

PRELIMINARY RESULTS OF A SCHOOL-BASED INTERVENTION (PANPAS) ON BODY FAT AND PHYSICAL ACTIVITY

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Scientific evidence has been showing an increase in the prevalence of obesity and its association with various pathologies in adults as well as children and adolescents. Therefore, there is a need for intervention programs targeted for promoting healthy lifestyles in children and adolescents. The aim of this study was to identify the effects of a school-based intervention on adiposity and physical activity (PA) levels in adolescents.

Participants in this study were 418 adolescents (193 boys), between the ages of 10 and 13.9 years (11.6 ± 1.2) from 2 Madeira public schools, one intervention (ISc) ($n=225$) and one control (CSc) ($n=193$). Percent body fat (%BF) was estimated according to Slaughter et al. (1998), and participants classified according to Lohman's (1987) health risk categories. Self-report was used for assessing sexual maturation (Tanner et al., 1969), level of PA (Crocker et al., 1997) and sedentary activities (SedA). The intervention lasted 16 months and was based on the socio-ecological model, favoring several components: educational, teacher training, strategies for promoting PA during recess. Both schools had implemented a regional program for healthy diet.

At baseline there were no significant differences between CSc and ISc for: (i) %BF (CSc= 26.9 ± 9.9 vs ISc= 25.3 ± 8.6), (ii) gender distribution (Boys: CSc=46,6% vs. ISc=49,8%) (iii) Sexual maturation (Pre-pubertal: CSc=35,6% vs. ISc=33,4%). There were differences in PA (CSc= 2.58 ± 0.61 vs. ISc= 2.31 ± 0.59) and SedA (CSc= 140.5 ± 99.1 min. vs. ISc= 104.9 ± 93.6) ($p < 0.05$). At follow-up, average %BF was significantly lower in the ISc (24.1%) compared to the CSc (30.7 %) ($p < 0.05$). Intragroup differences showed a significant decrease in %BF for the ISc ($p < .001$) and an increase for the CSc ($p < .001$). No significant differences were found between ISc and CSc for PA (2.28 ± 0.65 vs. 2.27 ± 0.59 , respectively) or SedA (133.9 ± 105.7 vs. 159.8 ± 116.5 min.). However, the CSc showed a significant decrease in PA levels ($p < 0.001$) whereas in the ISc they stabilized ($p > 0.05$). Regarding SedA, both groups registered an increase ($p < .01$) from baseline to follow-up.

Intervention programs based on the socio-ecological model seem to be effective in decreasing adiposity and stopping the decline in PA. However it is necessary to better understand which components in the intervention have greater effectiveness.

PHYSICAL ACTIVITY ASSESSED BY ACCELEROMETRY IN AFRICAN URBAN SCHOOL AGE CHILDREN AND ADOLESCENTS

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Reduced levels of physical activity in African urban children and adolescents seem to be a new public health concern. Although objective data from this population are very scarce, there is evidence suggesting important changes in activity habits in urban centers that are also mediated by socioeconomic status. The aim of this study was to evaluate levels of physical activity, measured by accelerometer, of urban children and adolescents from Maputo, Mozambique.

283 school aged subjects (boys=136 boys; girls=147) from 7 to 16 years of age in the study. Subjects wore a triaxial accelerometer (Actigraph GTX3) for 7 consecutive days. Average time per day spent on sedentary, light, moderate and vigorous activity intensity were estimated. Sample was split in two socioeconomic groups based on region of residence, namely middle socioeconomic level (MSE) and lower socioeconomic level (LSE). High socioeconomic status subjects were not included in this study. Percentage of time spent in each intensity level of activity were $88.2 \pm 5.0\%$ for sedentary, $6.8 \pm 1.5\%$ for light, $3.9 \pm 1.8\%$ for moderate, $0.5 \pm 0.3\%$ for vigorous and $0.3 \pm 1.3\%$ very vigorous activity. Comparison between socioeconomic groups using controlling for age and sex shows that MSE groups spent more time in sedentary activities (21.0 ± 0.08 vs. 20.7 ± 0.10 hours per day; $F=24.3$, $p=0.000$) and more time in moderate to vigorous activities (1.0 ± 0.04 vs. 1.4 ± 0.05 hours per day; $F=34.7$, $p=0.000$). Comparing with accelerometer data from Mozambican rural areas, this population spends more time in sedentary activities but also in vigorous to very vigorous activities suggesting a very different activity pattern. Urbanization in Africa seems to drive school age population for a more sedentary lifestyle, which may affect public health issues.

EFFECTS OF A 1-YEAR TRAINING PROGRAM ON THE SKELETON OF DOWN SYNDROME CHILDREN

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Down syndrome (DS), the most common genetic cause of developmental disability, is characterized by mental retardation and musculoskeletal disorders. Recently, osteoporosis has been identified in individuals with DS, being one of the main factors contributing to both premature morbidity and mortality in this population. Childhood is the best period of life to improve the bone properties. Moreover physical practice has been shown to play a major role on bone accretion, in ordinary subjects.

The purpose of this study was to assess the effects of a training program on the skeleton of DS children.

Two groups of DS subjects (22 controls - CTL, 16.7 ± 1.4 years and 20 exercisers - EXE, 15.8 ± 1.8 years) participated in this study. Body weight and height were assessed. Anthropometric measures were done including the skinfold thickness assessment at bicipital, tricipital, subscapular and suprailiac regions of interest. Bone tissue was measured by DXA at the total hip (THip), femoral neck (FN) and lumbar spine (LS). Ultrasound parameters (BUA and SOS) were performed at the calcaneus. EXE group was trained twice a week (sessions of 1 hour) for one year, using impact and weight bearing activities. The subjects had increased their body weight ($p < 0.02$), BUA ($p < 0.001$) and SOS ($p < 0.05$) data for the period of training without any significant difference between groups. EXE had diminished the sum of skinfolds ($p = 0.004$) when CTL did not. Both groups had increased the density in LS, THip, and FN ($p < 0.001$). The gain in bone density was higher in Exe Group compared with CTL group: LS, +6% vs. 1.6%; THip, +5% vs. 1.6%; Neck, +5.11% vs. 1.9%, $p < 0.01$.

As observed in healthy children, a period of regular training based on impact and weight-bearing activities is able to improve the bone density in subjects with Down syndrome. The trained subjects had lost some peripheral fat mass as evidenced by the skinfold measure, which is also of great interest in these subjects.

PHYSICAL ACTIVITY, SEDENTARY TIME AND COGNITIVE FUNCTIONS IN FINNISH CHILDREN

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Physical activity may have beneficial effects on children's cognition. The purpose of this study was to evaluate the associations between physical activity, sedentary behaviour and cognitive functions in children.

The study population consisted of 277 children from five schools in the Jyväskylä school district in Finland (mean age 12.2 years; 56% girls). Self-reported physical activity and screen time were evaluated with questions used in the "WHO Health Behaviour in School-aged Children" (HBSC) study. Children's physical activity and sedentary time were measured objectively for seven consecutive days using the ActiGraph GT1M/ GT3X accelerometer. A cut-off value of 2,296 counts per minute was used for moderate to vigorous physical activity (MVPA) and 100 counts per minute for sedentary time.

Neurocognitive functioning was evaluated with a computerised Cambridge Neuropsychological Test Automated Battery (CANTAB) to assess a broad range of cognitive functions: visual memory (Tests: 1) Pattern Recognition Memory and 2) Spatial Recognition Memory), executive function (1) Spatial Span, 2) Stockings of Cambridge [SOC] and 3) Intra-Extra Dimensional Set Shift) and attention (1) Reaction Time [RTI] and 2) Rapid Visual Information Processing [RVP]). Pearson's correlation coefficients were calculated to evaluate how cognitive functions were associated with self-reported MVPA and screen time, as well as with objectively measured MVPA and sedentary time.

High levels of objectively measured MVPA were associated with good performance in the reaction time test (RTI) ($p < 0.001$) and low levels of self-reported screen time were associated with good performance in the spatial planning test (SOC) ($p = 0.023$). However, high levels of objectively measured sedentary time were associated with good performance in the sustained attention test (RVP) ($p = 0.003$). Physical activity and sedentary behaviour were not associated with other measures of cognitive function.

The preliminary findings of this study indicate that physical activity and sedentary behaviour are associated with some types of cognitive function in children. However, the results were somewhat inconsistent, highlighting the need for future studies to clarify our understanding of these associations.

PREVALENCE OF ACUTE MOUNTAIN SICKNESS AT 3500M WITHIN AND BETWEEN FAMILIES

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Worldwide, more than 200'000 children travel for recreational or professional reasons of the families to high altitude (HA) where acute mountain sickness (AMS) can affect people of all ages. However, there is only scarce data about AMS prevalence in prepubertal and pubertal children and hardly any data in comparison with adults. We therefore investigated symptoms, prevalence and associated factors of AMS in families upon fast ascent to 3500m.

We prospectively studied 87 prepubertal children (9-13 years, 34 girls), 70 adolescents (10-16 years, 33 girls) and their parents (n=155, 30-65 years, 67 women) residing in Switzerland at altitudes <800m, recruited by announcements in Alpine Club Journals. AMS was assessed 8-10 and 20-24 hours after fast passive ascent by the Lake Louise Score (LLS) and was defined as LLS >5. Moreover, oxygen saturation and pain sensibility (cold pressure task by time in water) were measured. For analyses, mixed linear regression models were used with generation and gender as fixed factors and family (cluster) as random factor.

AMS prevalence was significantly lower in children (21%) compared to adolescents (34%) and adults (39%) on day 1 ($p=0.02$), but not on day 2 (18% vs. 19% and 25%, $p=0.3$). Cumulative prevalence of AMS was 30, 37 and 45% in children, adolescents and adults, respectively ($p<0.001$). Familial clustering of AMS was consistent and explained 30-50% of variability in AMS. Among all groups SO_2 at high altitude was not related to the presence of AMS. Pain tolerance (time in water) decreased in all generation significantly from low to high altitude ($p<0.001$) and was significantly higher at low altitude in those without AMS compared to those with AMS ($p<0.001$).

Children are less susceptible to AMS than adolescents and adults at the first day of exposure to HA, but no serious problems were seen. In conclusion, children may travel at least as safely to an altitude of 3500m as adolescents and adults, even if risk factors (pain sensitivity and heredity) are present.

PHYSICAL ACTIVITY, DAILY CORTISOL PATTERNS, AND THE METABOLIC SYNDROME IN OBESE ADOLESCENTS

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The influence of stress in the development of pediatric obesity and metabolic syndrome (MetS) has recently received increased interest. Studies have shown relationships among stress, moderate-to-vigorous physical activity (MVPA) and MetS using survey measures, but the suspected mechanism, elevated daily cortisol, has not been thoroughly examined. Therefore, the purpose of this study was to examine the associations among daily cortisol and MetS MVPA, and MetS in obese youth.

Obese adolescents ($n=50$; 15 boys, 35 girls; mean age 14.8 ± 1.9 y) were recruited from a stage 3 weight management clinic and a general pediatrics clinic. Height, weight, waist circumference, blood pressure, and pubertal stage were obtained at the time of a routine clinic visit, and BMI was calculated. Minutes per day of MVPA was monitored using the SenseWear Pro III armband (SWA). Participants provided saliva samples (while at home on a weekend day) at prescribed times: 1) immediately upon waking; 2) 30-minutes after waking; 3) 3 hours after waking; 4) 6 hours after waking; 5) 9 hours after waking; 6) 12 hours after waking. Fasting HDL cholesterol, triglycerides, and glucose were obtained from physician-ordered blood draws and used with waist circumference and systolic blood pressure to calculate a continuous metabolic syndrome risk score (cMetS). Multiple linear regression analysis was used to examine associations among variables.

The mean cMetS score was 4.16 ± 4.30 and did not differ by clinic or sex. Subjects participated in approximately 46 min of MVPA per day. Mean cortisol area under the curve (cAUC) was 1.337 ± 0.867 $\mu\text{g/dl}$ (1.180 ± 0.753 $\mu\text{g/dl}$ and 1.408 ± 0.922 $\mu\text{g/dl}$ for males and females, respectively) and did not differ by sex or clinic. No significant relationship was found between cAUC and cMetS ($R^2=0.113$, $p=0.66$), nor did the interaction of MVPA with cAUC significantly predict cMetS.

The results of this study did not support a relationship between cortisol and MetS in this sample, nor was there evidence of a moderating effect of MVPA. Future studies should include longitudinal data to identify the timing of altered cortisol release, metabolic effects, and exposure and reactions to stressors.

RELATIONSHIP BETWEEN PHYSICAL ACTIVITY/FITNESS LEVEL AND CARDIOVASCULAR RISK IN YOUTHS FROM AN ACTIVE POPULATION

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The inverse relationship between physical activity (PA), physical fitness (PF) and cardiovascular risk (CR) is well established in pediatric populations with low levels of PA. However, this is not clear in children and adolescents living in cities that have high level of PA. This knowledge will assist the development of appropriate strategies for the control of CR in these populations. Therefore, the objective of this study was to investigate this relationship in youths from Muzambinho, a city in Brazil where PA level is high. 235 children/adolescents (11±3 years) were evaluated. CR markers were evaluated: blood glucose, cholesterol, waist circumference, systolic and diastolic blood pressure. Physical fitness was evaluated with maximal handgrip and 1 mile run. Leisure/commuting PA were evaluated using a standardized questionnaire. The CR (dependent variable) was calculated by sum of the Z scores of these markers. Age, sex, body mass index (BMI), weekly leisure time and commuting PA volumes, aerobic fitness (1 mile test) and muscle strength (maximal handgrip) were assessed and set as independent variables. Statistical procedures included simple and multiple linear regression models. SPSS 20 was used in all analyses.

68% of the participants performed more than 300min/week of PA, characterizing a very active population. Simple regression analysis indicated that the CR increased with age ($\beta=0.546$; 95%IC=0.432-0.659, $p<0.001$), BMI ($\beta=0.514$; 95%IC=0.438-0.590, $p<0.001$), and decreased with weekly leisure time ($\beta=-0.001$; 95%IC= -0.001-0.000, $p=0.001$), and commuting ($\beta=0.004$; 95%IC=0.005-0.007, $p=0.012$) PA volumes, and strength ($\beta= 0.144$; 95%IC= 0.107-0.180, $p< 0.001$). The multiple regression showed that this risk was positively associated with age ($\beta=0.277$; 95%IC=0.047; 0.506, $p=0.018$) and BMI ($\beta=0.463$; 95%IC=0.351-0.574, $p<0.001$) and negatively related with weekly leisure time PA volume ($\beta= -0.001$; 95%IC= -0.001-0.000, $p=0.018$).

In children/adolescents from an active population, CR increases with age and BMI, and decreases with increasing leisure PA, but not with commuting PA, aerobic fitness or strength. These findings suggest that even in active populations, increase in leisure time PA should be encouraged as a strategy to help reducing the CR of children and adolescents.

MODERATE EXERCISE, ENERGY INTAKE RESTRICTION AND POSTPRANDIAL PLASMA TRIACYLGLYCEROL CONCENTRATIONS IN HEALTHY GIRLS

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The lower postprandial triacylglycerol (TAG) concentration following acute exercise in young people may be attributable to an ensuing energy deficit. Therefore, this study compared the effect of an isoenergetic energy deficit, induced by acute exercise or mild food energy-intake restriction, on postprandial [TAG] in girls.

Eleven healthy, recreationally active girls (mean(SD): age 12.1(0.6) years; body mass 42.1(5.8) kg; peak oxygen uptake (VO₂ peak) 47(6) mL/kg/min) completed three, two-day conditions in a counter-balanced, cross-over design. On day 1, participants either rested (CON), walked at 60% peak VO₂ inducing a net energy expenditure of 1.46(0.01) MJ (EX) or restricted food energy-intake by 1.47(0.18) MJ (ER). On day 2, capillary blood samples were taken in the fasted state and at pre-determined intervals throughout the 6.5 hour postprandial period. A standardised breakfast was consumed immediately after the fasting sample and a standardised lunch at 4 hours.

Compared with CON, fasting [TAG] was lower after EX (95% confidence interval (95% CI) -0.38 to -0.19, effect size (ES) = 1.33) and ER (95% CI -0.22 to -0.01, ES = 0.42); EX was lower than ER (95% CI -0.30 to -0.03, ES = 0.66). Differences in postprandial [TAG] between conditions were moderate (ES = 0.50). The total area under the [TAG] versus time curve was lower after EX than CON (95% CI -2.89 to -0.86, ES = 0.80), with a small to moderate difference between ER and CON (95% CI -1.85 to 0.16, ES = 0.27) and EX and ER (95% CI -2.48 to 0.42, ES = 0.40).

An exercise-induced energy deficit elicits a greater reduction in fasting and postprandial [TAG] than an isoenergetic diet-induced energy deficit. Therefore, exercise prescription may promote greater acute benefits in lipid metabolism than dietary restriction in healthy, active girls.

THE EFFECT OF PUBERTY ON FAT OXIDATION DURING EXERCISE IN OVERWEIGHT AND NORMAL WEIGHT GIRLS

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Excess weight is often associated with insulin resistance (IR), and may disrupt fat oxidation at rest and during exercise. This effect is further complicated by puberty. While studies have shown that maximal fat oxidation rates (FOR) during exercise decrease with puberty in normal weight (NW) and overweight (OW) boys, the effect of puberty in NW and OW girls is not as clear. We hypothesized that FOR would be: i) higher in pre- and early-pubertal girls (Tanner I-II) compared to mid- and late-pubertal girls (Tanner III-V) and; ii) higher in NW girls than OW girls at all stages of puberty.

Thirty-three NW and OW girls ages 8-18 years old completed a VO₂peak test on a cycle ergometer. FOR were calculated during progressive submaximal exercise, and body composition via bioelectric impedance analysis and Tanner stage were determined. For each participant, a best-fit polynomial curve was constructed using FOR (mg/kg fat free mass (kgFFM)/min) vs. exercise intensity (%VO₂peak) to estimate maximal FOR.

NW pre-early pubertal girls had higher maximal FOR (6.9 ± 1.4 mg/kgFFM/min) than NW late-pubertal girls (2.2 ± 0.9 mg/kgFFM/min) ($p=0.002$), OW pre-early pubertal girls (3.8 ± 2.1 mg/kg FFM/min) and OW mid-late pubertal girls (3.3 ± 0.9 mg/kgFFM/min) ($p<0.05$). The exercise intensity at maximal FOR (FATmax) was greater in NW pre-early pubertal girls compared to all groups ($p<0.001$). Surprisingly, NW mid-late pubertal girls had a lower FATmax than OW pre-early pubertal girls ($p=0.02$) and OW mid-late pubertal girls ($p=0.01$). When fat oxidation was examined at 50% VO₂peak, NW mid-late pubertal girls had lower FOR than both OW groups ($p=0.03$).

FOR decreased in NW girls during mid-late puberty, however this was blunted in OW girls. Greater IR due to adiposity in the OW groups may lead to higher fat oxidation than NW mid-late pubertal girls because of a poor suppression of lipolysis at rest and greater free fatty acid availability. More insight into the mechanistic differences and effect of transient IR due to puberty compared with IR associated with adiposity on FOR during exercise is required. This study was funded by CIHR.

LONGITUDINAL EFFECTS OF TRAINING ON THE CARDIOPULMONARY RESPONSES TO RAMP INCREMENTAL EXERCISE IN CHILDREN

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Considerable controversy surrounds the potential presence of a maturational threshold below which significant physiological adaptations to training cannot occur and/or a “golden” period during which training has an especially pronounced effect. However, the interpretation of many previous studies is limited by their cross-sectional nature, which precludes the appropriate partitioning of the influences of training from the concomitant influences of growth and maturation.

Eighteen trained (baseline: 10.8 ± 1.4 y; mean training, 6 ± 3 hrs/week; 11 girls) and fifteen untrained (baseline: 10.0 ± 0.9 y; 10 girls) children annually completed ramp incremental cycle exercise for three consecutive years. Throughout these tests, pulmonary gas exchange, stroke volume (SV) and cardiac output (Q) were continuously measured. Maturity status was estimated according to years to peak height velocity. The influence of participant level (training, maturity, sex and BMI) covariates on the outcome variables (peak oxygen uptake (VO_2), SV, heart rate (HR), Q and arterial-venous oxygen difference (avO_2 diff)) were investigated longitudinally over time.

The baseline model revealed that time exerted a significant positive effect upon peak VO_2 (mean \pm SE; 0.71 ± 0.08 l·min⁻¹), HR (0.60 ± 0.12 b·min⁻¹) and SV (0.33 ± 0.15 ml). However following scaling to account for body size, non-significant parameter estimates were obtained for peak VO_2 and SV. There was a significant incremental influence of training on peak VO_2 (0.17 ± 0.06 l·min⁻¹) and avO_2 diff (1.94 ± 0.71 ml·dl⁻¹) but not on scaled peak VO_2 or any peak cardiovascular parameter irrespective of the method of expression. Subsequently, sex, BMI and maturity status were introduced as additional explanatory variables, but non-significant parameter estimates were obtained. The addition of these covariates significantly increased the exponents describing the relationship between time and peak VO_2 (0.97 ± 0.13 l·min⁻¹), scaled peak VO_2 (0.83 ± 0.16 l·kg⁻¹·min⁻¹), HR (0.96 ± 0.19 b·min⁻¹) and SV (0.76 ± 0.24 ml). Furthermore, the addition of these variables increased the exponents associated with training and scaled peak VO_2 (17.86 ± 6.5 l·kg⁻¹·min⁻¹) and avO_2 diff (3.39 ± 1.60 ml·dl⁻¹).

These findings challenge the notion that there is a “golden period” or maturational threshold regulating the influence of training status on the peak physiological responses to exercise in young people.

PROMOTING HEALTHY WEIGHT IN PRIMARY SCHOOL CHILDREN THROUGH A HEALTH-PROMOTING CURRICULUM: THE CHANGE! PROJECT

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It is well established that paediatric obesity is associated with numerous health implications. Low physical activity levels and high engagement in sedentary behaviours are key associated variables. This pragmatic evaluation investigated the effectiveness of the Children's Health, Activity and Nutrition: Get Educated! (CHANGE!) Project: a cluster randomised intervention to promote healthy weight using an educational focus on physical activity and healthy eating.

Twelve primary schools, incorporating 318, 10-11 year old children, were randomised to an intervention (n = 6 schools) or comparison condition. Primary outcome measures were waist circumference, body mass index (BMI), and BMI z-scores. Secondary outcomes were objectively-assessed physical activity and sedentary time (7-day accelerometry). Outcomes were assessed at baseline, after the 20 week intervention and at a 10 week follow-up. Data were analysed using 3-level multi-level modelling and adjusted for baseline values of the outcome and potential confounders, at both school and child level. Differences in intervention effect over time and by subgroup (sex, weight status, socio-economic status) were explored using statistical interaction.

Significant between-group effects were observed for waist circumference (β for average intervention effect over time = -1.73 cm, $p < 0.001$), and BMI z-scores ($\beta = -0.22$, $p < 0.01$). Significant intervention effects were apparent for sedentary time ($\beta = 28.91$ min, $p = 0.04$). The intervention participants engaged in 3.48 minutes more vigorous physical activity, which approached statistical significance ($p = 0.05$), but there was no intervention effects on moderate physical activity. The intervention was most effective for overweight/obese participants (waist circumference, $p < 0.001$), girls (BMI z-scores, $p = 0.02$), and participants with lowest family socioeconomic status (BMI, $p < 0.01$; BMI z-scores, $p < 0.01$).

The CHANGE! intervention positively influenced body size outcomes and was most effective among socio-demographic groups at greatest risk of poor health status. The findings add support for the effectiveness of combined school-based physical activity and nutrition interventions. Additional work is required to test intervention fidelity and the sustained effectiveness of this intervention in the medium- and long-term

IS GYMNASTICS EXPOSURE ASSOCIATED WITH SKELETAL BENEFITS IN THE FOREARM IN YOUNG CHILDREN?

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The amount of bone gained during childhood and adolescence impacts greatly on lifetime skeletal health. Gymnastics training results in unique high mechanical loading to the skeleton and therefore, provides an excellent model for assessing the effects of weight-bearing physical activity on bone development. It has been recently observed that early recreational and precompetitive gymnastics participation may confer a 6-25% greater adjusted bone strength at the distal radius. What remains unsubstantiated is the long term effects of early recreational gymnastics on the development of childhood bone strength. The purpose of this study was to investigate the relationship between early childhood recreational gymnastic participation and bone strength, derived from peripheral quantitative computed tomography (pQCT) at the distal radius in young males and females. One hundred and twenty six children (58 males, 68 females) involved in either recreational gymnastics (gymnasts) or other recreational sport camps (non-gymnasts) between 4 and 6 years were recruited. Annual pQCT scans of their distal (4% of limb length) and proximal (65%) forearms were obtained over a 3 year period. Participants were aged 8 to 10 years at study completion. Multilevel random effects models were constructed to assess differences in the development of pQCT estimated bone strength measures whilst controlling for age, radius length, weight, physical activity, muscle area, sex and hours of training and gymnastics exposure. Once age, radius length, weight, muscle area, physical activity, sex and hours of training were accounted, it was observed that individuals exposed to in recreation level gymnastics had significantly greater total bone area ($+18.0 \pm 7.5 \text{ mm}^2$), and total bone content ($+6.0 \pm 3.0 \text{ g/cm}$) at the distal radius than the controls who were not exposed to gymnastics ($p < 0.05$). No significant differences between groups were observed for any bone measures at the proximal radius site ($p > 0.05$). Early life recreational gymnastic participation provides skeletal benefits at the distal radius. Thus, childhood recreational gymnastics exposure may be advantageous to forearm bone strength development.

FAIR TO MODERATE TRACKING OF PULSE WAVE VELOCITY IN HEALTHY PRESCHOOL CHILDREN (AGES 3-5)

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Pulse Wave Velocity (PWV), the speed of a pressure waveform traveling along a segment of the arterial tree, is considered to be the gold-standard measurement for assessing arterial stiffness non-invasively. PWV, while established for use in adults and older children, has not been used extensively in studies of preschool-aged children (3-5 years). Our primary objective was to determine how PWV tracks over a one-year period in healthy preschoolers. A secondary objective was to investigate sex differences in PWV tracking

49 boys (age = 4.52 ± 0.89 years, BMI = 15.77 ± 1.02 kg/m²) and 49 girls (mean age = 4.32 ± 0.88 years, BMI, 15.80 ± 1.11 kg/m²) completed baseline and follow-up assessments one year apart (12.45 ± 1.05 months). Whole-body PWV (m/s) was measured between the right carotid and dorsalis pedis arteries. The time delay between pressure waveforms obtained at the carotid artery and at the dorsalis pedis artery was determined. An anthropometric measuring tape was used to estimate the distance between sites across the surface of the body. Tracking of PWV from year 1 (baseline) to year 2 (follow-up) was evaluated with the Spearman rank-order correlation. Kappa statistics were used to determine the agreement in PWV tertile categorization (low, moderate, high) over time, and a chi-square test was used to determine the effect of sex on agreement in PWV tertile categorization.

Mean \pm SD values (m/s) of PWV for boys and girls, respectively, were 4.26 ± 0.47 and 4.28 ± 0.33 at year 1, and 4.76 ± 0.50 and 4.87 ± 0.51 at year 2. PWV showed moderate tracking according to the Spearman rank-order correlation ($r_s = 0.37$, $p < 0.01$). Consistent with this finding, the Kappa statistics also revealed a fair agreement of PWV ranks between year 1 and year 2 ($K = 0.25$). There were no sex differences observed in the agreement of PWV ranks ($\chi^2(2, N=98) = 0.49$, $p = 0.79$).

Whole-body PWV exhibited fair to moderate tracking over a one-year period in healthy 3-5 year old children. Furthermore, sex does not appear to influence how PWV tracks from one year to the next during early childhood.

EVALUATION OF HEALTH BENEFITS ASSOCIATED WITH MEETING PHYSICAL ACTIVITY GUIDELINES FOR THE EARLY YEARS

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Physical activity guidelines for 3 and 4 year-olds recommend at least 180 minutes of activity at any intensity each day. The health benefits associated with meeting this target have not been evaluated. The purpose of this study was to determine if children meeting physical activity guidelines for the early years have lower body fat (BF) and higher aerobic fitness, two important health indicators, than children not meeting the recommendations.

Two hundred and seventy nine 3-to 4-year-olds (138 girls; age: 4.0 ± 0.6 years, BMI percentile: 53.5 ± 28.4) participated. Percent BF was calculated using bioelectrical impedance analysis. Time to exhaustion on a maximal treadmill test (Bruce Protocol) and heart rate recovery (HRR) 1-min following the test were used as indicators of aerobic fitness. Children who reached a heart rate of ≥ 180 bpm during the treadmill test were included in fitness analyses. Physical activity was assessed over 7-days using accelerometry with 3-second epochs. Participants who wore the accelerometer for at least 10 hours on 3 or more days were included. To be classified as meeting the physical activity guidelines, the activity target had to be met each day. Independent t-tests were performed to assess differences between groups meeting and not meeting the guidelines.

Seventy-three percent of participants were active for at least 180 minutes every day. Boys were more likely to reach the target than girls (81% vs. 65%). Children meeting the recommendation had significantly lower percent BF (23.6 ± 4.2 vs. $25.8 \pm 4.5\%$, $p=0.001$) and faster HRR (65 ± 13 vs. 61 ± 15 bpm, $p=0.04$) than children not meeting the guideline. There was no significant difference between groups in time to exhaustion on the treadmill (8.6 ± 2.1 vs. 8.1 ± 1.6 min, $p=0.09$).

Children meeting physical activity guidelines have greater HRR, indicating higher aerobic fitness, and lower BF levels than their peers not meeting the targets. These findings provide support for the health benefits associated with meeting physical activity guidelines for the early years.

PROSPECTIVE ASSOCIATIONS BETWEEN PHYSICAL ACTIVITY AND SEDENTARY TIME WITH ADIPOSITY IN ADOLESCENCE

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The literature investigating physical activity (PA) and its relationship with adiposity is inconsistent in children. It also remains unknown if total time spent sedentary is associated with adiposity in childhood, as seems to be the case for specific sedentary behaviours, such as television viewing. This study will investigate associations between PA and total time spent sedentary (both objectively measured) with adiposity in adolescents.

Students were recruited from schools in Cambridgeshire, UK. Percentage body fat (%BF) and fat mass (FM) were estimated at 15.0 and 17.5 years of age by bioelectrical impedance; waist circumference was also measured. Habitual PA and sedentary time were assessed at the same ages over 4 days by combined heart rate and movement sensing. Absolute METs were used to define average daily time spent sedentary and in light, moderate, vigorous, and moderate-to-vigorous intensity physical activity (MVPA). Main analyses will use multilevel regression models, stratified by sex, with each (in)activity parameter in turn as the independent variable, and considering adjustment for ethnicity, SES, maturation, birthweight, maternal factors (age at parturition, pre-pregnancy BMI, smoking in pregnancy), parental BMI, sleep duration, and energy intake. Sedentary time and PA will also be mutually adjusted for one another.

Over 700 adolescents provided sufficient data to be included in analyses. Descriptive statistics have shown that %BF, FM and WC increased in both sexes from 15.0 to 17.5 years of age ($p < 0.001$); rate of increase was shown to be higher in girls than boys ($p < 0.01$). Sedentary time (plus sleep) remained stable in boys but increased in girls by 10 min/day per year ($p < 0.05$). In contrast, MVPA decreased in boys and girls. Girls' MVPA exhibited an annual decline of 6.5 min/day (-5.5%, $p < 0.01$). Our main analyses investigating associations between PA and sedentariness with adiposity remain to be conducted.

This analysis will be based on a larger sample but with equivalent duration of follow-up compared to most other prospective observational studies on PA and adiposity. Other strengths include precision measurements of exposure and outcome, investigation of subcomponent PA, and adjustment for several covariates. Our results stand to make a substantial contribution to the existing literature.

3-YEAR FOLLOW-UP RESULTS OF BONE MINERAL CONTENT AND DENSITY AFTER A SCHOOL-BASED PHYSICAL ACTIVITY INTERVENTION

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As an important modifiable lifestyle factor in osteoporosis prevention, physical activity (PA) positively influences bone mass accrual during growth. We have previously shown that a nine month general school-based physical activity intervention increased bone mineral content (BMC) and density (aBMD) in children. From a public health perspective, a major key issue is whether these effects persist during adolescence. We therefore measured BMC and aBMD three years after cessation of the intervention to investigate whether the beneficial short-term effects persisted.

Children from 28 randomly selected first and fifth grade classes (Intervention group (INT): 16 classes; control group (CON): 12 classes) who had participated in KISS (Kinder- und Jugendsportstudie) were contacted 3yrs after cessation of the intervention. The intervention included daily physical education with impact loading activities over nine months. Measurements included anthropometry, vigorous PA (VPA) by accelerometers, and BMC/aBMD for total body, femoral neck, total hip, and lumbar spine by dual-energy X-ray absorptiometry (DXA). Sex- and age-adjusted Z-scores of BMC or aBMD at follow-up were regressed on intervention (1 vs 0), the respective Z-score at baseline, gender, follow-up height and weight, pubertal stage at follow-up, previous and current VPA, adjusting for clustering within schools.

377 of 502 (75%) children participated in baseline DXA measurements and of those, 214 (57%) participated to follow-up. At follow-up INT showed significantly higher Z-scores of BMC at total body (adjusted group difference: 0.157 units (0.031 - 0.283); $p=0.015$), femoral neck (0.205 (0.007 - 0.402); $p=0.042$) and at total hip (0.195 (0.036 to 0.353); $p=0.016$) and higher Z-scores of aBMD for total body (0.167 (0.016 to 0.317); $p=0.030$) compared to CON, representing 6-8% higher values for children in the INT. No differences could be found for the remaining bone parameters. For the subpopulation with baseline VPA ($n=163$), effect sizes became stronger after baseline VPA adjustment. After adjustment for baseline and current VPA ($n=101$), intervention effects were no longer significant, while effect sizes remained the same as without adjustment for VPA.

Beneficial effects on BMC of a 9mt general physical activity intervention appeared to persist over 3yrs. Part of the maintained effects may be explained by current PA.

PEER SUPPORT FOR PHYSICAL ACTIVITY PROMOTION IN CHILDREN AND ADOLESCENTS. SYSTEMATIC REVIEW OF THE LITERATURE

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Physical inactivity is the fourth leading risk factor for global mortality, notwithstanding the wide spread knowledge about the multiple health benefits associated with regular physical activity. Therefore, it seems necessary to promote behavior changes, especially at earlier ages. In this field, recent research seems to show that physical activity trials using peer support are effective in behavior modification. Nevertheless, previous reviews on this issue have been essentially narratives. Thus, our purpose was to analyze, through a systematic review of the literature, if interventions using peer support can increase physical activity and decrease sedentary behavior among children and adolescents (5-17 years). In this systematic review, a PICO (Population, Intervention, Control and Outcomes) model strategy was used. Literature published between 1st January 2008 and 21st January 2012 was obtained through searching PubMed electronic database, according to previously defined inclusion criteria. All analogous keywords were placed, to avoid selection bias. The search was limited to English language papers in peer-reviewed journals. Data were extracted for a standard table and study quality was evaluated through PEDro Scale (Physiotherapy Evidence Database), by a not blinded reviewer. We identified 951 papers that related the four groups of keywords. 472 were excluded based on publication date and 471 were excluded, because titles and abstracts consulted did not fulfilled eligibility criteria. Eight randomized controlled trials, which had the purpose of increasing the levels of physical activity or decreasing sedentary behavior, in children and adolescents, based on peers support, were selected. Data, covering a total of 11,014 participants, shows that peers support appears to promote a decrease in sedentary activities and an increase in moderate and moderate-to-vigorous physical activity in children and adolescents, since the presence of a friend can increase motivation for performing physical activity. Based on this systematic review, peer support in children and adolescents seems to be an effective mediator for physical activity promotion and sedentary behavior reduction. Thus, the implementation of programs to encourage physical activity should consider including peer support. The information gathered, not only will provide clues to further investigations, but also will help pediatric health promotion through an evidence-based practice.