Gait and Posture

Effects of obesity on dynamic plantar pressure distribution in Chinese prepubescent children during walking.

The purpose of this study was to examine the effects of obesity on dynamic plantar pressure distribution during walking for prepubescent children. A Footscan® plantar pressure plate system was used to collect the gait data. Fifty obese prepubescent children and fifty non-obese prepubescent children walked across the plate at preferred speed while barefoot. SPSS11.5 was used for analysis and significance is defined as p < 0.05. Obese subjects had longer midstance duration (p = 0.004) and shorter propulsion duration (p = 0.047) compared to non-obese subjects. The peak pressures under the metatarsal heads II–V, midfoot and heel lateral (p = 0.004, p = 0.03, p = 0.004) were significantly higher for obese subjects. The time to peak pressures under the toes II–V, the metatarsal heads IV, V and midfoot (p = 0.008, p = 0.009, p = 0.01, p = 0.006), and pressure rate under the heel medial and lateral heel (p = 0.03, p = 0.009) were also significantly higher. In addition, the arch index for the left foot (p = 0.01), the left and right foot axis angle (p = 0.027, p = 0.03) were significant larger among obese subjects. We also found that obese subjects had significantly higher relative regional impulses of contact with the plate at the midfoot of left foot (p = 0.01) and the forefoot of right foot (p = 0.047). There were also differences in foot balance during the midstance and propulsion phase (p = 0.0004, p = 0.03) and in pronation extent during midstance and propulsion phases between left and right foot in the obese group (p = 0.03, p = 0.01). In conclusion, the obese children have weaker walking stability with flatter foot pattern, the larger foot axis angle and dynamic plantar pressure distribution changes compared to non-obese children.

Gait speed and gender effects on center of pressure progression during normal walking.

The COP progression is the trajectory of the center of foot pressure. Thirty healthy young adults were recruited to participate in this study. All subjects were asked to walk randomly at four different speeds (3 km/h, preferred walking speed, 4 km/h and 5 km/h). A foot pressure measurement system (RS-scan system) was used to collect the center of pressure (COP) coordinates, COP progression angle and the COP velocity. Four sub-phases of the stance phase were calculated. The initial contact (ICP) and forefoot contact phase (FFCP) corresponded to the loading response. The foot flat phase (FFP) coincided with the mid-stance. The forefoot push-off phase (FFPOP) corresponded to the terminal stance and pre-swing phases. The results of this study indicate that the percentage of time (% time) of COP progression on the ICP, FFCP, FFP and FFPOP were approximately 7.0%, 4.8%, 48.8% and 39.4%, respectively. The COP progression angle was 4.1 (SD = 1.6) with an inward curve and the average COP velocity was 31.6 cm/s (SD = 5.3). The walking speed influenced the % time in the FFP and FFPOP. As the walking speed increased, the % time of COP progression decreased in mid-stance and increased in the terminal and pre-swing stances. Moreover, gender affected the COP progression angle. Men had a significantly larger deviating angle than women during FFCP, FFP and FFPOP. The COP characteristics can offer useful information for clinical rehabilitation in foot functional and structural evaluation.
Kicking performance in relation to balance ability over the support leg.

Balance control is presumed to be a fundamental constraint on the organization of skilled movement. The current experiment explored whether single-leg balance ability predicted kicking performance on the other leg. Thirty-eight participants ranging widely in skill kicked a soccer ball with the right and left legs for maximum accuracy and velocity and performed single-leg balance on a force plate for 30 s with the right and left legs. Significant correlations between single-leg balance and kicking accuracy, but not velocity, were found. Left leg balance was more highly correlated than right leg balance with right (dominant) leg kicking accuracy. However, the same pattern of relations was not seen between single-leg balance and left (non-dominant) leg kicking accuracy. These findings provide preliminary support for the importance of balance ability in kicking performance. The importance of balance in the production of athletic skills is discussed and additional experimental paradigms are suggested that might further our knowledge in this area.

Learning an energy-demanding and biomechanically constrained motor skill, racewalking: Movement reorganization and contribution of metabolic efficiency and sensory information.

This study investigated how novices learn an energy demanding and biomechanically constrained task like racewalking. The first aim was to examine if movement reorganizes according to some fundamental strategies, proceeding in different stages (Newell, 1985). The second aim was to investigate the link between movement reorganization, metabolic efficiency and perceived exertion. Seven participants undertook seven racewalking learning sessions on a motorized treadmill, with increased velocity as the experiment progressed, to reach a goal performance speed of 10 km/h. Peripheral.central perceived exertion ratings, kinematic and metabolic data were collected during the 1st, 4th, 6th and 7th session. Repeated-measures (Learning session × Speed) ANOVAs on kinematic data showed a proximal-to-distal directional trend in movement reorganization, with significant practice-related changes in pattern coordination and decreased variability. Early movement reorganization occurred at the 1st session (“coordination stage”) and progressed until the 4th session (“control stage”) to reach a plateau. In contrast, metabolic efficiency and peripheral perceived exertion continued optimizing until the last session, probably occurring in concurrence with the control stage. Peripheral perceived exertion presented the highest correlation with the global movement reorganization variables suggesting that it could play a key role in guiding movement reorganization in the learning process, improving efficiency as a result.
**Sustained and shorter bouts of physical activity are related to cardiovascular health.**

Purpose: Whereas greater physical activity (PA) is known to prevent cardiovascular disease (CVD), the relative importance of performing PA in sustained bouts of activity versus shorter bouts of activity on CVD risk is not known. The objective of this study was to investigate the relationship between moderate-to-vigorous PA (MVPA), measured in bouts $\geq 10$ and $<10$ min, and CVD risk factors in a well-characterized community-based sample of white adults.

Methods: We conducted a cross-sectional analysis of 2109 participants in the Third Generation Cohort of the Framingham Heart Study (mean age = 47 yr, 55% women) who underwent objective assessment of PA by accelerometry over 5–7 d. Total MVPA, MVPA done in bouts $\geq 10$ min (MVPA10+), and MVPA done in bouts $<10$ min (MVPA<10) were calculated. MVPA exposures were related to individual CVD risk factors, including measures of adiposity and blood lipid and glucose levels, using linear and logistic regression.

Results: Total MVPA was significantly associated with higher HDL levels and with lower triglycerides, BMI, waist circumference, and Framingham risk score ($P < 0.0001$). MVPA<10 showed similar statistically significant associations with these CVD risk factors ($P < 0.001$). Compliance with national guidelines ($\geq 150$ min of total MVPA) was significantly related to lower BMI, triglycerides, Framingham risk score, waist circumference, higher HDL, and a lower prevalence of obesity and impaired fasting glucose ($P < 0.001$ for all).

Conclusions: Our cross-sectional observations on a large middle-age community-based sample confirm a positive association of MVPA with a healthier CVD risk factor profile and indicate that accruing PA in bouts $<10$ min may favourably influence cardiometabolic risk. Additional investigations are warranted to confirm our findings.

**High volumes of resistance exercise are not required for greater bone mineral density during growth.**

Purpose: The purpose of this study was to determine the minimum amount of resistance exercise that would stimulate bone formation, via an elevation in bone mineral density (BMD), during the growth period in male rats.

Methods: Forty male rats were randomly divided into control group (Con, n = 8), one ladder climb resistance-trained group (1LC, n = 8), two ladder climb resistance-trained group (2LC, n = 8), three ladder climb resistance-trained group (3LC, n = 8), and four ladder climb resistance-trained group (4LC, n = 8). All exercised groups were conditioned to climb a vertical ladder with weights appended to their tail $3$ d·wk$^{-1}$ for a total of $6$ wk.

Results: After 6 wk, left tibia BMD (mean ± SE) was significantly greater for 2LC, 3LC, and 4LC (0.233 ± 0.003 g·cm$^{-2}$) when compared with Con (0.218 ± 0.003 g·cm$^{-2}$). Left femur BMD was significantly greater for 2LC, 3LC, and 4LC (0.318 ± 0.003 g·cm$^{-2}$) when compared with 1LC (0.299 ± 0.008 g·cm$^{-2}$) and Con (0.289 ± 0.010 g·cm$^{-2}$). There were no significant differences in BMD between 2LC, 3LC, and 4LC groups.

Conclusion: The results suggest that during growth, a low amount of resistance exercise was just as effective as high volumes of strength training for stimulating bone modelling.
Effect of beta-alanine and carnosine supplementation on muscle contractility in mice.

Purpose: Enhanced carnosine levels have been shown to be ergogenic for high-intensity exercise performances, although the role of carnosine in the control of muscle function is poorly understood. Therefore, the aim of this study was to investigate the effect of long-term supplementation with increasing doses of carnosine and beta-alanine on muscle carnosine, anserine, and taurine levels and on in vitro contractility and fatigue in mice.

Methods: Male Naval Medical Research Institute mice (n = 66) were control fed or supplemented with either carnosine (0.1%, 0.5%, or 1.8%) or beta-alanine (0.6 or 1.2%) in their drinking water for 8–12 wk. Soleus and extensor digitorum longus (EDL) were tested for in vitro contractile properties, and carnosine, anserine, and taurine content were measured in EDL and tibialis anterior by high-performance liquid chromatography.

Results: Only supplementation with 1.8% carnosine and 1.2% beta-alanine resulted in markedly higher carnosine (up to +160%) and anserine levels (up to +46%) compared with control mice. Beta-alanine supplementation (1.2%) resulted in increased fatigue resistance in the beginning of the fatigue protocol in soleus (+2%–4%) and a marked leftward shift of the force–frequency relation in EDL (10%–31% higher relative forces).

Conclusion: Comparable with humans, beta-alanine availability seems to be the rate-limiting step for synthesis of muscle histidine-containing dipeptides in mice. Moreover, muscle histidine-containing dipeptides loading in mice moderately and muscle dependently affects excitation–contraction coupling and fatigue.

Lack of negative correlation in glucose dynamics by nonexercise activity thermogenesis restriction in healthy adults.

Introduction: Recently, nonexercise activity thermogenesis (NEAT) has been highlighted for its ability to prevent weight gain and obesity. It has also been shown that the long-range negative autocorrelation of glucose dynamics, considered to reflect long-term blood glucose controllability, breaks down in patients with diabetes.

Purpose: The purpose of this study was to clarify the effect of restricted NEAT on the glycemic profile and/or control characterized by glucose autocorrelation.

Methods: The glucose dynamics of 10 young healthy subjects were measured by continuous glucose monitoring during a day with normal activity and a day with restricted NEAT. To estimate the correlation property of the glycemic fluctuation, we used detrended fluctuation analysis, a method that analyzes the long-range temporal autocorrelation of signals.

Results: In the long-range regime (>130 min) on a normal activity day, the detrended fluctuation analysis scaling exponent was $a_2 = 1.37 \pm 0.21$. This was significantly ($P = 0.036$) smaller than the reference “uncorrelated value” of $a = 1.5$, suggesting that glycemic fluctuation was negatively autocorrelated. In contrast, on a day with restricted NEAT in the long-range regime (>167.5 min), the exponent was $a_2 = 1.57 \pm 0.15$; this was significantly ($P = 0.024$) larger than 1.5, implying a lack of negative correlation.

Conclusions: The negative autocorrelation of glucose dynamics disappears with restricted NEAT compared with normal activity. This indicates that NEAT, reflective of all nonvolitional muscle activity, plays an important role in long-range negative correlation and hence long-term blood glucose control in healthy young adults.