

University of St. Thomas, Minnesota

UST Research Online

Health and Exercise Science Faculty/Staff
Publications

Department of Health and Exercise Science

2016

Comparison of Tibial Strength Between Adult Female Dancers, Gymnasts, and Runners

A. B. Freire Ribeiro

G. M. Street

A. J. Smock

B. D. Bruininks

L. M. Scibora

Follow this and additional works at: https://ir.stthomas.edu/mfcoh_hes_pub

This Article is brought to you for free and open access by the Department of Health and Exercise Science at UST Research Online. It has been accepted for inclusion in Health and Exercise Science Faculty/Staff Publications by an authorized administrator of UST Research Online. For more information, please contact asle4660@stthomas.edu.

The Influence of Different Training Programs on the Expression of Plasma Proenkephalin Peptide F in Women

William H. DuPont¹, William J. Kraemer, FACSM¹, Bradley C. Nindl², Jakob L. Vingren, FACSM³, Barry A. Spiering⁴, Shawn D. Flanagan¹, Lydia K. Caldwell¹, Tunde K. Szivak¹, Emily C. Barnhart¹, Emily C. Borden¹, Carl M. Maresh, FACSM¹. ¹The Ohio State University, Columbus, OH. ²University of Pittsburgh, Pittsburgh, PA. ³University of North Texas, Denton, TX. ⁴Nike, Inc., Beaverton, OR. (Sponsor: William J. Kraemer, FACSM)

Email: dupont.35@osu.edu

(No relationships reported)

To date there are no studies that have examined peptide F's acute and chronic response to different exercise modalities in women in a single study.

PURPOSE: To investigate the acute and chronic effects of resistance exercise (RE) and different exercise modalities on peptide F concentrations in women.

METHODS: Fifty-nine healthy recreationally active women were recruited and matched for age, body mass, height, strength, and peak O₂ consumption (VO_{2peak}) and then randomly assigned to one of four training groups: control group (CN); endurance exercise only training group (EE), resistance exercise only training group (RT), and combined endurance and resistance exercise training group (CB). The treatment groups trained three days a week for eight weeks. The control group did not complete any training, but was tested at the same time points as the three treatment groups. Proenkephalin peptide F concentrations were measured prior to and following an intense acute resistance exercise test (ARET) both before and after training. A four (group) x two (time) block analysis of variance (ANOVA) was for analysis. Significance was set a priori at p≤0.05.

RESULTS: Before training there were no significant differences in the concentration (pmol/ml) of plasma proenkephalin peptide F for any of the groups. For each treatment group, after training, peptide F concentration was significantly greater post-exercise than pre-exercise. In addition, peptide F in the EE and CB groups increased both pre- and post-exercise compared to their corresponding values before training. For the RT group peptide F increased post-exercise, but not pre-exercise compared to the before training values. Compared to the control group all of the treatment groups after training had a significantly greater concentration of peptide F post-exercise compared to the corresponding value for the control group. The CB group after training had a significantly greater concentration of peptide F than the other two (EE, RT) treatment groups.

CONCLUSION: There are differential responses to different training programs from young, healthy, untrained women to acute and chronic resistance exercise stress after training. Training-induced adaptations appear to occur in the adrenal gland leading to changes in the circulating concentrations of proenkephalin Peptide F.

Dynamic Stability is Associated with Moderate-to-Vigorous Physical Activity in Older Women

Ben J. Hoffmann, Scott S. Ducharme, Jane A. Kent, FACSM. *University of Massachusetts, Amherst, MA.* (Sponsor: Jane Kent, FACSM)

Email: bhoffmann@kin.umass.edu

(No relationships reported)

Old age is associated with a decline in skeletal muscle function and increased fall risk, with older women at a greater risk than men. While greater physical activity (PA) may be associated with better skeletal muscle function and a lower risk of falling in older adults, the contributions of muscle contractile properties and PA intensity to dynamic stability are not known.

PURPOSE: To determine the association between dynamic stability and both MVPA (min·d⁻¹) and knee extensor (KE) muscle contractile properties in older women.

METHODS: Nine healthy older women (68±2.5yr, mean±SD) were studied. Stimulated isometric contractions of the KE muscles were used to quantify muscle contractile properties (maximal rate of force development (RFD, %peak force·ms⁻¹) and force half relaxation time (T_{1/2}, ms). Dynamic stability was determined with a forward fall test and quantified as the margin of stability (MoS, m). In the forward fall tests, participants were released without warning from a fixed forward-leaning position (25% of body weight) and asked to recover balance with a single forward step. Ten trials were conducted, with the average of the last 4 trials used for analysis. Actigraph accelerometers were worn for 1 week on the right hip to determine average total PA counts and moderate-vigorous (MVPA) minutes per day. Pearson product moment correlations were used to determine associations between variables.

RESULTS: Linear regression analyses indicated a positive relationship between MoS and MVPA (r²=0.58, p=0.02) and no association between MoS and KE muscle contractile properties (RFD: r²=0.02, p=0.71; T_{1/2}: r²=0.15, p=0.30) or MoS and total PA (counts·d⁻¹, r²=0.11, p=0.38).

CONCLUSION: The observation that dynamic stability is positively associated with MVPA but not KE muscle contractile characteristics in older women suggests that factors external to the muscle (i.e., neurological factors) likely contribute to the benefits of MVPA on dynamic stability in older women.

Comparison of Tibial Strength Between Adult Female Dancers, Gymnasts, and Runners

Ana B. Freire Ribeiro¹, Glenn M. Street², Amanda J. Smock³, Brett Bruininks⁴, Lesley M. Scibora⁴. ¹Augsburg College, Minneapolis, MN. ²Saint Cloud State University, St. Cloud, MN. ³University of Minnesota, Minneapolis, MN. ⁴University of Saint Thomas, Saint Paul, MN. (Sponsor: Mark Blegen, FACSM)

Email: ribeiro@augsborg.edu

(No relationships reported)

The magnitude, frequency, and patterns of mechanical loading are important factors in how weight-bearing bones adapt their strength. Overall, adolescent and adult female athletes that participate in high impact physical activity have greater gains in bone strength than athletes that participate in low-repetitive impact activities (Nichols et al., 2007, Uusi-Rasi et al., 2006, and Nikander et al., 2010); however, it is not clear how medium impact activities (dance) compare to high impact activities (gymnastics) and low-repetitive activities (running) with respect to their osteogenic effects at the tibia.

PURPOSE: To compare tibial strength between female adult dancers, gymnasts, and runners.

METHODS: Eleven eumenorrheic dance majors and eleven eumenorrheic collegiate gymnasts (ages 18-22) were recruited. Runner (n=22) and sedentary control (n=19) data were obtained from the University of Minnesota Laboratory of Musculoskeletal Health database (Smock et al., 2009 and Bruininks, 2009). Participants' non-dominant tibiae were scanned using peripheral quantitative computed tomography at two locations - 4% (metaphyseal) and 66% (diaphyseal) sites from the distal tibia endplate. The scans provided two estimates of bone strength; bone strength index (BSI; mg·mm⁻⁴/10,000) and polar strength-strain index (SSIp, mm³). BSI is an estimate of bone compressive strength at metaphyseal sites and SSIp is an estimate of bone's ability to resist torsion at diaphyseal sites (Smock et al. 2009; Farr et al. 2010). BSI at the 4% site and the SSIp at the 66% site were compared between groups using linear regression models.

RESULTS: Participants did not differ in age, weight, or tibial length. After controlling for height and body mass, SSIp did not differ significantly between groups. Dancers, gymnasts and runners had significantly greater BSI (33.2%, 43.7% and 20%, respectively) than controls (p=0.001, p<0.001, and p=0.03, respectively).

CONCLUSIONS: Despite differences in impact type, dance, gymnastics, and running appear to be effective at increasing distal tibia compressive strength - which is known to delay or prevent bone fragility later in life. Future studies should analyze the magnitude and frequency of loadings to further identify which activities provide the greatest osteogenic benefits in adult females.