentation. He was kneed in the left thigh at that time, and he subsequently sat out of a few games until the thigh pain improved. Upon improvement of his thigh pain, he began noticing increasing groin pain. Pain was sharp, constant, 1/10 when not active, however pain worsened with running (9/10). The pain was at times debilitating, causing him to have to lay still without moving. After about 2 hours of rest and immobility, the pain would improve. He was doing strengthening exercises with his certified athletic trainer, but were not helping. He had not taken pain medication, and the pain was not alleviated by any positions. At the time of evaluation he was not participating in practices, only participating in drills, and noted exacerbation of symptoms with any cutting movements. He denied any numbness or tingling in the legs. He also denied any weakness, pain with coughing, sneezing, or sex. Additionally, he denied any history of groin surgery or recent infections.

**PHYSICAL EXAMINATION:** Left hip appearance was normal. There was tenderness along the pubic symphysis as well as the proximal adductors, but not the ASIS, not the gluteus maximus, not the gluteus medius, not the greater trochanter and bursa, not the proximal hamstring and not the proximal quadriceps. Reproducible point tenderness in the left pubic symphysis. There was a relative decrease in range of motion of the left hip in all planes compared to right side with a component of pain limiting ROM testing, however overall within normal range. Motor strength of the left hip was normal. There was a positive impingement test in FADIR and there was reproducible pain with left leg adductor testing producing pain in the left groin. There was a negative FABER. The right hip had a normal appearance. There was no tenderness of the right hip. There was a full range of motion of the right hip. Motor strength was normal. Ely test was negative, as well as negative FABER test and negative impingement test. Negative for reproducible pain with right sided adductor testing, as well as bilateral rectus abdominus testing with resisted crutch.

### **DIFFERENTIAL DIAGNOSIS:**

Core muscle injury  
Adductor strain  
Stress fracture of pubic ramus  
Osteitis Pubis

### **TESTS AND RESULTS:**

MRI Pelvis and Left Hip Without Contrast (sports hernia protocol):

Normal appearance of the tendinous junctions of the rectus muscles and adductor muscles.

There is increased T2 signal in both superior pubic rami adjacent to the symphysis pubis. There is prominent degenerative changes seen at the pubic symphysis, most consistent with osteitis pubis and/or pelvic instability. Evaluation of the left hip demonstrates normal signal intensity from bone marrow. The joint space is preserved. There is no suggestion of labral tear.

### **FINAL/WORKING DIAGNOSIS:**

Osteitis Pubis

(Cont. on next page)

**TREATMENT AND OUTCOMES:**

1. Ibuprofen 800mg before games and/or practices.
2. Icing of the left groin after games and practices.
3. He was advised to initiate a core strengthening program under the direction of his certified athletic trainer. After 3 weeks, he states his pain is much improved, he is now participating in full practices and games, and has no limitations from his pain. He states he is doing core strengthening at home on a daily basis. He takes ibuprofen 800mg prior to playing, which he states helps prevent the pain from coming on, along with icing after games and practices, for which he states helps tremendously with pain and discomfort. He has 0/10 pain at rest, and states the worse pain he will have after prolonged intense activity is 5/10.

## Leg Pain in a Female College Soccer Player

*Eric Requa DO, York Hospital Sports*

*Sponsor: Mark Lavallee MD*

**HISTORY:** 19-year-old female with a past medical history of right popliteal artery entrapment and ischemic right foot s/p surgical dissection presents with persistent right leg pain for two years. She has had extensive work-up and evaluations by various specialists for her symptoms. Initially was diagnosed with Raynaud's phenomenon and had rheumatologic work-up done which was negative. She was then referred to vascular surgery and diagnosed with right popliteal artery entrapment and complete occlusion. Urgent surgery was performed and she was found to have occluded right popliteal artery by adventitial cystic disease. Cystic tissue was removed and occlusion was dissected, normal perfusion was re-established to the leg.

For two years post-operatively, she continued to have intermittent, exertional right lower leg pain and underwent more vascular studies, which demonstrated normal arterial flow. She was referred to a foot and ankle specialist. Orthopedic surgeon diagnosed her with exertional compartment syndrome and referred to primary care sports medicine for compartment syndrome pressure testing, with plans to attempt fascial release.

On presentation to PCSM physician, she complains of right medial anterior leg pain as well as continued numbness and tingling on her right foot. Symptoms are present at rest but worsen with activity and running. Occasionally feels weak in her right foot. She has had to stop playing soccer for 2 years due to symptoms.

### **PHYSICAL EXAMINATION:**

#### RIGHT LOWER EXTREMITY EXAM:

Skin: intact

Gait: antalgic

Standing alignment: normal

Knee exam: normal

Hip exam: normal

Calf: tenderness to medial edge of distal tibia. no tenderness when palpating gastrocnemius or lateral compartment.

Achilles: no deformity or defects, non-tender

Ankle: normal appearance. Normal strength in EHL, Peroneal muscles, anterior tibialis. Weakness of posterior tibialis.

Special testing: positive single heel raise. Negative squeeze test, anterior drawer test and talar tilt test.

Vascular: capillary refill < 2 sec, Dorsalis Pedis and Post. Tibial pulses intact.

Foot exam: pes planus

### **DIFFERENTIAL DIAGNOSIS:**

Medial tibial stress syndrome

Tibial Stress Fracture

Popliteal Artery Entrapment

Exertional Compartment Syndrome

Osgood Schlatters

Posterior Tibial Tendon dysfunction

(cont. next page)

**TESTS AND RESULTS:**

Tibia / Fibula XR of right leg – no acute bony pathology

US Vascular PVR and ABI with treadmill: no evidence of arterial insufficiency

MSK U/S Right ankle – posterior tibialis tendon identified with fluid surrounding the tendon, minimal movement when attempted to activate the posterior tibialis.

**FINAL/WORKING DIAGNOSIS:**

Posterior Tibial Tendon dysfunction

**TREATMENT AND OUTCOMES:**

Ultrasound guided hydrodissection of posterior tibial tendon sheath using Lidocaine 1% 2ML, Bupivacaine 0.5% 2ML, Kenalog 40 mg/ml 2ML. She was placed in a walking boot for 6 weeks, and to come out of boot daily for walking. She underwent 6 weeks of physical therapy. 100% relief of symptoms at rest and with running immediately following injection and at 4 week follow up.

## **Arm pain and weakness – Football**

*Erika Sadeghi MD, St. Joseph's Family Medicine Residency*

*Sponsor: Michael Kernan MD*

**HISTORY:** 21 year old male with unremarkable past medical history presented to the Emergency Department (ED) via ambulance with left arm pain and weakness after a tackle during football practice. Patient was running at high speed following a kick off and tackled another playing leading with his left shoulder and head extended to the right. Patient immediately had burning pain radiating down his distal left arm in a circumferential pattern. Associated symptoms included weakness, paresthesias, and decreased sensation. Patient did not lose consciousness. He denied previous neck injury.

**PHYSICAL EXAMINATION:** Patient was placed in a C-collar and on to a backboard at the field by EMS. Evaluation in the ED revealed decreased motor strength of the left upper extremity, specifically shoulder abduction, biceps flexion, triceps extension, and wrist extension. Patient had sensory deficit throughout the entire left upper extremity. There was no cervical spine tenderness. Extremities were atraumatic without cyanosis or edema.

**DIFFERENTIAL DIAGNOSIS:** 1. Brachial plexus injury 2. Cervical fracture 3. Cervical dislocation 4. Spinal cord contusion 5. disc herniation.

**TEST AND RESULTS:** CT C Spine was negative for acute fracture or dislocation. XRay of the left shoulder, elbow, forearm, humerus, and wrist were negative for acute fracture. MRI of the cervical spine showed no injury to the spinal column or cervical cord. Increased T2 uptake near left cervical nerve roots suggested brachial plexus injury.

**FINAL/WORKING DIAGNOSIS:** Brachial plexus injury.

**TREATMENT AND OUTCOMES:** 1. Discontinuation of C-Collar given no injury to cervical spinal column or cord. 2. Supportive sling for patient's left arm. 3. Outpatient nerve conduction study in 3 weeks time. 4. Physical therapy for the remainder of football season, focusing on chest out posturing, concentric and eccentric loading at various speeds and directions. 5. Weekly follow up with doctor and returning to play once complete resolution of symptoms. 6. Enhanced protective equipment, including high riding shoulder pads and neck rolls.

## **“I stopped boxing, and now my wrist hurts”**

*Lindsey Szymaszek MD, Cristiana Care Health System Sports Medicine Fellowship*

*Sponsor: Bradley Sandella DO*

**HISTORY:** A 31 year-old right hand dominant male presents with left wrist pain for 3 years. He denies injuring his wrist at any time, and the onset of pain has been insidious. He works in maintenance and complains of difficulty doing his job when he has to grip or lift anything heavy. He will drop things due to severe pain with a tight grip, but denies other weakness. Pain is worst in the evening, but also complains of morning stiffness. He has tried wearing a brace and taking NSAIDs on a regular basis without improvement in pain. He is a former boxer and denies any significant injury while boxing. He stopped boxing 4 years ago for reasons he can't recall. He wore protective gloves and taped his wrists every time he boxed.

### **PHYSICAL EXAMINATION:**

Examination of left wrist revealed dorsal wrist swelling. Range of motion was primarily limited in wrist extension. Active extension to 25 degrees; passive extension to 35 degree. Significant tenderness over TFCC and scapholunate junction. DRUJ was stable. Positive TFCC grind. Negative Watson's test. No scaphoid tenderness. Strength was 5/5 with wrist flexion and extension. Able to make a good fist, but strength with finger grip was decreased to 4/5. Subjective decreased sensation over C8 dermatome along his left 5th digit.

### **DIFFERENTIAL DIAGNOSIS:**

Scapholunate ligament tear 2. Fracture 3. TFCC tear 4. Osteonecrosis of carpal bone

### **TEST/RESULTS:**

**Left wrist xray:** volume loss, sclerosis, and fragmentation of the lunate bone likely secondary to chronic AVN.

**MRI with contrast:** abnormal lunate, with central portion demonstrating extensive signal heterogeneity and fragmentation, accompanied by dorsal displacement of the dorsal component, and volar displacement of the volar portion consistent with sequelae of lunate osteonecrosis and/or prior lunate fracture. Mild stretching of the scapholunate ligament and small punctate micro tears, no well-defined defect or full thickness tear.

### **FINAL/WORKING DIAGNOSIS:**

Osteonecrosis of the lunate; i.e. Kienbock's Disease

### **TREATMENT/OUTCOMES:**

1. Immobilization with wrist splint to wear while working. 2. Corticosteroid injection around lunate bone in attempt to delay surgical treatment for stage IV Kienbock's disease. 3. Recommended surgery, however this has not been pursued. 4. Continues immobilization with work and is unable to return to boxing.

## **Hamstring Injury – Football**

*Justin G. Tunis MD, Geisinger Health System Sports Medicine*

*Sponsor: David Ross MD, William Krywicki MD*

**HISTORY:** A 15 year old male sustained a posterior leg injury while playing football in August 2014. He is unable to recall the exact mechanism of injury, however, he noted pain in the buttock region and into the posterior aspect of the left leg. Patient was subsequently evaluated by orthopedics. X-rays demonstrated hamstring avulsion off the ischial tuberosity, and patient was advised to undergo surgical repair. Patient elected to avoid surgery, and started a formal rehabilitation program. Symptoms subjectively improved with therapy, however, have not resolved. Patient now denies any pain at rest, but does report pain while sitting and when participating in sport-related activity. Specifically, pain is exacerbated with running and while flexing the hip. Pain is sharp, shooting, and burning in nature and radiates down the posterior aspect of the left leg.

**PHYSICAL EXAMINATION:** Normal gait. Normal inspection. ROM equal and symmetric bilaterally. Hamstring tightness noted with popliteal angle 35 degrees bilaterally. No tenderness to palpation over the hip or pelvis. Strength intact and symmetric bilaterally to hip flexion, extension, adduction, abduction. FABER/FADIR negative. Pain exacerbated with strait leg raise on the left as well as with forward flexion of the hip. Neurovascular exam unremarkable. Reflexes intact and symmetric bilaterally.

**DIFFERENTIAL DIAGNOSIS:** 1. Residual pain from hamstring avulsion 2. Stress reaction of the pelvis 3. Herniated disc in the lumbar spine 4. Piriformis syndrome 5. Sciatic nerve entrapment from scar tissue

**TESTS AND RESULTS:** Prior MRI was reviewed which demonstrated acute hamstring avulsion off the ischial tuberosity, less than 10 mm separation. New radiographs were obtained and compared to prior studies. New radiographs demonstrate chronic avulsion type injury with increased heterotrophic bone formation.

**FINAL/WORKING DIAGNOSIS:** Chronic hamstring avulsion with heterotrophic bone formation which is compressing the sciatic nerve.

**TREATMENT AND OUTCOMES:** Surgery performed to decompress sciatic nerve and repair chronic hamstring avulsion.

# **2015 Annual Meeting**

## **Research Abstracts**

## **Acute Cheese Consumption Reduces Sodium-Induced Cutaneous Microvascular Dysfunction by Decreasing Oxidative Stress**

Alba, BK., Stanhewicz, AE., Kenney, WL., and Alexander, LM. Penn State University, University Park, PA

Chronic dairy consumption is associated with improved cardiovascular health; however, high dietary sodium (Na) intake impairs endothelial function through increased oxidative stress and attenuated nitric oxide (NO)-dependent mechanisms. **PURPOSE:** To determine if Na intake in dairy products (cheese) has a beneficial effect on microvascular function relative to other dietary Na sources due to the actions of milk-based macronutrients and proteins. We hypothesized that 1) acute cheese consumption would improve NO-dependent vasodilation (VD) compared to an equal amount of Na from non-dairy sources and 2) Na-induced reduction in NO-dependent VD is mediated by oxidant stress mechanisms.

**METHODS:** On 5 separate visits, 14 subjects ( $61 \pm 2$  years) consumed 3 oz. cheddar cheese (560 mg Na), 3 oz. soy cheese (560 mg Na), 2.3 oz pretzels (560 mg Na), 6 oz. cheddar cheese (1120 mg Na), or 4.6 oz pretzels (1120 mg Na). Two intradermal microdialysis fibers were placed in the forearm skin for local delivery of 1) Ringer's solution to serve as control and 2) ascorbate to serve as antioxidant. Red cell flux was measured by laser-Doppler flowmetry (LDF) during a standard local heating protocol ( $42^\circ\text{C}$ ). Once a plateau in cutaneous vascular conductance ( $\text{CVC} = \text{LDF}/\text{MAP}$ ) was reached, 20 mM L-NAME was perfused at all sites to quantify NO-dependent VD. Data were expressed as a percentage of maximum ( $\% \text{CVC}_{\text{max}}$ ; 28mM SNP). **RESULTS:** The local heating plateau was not different among the dietary treatments. NO-dependent VD was greater after cheese consumption compared to a Na-equivalent in soy cheese ( $59 \pm 5$  vs.  $44 \pm 6\%$ ;  $p=0.03$ ) or pretzels (560 mg Na:  $59 \pm 5$  vs.  $45 \pm 4\%$ ;  $p=0.03$ , 1120 mg Na:  $57 \pm 4$  vs.  $46 \pm 5\%$ ;  $p=0.02$ ). There was no difference in NO-dependent VD following ingestion of a Na-equivalent in cheddar cheese, pretzels, or soy cheese with local ascorbate administration (no main treatment effect). **CONCLUSION:** Na ingestion in cheese augmented NO-dependent VD compared to non-dairy Na ingestion and this difference was eliminated with a local antioxidant. These results suggest that macronutrients in cheese may protect against acute dietary Na-induced microvascular dysfunction through a reduction in oxidative stress.

Supported by Dairy Management Inc.

## Simvastatin Alters the RhoA Adaptation to Skeletal Muscle Stress Conditions

Amici DR., Chen D., Chin ER. University of Maryland, College Park, MD

Statin lipid-lowering drugs have been shown to induce muscular stress conditions and increase incidence of myopathy, especially in exercising individuals. RhoA, a GTPase involved in muscle repair and intracellular damage signaling, adapts both acutely (increased activation) and chronically (increased protein expression) to muscular stress conditions. Statins inhibit production of mevalonate, upstream of geranylgeranyl pyrophosphate (GGPP), which anchors newly translated RhoA to the cell membrane. This inhibition may suppress the ability to chronically increase RhoA expression. **Purpose:** To determine if exercise and statin treatment elicit different RhoA adaptations to muscular stress conditions. **Methods:** Mice were randomized into vehicle (Veh) control, one of three simvastatin doses (60, 200, or 400 mg · kg<sup>-1</sup>), or Veh plus intense eccentric exercise (Veh+EX). After two weeks, tibialis anterior muscle was harvested and analyzed via western blot for RhoA activity (percentage activated) and total RhoA expression. **Results:** Both the Veh+EX and all statin groups had elevated RhoA activity (p<0.05). RhoA expression increased in the Veh+EX group (p<0.01), but was unchanged between Veh and statin groups. There were no significant differences between statin doses. **Conclusion:** The increased RhoA activity with statin treatment and exercise shows a similar acute adaptation to stress, but the expected increase in RhoA expression was suppressed by all doses of simvastatin. This may play a role in the increased myopathy rate observed in exercising statin users. Future study should investigate if other signaling proteins modified by GGPP are also affected.

Supported by Maryland Summer Scholars stipend and UMD new investigator funds.

	<b>Control (Veh)</b>	<b>Exercise (Veh+EX)</b>	<b>Statin 60 mg · kg<sup>-1</sup></b>	<b>Statin 200 mg · kg<sup>-1</sup></b>	<b>Statin 400 mg · kg<sup>-1</sup></b>
<b>RhoA Expression (AU)</b>	527 ± 12	801 ± 22*	470 ± 73	541 ± 15	497 ± 22
<b>RhoA Activity (%)</b>	14.7 ± 1.1	20.0 ± 1.2*	22.9 ± 1.7*	19.5 ± 1.6*	18.5 ± 1.5*

## Menstrual Phase and the Vascular Response to Acute Resistance Exercise In Women

Augustine, J., Nunemacher, K., Heffernan, K. Syracuse University, Syracuse, NY

Aerobic exercise has a favorable effect on arterial stiffness and reduces the risk for cardiovascular disease (CVD). The effects of resistance exercise (RE) on arterial stiffness are less clear. Acute RE increases central stiffness and decreases peripheral stiffness in men. However, cyclic hormonal changes in women may modulate the vascular response to RE. **PURPOSE:** To examine the effect of acute RE on central and peripheral arterial stiffness in women during the early follicular and the ovulatory phase of the menstrual cycle. **METHODS:** Eighteen healthy women ( $28 \pm 7$  years, Body Mass Index (BMI)  $22.6 \pm 2.9$  kg/m<sup>2</sup>) completed an acute RE bout during the early follicular and the ovulatory phase of their menstrual cycle. Salivary 17 $\beta$ -Estradiol concentration was measured during each phase, using a passive drool technique. Pulse-Wave Velocity (PWV) was obtained from the carotid-femoral and carotid-radial pulse sites to measure central and peripheral arterial stiffness, respectively, using applanation tonometry. PWV was measured at rest, immediately, 10, 20 and 30 minutes post-RE. **RESULTS:** 17 $\beta$ -Estradiol concentration was significantly lower in the early follicular versus the ovulatory phase of the menstrual cycle ( $1.78 \pm 0.51$  pg/ml vs.  $2.40 \pm 0.26$  pg/ml,  $p=0.01$ ). Central PWV significantly increased ( $p<0.05$ ) and peripheral PWV significantly decreased ( $p<0.05$ ) post-RE in both early follicular and ovulatory phases. No phase-by-time interaction was detected for either vascular segment (Table,  $p>0.05$ ).

**CONCLUSION:** Menstrual cycle phase may not influence the vascular response to acute RE, even though there are significant differences in 17 $\beta$ -Estradiol concentrations between menstrual phases.

Supported by NIH NIA P30 AG0344645 05 (KSH).

Variable	Condition	Baseline	Post-1	10 min	20 min	30 min
CF-PWV (m/s)	Early Follicular	5.6 $\pm$ 0.8	5.8 $\pm$ 0.7 <sup>a</sup>	5.8 $\pm$ 0.8 <sup>a</sup>	5.7 $\pm$ 0.7	5.8 $\pm$ 0.7 <sup>a</sup>
	Ovulation	5.6 $\pm$ 0.6	5.9 $\pm$ 0.7 <sup>a</sup>	6.1 $\pm$ 0.8 <sup>a</sup>	6.1 $\pm$ 0.9 <sup>a</sup>	6.0 $\pm$ 0.9 <sup>a</sup>
CR-PWV (m/s)	Early Follicular	7.9 $\pm$ 0.3	6.8 $\pm$ 0.3 <sup>a</sup>	7.2 $\pm$ 0.3 <sup>a</sup>	7.8 $\pm$ 0.3	7.7 $\pm$ 0.4
	Ovulation	7.9 $\pm$ 0.3	6.8 $\pm$ 0.2 <sup>a</sup>	7.1 $\pm$ 0.3 <sup>a</sup>	7.6 $\pm$ 0.3	7.3 $\pm$ 0.3
MAP (mmHg)	Early Follicular	79 $\pm$ 7	83 $\pm$ 9 <sup>a</sup>	80 $\pm$ 10	76 $\pm$ 10	79 $\pm$ 9
	Ovulation	78 $\pm$ 6	79 $\pm$ 6	75 $\pm$ 7 <sup>a</sup>	76 $\pm$ 6	76 $\pm$ 8

<sup>a</sup> Significantly different from baseline (time effect),  $p<0.05$ ; No significant phase effect; CF-PWV, Carotid-femoral Pulse Wave Velocity; CR-PWV, Carotid-radial Pulse Wave Velocity; MAP, Mean Arterial Pressure.

## Acute Effects of High-Intensity Exercise on Peripheral Conduit Artery Blood Flow

Babcock, M., Lefferts, W., Heffernan, K. Syracuse University, Syracuse, NY

Blood flow patterns influence vascular function. Antegrade shear stress (caused by forward blood flow) promotes an antiatherogenic phenotype while retrograde shear stress (caused by backward blood flow) promotes a proatherosclerotic phenotype. Shear patterns may be influenced by regional vascular factors including vessel wall stiffness and pressure from wave reflections. **PURPOSE:** Examine the effect of acute high-intensity exercise on superficial femoral artery (SFA) stiffness, wave reflections and shear patterns. **METHODS:** 10 healthy men (age  $24 \pm 5$  yr; BMI  $25.8 \pm 3.7$  kg·m<sup>-2</sup>) completed a 5-minute time control followed by a 30-second Wingate anaerobic test (WAT). Doppler-ultrasound was used to measure SFA antegrade shear and retrograde shear from diameter and velocity profiles. Forward pressure wave intensity ( $W_1$ ) and reflected pressure wave intensity (NA) were measured using wave intensity analysis and the ratio of NA/ $W_1$  taken as an index of wave reflection magnitude. Arterial compliance, the inverse of stiffness, was calculated from regional changes in vessel diameter and pressure. **RESULTS:** No measure was significantly altered following the time control (Table 1,  $p > 0.05$ ). There was a significant increase in antegrade shear rate following WAT ( $p < 0.05$ ). There were significant reductions in retrograde shear rate and NA/ $W_1$  following WAT ( $p < 0.05$ ). There was no change in SFA compliance ( $p > 0.05$ ). **CONCLUSION:** Acute high-intensity cycling exercise results in antiatherogenic shear patterns in the SFA characterized by increased antegrade and reduced retrograde shear without impacting regional vessel wall stiffness. Reductions in retrograde shear may be influenced by reductions in the magnitude of pressure from wave reflections.

**Table 1.** Superficial Femoral Artery Properties and Hemodynamics ( $n = 10$ )

Variable	Baseline	Time Control	Post-WAT	P-value
Mean SFA Diameter (mm)	$5.88 \pm 0.57$	$5.89 \pm 0.64$	$6.15 \pm 0.41$	0.430
Antegrade Shear Rate (s <sup>-1</sup> )	$23.91 \pm 6.11$	$23.12 \pm 5.01$	$48.65 \pm 13.31$	<0.001
Retrograde Shear Rate (s <sup>-1</sup> )	$11.89 \pm 3.63$	$12.24 \pm 3.49$	$5.83 \pm 4.34$	<0.001
Reflection Magnitude (aU)	$1.06 \pm 0.72$	$2.10 \pm 1.94$	$0.35 \pm 0.41$	0.042
SFA Compliance (mm <sup>2</sup> /mmHg)	$0.04 \pm 0.03$	$0.05 \pm 0.03$	$0.04 \pm 0.03$	0.780

## Prevalence of Metabolic Syndrome Risk Factors in College-Aged Students

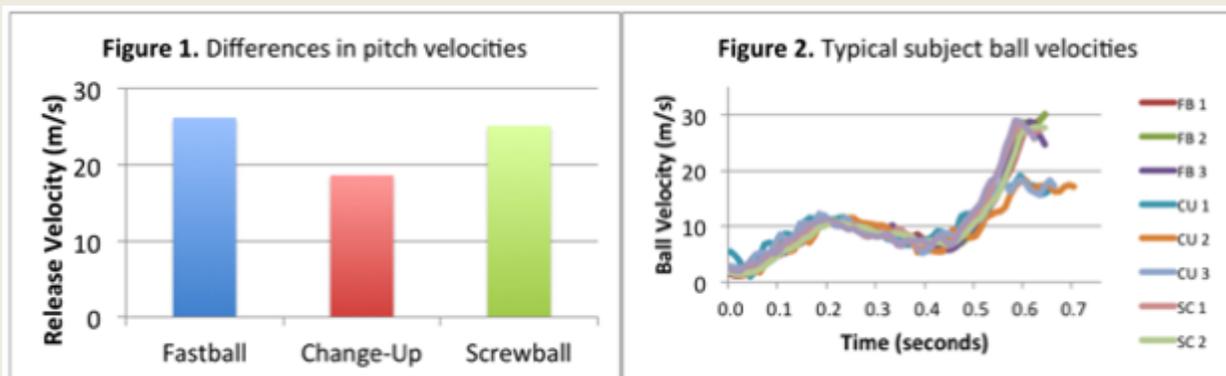
Biben, S., Orkin, S., Bopp, C. Department of Kinesiology, Pennsylvania State University, University Park, PA

The National Cholesterol Education Program Adult Treatment Panel III has established criteria for metabolic syndrome, including abdominal obesity and elevated triglycerides, High Density Lipoprotein (HDL) cholesterol, blood pressure, and impaired fasting glucose. A participant with metabolic syndrome would test positive for at least three risk factors. **Purpose:** To determine prevalence of metabolic syndrome in college-aged men and women. **Methods:** Three-hundred Kinesiology Physical Activity Program students were tested for metabolic syndrome risk factors. Fasting lipid and glucose values were obtained via finger stick. Blood was collected into a 40  $\mu$ L capillary tube for analysis with a commercially available analyzer. Waist girth was measured with a tension-regulated tape measure. Blood pressure was auscultated following standard procedures. **Results:** Out of 300 students, 12 (4.0%) of the students met criteria for metabolic syndrome. Out of the total 150 males studied, 1.33% had metabolic syndrome, 6.67% tested positive for at least two risk factors, 25.3% had at least one risk factor, and 66.7% showed no risks for metabolic syndrome. In males, 4.0% met criteria for abdominal obesity, 16.0% had elevated triglyceride levels, 14.7% demonstrated below recommended HDL levels, 2.0% had elevated blood pressure, and 6.0% had elevated glucose levels. In females, 6.67% demonstrated characteristics of metabolic syndrome, 20.7% met criteria for 2 risk factors, 26.7% met criteria for one risk factor, and less than half (46.0%) met criteria for 0 risk factors. Of women, 24.6% met criteria for abdominal obesity, 14.0% had elevated triglyceride levels, 34.7% demonstrated below recommended HDL levels, 0.67% had elevated blood pressure, and 10.0% had elevated glucose levels. **Conclusion:** In the cohort of 150 men (average age 21.2) and 150 women (average age 21.6), 4.0% met criteria for metabolic syndrome, 13.7% met criteria for at least two risk factors, 26.0% for at least one risk factor, and 56.3% were negative for any factors. These findings stress the importance of having college-aged adults participate in health screenings, specifically testing for fasting lipids, body fat, and glucose measures.

## Kinematic Variability in Three Types of Softball Windmill Pitches

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**PURPOSE:** Softball pitchers have numerous types of pitches in their arsenal, but previous researchers have focused primarily on the fastball technique. The purpose of this study was to assess kinematic variability for the fastball, change-up, and screwball pitches. **METHODS:** Five female NCAA Division II softball pitchers participated in the study. Participants performed five pitches for each of the following pitch types: fastball, change-up, and screwball. The velocity of the ball was computed from videos of the pitches using Logger Pro software. The three best attempts (for each pitch type) based on velocity at release (VR) were used in the analysis. Differences between measures were tested for statistical significance using ANOVA (criterion of  $p = 0.05$ ). **RESULTS:** Figure 1 shows that pitchers achieved the largest VR values using the fastpitch ( $26.2 \pm 1.4$  m/s) and screwball ( $25.1 \pm 1.5$  m/s), while the smallest VR values were obtained using the change-up ( $18.7 \pm 1.6$  m/s). The fastball and screwball VR values were not significantly different from each other, but VR values for both fastball and screwball were significantly larger than the change-up technique. Figure 2 shows the ball velocity from the start of the windmill motion until ball release (for all attempts by a typical subject). Ball velocity values are similar for all pitch types until the very end of the pitching motion, when fastball and screwball ball velocity values become nearly 40% larger than the change-up. **CONCLUSION:** The results of this project indicate that for a small sample of NCAA Division II softball pitchers, kinematic variability within a given type of pitch is minimal. Future studies should use a larger sample and explore other pitch types such as the curveball and riseball.



## **Exercise Improves Vascular Dilator Reactivity in Chronically Stressed Rats with Pre-existing Metabolic Syndrome**

Branyan, KW, Brooks SD, Asano S, Hoskinson HN, Mancini BB, Bryner RW, Olfert IM, Frisbee JC, Chantler, PD.  
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The prevalence of the metabolic syndrome (MetS) and chronic stress/depression is rapidly increasing as well as an increased risk for poor cardiovascular outcomes. Poor cardiovascular outcomes produced by each of these disease states are caused by impaired vascular function. It is not known if comorbidity between the MetS and chronic stress has a confounding effect on the cerebrovascular system. It is known that exercise is an effective intervention to improve vascular dysfunction. Obese Zucker Rats (OZR) are used as a representative model of the MetS, where their lean counterparts (LZR) are considered healthy controls. To induce depressive symptoms in these rodents, an Unpredictable Chronic Mild Stress (UCMS) protocol was administered to mimic daily, chronic stress. **PURPOSE:** To determine if UCMS has a confounding effect on cerebrovascular dysfunction in OZR and to what degree an exercise intervention can improve this vascular dysfunction. **METHODS:** OZR and LZRs were separated into experimental groups including: control, UCMS, and UCMS plus exercise. The middle cerebral artery (MCA) was isolated and exposed to increasing doses of acetylcholine to assess endothelial function. TEMPOL was also used to determine the role of oxidant stress in modulating reactivity via vasodilation. **RESULTS:** LZR MCAs experienced a 30% decrease in dilation after UCMS but with added exercise, MCA dilation was improved by 15%. Dilation response in OZR MCAs was attenuated by approximately 40%. This impairment was recovered by exercise and increased dilation by 50% from UCMS alone. TEMPOL incubation improved dilation in OZR control MCAs but did not have an effect on LZR control MCAs. Dilation responses in both OZR and LZR UCMS MCAs were improved to almost control values with TEMPOL incubation but with exercise, TEMPOL did not augment dilation. **CONCLUSIONS:** Chronic stress has a confounding effect on cerebrovascular dysfunction in rats with pre-existing metabolic syndrome. Exercise proves to be an effective intervention to improve microvascular reactivity in comorbidity between the MetS and chronic stress.

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## Nocturnal Blood Pressure Dipping in Normotensive Adults: Effect of Dietary Sodium and Sex

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Normal nocturnal blood pressure (BP) dipping is arbitrarily defined as a decrease in mean daytime to mean nighttime BP by 10% to 20%. Individuals that have impaired nocturnal BP dipping (i.e., <10%) have an increased risk of cerebrovascular and cardiovascular diseases. Excess sodium consumption is associated with increased cardiovascular disease risks and no studies have examined nocturnal BP dipping under a controlled sodium diet. **PURPOSE:** To assess nocturnal BP dipping during low (LS) and high sodium (HS) diets in men and women. We hypothesized that a HS diet would impair nocturnal BP dipping, and men would have a greater impairment than women. **METHODS:** Eighty-seven healthy normotensive men (n = 41; age:  $35 \pm 2$  years) and women (n = 46; age:  $40 \pm 2$  years) participated in a controlled feeding study where LS (20 mmol Na<sup>+</sup>/day) and HS (300 mmol Na<sup>+</sup>/day) diets were provided for 7 days each in random order. Subjects wore a 24-hour ambulatory BP monitor, and we collected a 24-hour urine sample and fasted blood sample on the final day of each diet. Nocturnal BP dipping was calculated as:  $((\text{mean daytime BP} - \text{mean nighttime BP}) / \text{mean daytime pressure}) * 100$ . **RESULTS:** As expected, there was a significant increase in urinary sodium excretion during the HS diet (women: LS =  $26.0 \pm 2.1$  vs. HS =  $238.4 \pm 14.1$  mmol/24hr; men: LS =  $31.5 \pm 4.4$  vs. HS =  $234.4 \pm 13.3$  mmol/24hr; p < 0.01) and serum sodium (women: LS =  $137.7 \pm 0.3$  vs. HS =  $139.7 \pm 0.2$  mmol/L; men: LS  $137.9 \pm 0.4$  vs. HS =  $139.8 \pm 0.3$ ; p < 0.05) with no differences observed between the sexes. Nocturnal BP dipping was not different between the diets (women: LS =  $10 \pm 1\%$  vs. HS =  $10 \pm 1\%$  mmHg; men: LS =  $9 \pm 1\%$  vs. HS =  $10 \pm 1\%$  mmHg; p > 0.05) with no differences observed between the sexes. **CONCLUSION:** Our findings suggest that increased dietary sodium does not influence nocturnal BP dipping responses in normotensive men and women.

Supported by the NIH Grant R01 HL104106

## **Preliminary Analysis of Incident Rate of Head Impacts in Collegiate Women's Lacrosse.**

Bula, MK., Stritch, T., Higgins MJ. Towson University, Towson, MD

It has been estimated that a player (e.g., football and soccer) may experience more than 1,000 head impacts during a season and upwards of 10,000 during their careers. Many of these head impacts likely result in concussion signs and symptoms yet go unreported. Frequency and location of head impacts are important factors in determining the probability of head injury in athletes. **PURPOSE:** To investigate the incident rate and location of head impacts sustained in National Collegiate Athletic Association Division I (D1) women's lacrosse athletes comparing practices, games, and player positions over the course of one full season. **METHODS:** This was a descriptive epidemiology study with data collection occurring during games and practices. Nine female D1 Lacrosse athletes (height=65.875±1.642cm, mass=66±13.804kg, age=19.875±1.125years) wore goggles instrumented with the GForce Tracker (Gforcetracker Inc., Markham, Ontario, Canada). GForce tracker sensors are programmed to record acceleration-time history, location about the head, and magnitude of both linear acceleration (g) and rotational velocity for each impact. Incident rates per 1000 exposures and incidence rate ratios (IRRs) with corresponding 95% confidence intervals (CIs) were calculated for all sessions. **RESULTS:** 965 impacts over 20 g's throughout 331 exposures were recorded in the participants. Over the course of 41 games, 281 impacts occurred (IR=6.85, 95% CI=6.05-7.65; IRR= 1.00, 95% CI 0.85 – 1.17) while 684 impacts occurred (IR=2.35, 95% CI=2.18-2.53; IRR: = 1.00, 95% CI = 0.89 – 1.11) throughout 290 practices. Player position (attack, midfield, defense, and goalie) affected the head impact incident rate and location of impact. **CONCLUSION:** The head impact incident rate and location impact in D1 women's lacrosse varies on player position and session type. We speculate that impact incident rate is greater during games than practice because of the higher intensity of play. Comparing the relationship of rate of impact exposures and location of impacts can assist in creating strategies to prevent the frequency of head injury in athletes.

## **Physical and Strength Characteristics of College Lacrosse Players in Relation to Player Role**

Burns, DC, Peditto, BD, Bernier, JP, Colish, A, Wilson, JK. DeSales University, Center Valley, PA

Although lacrosse continues to grow in popularity and participation, there is little research on the physical and physiological characteristics of these athletes. Understanding these characteristics with reference to the athletes' roles in the sport can help guide the design of specific training regimens.

**PURPOSE:** To measure body size, adiposity, and strength in a collegiate lacrosse team engaged in a pre-season training regimen in order to help define these characteristics, especially with respect to the on-field role of the athletes. **METHODS:** Twenty male lacrosse players on a Division III varsity team participated in this study. Ten played a principally offensive role (O) and ten primarily a defensive role (D). Upper and lower body strength were assessed by measuring the 1-repetition maximum during bench press and squat exercise, prior to and following a 12-week conditioning program designed and supervised by an experienced strength and conditioning coach. Body mass, height, and adiposity were measured at the conclusion of the training program. Comparison of measures between O and D athletes used the t-statistic. **RESULTS:** No significant differences between O and D athletes were found ( $p$  values  $> 0.15$ .) In this small sample, defensive players as a group were heavier (D=86.7 Kg; O = 83.5 Kg), taller (D = 178.5 cm; O = 177.3 cm), had greater adiposity (D = 18.1 % fat; O = 17.5% fat) and greater lean mass (D = 70.7 Kg; O = 68.3 Kg) than their offensive counterparts. Defensive players were stronger both before (D squat = 321 lb; O squat = 296 lb. D bench = 231 lb; O bench = 213 lb) and after (D squat = 354 lb; O squat = 318 lb. D bench = 242 lb; O bench = 221 lb) the training regimen. **CONCLUSION:** There were consistent but statistically insignificant differences in physical and strength characteristics between O and D player roles among varsity collegiate lacrosse players in this study. Additional research with a larger sample size, players from other divisions, and measurement of physiological characteristics would further define these athletes and their training needs.

## Reliability of Mainstream Tablets for 2D Analysis of a Drop Jump Landing

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Clinicians, coaches, and trainers would benefit from a reliable and practical tool to analyze movement patterns such as a drop vertical jump (DVJ) which is often used to screen for lower extremity injury risk. Smart devices such as handheld tablets and phones offer attractive possibilities for analyzing these skills. However, little is known about the validity of using these devices in the day to day clinical or field settings where the observation and recording may often be done from different locations or by different evaluators. **PURPOSE:** To determine the effect of position and evaluator on the reliability of a mainstream tablet to perform a 2D frontal plane analysis of DVJs. **METHODS:** Six college students studying human movement analysis were arbitrarily assigned to hold one of two tablets while concurrently recording the frontal plane of a standard DVJ. The students held the tablets close to chest height while standing side by side 3.7 m in front of the DVJ landing area creating variability in tablet positioning of approximately 25 cm in vertical height, 30 cm left or right from midline, and 20 cm in front of the landing. The six students were then randomly assigned to measure left leg frontal plane projection angle (FPPA) at the instant of maximum downward displacement of the initial DVJ landing using a free video analysis app. No student analyzed the same DVJ on both tablets. In total, 90 DVJs performed by 30 college aged volunteers were analyzed. Intraclass correlation coefficients (ICC), standard error of measurement, and minimal detectable change (MDC) were calculated. Alpha = 0.05. **RESULTS:** ICC between the two tablets was 0.83 ( $p < 0.001$ ) with a 95% confidence interval of 0.76 to 0.88. FPPA standard error of measurement was  $1.7^\circ$  with a MDC of  $2.4^\circ$ . **CONCLUSION:** The exact positioning of an observer does not make a significant difference when using a tablet to capture and evaluate a DVJ and different evaluators can assess FPPA. These findings increase the practicality and reliability for using tablets to perform a 2D motion analysis of a drop jump landing.

## **Rest Interval Length Does Not Affect Total Exercise Volume during Lower Body Resistance Training**

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Rest intervals between sets of resistance training appear to be an important variable that can directly affect training volume. **PURPOSE:** to investigate the influence of different rest intervals (1, 3, and 5 min.) on lower body resistance training in NCAA Division III collegiate male basketball players. **METHODS:** Ten male basketball players ( $19.4 \pm 1.3$  years,  $83.3 \pm 10.7$  kg,  $189.1 \pm 7.8$  cm) were randomized to a rest interval of 1, 3, or 5 minutes. Repetitions to failure was assessed for three sets of the leg press at 85% 1RM. Heart rate (HR) was recorded at rest, RPE was recorded every four repetitions, and HR and RPE were recorded immediately post-exercise, and halfway through each rest interval. **RESULTS:** No significant differences were observed in volume between rest intervals or in RPE between rest intervals ( $p < 0.05$ ). Significant differences in HR were noted between rest intervals ( $p < 0.05$ ). Differences in HR were observed between 1-minute ( $131.900 \pm 22.8$  beats/min<sup>-1</sup>) and 5-minute rest intervals ( $120.452 \pm 18.3$  beats/min<sup>-1</sup>). Finally, we found that subjects were able to complete significantly more repetitions to failure during the first set of each rest interval ( $p < 0.05$ ; Set 1:  $12.43 \pm 1.5$  reps; Set 2:  $10.43 \pm 1.5$  reps; Set 3:  $9.500 \pm 1.1$  reps). **CONCLUSION:** These results indicate that rest interval length does not affect exercise volume, which may have direct application for coaches and strength and conditioning specialists prescribing rest intervals between sets of collegiate basketball players.

## **Discrepancies in Obesity Levels by Three Separate Criteria (Waist Girth, BMI, and Body Fat Percentage)**

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Body Mass Index (BMI) is a widely used measure of body composition. However, only relying on height and weight, and thus BMI, can lead to misclassification of obesity status. **Purpose:** To determine discrepancies in obesity status against the three separate measures (waist girth, BMI, and body fat percentage) in both males and females. **Methods:** Data was collected on 3,842 college-aged males and 2,995 college-aged females. BMI was calculated from height and weight measured using standard procedures. Waist girth was measured using a tension-regulated tape measure. Body fat percentage was measured using a bioelectrical impedance analysis (BIA) machine. Obesity status for each subject was determined for each technique. The correlation coefficients between BMI and the other two criteria were calculated using Pearson product moment correlation. **Results:** There was a discrepancy in obesity classification between Body Mass Index (BMI) and waist girth of 9.52% (366 out of 3842) in males. The correlation coefficient between BMI and waist girth in males was 0.65. There was a discrepancy in obesity classification between BMI and body fat percentage of 6.56% (252 out of 3842) in males. The correlation coefficient between BMI and body fat percentage in males was 0.51. There was a discrepancy in obesity classification between BMI and waist girth of 1.80% (54 out of 2995) in females. The correlation coefficient between BMI and waist girth in females was 0.51. There was a discrepancy in obesity classification between BMI and body fat percentage of 3.21% (96 out of 2995) in females. The correlation coefficient between BMI and body fat percentage in females was 0.56. **Conclusion:** The data suggests a strong positive correlation between BMI and both waist girth and body fat percentage in both males and females. The data also suggests BMI, a measure of obesity that is widely considered inaccurate, to be reliable in college-aged individuals with less than 10% of males and less than 3.5% of females having a discrepancy in obesity classification in a population of over 6,800 subjects.

## **The Influence of a Morton's Foot on Arch Characteristics in Minimally-Shod Runners**

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Individuals with a Morton's foot exhibit hypermobility of the first ray of the foot. It is unknown if this increased mobility affects static arch characteristics such as arch height, arch flexibility, and arch drop during stance in minimally-shod runners. We have previously reported that minimally shod runners with Morton's foot report more foot pain than those with a 'regular' foot. However, the relationship between Morton's foot and static arch characteristics has not been established. Therefore, **purpose** of this pilot study was to determine if having a Morton's foot is related to alterations in Arch Height Index (AHI), Arch Rigidity Index (ARI) and Arch Drop (AD). **Methods:** Sixteen experienced minimalist runners participated (age  $27.4 \pm 10.1$  yrs, hgt:  $170.3 \pm 25.0$  cm, mass  $78.1 \pm 18.0$  kg, gender 8M, 8F). Following informed consent, subjects were asked to stand barefoot with feet placed shoulder width apart while superior view photographs were taken of each foot. Feet were classified as Morton's if the second toe was longer than the great toe ( $n=8$ ). AHI, ARI and AD were obtained using the AHI measurement system. Left and right side data were considered separately, such that each subject had two data points in analyses. A MANOVA was performed with the dependent variables of AHI, ARI, and AD between subjects with a Morton's foot or a regular foot. Alpha was set at the level of 0.10. **Results:** Minimally-shod runners with a Morton's foot had a lower arch ( $AHI=0.314 \pm 0.024$ ) than runners without a Morton's foot ( $AHI= 0.34 \pm 0.03$ ) ( $p = 0.062$ ). Also, those with a Morton's foot demonstrated greater arch rigidity ( $ARI = 0.94 \pm 0.06$ ) than those without ( $ARI = 0.92 \pm 0.03$ ) ( $p = 0.088$ ). Arch drop (in mm) did not differ between the two groups ( $p = 0.137$ ). **Conclusions:** This study revealed that runners with a Morton's foot have a lower, more rigid static arch than their counterparts with a regular foot. Anatomical features of the lower extremity, such as arch characteristics, are believed to dictate the function of the foot and are associated with running injuries. Previous data indicate that minimally-shod runners with a Morton's foot report greater foot pain than those with a regular foot. Future studies should examine running biomechanics, including kinematics and loading at foot contact, to better understand the mechanism of injury in this population.

## Effects of Dietary and Plasma Lipid Levels on Vascular Health Measures

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Cardiovascular disease remains the leading cause of death in the world. Research consistently shows that those at the highest risk are those with a higher level of cholesterol throughout the body. Poor nutrition and a sedentary lifestyle can cause elevated plasma cholesterol levels which lead to numerous medical conditions. Both nutrition and activity level can also impact body fat and vascular measures such as brachial flow-mediated dilation (FMD) and intima-media thickness (IMT). To the best of our knowledge, no study has compared plasma and dietary lipid levels with vascular health in a young adult population. **PURPOSE:** To examine the relationship between dietary lipids, plasma circulating lipid levels, and vascular health measures. **METHODS:** Sixty one fasted adults (30M, 31F) with an average age of  $25.3 \pm 11$  years were included in our study. All participants completed a three-day dietary recall and underwent fasted lipid level, blood pressure, body composition, carotid artery IMT, and flow-mediated dilation FMD measurements. **RESULTS:** The participants' average diet over the three-day period was  $2244.9 \pm 537.3$  calories; including 18.3% fat, 60.2% carbohydrates, and 21.3% protein. Plasma lipid levels were all within the healthy range (total cholesterol:  $158.9 \pm 33.8$  mg/dL; HDL:  $50.6 \pm 16.4$  mg/dL; triglycerides:  $89.4 \pm 39.4$ ; and LDL:  $94.8 \pm 27.8$  mg/dL). We found an indirect relationship between dietary saturated fat intake and plasma HDL levels ( $r = -0.279$ ,  $p < 0.05$ ). Also, we found a direct relationship between dietary mono-unsaturated fat intake and IMT levels ( $r = 0.269$ ,  $p < 0.05$ ). Results also displayed that measurements of the fasted lipid LDL levels were directly related to carotid artery IMT ( $r = 0.283$ ,  $p < 0.05$ ). **CONCLUSION:** Our data suggests that dietary and plasma lipid levels have an association with vascular health measures in young adults. Future studies should be performed to examine inflammatory markers to further examine these relationships.

## **Objectively Measured Physical Activity Varies by Task and Accelerometer Location in Younger and Older Adults**

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Assessing physical activity with accelerometers has become common in research; however, most accelerometer validation studies have been performed using treadmills and young, healthy individuals. Treadmills alter stride length and step cadence and have been shown to exacerbate balance difficulties in older adults. Thus, movement difference between young and old when walking on a treadmill could lead to inaccurate representation of physical activity detected by accelerometers. **PURPOSE:** To examine differences in movement patterns between younger and older adults using accelerometers at the hip and the wrist. **METHODS:** Physical activity was measured simultaneously using three separate Actigraph Link accelerometers placed at: 1) dominant-anterior-superior iliac spine (hip), 2) dominant wrist (D), and 3) non-dominant wrist (ND) in 10 younger (age 23±3) and 10 older (age 71±3) adults. Subjects performed 4 walking tasks, for 5 minutes each: 1) treadmill walking at 1.5 mph, 2 & 3) normal-paced walking on a 20m course with and without a walker, and 4) fast-paced walking on a 20m course. The accelerometer data was downloaded in 30 second epochs and physical activity during each task was calculated as the average vector magnitude over the five minutes, excluding the first 30 second epoch. **RESULTS:** Treadmill walking activity measured at the hip did not differ between old and young (1180±252 vs. 1286±236 respectively,  $p=0.35$ ), however, significantly higher activity was recorded at both wrist locations in older adults (D: 1775±528 vs. 1246±377,  $p<0.05$ ; ND: 1907±686 vs. 1340±329,  $p<0.05$ ). No significant differences between young and old were found during the normal-paced over ground walking tasks; however, as a group, pushing the walker resulted in significantly lower measurement of physical activity at both wrists (D: 2593±873 vs. 762±321,  $p<0.001$ ; ND: 2801±885 vs. 558±236,  $p<0.001$ ) with a trend toward lower measurement at the hip (2025±433 vs. 1937±436,  $p=0.06$ ). Fast-paced walking activity was significantly lower in older adults at the hip (2464±556 vs. 2926±435,  $p=0.05$ ), but not at the wrist (D: 3687±1384 vs. 4471±1427,  $p=0.23$ ; ND: 3955±1581 vs. 4619±1123,  $p=0.29$ ). **CONCLUSION:** Physical activity movement patterns may differ by age and type of walking task. Further accelerometer validation is needed in older populations.

## Post Activation Potentiation of Back Squat and Trap Bar Deadlift on Acute Sprint Performance

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**PURPOSE:** We investigated the ability of back squat (BS) and trap bar deadlift (TBD) to elicit post activation potentiation (PAP) and hence improve 40m sprint performance in college age female rowers. **METHODS:** Twenty division III collegiate female rowers, whose  $\bar{X} \pm SD$  for age, height, weight, and  $VO_2$  Max were  $19.2 \pm 1.1$  y,  $1.7 \pm 0.06$  m,  $67.4 \pm 6.8$  kg and  $42.5 \pm 3.9$   $ml \cdot kg^{-1} \cdot min^{-1}$ , completed a 40m sprint timed at 10m, 20m, and 40m with a timing system. Based on sprint times, subjects were divided into two groups: BS and TBD. Subsequently, we determined their one repetition maximum (1 RM) for the BS and TBD. One week later, subjects completed a 40m sprint, and then three repetitions at 90% of their 1RM for BS or TBD; after 7 min of active rest, they completed another 40m sprint. A dynamic warm-up and active cool down preceded and followed all testing sessions. Data were analyzed with three 2x2 repeated measures ANOVA. **RESULTS:** We found both conditions significantly increased 20m and 40m sprint times as shown below:

### *Sprint Times (s) by Group*

	Trap Bar Dead Lift (n=10)			Back Squat (n = 10)		
	10m	20m	40m	10m	20m	40m
Pre	$2.06 \pm 0.11$	$3.53 \pm 0.19$	$6.48 \pm 0.44$	$2.10 \pm 0.09$	$3.62 \pm 0.14$	$6.61 \pm 0.32$
Post	$2.07 \pm 0.11$	$3.60 \pm 0.19^*$	$6.57 \pm 0.42^*$	$2.10 \pm 0.09$	$3.66 \pm 0.17^*$	$6.67 \pm 0.36^*$

Note.  $* = p < 0.05$

**CONCLUSION:** The data show that three repetitions at 90% of 1RM for BS or TBD did not elicit PAP in female college rowers. These findings may be related to sex, load, training incompatibility, and sprinting proficiency in this subject population.

## Topical Menthol Application Augments Cutaneous Microvascular Blood Flow

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**Purpose:** Menthol containing topical analgesic gels are used clinically to activate transient receptor potential melastatin 8 (TRPM8) receptors, which elicits a cold sensation that purportedly mimics cryotherapy. However, there is controversy as to the precise vascular effects of menthol containing topical analgesics. We sought to more fully characterize the mechanism(s) of action through which topical menthol application may alter skin blood flow (SkBF). **Methods:** Three distinct protocols were conducted in three groups of 10 young, healthy subjects. Red cell flux was measured via laser speckle contrast imaging in all protocols. Protocol 1: Menthol (4%) and placebo gels were applied to 45cm<sup>2</sup> of skin without thermal control and SkBF was measured until SkBF reached a stable plateau. Protocol 2: Menthol and placebo gels were applied to skin under local thermal control (33<sup>0</sup>C). Post-occlusive reactive hyperemia (PORH) and local heating (42<sup>0</sup>C) protocols were conducted to determine the contribution of endothelium derived hyperpolarizing factors (EDHFs) and nitric oxide, respectively. Protocol 2 was repeated with Lidocaine pretreatment to determine sensory nerve contribution. Protocol 3: Seven concentrations of menthol gel (0.04%, 0.4%, 1%, 2%, 4%, 7%, 8%) were applied to the skin to model the dose-response relation between menthol and SkBF. Data for all protocols were normalized to cutaneous vascular conductance (CVC: flux/mean pressure) and expressed as percent maximum CVC (%CVC<sub>max</sub>) where appropriate. **Results:** Protocol 1: menthol gel increased SkBF compared to placebo (3.4±0.3 v 1.1±0.2 CVC: p<0.001). Protocol 2: menthol augmented SkBF compared to placebo during baseline (63±7 v 20±2 %CVC<sub>max</sub>; p<0.001), PORH (90±4 v 69±5 %CVC<sub>max</sub>; p<0.001), and local heating (81±2 v 74±3 %CVC<sub>max</sub>; p=0.03). Sensory nerve inhibition attenuated menthol-mediated dilation at baseline (32±4 %CVC<sub>max</sub>; p<0.001) and PORH (70±5 %CVC<sub>max</sub>; p<0.001). Protocol 3: SkBF increased with increasing doses of menthol (main effect, p<0.05). Pharmacological curve modeling indicated that the ED<sub>50</sub> for menthol was a 1% concentration. **Conclusion:** Topically applied menthol dose-dependently increases blood flow in the cutaneous microvasculature. This increase in blood flow is mediated in part by EDHFs and sensory nerves.

## Observation of Inter-arm Systolic Blood Pressure Difference during Exercise

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Interarm systolic blood pressure difference (ISBPD), wherein a difference of  $\geq 10$  mmHg in systolic pressure between arms is noted, has been reported in the medical literature during resting measurement in normotensive as well as hypertensive individuals. The presence of ISBPD has been linked with peripheral vascular disease, and an increased risk of cardiovascular disease and mortality. Exercise as a perturbation often reveals underlying cardiovascular pathologies that are otherwise absent during resting conditions. To the authors' knowledge, there have been no investigations into ISBPD during exercise.

**PURPOSE:** To quantify ISBPD in normotensive individuals, and determine if exercise may reveal ISBPD, or exacerbate ISBPD seen at rest. **METHODS:** The difference between arterial blood pressure measurement in the right and left arm (measurement order randomized) was used to quantify ISBPD ( $\Delta$  systolic blood pressure  $arm_1$  and  $arm_2$ ). Blood pressure measures were acquired using standard auscultation methods by an experienced investigator. ISBPD was first determined at rest. Participants then cycled at a cadence of 50 rpm at two different exercise intensities (3 and 6 METS; metabolic equivalents) and during active recovery, with ISBPD recorded upon achieving a steady-state heart rate at each intensity. Pearson's correlation coefficient and descriptive statistics were used to determine the incidence of ISBPD, and relationship between resting and exercise ISBPD. **RESULTS:** Sixty-nine participants (28 male, 41 female) completed all of the requirements of the study. ISBPD was noted with an incidence of 10.1% at rest, 13.0% during 3 MET exercise, 36.2% during 6 MET exercise, and 15.9% in recovery. In the seven individuals who demonstrated ISBPD at rest, strong correlations were found with EX-6 (.786) and recovery (.781) measures. In the 62 individuals who did not demonstrate ISBPD at rest, ISBPD was present in 9.7% of participants at 3 METS, 32.3% at 6 METS, and 12.9% during recovery. **CONCLUSION:** Incidence of ISBPD with exercise is increased independent of an inter-arm SBP difference of 10 mmHg or more at rest.

## Changes in Balance Measures During a Pedometer-Based Senior Citizen Walking Program

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**PURPOSE:** Balance is an important component of senior citizens' overall health and wellness. The purpose of this study was to assess the effect of a pedometer-based walking program on several balance measures. **METHODS:** Sixteen senior citizens (age =  $73 \pm 5$  years) participated in the walking group, while five (age =  $69 \pm 4$  years) participated in a non-walking control group. Participants completed a baseline test battery and monthly follow-up tests. The results reported here are for the first three months of the walking program. The assessments included the Balance Self-Efficacy Scale (BSE), Single-Leg Balance (SLB), and Get-Up-and-Go (GTAG). Differences between baseline and the three month assessment for each measure were tested for statistical significance using repeated measures ANOVA (criterion of  $p = 0.05$ ). **RESULTS:** The BSE, SLB, and GTAG results are shown in Figures 1-3. Significant differences were found between the walking and control groups for SLB and GTAG at both baseline and three months. The walking and control groups did not differ at baseline on BSE, but they were significantly different at the three-month assessment. **CONCLUSION:** The results of this project indicate that after three months in a pedometer-based walking program, it is possible to identify differences between walking and control groups on balance measures. Future studies should explore the effectiveness of a pedometer-based walking program intervention on senior citizens of even more advanced age.

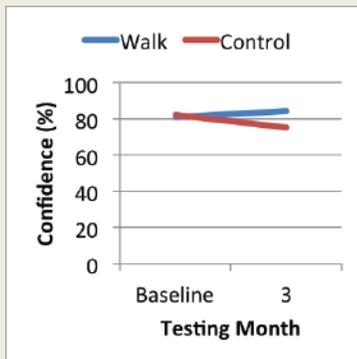


Figure 1. Balance Self-Efficacy Scale results.

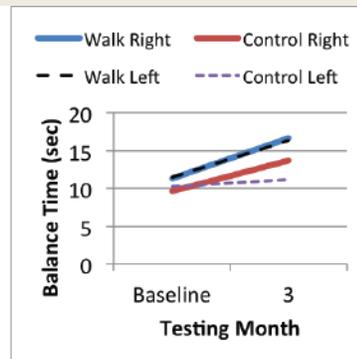


Figure 2. Single-Leg Stance Balance results.

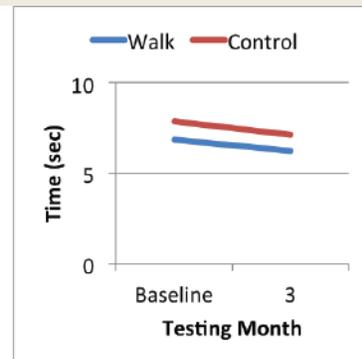


Figure 3. Get-Up-And-Go assessment results.

## **Effect of Carbohydrates on Landing Mechanics and Postural Stability During Intermittent High-Intensity Exercise to Fatigue**

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Carbohydrate intake has demonstrated the ability to delay fatigue and improve performance during exercise, however its role on delaying neuromuscular risk factors for lower limb injuries linked to exercise and fatigue has not been studied. **PURPOSE:** To evaluate the effect of a carbohydrate beverage (CHO) compared to a placebo (PLA) on landing kinematics, stability, and muscle activation patterns throughout an intermittent high-intensity exercise (IHE) protocol. **METHODS:** A total of 24 (12 male, 12 female) athletes (age:  $23.0 \pm 4.0$  yrs; ht:  $173.3 \pm 7.1$  cm; wt:  $72.9 \pm 11.5$  kg; body fat:  $18.0 \pm 6.4\%$ ) completed three days of testing. The first day of testing consisted of anthropometrics and familiarization with the IHE protocol. During the latter two testing sessions, participants performed four quarters of IHE while consuming either CHO or PLA during breaks between the quarters. Landing kinematics, muscle activation, and dynamic postural stability index (DPSI) scores were assessed immediately prior to starting the IHE protocol, at break three, and at break four. The DPSI scores were measured during a single-leg jump landing. Knee flexion and valgus/varus at initial contact, peak hip flexion, and surface electromyography pre-activity and re-activity of the hamstrings and quadriceps were measured during a single-leg stop-jump. Separate two-way repeated measures analyses of variance were performed to determine the interaction between time and treatment for landing kinematics and DPSI. Change in muscle activation was examined using a related samples Wilcoxon Signed Rank test. **RESULTS:** The CHO beverage had no effect on delaying changes in knee flexion at initial contact ( $p = 0.472$ ), peak hip flexion ( $p = 0.456$ ), and muscle activation ( $p > 0.05$ ). A significant interaction effect occurred for DPSI scores ( $p = 0.023$ ) and knee valgus/varus at initial contact ( $p = 0.007$ ) however, these changes were small and may lack clinical significance. **CONCLUSION:** Subjects responded similarly to the IHE protocol regardless of treatment. Consuming a CHO beverage before, during, and after IHE had no effect on delaying neuromuscular/biomechanical changes resulting from IHE.

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## **Perivascular Adipose Tissue Diminishes Nitric Oxide Bioavailability in Metabolic Syndrome**

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Metabolic syndrome (MetS) is a major risk factor of cardiovascular disease. Over the past decade compelling evidence has been collected suggesting a unique depot of adipose tissue called perivascular adipose tissue (PVAT) plays an active roll in vascular function. PVAT is known to release a multitude of vaso-active substances. Just like endothelium, PVAT produces nitric oxide (NO) from the enzyme endothelium nitric oxide synthase (eNOS). In order for eNOS to function properly it must be coupled in a homo-dimer configuration assisted by the co-factor tetrahydrobiopterin (BH4). A three-step process produces BH4 locally with GTP-cyclohydrolase-1 (Gch1) catalyzing the rate-limiting step. The production of NO from the PVAT surrounding the aorta may contribute directly to vascular tone. Furthermore other factors release from PVAT may effect aortic endothelium's production of nitric oxide. **PURPOSE:** To show MetS causes a disruption in normal expression of eNOS and its cofactor BH4 causing a decrease in PVAT derived NO. Further, to reveal healthy PVAT exudate augments endothelium NO production while obese PVAT exudate blunts endothelium NO production. **METHODS:** Lean (LZR) and Obese (OZR) Zucker Rats were utilized for our model of health and MetS. PVAT expression for eNOS and BH4 were measured by qPCR. NO bioavailability was assessed using a DAF-FM diacetate assay. **RESULTS:** Similar to previous findings in visceral adipose, MetS caused an up-regulation of eNOS, 1.8 fold increase in OZR from LZR ( $p \leq 0.001$ ). However, this was accompanied by a 1.6 fold decrease in Gch1 expression in OZR ( $p \leq 0.001$ ). NO production from OZR PVAT was decreased 36% ( $p \leq 0.01$ ). Aortic ring segments treated with exudate from the surrounding PVAT caused a relative 20% increase of NO in LZR and a 20% decrease in OZR. PVAT treated aortic rings from OZR had a 54% decrease in relative NO release ( $p \leq 0.001$ ). **CONCLUSIONS:** MetS decreases PVAT released NO despite an increase in eNOS expression. This may be attributed to the mismatched expression of Gch1, which may lead to a lower BH4, greater uncoupling of PVAT eNOS, and reactive oxygen species production. Furthermore PVAT exudate treatment had opposite effects on endothelium NO production. This decrease in bioavailable NO may contribute to the greater aortic tone associated with MetS.

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## Greater Forearm Blood Flow is Associated with Higher Physical Activity in Older Individuals

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Aging is associated with increased risk for cardiovascular disease (CVD), in part, because there is an age-related decline in vascular function. Increased physical activity has been shown to improve vascular function and protect against the development of CVD; however, the association between physical activity and vascular function in older adults is not well known. **PURPOSE:** Examine the relationship between objectively measured physical activity levels and forearm blood flow in a group of older men and women. **METHODS:** Resting arterial inflow and reactive hyperemic blood flow (RHBF) of the left forearm was measured in 48 participants of the Longitudinal Aging Study at Towson (LAST; 54% male, mean age 69, range 46-91) using venous occlusion plethysmography. Physical activity energy expenditure (PAEE) was assessed over 7 days using an Actigraph Link accelerometer worn on the non-dominant wrist. Dual energy X-ray absorptiometry was used to quantify body composition. The association between blood flow and physical activity was modeled using linear regression, with PAEE as a predictor adjusting for age, fat mass and fat-free mass. **RESULTS:** Mean RHBF was  $19.5 \pm 6.0$  mL•100mL tissue<sup>-1</sup>•min<sup>-1</sup> (range 8.1-32.3 mL•100mL tissue<sup>-1</sup>•min<sup>-1</sup>), and mean PAEE per day was  $1442 \pm 574$  kcals (range 328-3249 kcals). In the adjusted model, higher RHBF was positively associated with PAEE ( $\beta = 0.003$ ,  $p = 0.026$ ), indicating that blood flow was 0.3 mL•100mL tissue<sup>-1</sup>•min<sup>-1</sup> higher for each 100 kcal increase in PAEE. **CONCLUSION:** Physical activity is a significant predictor of RHBF in older populations, suggesting that a greater degree of physical activity is related to better overall vascular health. Therefore, increased physical activity in the aging population may be beneficial in reducing the risk of developing CVD.

## Physical Performance Differences in Sea, Air and Land (SEAL) Operator Cohorts Separated by Demographics

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U.S. Navy SEALs must maintain elite physical fitness throughout their careers, but there is little previous research investigating how rank and injury rates impact SEAL fitness. **PURPOSE:** Investigate differences in a performance testing protocol and self-reported injury history survey between cohorts grouped by similar rank and prior musculoskeletal injuries. **METHODS:** A total of 255 Operators (age:  $28.5 \pm 5.9$  years, height:  $70.1 \pm 2.5$  inches, weight:  $188.7 \pm 20.8$  pounds) participated in testing of body composition (%), muscular strength (%BW), flexibility ( $^{\circ}$ ), anaerobic power/capacity (W/kg), aerobic capacity (mL/kg/min), peak vertical ground reaction force (%BW) and joint landing angles ( $^{\circ}$ ). The groups were stratified based on similar-level ranks (younger officers: O1-O3, older officers O4-O6, younger enlisted E4-E6, older enlisted E7-E9) and above or below the mean ( $3.4 \pm 2.9$  injuries) for self-reported injury history throughout the lifespan. Significant results had a p-value of  $< 0.05$ . **RESULTS:** O1-O3 and E4-E6 had greater shoulder external rotation strength than E7-E9 ( $46.7 \pm 7.0$ ,  $37.9 \pm 7.7$ ;  $42.8 \pm 6.5$ ,  $37.9 \pm 7.7$ ). O1-O3 and E4-E6 had less body fat ( $15.8 \pm 5.7$ ,  $19.9 \pm 7.3$ ;  $16.1 \pm 5.1$ ,  $19.9 \pm 7.3$ ) and higher aerobic capacity ( $52.4 \pm 7.6$ ,  $46.6 \pm 6.0$ ;  $51.1 \pm 6.1$ ,  $46.6 \pm 6.0$ ) than E7-E9. Subjects reporting  $\leq 3$  injuries demonstrated greater strength in shoulder external rotation ( $47.6 \pm 11.9$ ,  $44.3 \pm 7.3$ ), ankle inversion ( $39.6 \pm 5.6$ ,  $37.9 \pm 6.7$ ), and ankle eversion ( $50.9 \pm 7.8$ ,  $48.0 \pm 9.4$ ) than those reporting  $> 3$  injuries. Subjects with  $\leq 3$  injuries had greater left hip extension ( $17.7 \pm 3.0$ ,  $16.9 \pm 2.9$ ) and left trunk rotation range of motion ( $58.3 \pm 11.2$ ,  $54.8 \pm 10.5$ ) than subjects with  $> 3$  injuries. Subjects with  $\leq 3$  injuries had lesser peak vertical ground reaction force ( $189.5 \pm 48.0$ ,  $211.7 \pm 75.4$ ), lesser hip abduction angle at initial contact ( $-6.0 \pm 3.1$ ,  $-4.5 \pm 3.7$ ), and lesser knee varus angle at initial contact ( $2.8 \pm 3.0$ ,  $3.9 \pm 2.9$ ) than subjects with  $> 3$  injuries. **CONCLUSION:** Differences in job requirements could negatively affect performance measures in higher-ranked Operators. SEALs with numerous injuries throughout their lifespan may benefit from strengthening the dynamic stabilizers of the ankle, balancing side-to-side range of motion, and practicing optimal landing mechanics to prevent further injuries.

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## Effects of a Six-Month Walking Intervention on the Physical Activity Measures among Older Adults

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Engaging in physical activity is an important part of slowing the decline of mental and physical health, especially among an aging population. **PURPOSE:** The purpose was to track and evaluate a six-month, pedometer-based walking program evaluating the physical activity level in a sample of older adults living in a rural community. **METHODS:** Twenty-one older adults (age:  $71.8 \pm 5.4$  years) from an area senior center volunteered for the study. Sixteen subjects (age:  $72.6 \pm 5.5$  years; height:  $158.6 \pm 6.3$  cm; mass:  $81.6 \pm 12.6$  kg) self-selected to participate in the walking group (WG) and 5 (age:  $68.6 \pm 4.0$  years; height:  $157.4 \pm 6.2$  cm; mass:  $80.4 \pm 15.5$  kg) subjects volunteered for the control group (CON). Daily step frequency (SF) was used to determine baseline activity level by averaging seven consecutive days of pedometer data. The WG followed a ramping protocol designed to increase SF weekly by 1,000 steps until they reached a daily goal of 10,000 steps/day. During the program, the CON was asked to continue their normal activity while wearing the pedometer. The first 3 months (baseline and weeks 4, 8, and 12) of pedometer data were analyzed. SF was analyzed using a 2x4 repeated measures ANOVA. The 12-week average was assessed using a one-way ANOVA. One subject from the WG was not included in the data analysis due to missing pedometer data. **RESULTS:** Initially, there was not a difference between the groups at baseline (WG:  $4895 \pm 2589$  steps/day, CON:  $2378 \pm 1234$  steps/day,  $p = .053$ ). The interaction for group and time was not significant ( $p = .059$ ). However, there were significant main effects for group ( $p < .05$ ) and time ( $p = .03$ ). The independent  $t$  tests yielded a significant difference between the groups at week 4 (WG:  $7364 \pm 3319$  steps/day, CON:  $3129 \pm 1629$  steps/day,  $p = .01$ ), week 8 (WG:  $7859 \pm 4332$  steps/day, CON:  $2340 \pm 843$  steps/day,  $p < .01$ ), and week 12 (WG:  $7591 \pm 3585$  steps/day, CON:  $2355 \pm 1421$  steps/day,  $p < .01$ ). The 12-week average was higher in the WG ( $7251 \pm 3305$  steps/day) than the CON ( $2692 \pm 799$  steps/day). **CONCLUSION:** The first 12 weeks of the study have shown that implementing a pedometer-based walking program, with goals for individuals to achieve, is an effective way of increasing physical activity in older adults.

## Changes in Health Behaviors of Students during Summer Break Following a Year-Long School Health Intervention

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Approximately 17% of children in the United States, 2 to 19 years of age, are obese. Additionally, 41% of children, 6 to 17 years of age, in Philadelphia are obese or overweight. School-based interventions provide impact in changing health behaviors of students. However, the lack of intervention during summer break presents the opportunity for children to revert to old behaviors. **PURPOSE:** To assess how the summer break affects the health behaviors of students in the 4<sup>th</sup> and 5<sup>th</sup> grades previously provided health intervention programming in the school setting. **METHODS:** These cross-sectional data included questionnaire responses from students in one school participating in a larger three-year school-based health intervention. The intervention included programming focused on eating right, getting fit and staying well. Health behavior questionnaires were provided to students on a biannual basis (fall and spring). The current data were collected during Year 1 (4<sup>th</sup> grade) and Year 2 (5<sup>th</sup> grade) of the intervention. Questions analyzed were: “During the past 7 days, on how many days were you physically active for a total of at least 60 minutes per day?”; and “During the past 7 days, on how many days did you eat breakfast?” **RESULTS:** Baseline Year 1 physical activity response mean ( $\pm$  standard deviation) was  $4.06 \pm 2.29$  days; follow up mean was  $4.78 \pm 2.35$  days ( $p=0.165$ ). Baseline Year 2 response mean decreased to  $4.18 \pm 2.54$  days ( $p=0.29$ ); Cohen’s  $d$  effect size [95% Confidence Interval] = 0.2 [-0.25, 0.65]. Baseline Year 1 breakfast intake response mean was  $5.35 \pm 2.35$  days; follow-up mean was  $6.31 \pm 1.69$  days ( $p=0.08$ ). Baseline Year 2 response mean was  $5.29 \pm 2.56$  days, ( $p=0.08$ ); Cohen’s  $d= 0.42$  [-0.16, 1.16]. **CONCLUSION:** Summer break did not significantly affect children’s physical activity ( $p=0.29$ ) or breakfast intake ( $p=0.08$ ) after one year of program intervention in the schools. Although statistical significance was not achieved, a small to moderate effect size was seen for changes between follow-up Year 1 to baseline Year 2 in both physical activity (Cohen’s  $d=0.2$ ) and breakfast intake (Cohen’s  $d= -0.41$ ). This shows clinical relevance to the impact of summer break on health behaviors.

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## **Examination of Sedentary Time and Physical Activity in University Office Workers**

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Regular exercise and physical activity (PA) reduce the risk of chronic disease and premature mortality. Emerging evidence links sedentary behaviors, independent of exercise and PA, with increased risk of disease and premature mortality. Sedentary behaviors include sitting or lying during waking hours. Many adults spend the majority of time in sedentary occupations. **PURPOSE:** To determine, in sedentary office workers: 1) time spent in PA and sedentary behaviors and 2) whether the workers who were most active also spent the least time sitting during a typical 5 day work week. **METHODS:** Participants (n = 44) were women who had a sedentary, office-based job. The activPAL3 activity monitor was placed on the thigh and participants were asked to maintain normal daily activities while wearing it continuously for seven days. Objective measures of PA and sedentary behavior during a 8.5 hour work day were obtained. Participants were divided into tertials based on average daily step count. A comparison of PA and sedentary time during work hours was made between participants in the lowest (n=15) and highest (n=15) tertiles. **RESULTS:** Participants were predominantly Caucasian (95%), middle-aged ( $48 \pm 9$ y), with a BMI of ( $30.5 \pm 8.2$ ). During the workday, participants spent  $5.7 \pm 1.1$  hrs sitting,  $2.0 \pm 1.1$  hrs standing, and  $0.7 \pm 0.2$  stepping. Participants in the lowest step tertile spent  $5.6 \pm 1.6$  hrs sitting,  $2.4 \pm 1.6$  hrs standing, and  $0.5 \pm 0.2$  stepping. Those in the highest step tertile spent  $6.1 \pm 0.7$  hrs sitting,  $1.5 \pm 0.7$  hrs standing, and  $0.9 \pm 0.3$  stepping. A significant difference was observed in time spent stepping between those in the lowest and highest step count tertiles ( $p < 0.001$ ). No significant difference in time spent sitting ( $p = 0.3$ ) or standing ( $p = 0.07$ ) was found between those in the lowest and highest step count tertiles. **CONCLUSION:** Employees with the most time stepping did not sit less than employees with the least time stepping. This may suggest that employees classified as active might also be classified as sedentary. Therefore, to have the greatest value, interventions intended to improve employee health must target both physical activity and time spent sitting.

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## **The Effects of Testosterone Boosters on Testosterone, Strength, and Body Composition in Young Trained Males**

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Athletes frequently use nutritional supplementation to improve physical performance. Herbal testosterone boosters claim to increase testosterone and maximize strength gains and lean body mass. **PURPOSE:** To investigate if testosterone, strength and lean body mass are increased in young trained males taking an herbal testosterone supplement compared to a placebo during a 6-week resistance training period. **METHODS:** Participants were randomly assigned to the placebo (pl) group (n = 6) or the experimental (exp) group (n = 5). Participants and researchers were blinded to group assignments. Blood and saliva samples were collected in the fasted state prior to the intervention (pre), 3 weeks (mid) and 6 weeks (post) to measure testosterone. 1RM squat and bench press and body composition were measured at all three time points. Participants supplemented with the herbal testosterone booster or 500mg of oregano in capsule form twice daily. **RESULTS:** No significant difference was detected between groups for % change in squat (p = 0.792) or bench press (p = 0.429). There was no significant difference between groups for unbound serum testosterone % change from pre to post (p = 1.000) as well as between groups for unbound serum testosterone concentrations (pre p = 0.429, 3w p = 0.622, post p = 0.537). No significant difference occurred between groups for total saliva testosterone % change from pre to post (exp =  $16.69 \pm 21.22\%$ , pl =  $40.48 \pm 38.17\%$ ; p = 0.329). A significant difference was detected between groups post -test saliva testosterone concentration (exp  $728.82 \pm 199.37$  ng·dl<sup>-1</sup>, pl  $1153.54 \pm 357.11$  ng·dl<sup>-1</sup>; p = 0.030) as well as for % weight change (WT%) for the exp group compared to the pl group from pre to mid (p = 0.004, exp mean WT % change  $-1.44 \pm 0.288\%$ . pl mean WT % change  $1.76 \pm 1.39\%$ ; p = 0.004). **CONCLUSION:** It appears that supplementation with a testosterone booster during a resistance training intervention does not increase testosterone, strength or lean body mass when compared to a placebo.

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## **Risk Factors Associated with Running Related Injuries in Physically Active Young Men.**

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**PURPOSE:** To identify risk factors for running-related injuries (RRI) in physically active young men. **METHODS:** Personal characteristics, physical training, previous Army Physical Fitness Test (APFT) scores, and injury data were obtained by survey from men in a U.S. Army Division. APFT variables (push-ups, sit-ups and 2-mile run) were converted into quartiles (Q), where Q1 = lowest performance and Q4 = highest performance.  $VO_2$  max was estimated from 2-mile run times. Odds ratios (OR) and 95% confidence intervals (95% CI) were calculated using multivariate logistic regression. **RESULTS:** Over 4,000 (n=4,236) Soldiers were surveyed. Average age was  $26.4 \pm 5.8$  years. Running injury incidence in the prior 12 months was 14%. Higher mileage run for unit physical training (PT) had little effect on estimated  $VO_2$  max, whereas, higher mileage run during personal PT increased estimated  $VO_2$  max by 8.4%. A greater risk of a RRI was associated with older age OR  $_{31+ / < 22 \text{ yrs}} = 1.62$ , 95%CI 1.21-2.18, higher BMI OR  $_{\text{BMI } 26-29 / < 25 \text{ kg/m}^2} = 1.34$ , 95%CI 1.07-1.68, OR  $_{\text{BMI} > 29 / 25 \text{ kg/m}^2} = 1.46$ , 95%CI 1.06-2.00, and total distance ran per week during unit physical training (PT) OR  $_{16.1 + / 1-5 \text{ miles}} = 1.66$ , 95%CI 1.15-2.41. A lower risk of a RRI was associated with total distance run per week during personal PT OR  $_{5.1-10 / 1-5 \text{ miles}} = 0.70$ , 95%CI 0.53-0.91, OR  $_{10.1-16 + / 1-5 \text{ miles}} = 0.58$ , 95%CI 0.35-0.97, OR  $_{16.1 + / 1-5 \text{ miles}} = 0.54$ , 95%CI 0.30-0.98, higher aerobic endurance as measured by 2-mile run performance OR  $_{Q4 / Q1} = 0.50$ , 95%CI 0.35-0.72, OR  $_{Q3 / Q1} = 0.51$ , 95%CI 0.38-0.72, OR  $_{Q2 / Q1} = 0.65$ , 95%CI 0.49-0.87, and unit resistance training  $\geq 3$  times a week OR  $_{\geq 3 \text{ times per week} / \text{none}} = 0.46$ , 95%CI 0.29-0.73. **CONCLUSION:** Those who ran more mileage during personal PT exhibited higher levels of aerobic endurance as measured by 2-mile run time and estimated  $VO_2$  max. Results also indicate that greater personal PT running mileage decreased injuries in this population suggesting that the increased protective effect of higher aerobic fitness outweighed the injurious effect of running more miles during personal PT. Countermeasures to prevent RRIs could entail enhancing aerobic endurance, providing opportunities for personal aerobic training, monitoring for excessive unit PT running mileage and encouraging unit resistance training  $\geq 3$  times per week.

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## **Exercise Prevents Reactive Oxygen Species Mediated Endothelial Dysfunction in Rats Fed a High Sodium Diet**

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High sodium diets have been shown to cause endothelial dysfunction and diminish nitric oxide bioavailability independent of blood pressure (BP). This deleterious effect has been linked to increases in reactive oxygen species (ROS). The beneficial effects of exercise on endothelial function have been well established and are due, in part, to a reduction in ROS production. **PURPOSE:** To test the hypothesis that voluntary wheel running can prevent the deleterious effect of high sodium on endothelial function. We further hypothesized that this effect would be independent of blood pressure.

**METHODS:** Eight week old male Sprague-Dawley rats were placed on either a normal sodium (NS, 0.4%) or high sodium (HS, 4%) diet for 6 weeks. Diet groups were further subdivided into a sedentary (NS, HS) or exercise group (NS-EX, HS-EX), the latter were placed in a cage with 24-hour access to a running wheel. BP was measured 3 times per week. Blood and urine were collected at baseline (BSL), 3 and 6 weeks in order to assess serum and urinary sodium. Animals were sacrificed after 6 weeks and endothelium-dependent relaxation (EDR) was assessed by dose response to acetylcholine (ACh), with and without the presence of the superoxide scavenger tempol and the NADPH oxidase inhibitor apocynin (Apo) in femoral rings. Citrate synthase (CS) activity was measured in the soleus muscle.

**RESULTS:** Serum and urinary sodium levels were elevated in HS groups relative to NS ( $p < 0.05$ ). CS activity was greater in both exercise groups indicating a training effect ( $p < 0.05$ ). Femoral EDR was reduced in HS ( $n=11$ ) compared to NS ( $n=10$ ) rats as demonstrated by an attenuated maximal response ( $E_{max}$ :  $39.4\% \pm 4.8$  vs.  $66.9\% \pm 3.9$ ;  $p < 0.05$ ).  $E_{max}$  was improved by tempol (HS,  $39.4\% \pm 4.8$  vs. HS-T,  $65.9\% \pm 5.6$ ;  $p < 0.05$ ) and Apo (HS,  $39.4\% \pm 4.8$  vs. HS-Apo,  $62.9\% \pm 10.9$ ;  $p < 0.05$ ) in the HS group but was unaltered in HS-EX ( $n = 9$ ). Exercise rescued  $E_{max}$  in the HS-EX group ( $76.8\% \pm 7.3$  vs. HS;  $p < 0.05$ ) and total EDR as assessed by area under the curve (AUC: HS,  $65.7\% \pm 0.08$  vs. HS-EX,  $127.1\% \pm 0.1$   $p < 0.05$ ). BP remained unchanged at 6 weeks indicating our findings are independent of BP changes. **CONCLUSION:** HS impairs EDR through a NADPH oxidase mediated ROS. Voluntary wheel running restored EDR likely through a reduction in ROS.

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## **Cardiac Output Dependency on Exercising Muscle Mass during Ergometer Exercise in Healthy Women.**

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Women may have different muscle perfusion capabilities when compared to men due to differences in hemodynamics and quantity of muscle mass. **Purpose:** To assess the effects of exercising muscle mass on cardiac output (CO) during small and large muscle exercise in healthy, college-aged women and compare those responses to men. It was hypothesized that: 1) Cardiac output (L/min) and stroke volume (SV (ml/beat) would be greater during leg exercise when compared to arm exercise, 2) CO and SV relative to exercising muscle mass would be greater during arm exercise when compared to leg exercise, 3) CO and SV would be greater in those with greater musculature of the arms and legs, and 4) Similar responses exhibited by men would be found for women. **Methods:** Eleven apparently healthy women volunteers, between the ages of 18 and 26, participated. Arm and leg ergometer testing was performed in one session with the order randomly assigned for each participant. Cardiac output and SV were measured at each incremental workload. **Results:** Absolute and relative CO and SV were both significantly greater during arm exercise when compared to leg exercise ( $p < 0.001$ ). Stroke volume did not increase after an initial increase to 25 Watts, while CO continued to increase in a linear fashion. When expressed relative to muscle mass, CO and SV were greater and increased more rapidly with increasing workload during arm exercise ( $p < 0.001$  &  $p < 0.003$ , respectively). When comparing those with High versus Low muscle mass, there were no significant differences between groups for arm or leg exercise and no significant interaction between main effects. **Conclusions:** Women exhibited similar CO values as men, but smaller SV values at each workload. In conclusion, CO and SV were significantly greater during arm exercise, in spite of the lower muscle mass. The reduced SV response in women suggests an impaired ability for skeletal muscle perfusion during arm and leg exercise and a greater HR response to maintain CO. Men had a greater muscle mass when compared to women, which was to be expected. In addition, there was a smaller difference between High and Low muscle mass for women, particularly during leg exercise, which could have made the CO perfusion more difficult for men than women due to the greater amount of muscle mass.

## Four Days of Caffeine Withdrawal in Caffeine Consumers Lowers Strength in Knee Flexors and Extensors

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There is strong evidence supporting the ergogenic properties of caffeine with aerobic exercise, but potential ergogenic benefits to anaerobic activities remain in question. These studies of anaerobic exercise have varied designs and equivocal results. It is also unclear how caffeine withdrawal can affect performance. **PURPOSE:** To study the effects of caffeine withdrawal on peak torque (PT), average power, perceived exertion (RPE) and perceived pain index (PPI) during exercise with an isokinetic dynamometer in habitual caffeine consumers. **METHODS:** Physically active subjects ( $n=33$ ; 30 female, 3 male; age:  $21\pm 1$ ; mass:  $60.25\pm 6.79$  kg) performed anaerobic exercise tests before and after 4 days of caffeine withdrawal. Isokinetic PT and average power were tested in the subjects' dominant leg at  $60^\circ\cdot s^{-1}$ ,  $180^\circ\cdot s^{-1}$ , and  $300^\circ\cdot s^{-1}$ . Short duration endurance was assessed in 30 repetitions at  $180^\circ\cdot s^{-1}$ . Isometric PT was measured at  $30^\circ$  and  $90^\circ$  flexion. Data were analyzed with either paired t-tests or repeated measures ANOVA with an alpha of 0.05 and presented as means  $\pm$  SD. **RESULTS:** Following caffeine withdrawal, knee extension PT at  $60^\circ\cdot s^{-1}$  decreased by 7.5 N-m ( $92\pm 21$  vs.  $84\pm 25$  N-m;  $p=0.006$ ); 30 repetitions PT at  $180^\circ\cdot s^{-1}$  decreased from  $69\pm 16$  to  $65\pm 14$  N-m ( $p=0.016$ ); isometric PT at  $30^\circ$  of knee flexion decreased from  $54\pm 16$  to  $48\pm 10$  N-m ( $p=0.005$ ); and isometric PT at  $90^\circ$  of knee flexion declined by 8.2 N-m ( $102\pm 39$  vs.  $94\pm 38$  N-m;  $p<0.001$ ). Knee flexion PT at  $180^\circ\cdot s^{-1}$  decreased by 2.8 N-m ( $40\pm 12$  vs.  $37\pm 10$  N-m;  $p=0.049$ ) and during 30 repetitions at  $180^\circ\cdot s^{-1}$  decreased from  $40\pm 9$  to  $37\pm 10$  N-m ( $p=0.04$ ). Average power for extension at  $60^\circ\cdot s^{-1}$  decreased 6.6 N-m ( $78\pm 23$  N-m vs.  $72\pm 19$  N-m;  $p=0.015$ ) and flexion average power at  $180^\circ\cdot s^{-1}$  decreased from  $86\pm 37$  to  $78\pm 29$  N-m ( $p=0.05$ ) following caffeine withdrawal. For 30 repetitions at  $180^\circ\cdot s^{-1}$ , knee extension average power decreased 6 N-m ( $135\pm 35$  vs.  $129\pm 31$  N-m;  $p=0.039$ ) and flexion average power decreased 7.5 N-m ( $68\pm 24$  vs.  $61\pm 22$  N-m;  $p=0.02$ ). No significant differences in RPE or PPI following withdrawal were observed in response to the exercises. **CONCLUSION:** The current study demonstrated that caffeine withdrawal significantly decreases isokinetic and isometric torque and power in moderate-to-high caffeine consumers.

## Method Validation of Testosterone Assays in Samples from Resistance Trained Males

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There are several reasons for researchers to investigate different methods for measuring testosterone including; hypogonadism, decreasing testosterone levels due to age, drug testing in athletes, gender differences, and responses to resistance exercises. However there has been little insight as to how the different methods correlate with the others. **PURPOSE:** To investigate if saliva testosterone (T) testing methods could be validated when compared to clinically used serum methodology. **METHODS:** The samples were obtained from eleven healthy college aged males who underwent a 6-week resistance training protocol. Samples were taken before participants began the study, at the 3-week mid point, and at 6-weeks when the study concluded. Equilibrium dialysis was performed on the serum samples before they were extracted with methyl-*tert*-butyl ether (MTBE) for purification and then analyzed by liquid chromatography-tandem mass spectrometry (LC-MS/MS). The saliva samples were only extracted with the MTBE before being analyzed by LC-MS/MS. **RESULTS:** Plasma free testosterone ( $m_{\text{plasma}} = 2.016 \pm 1.025$  ng/mL) was found to be significantly higher than salivary calculated free testosterone ( $m_{\text{saliva}} = 0.009 \pm 0.004$  ng/ml,  $p < 0.000$ ). When linear regression was performed a significant positive correlation between the methods was found ( $R^2 = 0.245$ ,  $p = 0.001$ ). **CONCLUSION:** It appears that from the correlation found, saliva and plasma testosterone levels are significantly correlated. This was expected because even though there was a difference in the values with the different methodologies, the amount in which the testosterone levels changed between testing points was associated. From the promising data found coupled with the limitations, further investigation is needed to draw further conclusion between the methods.

## Youth who are Obese Sustain Moderate-to-Vigorous Physical Activity Intensity during Active Video Games

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Nearly one third of American youth are overweight or obese. Many youth who are obese (75%) do not meet the recommended levels for daily physical activity (PA). Based on previous active video game (AVG) research, it is unclear if youth who are obese can achieve moderate to vigorous physical activity (MVPA) for an extended period of time while playing AVG. **Purpose:** To determine if youth who are obese can reach and sustain MVPA while playing a 25-minute conditioning phase of an AVG protocol. **Methods:** Six youth (mean (SD) = 11.3 (0.4) years old; 83% male; 100% African-American) participated in the study. Youth and one parent each completed questionnaires on PA behaviors and health. Anthropometric measurements (height, weight) were collected on youth participants. The AVG protocol included a 5-minute warm-up phase to achieve light to moderate intensity (40-60% of heart rate maximum (HRmax)) and a 25-minute conditioning phase to achieve MVPA (60-80% of HRmax). To cool down participants walked slowly for 5 minutes to return to baseline HR. Lastly, they completed a questionnaire to evaluate how much they enjoyed the video game session. During the AVG protocol, youth wore a portable indirect calorimetry unit (chest harness, heart rate monitor, data unit, face mask, head harness) to measure oxygen consumption (VO<sub>2</sub>) and heart rate (HR). **Results:** Table 1 demonstrates that participants achieved and sustained MVPA during the conditioning phase, as determined by HR, VO<sub>2</sub>, and MET levels. MET levels for youth were calculated using the ratio of active VO<sub>2</sub> to resting VO<sub>2</sub>. **Conclusion:** Youth are able to reach and sustain MVPA using an AVG protocol that is designed for that purpose. AVGs may help youth reach the recommended levels of 60 minutes of MVPA per day.

Phase	HR mean (SD) (bpm)*	VO <sub>2</sub> Mean (SD) (ml/kg/min)**	METS
Rest	100 (7.9)	3.4 (1.0)	1.0
Warm-up	116 (15.9)	8.6 (3.4)	2.5
Conditioning	148 (24)	13.6 (4.1)	4
Cool-down	129(11)	8.6 (3.2)	2.5

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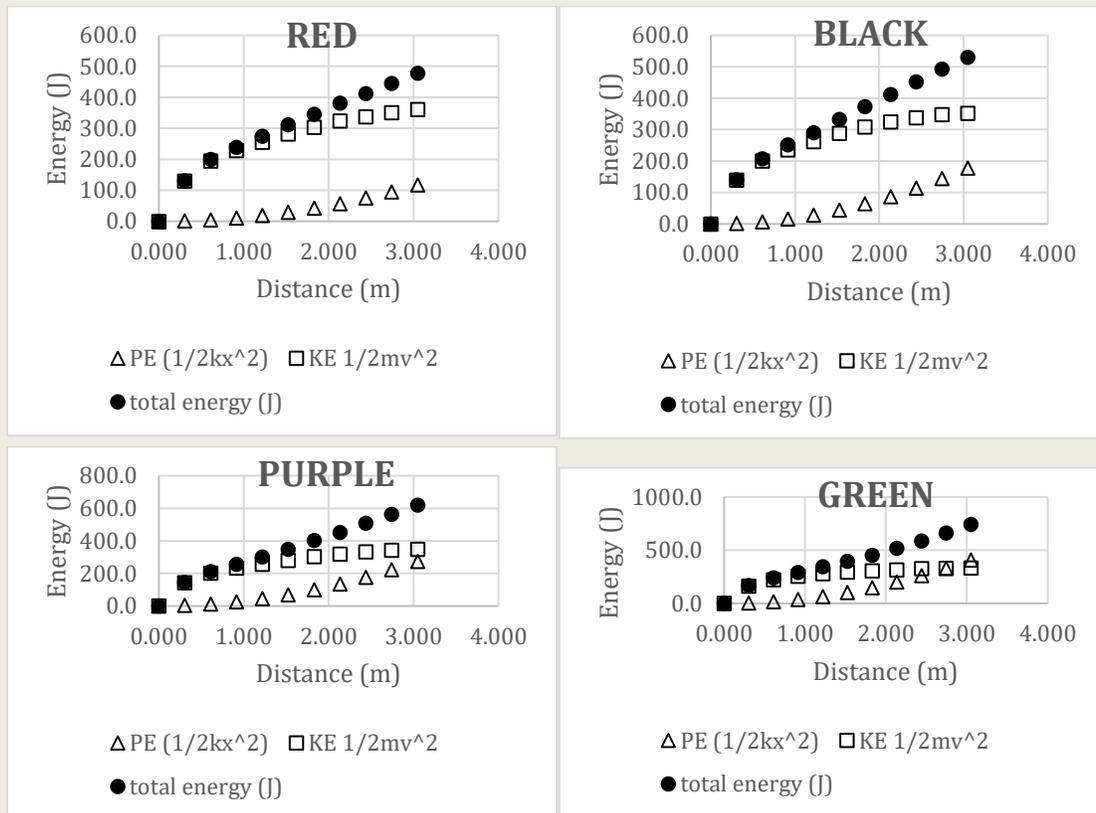
min= milliliters per kilogram per minute

## The Influence of Series Elastic Bands on Energy during Acceleration Training

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Series elastic bands have been used as a form of acceleration training with limited research.

**PURPOSE:** The purpose of this study was to examine the effects of series elastic bands on energy during acceleration training. **METHODS:** Twenty volunteers (mean  $\pm$  SD; age  $20 \pm 1$  years; body mass  $74.6 \pm 10$  kg; height  $177.2 \pm 11.8$  cm) participated. Four different bands (Flexbands, Speed and Explosion, Stow, OH) were tested (listed in order of increasing resistance): RED, BLACK, PURPLE, and GREEN. Tying four bands of the same color in a series created an elastic band chain (EBC). One end of the EBC was secured to a custom designed slide tension assembly (Sweeney Automation, Baltimore, MD) while the other end went around the waist of the participant prior to walking to the 14-foot starting position so slack was removed from the EBC. Elastic potential energy (PE), kinetic energy (KE), and total energy (TE) for each EBC were then determined at one-foot intervals in a ten-foot training range. The slide tension assembly recorded band force based on EBC elongation length, and an electronic timing system (Brower Training Systems, Speedtrap 2, Draper, UT) recorded the time taken to run through the ten-foot range. **RESULTS:** Based on one-foot interval force and time zero-intercept regression analysis constants and energy calculations, intensity increases associated with each EBC resulted in an increase in elastic PE, decrease in KE, and increase in TE (refer to Figures). **CONCLUSION:** Despite TE increasing, the diminishing KE and elevated elastic PE appear to have detrimental effects on acceleration training as series elastic bands increase in resistance.



## **Longitudinal Changes of Breakfast and Physical Activity Behaviors of Children in 5<sup>th</sup> Grade**

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In Philadelphia, 40% of children, 6 to 17 years of age, are currently categorized as overweight or obese. Additionally, 86.2% of this population exercise three or more times per week for at least 30 minutes. School-based interventions have been shown to be effective to help increase healthy behaviors and decrease childhood obesity rates. **PURPOSE:** To assess changes in consumption of breakfast and days spent participating in 60 minutes of physical activity per week, over the 2014 to 2015 school year, in children in the fifth grade provided health intervention programming in the school setting. **METHODS:** Children in the fifth grade from 12 elementary schools in the Greater Philadelphia area participated in a three-year school-based ecological intervention, which included two levels of intervention schools (Core and Level 1) and Control schools. Throughout the school year, intervention components for Core schools included preparation of healthy lunches, produce tastings and fitness classes. Level 1 schools included the same components as Core schools, but with less frequency and without preparation of healthy lunches. Control schools received no intervention. Youth behavior surveys were completed at the beginning and end of the school year to measure frequency of breakfast consumption and physical activity. **RESULTS:** Baseline breakfast intake response means were  $5.90 \pm 2.11$  days for Core schools,  $6.05 \pm 1.79$  days for Level 1 schools and  $5.70 \pm 2.07$  days for Control schools. Post-intervention means increased to  $5.92 \pm 1.97$  days ( $p=0.92$ ), decreased to  $5.90 \pm 2.08$  days ( $p=0.40$ ) and increased to  $5.90 \pm 2.26$  days ( $p=0.43$ ), respectively. Baseline physical activity response means were  $4.58 \pm 2.44$  days for Core schools,  $4.44 \pm 2.10$  days for Level 1 schools and  $4.57 \pm 2.13$  days for Control schools. Post-intervention means decreased to  $4.68 \pm 2.11$  days ( $p=0.66$ ), increased to  $4.67 \pm 2.10$  days ( $p=0.23$ ) and increased to  $4.68 \pm 2.12$  days ( $p=0.66$ ), respectively. **CONCLUSION:** No significant changes were observed in daily breakfast consumption or number of days engaged in 60 minutes of physical activity from baseline to post-intervention in this population of children in 5<sup>th</sup> grade. Approaches aimed to increase healthy behaviors in children to decrease the rate of childhood obesity warrant further investigation.

Funding was provided by the Independence Blue Cross Foundation

## **The Effects of Tart Cherry Supplement on Markers of Inflammation and Quality of Life in Arthritic Patients**

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Limited research suggests that supplementing with tart cherry juice reduces inflammation and decreases symptoms of arthritis in adults. The majority of research with tart cherries utilizes a juice form of supplementation, which is high in sugar and may increase inflammation. An alternative is powdered cherry capsules, which contain 435 mg of freeze dried Montmorency cherry, the equivalent of 16 oz. of tart cherry juice and less than 1g sugar. However, it is not known how the powdered cherry supplement affects markers of inflammation in patients with arthritis. **PURPOSE:** to investigate the effects of tart cherry powder supplement as compared to a placebo on inflammation and quality of life in patients diagnosed with arthritis. **METHODS:** 10 participants (2 Male; Age:  $51 \pm 11$  yo, Height:  $165 \pm 8$  cm, Weight:  $75 \pm 19$  kg) previously diagnosed by a physician with arthritis consumed either placebo or freeze dried tart cherry capsules twice daily for 20 days. Biomarkers of inflammation, cholesterol, body composition and blood pressure were assessed at baseline, 10 days and 20 days. **RESULTS:** There were no significant changes in blood pressure or body composition over the supplementation period. Similarly, uric acid (TC:  $5.3 \pm 1.2$  vs.  $5.5 \pm 1.1$  and PL:  $4.9 \pm 0.6$  vs.  $4.5 \pm 0.7$ ), erythrocyte sedimentation rate (TC:  $16.6 \pm 9.0$  vs.  $14.8 \pm 10.08$  and PL:  $12.8 \pm 8.6$  vs.  $10.2 \pm 11.1$ ) and quality of life (TC:  $8.0 \pm 6.0$  vs.  $7.8 \pm 5.9$  and PL:  $5.4 \pm 5.5$  vs.  $4.0 \pm 3.7$ ) were not changed pre to 20 days post supplementation. **CONCLUSION:** 20 days of supplementation with powdered tart cherry did not significantly affect inflammation or quality of life in arthritic patients. Sample size was small as this was a pilot study, therefore larger scale studies need to be performed.

Supported by TecBridge, Scranton, PA

## Comparing Short Physical Performance Battery Results in Active vs. Non-Active Geriatric Individuals

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Older adults experience age-related declines in skeletal muscle tissue, but staying active throughout life can decrease this risk, which in turn, allows individuals to maintain independence for longer.

**PURPOSE:** To determine if increases in daily physical activity would lead to improvements on the Short Physical Performance Battery, which assesses lower extremity physical functioning. **METHODS:** Twenty-one participants (age =  $71.76 \pm 5.40$  years; height =  $158.33 \pm 6.10$  cm; mass =  $81.31 \pm 12.92$  kg; body fat percent =  $41.99 \pm 5.64$  %; BMI =  $32.35 \pm 5.56$  kg/m<sup>2</sup>) were pre-screened using the Health History Questionnaire and Montreal Cognitive Assessment. Participants self-selected into the walking experimental group, where they were asked to increase their average number of steps per day. Participants in the control group were asked to proceed with their usual daily routines. Individuals were tested monthly for the following variables to determine improvement over the first three months of the program: 8' (2.44 m) walk at a habitual pace (gait speed), how long it took to complete five chair stands, and static balance (side-by-side stance, semi-tandem stance, tandem stance). A one-way ANOVA was used to assess baseline differences between groups and the remaining analyses were conducted using a 2 (Condition: Control, Walking) x 4 (Time: Baseline, Month 1, Month 2, Month 3) repeated measures ANOVA. **RESULTS:** No significant differences at baseline between the two groups were observed (all  $p$  values > .20). The main analyses revealed no significant interaction effects (all  $p$  values > .23), but significant main effects of Time emerged for gait speed ( $F_{3,51} = 5.20$ ,  $p = .01$ ) and chair stands ( $F_{3,51} = 3.92$ ,  $p = .03$ ). Across groups, participants' average gait speed improved from Baseline ( $0.99 \pm 0.13$  m/s) to Month 3 ( $1.13 \pm 0.17$  m/s). Similarly, the average time it took participants to complete five chair stands decreased from Baseline ( $12.60 \pm 4.05$  seconds) to Month 3 ( $10.45 \pm 3.79$  seconds). **CONCLUSION:** Both groups improved on measures of gait speed and chair stands. While there were no significant group differences, the walking group improved at a greater rate. Significant differences may be seen at the conclusion of the study (Month 6).

## Acute Caffeine Supplementation in Regular Caffeine Consumers Minimally Affects Strength in Knee Flexors

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There is strong evidence supporting the ergogenic properties of caffeine with aerobic exercise, but potential ergogenic benefits to anaerobic activities remain in question. These studies of anaerobic exercise have varied designs and equivocal results. The impact of acute caffeine ingestion in habitual caffeine consumers is also unclear. **PURPOSE:** To study the effects of acute caffeine ingestion on peak torque (PT), average power, perceived exertion (RPE) and perceived pain index (PPI) during exercise with an isokinetic dynamometer in habitual caffeine consumers. **METHODS:** Physically active, habitual caffeine consumers (n=33; 30 female, 3 male; age:  $21\pm 1$ ; mass:  $60.25\pm 6.79$  kg) participated in a placebo-controlled intervention. Subjects were matched and added to a caffeine or placebo group. All subjects abstained from caffeine for 4 days, supplemented with 5mg·kg of caffeine for 3 days and on the final testing day consumed 6mg·kg of caffeine or placebo (insoluble fiber) one hour before testing. Isokinetic PT and average power were tested in the subjects' dominant leg at  $60^\circ\cdot s^{-1}$ ,  $180^\circ\cdot s^{-1}$ , and  $300^\circ\cdot s^{-1}$ . Short duration endurance was assessed in 30 repetitions at  $180^\circ\cdot s^{-1}$ . Isometric PT was measured at  $30^\circ$  and  $90^\circ$  flexion. Data were analyzed with either independent t-tests or repeated measures ANOVA with an alpha of 0.05 and presented as mean differences (caffeine vs. placebo)  $\pm$  SD. **RESULTS:** No significant differences between caffeine and placebo groups were observed for any knee extension variables. Knee flexion peak torque at  $60^\circ\cdot s^{-1}$  ( $0.85\pm 0.23$  vs.  $0.66\pm 0.18$  N·m/kg;  $p=0.03$ ) and  $300^\circ\cdot s^{-1}$  ( $0.61\pm 0.11$  vs.  $0.58\pm 0.22$  N·m/kg;  $p=0.02$ ) were statistically significantly higher in caffeine group compared with placebo. No significant differences observed in average power. No between group differences in RPE or PPI were observed in response to the exercises. **CONCLUSION:** The current study demonstrates that acute caffeine ingestion slightly increases isokinetic peak torque in subjects regularly ingesting moderate amounts of caffeine, but many other anaerobic performance markers remain unaffected by caffeine ingestion.

## Caloric Expenditure of Normal and Lower Body Positive Pressure Treadmill Running

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Lower body positive pressure (LBPP) treadmill walking and running are being used more frequently in clinical and athletic settings. Accurate intensity is a requirement for proper exercise prescription, especially for obese patients that may benefit from LBPP exercise. It is unclear if ACSM metabolic equations are suitable for LBPP running. There are currently no accepted calculations to estimate caloric cost or exercise intensity for LBPP running. **PURPOSE:** To measure the oxygen consumption ( $\dot{V}O_2$ ) and caloric expenditure of treadmill running at normal body weight and LBPP. **METHODS:** Thirteen moderately trained, non-obese participants (Age:  $25.8 \pm 7.2$  years; BMI:  $25.52 \pm 3.29$   $\text{kg} \cdot \text{m}^{-2}$ ) completed two bouts of running exercise in a counterbalanced manner: (a) running on a normal treadmill (TM) and (b) running on a LBPP treadmill at 60% (40% of body weight supported) for 4 min. at 2.24, 2.68, and 3.13  $\text{m} \cdot \text{s}^{-1}$ . Oxygen consumption was measured using open flow indirect calorimetry and last minute averages were defined as steady state. **RESULTS:** Volunteers' average ( $\pm$ SD) absolute  $\dot{V}O_2$  at rest was  $328.05 \pm 85.59$   $\text{ml} \cdot \text{min}^{-1}$  and  $365.80 \pm 119.82$   $\text{ml} \cdot \text{min}^{-1}$  for TM and LBPP trials. Average TM  $\dot{V}O_2$  for three treadmill speeds was for  $2281.5 \pm 376.6$ ,  $2609.5 \pm 427.4$ , and  $2730.2 \pm 541.7$   $\text{ml} \cdot \text{min}^{-1}$ . Average LBPP  $\dot{V}O_2$  for three treadmill speeds was  $1714.1 \pm 374.6$ ,  $1913.2 \pm 478.8$ , and  $2064.4 \pm 470.2$   $\text{ml} \cdot \text{min}^{-1}$ . Caloric expenditure for three TM speeds was  $11.4 \pm 1.9$ ,  $13.0 \pm 2.1$ ,  $13.7 \pm 2.7$   $\text{kcal} \cdot \text{min}^{-1}$ . Caloric expenditure during three LBPP treadmill speeds was  $8.6 \pm 1.9$ ,  $9.6 \pm 2.4$ , and  $10.3 \pm 2.3$   $\text{kcal} \cdot \text{min}^{-1}$ . Repeated measures ANOVA indicated a significant main effect of treadmill condition and  $\dot{V}O_2$   $F(1, 12) = 35.635$ ,  $p < .05$ , partial  $\eta^2 = .748$ , and running speed and  $\dot{V}O_2$   $F(2, 24) = 29.062$ ,  $p < .05$ , partial  $\eta^2 = .708$ . There was no significant interaction between treadmill condition and speed on  $\dot{V}O_2$ ,  $F(2, 24) = 2.502$ ,  $p > .05$ , partial  $\eta^2 = .173$ . **CONCLUSION:** As expected, treadmill running in LBPP resulted in significantly lower oxygen consumption at all three running speeds. Interestingly, the percent difference in  $\dot{V}O_2$  from TM and LBPP conditions was ~33% not the expected 40%. We conclude that metabolic cost of LBPP running is significantly less than normal treadmill running, yet the decrease is not as great as predicted by the change in body mass.

## **An Analysis of Musculoskeletal Variables, Comparative to Team Norms, Leading to an ACL Rupture.**

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The identification of sport and gender specific, prospective, and modifiable risk factors contributing to non-contact, anterior cruciate ligament (ACL) injury is limited. This lack of information leaves clinicians at a loss in practicing evidence-based, injury prevention. **PURPOSE:** The purpose of this study is to describe the methods by which a female soccer player suffering from a non-contact ACL injury was compared to the rest of her team to identify modifiable strength and flexibility deficits possibly contributing to the injury. **METHODS:** 22 Subjects were recruited from a Division I, female soccer team (Age=19.3±1.2). All testing was completed two months or less prior to competitive play. A hand-held dynamometer was used to assess strength for ankle inversion/eversion and dorsiflexion (AIS/AES, ADS), knee flexion/extension (KFS/KES), hip abduction/adduction (HABS/HADS), and hip internal/external rotation (HIS/HES). All strength variables are expressed as a percentage of body weight and agonist/antagonist ratios were calculated. A standard goniometer and digital inclinometer were used to assess flexibility for active ankle dorsiflexion (DF), weight-bearing ankle dorsiflexion mobility, hamstring flexibility with passive hip flexion (PHF), and active knee extension. The ACL case's strength and flexibility variables were compared to team averages for the dominant leg (affected side) using one-sample t-tests and Wilcoxon signed-rank tests. Statistical significance was set *a priori* at  $\alpha < .05$  **RESULTS:** The ACL case's injury was the result of a planting and cutting motion. The ACL case displayed significantly lower ADS (-7.84% of body weight), AIS (-7.41%), AES (-6.58%), KFS (-5.39%), HABS (-3.14%), HES (-2.84%), and a significantly lower HABS to HADS ratio (-.12). The ACL case also displayed significantly lower PHF (-16.89°) and higher DF (+1.85°). **CONCLUSION:** Several plausible strength and flexibility deficits were identified that could have played a role in the ACL case's injury. Further, the methods and instrumentation used to identify these deficits are relatively inexpensive and field friendly. The significance of these findings, lies in providing a rationale and set of methods by which a clinician can track and assess their athletes for modifiable variables that may predict future injury.

No funding to report.

## **The Effect of Headphone Verses Room Music on Aerobic Performance.**

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Listening to faster paced music while performing aerobic activities promotes elevation of personal motivation and faster activity paces. However, limited research is available supporting the improvement of performance while listening to music. **PURPOSE:** To investigate if there is a greater improvement in aerobic performance while listening to music through headphones (H) when compared to room music (R) and no music (C). **METHODS:** Twenty three moderately active college aged males and females (age:  $21.0 \pm 1.1$  yrs.) participated in the study. After obtaining baseline measures, each subject performed a 3 km cycle ergometer exercise test under three conditions; H, R, and C. During C condition, no music was introduced while in R condition, music was played through a room speaker at 70 decibel and in H condition, music was played at 70 decibels through noise reducing headphones. Songs were chosen from a pre-selected 25 songs that had a BPM of 125-140 bpm and were then narrowed to the top five scored songs using the Brunels Music Rating Inventory. Heart rate (HR), blood pressure (BP), rate of perceived exertion (RPE) and Syebak and Murgatroyd's felt arousal were measured before, during, and after exercise. At the completion of a 3 km cycle test, exercise time and Physical Activity Enjoyment (PACE) were also recorded. After two minutes of cool down, PACES, Felt arousal, and Tammen's Activation scores were obtained. Using a one-way ANOVA, different music conditions were compared on all measured variables. **RESULTS:** Although a trend of decrease in 3 km exercise time was shown in H condition when compared to R and C, one-way ANOVA tests deemed no significant differences in exercise times ( $380.1 \pm 60.5$  vs.  $382.4 \pm 46.7$  vs.  $395.2 \pm 64.6$  sec., respectively). No significant differences were observed in any of the physiological measures including, HR, BP, and RPE under these conditions. There was however, a significantly greater interest-enjoyment (from PACES) in H and R conditions when compared to C ( $3.9 \pm 1.3$  and  $3.7 \pm 1.3$  vs.  $3.3 \pm 1.2$ ,  $p < 0.01$ ). **CONCLUSION:** The results of current findings suggest that even though music does not appear to significantly enhance aerobic performance, moderate intensity aerobic activities can be more enjoyable while listening to music when compared to no music.

## Can We Reduce Prolonged Sitting? Feasibility of a Tactile Vibration Prompt To Initiate Movement

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Prolonged sitting behaviors are associated with an increased risk for cardiovascular disease, regardless of overall physical activity level. As such, there is a need for novel strategies to reduce prolonged sitting behavior. New activity monitoring devices are now capable of accurately monitoring sitting and can provide a tactile vibration prompt (TVP) to encourage users to stand/walk during bouts of prolonged sitting. In order to better inform future interventions there is a need to understand how individuals adhere to a TVP program. **PURPOSE:** The purpose of this study was to measure adherence rates to a TVP-based intervention in an exceedingly sedentary population. **METHODS:** Fourteen healthy adults who screened via online survey for self-reported sitting behaviors  $\geq 7$  hrs/day typically in bouts  $\geq 30$  min were eligible. Participants wore a thigh-based accelerometer with a TVP feature for seven days. The TVP vibrated when 30 min of consecutive sitting occurred. Following the TVP, participants were instructed to walk or stand for  $\geq 1$  min. **RESULTS:** Of the fourteen participants who enrolled in the study, two (14.2%) dropped out due to intolerability of the TVP intervention. Among the twelve participants who completed the study, the average number of TVPs per day was 5.6 (SE=0.6). Overall, adherence rates to the TVP intervention were moderate (M = 42.6%, SE = 7.4%, range=7.3-85.4%). The mean adherence in the morning, afternoon, and evening were 46.0% (SE=8.6%), 40.3% (SE=8.1%), and 49.7% (SE=8.2%), respectively. The mean adherence at work, outside of work, on weekdays, and on the weekend was 40.8% (SE=9.2%), 42.9% (SE=7.5%), 43.3% (SE=8.2%), and 43.9% (SE=9.2%), respectively. No significant difference was found for adherence rates by time of day (morning vs. afternoon:  $p=0.44$ , morning vs. evening:  $p=0.63$ , afternoon vs. evening:  $p=0.19$ ), type of day (weekend vs. weekday:  $p=0.95$ ), or work vs. non-work ( $p=0.74$ ). **CONCLUSION:** Our findings indicate that participants showed only moderate adherence to a TVP regardless of context (work/non-work, time of day, weekend/weekday). These findings suggest a TVP as a stand-alone intervention tool may not be sufficient to dramatically reduce prolonged sitting and that further research is needed to elucidate factors for increasing adherence to a sedentary intervention.

Statement of Disclosure: No disclosures.

## **Pedometer Use on Walking Performance, Body Composition, and Bone Density in Older Adults**

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**PURPOSE:** This study examined pedometer use in older adults to examine whether performance, body composition, and bone density changed over the course of a 12 week period of time. **METHODS:** Participants (N = 15, mean age =  $69.2 \pm 9$  years) were recruited from an educational and health service agency, and regularly participated in a walking group provided by the agency. Participants were given a pedometer and were asked to record his or her number of steps accrued in the 30 minute span of the walking group activity. Walkers were able to walk at their leisure and choose which and how many days they would like to walk per week. Height, weight, body mass index, % body fat, bone density, walking speed (via 6 minute walk test), and muscular strength (via the 30 second chair stand test) were measured prior to the intervention and at the end of 12 weeks. **RESULTS:** The average number of steps taken per day per participant increased by 43.8% from the 1<sup>st</sup> to the 12<sup>th</sup> week. For each dependent measure, no statistical differences were found pre- versus post-test, including body composition measures. However, a 4% gain in walking speed was observed for the six minute walk test, and a 4.1% gain in muscular strength was observed for the chair stand test. T-scores measuring bone density decreased 9.1%. **CONCLUSION:** Overall, the introduction of the pedometer led to performance gains in walking. While not significant, the results suggest that within the 12 week span, participants increased walking speed and muscular strength. Declines in t-scores for the bone density scans may have been due to participant injury and sickness, as reported by the participants. In conclusion, pedometer use is a viable instrument for assessing and increasing walking performance in older adults. More research is needed on long-term effects of pedometer use on body composition and bone density measures.

## Different Ankle Joint Energetic Pattern between Subjects with Copers and Ankle Instability

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Lateral ankle sprains are common sport-related injuries, which often lead to ankle instability (AI) or may not develop into AI (coper). Identification of coper energetic patterns may clarify underlying injury pathomechanics, which can help us better understand AI. **PURPOSE:** To examine if AI and coper subjects demonstrate different ankle joint power patterns during a forward-side jump when compared to controls. **METHODS:** 19 AI (22.9±2.0yrs, 175.3±10.7cm, 73.7±12.2kg), 19 Coper (22.1±2.2yrs, 173.9±8.2cm, 72.9±12.9kg) and 19 control subjects (21.6±2.5yrs, 172.9±7.7cm, 68.4±10.8kg) were categorized according to the FAAM and the MAII. They performed 5 forward-side jumps on the force plate. Joint power (W/kg) was measured during the landing (eccentric power: 0-50% of stance) and take-off (concentric power: 50-100% of stance) phases of a forward-side jump, which was from initial foot contact to take-off. Functional linear models ( $\alpha=0.05$ ) were used to evaluate differences between two groups (AI vs control; coper vs control) for ankle joint power. This analysis compared variables as polynomial functions rather than discrete values. Functions of each group as well as 95% confidence interval (CI) bands were plotted to determine significant differences. **RESULTS:** The AI group had greater ankle eccentric power during 0-8% of stance while less ankle eccentric and concentric power during 10-50% and 55-90% respectively compared to the control group ( $p<.05$ ). The coper group showed greater ankle eccentric power during 0-8% of stance and decreased ankle concentric power during 80-90% compared to the control group ( $p<.05$ ). Significant group difference of ankle power between AI and coper groups were found at initial contact and between 10-45% of stance during landing phase and during 55-85% of stance during take-off phase ( $p<.05$ ). **CONCLUSION:** After initial foot contact, the AI group dramatically decreased ankle joint energy absorption throughout the rest of landing phase compared to two other groups. Less shock attenuation by the ankle joint may place more stress on ankle joint, resulting in ankle injuries such as ligament sprains, and articular cartilage lesions. AI subjects showed less ankle concentric power during take-off phase which may lead to performance decrements compared to other groups.

## Endothelin-B Receptor Responses in Young and Postmenopausal Women

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Cardiovascular disease (CVD) is the leading cause of the death in women, and postmenopausal women (PMW) are at an increased risk for developing CVD. Endothelin-1 (ET-1) contributes to age-related endothelial dysfunction in men via the ETA receptor. However, there are sex differences in ET-1 regulation of vascular function, and ETB receptors are influenced by fluctuations in ovarian hormones.

**PURPOSE:** The purpose of this study was to test the hypothesis that ETB receptors contribute to impaired microvascular function in PMW. **METHODS:** We measured skin blood flow (SkBF) in 11 young women (YW;  $22\pm 1$  years,  $22\pm 1$  kg/m<sup>2</sup>) and 10 PMW ( $58\pm 2$  years,  $24\pm 1$  kg/m<sup>2</sup>) using laser Doppler flowmetry during microdialysis perfusions of lactated Ringer's (control), an ETB receptor antagonist (BQ-788, 300nM), and an ETA receptor antagonist (BQ-123, 500 nM). We utilized local skin heating ( $42^{\circ}\text{C}$ ) to induce microvascular vasodilation, followed by perfusion of sodium nitroprusside (28mM) to elicit maximal dilation. Mean arterial blood pressure (MAP) was measured throughout. Cutaneous vascular conductance (CVC) was calculated as SkBF/MAP during the plateau established during local heating, and expressed as a percent of maximal dilation. Unpaired t-tests were used to compare variables between YW and PMW. **RESULTS:** Resting MAP was higher in PMW ( $93\pm 2$  mmHg) compared to YW ( $80\pm 2$  mmHg;  $P<0.05$ ). Vasodilatory responses to local heating (control site) tended to be lower in PMW (YW:  $91\pm 2$  vs. PMW:  $81\pm 5$  CVC % max;  $P=0.12$ ). ETB receptor blockade tended to decrease cutaneous vasodilation in YW (control:  $91\pm 2$  vs. BQ-788:  $85\pm 3$  CVC % max;  $P=0.08$ ), but tended to enhanced vasodilation in PMW (control:  $81\pm 5$  vs. BQ-788:  $92\pm 1$  CVC % max;  $P=0.08$ ). ETA receptor blockade had minimal effect in YW (control:  $91\pm 2$  vs. BQ-123:  $92\pm 2$  CVC % max;  $P=0.35$ ), but tended to increase cutaneous vasodilation in PMW (control:  $81\pm 5$  vs. BQ-123:  $90\pm 2$  CVC % max;  $P=0.11$ ). **CONCLUSION:** ETB receptors appear to mediate vasodilation in YW. However, microvascular vasodilation is blunted in PMW, possibly due to greater ETB and ETA mediated vasoconstriction.

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## **Differences between an Aerobic and Yoga Group Exercise on Measures of Mood, Stress, and Group Cohesion**

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**PURPOSE:** To observe the psychological benefits associated with participating in a group exercise class. Specifically, mood, stress, and group cohesion were measured of participants in an aerobic based Zumba® class and a mind and body based yoga class. **METHODS:** Subjects were recruited from group fitness classes offered at the university recreation center. A total of 18 subjects volunteered: 9 subjects ( $M \pm SD =$  age  $18.78 \pm 2.90$  yrs, height  $165.37 \pm 4.76$  cm, mass  $60.37 \pm 8.50$  kg, body fat  $21.66 \pm 5.13\%$ ) participated in the Yoga class and 9 ( $M \pm SD =$  age  $20.22 \pm 1.09$  yrs, height  $164.68 \pm 8.45$  cm, mass  $57.44 \pm 8.43$  kg, body fat  $20.62 \pm 4.07\%$ ) participated in the Zumba® class. Prior to the class, anthropometric measures were measured and subjects completed the Positive and Negative Affect Schedule (PANAS). Following the class, subjects completed the PANAS, Dundee Stress State Questionnaire (DSSQ), and the Physical Activity Group Exercise Questionnaire (PAGE-Q). A two-way ANOVA with repeated measures was used to analyze the PANAS variables and a one-way ANOVA analyzed all remaining measures. **RESULTS:** There was a significant difference between the groups on Group Integration-Task (GIT),  $p = .01$ , and the Group Integration-Social (GIS),  $p = .03$ . However, there were no significant differences between the groups on the Attraction to Group-Task ( $p > .05$ ) or Attraction to Group-Social ( $p > .05$ ). All variables for the DSSQ also showed no significant difference between the groups ( $p > .05$ ). There were no significant interactions or effects on the PANAS variables ( $p > .05$ ). **CONCLUSION:** The study showed participants in the Zumba® class had higher perceptions of closeness and similarity associated with the task and social aspects of the exercise class.

## Effect of Depth Jumps and Back Squats on Eliciting Postactivation Potentiation for a 40-meter Sprint

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**PURPOSE:** Data show that heavy preload stimuli preceding a sprint can improve performance by eliciting postactivation potentiation (PAP), an increased intramuscular sensitivity to calcium that enhances cross-bridge cycling, thereby acutely enhancing force production and strength. The aim of this study was to compare depth jumps (DJ) to back squats (S) as a means to elicit PAP in college aged female rowers. **METHODS:** Twenty Division III collegiate female athletes, whose  $X \pm SD$  for age, height, weight, and  $VO_2$  Max were, respectively,  $18.9 \pm 0.9y$ ,  $1.5 \pm 0.05m$ ,  $60.7 \pm 21.4kg$  and  $42.8 \pm 4.4ml.kg^{-1}.min^{-1}$ , completed a 40 m sprint timed at 10 m, 20 m, and 40 m with a timing system. Subjects were randomly divided into either the DJ or S group. Subsequently, their one repetition maximum (1 RM) for the BS or DJ was measured. One week later, subjects completed a 40m sprint, and then three repetitions at 90% of their 1RM for BS or DJ; after 7 min of active rest, they completed another 40m sprint. A dynamic warm-up and active cool down preceded and followed each testing session. Data were analyzed with three 2x2 repeated measures ANOVA. **RESULTS:** Both conditions significantly increased sprint time at 40m; BS 20m sprint time was also slower. **CONCLUSION:** The data show that three repetitions at 90% of 1RM for BS or DJ did not elicit PAP in female college rowers. These findings may be related to sex, load, training incompatibility, or sprinting proficiency in this subject population.

*Mean Sprint Times (s) by Group*

	Depth Jump (n=10)			Squat (n= 10)		
	10m	20m	40m	10m	20m	40m
Pre	2.06 ± 0.09	3.62 ± 0.12	6.55 ± 0.27	2.10 ± 0.09	3.62 ± 0.14	6.61 ± 0.32
Post	2.09 ± 0.11	3.68 ± 0.13	6.66 ± 0.27*	2.10 ± 0.09	3.66 ± 0.17*	6.67 ± 0.36*

Note. \*  $p < 0.05$

## Perceived Exertion and Affective Responses During Normal and Lower Body Positive Pressure Treadmill Running

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Lower body positive pressure (LBPP) treadmill running has been shown to produce a decrease in perceived exertion (RPE) when compared to normal treadmill (TM) running at comparable velocities. Lower RPE has also been shown to be related to more positive affect (FS) due to reduced physical demand. However, the separate effect of treadmill type (normal vs. LBPP treadmill) on RPE and FS is unknown. **PURPOSE:** To examine the interaction effect of treadmill type and three different running velocities on RPE, and separately, FS. **METHODS:** Thirteen moderately trained participants (age:  $25.8 \pm 7.2$  years; BMI:  $25.5 \pm 3.3$  kg·m<sup>-2</sup>) completed counterbalanced bouts of running exercise on a normal treadmill and LBPP treadmill at 60% (40% of body weight supported) for 4 min stages at 2.24, 2.68, and 3.13 m·s<sup>-1</sup>. Participants reported RPE and FS at the end of every stage. **RESULTS:** Repeated measures ANOVA indicated a significant interaction between treadmill condition and velocity on RPE,  $F(2, 22) = 5.027, p < .05$ , partial  $\eta^2 = .314$ . There was no significant difference in RPE between conditions at the 2.24 m·s<sup>-1</sup> velocity ( $p > .05$ ). RPE was significantly lower in the LBPP treadmill ( $M = 10.42, SE = .668$ ) compared to TM ( $M = 11.83, SE = .705$ ) at both the 2.68 m·s<sup>-1</sup> velocity,  $F(1, 11) = 8.048, p < .05$ , partial  $\eta^2 = .423$  and in the LBPP treadmill ( $M = 11.67, SE = .711$ ) compared to TM ( $M = 13.83, SE = .806$ ) at the 3.13 m·s<sup>-1</sup> velocity,  $F(1, 11) = 9.437, p < .01$ , partial  $\eta^2 = .462$ . The interaction between treadmill condition and velocity on FS approached significance ( $p = .078$ ). There was no significant difference in FS between conditions at the 2.24 m·s<sup>-1</sup> velocity ( $p > .05$ ). FS was more positive in the LBPP treadmill ( $M = 2.417, SE = .379$ ) compared to TM ( $M = 1.667, SE = .482$ ) at the 2.68 m·s<sup>-1</sup> velocity,  $F(1, 11) = 4.068, p = .069$ , partial  $\eta^2 = .270$ . FS was significantly more positive in the LBPP treadmill ( $M = 1.750, SE = .538$ ) compared to TM ( $M = .833, SE = .672$ ) at the 3.13 m·s<sup>-1</sup> velocity,  $F(1, 11) = 5.863, p < .05$ , partial  $\eta^2 = .348$ . **CONCLUSIONS:** Findings suggest that changes to both treadmill velocity and weighting may account for 35-46% of variance in perceived exertion and affective valence. In turn, this may have compliance implications for rehabilitative and obese populations using LBPP treadmill exercise.

## **Effect of Recovery Modality on Rate of Force Development, Vertical Jump, and Lactate Clearance.**

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**Purpose:** The purpose of this study was to investigate the efficacy of 3 recovery interventions in their ability to maintain muscular performance and promote lactate clearance following a fatigue protocol. **Methods:** Healthy men ( $n = 9$ ;  $22.4 \pm 2.2$  yr) and women ( $n = 9$ ;  $21 \pm 1.2$  yr) agreed to participate in this investigation. On 3 occasions participants completed preliminary muscular testing including countermovement vertical jump and maximal effort isometric squat initiated from a knee angle of  $140^\circ$  followed by a 60 s maximal effort fatigue protocol. Participants then completed, in counterbalanced fashion, 1 of 3 recovery protocols which each lasted 20 minutes. In short, active recovery consisted of low intensity aerobic exercise completed on a cycle ergometer, passive recovery involved seated rest, and the combination protocol included both low intensity walking and use of foam rollers on all major muscles of the lower body. Blood lactate measurements were obtained at 1, 5, 10, and 20 minutes of recovery. Following the completion of each recovery protocol, preliminary testing was repeated. **Results:** All data are presented as mean  $\pm$  SD. Baseline testing values were not significantly different between days ( $p > 0.05$ ), nor were the number of squat jumps completed during the fatigue protocol ( $p > 0.05$ ). Following fatigue and recovery protocols, changes in vertical jump height and rate of force development measures did not differ (all  $p > 0.05$ ). Initial lactate measurements were not significantly different following the fatigue protocol on any of the 3 days ( $p > 0.05$ ). Significant differences were detected in lactate levels between passive and combination recovery protocols at minute 5 ( $11.3 \pm 1.2$  vs.  $10.2 \pm 1.9$  mM;  $p < 0.05$ ) and minute 10 ( $10.2 \pm 1.9$  vs.  $8.6 \pm 2.4$  mM;  $p < 0.01$ ). Measurements obtained at minute 20 displayed significant differences between passive ( $7.2 \pm 2.0$  mM), combination ( $4.9 \pm 1.8$  mM;  $p < 0.001$ ), and active ( $4.7 \pm 1.6$  mM;  $p < 0.001$ ) recovery protocols while no difference was detected between active and combination protocols ( $p > 0.05$ ). **Conclusion:** The recovery method utilized had an effect on circulating lactate levels, but it did not have a consistent impact on vertical jump or rate of force development measures in the fatigued state.

## The Effects of Foam Rolling vs Dynamic Stretching on Anaerobic Performance

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Foam rolling is a growing trend in the fitness industry for all ages and fitness levels. It is commonly used to loosen muscle, alleviate pain, and improve performance, however more research is needed to support these claims. It has been well supported by studies that dynamic stretching has a positive effect on anaerobic performance but to date few investigators have studied the use of foam rolling prior to anaerobic exercise. **PURPOSE:** To examine the impact of pre-performance foam rolling as compared to dynamic stretching on anaerobic performance. **METHODS:** Ten college aged individuals (6 male & 4 females, age  $20.8 \pm 1.32$  yrs), with no prior lower extremity injuries, volunteered for this study. Three tests were used to assess anaerobic power; vertical jump (VJ), broad jump (BJ) and a 20 yard sprint (ST). Prior to the intervention and tests, each subject jogged at a self-selected pace for 5-10 minutes until 60% of age-predicted heart rate maximum was reached. Each subject performed the three tests on each of two intervention days: dynamic stretching and foam rolling as well as a control day for comparison. A day for rest was given between intervention days to prevent fatigue from affecting the data. On a foam roll day, subjects rolled each lower extremity muscle for two sets of 30 s prior to performing the anaerobic test. On dynamic stretching day, subjects performed six different dynamic stretches twice for a distance of 10 yards each. Subjects performed each test three times and the best trial was recorded. **RESULTS:** There were no significant differences ( $p > .05$ ) for either intervention for all three tests of anaerobic power. Data for the control, dynamic stretching and foam rolling for each test are as follow, respectively: VJ height (m) ( $0.57 \pm 0.16$ ;  $0.58 \pm 0.15$ ;  $0.60 \pm 0.14$ ;  $p = .93$ ), BJ distance (m) ( $2.07 \pm 0.36$ ,  $2.11 \pm 0.36$ ,  $2.09 \pm 0.41$ ;  $p = .98$ ), 10 yard ST time (s) ( $1.87 \pm 0.18$ ,  $1.86 \pm 0.13$ ,  $1.85 \pm 0.15$ ;  $p = .95$ ) and 20 yard ST time (s) ( $3.21 \pm 0.309$ ,  $3.19 \pm 0.22$ ,  $3.19 \pm 0.27$ ;  $p = .98$ ). **CONCLUSION:** There were no differences in anaerobic performance between each of the pre-performance techniques. Expected differences because of the dynamic warm-up did not occur. The jogging warm-up alone may have been sufficient for optimal performance. Perhaps the dynamic stretching protocol needs to be more controlled and specific for each of the tests.

## Effect of Hypoxia on Cerebrovascular and Cognitive Function During Exercise

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Optimal cognitive function requires a balance between cerebral blood flow to active brain regions (oxygen supply) and oxygen extraction by cerebral tissue (neuronal metabolic demand). Exercise and cognitive engagement creates competing demands for oxygen which can be exaggerated during hypoxia.

**PURPOSE:** Investigate the effect of acute hypoxia on cerebral and cognitive function during exercise.

**METHODS:** Thirty healthy participants ( $21 \pm 4$  yrs, BMI  $24.0 \pm 2.6$  kg·m<sup>-2</sup>; 15 men) were randomized to both a ~2.5 hour normoxic (20.0% O<sub>2</sub>) and hypoxic (12.5% O<sub>2</sub>) condition on two separate days. During the final 25 min of each condition, participants underwent 10 min of exercise-alone and 15 min of exercise+cognitive testing (cycling at 55% HR<sub>max</sub>). Accuracy and reaction time (RT) were averaged across memory, N-Back and Flanker tasks. Prefrontal cortex tissue saturation index (TSI) and middle cerebral artery (MCA) blood flow velocity were measured using near-infrared spectroscopy and transcranial Doppler respectively at rest, during exercise alone, and during exercise+cognitive tasks.

**RESULTS:** MCA velocity was overall greater in hypoxia vs normoxia, and increased similarly from rest to exercise in normoxia ( $66 \pm 3$  to  $79 \pm 3$  cm/s,  $p < 0.05$ ) and hypoxia ( $71 \pm 3$  to  $82 \pm 3$  cm/s,  $p < 0.05$ ). Addition of cognitive tasks during exercise had no effect on MCA velocity in normoxia ( $74 \pm 3$  cm/s) or hypoxia ( $80 \pm 3$  cm/s).  $\Delta$ TSI increased from rest to exercise in normoxia ( $-0.02 \pm 0.05$  to  $1.15 \pm 0.35\%$ ,  $p < 0.05$ ) with no further changes with the addition of cognitive tasks ( $0.86 \pm 0.50\%$ ).  $\Delta$ TSI decreased from rest to exercise in hypoxia ( $-0.05 \pm 0.05$  to  $-1.77 \pm 0.26\%$ ,  $p < 0.05$ ) with attenuated reductions occurring with addition of cognitive tasks ( $-1.28 \pm 0.30\%$ ,  $p < 0.05$ ). Accuracy on cognitive tasks was similar in normoxia ( $84.2 \pm 7.0\%$ ) compared to hypoxia ( $83.9 \pm 1.0\%$ ) while RT was slower in hypoxia vs normoxia ( $537 \pm 14$  vs  $513 \pm 13$  ms;  $p < 0.05$ ). **CONCLUSION:** Prefrontal oxygenation was reduced during exercise and cognitive engagement in hypoxia despite greater MCA blood flow in hypoxia and similar changes in MCA blood flow during exercise and cognitive engagement vs normoxia. Cognitive slowing during hypoxic exercise may be related to reductions in prefrontal oxygenation rather than macrovascular cerebral blood flow.

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## **24-hour Heart Rate is Related to Lower Extremity Venous Vascular Function in Persons with Paraplegia**

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The 24-hour heart rate (HR) has been previously demonstrated by our group to be elevated in individuals with paraplegia (Para) compared to able-bodied (AB) controls, and now we speculate that this may be related to changes in lower extremity venous vascular function in persons with spinal cord injury (SCI). **PURPOSE:** Prospective cross-sectional study to explore the relationship between 24-hour HR and venous vascular function in persons with Para compared to AB controls. **METHODS:** Sixteen individuals with paraplegia (Para: T1-T12) and 10 AB controls were studied. An ambulatory Holter monitor was used to assess 24-hour HR (bpm). Venous occlusion strain gauge technology was used to determine lower extremity peak fill rate (PFR: % volume change per min), venous volume variation (VVV: % volume change), peak emptying rate (PER: % volume change per min), and venous compliance [VC: (venous volume variation/ occlusion pressure) \* 100]. **RESULTS:** The 24-hour HR was significantly elevated in the Para group compared to the AB group (80±12 vs. 70±9 bpm, respectively; p=0.025), as has been previously demonstrated. PFR was significantly increased in the Para compared to the AB group (8±9 vs. 2±1 %, respectively; p=0.032), but group differences were not noted for VVV, PER or VC. Further, lower extremity PFR was associated with 24-hour HR in the Para group ( $R^2 = 0.32$ , p=0.023) but not in AB group. **CONCLUSION:** Increased PFR in persons with paraplegia as compared to the AB group likely represents loss of venous vascular tone due to remodeling after SCI. Our findings support the hypothesis that loss of venous vascular tone contributes to lower extremity blood pooling and a compensation mechanism of increasing HR, as evidenced by the significant association between PFR and 24-hour HR in these individuals with SCI. The potential deleterious long-term cardiovascular consequences of this association warrant further investigation.

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## Texting & Walking: A Dual-Task Study on Gait Patterns in a College-Aged Sample

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Texting and walking is a common occurrence in the college-aged population due to the influence of cell phones on society. This may lead to altered gait patterns and possible injury. **PURPOSE:** To examine the effects of texting and walking on selected gait parameters between males and females in a college-aged sample. **METHODS:** Twenty-one students from Shippensburg University (14 females, 7 males, age:  $21.2 \pm 0.9$  years) volunteered to walk through a mock intersection under two conditions: walking without texting (CON) and texting while walking (DT). Two trials were performed for each condition and the order was randomized. Selected kinematic gait variables were measured using a gait mat and differences in time were measured using a digital timing system. **RESULTS:** There were not any significant gender differences for the measured gait variables ( $p > .05$ ), but there were differences between conditions. The results showed gait speed (GS) was significantly lower ( $p \leq .05$ ), cadence (CAD) decreased ( $p \leq .05$ ), and double-support time (DST) increased ( $p \leq .05$ ), during the DT condition. **CONCLUSION:** Texting while walking resulted in reduced gait speed, decreased step frequency, and an increased time spent in double support. These effects were not affected by sex. Causations for these outcomes should be investigated further.

Variables	DT Condition (M $\pm$ SD)			CON Condition (M $\pm$ SD)		
	Female	Male	Total	Female	Male	Total
GS 1 (m/s)	0.95 $\pm$ 0.13	1.02 $\pm$ 0.22	0.98 $\pm$ 0.16	1.18 $\pm$ 0.10	1.21 $\pm$ 0.15	1.19 $\pm$ 0.12
GS 2 (m/s)	0.97 $\pm$ 0.11	0.99 $\pm$ 0.25	0.97 $\pm$ 0.16	1.20 $\pm$ 0.08	1.18 $\pm$ 0.14	1.19 $\pm$ 0.10
GS 3 (m/s)	0.94 $\pm$ 0.11	0.96 $\pm$ 0.21	0.95 $\pm$ 0.15	1.16 $\pm$ 0.08	1.13 $\pm$ 0.14	1.15 $\pm$ 0.10
GS Total (m/s)	0.95 $\pm$ 0.10	0.98 $\pm$ 0.23	0.96 $\pm$ 0.15	1.18 $\pm$ 0.08	1.16 $\pm$ 0.13	1.17 $\pm$ 0.10
CAD (steps/min)	103.69 $\pm$ 10.04	99.37 $\pm$ 14.63	102.25 $\pm$ 11.58	111.9 $\pm$ 9.26	107.26 $\pm$ 10.05	109.62 $\pm$ 9.56
DST (s)	0.19 $\pm$ 0.04	0.19 $\pm$ 0.06	0.19 $\pm$ 0.04	0.16 $\pm$ 0.02	0.16 $\pm$ 0.02	0.16 $\pm$ 0.02

## Simple Cardiac Screening of NCAA and USAC Collegiate Athletes Using Smartphone Electrocardiogram

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The recent development of modern smartphone technology is quickly revolutionizing the medical field. For the last 100 years, the standard 12-lead electrocardiogram (ECG) has been the primary tool in clinically diagnosing cardiac disease and arrhythmias in patients. In large diverse populations, new smartphone technology could provide a new platform for a cost effective, efficient, and accurate cardiac screening tool. The AliveCor ECG device (AliveCor, San Francisco, CA) allows wireless acquisition of a single-lead ECG on any iOS or Android device. Results can be downloaded and reviewed using an internet browser. **PURPOSE:** In this feasibility study, we screened competitive collegiate athletes using a smartphone ECG. We assessed the rate and rhythm pre- and post-exercise. We compared the smartphone ECG with the standard 12-lead ECG tracings. **METHODS:** A total of 20 subjects ( $21\pm 4$  yrs, 10 male, 10 female) provided written informed consent. A standard 12-lead ECG was obtained at rest followed by a smartphone generated 12-lead ECG. A one-minute smartphone ECG of lead I was recorded pre-exercise. Exercise was completed at  $\leq 80\%$  of perceived rate of exertion (PRE) or  $\leq 80\%$  of maximum predicted heart rate (MPHR). A one-minute smartphone ECG was acquired within ten seconds of terminating physical exertion. All ECGs were de-identified and interpreted by a board-certified cardiology electrophysiologist. The main outcome measure was the difference in voltage (mV) between the smartphone ECG and the standard 12-lead ECG. **RESULTS:** Smartphone ECG tracings were consistent with the standard 12-lead ECG in all 20 subjects. ( $P = 0.08\pm 0.1$  mV,  $Q = 0.03\pm 0.4$  mV,  $R = 2.19\pm 0.8$  mV,  $S = 0.51\pm 0.5$  mV,  $T = 0.38\pm 0.4$  mV). No critical cardiac conditions were detected in either the smartphone ECG or standard 12-lead ECG (interpretation was normal sinus rhythm 40%; sinus bradycardia 60%). The observed mean  $HR_{max}$  was  $176\pm 35$  bpm;  $HR_{recovery}$  was  $112\pm 48$  bpm; absolute decrease in HR was  $63\pm 32$  bpm; percent MPHR was 88%. **CONCLUSION:** The smartphone ECG compared favorably with the 12-lead ECG. This protocol can be easily adapted to enhance the preseason screening process carried out by athletic trainers.

## Examination of Weekly Step Count Patterns during a 12 Week Pedometer Program

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A 12 week pedometer-based walking program, *Walk the Rock*, was implemented at Slippery Rock University as a means to provide an interactive way to increase step counts among students and non-students. **PURPOSE:** The purpose of this study was to examine the step counts between students and non-students during a 12 week, pedometer-based physical activity intervention. A secondary purpose was to determine if there was a significant difference in step counts taken during weekdays versus weekend days for both students and non-students. **METHODS:** Participants (n=258) were encouraged to wear a pedometer every day for 12 weeks during the spring semester of 2015. Each Monday, participants received an email requesting daily step counts from the previous week. Participants were encouraged and incentivized to increase step counts throughout the 12 week program. **RESULTS:** Of the 258 participants who registered, 160 completed the program (62% adherence). Of the completers, both students and non-students significantly increased weekly step counts from week 1 (68991±24217) to week 12 (83978±27618) ( $p < 0.01$ ). Upon further analysis, it was found that both students and non-students had the highest step counts on Mondays (10989±5205) and the lowest step counts on Saturdays (9353±6322) and Sundays (8564±5780). There was a significant difference between step counts taken on weekdays (10604±6184) versus weekend days (8958±6069) ( $p < 0.01$ ) for both students and non-students. Although students and non-students mimic the same physical activity patterns throughout the week, students actually had a significantly higher number of daily step counts than non-students (10288±6321, 9666±5777 respectively) ( $p < 0.01$ ). **CONCLUSION:** This program was successful at increasing step counts throughout the 12 weeks for both students and non-students. However, in the future, program coordinators should consider incentivizing participants to increase step counts during the weekend, where step counts were reportedly the lowest.

## **Impact of Cell Phone Texting on the Amount of Time Spent Exercising at Different Intensities**

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**PURPOSE:** This study assessed the effect of cell phone texting during a 30-minute bout of treadmill exercise on the amount of time spent exercising at different intensities. **METHODS:** Thirty-two college students participated in two conditions (*cell phone, control*). Participants were instructed that once they achieved a moderate intensity, the session would begin and they would be allowed to alter the treadmill speed. During the *cell phone* condition participants could use their cell phone for texting. During the *control* condition participants did not have access to their cell phone nor any interaction with other individuals/electronics. Heart rate was measured continuously and was used to determine how much time was spent exercising at different intensities. **RESULTS:** Vigorous intensity minutes was significantly greater ( $p = 0.001$ ) in the *control* condition ( $12.94 \pm 8.76$  minutes) than the *cell phone* condition ( $7.09 \pm 8.38$  minutes). Low intensity minutes was significantly greater ( $p = 0.001$ ) in the *cell phone* condition ( $9.47 \pm 9.73$  minutes) than the *control* condition ( $3.44 \pm 6.52$  minutes). Moderate intensity minutes in the *cell phone* ( $13.44 \pm 8.43$  minutes) and *control* ( $13.69 \pm 8.13$  minutes) conditions were not significantly ( $p = 0.89$ ) different. **CONCLUSION:** Using a cell phone for texting can interfere with treadmill exercise.

## The Effect of Added Weight on Foot Anthropometry in Pregnant Women and Controls

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Foot anthropometry is altered by pregnancy, but it is not known if these changes are due to increased weight or hormonal effects of pregnancy on the body. The **purpose** of this study was to examine the effect of added weight on foot anthropometry in pregnant women and never-pregnant controls.

**Methods:** Fifteen primigravid women and 13 nulliparous controls participated. Controls were matched to the pregnant women based on the pregnant women's self-reported pre-pregnancy weight. Informed consent was obtained. Data were collected on the pregnant subjects in each trimester and post-partum. Foot length, foot width, arch index, arch height index, arch rigidity index, and arch drop were assessed. To determine the effect of added weight on foot anthropometry, pregnant subjects in their first two trimesters donned a weighted pack on the anterior trunk such that total weight difference from pre-pregnancy weight was 124N, which was based on data from a previous study. Foot measurements were then repeated while the subjects wore this pack. Third trimester subjects did not wear a pack as they were at full-pregnancy weight. For post-partum subjects, their body weight plus the weight of the pack equaled their third trimester weight. For control subjects, their body weight plus the weight of the pack equaled the third trimester weight of the pregnant subject to whom they were matched. A MANOVA was performed with the independent variables of trimester (control, 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, and post-partum) and weight condition (natural or weighted). Tukey post-hoc analyses were performed if appropriate ( $\alpha=0.05$ ). **Results:** Arch drop increased by 18% ( $p=0.001$ ) and arch rigidity index decreased by 1% ( $p=0.002$ ) in the weighted condition compared to the natural condition. Increase in foot length and width and decrease in AHI with added weight was greater in pregnant subjects vs controls, with the change increasing over the course of the pregnancy. ( $p<0.05$ ). **Conclusions:** Adding weight produced significant changes in arch drop and arch rigidity index, although weight plus advancing pregnancy was related to further alterations in foot anthropometry, indicating that other factors, such as increased hormone concentrations, may play a role in foot anthropometry changes in pregnancy.

## **Oral Sapropterin Increases Reflex Vasodilation but Not Cardiac Output during Passive Heating in Older Adults**

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**PURPOSE:** Reflex cutaneous vasodilation is attenuated in older adults, potentially resulting in reduced heat loss during hyperthermia. Acute oral sapropterin (Kuvan™) increases reflex cutaneous vasodilation in older adults. Despite this increase in cutaneous conductance, the blood pressure (MAP) and heart rate (HR) responses to heating remain unchanged compared to placebo treatment. The purpose of this study was to examine sapropterin-induced changes in cardiac output ( $Q_c$ ) in older adults during supine passive heating. We hypothesized that  $Q_c$  would increase with increased cutaneous conductance to maintain MAP during sapropterin treatment. **METHODS:** 11 older adults ( $69 \pm 3$  yrs) ingested sapropterin (S, 10mg/kg) or placebo (P) in a randomized double-blind crossover study design. Skin blood flow (SkBF; laser Doppler flowmetry), heart rate (HR; polar monitor), MAP (brachial auscultation), and  $Q_c$  (open-circuit acetylene wash-in) were measured during supine passive heating (water-perfused suit) to increase esophageal temperature by  $0.8^\circ\text{C}$ . Cutaneous vascular conductance was calculated ( $\text{CVC} = \text{LDF}/\text{MAP}$ ) and normalized to maximum. **RESULTS:** During supine passive heating, sapropterin increased SkBF compared to placebo (S:  $57.2 \pm 6.9$ , P:  $29.5 \pm 3.6\%$  CVC max;  $p < 0.001$ ). As expected, there was no difference in HR (S:  $76 \pm 3$ , P:  $77 \pm 3$  bpm;  $p = 0.7$ ) or MAP (S:  $76 \pm 3$ , P:  $79 \pm 2$  mmHg;  $p = 0.1$ ) between treatments. The  $Q_c$  response to passive heating was not different between treatments (S:  $7.4 \pm 0.5$ , P:  $7.1 \pm 0.4$  L·min<sup>-1</sup>;  $p = 0.2$ ). **CONCLUSION:** Following oral sapropterin, older adults increase SkBF during supine passive heating but do not increase  $Q_c$ , suggesting that MAP is maintained via mechanisms other than increased  $Q_c$ .

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## **The Relationship Between Lower Extremity Functional Strength and Aerobic Performance in Youth with Cerebral Palsy (CP)**

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Youth with CP have lower aerobic performance levels and increased energy cost of walking compared to their peers. Youth with CP are at a high risk for being overweight, and developing cardiovascular and metabolic disease such as hypertension, dyslipidemia, and metabolic syndrome. Lower extremity extensor strength has been shown to explain 7.5% of the variability in oxygen cost of walking and lower extremity strengthening can improve walking ability in ambulatory youth with CP. **PURPOSE:** To examine the relationship between muscle endurance and aerobic performance in youth with CP.

**METHODS:** Eleven (n=11) ambulatory youth with CP aged 9-20 years (M = 15.67, SD = 3.7) were assessed. The sample consists of; 9 males and 3 females, n=7 individuals levels I-II and n=5 level III on the Gross Motor Function Classification System (GMFCS). Seven participants have unilateral CP while five have a bilateral distribution. Functional strength was measured using a 30 second repetition maximum sit to stand test and a 30 repetition maximum second lateral step up test on both lower extremities. Aerobic performance was measured using the shuttle run test for youth with CP at GMFCS levels II and III (SRT-II or SRT-III). Number of shuttles, time to conclusion, test level, total distance, maximum heart rate, and ratings of perceived exertion were recorded. Analysis was completed using a two-tailed Spearman Rank Correlation Coefficient ( $r_s$ ) because data for shuttle run test total distance were not normally distributed. **RESULTS:** There is a strong positive correlation between repetitions completed on the 30 second sit to stand test and total distance in the SRT-II or SRT-III test ( $r_s = .69$ ,  $p < .05$ , 95% CI .19-.90). **CONCLUSION:** Results show that functional strength and aerobic performance may influence one another. These findings support research showing a link between strength and aerobic performance in youth with CP; however it is unclear whether the relationship is due to energy cost, walking ability, or some other function.

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## The Abdominal Musculature and Cycling Performance

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**Purpose:** Our purposes were to determine if abdominal power and endurance were related to anaerobic and aerobic cycling performance and to evaluate if abdominal fatigue effects the aforementioned cycling parameters. **Methods:** Twenty three college aged subjects had their age ( $19.17 \pm 0.98$  yrs), height ( $170.41 \pm 7.54$  cm), and weight ( $74.48 \pm 14.06$  kg) taken and completed the front abdominal power throw and ACSM Crunch test so we could evaluate their abdominal power and endurance, respectively; the tests were completed twice across 48 hr to attenuate any learning effects. Twelve of the subjects completed the Wingate anaerobic power test on a Monark 834 E ergometer set at 7.5% of body mass. The remaining 11 subjects completed a 3 km cycling time trail (TT), an aerobic cycling test, on an Espresso S3U virtual reality bike. Subjects completed familiarization, baseline, and performance trials for the cycling measures; immediately before the performance trials, subjects completed abdominal crunches to fatigue. All tests were preceded and followed by a warm-up and cool-down. Dependent *t*-tests were used to assess differences between baseline and performance cycling trails, whereas correlational analyses were used to evaluate the relationships between abdominal and cycling measures;  $\alpha$  was set at 0.05. **Results:** Abdominal muscle fatigue significantly decreased mean anaerobic power ( $p = 0.000$ ) and rate of fatigue ( $p = 0.004$ ); the decrease in peak power approached significance ( $p = 0.088$ ). Abdominal muscle fatigue didn't affect TT performance; however, after fatigue, abdominal power was significantly correlated to TT mean power and time ( $r = -0.708$  and  $0.704$ , respectively). No other significant correlations were found before or after fatigue between the abdominal and cycling measures. **Conclusion:** The data show that abdominal fatigue affects anaerobic cycling performance in our subject population; consequently, individuals may wish to avoid fatiguing abdominal exercise prior to anaerobic power tests or competitions that include anaerobic power elements.

## The Relation Between Self-Reported Activity and Fitness Levels in Primary Care

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Establishing physical activity as a standard in healthcare is a major objective of the American College of Sports Medicine *Exercise is Medicine* initiative. Yet, few primary care physicians (PCP) routinely assess the fitness of patients. Thus, providing patients with an exercise prescription that can be tailored for their physical activity needs remains a challenge. **PURPOSE:** To examine the relation between self-reported cardiorespiratory exercise participation and cardiorespiratory fitness in patients visiting their PCP. **METHODS:** All patients who underwent a medical exam at a primary care practice between June and August 2015 were enrolled in this study. Each patient was asked whether he participates in cardiorespiratory exercise and to report the number of sessions per week, as well as the duration (minutes) and intensity (perceived exertion) of each session. A YMCA bike protocol was administered to estimate  $VO_{2max}$ . **RESULTS:** Ninety patients (age  $65 \pm 12$  years; 24% women) completed all aspects of the study. Forty two percent of patients reported no participation in cardiorespiratory exercise. As expected, the estimated  $VO_{2max}$  was higher among patients who participated in cardiorespiratory exercise compared to those who did not participate (Yes:  $30.0 \pm 9.9$  ml•kg<sup>-1</sup>•min<sup>-1</sup> vs. No:  $26.2 \pm 8.4$  ml•kg<sup>-1</sup>•min<sup>-1</sup>;  $p=0.06$ ). A higher estimated  $VO_{2max}$  was associated with a greater number of sessions per week ( $r= 0.22$ ,  $p=0.04$ ) and intensity per session ( $r=0.32$ ,  $p<0.01$ ). **CONCLUSION:** We found a strong relation between higher amounts of self-reported cardiorespiratory exercise and increased cardiorespiratory fitness among patients visiting their PCP. Whether increasing knowledge of the fitness levels of patients facilitates the promotion of and adherence to physical activity warrants further investigation.

## **Relationship Among Waist Girth, Body Mass Index, Total Cholesterol in College-Aged Males**

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ACSM risk stratification includes fasting glucose and lipid measures. Assessment of these risk factors often requires specialized equipment that may not be available in all settings. **PURPOSE:** To determine what relationship, if any, exists between waist girth (WG) and body mass index (BMI) in individuals with elevated total cholesterol (tCHO)  $\geq 200$  mg/dL. A secondary purpose was to determine if the addition of cholesterol testing to our screening procedures changed risk status in our participants. **METHODS:** A blood sample of 40 $\mu$ L was obtained from the participants' distal phalange using a single use lancet. The sample was placed in a lipid/glucose cassette and analyzed by a commercially available analyzer. BMI was calculated from height and weight collected using standard procedures. WG was measured with a standard tension tape measure. Correlations between variables was assessed with Pearson product moment correlation. **RESULTS:** The males ( $N=666$ ) tested for the study had an average age of 21.92 years. 9.9% of the test subjects ( $n=66$ ) had a tCHO value  $\geq 200$  mg/dL. A strong linear correlation was observed between Wg and BMI ( $r=0.64$ ). No relationship was observed between tCHO and BMI ( $r=0.16$ ) or WG( $r=.23$ ). Among our subjects with elevated cholesterol, tCHO on average was 257mg/dL, WG on average was 37 inches, and a BMI average of 26.25 kg/m<sup>2</sup>. **CONCLUSION:** Adding tCHO testing to the screening procedures identifies additional participants not captured by the remaining risk factors. Despite the cost, fasting cholesterol assessments should be performed to get a complete risk factor profile on all college aged subjects.

## Can Deep Water Exercise Training Improve Arterial Stiffness in Women with Metabolic Syndrome?

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Metabolic syndrome (MetS) is associated with an increase in cardiovascular (CV) mortality, partially due to arterial stiffening, which can be measured non-invasively via pulse wave velocity (PWV). Arterial stiffness is a clinically relevant CV marker of mortality; an increase in PWV by only 1 SD is associated with an increase of CV risk by 15%. We tested the hypothesis that 8 weeks, 3 days per week, of deep-water exercise can lower the PWV in individuals with MetS. **Purpose:** To determine whether exercising in deep water, aquatic environment can effectively lower PWV in women with MetS and how that compares to changes in PWV with land based exercise. **Methods:** 10 women (age=58±5) were recruited to participate in the study. Carotid to femoral PWV was measured using applanation tonometry; radial artery waveforms were used for pulse wave analysis and to calculate central pressures. **Results:** Aquatic exercise significantly lowered PWV by 0.53 m/s ( $p \leq 0.05$ ). Other significant changes observed were BMI ( $p=0.03$ ) from 33.5±1.5 to 32.9±1.5, blood glucose ( $p=0.01$ , from 110±8 to 101±7), insulin ( $p=0.02$ , from 20±2 to 14±1), insulin resistance ( $p=0.01$ , from 5.39±0.81 to 3.55±0.50), augmentation index ( $p=0.05$ , from 25±2 to 22±2), and aerobic capacity ( $p=0.02$ , from 15.9±1.3 to 17.8±1.7). **Conclusion:** These findings indicate that the introduction of deep-water exercise positively influences the PWV. This decrease in PWV portends improvements in overall CV health and it may be useful in managing other CV related diseases. Much of the data showed significant improvement in clinical measures and this illustrates the efficacy of deep-water exercise. While the benefits of land based exercise have long been well known, these findings indicate that aquatic based exercise is also a very effective method for improving CV health.

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## **Muscle MiR-27a is Decreased During Diabetes and is Regulated by Calcineurin Signaling**

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Skeletal muscle atrophy occurs during a variety of conditions including diabetes. Elevated levels of muscle myostatin (MSTN) play a central role in the development of muscle atrophy during these conditions. Recently, research has focused on understanding the control of myostatin in skeletal muscle during both atrophy and hypertrophy. Specifically, recent evidence indicates that microRNA-27a (miR-27a) can target MSTN mRNA and decrease MSTN protein in muscle cells. However, the mechanisms that controls the level of miR-27a in muscle during atrophy-inducing conditions are unknown.

**PURPOSE:** To investigate how miR-27a is regulated during muscle atrophy. **METHODS:** Acute uncontrolled type I diabetes was induced in rats by a single IV injection of 125/mg streptozotocin (STZ), and muscles were harvested 3 days later. Since elevated glucocorticoids mediate some atrophy-inducing effects during diabetes experiments were also performed in C2C12 muscle cells incubated with dexamethasone (DEX; 100 nM). In both muscle and muscle cells miR-27a was measured via qPCR using U6 as a control miR. **RESULTS:** In gastrocnemius muscles of diabetic rats miR-27a was decreased  $40\pm 3\%$  (mean $\pm$ SEM), a finding consistent with the reported elevation in MSTN during diabetes. Similarly, treatment of C2C12 myotubes with DEX also reduced the level of miR-27a  $68\pm 3\%$  within 0.5 hr and this suppression was sustained at  $>51\%$  for 48 hr. The miR-23a/miR24-2/miR-27a cluster was previously reported to be regulated by Calcineurin (CnA) signaling and we have previously shown that CnA activity in skeletal muscle is reduced during diabetes and in muscle cells following DEX treatment. Therefore, we investigated the relationship between CnA activity and miR-27a in muscle cells. Infection of muscle cells with an adenovirus to overexpress a constitutively active form of CnA increased miR-27a by  $35\pm 3\%$ , showing CnA directly regulates miR-27a in muscle.

**CONCLUSION:** These results are consistent with a model in which atrophy-inducing conditions regulate MSTN production in skeletal muscle in part by reducing the level of miR-27a via a mechanism that involves decreased CnA signaling. Thus, miR-27a appears to play a pivotal role in the pathogenesis of muscle atrophy during conditions such as diabetes.

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## Arterial Stiffness and Central Blood Pressure Response to Dietary Sodium in Young and Middle-Aged Adults

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High dietary sodium intake has been associated with the development of hypertension and increased incidence of cardiovascular disease. **PURPOSE:** The aim of this study was to determine the effect of short-term dietary sodium loading on arterial stiffness and central blood pressure in young (YG; 22-40 years old, n=49, 27±1 yrs) and middle-aged (MA; 41-60 years old, n=36, 52±1 yrs) normotensive adults. **METHODS:** Subjects were randomized to 7 days of low sodium (LS: 20 mmol/d) and 7 days of high sodium diet (HS: 300 mmol/d). On the last day of each diet, carotid-femoral pulse wave velocity (PWV), central aortic pressure waveform (synthesized by radial artery applanation tonometry and generalized transfer function), and wave separation analysis were assessed. **RESULTS:** In comparison to the LS diet, the HS diet elicited an increase in central systolic blood pressure (cSBP) in both YG (LS: 96±1 vs. HS: 99±1 mmHg,  $p < 0.05$ ) and MA (LS: 106±2 vs. HS: 115±3 mmHg,  $p < 0.05$ ). The increase in cSBP was greater in MA (YG: 4±1 vs. MA: 9±2,  $p < 0.05$ ). In MA, HS elicited greater central forward wave amplitude (LS: 25±1 vs. HS: 29±1 mmHg,  $p < 0.05$ ), central reflected wave amplitude (LS: 19±1 vs. HS: 23±1 mmHg,  $p < 0.05$ ), and PWV (LS: 7.1±0.3 vs. HS: 7.7±0.5 ms,  $p < 0.05$ ) whereas these were not different in the YG. **CONCLUSION:** These data suggest that high sodium intake is associated with a greater increase in cSBP in MA that may be the result of increased arterial stiffness and forward and reflected wave amplitudes.

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## Gender Differences in O<sub>2</sub> Pulse During Single Set vs. Multiple-set Resistance Exercise

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**Purpose:** To compare O<sub>2</sub> pulse in males and females during single and multiple set upper body resistance training. **Methods:** A total of 24 subjects (12 ♂, 12 ♀) mean age ( $\pm$ SD) 21.4 ( $\pm$ 1.3) years, performed both a 1 and 3-set, 5-exercise, 10-repetition, upper body protocol (bench press, lat pulldown military press, biceps curl, triceps pushdown). Loads were set at 70% of their 1-repetition maximum using a lifting cadence of 15 reps·min<sup>-1</sup>. A minimum of 48 hours elapsed between testing sessions. Breath-by-breath data were recorded via a portable, telemetry metabolic measurement system. **Results:** Two-way repeated measures ANOVA was used to analyze differences between sets and genders. Data (mean  $\pm$ SD) are presented in the table below:

Set #	Bench Press		Lat Pulls		Military Press		Tricep Press		Bicep Curl	
	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
1- set Mn	6.41	4.96	8.78	4.83	8.71*	4.17	7.04*	3.72	6.95*	3.99
SD	3.53	2.84	4.94	2.60	4.98	2.25	3.26	2.07	3.85	2.04
3- set Mn	7.00	5.65	8.12	5.13	5.60	3.90	5.88	3.69	5.74 <sup>#</sup>	3.89
SD	3.94	3.03	4.32	2.56	3.07	2.35	2.78	1.85	2.94	1.99

Sign. Diff. ( $p < 0.05$ ) \* between genders, # between sets

There were significant differences in O<sub>2</sub> pulse between genders in the smaller muscle group exercises. Between single and 3 set differences were only seen in the males for the bicep curl exercise. Variations in O<sub>2</sub> pulse during exercise represent changes in stroke volume and arterial-mixed venous O<sub>2</sub> difference.

**Conclusion:** The significantly higher O<sub>2</sub> pulse recorded during the smaller muscle exercises were possibly due to increased sympathetic drive.

## Physical Activity Mediates the Relationship between Sleep and Vascular Health in Older Adults

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Stiffening of the arterial wall with advancing age increases risk for cardiovascular disease. Optimal sleep quality is correlated with lower arterial stiffness. Sleep quality decreases with age which may negatively impact vascular health. It is unclear if there is a direct relationship between arterial stiffness and sleep quality in older adults, and if the relation is mediated by other lifestyle factors such as physical activity (PA). **PURPOSE:** To evaluate PA as a mediating factor in the relationship between sleep quality and arterial stiffness in older adults. **METHODS:** Seventy-five older adults (mean age  $68 \pm 6$  years, body mass  $74.2 \pm 15$  kg, 40 female) participated in the study. Body fat was assessed using air displacement plethysmography. Central artery stiffness was assessed as carotid-femoral pulse wave velocity (PWV) using applanation tonometry, and brachial systolic and diastolic blood pressure were assessed using an automated oscillometric brachial cuff. Self-reported sleep quality was assessed using the Pittsburgh Sleep Quality Index. PA was measured using an accelerometer worn around the waist and expressed as total activity counts. The accelerometer was worn for at least 3 days (mean wear  $4.92 \pm 1.5$  days). **RESULTS:** When separating participants into low and high sleep quality index using cluster analysis, those with higher sleep quality index (indicating poor sleep quality) had higher PWV ( $11.0 \pm 2.7$  vs  $9.4 \pm 2.4$  m/s,  $p < 0.05$ ) and lower total activity counts ( $184,129 \pm 95,322$  vs  $275,726 \pm 164,323$  counts/day,  $p < 0.05$ ) compared to participants with lower sleep quality index. After co-varying for sex, body fat, and mean arterial pressure, higher sleep quality index was associated with lower total activity counts ( $\beta = -0.22$ ,  $p < 0.05$ ) and higher PWV ( $\beta = 0.29$ ,  $p < 0.05$ ). The significant association between sleep quality index and PWV was attenuated when the indirect effect of total activity counts on PWV ( $\beta = -0.27$ ,  $p < 0.05$ ) was statistically removed using mediation analysis ( $\beta = 0.23$ ,  $p > 0.05$ ). **CONCLUSION:** PA may have a mediating effect on the relationship between sleep quality and arterial stiffness in older adults. Whether higher PA contributes to better sleep quality or *vice versa* requires further study.

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### ***Examining Gender Differences in the Relationship Between Active Travel and Fitness Outcomes***

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Active travel (AT), transportation by walking and biking, has many health benefits and can provide the recommended daily physical activity for many college students. **PURPOSE:** To examine gender differences of the relationship between AT and fitness outcomes. **METHODS:** Participants were a volunteer sample of college students who completed an objective fitness assessment (VO<sub>2</sub>max, BMI, body fat percentage, blood glucose, and lipids) and self-reported their travel modes to campus and demographics. Basic statistics described the sample, Pearson correlations, and t-tests examined the relationship between active travel and fitness variables for males and females separately. **RESULTS:** Participants (n=382) were primarily male (52%), and Non-Hispanic White (76%). Males had a mean of VO<sub>2</sub>max of  $37.7 \pm 8.9$  ml/kg/min, body fat of  $16.0 \pm 4.9\%$ , and BMI of  $25.6 \pm 3.8$  kg/m<sup>2</sup>. Females had a mean of VO<sub>2</sub>max  $36.0 \pm 7.3$  ml/kg/min, body fat of  $26.5 \pm 6.4\%$ , and BMI of  $24.2 \pm 4.1$  kg/m<sup>2</sup>. Males had more total AT trips/week ( $10.8 \pm 6.0$ ), and biking trips/week;  $2.0 \pm 3.3$ ; compared with females (AT  $8.9 \pm 6.5$ ,  $p=.006$ ; bike  $1.0 \pm 2.0$ ,  $p=.001$ ). There was no significant difference in walk trips/week between men  $9.2 \pm 5.4$  and women  $8.5 \pm 5.8$  trips/week. For males, biking was related to pushups ( $r=.20$ ,  $p=.01$ ) and walking was related to LDL levels ( $r=.53$ ,  $p=.006$ ). For females, biking was related to HDL ( $r=-.44$ ,  $p=.02$ ), walking was related to body fat percentage ( $r=-.21$ ,  $p=.007$ ), curl ups ( $r=.18$ ,  $p=.02$ ) and LDL ( $r=.34$ ,  $p=.06$ ). **CONCLUSION:** The results of this study illustrate that males and females participate in AT at different rates. It also illustrates that active travel provides different health and fitness outcomes for different genders. Further investigation is warranted on how gender moderates the relationship between AT participation and health and fitness outcomes.

## Effectiveness of a Walking Program for Children and Their Families

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**PURPOSE:** To implement and assess the effectiveness of a 10-week walking program on physical activity levels for 9-11 year old children and their families. **METHODS:** Eighteen children, aged 9-11, and their families (guardians and siblings) (n=34) were recruited through an open invitation within the Butler YMCA membership (Butler, PA). Participants were provided a free pedometer and family walking log to record steps; they were instructed to use these tools as motivation to increase physical activity over a 10-week period. Free, guided exercise classes were offered 5 days per week exclusively for the research participants and their family members. **RESULTS:** Eleven children, aged 9-11, and their families (n=23) completed the 10-week walking program (61% retention). Participants' steps significantly increased between week 1 (44,251±32,592) and week 10 (64,913±22,887) ( $p < 0.001$ ). Step counts were then further analyzed for children aged 9-11, their guardians, and their siblings. Children aged 9-11 had a non-significant increase in steps between week 1 (52,295±46,646) and week 10 (65,253±27,747) ( $p = .435$ ). Conversely, parents had a significant increase between week 1 (40,195±27,568) and week 10 (63,481±23,265) ( $p < .001$ ). Siblings also had a significant increase between week 1 (40,795±15,124) and week 10 (67,129±16,643) ( $p < .001$ ). A One-Way ANOVA revealed that there were no statistical differences between the 3 groups at week 1 ( $p = .623$ ), nor week 10 ( $p = .938$ ). **CONCLUSION:** A 10-week walking program is a feasible option for increasing physical activity levels among family members. Even though the target population, children aged 9-11 years, did not significantly increase step counts, they improved by 25% from week 1 to week 10. It should be noted that the children's family members increased physical activity as a result of participating in this program and further investigation is warranted to determine the impact of familial support on physical activity levels.

## **The Effects of Creatine Monohydrate and Creatine Hydrochloride Supplementation on Power in Trained Individuals**

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Currently, there are no performance studies that compare the effects of creatine monohydrate and creatine hydrochloride (HCL). **PURPOSE:** The purpose of this study was to investigate how the supplementation of creatine monohydrate and creatine hydrochloride (HCL) affects performance on one repetition maximum (1 RM) lifts in the barbell back squat (BBBS), barbell deadlift (BBD), and the standing vertical Jump (SVJ). **METHODS:** Nine trained individuals entered the laboratory on day one to complete baseline testing for the study consisting of a 1 RM in the BBBS, BBD and SVJ. All participants supplemented with either creatine monohydrate (n=3), creatine HCL (n=4), or placebo (n=2). The creatine monohydrate group received two 5 g doses per day, the creatine HCL group received two 0.750 mg doses per day, and the placebo group received two doses of the placebo per day. After the six-day loading phase, all participants returned to the laboratory for post testing. **RESULTS:** No significant differences were found within each supplementation group from pre to post supplementation measurements for any of the three exercises ( $p > 0.05$ ). The percent changes for the BBBS exercise for the creatine monohydrate, creatine HCL, and placebo groups were 2.44%, 1.54%, and 10.33% respectively. The percent changes for the BBD for the creatine monohydrate, creatine HCL, and placebo groups were 1.4%, 2.21%, and 6.67% respectively. The percent changes for the SVJ for the creatine monohydrate, creatine HCL, and placebo groups were 2.04%, 3.61%, and -2.15% respectively. **CONCLUSION:** These data suggest that neither form of creatine is helpful in increasing 1 RM lifts or SVJ height, over a supplementation period of six days, however, the very small sample size is a limitation of the study.

## **The Acute Effect of Exposure to Barefoot Running on VO<sub>2</sub>peak, Fatigue, and Time to Exhaustion in Recreational Runners**

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The concept of Bare Foot (BF) is based on a naturalistic approach to promote running efficiency through forefoot striking patterns. In Contrast, Lieberman et al, 2010 showed that traditional running shoes with high cushioned heels facilitate a rear foot striking pattern. This pattern of running has been found to be relatively inefficient. Hasegawa et al, 2007, showed that 75% of half marathon runners were rear foot strikers which correlated with slower running speeds, in contrast those athletes who demonstrated mid or forefoot striking patterns were more efficient with faster running speeds. This suggests that a forefoot or mid foot striking pattern may increase performance. To date, the majority of studies investigating the effects BF running have used trained runners with multiple exposures before data collection. This limits the generalizability of the data and may not depict the physiological changes that occur with acute exposure. **Purpose:** The purpose of this study was to investigate the physiologic response during the acute exposure to BF running. **Methods:** The subjects consisted of 12 recreational runners with no previous history of BF running. The subjects reported to the lab on two separate occasions for either the shod running trial in which they wore running shoes or the BF trial in which a pair of athletic socks was worn. The protocol for both sessions consisted of a brief warm-up followed by the Astrand Treadmill protocol. VO<sub>2</sub>peak, local RPE (lower extremity), systemic RPE, and time to exhaustion were collected and analyzed. **Results:** The results of this study found no statistically significant differences ( $p > 0.05$ ) for time to exhaustion  $821.75 \pm 104.7$  and  $793.0 \pm 131.98$  seconds, VO<sub>2</sub>peak  $52.05 \pm 4.69$  and  $52.38 \pm 7.46$  ml/kg/min, local RPE  $17.25 \pm 2.01$  and  $17.75 \pm 1.86$ , and systemic RPE  $17.17 \pm 1.59$  and  $17.42 \pm 1.00$  for shod and BF running respectively. The researchers found that each subject did transition within 60 seconds from rear foot strikers to mid/ fore foot strikers. **Conclusion:** The findings of this study suggest that there is no difference in physiologic or fatigue values between shod and barefoot running during an acute exposure, however transition of running style did occur. This would suggest that novice runners with no BF experience might in fact benefit just as experienced runners do from BF running.

## Performance Asymmetry in the Star Excursion Balance Test

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The Star Excursion Balance Test (SEBT) is a common assessment used by clinicians to evaluate dynamic postural control. The SEBT incorporates aspects of strength, flexibility, and neuromuscular control. It often used to predict individuals at risk of certain lower extremity injury and to track rehabilitation progress. However, to better evaluate performance in clinical populations or identify injury risk, it is necessary to understand bi-lateral asymmetry in the SEBT in a healthy population.

**PUPROSE:** To determine bi-lateral asymmetry in SEBT reach distances in healthy college aged individuals. **METHODS:** Twenty-eight healthy male and female college aged students (Age:  $19.8 \pm 1.0$  yrs, Ht:  $171.4 \pm 12.3$  cm, Mass:  $78.7 \pm 22.6$  kg) performed 3 practice and 3 successful trials for the three directions of the SEBT: anterior (ANT), posterior-medial (PM), and posterior-lateral (PL) on their dominate (D) and non-dominate (ND) legs. Successful trials were defined as trials for which the subject, while performing their maximal reach, kept hands on hips, the balancing foot flat, and maintained static balance for 3 seconds after returning to the start position. The dominate leg was defined as their preferred kicking leg. Reach distance was recorded to the nearest cm. A 3 trial mean was calculated for each subject, each distance, and each leg and used in all subsequent analyses. Bi-lateral asymmetries were evaluated using Bland-Altman Limits of Agreement analyses with 95% confidence intervals around the mean asymmetry. **RESULTS:** The anterior reach demonstrated the lowest mean asymmetry of the three reach distances but the greatest asymmetry variability ( $0.9 \pm 4.3$  cm) with a potential 7.6 to -9.4 cm asymmetry based on the 95% confidence intervals. The PM and PL demonstrated larger asymmetries (PM:  $4.3 \pm 2.9$ cm, P:  $3.6 \pm 2.2$  cm) with 1.3 to -10.0 cm and 7.9 to -0.8 cm asymmetries, respectively. Based on the LoA analysis, the PM asymmetry appeared to favor the dominant limb while the PL favored the non-dominant. **CONCLUSION:** Healthy college aged adults exhibited bi-lateral asymmetries during the SEBT when performing posterior reaches. These asymmetries appear to be limb dependent. Understanding asymmetries in healthy populations could lead to improved utilization of SEBT in clinical assessment.

## Greater Energy Cost During Standardized Walking is Associated With Diminished Fitness in Older Adults

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Persistently elevated walking economy, or energetic inefficiency, may lead to diminished energy reserve for physical activity. Over time this may lead to accelerated loss of function with age and development of fatigue; however, the relationship between walking economy and functional capacity in older adults is not well known. **PURPOSE:** To examine the relationship between walking economy and fitness in older adults. **METHODS:** Walking economy was measured as the average rate of oxygen consumption over the last 2 minutes of 5 minutes of treadmill walking at 1.5 mile per hour in 50 older participants (23 women, aged  $69\pm 9$  yrs) of the Towson University Longitudinal Aging Study at Towson (LAST). Aerobic fitness was assessed as time to complete 400 meters of fast-paced walking over a 20-meter course. Fatigability was defined as performance deterioration between laps and was calculated as the greatest percent increase in lap time between the second and subsequent laps. The association between the rate of oxygen consumption and aerobic fitness and fatigability was modeled using linear regression, with 400m walk time or fatigability as a predictor adjusting for age, fat mass, and fat-free mass. **RESULTS:** In the adjusted model, time to complete the 400m walk (mean  $273\pm 50$  seconds) showed a significant relationship with rate of oxygen consumption ( $\beta = 0.6$ ,  $p = 0.05$ ), indicating that the cost of walking was 0.6 mL/min higher for each one second increase in 400m walk time. Fatigability (mean  $5.8\pm 4.1\%$ ) also showed a significant relationship with the rate of oxygen consumption ( $\beta = 661$ ,  $p < 0.05$ ), indicating that the cost of walking was 661 mL/min higher for each 1 percent increase in fatigability. **CONCLUSION:** A significant relationship occurs between poor walking economy and reduced aerobic fitness in older adults. The temporal association between reduced aerobic fitness and poor efficiency is unknown, however the combination of these two factor made lead to greater fatigability hastening the age related decline in physical activity.

## Effect of a Walking Program on Functional Fitness Measures in Older Adults

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Increasing physical activity for an elderly population can have a significant effect on functional fitness and activities of daily living by increasing muscular strength, endurance, and gait speed. **PURPOSE:** To identify functional fitness changes on an elderly population through a 6-month walking intervention program. **METHODS:** Twenty one healthy, older individuals were recruited from a Senior Center (age: 72.4±6.1 yrs; height: 158.9±6.6 cm; weight: 81.1±12.7 kg; BMI: 31.9±0.9). Subjects self-selected to participate in either a walking (WG) or control (CON) group. Subjects in the WG were given a pedometer to wear and were assigned a daily step goal of eventually reaching ≥10,000 steps/day. Each month, subjects were evaluated using: six-minute walk (6min) test, a 20 m walk at a maximum pace (with initial 2.44 m and middle 10 m components), 30 s chair stand (CS) task that measured the number of CS, and lastly a get-up-and-go (GUAG) task that measured the time to walk 2.44 m after standing from a seated position and returning to a seated position. A two-way ANOVA with repeated measures was used to make group and time (baseline vs. month 3) comparisons. **RESULTS:** Compared to baseline, many of the functional fitness measures improved, after 3 months' of walking intervention.

	Walking Group			Control Group		
	Baseline	Month 3	% change	Baseline	Month 3	% change
6 min (m)	351.5±46.8	398.1±70.4*	13.3	312.7±52.0	360.8±42.7*	15.4
2.44 m Max (W)	987.9±186.4	1126.0±248.1*	14.0	877.6±239.2	939.8±217.5	7.1
2.44 m GS (m·s <sup>-1</sup> )	1.2±0.2	1.4±0.2*	15.4	1.1±0.2	1.2±0.3	6.6
10 m Max (s)	6.7±1.3	6.4±0.7	-3.3	7.7±1.6	7.5±1.4	-1.6
CS 30 (rep)	13.0±3.1	15.2±3.9*	17.0	11.8±2.4	13.3±1.5	12.3
GUAG (s)	6.9±1.2	6.2±1.0	-9.2	7.9±1.7	7.1±1.4	-9.6

Note: \*Significantly different from the baseline (p<0.05).

**CONCLUSION:** The preliminary findings suggest that a three-month walking intervention program for older adults can significantly improve some of their functional fitness measures, which may aid in their activities of daily living.

## **Endurance Training Attenuates Chemoreflex Sensitivity to Intermittent Hypoxia**

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The physiological response to hypoxemia is mediated by carotid body chemoreceptors that signal increases in ventilation and muscle sympathetic nerve activity (MSNA), termed the chemoreflex. Patients with heart failure and sleep apnea have greater chemoreflex sensitivity, presumably due to intermittent hypoxia (IH), and this is predictive of mortality. The effect of exercise training on chemoreflex sensitivity in humans is unknown. **PURPOSE:** To investigate the effect of endurance training on chemoreflex sensitivity to IH. **METHODS:** Eleven young healthy subjects (5 male,  $25 \pm 1$  years) were studied twice, before and after eight weeks of endurance training that included running four times/week at 80% predicted max heart rate (HR) and interval training. At each visit, chemoreflex sensitivity, blood pressure (BP), HR, and MSNA were assessed before and after 30 minutes of IH. Chemoreflex sensitivity (ie. our primary outcome variable) was calculated as the slope of minute ventilation / % arterial O<sub>2</sub> desaturation during transient inhalation of pure nitrogen gas. **RESULTS:** Endurance training increased VO<sub>2</sub> max ( $36.4 \pm 1.4$  to  $40.1 \pm 1.7$  ml/kg/min,  $P < .001$ ), decreased resting systolic BP ( $119 \pm 3$  to  $113 \pm 3$  mmHg,  $P = 0.027$ ) and HR ( $67 \pm 3$  to  $61 \pm 2$  beats/minute,  $P = 0.004$ ), but did not alter respiratory parameters at rest ( $P > 0.2$ ). Endurance training attenuated the IH-induced increase in chemoreflex sensitivity (pre-training:  $\Delta 0.045 \pm 0.026$  vs. post-training:  $\Delta - 0.028 \pm 0.040$  L/min/ %O<sub>2</sub> desaturation,  $P = 0.045$ ). Furthermore, IH increased mean BP and MSNA burst rate before training ( $P < 0.05$ ), but IH did not alter these measures after training ( $P > 0.2$ ). **CONCLUSION:** Endurance training attenuates chemoreflex sensitization to IH, which may partially explain the beneficial effects of exercise training in patients with sleep apnea and heart failure.

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## Functional Movement Screen Scores in High School Football Players

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The Functional Movement Screen (FMS) is a 7-step screen that identifies major fundamental pattern limitations and asymmetries to determine potential injury risk. Previous reports have presented normative data for FMS scores, and shown that low composite scores ( $\leq 14$ ) and pattern asymmetry are associated with increased risk of injury in professional football players. To our knowledge, descriptive FMS data for HS football players has yet to be presented. **PURPOSE:** Develop normative data and distributions of scores for the FMS in HS football players. **METHODS:** A total of 60 HS football players ( $15.3 \pm 1.1$  yrs;  $180.9 \pm 6.9$  cm;  $82.1 \pm 15.5$  kg) completed FMS testing prior to the start of the 2015 football season. The FMS was comprised of the deep squat (DS), push-up (PU), shoulder mobility (SM), in-line lunge (ILL), hurdle step (HS), active straight leg raise (ASLR), and rotary stability (RS), which were scored on a 0-3 scale with a max. score of 21. A score of 3 on any test indicated full movement completion without compensation. A score of 2 indicates movement completion but with compensation; a score of 1 indicates the movement was not completed; and a score of 0 was recorded if pain was reported. Descriptive statistics were calculated for FMS results. FMS composite scores were dichotomized as low ( $\leq 14$ ) versus high ( $> 14$ ) whereas movement asymmetry was defined as the presence of 1 or more right/left differences on any of the 5 tests scored unilaterally (HS, ILL, SM, ASLR, RS). **RESULTS:** The mean composite FMS score was  $12.9 \pm 2.2$  (range 5 – 16), with 14 being the most frequent score among players (23.3%). The majority (44 of 60; 73.3%) of participants scored  $\leq 14$ , whereas 33.3% (20 of 60) of players had scores  $\leq 12$ . Approximately half of the players (31 of 60) had 1 or more asymmetries on any of the movements scored unilaterally; 25.0% (15 of 60) had 2 or more asymmetries. Almost half (26 of 60; 43.3%) of the participants scored  $\leq 14$  and had at least 1 asymmetry. The highest frequency of 1s was recorded on the DS (48.3%), while RS had the highest frequency of 2s (86.7%). The SM test had the highest frequency of 3 as a score (58.3%). **CONCLUSION:** FMS scores in HS football players were lower than previously reported for collegiate and professional players. Future work will determine if low FMS scores and pattern asymmetry are predictors of injury in HS football players.

## Correlation Between Handgrip Strength and Functional Fitness Among Older Adults

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Maintaining functional fitness is important in order to preserve quality of life and independence as an older adult. Handgrip strength has been used to determine one's overall strength in many populations, including geriatric. **PURPOSE:** The purpose was to examine the relationship between handgrip strength (HGS) and functional fitness (FF) among older adults. **METHODS:** Twenty older adults (age:  $71.60 \pm 5.59$  years; height:  $1.64 \pm 0.14$  m; mass:  $73.85 \pm 14.90$  kg) volunteered to complete the HGS test and the following FF tests: 30-s chair stand (CS), 8-foot up-and-go (UPGO), power stair climb (PSC), habitual walk (HW), and fast walk (FW). During the CS test, subjects stood from a seated position as many times as possible during a 30 s time period. Each subject completed this test one time. The UPGO test included getting up from a seated position, walking 8 feet and returning to the seated position. During the PSC Test, subjects were asked to ascend a flight of 9 stairs as quickly and safely as possible. Subjects completed three trials of the UPGO and PSC tests with a 60 s rest between trials and the best time was used for analysis. Subjects completed two trials of the HW and FW over 20-m with a 60 s rest between trials. Gait speed was calculated for each walk. Data were analyzed using a bivariate Pearson correlation ( $\alpha = .05$ ). **RESULTS:** The results of the Pearson correlation found significant relationships between HGS and HW ( $r = .51, p = .02$ ), FW ( $r = .54, p = .01$ ), and PSC ( $r = .67, p < .01$ ). No relationship was yielded between HGS and CS or UPGO. **CONCLUSION:** The results of the study suggested HGS was moderately correlated to gait speed and stair-climb power within a sample of community-dwelling older adults. These results are promising for healthcare professionals that do not have adequate time to assess time-consuming measures of functional fitness.

## **World Aging Lessons Learned: Engaging Older Adults in International Activities to increase Physical Activity Levels**

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**PURPOSE:** The purpose of this project was to determine how applying longevity techniques in an interactive group setting for older adults affected their physical activity levels and nutritional habits. **METHODS:** Participants consisted of older adults (14 female, 3 male) from two older adult senior centers in the state. The age of participants ranged from 51 to 83 years of age ( $X$  age = 70 ). Participants were educated about the various countries and were given information about the types of physical activity taking place there as well as their lifestyles and habits. Pre and Post test questionnaires for older adults consisted of: Goden Physical Activity Scale, The Blue Zones Vitality Compass, and the Satisfaction with Life Scale. The program consisted of ten weeks, with two meetings a week for each center. **RESULTS:** There were no significant differences in pre=post satisfaction with life, (Pre: 25.7, Post: 26.4). There were significant increases in the Goden Physical Activity Scale level of frequency of mild physical activity a week (Pre: 1.7, Post: 3.1) ( $t=2.8$   $p<0.05$ ). There were also shown to be significant increases ( $p<005$ ) in the number of times participants competed twenty minutes of vigorous physical activity a week (Pre: 2, Post: 3.3). There were no significant changes within the Vitality Compass life expectancy scores. **CONCLUSIONS:** Overall, older adults who participated in the international activities on a regular basis saw significant increases in their mild physical activity levels and short increments of vigorous physical activity. This would indicate that they are receptive to trying new physical activities and that further exposure would only continue to increase their levels further. While there were not any changes within the Satisfaction with Life Scale, there may have been a ceiling effect in place as many of the participants rated within the top tier of satisfaction in the pre evaluation. This study suggests that exposing older adults to other types of physical activity within a focused group setting as a regular activity within the senior communities has the ability to increase the health and wellness of its members.

## **Effect of Physical Fitness on the Risk of Stress Fracture Injury in Army Basic Training**

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The 10-week Army basic training course (BT) includes a high volume of weight bearing activity that increases risk for stress fracture. These injuries limit the ability to train and increase the risk for attrition. Previous studies have shown that the injury risk for women in BT is 3.4 – 6.5 times higher than for men. Some studies have found that the overall injury risk for women is significantly reduced when multivariate models adjust for the fitness levels of women and men. **PURPOSE:** The purpose of this retrospective study is to examine the stress fracture risk for women and men in BT while adjusting for aerobic fitness and muscle endurance of new recruits. **METHODS:** Demographics, stress fracture incidence, and performance data on the initial (1<sup>st</sup> week of BT) Army Physical Fitness Test (APFT) were linked for 34,931 women and 136,797 men in BT in fiscal years 2010 through 2013. The APFT consists of maximum number of pushups and sit-ups in 2 minutes and a timed 2-mile run. Gender neutral quintiles were created for the pushup and sit-up events and the 2-mile run. The 2-mile run time was used as an indicator of aerobic fitness (Q1 [fastest] -> Q5 [slowest]) and pushup and sit-up records were used as an indicator for muscle endurance (Q1 [low] -> Q5 [high]). Unadjusted and adjusted (adjusted for aerobic fitness) risk ratios for stress fracture (women [w]:men [m]) were compared to evaluate the effects of aerobic fitness and gender on stress fractures. Combinations of demographic and fitness variables were evaluated to determine the best model to estimate risk. **RESULTS:** Overall, 3.7% of women and 0.8% of men experienced a stress fracture while in BT. The unadjusted risk for women compared to men (w:m) was 4.54 (4.19-4.91). After adjusting for runtime, the Maental-Hansel risk ratio (w:m) dropped to 2.37 (2.16-2.60). **CONCLUSION:** Overall, women have a higher risk of stress fracture than men; however, when adjusting for fitness, the relative risk decreases by 47%. Though the risk decreases when adjusting for aerobic fitness, female gender remains an important risk factor for stress fractures.

**Disclaimer:** The views expressed in this article are those of the author and do not reflect the official policy or position of the Department of the Army, Department of Defense or the U.S. Government. Approved for public release, distribution unlimited. This research was supported in part by an appointment to the Postgraduate Research Participation Program at the U.S. Army Public Health Center administered by the Oak Ridge Institute for Science and Education through an interagency agreement between the U.S. Department of Energy and USAPHC.

## Gender Differences in Health-Related Physical Fitness Among College Students

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**PURPOSE:** To analyze health-related physical fitness in college students and examine gender differences. **METHODS:** Between 2012 and 2014, a convenient sample of 170 college students (37% females, 63% males, mean age of  $22.74 \pm 5.04$  years) underwent a series of standardized health-related physical fitness tests. Tests included Jackson-Pollock 3 site skinfolds, the Cooper 12-minute run/walk, push-up, abdominal curl-up, and YMCA sit-and-reach. We used mean and standard deviation to describe health-related physical fitness levels of participants and independent sample t-test to examine gender differences. A Mann-Whitney U test was performed to determine if there were differences in body fat categories between males and females. **RESULTS:** The sample mean estimated VO<sub>2</sub>max value was  $38.93 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1} \pm 11.32 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$ . Participants performed  $22.55 \pm 10.66$  and  $31.29 \pm 19.31$  push-ups and curl-ups respectively. Males completed significantly more push-ups than females. However, females showed significantly greater flexibility values compared to their male counterparts. There was a statistically significant difference in mean body fat percentage between males and females, with females scoring higher than males. However, body fat categories were not statistically significantly different between males and females. **CONCLUSION:** Despite participants meeting average standards for most of the fitness components, it is clear that there is opportunity for improvement. In order to delay potential declines in health-related physical fitness, colleges should consider developing comprehensive programs targeting psychosocial as well as environmental factors that enhance behaviors, curriculum, opportunities and policies.

	% body fat	VO <sub>2</sub> max (ml/kg/min)	Push-ups	Curl-ups	YMCA sit- and-reach (inches)
Males	<b>12.19**</b> ±5.00	<b>40.04</b> ±10.56	<b>25.81</b> ± 10.00**	<b>33.17</b> ±18.79	<b>16.71**</b> ± 3.91
Females	<b>23.78**</b> ± 5.99	<b>37.00</b> ±11.64	<b>16.89</b> ± 9.39**	<b>28.01</b> ±19.43	<b>19.43**</b> ± 4.11

\*\* Significant difference  $p < 0.01$

## **Comparison of Muscle Activation during an Overhead Press: Kettlebell v. Dumbbell**

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Though little scientific evidence has been reported, kettlebells are often used to replace dumbbells during common resistance exercises. In reviewing the mechanics of the overhead press exercise, it was surmised that the kettlebell's center of gravity is located posterior to the glenohumeral (GH) joint. The location of this center of gravity may place additional external rotation torque on the GH joint as compared to a dumbbell. **PURPOSE:** To examine if muscle activity is altered during the performance of an overhead press using a kettlebell vs. a dumbbell. **METHODS:** Surface electromyography (EMG) was conducted on 21 subjects (7 female, 14 male). The anterior deltoid (AD), a prime mover, and pectoralis major (PM), both superficial muscles that contribute to internal rotation of the shoulder, were chosen for examination. For consistency, the overhead press was standardized. Each subject performed a two second isometric hold followed by a two second concentric phase, two second eccentric phase, and one second isometric hold at the end. EMG data were normalized and an RMS value was calculated for use in the analysis. A repeated-measures ANOVA compared RMS values for the AD and PM across conditions (kettlebell press v. dumbbell press). **RESULTS:** A statistically significant increase in the RMS value ( $0.000388 \pm 0.000185$  v.  $0.000423 \pm 0.000187$ ;  $p=0.003$ ) was identified in the AD when performing the dumbbell press as compared to the kettlebell press. No significant difference ( $0.0000974 \pm 0.000125$  v.  $0.0000756 \pm 0.000033$ ;  $p=0.437$ ) was noted in the PM between conditions. **CONCLUSION:** The results from this study support previous literature examining muscle activity using implements of varying stability. In this study, EMG activity was attenuated in the prime mover (AD) while using an implement that may require more stabilization, the kettlebell. This finding may be the result of a potential increase in recruitment of the muscles that stabilize the GH joint during overhead activity.

## **Exercise as a Treatment for Peripheral Vascular Dysfunction caused by Metabolic Syndrome and Depression**

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Metabolic Syndrome (MetS) and chronic stress/depression are associated with an increased risk for poor cardiovascular outcomes and impaired vascular function. Both of these diseases are continuously increasing in prevalence, but not much is known about the pathological effects of their comorbidity. Exercise is a widely accepted and supported modality for combating MetS and managing chronic stress. However, a gap in the literature exists regarding the degree to which exercise can mitigate the vascular dysfunction associated with MetS and chronic stress simultaneously. The Unpredictable Chronic Mild Stress (UCMS) model is used as a simulation of daily, prolonged stress. The Obese Zucker Rat (OZR) represents MetS, with Lean Zucker Rats (LZR) paralleling a healthy individual. **PURPOSE:** To determine the degree to which exercise can attenuate vascular dysfunction caused by chronic stress and metabolic syndrome. **METHODS:** OZRs and LZRs were separated into experimental groups including: control (C), exercise (Ex), UCMS, and UCMS with exercise (UCMS+Ex). The gracilis arteriole was isolated and vasodilator/constrictor responses of endothelium and vascular smooth muscle were assessed using acetylcholine (ACh), sodium nitroprusside, and phenylephrine, respectively. **RESULTS:** OZR-C overall reactivity was decreased 10-20% from that of LZR-C. Exercise improved the reactivity of the gracilis in OZRs by 20% compared to OZR-C. OZR UCMS reactivity was impaired compared to OZR-C, but rescued with exercise training. **CONCLUSIONS:** Comorbidity between MetS and chronic stress is a confounding factor on healthy vasculature, but does not increase vascular dysfunction in already impaired vessels. Exercise can be used as an intervention for these two diseases to improve microvascular reactivity.

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## **The Effects of De-Training and Re-Training the Cardiovascular and Respiratory Systems on Female Collegiate Swimmers**

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**PURPOSE:** To investigate the effects of a de-training (off-season) and re-training (in-season) period on the cardiovascular and respiratory systems in collegiate swimmers. Swimming is a unique sport that requires months of strict training to produce gains in performance. Unfortunately when the season ends, collegiate swimmers have nearly four months of off-season where the physiological gains they achieved during the season can be partially or completely lost if proper training does not take place. **METHODS:** The cardiovascular and respiratory systems were evaluated through the use of VO<sub>2</sub>max treadmill testing and spirometry, focusing on maximal oxygen uptake (ml/kg/min) and three lung capacities (forced vital capacity, FVC; peak expiratory flow, PEF; forced expiratory volume in one second, FEV<sub>1</sub>). Secondary variables evaluated included anthropometrics (body weight (kg) and BMI), as well as resting heart rate, maximal heart rate, maximal time, and maximal METs achieved during the VO<sub>2</sub>max test. Six collegiately trained swimmers completed two trials separated by three months of re-training on campus as provided by the university coaching staff. Spirometry was measured before cardiovascular values during both pre-testing and post-testing. **RESULTS:** Mean body weight (kg) was found to be significantly lower from pre- to post-testing (pre 67.9 ± 7.26 vs. post 66.4 ± 6.86; p=.011) and all other variables were trending towards significance (p > 0.05) when comparing pre- to post- testing cardiovascular and respiratory fitness. **CONCLUSION:** It appears that the off-season for female collegiate swimmers causes reductions of in-season fitness levels; the coaching staff and athletes should focus on maintaining cardiorespiratory fitness during the off-season to improve their chances of achieving peak swim performance.

## CROSS VALIDATION OF A FIGURE SKATING BLADE INSTRUMENTED TO MEASURE FIGURE SKATING IMPACT FORCES.

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Competitive figure skating requires a vast amount of athleticism with an artistic touch. Skaters spend hours each day on-ice mastering jumps, spins, and footwork. The high workload may be related to overuse injuries, which are very common in figure skating, especially at the elite level. To better understand the relationships between on ice training and injuries, it is important to understand the loading patterns acting on skaters. **Purpose:** To validate an instrumented figure skating blade that is designed to measure impact forces while skating. **Methods:** Seven subjects (Age:  $21.3 \pm 2.8$  yrs, Ht:  $166.9 \pm 2.5$  cm, Mass:  $64.7 \pm 7.9$  kg) performed 20 landings each onto artificial ice while landing on the instrumented blade from heights of 17.5cm, 25cm, and 33cm. A custom instrumented blade calibrated to measure in forces in Newtons (N) was used to measure impact forces (1000Hz) during landings. These forces were compared to forces obtained while subjects landed on AMTI force plates located underneath the artificial ice surface. Boot angle (250Hz) and force plate data (1000Hz) were collected using Vicon Nexus. Custom LabVIEW programs were used to determine peak force, loading rate, impulse, and the correlation between the blade force data and the force plate data. Paired T-tests were used to compare peak force, loading rate, and impulse between the blade and force plate data. Alpha = 0.05. **Results:** Correlations between the blade force data and force plate data were good to excellent: mean  $r (\pm SD) = .86 \pm 0.08$ . No significant differences were found for peak force and impulse between the blade and force plate data. Peak force means ( $\pm SD$ ) were  $1353.7 \pm 352.2$  N for the blade and  $1361.2 \pm 309.7$  N for the force plate ( $p=.86$ ). The means ( $\pm SD$ ) for impulse were  $44.99 \pm 21.2$  Ns for the blade and  $48.1 \pm 17.7$  Ns for the force plate ( $p=.125$ ). Loading rate, calculated from impact to time of peak force, was significantly higher ( $p = 0.0004$ ) for the blade data ( $28.88 \pm 22.8$  N/ms) as compared to the force plate data ( $9.77 \pm 7.5$  N/ms). **Conclusion:** The custom instrumented blade is a valid tool for measuring peak forces and impulse during landings. Current research is focused on increasing the gain of the instrumented blade to improve loading rate accuracy.

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## **Body Weight Perceptions and Contributing Weight Gain Factors in Scandinavian, French, and American College Students**

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Worldwide obesity has more than doubled since 1980. By 2014, 39% of the world's adult population was considered overweight and 13% overweight. **PURPOSE:** To compare the differences of body weight perception and perceived contributing weight gain factors in Swedish, Danish, French, and American college students. **METHODS:** A survey including questions regarding self-reported height and weight, body weight perception, and perceived contributing weight gain factors was distributed to Swedish, Danish, French, and American college students. A total of 487 students responded to the survey (Sweden n=94; Denmark n=97; France n= 200; US n=96). Based upon their self-reported height and weight, participants were classified into one of three Body Mass Index (BMI) categories: underweight (BMI<18.5), normal weight (BMI =18.5-24.9), or overweight (BMI ≥25). Without knowledge of their BMI category, subjects were then asked to classify themselves into one of three perceived categories (underweight, normal weight, and overweight). Lastly, participants were asked to rank perceived factors contributing to weight gain in their own respective country. **RESULTS:** When comparing their perceived body weight category to actual BMI category, 77% of Swedish, 80% of Danish, 69% of French, and 80% of American students classified themselves correctly. The results were as follows: 42.55% of American respondents thought lack of physical activity was the greatest contributing factor, 76.09% of Swedish and 62.37% of Danish respondents thought overconsumption of food was the greatest factor, whereas 31.5% of French respondents stated that sugar was the greatest contributing factor to weight gain in their country. **CONCLUSION:** A majority of participants were able to correctly classify themselves as underweight, normal weight, or overweight according to BMI standards, regardless of their nationality. However, American students attributed lack of physical activity, French students attributed sugar, while both Swedish and Danish students attributed overconsumption of food to be the greatest contributing factor to weight gain in their respective countries. This information can provide implications for healthcare professionals who may want to tailor their efforts of preventative and educational strategies toward these content areas.

## **The Effects of an Acute Bout of Self-Myofascial Release on the Physiological Parameters of Running**

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Self-myofascial release (SMR) is an ergogenic aid which has grown in popularity with endurance runners. SMR uses an instrument to provide soft tissue mobilization which releases adhesions in the fascial tissue. There has been a limited amount of research as to whether SMR tools can improve the physiological parameters of running performance when SMR is used prior to an endurance event.

**PURPOSE:** To examine changes in the physiological parameters of running performance when self-myofascial release was used prior to a submaximal run. **METHODS:** A total of 16 male recreational runners, between the ages of 18 and 55 volunteered for the study. The subjects were required to have completed a running event equaling a 10K or longer in the past 12 months as well as achieving a peak oxygen consumption of  $45 \text{ ml} \cdot \text{min}^{-1} \cdot \text{kg}^{-1}$ . The subjects took part in two 40 min treadmill runs at 75% of their  $\text{VO}_{2\text{peak}}$ , one session used a SMR kit prior to the run while the other session required subjects to rest for 20 minutes. Prior to and during the run measurements of heart rate, blood lactate concentration, ventilatory efficiency, RPE, and running velocity were assessed. A two level repeated measures analyses of variance (ANOVA) was used to analyze the dependent variables of heart rate, ventilatory efficiency, lactate and rate of perceived exertion. A paired samples t-test was used to analyze the dependent variable of running velocity at 75% of  $\text{VO}_{2\text{peak}}$ . **RESULTS :** There was no interaction or treatment effect ( $p > .05$ ) when SMR was used prior to the 40 min treadmill run for heart rate ( $p = .93$ ), ventilatory efficiency ( $p = .36$ ) and RPE ( $p = .37$ ). Lactate also did not have an interaction or treatment effect ( $p > .05$ ) when SMR was used prior to the 40 min run ( $p = .06$ ). The subjects were kept at 75% of their  $\text{VO}_{2\text{peak}}$  for 40 min and the velocity at which the subject ran was averaged over the 40 min. The mean velocity for the run with no SMR was  $12.47 \text{ km/hr} \pm 1.70$ . The mean velocity for the run with SMR was  $12.57 \text{ km/hr} \pm 1.69$ . No significant differences existed between the two running bouts ( $t(15) = -.838, p > .05$ ). **CONCLUSION:** No improvements in the physiological parameters of running performance were found, however there was also no decrease in these physiological parameters suggesting that the use of SMR prior to running does not hinder performance.

## **A New Prescription for Pain Management in Humans: Does Exercise Dose Matter?**

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Affecting over 116 million American adults, chronic pain presents itself both as idiopathic pain and as a comorbidity for other health-related conditions, such as cancer and obesity. Although numerous pharmacological interventions exist, few have proven effective. Exercise has proven effective in reducing sensitivity to chronic pain, but research has yet to verify an appropriate dose. **PURPOSE:** To determine the minimal beneficial dose of exercise for reducing acute pain in healthy human participants. **METHODS:** In a lab-based study, moderately active human participants were screened to determine eligibility. Eligible participants were randomized to 1 of 3 groups: control (no exercise), low dose exercise (3x/wk), and moderate dose exercise (5x/wk). Over 7 days, participants performed 30 minutes of moderate intensity walking on a treadmill during assigned exercise days. Sensitivity thresholds for painful thermal stimulation and painful pressure stimulation were examined. Participants also rated the intensity and unpleasantness of both thermal and pressure pain. **RESULTS:** Currently, 14 subjects have completed the study and descriptive data (averages, percent change) have been calculated for 3 subjects per group. Subjects in the moderate dose group demonstrated less sensitivity to constant heat pain (-58% change from baseline). Subjects in both the low and moderate dose groups, at follow-up, tolerated greater pressure thresholds, 24.4% and 27.3% respectively. However, the low dose group demonstrated greater sensitivity (63.3%) while the moderate dose group demonstrated less sensitivity (-66.3%) to constant pressure pain. **CONCLUSION:** The moderate dose group displayed the greatest reduction in overall pain sensitivity, with decreases in sensitivity to heat and pressure intensity. The low dose group displayed both increases and decreases in pain sensitivity, suggesting that a low dose of exercises is insufficient. The study is ongoing, but the preliminary analysis suggests that the analgesic effects of exercise are dose-dependent. This will have important implications when prescribing exercise for individuals with a chronic pain syndrome.

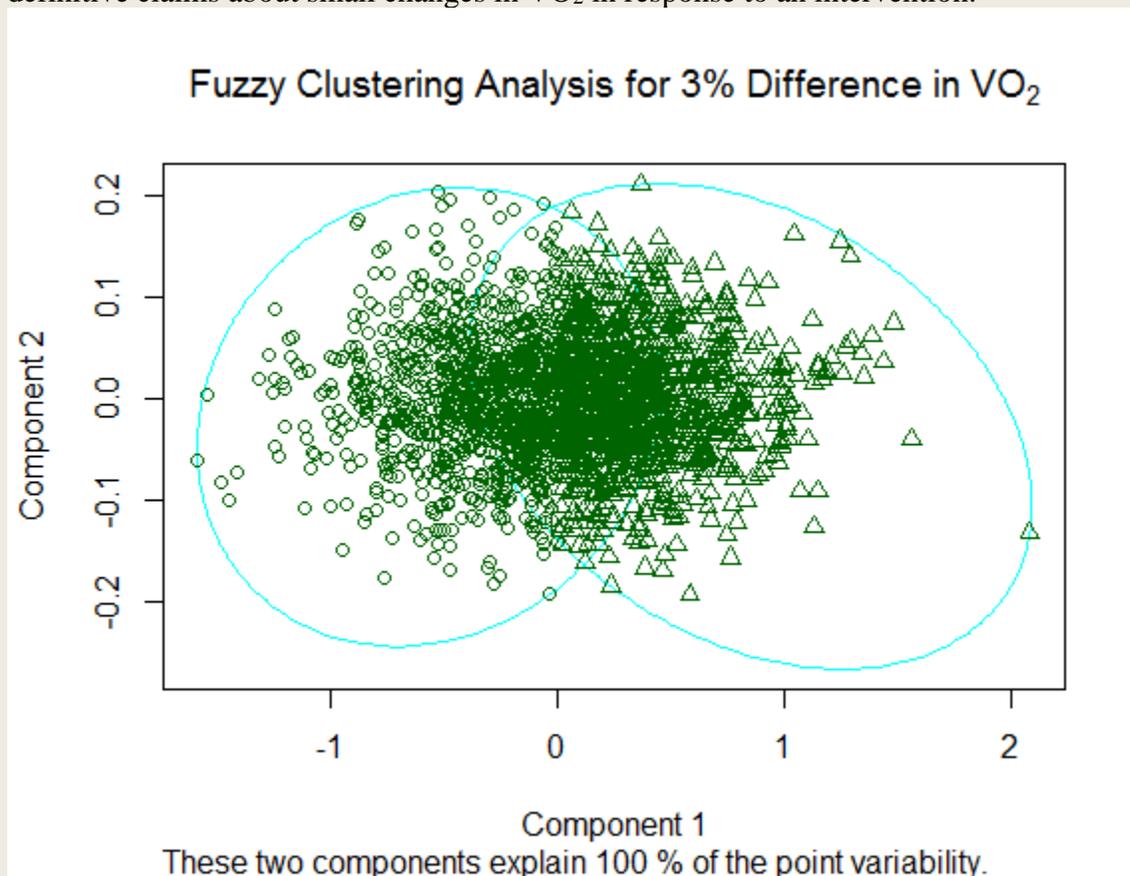
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## Using Statistical Simulation to Visualize and Quantify Day-to-Day Measurement Error in Indirect Calorimetry

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Indirect calorimetry and oxygen consumption ( $\text{VO}_2$ ) is an accepted tool in exercise science. A common study design entails  $\text{VO}_2$  testing before and after a training, nutrition or equipment intervention. Changes in metabolic cost as small as 3% have been suggested to be “significant”; however, it is unknown if small variations in  $\text{VO}_2$  are actually able to be detected by indirect calorimetry.

**PURPOSE:** Use a custom statistical simulation, specific to the ParvoMedics TrueOne 2400, which probabilistically determines if two day-to-day measurements in  $\text{VO}_2$  are different. Specifically, the simulation will determine the probability that a  $\text{VO}_2$  of 3.66 L/min is different from 3.77 L/min (3% difference). **METHODS:** Day-to-day repeatability data and standard error for the ParvoMedics TrueOne 2400 were extracted across a continuum of volumes from previous validation study (Crouter et al., 2006). Based on this data, multivariate normal distributions ( $n=2000$ ) were simulated for the hypothetical  $\text{VO}_2$  data. The two multivariate normal distributions for 3.66 L/min and 3.77 L/min were assessed with a fuzzy clustering analysis and the normalized Dunn’s partition coefficient was calculated to determine the probability that the measures are separate. **RESULTS:** Standardized plots of simulated data and assigned clusters (blue lines) are in the figure. The normalized Dunn’s coefficient was 0.62, indicating a 62% probability that the two measurements are different. **CONCLUSION:** Claims that interventions can cause measurable changes in oxygen consumption need to be re-examined. The present simulation suggests that the measurement error of indirect calorimetry is too great to make definitive claims about small changes in  $\text{VO}_2$  in response to an intervention.



## **Blood Lactate Levels and the Effects of Recovery Methods on Repeated Sprint Performance**

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A drop in muscle pH associated with lactate accumulation during short-term, high-intensity exercise may be a cause for local muscle fatigue. Lactate removal occurs naturally within the body; however, it is unclear if certain recovery modalities might be used to enhance lactate clearance and subsequent performance. **PURPOSE:** To examine the difference in effects of cold water immersion (CWI), active recovery (AR), and passive recovery (CON) on blood lactate levels after successive bouts of sprinting. **METHODS:** Eight active healthy male university students participated in this study. The subjects had a mean age of  $21.5 \pm 1.31$  years, mean mass of  $81.25 \pm 15.39$  kg, and mean height of  $181.45 \pm 9.68$  cm. Resting measurements for blood lactate and heart rate (HR) were taken after 10 minutes of seated rest. Subjects then performed a 400m sprint at maximal effort. HR and blood lactate were then recorded again. Each subject was required to test three different days, each day consisting of a random recovery modality. HR was taken every five minutes during each 20 minute recovery period. Blood lactate was taken within three minutes after the recovery period and after a 35 minute rest period for all three conditions. Subjects completed a 200 m sprint and HR and lactate were taken upon completion. A two-way ANOVA with repeated measures was used to determine any significant differences in blood lactate or HR between the three recovery modalities. A one-way ANOVA with repeated measures was used to determine any significant difference in sprint performance times after each recovery method. **RESULTS:** There was no significant difference shown between the recovery modalities on all 3 variables: lactate ( $p = .21$ ), HR ( $p = .70$ ), and 200 m performance time (CON:  $32.13 \pm 1.34$  s; AR:  $33.56 \pm 1.95$  s; and CWI:  $32.91 \pm 1.75$  s) ( $p = .30$ ). **CONCLUSION:** The results of this study do not support an advantage for blood lactate clearance or an impact on 200 m sprint performance time between the three recovery modalities.

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## Effects of Cognitive Fatigue on High Intensity Circuit Exercise: Preliminary study

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Cognitive fatigue (i.e., mental fatigue) is the psychophysiological response to a prolonged cognitively demanding task which results in the subjective feeling of “tiredness” and “lack of energy” (Marcora, et al., 2009). Evidence for cognitive fatigue impairing subsequent physical performance was supported by two prior studies using continuous aerobic exercise tasks (treadmill running, and stationary cycling).

**PURPOSE:** To determine whether cognitive fatigue impairs subsequent physical performance in discontinuous high intensity circuit exercise (HIT). **METHODS:** As a counterbalanced repeated measure design, eleven participants (7 male and 4 female) completed a cognitively fatiguing computer task (vigilance) and a control task (video) for 52 minutes prior to completing HIT. The two visits were separated by at least 7 days. The HIT task involved participants completing 5 pull ups, 10 pushups, and 15 air squats consecutively for a 20 minute period. Participants were filmed during HIT to quantify behavioral performance (e.g., time-on-task and repetitions completed). **RESULTS:** Participants who were cognitively fatigued had decreased time-on-task ( $663 \pm 108$  sec) relative to when not cognitively fatigued ( $700 \pm 100$  sec),  $t(10) = 2.54, p = .03$ . Participants had decreased repetitions completed during the HIT when preceded by a cognitive fatiguing task ( $420 \pm 106$  sec) relative to a control task ( $436 \pm 93$ ); however, the difference failed to reach significance ( $t(10) = 1.42, p = .19$ ). **CONCLUSION:** Preliminary findings indicate that participants experiencing cognitive fatigue prior to the HIT task decreases time-on-task. This study corroborates previous research on continuous aerobic exercise and suggests that mitigating cognitive fatigue is important to achieve optimal physical performance. Though there was a trend of decreased repetitions completed as a function of cognitive fatigue, further data collection is needed to determine whether the differences can reach statistical significance.

## **Effects of Exercise Intensity on Post-Exercise Oral Glucose Tolerance Test Response**

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Glucose is an essential energy source for working muscle. Higher intensity exercise will increase the amount of glucose needed to fuel the working muscles. Whether exercise intensity affects blood glucose regulation during recovery from exercise is of interest. **PURPOSE:** To examine whether fixed distance exercise (walking vs. running) causes differences in oral glucose tolerance test (OGTT) response following the exercise. **METHODS:** Seven participants performed two exercise trials, consisting of one trial of running (7.5 mph for 3 miles using 2-min intervals with 2-min recovery segments) and one trial of continuous walking (4 mph for 3 miles). Each trial day, participants arrived having fasted for at least four hours prior to testing. Participants ingested 75 mg of dextrose, in 300 ml of water, immediately following completion of the assigned exercise. Blood glucose (BG) was sampled every 15 min over a 75-min OGTT period. Trial order was counter-balanced. **RESULTS:**  $VO_2$ , HR, RER, and RPE for the running condition were significantly higher ( $p < .02$ ). BG levels were significantly higher for running post exercise and at 15 minutes of the OGTT ( $p < .01$ ). When outliers were removed ( $n=2$ ), these differences disappeared. Area under the curve during the OGTT following running tended ( $p = .109$ ) to be smaller ( $9535 \pm 534$  vs.  $10,834 \pm 482$  a.u.) with outliers removed. **CONCLUSION:** Based on the study results, when energy expenditure is controlled between low and high exercise intensities, BG regulation following exercise of the same fixed distance tends to be enhanced in following exercise of a higher intensity.

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## Comparison of Astrand VO<sub>2</sub>max Prediction to a Graded Leg Ergometry VO<sub>2</sub> Max Test in Endurance Athletes

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Numerous methods for estimating aerobic power (VO<sub>2</sub>max) exist. Assessing the predictive accuracy of such estimations can be of value for gauging their generalizability. **PURPOSE:** To determine whether the Astrand submaximal protocol over/under- estimates the prediction of the VO<sub>2</sub>max in aerobically trained athletes. Participants were 11 (6 male and 5 female) aerobically trained athletes, who trained at least 300+ minutes per week. **METHODS:** Subjects were tested on two protocols: 1) the Astrand and 2) a VO<sub>2</sub>max test using indirect calorimetry. Both tests were performed on cycle ergometers at a fixed RPM, with the Astrand maintaining a constant workload while the True VO<sub>2</sub>max test employed a graded test protocol. Heart rate and RPE (rate of perceived exertion) were collected throughout both protocols. **RESULTS:** The Astrand protocol tended to predict a higher aerobic power ( $57.6 \pm 8.3 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ ) vs. the actual VO<sub>2</sub>max ( $50.0 \pm 8.6 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ ) determination ( $p=0.054$ ). The Pearson correlation between the predicted VO<sub>2</sub>max and actual VO<sub>2</sub>max was  $r = 0.088$ , with a  $p$ -value of 0.796 between the two variables. **CONCLUSION:** There was a 15% over-prediction found when comparing the Astrand to the measured aerobic power as determined from graded exercise. Though on the cusp of statistical significance, this is a meaningful difference in measures. It appears that the Astrand protocol over-predicts the actual VO<sub>2</sub>max in aerobically trained individuals and the Astrand test may be more suitable for recreationally active people.

## Noninvasive Measurement of Coronary Blood Flow During Exercise and Adrenergic Receptor Stimulation

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During exercise, coronary blood flow must increase because myocardial metabolism increases and the myocardium cannot significantly augment oxygen extraction. Blood flow through the left anterior descending coronary artery occurs during diastole and can be measured noninvasively by transthoracic Doppler echocardiography. Presently, most human research studies present the peak velocity of the coronary Doppler tracing, but peak velocity may be inaccurate at higher heart rates (HR) because diastole is shorter. **PURPOSE:** We hypothesized that the coronary velocity time integral (VTI or the area under the entire diastolic profile) correlates to peak coronary velocity during stressors that raise HR and blood pressure (BP). **METHODS:** Eleven healthy humans were studied in the supine posture. Subjects performed isometric handgrip exercise to fatigue followed by separate infusions of isoproterenol, phenylephrine, and terbutaline with dosages based on fat-free mass (derived from DEXA). The left anterior descending coronary artery was visualized using the adjusted apical 4-chamber view and images were analyzed offline. Changes ( $\Delta$ ) in beat-by-beat HR, BP, peak coronary velocity, and coronary VTI in response to the stressors were calculated and compared with bivariate correlations. Data are presented as mean  $\pm$  SEM and P-values  $< 0.05$  were considered statistically significant. **RESULTS:** Isometric handgrip exercise evoked a significant rise in mean BP ( $\Delta = 34 \pm 5$  mmHg), HR ( $\Delta = 19 \pm 4$  beats/min), peak coronary velocity ( $\Delta = 12 \pm 3$  cm/sec), and VTI ( $\Delta = 1.7 \pm 0.5$  cm). The  $\Delta$  peak coronary velocity and  $\Delta$ VTI were strongly correlated ( $R = 0.869$ ,  $P < 0.001$ ). Isoproterenol infusion increased HR ( $\Delta = 21 \pm 4$  beats/min), peak coronary velocity ( $\Delta = 20 \pm 5$  cm/sec), and VTI ( $\Delta = 4.1 \pm 1.7$  cm); the correlation was moderate ( $R = 0.698$ ,  $P = 0.017$ ). Terbutaline infusion increased HR ( $\Delta = 13 \pm 3$  beats/min), peak coronary velocity ( $\Delta = 10 \pm 2$  cm/sec), and VTI ( $\Delta = 2.1 \pm 1.2$  cm); the correlation was strong ( $R = 0.939$ ,  $P < 0.001$ ). **CONCLUSION:** Coronary VTI correlates with peak coronary velocity during exercise and adrenergic receptor stimulation. More studies are needed to determine the accuracy of VTI compared to true coronary blood flow, especially at higher heart rates.

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## The Effects of Acute Resistance Exercise on Vascular and Cognitive Function

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Arterial stiffness increases risk for cardiovascular diseases. Recent studies note that when arteries stiffen with age and disease, blood flow to the brain is affected and can impair cognitive function. Acute resistance exercise increases arterial stiffness. **PURPOSE:** To examine if artery stiffness from resistance exercise negatively affects cognitive function. **METHODS:** Fourteen healthy young adults ( $24 \pm 5$  years, Body Mass Index (BMI)  $26 \pm 7$   $\text{kg} \cdot \text{m}^{-2}$ ; 9 female) completed two separate visits. For the experimental visit, all participants completed cognitive testing and underwent measures of arterial stiffness before and after a bout of intense upper body resistance exercise. For the control visit, participants engaged in 30 minutes of seated rest. We estimated carotid to femoral pulse wave velocity (PWV) as a measure of aortic stiffness. Working memory and executive functions were assessed using an N-Back task and the Erikson flanker task, respectively. **RESULTS:** Aortic PWV increased after acute resistance exercise ( $5.2 \pm 0.5$  to  $5.6 \pm 0.6$  m/s,  $p < 0.05$ ), but did not change following the control condition ( $5.2 \pm 0.7$  to  $5.3 \pm 0.7$  m/s,  $p > 0.05$ ). There were no significant changes in the N-back percentage correct following acute resistance exercise ( $81.5 \pm 14.0$  to  $80.8 \pm 16.9\%$ ,  $p > 0.05$ ) or following the control condition ( $77.7 \pm 17.7$  to  $75.0 \pm 15.0\%$ ,  $p > 0.05$ ). There were also no significant changes in the Flanker percentage correct following acute resistance exercise ( $90.0 \pm 6.0$  to  $90.0 \pm 5.54\%$ ,  $p > 0.05$ ) or following the control condition ( $88.1 \pm 9.6$  to  $90.0 \pm 6.0\%$ ,  $p > 0.05$ ). **CONCLUSION:** Even though there was an increase in aortic stiffness after resistance exercise, there was no change in cognitive function. These findings suggest that unlike the artery stiffening that occurs with aging and disease, artery stiffening from acute resistance exercise does not have a negative effect on cognitive performance in young healthy adults

## Evaluation of Average Nutrient Intakes of Collegiate Athletes and ROTC Cadets and Midshipmen

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Dietary intake can greatly affect athletic performance. A number of factors should be considered when determining diets for athletes, such as individual body types and sport-specific demands; however, there are common goals for which every athlete should strive. Such goals include: eating adequate amounts of energy and meeting recommendations for macro- and micronutrients. **PURPOSE:** To evaluate the dietary intakes of collegiate athletes and Reserve Officer's Training Corps (ROTC) Cadets and midshipmen. **METHODS:** This cross-sectional study included 24 collegiate athletes (15 males, 9 females) and 16 ROTC Cadets and midshipmen (12 males, 4 females), 18 to 25 years of age. Participants completed a self-administered the Block Food Frequency Questionnaire (FFQ) that assessed their dietary patterns over the previous year. The FFQs were analyzed by a third party source. **RESULTS:** Average energy intake of all participants was  $1817.8 \pm 484.7$  kilocalories (kcal). Average carbohydrate intake was  $208.4 \pm 8.4$  grams (g), representing  $45.8\% \pm 8.4\%$  of total energy consumed. Average protein intake was  $72.1 \pm 23.4$  g, representing  $15.8\% \pm 2.5\%$  of total energy intake. Average fat intake was  $75.3 \pm 25.6$  g, representing  $37.3\% \pm 7.5\%$  of total energy intake. Average fiber intake was  $18.2 \pm 9.6$  g/day. Average vitamin intake was as follows: Vitamin A:  $889.9 \pm 415.8$  retinol activity equivalents (RAE),  $\beta$ -carotene:  $5535.7 \pm 4497.4$  micrograms (mcg), Vitamin C:  $118.4 \pm 51.0$  milligrams (mg), Vitamin E: was  $8.3 \pm 3.6$  mg, thiamin and riboflavin combined:  $1.5 \pm 0.5$  mg, niacin:  $21.0 \pm 7.5$  mg, Vitamin B<sub>6</sub> was  $2.0 \pm 0.8$  mg. Average mineral intake was as follows: calcium:  $826.0 \pm 303.1$  mg, zinc:  $10.6 \pm 3.1$  mg, iron:  $13.5 \pm 4.4$  mg, potassium:  $2612.9 \pm 877.9$  mg, sodium:  $3066.8 \pm 1006.6$  mg, magnesium:  $323.2 \pm 314.0$  mg. **CONCLUSIONS:** Although they seem to be meeting energy recommendations, college athletes and ROTC Cadets and midshipmen are not meeting the recommendations of many macro- and micronutrients. It is important that athletes consume well-balanced diets to meet nutrition recommendations and best enhance their performance.

## **The Effects of Kinesio Tape on Postural Control in Female Athletes with Chronic Ankle Instability**

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Kinesio Tape (KT) is an innovative product used in sports medicine to treat a variety of acute and chronic injuries. Although the use of KT has gained popularity among practitioners, there has not been agreement regarding the efficacy of KT for improving ankle stability. **PURPOSE:** Therefore, the purpose of this study was to determine the effects of KT application on postural stability in athletes with chronic ankle instability over a 72 hour time period. **METHODS:** The efficacy of KT application in improving chronic ankle instability was determined with 3 consecutive days of postural instability testing on five NCAA Division III female soccer players and one NCAA Division III female lacrosse player. The subjects underwent a familiarization session to minimize the learning effect of the stability protocol during a 30s single-leg stance on a forceplate using the Accusway Balance Software. Stability measures were taken prior to the application of the KT to obtain baseline measures, immediately after the taping, and subsequent measures were taken at 24, 48 and 72 hours. Data from overall postural sway (path length), anterior-posterior sway (y-axis) and medial-lateral sway (x-axis) were analyzed using a one-way ANOVA with repeated measures with an alpha level set at  $p < 0.05$ . **RESULTS:** Comparison between immediately after (0 hours) application and 72 hours presented significance difference for path length of 92.5cm and 114.7cm, respectively ( $p = 0.048$ ) and  $V_{total}$  ave 1.2 m/sec and 1.5m/s, respectively ( $p = 0.047$ ). The data between pre-trial and 72 hours also proved to be significant for X avg ( $p = 0.029$ ). Significance was also found between 0 and 48 hours for Y avg ( $p = 0.023$ ). **CONCLUSION:** Kinesio tape improved balance for athletes with chronic ankle instability for the first 48-hour period of application. Additional research should be conducted to determine significance with a larger subject pool.