



Université Lille 2
Droit et Santé

Faculté des
Sciences du Sport
et de l'Éducation Physique
Lille 2

CHILDREN AND EXERCISE XXV

**Physical Activity and Exercise for
Disabled and Healthy children**

*XXVth International Symposium of
Pediatric Work Physiology*

Le Touquet Paris Plage
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XXVth International Symposium of Pediatric Work Physiology

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And a special thank to Jean-Marie Deruelle for is personal help

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*XXVth International Symposium of Pediatric
Work Physiology.*

Conferences

Child as a Source of Mechanical Power**Pr Emmanuel Van Praagh**

BAPS Laboratory, University Blaise Pascal, Clermont-Ferrand, France

During growth, the study of short-term high-intensity exercise, has not received the same attention from researchers as, for instance, aerobic fitness. This is surprising given the level of aerobic energy used daily during childhood and adolescence. During physical activity and sport, the child is spontaneously more attracted to short-burst movements than to long-term activities. It is, however, well known that in sports events such as sprint cycling, jumping, sprint running or sprint swimming, the children's performance is distinctly lower than that of adults. This partly reflects children's lesser ability to generate mechanical energy from chemical energy sources during short-term high-intensity work or exercise. For many years, various attempts have been made to quantify the « anaerobic » energy yield in maximal intensity exercise, but many assumptions have had to be made with respect to mechanical efficiency, lactate turnover, dilution space for lactate, and so on. Therefore, during childhood, direct measurements of the rate or capacity of « anaerobic » pathways for energy turnover presents several ethical and methodological difficulties. Thus, rather than measure energy supply, paediatric exercise scientists have concentrated on measuring short-term power output by means of standardised tests. There is, however, no perfect test and, therefore, it is important to acknowledge the benefits and limitations of each testing method. Mass-related short-term power output was shown to increase dramatically during growth and development. This suggests that the observed difference between children and adolescents during short-term power output testing may be related to body composition, neuromuscular factors, hormonal factors and improved motor coordination.

Cardiovascular Adaptations in Response to Exercise, Training and Physical Activity in Children**Pr Daniel Green**

John Moore University, Liverpool and School of Sport Science-Exercise, United Kingdom, and Health University of Western Australia, Australia

In this lecture I will present the idea that atherosclerosis is a disease, which begins early in life, and that preventative measures should be focussed on young individuals who are at elevated risk.

Identifying young asymptomatic individuals at the highest risk of developing cardiovascular disease in future is challenging and an argument will be presented that direct assessment of arterial endothelial function provides a better prediction method than reliance upon traditional risk factor algorithms. I will discuss arterial shear stress, the physiological stimulus which leads to anti-atherogenic changes in endothelial function and vascular remodelling, and the impact of different exercise modalities and intensities on arterial shear patterns. Finally, I will review the impact of exercise training on vascular, cardiac and metabolic function in children and adolescents with obesity, effects which should decrease the risk of future cardiovascular (CV) events in young people at high risk.

Background: There is now broad acceptance that the prevalence of overweight/obesity, insulin resistance and type 2 diabetes is increasing in highly urbanised western countries and, in particular, in lower socioeconomic postal ("zip") codes. Although atherosclerosis has been perceived as a disease of older people, several lines of evidence indicate that it begins early in life. The challenge is to identify those young asymptomatic individuals who are at highest risk of future CV disease manifestation. Algorithms based on traditional risk factors predict future cardiovascular events poorly, partly because the factors which predispose to plaque rupture, which is responsible for the majority of cardiac events, are not identical to those responsible for atherosclerotic development.

Assessment of arterial endothelial dysfunction in humans represents an attractive candidate for CV risk prediction, as it is associated with plaque vulnerability, thrombogenesis and reflects the compound impact of traditional cardiovascular risk factors on atherogenic development. Flow mediated dilation (FMD), a non-invasive assessment of nitric oxide (NO)-mediated endothelial function, provides independent prognostic information which exceeds that available from traditional risk factors in asymptomatic subjects and those with existing cardiovascular disease. These findings suggest that early detection and treatment of endothelial dysfunction may represent a novel primary prevention strategy in adolescents who are at elevated risk for development of cardiovascular disease in later life.

We recently completed studies which revealed that endothelial function in children and adolescents with obesity is impaired relative to age and gender matched lean controls, suggesting the presence of early atherogenic changes. This data suggests that endothelial dysfunction may be an antecedent of type 2 diabetes and the metabolic syndrome in obese children and we have previously demonstrated that endothelial function is impaired in adults with type 2 diabetic subjects.

If endothelial dysfunction is an important atherogenic event, then improvement in endothelial function may prevent, or decrease the progression of, cardiovascular disease. We therefore need to understand the physiological stimulus which upregulates or improves endothelial function. Increases in blood flow through the lumen of arteries, and hence wall shear stress, lead to arterial dilation via NO-dependent flow-mediated dilation. Changes in the circumferential size of arteries, "*arterial remodelling*", are also dependent upon endothelium-dependent shear stress transduction. Hence, artery function, remodelling and wall morphology (e.g. thickness, stiffness) are all-dependent upon, and modulated by, the endothelium. Acute and chronic changes in blood flow, and shear forces, induce adaptation in artery function and structure which are antiatherogenic and transduced by the endothelium.

Exercise increases arterial shear stress and in this way modulates endothelial function and arterial remodelling in animals. In humans, we observed that endothelial function contributes significantly to upper limb blood flow during lower limb exercise and that cycling exercise induces substantial *retrograde* flows through the upper limbs during diastole. These observations have led to recent work characterising the impact of different forms of exercise on arterial shear forces and the observation that increases in antegrade flow and shear stress enhance NO-mediated endothelial function, whilst retrograde flow and shear may have the opposite impact. Exercise is clearly a stimulus which modulates endothelial NO-mediated function and different types or modes of exercise have distinct impacts upon endothelial function.

In animals, exercise training improves NO-mediated responses and upregulates NO-synthase expression. We have reported improved indices of arterial remodelling in humans, as well as enhanced endothelium-dependent NO function in patients with heart failure, coronary disease and hypercholesterolaemia. We also observed beneficial effects of exercise training on endothelial function in adults with type 2 diabetes. This data suggests that exercise training may have important clinical significance in diabetes, since improvement in endothelial function parallels anti-atherogenic benefits and may ameliorate the vascular complications which account for most deaths in type 2 diabetic subjects. In obese children and adolescents, we demonstrated that exercise training enhances, and may normalise, endothelial function (FMD). This effect was not associated with changes in body weight or BMI, although DEXA revealed significant decreases in central measures of fat mass. Training was also associated with enhanced insulin resistance and improved diastolic function in these subjects. Taken together, these data suggest that exercise training is a powerful intervention which normalises vascular, cardiac and metabolic function in young people at high risk of future manifestations of atherosclerotic cardiovascular disease.

In summary, exercise training improves vascular function, induces arterial remodelling, and improves cardiac diastolic function and insulin sensitivity in obese adolescents. These effects should decrease the risk of future cardiovascular events in young people at high risk. Exercise (and increased physical activity levels) are a key preventative health strategy in young people.

2:00-2:45 p.m.

Wednesday September 29th

Genetic, Obesity and Physical Activity

Pr Philippe Froguel

CNRS, UMR 8090, Institute Pasteur, Lille, France, and Imperial College of London, United Kingdom

To be added later...

Fatigue Mechanisms in Children

Pr Craig A. Williams

Children's Health and Exercise Research Centre, School of Sport and Health Sciences, University of Exeter

Background: In adult physiological studies, muscle fatigue is a well studied phenomenon. However, with children the study of fatigue has not attracted as much research. This is surprising given that the ultimate consequence of fatigue i.e. the decline in muscle performance, is found as readily in children as it is in adults. To a physically active child this decline in muscle performance will have been regularly experienced.

There are numerous definitions of fatigue but a commonly accepted one is 'any exercise-induced reduction in the maximal capacity to generate force or power output' (Vollestad, 1997, p. 220). Another definition by Edwards (1983) is the 'failure to maintain the required or expected force or power output (p. 3).' Edwards' (1983) model of fatigue, proposed as an inhibition of force, represented fatigue that could reside in one or several sites of the chain of command that result in force contraction. This chain of command which encompasses activation and stimulation from the brain and central nervous system to the stimulation and relaxation of the muscles itself has resulted in fatigue being divided into two categories. Firstly, central fatigue which involves the central nervous system and nervous pathways and secondly, peripheral fatigue that resides from the neuromuscular junction to the muscle. One of the difficulties in quantifying the degree of fatigue in children has been the use of invasive methodologies which have been prevalent in adult studies (Williams and Ratel, 2009). In studies of fatigue with children, external measures such as mechanical power output have had to be relied upon to infer fatigue. The Wingate test (WAnT) with its fatigue index was often used to quantify fatiguing processes during maximal intensity cycling. Other tests of time to exhaustion, time trials or protocols using different contraction types have also been used with some success. Instruments such as electromyography (EMG), ³¹P magnetic resonance spectroscopy (³¹P-MRS) and evoked twitch interpolated techniques have been utilised in an effort to investigate causal factors of fatigue. In the paediatric literature accumulated results have shown that there is a trend that children are able to resist fatigue better than adults during exercise. These findings have typically used measurements of mechanical force or power output profiles during sustained maximal isometric and repeated bouts of high-intensity dynamic exercises. More recent evidence has shown that boys can recover faster than men following submaximal isometric plantar flexion exercise (Hatzikotoulas et al., 2009).

The observation of better resistance to fatigue in children may be explained by muscle characteristics which are quantitatively and qualitatively different to those of adults. These characteristics include the amounts of recruited muscle mass and the absolute work rates during exercise. Currently, it is an accepted tenet that children are equipped better for oxidative than glycolytic pathways. This metabolic profile results in children's lesser production and better clearance of muscle by-products inhibiting to contraction, as well as, a faster resynthesis of initial creatine phosphate stores necessary to the reconstitution of muscle power following exercise. The lower accumulation of muscle by-products found in children may be indicative of a reduced metabolic signal which would induce lower ratings of perceived exertions. From neuromuscular studies, some reports have indicated that children's lesser ability to activate their type II motor units would also

explain a greater resistance to fatigue. The findings based on fatigue of agonist and antagonist muscles during isokinetic tests showed that higher levels of muscle co-activation with advancing muscle fatigue are similar in children and adults (Paraschos et al., 2007). It is interesting to observe that during fatiguing intermittent running, motor efficiency is less disturbed in young children compared with adults. In fact, the lower decrease in running velocity in children is related to their lower decline in step rate because the shortening in step length is similar in children and adults.

Methodology to assess fatigue: There are a range of methodological assessments that can be used in the measurement of fatigue. These include maximal voluntary force, power output, endurance time, EMG, tetanic forces, low frequency twitch measures and twitch interpolation (Vollestad, 1997). In studies with children and adolescents the most common methods are the use of maximal voluntary force, power output, endurance time and EMG. This is largely a consequence of their ease of use, reliability and their ethical approval as compared to the twitch interpolation technique which is painful and unlikely to be well tolerated by children. The reliability of the assessment of fatigue is an important one and often overlooked. In the use of the maximal voluntary contraction method, the force generated can be reduced if the child is not motivated or has not learnt the skill to initiate a “best effort.” As the ability to measure this force is crucial to the study of fatigue, more information is needed on these reliability issues. For example, the only way to truly determine if a voluntary effort is “maximal” is to supersede the contraction with an electrical tetanic stimulation. If the electrical stimulation does not evoke a force response greater than the voluntary one, then a maximal effort is judged to have occurred. In children, this is not practical and researchers are likely to have difficulty obtaining ethical approval. Other direct and reliable non invasive measures of fatigue are available. In one such study De Ste Croix found the maximal voluntary contractions of knee extensors during a fatiguing protocol to be reliable (coefficient of variation up to 5.4 %). Laboratory measures using endurance time as a basis for examining fluid ingestion and fatigue during cycling performance have been found to have a typical error of up to 7.3 % (Montfort-Steiger et al., 2005).

During the measurement of mechanical power output, usually during cycle ergometry, the decline in the power output is most often investigated by measuring the temporal change in mechanical power output. The most common test is the Wingate test comprising peak power (usually within 1 or 5-s), mean power (averaged over 30-s) and total work done. Repeated sprint tests and the fatigue index, representing the decline in performance, have also been used. However, this has been criticised as being an unreliable measure (Oliver et al., 2007). Therefore, its use is questioned.

The use of EMG during maximal voluntary isometric or dynamic single leg contractions or during submaximal cycling is commonly utilised. The electrical activity of superficial muscles via the amplitude and power spectrum of the signal can be assessed. The number and size of action potentials for the muscle of interest is a reflection of the amplitude. Thus changes in numbers of active fibres or activation can be detected but it is not possible to differentiate between the two. During isometric maximal contractions EMG amplitude falls progressively, which is often attributed to the gradual decline in the motor unit excitation rate. EMG recorded during submaximal repetitive or sustained contractions shows the opposite, a gradual rise. This is most probably due to muscle recruitment as previously recruited fibres fatigue and drop out only to be replaced by additional fibres which are recruited so as to maintain the force or power output. In one study by Hatzikotoulas et al. (2009) EMG activity of the soleus, medial gastrocnemius and tibialis anterior of prepubescent boys and men were found to increase similarly

following submaximal isometric plantar and dorsal flexion. Despite the findings of similar fatigue levels in boys and men, the boys recovered faster for torque, soleus and medial gastrocnemius EMG (all normalised to the maximum achieved prior to the fatiguing exercise). Due to its ease of use and as a non invasive technique more protocols should utilise EMG. Although muscle biopsies are often used in adult studies of fatigue it is not a viable option with children. However, exciting developments with ^{31}P -MRS could be considered as a tool for assessing the mechanisms of fatigue within the exercising muscle (Williams and Ratel, 2009).

Current developments: It is likely that advances in technology will have a significant part to play in the investigations of fatigue in children. As instrumentation becomes more sophisticated and procedures become less invasive and therefore applicable to children, more valid experimentation can be established. A prime example is the use of magnetic resonance. Although expensive, magnet resonance scanning costs are decreasing and the size of the magnet bore is increasing to allow exercise to take place within the magnet. Other advancements in instrumentation include near infrared spectroscopy and thermoregulatory telemetry ingestible pills, both of which should allow measurement of oxy- and deoxyhemoglobin and temperature, as mechanisms of fatigue during exercise.

Conclusion: For such a common phenomenon as fatigue, it is surprising how little data there are on children's tolerance to exercise. To date the study of fatigue has largely been confined to the utilisation of external measurements of mechanical power output, supplemented by the additional measurement of EMG. However, there appears to be very little data on the force-time or power-time duration relationships. Considering the number of children engaged in exercise and sporting competitions, more needs to be known about the fatiguing effects of these activities. More paediatric studies involving the use of non-invasive instruments which are able to determine the mechanisms underlying fatigue are therefore warranted. These studies need to be both field and laboratory based.

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Respiratory Responses to Exercise in Healthy and with Respiratory Disease Children**Pr Stephan Matecki**

INSERM ERI 25, University of Montpellier 1, Montpellier, France

Ventilatory function is the first step of the oxygen delivery chain, which makes the link between ambient air (the source of oxygen) and the muscle, which is the localization of oxygen consumption. This presentation will particularly focus on the specificities of children's ventilatory response to exercise. For example, breathing pattern strategy during exercise is a result of feed back and feed forward mechanisms on the pontomedullary rhythm and pattern generator that produce the output to the respiratory muscles. Ventilation (VE) is the product of a volume parameter (tidal volume:Vt) that is under a strict chemical control and a respiratory timing parameter (breathing frequency: f), which is a non-metabolic function of breathing. Young children compared to adults hyperventilate during exercise. This hyperventilation may be partly explained by a lower CO₂ set point at the central chemoreceptor level, which increases with growth. Although this physiological observation is relevant to explain during exercise the decrease of VE per kg of body mass with age, it fails to explain why the value of Vt per kg of body mass remains constant. Thus other associated mechanisms can be speculated to explain why this lower ventilatory efficiency observed in young children is mainly due to a high value of breathing frequency. In this topic three hypothesis are proposed: young children may present: a) a lower respiratory muscle threshold fatigue which may produce a rapid but not shallow breathing pattern during exercise, b) an altered perception of ventilatory effort during exercise which may modify the cortical respiratory premotor activity, c) an immature response of the pontomedullary rhythm and pattern generator to ventilatory load during exercise. Respiratory pathology can be considered as a model of an additional internal load to the respiratory muscles. When evaluating breathing pattern strategy during exercise in sick children, it seems they present a normal and mature response to ventilatory load, compared to adults. To better understand specificities of ventilatory response to exercise in children, there is a need for additional studies to evaluate changes with growth of respiratory muscles threshold fatigue and its impact on breathing pattern strategy. Furthermore, there is also a clear needfulness of studies which assess the level of dyspnoea sensing in children, taking into account its role as an alarm mechanism for triggering adaptive breathing pattern strategy during exercise.

Physical Activity and Obesity: from the Population to the Patient**Pr Jean-Michel Oppert**

Physical activity unit/Dept of Nutrition, Pitié-Salpêtrière Hospital, University P6, Paris
INSERM U557, Nutritional epidemiology unit, Bobigny, France

Body weight gain over time depends on an extremely complex interplay of behavioural, environmental and genetic factors. It is generally well accepted that physical inactivity is an important factor in the development of obesity, however, this has to be put in the nutritional context of the population under study. Independent of physical activity level, sedentary behaviours, such as screen viewing, have been associated with body weight gain and obesity, in children and in adults. Decreasing sedentary behaviour as well as increasing the level of habitual physical activity may therefore be warranted for obesity prevention. New data suggest the importance of environmental factors, such as physical activity-related built environment, for obesity development. Data in this field have however been produced in only few selected countries and may be difficult to generalize.

In patients, a major benefit of physical activity is the association with better long-term weight maintenance of weight loss. Physical activity has also been shown to substantially decrease the risk of obese subjects for metabolic and cardiovascular disease. A critical question is the optimal volume of physical activity that would allow prevention of weight regain in obese patients. One of the challenges in this area is to better understand how to individualize the counselling and improve adherence over time.

Daily Activities and Body Weight Stability in Children: the Unfortunate Influence of Modernity**Pr Angelo Tremblay**

Departement of Social and Preventive Medicine, University of Laval, Quebec, Canada

The study of the relationship between physical activity participation and the risk of overweight has been traditionally performed by considering the sedentariness-exercise continuum. According to this vision, the active person is less likely to be in positive energy balance compared to the physically inactive person, be it because of the increased energy expenditure of exercise and/or its ability to improve the “matching” of energy intake and expenditure via different biological effects. Recent literature however emphasizes that this perception is not sufficient to explain the impact of human activities on energy balance and body composition.

Since several decades, sleeping habits have changed in a way that daily sleep duration has decreased by at least one hour. In population studies, short sleeping has been related to an increase in body weight. Accordingly, standardized laboratory testing showed that sleep restriction favors a decrease in leptinemia and an increase in plasma concentrations of ghrelin and cortisol. This agrees with the increase in hunger and ad libitum high carbohydrate snack intake that was also documented in this context. Our investigation of variations in sleep duration in children has confirmed the increased risk to be overweight in the short sleeper. In addition, the predictability of variations in body weight by short sleeping was much better compared to that of TV viewing and physical inactivity. Also of interest is the fact that excess weight in the short sleeper child is associated with a preferential abdominal fat deposition. Finally, our research has also demonstrated that suboptimal sleep duration increases the proneness to hypoglycemia which is known to predict weight gain over time.

Another feature of modernity is the growing importance of knowledge-based work in daily activities. This is not so surprising since the productivity and competitiveness of most countries depend on cognitive effort and its related innovation in a context of globalization. For the physiologist, physical and mental work are two activity modalities which differ substantially in terms of the nature of solicited body cells and the related composition of the substrate mix oxidized. We have deduced from these observations that the dependence of mental work on carbohydrate metabolism might lead to a spontaneous increase in energy intake. In a first study to investigate the issue, we observed that a 60 min session of mental work increased hunger and plasma glucose instability. Subsequently, the testing of Laval University female students revealed that a 45 min mental work session had no impact on energy expenditure but increased ad libitum energy intake by 229 kcal following this cognitive effort. More recently, a second study performed in Laval University female students demonstrated that an increase in the intensity of cognitive effort was accompanied by an increase in cortisolemia, glycemic instability, and spontaneous caloric intake. This is concordant with our recent results obtained in young females who are characterized by a greater abdominal fat deposition when they perform more school homework.

In summary, our recent research experience suggests that it is relevant to reconsider the notion of sedentariness which is not only the omission to perform physical activity. In fact, some sedentary activities, such as those requiring a demanding cognitive effort, seem to be worst for the stability of energy balance than doing nothing.

XXVth International Symposium of Pediatric Work Physiology.

**Oral
Presentations**

Exercise Capacity and Pulmonary Function Following Repair of Transposition of the Great Vessels: Atrial Baffle Versus Arterial Switch

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Background: Surgical repairs for D-transposition of the great vessels (DTGA) include the older, less-anatomically preferred atrial baffle (BAFFLE) (Mustard or Senning) or the recent arterial switch (SWITCH). DTGA patients' functional ability may be restricted by both pulmonary and cardiovascular limitations.

Methods: Resting flow volume loops and peak oxygen consumption (VO_{2peak}) were examined to compare pulmonary and cardiovascular outcomes between patients with BAFFLE versus SWITCH repair. Pulmonary function test data were analyzed for BAFFLE (n=31) and SWITCH (n=34) patients. Peak exercise data were analyzed for BAFFLE (n= 38) and SWITCH (n=34) patients. Flow volume loops were analyzed for a restrictive lung disease marker, forced vital capacity (FVC), and obstructive lung disease markers, forced expiratory volume in one second (FEV1.0) and forced mid-expiratory flow rates ($FEF_{25-75\%}$). Pulmonary data is expressed as the percent of predicted value excluding FEV1.0/FVC ratio. All data were size and age-adjusted. ANOVAs and Pearson chi-square analysis were used to analyze the data.

Results: Lung disease (restrictive and/or obstructive) was present in 51% of patients post-DTGA repair despite the surgical repair (BAFFLE 58% and SWITCH 44%; $p=0.26$). Restrictive lung disease occurred more frequently in BAFFLE (45%) versus SWITCH (26%) patients, although not statistically significant ($p=0.12$). BAFFLE patients attained a lower FVC than SWITCH patients ($78.6\pm14.5\%$ versus $85.2\pm11.9\%$; $p<0.05$). There were no differences between groups in FEV1.0 (80.3 ± 15.4 and $85.8\pm13.4\%$ ($p=0.13$), $FEF_{25-75\%}$ ($89.1\pm28.7\%$ versus $89.3\pm26.4\%$; $p=ns$) or FEV1.0/FVC ratio (86.6 ± 73.5 versus 87.3 ± 53.1 ; $p=0.71$, respectively). BAFFLE patients had a lower peak oxygen consumption (VO_{2peak}) (27.41 ± 6.78 ml/kg/min versus 37.12 ± 8.28 ml/kg/min; $p<0.01$) and a lower percentage of predicted VO_{2peak} than SWITCH patients ($65.89\pm15.0\%$ versus $84.8\pm18.7\%$; $p<0.01$).

Discussion: The majority of patients after surgical repair for DTGA have significant lung disease. Restrictive lung disease tends to be more frequent in patients post-BAFFLE than SWITCH repair. BAFFLE patients have lower VO_{2peak} values than SWITCH patients which may be attributed to their anatomically less-preferable repair and/or their greater frequency of restrictive lung disease. The VO_{2peak} of DTGA patients following BAFFLE or SWITCH repair may be limited by both chronic lung disease and cardiac function. Clinicians should consider identification and treatment of lung disease in DTGA patients.

Cardiac Function During Exercise in Obese Prepubertal Boys: Effect of Degree of Obesity

A. Vinet, L. Karpoff, A. Perez-Martin, C. Oudot, P. Obert, and I. Schuster

Laboratoire de Physiologie et Physiopathologie des Adaptations Cardiovasculaires à l'Exercice, EA4278, Faculté des Sciences, Université d'Avignon, France

Background: Resting echocardiographic studies have reported morphologic abnormalities in obese children and adolescents, whereas data on systolic and, particularly, on diastolic function are still scarce and discordant. Exercise dysfunction precedes resting abnormalities and exercise testing offers an opportunity for early detection of cardiac dysfunction. The purposes of the present study were therefore 1) to assess cardiac morphology and function at rest in prepubertal boys with different degrees of obesity, and 2) to describe the dynamics of diastolic and systolic function from rest to maximal exercise using conventional echocardiography and tissue Doppler imaging taking into account the severity of obesity.

Methods: Eighteen obese (10 with first degree obesity and 8 with second degree obesity according to French curves, body mass index: 23.3 ± 1.8 and 29.0 ± 2.0 kg.m⁻², respectively) and 17 lean controls (BMI = 17.6 ± 0.6 kg.m⁻², $p < 0.001$), aged 10-12 years were recruited. After resting echocardiography, all children performed a maximal exercise test. Regional diastolic and systolic myocardial velocities were acquired at rest and each workload. Stroke volume and cardiac output were calculated.

Results: At rest, obese boys had greater left-ventricular diameters and LV mass. Boys in the first degree obese group showed no diastolic or systolic dysfunction, whereas boys with second degree obesity showed subtle diastolic dysfunction. During exercise, both obese groups showed greater stroke volume and cardiac output. First degree obese boys exhibited greater systolic and diastolic tissue Doppler velocities than controls, whereas second degree obese boys had lower diastolic tissue velocities whatever exercise intensity and lower fractional shortening at high exercise intensities than controls.

Discussion: No impairment in diastolic or systolic function is noticed in prepubertal boys with first degree of obesity. Enhanced regional myocardial function response to exercise was even demonstrated in this population, suggesting in the early stage of mild obesity adaptive compensatory cardiac changes. However, when obesity becomes more severe, impaired global and regional cardiac function at rest and during exercise can be observed.

Association Between High Intensity Physical Activity and Vascular Function in 9-11 Year Olds.

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Background: The prevalence of obesity and physical inactivity in Western countries has increased rapidly. Both are modifiable risk factors for cardiovascular disease; a process which has its origins in childhood. The earliest manifestation of the disease is endothelial dysfunction, which is evident in children as young as 6 years old. Few studies have attempted to determine the relationship between physical activity, cardiorespiratory fitness, body composition and vascular function in children. The present study therefore aimed to examine the relationships between change in artery health and its predictors in children.

Methods: This was an observational cohort study. We studied 109 nine-eleven year old children (66 female, 43 male). All children had flow mediated dilation (FMD), an index of endothelial function, assessed in the brachial artery. FMD was normalised for the eliciting shear rate stimulus for each subject (FMDSR_{AUC}). Participants had peak VO₂ assessed on a treadmill ergometer, body composition assessed by Dual Energy X-Ray Absorptiometry (DXA), and physical activity (PA) measured over 7 days at 5 second epochs using uniaxial accelerometry. Measurements were taken at baseline and repeated 16 weeks later, to assess whether changes in the above physiological variables or behaviour patterns are related to change in FMD. Change (Δ) scores were calculated and correlations were performed along with stepwise backwards linear regression to identify predictors of change in FMD.

Results: Across all measured variables no sex differences existed, data was therefore pooled. FMDSR_{AUC} Δ was correlated with high intensity PA Δ ($r=0.29$, $p=0.002$), average counts per minute Δ ($r=0.25$, $p=0.009$) and daily steps Δ ($r=0.202$, $p=0.034$). There were no significant associations between body fat or fitness and FMD scores. Regression analysis revealed high intensity PA Δ was the only predictor of FMDSR_{AUC} ($r^2=0.116$, $p<0.001$).

Discussion: Change in FMD score in 9-11 year old children is associated with change in high intensity PA. The data also suggests that FMD is unaffected by changes in body composition, cardiorespiratory fitness levels and low to moderate intensity PA.

Pacemaker Optimization in Patients after Fontan Surgery

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Background: With the high success rate of Fontan surgery for functional single ventricle anatomy, emphasis in pediatric cardiology has shifted from survival to long-term cardiac function. Given that Fontan patients are characterized by diastolic dysfunction, evaluation of atrioventricular (AV) synchronization and atrial contribution to ventricular filling are considered important factors influencing cardiac function. Our objectives were to assess the importance of AV synchrony in Fontan patients requiring pacing, as well as to determine the optimal pacemaker mode (atrioventricular synchronized DDI, versus ventricular pacing alone VVI) in those patients with dual chamber pacemakers.

Methods: Eight Fontan patients (4 male; 6 children) aged 18.6 ± 4.6 years with dual chamber pacemakers participated in this study. At rest, AV delay was sequentially tested from 50-300msec in 50msec increments and the optimal delay was determined as the one yielding the best cardiac output based on impedance cardiography. Cardiac output was remeasured by an inert gas rebreathing technique, systemic vascular resistance (SVR) calculated and ventricular function assessed by echocardiography at rest, and through two levels (25W:125HR and 50W:150HR) of recumbent cycle exercise, in DDI (using the optimal AV delay) and VVI modes, in random order.

Results: Cardiac output was optimal at long AV durations (>120 msec) for 5 patients and short AV intervals (<120 msec) for 3 patients. Aortic velocity time integral (aVTI), used as an echocardiographic surrogate for cardiac output, was significantly greater in DDI vs VVI mode at 125HR, for both pulse wave and continuous wave Doppler ($p<0.04$ and $p<0.02$ respectively), with no significant differences at rest or 150 level. Trends to lower SVR in exercise compared to rest and association of lower SVR with greater differences in aVTI between pacing modes were seen.

Discussion: The findings of this pilot study suggest that individualized AV delay settings may be more appropriate than nominal device settings for Fontan patients with dual chamber pacemakers. A small but significant improvement in heart function with atrioventricular synchronized pacing in this group warrants further study with a larger sample of Fontan patients. Application of a dual-chamber pacing system with individualized programming of AV interval may be indicated in such patients.

Gender Influence on Myocardial Function During Maximal Cycle Exercise in Youth

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Background: Increases in systolic and diastolic function are critical to the normal cardiovascular responses to exercise. Superior inotropic function in males compared to females during exercise has been described in adults and could underlie small gender-related differences in maximal stroke volume (SV) described in prepubertal subjects. This study compared left ventricular (LV) functional responses to progressive maximal upright cycle exercise in 10 healthy boys (15.3±0.5 years) and 9 girls (15.0±0.6 years) using Doppler ultrasound techniques.

Methods: Body composition was estimated by air displacement plethysmography. Subjects pedaled at 60 rpm to exhaustion with 3-minute stages of 35 W load increments with standard measures of gas exchange variables. SV was estimated by Doppler interrogation of aortic flow velocity. Systolic function was examined by peak aortic flow velocity and ejection flow rate (adjusted for aortic valve area), and diastolic function by pulse-wave transmitral E velocity, tissue Doppler E' velocity (adjusted for LV size), and E:E' as a marker of LV filling pressure.

Results: Average peak $\dot{V}O_2$ was greater in the boys (44.6±6.6 ml kg⁻¹ min⁻¹) than the girls (36.0±5.1 ml kg⁻¹ min⁻¹). No significant gender differences were observed in maximal heart rate (boys 195±11 bpm, girls 191±8 bpm). Maximal SV was 78±19 ml and 62±8 ml for the boys and girls, respectively (p<0.05), but mean maximal SV per fat free mass was similar in the two groups (1.53±0.26 versus 1.51±0.14 ml kg⁻¹, respectively). At maximal exercise, boys and girls demonstrated similar systolic ejection rate (125±28 and 131±10 ml s⁻¹ cm⁻², respectively) and peak aortic velocity (208±45 and 196±12 cm s⁻¹, respectively). No significant group differences were observed in E, E', or E:E' at rest or during exercise:

	E (cm s ⁻¹)		Adj. E' (cm s ⁻¹ mm ⁻¹)		E:adj E'	
	Rest	Max	Rest	Max	Rest	Max
Boys	72±9	149±23	2.5±0.5	5.8±0.5	29.2±7.5	26.2±5.6
Girls	75±17	155±18	2.6±0.5	6.0±0.5	29.9±9.9	26.3±3.4

Discussion: This study failed to reveal qualitative or quantitative differences between early adolescent boys and girls in ventricular systolic and diastolic functional responses to maximal cycle exercise.

The Test/re-Test Reliability of a Field-Based Fitness Test Battery in 9-10 Year Old Schoolchildren

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Background: The purpose of this study was to assess the test/re-test reliability of a field-based fitness test battery for use in 9-10 year old schoolchildren.

Methods: Fitness tests were taken from the EUROFIT test battery (Adam et al., 1998), with an additional test included to assess muscular endurance (speed bounce) and completed using standard techniques (Taylor et al., 2004). One-hundred and sixty-six 9-10 year old (mean age: 9.6 ± 0.3 years) schoolchildren completed test and re-test sessions. Group, order, venue, day, time, equipment and testing personnel were standardised between test and re-test.

Results: limits of agreement and ICC values can be viewed in Table 1. Cronbach's α and ICC analysis described acceptable levels (>0.8) of reliability for most tests, including anthropometrics and the 20m multi-stage shuttle runs test (20mMST). Limits of agreement analyses described wide limits for a number of tests, including 20mMST.

Table 1. Mean test and re-test results with limits of agreement

Measure	Mean Test	Mean Re-test	95% Limits of Agreement	ICC (average measures)
Stature (cm)	137.9	137.8	-7 to 7.3	0.92
Body mass (kg)	35.0	34.8	-3.9 to 4.4	0.99
BMI (kg/m^2)	18.2	18.0	-3.4 to 3.9	0.93
Triceps Skinfold (mm)	15.1	15.5	-3.2 to 2.5	0.99
Subscapular Skinfold (mm)	10.4	10.3	-7.3 to 7.6	0.93
20mMST (shuttles)	32.4	32.9	- 21.3 to 20.3	0.88
Right Hand Grip Strength (kg)	15.8	15.1	-4.3 to 5.5	0.84
Left Hand Grip Strength (kg)	15.1	14.5	-4.4 to 5.5	0.81
Sit and Reach (cm)	16.8	16.4	-8.4 to 9.1	0.83
10 x 5m Shuttle Runs (seconds)	23.4	23.8	-4.2 to 3.8	0.79
Standing Broad Jump (cm)	124.5	119.2	-27.3 to 37.8	0.84
Speed Bounce (bounces)	20.9	22.7	-9.5 to 5.9	0.87
Plate Tapping (seconds)	14.7	14.9	-8 to 7.5 s	0.38

Discussion: Findings suggest that based solely on ICC and Cronbach's α values most field-based fitness tests are reliable for use. However, limits of agreement results show varied levels of reliability, thus highlighting the need for more than one assessment of reliability in test/re-test analysis. Caution is urged when interpreting data where wide limits of agreement are apparent.

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Repeated Sprint Test Performance Indices and Aerobic Fitness in Normal Weight and Overweight Children

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Background: Aerobic and anaerobic capacities are thought to be reduced in obese compared to normal weight children. As a consequence, patterns of physical activity among overweight and obese children are usually characterized by brief segments of exercise, performed at different intensities and separated by rest intervals of different durations. Therefore, it would be valuable to assess Repeated Sprint Test (RST) indices and their relationship to aerobic fitness in this population. Surprisingly, however, to the best of our knowledge, this relationship has never been studied in obese or overweight children.

Methods: We determined the relationship between aerobic fitness (distance in 20 m Shuttle Run) and performance indices (fastest sprint time - FS, total sprint time – TS, and performance decrement - PD) of 12 X 20 m repeated sprint tests (RST) in normal weight (35.9 ± 6.3 kg) and overweight (52.5 ± 10.0 kg) pre- and early-pubertal children.

Results: Aerobic fitness was significantly higher ($p < 0.05$) in the normal weight (738.9 ± 393 m) compared to the overweight children (468.6 ± 107 m). Fastest sprint time and TS were significantly faster in normal weight (4.26 ± 0.49 and 52.99 ± 4.95 s) compared to overweight children (4.71 ± 0.65 and 60.30 ± 9.05 s). Significant negative correlations were found between aerobic fitness and TS ($r = -0.802$), FS ($r = -0.762$) and PD ($r = -0.670$) of the RST in normal weight children. Significant negative correlations were also found between aerobic fitness and TS ($r = -0.767$) and FS ($r = -0.738$) of the RST in overweight children. Aerobic fitness was significantly higher among males compared to females in normal and overweight children while TS in the RST was significantly faster and PD was significantly lower among males in normal and overweight children.

Discussion: The results indicate that the aerobic fitness as well as anaerobic capabilities of normal weight children are significantly higher than overweight children. The results also indicate that aerobic fitness plays an important role in intense intermittent activity in normal weight and overweight children. Aerobic and anaerobic characteristics of males are significantly higher than females in normal and overweight children.

Contributing Factors to Performance on the Leger Shuttle Run Among Children

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Background: Field assessments of aerobic capacity are an important element in epidemiologic investigations of children's physical activity and heart health. Among the most commonly used methods is the Leger shuttle run. While the assessment is straightforward this test is not without complexity. Children must be able to run efficiently, stop and change direction effectively, judge their speed, and maintain a high level of motivation. This investigation attempted to decipher the contributions that the following factors: anthropometric variables – which might affect biomechanical efficiency; psychological variables – motivation and self-efficacy; and motor proficiency may play in performance on the Leger.

Methods: Results from 190 children (100m, 90f) in Grade Eight (mean age 13.4) from six schools in the Niagara Region of Ontario Canada were analyzed. All children were familiar with the Leger and were evaluated for self-efficacy using the Children's Self-perceptions of Adequacy in and Predilection for Physical Activity (CSAPPA) scale, physical activity (Participation Questionnaire), height, weight, leg length, hip girth, and motor proficiency (Bruininks-Oseretsky). Immediately following the test children rated their perceived exertion (RPE) and motivation (RPM).

Results: Multiple regressions were performed using Leger Stage attained as the dependant variable and, as ANOVAs revealed that boys performed significantly better than girls on the Leger, were run separately by gender. After controlling for age and weight, each of self-efficacy, motivation, and hip to leg-length ratio added significantly to the R^2 of .52 for girls while physical activity levels, motivation, and hip to leg length ratio added significantly to the R^2 for of .62 for boys. Motor proficiency played no role for either gender.

Discussion: These findings suggest that the anthropometric characteristics of a child, along with their psychological profile relative to physical activity each play a substantial role in performance on the Leger. As girls have significantly higher hip to leg-length ratios and commonly report lower self-efficacy toward physical activity these findings provide an additional perspective from which to interpret gender differences found in field-based studies of aerobic capacity.

Muscle Deoxygenation Response at the Onset of Moderate-Intensity Exercise in Children and Adults

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Background: Some studies demonstrated that younger children displayed a faster pulmonary oxygen uptake (VO_{2p}) than adults at the onset of moderate intensity exercise. This faster adjustment may be due to a greater oxidative enzyme activity at the muscle level. The aim of the study was to examine the temporal relationship between the adaptation of muscle O_2 consumption, as reflected by the VO_{2p} phase 2 response, and deoxygenation of the vastus lateralis muscle measured with Near Infrared Spectroscopy during moderate intensity constant load cycling exercise in children and adults.

Methods: Eleven prepubertal boys (10.3 ± 0.9 yrs; 42.8 ± 4.7 ml.kg⁻¹.min⁻¹) and 12 men (23.9 ± 3.9 yrs; 46.6 ± 5.9 ml.kg⁻¹.min⁻¹), non trained and non obese, volunteered to participate in the study. They performed on cycle-ergometer a maximal graded exercise to determine the power associated to ventilatory threshold (PVT1) and four constant load exercises at 90% of PVT1. During each trial, VO_{2p} and muscle deoxygenation (HHb) were continuously monitored. VO_{2p} phase 2 and HHb kinetics were modelled and characterized by time to achieve 63% of the phase amplitude (τ) and 63% of the overall signal (mean response time – MRT) respectively.

Results: Mean values of τ for VO_{2p} ($p < 0.001$) phase 2 and of MRT for HHb ($p < 0.01$) were significantly lower in children (11.6 ± 3.5 s and 13.5 ± 1.4 s) than in adults (24.9 ± 4.2 s and 20.3 ± 6.8 s).

Discussion: Children presented significantly faster muscular VO_{2p} adjustment associated with a faster HHb kinetic at the onset of than in adults. Thus these results support the enhanced muscular oxidative metabolism in children.

Effect of Pedal Rate on Pulmonary Oxygen Uptake Kinetics during High-Intensity Exercise in Trained Adolescent Cyclists

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Background: Exercise above the lactate threshold results in a slow component in $p\dot{V}O_2$ that increases O_2 cost over time. This component in healthy adults is related to markers of muscle activity and is reported to be greater (~ 17 % of the total exercise $\dot{V}O_2$) at higher pedal cadences (> 100 rpm). Therefore, investigating the effect of different pedal rates on the $p\dot{V}O_2$ response in younger populations would provide important mechanistic insights into the basis for the $p\dot{V}O_2$ slow component in adolescents. We hypothesised that there would be a significant difference in the $p\dot{V}O_2$ kinetic parameters between low and high pedal rates in a group of young cyclists.

Methods: Seven trained males (mean age 16.3, $s = 0.9$) completed two 6 min 'step' transitions to very heavy exercise at a cadence of 55 rpm and 115 rpm. The exercise power output was set at 70% of the difference between the pedal rate-specific gas exchange threshold (GET) and peak $\dot{V}O_2$. Each participant's breath-by-breath responses were interpolated to 1 s intervals, time aligned, averaged, and fit using a single exponential model with a delay term to reveal parameters of the $p\dot{V}O_2$ kinetic response. The $p\dot{V}O_2$ slow component was computed as the difference between the amplitude of the primary component and the end-exercise $\dot{V}O_2$ and was expressed as the percent contribution to the total change in $\dot{V}O_2$.

Results: There were no significant differences in either the phase II time constant (55 rpm: 30 ± 5 s, 115 rpm: 29 ± 8 s, $P = 0.808$), or the relative amplitude of the $p\dot{V}O_2$ slow component (55 rpm: 13 ± 3 %; 115 rpm: 15 ± 3 %, $P = 0.056$) between pedal rates. The 'delta' efficiency, expressed as the change in $\dot{V}O_2$ above baseline per unit increment in work rate, was significantly greater at 115 rpm compared to 55 rpm (10.7 ± 1.2 vs. 12.6 ± 0.6 mL·min⁻¹·W⁻¹ respectively, $P = 0.001$).

Discussion: In contrast to adult data, our findings indicate a limited influence of pedal rate on the $p\dot{V}O_2$ kinetic response to high-intensity exercise in young trained cyclists. These results indicate possible training effects at higher pedal rates related to the recruitment of specific muscle fibre types.

Arm Cranking and Cycloergometer Wingate Test Performed by Differently Matured Swimmers: what is the Importance of Power Results Normalization?

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Background: Wingate test is probably the most widely used method for anaerobic performance evaluation. The test output gives maximal (max), mean and minimum (min) absolute and relative power (P) values. The need for the normalization of the force and power values is not a close discussion and the use of the body weight is not unanimously accepted. Indeed, it was not yet answered if the possible insufficiency of the weight as normalization factor is independent of the test performed. The present work intends to think over that question.

Methods: Ninety swimmers of three maturational status (30 pre-pubertal, 30 pubertal and 30 post-pubertal, been 15 males and 15 females in each group) participated in the present study. Swimmers performed two 30s Wingate tests in consecutive days, one arm cranking and one cycloergometer. Max, mean and min P values were compared between groups (ANOVA) and genders (independent samples T-Test), both for absolute and relative values. The total number of significant differences obtained using absolute values was compared with the total number of differences obtained using relative values.

Results: The results obtained could be observed in Table 1.

Table 1. Comparison of the total number (n) of differences obtained using absolute and relative power values.

	Arm cranking		Cycloergometer	
	absolute	relative	absolute	relative
Pmax	9	7	9	9
Pmean	8	5	9	8
Pmin	8	3	8	7
Total n	25	15	26	24

In arm cranking, a large number of results changed with the normalization of the P values. Changes were mainly observed for pre-pubertal group.

Discussion: Using body weight as a normalization factor could not be accurate for inter and intra group comparisons. Moreover, present study seems to reveal that the effects of normalization when body weight is used vary with both the test performed and the swimmers maturation. Those facts are of particular concern, once conclusions are dependent of statistical results.

Familiality in Metabolic Syndrome Indicators. A Study with Azorean Families

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Background: Family members share a lot in common, not only cultural and behavioral traits, but also genes identical by descent. As cardiovascular risk factors are highly prevalent in many populations, with highly negative implications in health, we wanted to identify prevalence's of family members with risk factors in the Metabolic syndrome (MS), and (2) to estimate the magnitude of genetic factors of the five indicators of the MS in families from the Azores archipelago, Portugal.

Methods: We sampled 133 nuclear families from Azores islands (mean ages: fathers=43.17±6.14; mothers=39.78±5.60; sons=12.90±2.56; daughters=13.40±2.66). MS indicators include: waist girth (WG), glucose (GLU), high density lipoproteins cholesterol (HDL-C), triglycerides (TRI), and systolic blood pressure (SBP). Assessments were conducted by specialized personnel (nurses) in Health Centers, and determinations of GLU, HDL-C and TRI was done using standard biochemical procedures with subjects in fasting conditions. WG and SBP were also measured by nurses during subject's visits to Health Centers. All subjects gave their written consent. NCEP (2001), and Cook et al (2003) cut-off values were used to identify adults and youngsters at risk, respectively. Estimation of genetic factors was done in SOLAR, 4.0 using maximum likelihood estimation procedures and a t distribution when a high kurtosis was found in a variable. All estimates were adjusted for age, sex, and their interactions considering also a non linear effect of age.

Results: Mean values found in all subjects for all MS indicators were: WG=91.81±14.69;SBP=117.03±17.31;HDL-C=57.76±20.58;TRI=125.87±103.24;GLU=94.84±29.83. Prevalences of MS in fathers were 34.9%, 26% in mothers, 11.9% in sons, and 3.6% in daughters. After adjustments for all covariates (ranging from 0 to 23% of the total variance), heritability estimates were: WG=0.28±0.11, p=0.005; SBP=0.61±0.11, p<0.001; HDL-C=0.77±0.09, p<0.001; TRI=0.56±0.12, p<0.001; GLU=0.64±0.13, p<0.001.

Discussion: We found high prevalences of risk factors in fathers and mothers, moderate in sons, and low in daughters. All MS indicators showed moderate to high genetic dependency. This calls for adequate clinical, nutritional and physical activity interventions targeted at families at risk. In addition, these programs have to be family wise, given their specific clustering (genetic and environmental) so that they may be more effective.

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Ace I/D Genotype Does Not Modify The Longitudinal Relationship Between Physical Activity And Blood Pressure During Childhood

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Background: Our understanding of the inter-relationships among habitual, free-living physical activity and resting blood pressure (BP) in children are based mainly upon cross-sectional studies. In addition, little is known about the influence of candidate genes on the development of BP in children.

Purpose: The purpose of this study was to investigate the independent effects of physical activity and the angiotensin converting enzyme insertion/deletion (ACE I/D) genotype on BP development; whilst accounting for the confounding effects of growth.

Methods: Subject were 157 (75 girls, 77 boys) children participating in a mixed-longitudinal study. Age at entry was 4 to 8 years of age. Stature, body mass, body fatness, resting BP and moderate-to-vigorous physical activity (MVPA) were assessed annually for 3 to 4 years. Buccal cell samples were genotyped using newly developed PCR-RFLP tests for two SNPs (rs4341 and rs4343) in complete linkage disequilibrium with the ACE I/D polymorphism. Data were analyzed using multi-level random effects models.

Results: Levels of resting BP increased with chronological age, and MVPA decreased in the older age groups. The frequency of ACE I/D genotypes was approximately 30% for both DD and II with the I/D genotype being the most frequent (41.7%). There was no significant influence of MVPA on BP development in boys or girls, even when removing fat mass as a confounder. Furthermore, the ACE I/D genotype had no significant influence on BP development nor modified the relationship between MVPA and BP development.

Discussion: In conclusion, the ACE I/D genotype had no influence on BP development during childhood. Further study is required to examine if the influence of ACE I/D on BP occurs during adolescence or not until adulthood.

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Metabolic Syndrome and its Genetic Factors: A Study of Twins from Madeira and Porto Santo Islands, Portugal

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Background: Overweight and sedentary lifestyles are highly prevalent in modern societies. A related co-morbidity is the cluster of several cardiovascular risk factors known as metabolic syndrome (MS). Its prevalence is also increasing in most countries. Yet, a clear picture of its determinants (biological and environmental) is not yet available. We conducted a study in young Portuguese twins to address the question of the relevance of genetic factors in explaining the total variance observed in the five indicators of the MS.

Methods: Participants consisted of 207 twin pairs (84 MZ and 123 DZ) from 3 to 18 years of age. Height, weight and waist girth (WG) and systolic blood pressure (SBP) were measured according to standard protocols. Blood samples were collected from all subjects in fasting conditions to assess, according to standardized laboratory techniques, the levels of HDL-cholesterol (HDL), glucose (GLU) and triglycerides (TRI). Ferranti et al. (2004) cut-off values and other suggestions were used to determine the presence of risk in all 5 MS indicators across the considered age range. All MS indicators were adjusted for age, age², sex and respective interactions. Data were analyzed using STATA 10 and TWINAN92 software.

Results: Intra-pair correlations for the MS indicators were: SBP, $t_{MZ}=0.56\pm0.07$; $t_{DZ}=0.31\pm0.08$; GLU, $t_{MZ}=0.56\pm0.08$; $t_{DZ}=0.31\pm0.08$; HDL, $t_{MZ}=0.85\pm0.03$; $t_{DZ}=0.53\pm0.06$; TRI, $t_{MZ}=0.71\pm0.05$; $t_{DZ}=0.41\pm0.07$; WG, $t_{MZ}=0.81\pm0.03$; $t_{DZ}=0.26\pm0.08$. Model fitting results suggested the presence of significant genetic factors (h^2) in all MS indicators: SBP, $h^2=0.59$; GLU, $h^2=0.55$; HDL, $h^2=0.34$; TRI, $h^2=0.61$; WG, $h^2=0.80$. The importance of unique environmental factors was also evident as this component explained between 22 and 45% of the total phenotypic variance.

Discussion: (1) Additive genetic factors explained between 34 and 80% of the total variance of the 5 MS phenotypes; (2) the largest part of the common environmental variance was accounted for by HDL (explaining 44%), and unique/random variance explained between 22 and 45%. This information calls for some care in devising intervention programs to reduce these risks factors, because not all subjects will respond similarly. This heterogeneity of response should also be considered when designing nutritional advice to people with MS, although these issues can be resolved only with a genotype*environment interaction study.

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Effect of Continuous and Intermittent Exercise on Immune Cell Responses in Children With and Without a Chronic Inflammatory Disease

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Background: The optimal type, duration and intensity of exercise for children with a chronic inflammatory disease (CID) remains unknown. A complicating factor is that exercise induces an inflammatory response in healthy children. How this translates to children with CID remains unknown, but a clearer understanding of exercise and inflammation in this population would help inform evidence-based exercise prescription.

Methods: To date, six healthy children (HG; mean (range), age: 12.3 (9-17)) and three children with a CID (DG; 1 cystic fibrosis, 2 Crohn's disease; 14.7 (11-17)) of similar weight and height have participated in this study. The first session involved determination of peak mechanical power (PP). During their second and third sessions, children performed one of two exercise protocols consisting of either 2x30-min bouts of continuous cycling at 50% PP, or 6 sets of 4x15-sec bouts of intermittent cycling at 100% PP. Venous blood was drawn at rest (RT), at the mid-point (EX-MID) and end of exercise (EX-END), and after 30 (REC-30) and 60 min (REC-60) of recovery to determine changes in neutrophil, lymphocyte, and monocyte counts.

Results: With intermittent exercise, changes in neutrophil counts were similar between groups, and had returned to resting levels by REC-30. With continuous exercise, changes in neutrophil counts at EX-MID and EX-END were similar in HG and DG; however, during recovery, counts in DG continued to increase (mean change from RT \pm SD at REC-30: $4.0 \pm 2.0 \times 10^9/L$ and REC-60: $5.5 \pm 2.5 \times 10^9/L$), while counts in HG were maintained (REC-30: $1.4 \pm 1.4 \times 10^9/L$, REC-60: $2.4 \pm 2.3 \times 10^9/L$). Lymphocyte and monocyte responses during and following both types of exercise were not different between groups and returned to resting levels by REC-30.

Discussion: Recovery of these immune cells appears rapid in healthy children. However, neutrophil counts continued to increase following continuous cycling in children with CID, which may reflect a lack of habituation to prolonged exercise. In contrast, intermittent exercise did not have prolonged effects in this group, suggesting that intermittent activity may minimize the exercise-induced inflammatory response in children with CID.

Anabolic Hormones and Inflammatory Markers in Elite Male and Female Adolescent Payers Following a Volleyball Practice

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Background: The effect of a single exercise and/or exercise training on the GH-IGF-I axis and inflammatory cytokines was studied mainly in adults participating in individualized endurance-type sports. The gender-specific effect of exercise on these systems in adolescents is unknown.

Methods: Therefore, the purpose of this study was to evaluate the effect of a typical volleyball practice on anabolic (GH, IGF-I and testosterone) and catabolic hormones (cortisol), and inflammatory mediators (IL-6) in elite, national team level, male (n=14) and female (n=13) adolescent volleyball players (13-18 years, Tanner stage 4-5). Exercise consisted of a typical one hour volleyball practice. Blood samples were collected before and immediately after the practice.

Results: Exercise led to significant increases in GH (0.2 ± 0.1 to 2.7 ± 0.7 and 1.7 ± 0.5 to 6.4 ± 1.4 ng/ml, in males and females respectively, $p < 0.05$ for both), testosterone (6.1 ± 0.9 to 7.3 ± 1.0 and 2.4 ± 0.6 to 3.3 ± 0.7 ng/ml, in males and females respectively, $p < 0.05$ for both), and IL-6 (1.1 ± 0.6 to 3.1 ± 1.5 and 1.2 ± 0.5 to 2.5 ± 1.1 pg/ml, in males and females respectively, $p < 0.002$ for both). Exercise had no significant effect on IGF-I, IGFBP-3 and cortisol levels. There were no gender differences in the hormonal response to training.

Discussion: Changes in GH and testosterone following the volleyball practice suggest exercise-related anabolic adaptations. The increase in IL-6 may indicate its important role in muscle tissue repair. These changes may serve as an objective, quantitative tool to monitor training intensity in unique occasions in team sports.

Components of the Metabolic Syndrome and Cytokines in Adolescents

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Background: Increased adiposity has been associated with systemic inflammation and the production of specific cytokines linking obesity to insulin resistance and cardiovascular disease. This potential mechanism has been less studied in children. The purposes of this study were 1) to evaluate the associations of different adipokines (resistin, adiponectin, TNF- α and IL-6) with blood pressure and lipid profiles, and 2) to evaluate if these associations were dependent on weight status.

Methods: Sixty normal weight (BMI <75th %tile) and sixty overweight (BMI>95th %tile) adolescents ages 10-14 years participated in this study. Resting systolic and diastolic blood pressure (SBP, DBP) were obtained in duplicate. Circulating resistin, adiponectin, TNF- α , IL-6, total (TC), LDL, HDL- cholesterol, and triglycerides (TG) were measured from fasting plasma samples. In the regression analyses BMI percentile was dummy coded 1= <75th %tile and 0= > 95th %tile.

Results: Simple correlations showed that SBP was significantly correlated ($p<0.05$) with adiponectin ($r=-0.185$), resistin ($r=0.207$), and IL-6 ($r=0.238$); HDL was significantly related to adiponectin ($r=0.398$) and TNF- α ($r=-0.227$). TG was only related to adiponectin ($r=-0.292$, $p<0.05$). Multiple regression models controlling for gender and ethnicity indicated that SBP was associated with adiponectin ($R^2=0.075$, $p<0.05$), resistin ($R^2=0.072$, $p<0.05$), and IL-6 ($R^2=0.098$, $p<0.05$). These associations were independent of weight status except for resistin. Regression models showed the association between HDL and adiponectin was stronger in overweight versus normal weight youth ($p<0.05$). Triglycerides were only related to adiponectin ($R^2=0.176$, $p<0.05$) and this association disappeared when including weight status in the model.

Discussion: Similarly to adults, blood pressure and HDL are associated with adipokines in adolescents. From all the studied adipokines, adiponectin was the one associated with most of the components of the metabolic syndrome; perhaps because of its production by the adipose tissue. Some associations are dependent on weight status. Particularly, higher concentration of adiponectin is associated with higher concentration of HDL in overweight adolescents, certainly a protective mechanism for cardiovascular disease. However, the mechanism between resistin and blood pressure appears to be independent of body fat and warrants further study.

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Acute Hormonal Response of Male and Female Adolescents to a Taekwondo Fights Simulation Day

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Background: Taekwondo is characterized by discontinuous explosive, rapid movements and requires anaerobic and aerobic power. Little is known about the physiologic and endocrine response of young competitors to series of Taekwondo fights.. Thus, we examined hormonal response of males and females Taekwondo athletes to a fights simulation day.

Methods: Twenty three athletes (M=13; F= 10) 13.9 ± 1 yr , belonging to the junior Israeli national team participated in the study. Body weight, height, and LBM was 49 ± 9.9 , 50 ± 6.8 kg, 161.0 ± 13.7 , 158.0 ± 4.7 cm, 42.1 ± 1.8 , 38.0 ± 2.8 kg, for boys and girls, respectively. Sexual maturation based on Tanner scale was 3.7 ± 1.1 for males and 3.2 ± 0.8 , for females. Blood samples for hormone analysis were taken at early morning before and again immediately after the fights. Finger blood for lactate analysis was taken immediately after warm-up towards the first fight and again immediately after the third fight. The fights simulation day was managed by certified referees.

Results: Lactate level at the end of the third fight was 7.1 ± 2.7 and 8.6 ± 1.7 mmol/l in males and females, respectively. IGF-1 decreased from 349 ± 102 to 321 ± 96 ng/ml in males ($p < 0.05$) and from 401 ± 84 to 380 ± 77 ng/ml in females (N.S). Cortisol increased from 18.0 ± 3.7 to 19.3 ± 7.6 mcg/dl in males and from 20.4 ± 4.0 to 22.8 ± 5.1 mcg/dl in females. Testosterone decreased significantly after the third compared to first fight in males ($p < 0.05$) with no change in females. Free-androgen index (FAI) dropped markedly in males (from 32.4 ± 25.9 to 10.4 ± 10.8) but not in females. LH and FSH although decreased slightly in both genders, did not reach level of significance.

Discussion: Based on IGF-1 and testosterone response to a sequence of Taekwondo fights, it is suggested that under similar physical stress conditions, the anabolic response of female competitors is greater compared to males, reflecting a more efficient recovery phase in the formers. These differences should be considered when developing a sport-specific conditioning program for both male and female athletes.

Gender Specific Associations Between Components of Sedentary Behaviour, Physical Activity and Body Fatness In 8-10 Year Old Children Reporting High Media Usage

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Background: Studies examining associations between media use, physical activity (PA) and body fatness in children are limited by failing to isolate the strength of associations between specific components of sedentary behaviour or PA. Relationships between screen-based activities, PA components and percent subtotal body fat (%BF) were examined in children exceeding the daily recommended 2 hours of engagement with electronic media (American Academy of Pediatrics, 2001).

Methods: Dual-energy x-ray absorptiometry measured %BF in 18 girls (age mean 9.3, SD 0.6 years) and 29 boys (age mean 9.2, SD 0.6 years). Time spent viewing television (TV), playing inactive, active and all (inactive + active) video games (VG), and, total screen time (ST: total VG + TV) were assessed by self-report questionnaire. PA (counts and steps) was measured using ActiGraph accelerometers, with data analysed using individually calibrated activity count thresholds for PA at $4\text{km}\cdot\text{h}^{-1}$ (PA^4 , equivalent to walking) and $8\text{km}\cdot\text{h}^{-1}$ (PA^8 , equivalent to jogging), and a sedentary threshold of 100 counts per minute (cpm). Partial correlations (controlled for maturation) evaluated the strength of relationships between variables.

Results: Approximately 65% of girls and 72% of boys participated in at least 60 daily minutes of PA^4 . Boys' PA^8 was more than double that of girls (mins·day mean 14.3, 95% CI 9.6-19.1 compared with a mean of 6.0, 95% CI 3.2-8.8 in girls; $p<0.01$). There were significant negative correlations for inactive VG, total VG, TV and ST with PA^8 ($r>-0.4$, $p<0.05$) in girls, and between TV and PA^8 ($r=-0.481$, $p<0.001$) in boys. Correlations with %BF for all VG, TV and ST were non-significant in both genders. Daily steps were negatively correlated with %BF ($r=-0.428$, $p<0.05$) in girls. In boys, %BF was positively correlated with time spent sedentary ($r=0.419$, $p<0.05$) and negatively correlated with PA^4 , PA^8 , total PA, cpm and daily steps ($r>-0.35$, $p<0.05$).

Discussion: High intensity PA was inversely related to screen-based activities in boys and girls who exceed electronic media guidelines. In boys, %BF was positively associated with sedentary time and negatively associated with moderate-to-high intensity and total PA. Only daily steps were related to %BF in girls.

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The Influence of Maturity Status on Primary School Children's Physical Activity and Physical Self-Perceptions

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Background: Boys' and girls' activity levels are often compared by chronological age but maturity status can influence the physical activity of children within the same age groups. As physical self-perceptions and physical activity are often correlated, it is plausible that maturity status may also be associated with children's perceptions of their physical selves. The study purpose was to assess the influence of maturity status on the physical activity and physical self-perceptions of English primary school children.

Methods: One hundred and seventy five children (78 boys) aged 10.6 ± 3.1 y completed the children and youth Physical Self-Perception Profile (CY-PSPP) and wore an ActiGraph GT1M accelerometer for 5 consecutive days (including two weekend days). Anthropometric measures were completed in order to estimate body composition and maturity status. A two-level (pupil, school) multilevel analysis was used to assess the influence of maturity status on boys' and girls' physical activity and physical self-perceptions.

Results: Boys' daily moderate-to-vigorous physical activity (MVPA) was significantly greater than girls' (13.66 [2.43] min, $p < .0001$), but when the effect of maturity status was corrected for the difference was reduced (9.85 [4.60] min, $p = .02$). Significant gender differences were also observed for the CY-PSPP sub-domains of sport competence, physical condition, body attractiveness, strength and physical self-worth (boys > girls, $p = .06$ to $.0001$). When maturity status was added to the model these significant differences disappeared for each sub-domain, with the exception of strength, where differences increased by 45% (0.67 [0.16], $p < .0001$). Significant interactions between gender and maturity status revealed that boys' physical self-perceptions improved with more advanced maturity status, whereas girls' self-perceptions decreased ($p = .089$ to $.001$).

Discussion: Significant gender differences in MVPA and physical self-perceptions disappeared or were reduced when the effect of maturity status was controlled. Furthermore, maturity status may differentially influence boys' and girls' physical self-perceptions. Significant people in children's lives should be made aware of the effects of maturity status on primary school children's physical activity and physical self-perceptions. These effects should be accounted for during the design of physical activity promoting strategies and interventions.

Exploring the Contribution of Multidimensional Correlates to Adolescents' Physical Activity

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Background: There is a need for correlates of youth physical activity to be better understood as many young people currently do not meet public health physical activity recommendations. The purpose of the study was to investigate the contribution of demographic, environmental, biological, psychological and behavioural predictor variables on adolescents' physical activity levels.

Methods: Two hundred and seventy seven Year 8 and 9 adolescents (74 boys, 203 girls; aged 12-14 years) from three schools in north west England participated in this study. All youths completed the Physical Activity Questionnaire for Older Children (PAQ-C; Crocker et al., 1997), with a sub-sample (n = 109; 82 girls) wearing a uni-axial ActiGraph accelerometer for seven consecutive days. A two-level (pupil, school) multilevel analysis was used to assess the impact of the predictor variables on physical activity levels (PAQ-C score and minutes of MVPA), utilising a simple, best fit model.

Results: Minutes of daily MVPA were significantly predicted by sex [-13.276 (5.995) boys] and Perceived Physical Education (PE) Ability [8.903 (3.23)]. In addition, BMI and deprivation score were retained as they significantly improved the model fit. Scores on the PAQ-C were significantly predicted by sex [-.355 (.078) boys], Perceived PE Ability [.248 (.05)], BMI [.018 (.007)], PAQ-C PE [.24 (.036)] and number of school-based permanent resources [-.006 (.002)]. Deprivation score was retained in the overall model as it significantly improved the fit.

Discussion: Results are consistent with previous research suggesting that boys are more physically active than girls, and higher physical activity levels are associated with more positive perceptions of competence and self-efficacy in PE. In addition, scores on the PAQ-C suggest that youth with higher BMI are generally less active, whilst those who are active in PE classes are more physically active overall. Finally, the inverse association with permanent resources suggests that they may not be essential for adolescents to accumulate physical activity at school. Intervention strategies targeting girls to promote lifelong physical activity are needed. Furthermore, there are clear implications for physical educators to increase physical activity levels during PE lessons and to enhance students' perceptions of PE competence and self-efficacy.

Crocker P R, Bailey D A, Faulkner R A, Kowalski K C, McGrath, R. (1997).
Medicine & Science in Sports & Exercise, 29, 1344-1349.

Comparing Physical Activity Levels of Hungarian Boys and Girls during Weekdays

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Background: In Hungary, 38.3% of the male 27.9% of the female adult population were classified as overweight in 2000 (KSH 2002). Objectively measured physical activity has never been investigated in school children. The aim of this study was to determine the physical activity levels of Hungarian children during school days.

Method: One hundred and fifteen children (71 boys, age=11.06±0.97yrs; 44 girls, age=9.79±0.58yrs) from 3 schools returned signed informed parental consent and were recruited in to the study. Physical activity was quantified using uni-axial accelerometry for 3 consecutive school days. The accelerometer was worn on the right hip using a fitted elastic belt during all waking hours except for water-based activities. Epoch length was set at 5 seconds. Time spent in sedentary, light (LPA), moderate (MPA), and vigorous physical activity (VPA), and counts per minute (CPM) during school days was determined using existing age- appropriate cut-points (Freedson et al. 1997). Ninety-six percent of the boys and 90% of the girls had complete data for 3 weekdays, and were included in the analyses. Differences between boys and girls were assessed using independent samples t-tests. Statistical analyses were conducted using Statistica for Windows 8.0. Statistical significance was set at $p < 0.05$.

Results: Twelve percent of children were overweight. Boys were not more active than girls, though CPM were significantly higher in boys (864.75±356.7) than girls (695.35±246.68) ($p < 0.05$). On average, Hungarian children's MVPA was over double (boys=142.41±53.31 min; girls=128.53±45.0 min) the international 60 min./day recommendation.

Discussion: These results are not consistent with previous studies (Sallis 1993; Trost et al. 1999) that have shown boys are more active than girls. Both boys and girls engaged in high levels of daily weekday physical activity. The relatively high average of MVPA during weekdays may be explained by the relative intense physical education lessons and participation in afternoon clubs in schools.

Empirical Evidence to Inform Decisions Regarding Identification of Non-Wear Periods from Accelerometer Habitual Physical Activity Data

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Background: Participant non-compliance can lead to accelerometer removal during activity monitoring periods. When interpreting data it can be difficult to determine whether a string of zeros results from monitor removal or from inactivity. Various criteria have been used to distinguish between the two, but there is little empirical evidence as to the most biologically plausible duration of consecutive zeros and whether this differs by age. The aim of this study was to determine how many consecutive zeros are recorded by the ActiGraph during a prolonged seated period of time in boys and adults.

Method: Twenty-four boys (14-15 y) and 23 adults (18 men, 5 women) wore an ActiGraph, positioned over the right hip, while at the cinema or the theatre. Participants were seated for 60 to 120 minutes. Accelerometer data were analysed to determine the longest period of consecutive zeros and the number of strings of zeros lasting longer than 10, 20 and 30 minutes.

Results: Periods of consecutive zeros were significantly longer for adults than for boys (37.7 ± 24.7 cf. 16.0 ± 9.7 minutes, $p = 0.001$). In addition adults accumulated significantly more 10 (3.2 ± 1.7 cf. 1.5 ± 1.4 , $p < 0.001$), 20 (1.3 ± 1.2 cf. 0.3 ± 0.5 , $p < 0.001$) and 30 (0.8 ± 0.9 cf. 0.0 ± 0.2 , $p < 0.001$) minute periods of consecutive zeros relative to boys. Use of the 10 minute criterion to classify monitor removal resulted in 74 occurrences of assumed removal in adults (0-6 per adult) and 37 in boys (0-5 per boy). Use of the 20 minute criterion reduced this to 31 occurrences in adults (0-4 per adult) and six in boys (0-2 per boy); the 30 minute criterion reduced this further to 18 occurrences in adults (0-3 per adult) and one in boys.

Discussion: Several studies in the literature identify consecutive zeros lasting longer than 10 or 20 minutes as monitor removal periods. In this study, these criteria frequently misclassified inactivity as monitor removal. Use of a 30 minute criterion was unlikely to misclassify inactive periods as monitor removal times for boys, although the data suggests a longer string of zeros may be needed to avoid misclassification of inactivity in adults.

Sources of Stress in Young Athletes

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Background: The objective of this work was to contribute for a better understanding of stress in young athletes. Using mixed methodology, stress was studied trying to identify different categories and subcategories of stress sources, and compare to stress levels in other activities. Also examined which strategies young athletes use to deal with stress, their perception of the influence of sports in non-sportive stressful situations, and asked for their opinion about the ways their parents and coaches help them dealing with stress. The Researchers also analysed a possible relation between the questionnaires used, and the stress experienced by young athletes, and checked for differences according to the sports under analysis.

Methods: Thirty young athletes took part in this study (six female and twenty-four male athletes) ranging from 9 to 12 years old ($M=11$ and $SD=0,724$), practising football, roller hockey and swimming. A mixed methodology design was used, comprising the quantitative analysis based on the ACSI-28, TEOSQp, SAS-2D and CSAI-2RD instruments and the qualitative analysis was made through the use of a semi-structured interview protocol based on the interview script developed by Gould, Wilson, Tuffey e Lochbaum (1993), on twelve athletes of the original quantitative sample with a high anxiety trait.

Results: The results suggest that sports participation doesn't place too much stress on the majority of the athletes, but the results show that sports practice reveals higher levels of stress when compared to other activities done by the young athletes. The results seem to show that the majority of the young athletes under study reveal somatic responses to stress and that their performance is disturbed by the stress they feel. Only three athletes (25%) state that the fact that they practise sports allows them to calm down in non-sportive stressful situations. Six categories of stress sources were identified, and the most common was "worrying about the performance".

Discussion: Although the athletes are involved in different sports, some of the categories and subcategories of the stress sources are shared. The major pre-competitive factor seems to be related with a high trait anxiety and a low self-esteem. The way parents value the learning of physical activities seems to be directly related with the orientations of the young athlete towards a goal, and when parents put pressure on their children to practise sports, they respond with less motivation and less commitment towards the practise. The results of our study suggest that young athletes would benefit if they were taught strategies to cope with stress and that if the communication athlete-parents-coach was better, young athletes would deal with stress in a better way.

HCO₃⁻ and non-Respiratory HCO₃⁻ Buffering in Boys and Male Adolescents

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Background: The respiratory response to exercise seems to be faster at younger age resulting in lower carbon dioxide partial pressure (pCO₂) at given pH and bicarbonate concentrations (HCO₃⁻) in children than in adults. The relationship between changes in plasma HCO₃⁻ and pH can serve as a quantitative measure of the extra-cellular HCO₃⁻ related pH defense (β_{HCO}). It reflects a buffer capacity determined by titration in plasma under *in vivo* and *in vitro* conditions including respiratory compensation (RESPC) related decreases of pCO₂.

Aim: We tested the hypothesis that a lower pCO₂ at given pH and HCO₃⁻ reflects a lower β_{HCO} corrected for RESPC ($\beta_{\text{HCO_non-RESPC}}$) in boys than in male adolescents.

Methods: In 8 boys (mean \pm SD; age 11.7 ± 0.3 yrs, height 1.51 ± 0.06 m, body mass 39.1 ± 3.9 kg) and 8 adolescents (16.5 ± 0.7 yrs, 1.84 ± 0.08 m, 70.5 ± 8.0 kg) the acid-base status (pre and minutes 1, 5, 10, 15 and 20 post Wingate Anaerobic Test (WAnT)) and β_{HCO} without and with corrections for changes in pCO₂ were analyzed.

Results: At any post WAnT moment, pH was higher ($p < 0.05$) in boys than in adolescents. 1 min post WAnT pCO₂ was lower ($p < 0.05$) and HCO₃⁻_{non-RESPC} was higher ($p < 0.05$) in boys than in adolescents. HCO₃⁻ was higher ($p < 0.05$) in boys at minute 5, 10 and 15 post WAnT. β_{HCO} (62.3 ± 5.0 vs. 59.8 ± 6.1 mmol l⁻¹) and $\beta_{\text{HCO_non-RESPC}}$ (46.6 ± 1.7 vs. 45.2 ± 3.3 mmol l⁻¹) were not different between boys and adolescents.

Discussion: pCO₂ control is tighter in boys but there is no difference in β_{HCO} and $\beta_{\text{HCO_non-RESPC}}$ between boys and adolescents.

Effect of Maturation on the Relationship Between Muscle Size and Force Production

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Background: Although it is well accepted that muscle size and force increased concomitantly, the corresponding relationship during maturation is still discussed. In the present study we aimed at determining whether maturation affects the relationship between muscle size and maximal strength and at investigating the reasons accounting for the discrepancies among previous studies.

Methods: 13 prepubescent boys (11.3 ± 0.7 years old and tanner's stage ranging from 1 to 2), 16 pubescent boys (13.3 ± 1.4 years old and tanner's stage ranging from 3 to 4) and 15 men (35.7 ± 6.4 years old) participated to this study.

Maximal isometric handgrip strength (F_{\max}) was determined using a dedicated experimental setup including a force transducer (ZF 100, Scaime, France) connected to a handle bar.

Muscle volume of the dominant forearm was determined using MRI (V_M) and anthropometry (V_L). MRI investigations were performed at 1.5 T on a Siemens-Vision Plus Imaging system (Siemens, Germany) and the muscle volume was estimated from Transverse T_1 -weighted images (9 to 13 slices depending on the forearm length). Anthropometric assessment was performed using Jones and Pearson model (1969).

Results: F_{\max} was linearly correlated with V_M ($r^2=0.90$), V_L ($r^2=0.85$) and MCSA ($r^2=0.87$) while V_M was strongly correlated to V_L ($r^2=0.90$). The F_{\max}/V_M ratio did not differ among groups whereas F_{\max}/V_L and F_{\max}/MCSA ratios were significantly higher in adults than in children and adolescents. These results demonstrated that, when compared to MRI, anthropometric measurements led to a systematic overestimation of muscle volume. In addition, this overestimation was significantly larger in children and adolescents as compared to adults (43.1 %, 38.5 % and 20.5 % $p < 0.05$ respectively).

Discussion: Our results showed that the maximal isometric strength exerted by the forearm muscles in humans is proportional to their size whatever the age and that V_M is the best index of muscle size during growth. The previously reported increased ability to produce maximal strength from childhood to adulthood could be explained by systematic bias introduced by the method used to characterize muscle size rather than physiological or neural changes.

The Effect of a Stretch-Shortening Cycle Fatigue Test on the Acute (0-30 minutes) Neuromuscular Function of Lower Limbs in Untrained Boys and Men

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Background: The effect of the Stretch–Shortening Cycle fatigue test (SSCFT) is well-documented in adults. This type of exercise causes reduction in strength performance, reversionary muscle damage and important alterations in stretch reflex, muscle stiffness and kinematic characteristics. But the symptoms of SSCFT have not well studied in prepubertal boys. Thus the purpose of this research was to investigate the effect of SSCFT on the acute (0 and 30 minutes) neuromuscular function of lower limbs in men and prepubertal boys.

Methods: 11 adults and 11 prepubertal boys performed 10 sets of 10 continuous vertical jumps with 30 sec interval between sets. The participants were tested in isometric torque of knee extensor (Cybex Norm), squat jump (Sj) and drop jump (Dj30) before, immediately and 30 min after the fatigue protocol. Electromyographic activity (EMG) from the vastus lateralis, gastrocnemius and soleus muscles was recorded, as well. Pre-post fatigue changes were tested by analysis of variance (ANOVA) for repeated measurements on two factors and then post hoc multiple comparison was performed. The level of significance was set at $p < 0.05$.

Results: Isometric torque, SJ and DJ30cm height performance showed a greater reduction for the adults than prepubertal boys immediately and 30 min after the termination of protocol ($p < 0.05$). Similar results came along on the part of EMG activity of agonist muscle which reduced at a higher extend in adults ($p < 0.05$). The ground reaction forces and contact times of DJ were notably increased for the two age groups, mainly in adults ($p < 0.05$). Angular velocity during the take-off phase reduced in both groups, but the reduction was greater for adults ($p < 0.05$). Also, it was shown that the knee joint was flexed more in both groups, immediately and 30 min after the fatigue test ($p < 0.05$).

Discussion: It seems that immediately and 30 min after SSCFT the performance decrement was higher in adults. This higher decrement in adults could be explained by the higher failure in their neuromuscular system.

Recovery from Brief Isometric Calf Exercise in Young and Adult Females Measured with ³¹P-MRS

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Background: Phosphocreatine (PCr) recovery time constant (τ) can be used as an index of oxidative capacity, an important measure of muscular fitness in healthy and unhealthy individuals. The purpose of the study was to evaluate a gated isometric exercise protocol to measure PCr recovery τ .

Methods: Six girls (14 ± 0.2 y) and seven women (25 ± 3 y) completed a gated isometric exercise test on a custom-built plantarflexion ergometer within a 1.5 T magnetic resonance scanner. PCr and pH were measured every 4 s. Participants performed 23 contractions (4 s exercise, 12 s rest), and the final 18 contractions were included in analysis. Recovery τ was calculated from the degree of PCr recovery between contractions, and the net decrease in PCr over the test (Figure 1) according to the method of Slade et al., (2006)

Results: Recovery τ was similar in four girls (20 ± 6 s) and seven women (20 ± 5 s, $p = 0.93$). Low signal-to-noise ratio precluded analysis of data from two girls. pH was significantly higher in girls (7.11 ± 0.03) than women (7.07 ± 0.04 , $p=0.0014$).

Discussion: Gated exercise shows promise as a method of measuring PCr recovery τ without strenuous exercise, and revealed similar recovery rates in girls and women. However, we could not use this analysis on two of the girls tested, because the high temporal resolution required resulted in poor signal-to-noise ratio. In future gated exercise studies, signal-to-noise ratio should be optimised.

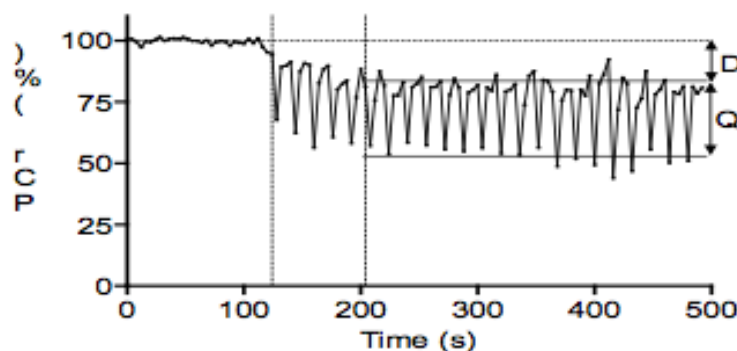


Figure 1. PCr averaged from all girls during the gated exercise test. Vertical dotted lines indicate the beginning of the exercise test and the beginning of analysis (the first five contractions were excluded). τ

was calculated according to the formula: $\tau = -\Delta t / \ln[D/(D+Q)]$, where Δt is the recovery interval between contractions (12 s), D is the overall drop in PCr, and Q is the drop in PCr with each contraction.

Slade J.M., Towse T.F., Delano M.C., Wiseman R.W., & Meyer R.A., 2006, A gated ³¹P NMR method for the estimation of phosphocreatine recovery time and contractile ATP cost in human muscle. *NMR Biomed*, **19**, pp. 573-580.

Muscle Activation in Pre- and Early-Pubertal Male Power and Endurance Athletes

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Background: Previous studies in adults have demonstrated that power athletes are characterized by greater muscle force and muscle activation. Findings on endurance athletes are scarce and inconsistent. No comparable data exist for children. This study compared peak torque (T), peak rate of force development (RTD), and muscle activation, in isometric elbow flexion (EF) and knee extension (KnE), in pre- and early-pubertal boys trained in sports typically characterized by power (P, gymnasts) or endurance (E, swimmers), vs. minimally-active boys (C).

Methods: Five gymnasts, 15 swimmers, & 20 non-athletes (7-12 yrs), performed fast, maximal isometric elbow flexions and knee extensions on the Biodex System 3 dynamometer. T, RTD, electro-mechanical delay (EMD), and rate of muscle activation (EMG rise, Q_{30}), were calculated from averaged torque and surface EMG traces.

Results: No group differences were observed in T or RTD in either EF or KnE, although RTD, corrected for T tended to be highest in P (EF: 6.5 ± 2.0 , 6.0 ± 1.3 , 5.4 ± 1.9 , and KnE: 5.5 ± 2.3 , 4.7 ± 1.1 , 5.0 ± 1.5 $\text{N} \cdot \text{m} \cdot \text{s}^{-1}$, for P, E & C, resp.). Q_{30} was significantly greater in P than in E & C, both in absolute terms and relative to peak EMG amplitude (EF: 43.0 ± 30.8 , 16.7 ± 11.2 , 17.0 ± 15.1 $\text{mV} \cdot \text{ms}$ and 2.1 ± 1.3 , 0.9 ± 0.5 , 1.0 ± 0.6 $(\text{mV} \cdot \text{ms})/(\text{mV})$, for P, E & C, resp.; KnE: 12.9 ± 4.7 , 6.7 ± 7.7 , 4.4 ± 2.3 and 2.4 ± 0.9 , 1.4 ± 1.3 , 1.0 ± 0.5 $(\text{mV} \cdot \text{ms})/(\text{mV})$ for P, E & C, resp.). EMD was shorter in P than in E & C, although differences were significant only in KnE (EF: 52.8 ± 6.9 , 63.9 ± 14.6 , 72.6 ± 29.4 ms, and KnE: 46.6 ± 16.0 , 56.3 ± 18.7 , 66.1 ± 17.2 ms, for P, E & C, resp.).

Discussion: Pre- and early-pubertal power athletes have enhanced muscle activation compared with endurance athletes and non-athletes. This characteristic did not differentiate the latter two groups. These findings suggest that specific muscle training can result in muscle activation changes already in prepubescence.

Obesity Modifies Ventilatory Responses to Exercise in Youth

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Background: The influence of obesity on ventilation at rest and during exercise is well-established in adults (Zavorsky. *Obes. Rev.* 2007), but little is known about the effects of obesity on the ventilation of youth. Thus, this study compared the ventilatory responses of 73 over-weight youth (BMI > 85th %tile) to 73 age, sex, and height matched normal-weight (BMI < 85th %tile) youth, at rest and during three exercise intensities.

Methods: Metabolic responses were obtained using the COSMED metabolic system, while ventilatory volumes and time intervals were obtained from a bidirectional flow meter and standard computations (West. *Respiratory Physiology*, 1979). The youth rested for 15 minutes, walked at 4 and 5.6 kpm, and ran at 8 kpm for seven minutes each, with all measures taken at steady-state. All analyses were adjusted for age, sex, and height.

Results: At rest the over-weight youth had higher $\dot{V}O_2$ (mL/min), minute ventilations (\dot{V}_E) and tidal volumes (V_T) than normal weight youth ($p < 0.02$); however, respiratory frequency (f_R), physiological dead air space (V_D), V_D/V_T ratio, end-tidal CO_2 ($P_{ET}CO_2$), and ventilatory equivalents for oxygen ($\dot{V}_E/\dot{V}O_2$) and CO_2 ($\dot{V}_E/\dot{V}CO_2$) were similar. Resting ventilatory drive (\dot{V}_T/T_i) was greater for the obese youth, but the correlations between $P_{ET}CO_2$ and ventilatory drive or T_i were stronger for normal than over-weight youth. During all three levels of exercise $\dot{V}_E/\dot{V}O_2$, $\dot{V}_E/\dot{V}CO_2$, and $P_{ET}CO_2$ were similar between groups, but $\dot{V}O_2$, \dot{V}_E , V_T , f_R , V_D , V_D/V_T , and \dot{V}_T/T_i were greater for over-weight compared to normal weight youth ($p < 0.003$). The exercise-induced ventilatory drive of the over-weight youth was more closely associated with $P_{ET}CO_2$ than for normal weight youth.

Discussion: These data suggest that compared to normal weight youth, obesity modifies the ventilatory responses during exercise, but not at rest. Ventilatory drive in over-weight youth is less linked to CO_2 at rest than for normal weight youth, but is more closely linked to CO_2 during exercise. These results, combined with the greater f_R and V_D of the obese youth suggest that their adiposity may in some way mechanically modify ventilation dynamics.

Effects of Antenatal Steroid Exposure on Pulmonary Function and Aerobic Fitness in Adolescents Born Prematurely with Very Low Birth Weight

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Background: Persons born prematurely with very low birth weight (VLBW) have been shown to have reduced pulmonary function, lower fitness, and increased risk for cardiovascular and other chronic diseases. Mothers are often given glucocorticoid injections with threatened premature birth to facilitate lung maturation and survival of the infant. While the immediate effects are beneficial in the infant, the long-term effects are not known. The purpose of this study was to examine the effects of antenatal glucocorticoid exposure (ANS) on pulmonary function and aerobic fitness in a cohort of prematurely born adolescents with very low birth weight (VLBW), 50% of whom were exposed to antenatal corticosteroid therapy.

Methods: Ninety 14 year-old adolescents (42% male, 50% Caucasian) underwent pulmonary function and exercise testing. Forced vital capacity (FVC) and forced expiratory volume in 1 sec (FEV₁) were assessed via standard spirometry, and aerobic fitness (VO_{2peak}) was assessed via progressive exercise testing on a cycle ergometer. Data are expressed as median (5th-95th percentile), and Mann-Whitney U tests were used to make between-group comparisons based on ANS exposure (exposed ANS+ v. unexposed ANS-).

Results: To date, 33 (36%) of children were exposed to ANS and 57 (64%) were not exposed. FVC, expressed as % of predicted, was significantly ($p=0.03$) higher in ANS+ (104% pred., 83-135%) than ANS- (96%, 70-125%), and FEV₁ tended ($p=0.095$) to be higher in ANS+ (89%, 66-123%) v. ANS- (86%, 37-127%). The FEV₁/FVC ratio, however, did not differ between ANS groups. VO_{2peak} was significantly higher ($p=0.04$) in the ANS+ (39.0 ml/kg/min, 18.3-58.5 ml/kg/min) compared to ANS- (33.4 ml/kg/min, 18.3-58.5 ml/kg/min).

Discussion: These data support a long-term beneficial effect of antenatal steroid exposure on pulmonary function and aerobic fitness in adolescents born prematurely with VLBW. Higher aerobic fitness may help to reduce their risk for developing cardiovascular as well as other chronic disease in adulthood.

Effects of Exercise Modality on Ventilatory Parameters in Prepubescent Children with Cystic Fibrosis

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Background: The aim of the study was to compare ventilatory responses and mechanical ventilatory constraints following two exercise modalities (i.e. continuous vs intermittent), at three intensity levels, in order to determine the benefits – risks of exercise on ventilatory function for children with cystic fibrosis.

Methods: Five prepubescent children with cystic fibrosis (aged 10.6 ± 1.5 years; $FEV_1 = 97.5 \pm 16.8\%$ of theoretical value; maximal aerobic speed = $10.2 \pm 2.1 \text{ km.h}^{-1}$) performed a graded test on treadmill in order to determine Maximal Aerobic Speed (MAS) for the individualization of exercise intensity (expressed in % of MAS). Then, children realized 3 continuous exercises (CE) at 60%, 70% and 80% of MAS and 3 intermittent exercises (IE) at 90%, 100% and 110% of MAS. Ventilatory parameters (tidal volume (V_t), breathing frequency (f), and ventilation (VE)) were measured breath by breath during exercise with a mouthpiece. Three exercise associations were designed to compare a continuous form of exercise with an intermittent one: CE60 vs. IE90, CE70 vs. IE100 and CE80 vs. IE110. To determine mechanical ventilatory constraints, exercise flow/volume loop measurement was realized during the last 30 seconds of each exercise and reported within maximal flow/volume loop, obtained by spirometry before exercise.

Results: For each exercise modality, ventilatory limitations were highlighted, ranging between 8 – 91% of V_t . For continuous vs intermittent exercise comparison, no significant difference was found for ventilatory constraints (ventilatory limitation, inspiratory capacity relative to vital capacity, V_t relative to inspiratory capacity). For CE70 vs. IE100 and CE80 vs. IE110, ventilatory parameters (V_t , f and VE) were not significantly different. For CE60 vs. IE90 association only, VE was significantly higher ($p < 0.05$) during IE90. However, no significant difference was observed for V_t and f .

Discussion: The main finding of this study was that ventilatory parameters and mechanical ventilatory constraints were comparable whatever exercise modality. However, during IE90, higher VE was measured which could be due to higher f ($p = 0.08$) and higher metabolic demand. Thus, intermittent and continuous exercises could be used for cystic fibrosis rehabilitation, allowing a diversification of physical activity programs and an enhancement of child adhesion to physical activity

Limiting Factors in Peak Oxygen Uptake in Ambulatory Children with Spina Bifida

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Background: To interpret outcomes of peak oxygen uptake (VO_{2peak}) in ambulatory children with Spina Bifida, in order to develop a better understanding of exercise testing in this group of children.

Methods: A Cross-sectional study, in Wilhelmina's Children's Hospital Utrecht, the Netherlands, including 49 ambulatory children with SB. Peak oxygen uptake (VO_{2peak}) was measured during a graded treadmill-test. Eschenbacher's and Maninna's algorithm was used to determine limiting factors for VO_{2peak} . Ventilatory reserve (VR) $\leq 30\%$ of maximum ventilatory volume, ventilatory coefficients for exhaled carbon dioxide (VE/VCO_2) ≥ 35 and oxygen desaturation of $\geq 4\%$ were evaluated for possible ventilatory limitations. Heart rate response (HRR) \geq predicted for age and $\%VO_2$ at anaerobic threshold (AT) $\leq 40\%$ of VO_{2peak} were evaluated for possible cardiac limitations and deconditioning. Cut off points were adapted for the pediatric population.

Results: VO_{2peak} , HR_{peak} , RER_{peak} and VE_{peak} were significantly lower compared to reference values. VR was low in 47.1%, VE/VCO_2 was high in 54.2%, while 7.8% of the children showed desaturation $\geq 4\%$ during exercise, indicating ventilatory mechanical limitations in exercise testing. HRR was high in 55.3%. AT was reached in 82.7% and was $\geq 40\%$ in all children, indicating deconditioning and/or muscular components rather than circulatory limitations in low VO_{2peak} .

Discussion: VO_{2peak} in ambulatory children seems to be limited by both ventilatory mechanical limitations and "deconditioning and/or muscular" limitations. Where the latter can be explained by both the disease and reduced physical activity level, the ventilatory limitations need further investigation. In the mean time, exercise training seems indicated to reverse the effects of deconditioning in ambulatory children with SB.

1 year Intervention on Clustered Cardiovascular Risk in Overweight and Obese 11-13 year Old Children in Denmark

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Background: Overweight and obesity is associated with clustering of CVD risk factors in children. Lifestyle factors such as sedentary behaviour and the sustained excess intake of unhealthy food contribute to the development of obesity and clustering of CVD risk factors, and should therefore be a primary target in prevention strategies. The aim of the present study is to examine the effect of a 6 week sports camp with a 46 week follow-up period on clustered CVD risk in overweight and obese 11-13 year old Danish children.

Methods: In a single-armed intervention study, 39 overweight or obese 11-13 year old (5th grade) children (20 boys and 19 girls) participated in a 6-week camp with emphasis on healthy food, but with no calory restriction, and fun based physical activity. During the subsequent 46 weeks, the families were invited to four group meetings, where dietary and physical activity behaviours were addressed and discussed. To evaluate clustered CVD risk, composite risk factor scores (mean of Z scores) were generated at baseline, week 6 and at 1-year follow-up from the following risk factors; systolic BP, triacylglyceride, total cholesterol/HDL ratio and HOMA score.

Results: From baseline to 6 weeks follow-up, we observed a decrease in clustered CVD risk proxied by the z-score (-0.97 SD, 95% CI[-1.13: -0.80], $p < 0.001$). Additionally cardiorespiratory fitness was also significantly lower at 6 weeks after baseline. After 1 year the clustered CVD risk was still significantly decreased (-0.36 SD, 95% CI [-0.65:-0.04], $p < 0.05$). Only single CVD riskfactors BMI, WC, and TC were significantly lower than at baseline (all $p < 0.05$).

Discussion: This study indicates significant short and long term effects from a combined diet and exercise intervention on clustered CVD risk. The observations should be interpreted with caution due to a large drop out, missing data and potential selection bias. Due to methodological shortcomings, this study needs to be replicated as a randomized controlled trial.

Canada's 2009 Report Card on Physical Activity for Children and Youth

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Background: Canada's 2009 Report Card on Physical Activity for Children and Youth is the 5th annual overview of the many factors impacting upon physical activity levels in children and youth in Canada. The primary audience of the report card is policy makers and practitioners who are in a position to make effective changes in program development and delivery, thus making the report card a tool to 'power the movement' to get kids moving. In 2009, the report card assigned letter grades to physical activity plus 18 key indicators.

Methods: Researchers collected and summarized the most recent data available in Canada across the 19 indicators. A framework is used to guide the grading process that considers prevalence rates, the presence of disparities (e.g., disability, socio-economic status, sex, ethnicity, geography, etc.), international comparisons and evidence of progress over time. The information is collated into a summary version as well as a detailed report which are both widely disseminated within Canada. A strategic partnership with ParticipACTION facilitates effective communication of report card messages.

Results: Objective measures of physical activity from 2007-2008 demonstrate that 13% of Canadian children and youth are meeting the current physical activity guidelines in Canada (90 minutes/day MVPA); marking a significant increase since 2005-2006. The grade assigned for physical activity was an F, however an upward arrow was applied to the grade to reflect evidence of potential progress. Other points of concern include high screen time values, absence of data on active play, poor quality of physical education in schools, low usage rates of parks and community facilities and the existence of municipal policies that hinder physical activity.

Discussion: To overcome a societal problem of this magnitude, there needs to be engagement among all levels of government, non-governmental organizations, researchers, corporations, and foundations in a collaborative effort to improve the physical activity profile of Canadian children. The report card serves as a mechanism to inform policy makers and practitioners with the information they need to support effective program and message development, and enhanced policy creation and implementation while identifying areas that require further work and action.

Comparison of Approaches for Evaluating Change in BMI in Youth

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Background: Evaluating changes in BMI over time is challenging due to individual variability and the confounding influences from normal growth and maturation. BMI growth charts are widely used to evaluate levels of risk but they may not be appropriate for evaluating change in BMI over time.

Purpose: The purpose of this study was to evaluate one year changes in the prevalence of overweight in first grade children from a large urban school district. The primary goal was to examine various methods for computing and evaluating BMI change in this large cohort of young children. A secondary goal was to determine if there are unique patterns of change in the prevalence of overweight for children from different ethnic and socio-economic backgrounds.

Methods: A prospective cohort design was used to examine 1-year changes in BMI in first graders from a large urban school district ($n = 1642$). BMI change was evaluated with two different indicators but both indicators were based on the widely used BMI growth curves developed by the CDC in the United States. One indicator (BMIpercentchange) was computed as the change in actual BMI percentile over time ($\text{BMI\% in Year 2} - \text{BMI\% in Year 1}$). The second indicator (referred to as BMI50change) was computed as the change in BMI relative to the deviation from a BMI at the 50th percentile. Direct comparisons were made between the BMIpercentchange and the BMI50change using descriptive and correlation analyses.

Results: Children classified in the lowest decile for BMI had larger positive average BMIpercentchanges (3.83 %) in the 1-year follow-up but had much smaller average BMI50 difference scores (0.83). In contrast, children in the highest BMI decile had negative average BMIpercentchanges (-0.43%) over the 1-year follow-up but much larger average BMI50 difference scores (5.83). BMI percent change was moderately correlated with BMI50 difference ($r = .62$) showing that they are not equivalent indicators.

Discussion: Care is needed when examining changes in BMI in longitudinal research. The results of the study provide indications of the relative utility of the BMI50change variable for evaluating longitudinal changes in BMI.

Long Term Leisure Time Physical Activity has Effect on Peak Bone Mass Gain in Girls

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Background: The purpose of this 7 year prospective longitudinal study was to examine if the level and consistency of leisure-time physical activity (LTPA) during adolescence affected the BMC and BMD attained at early adulthood.

Methods: The study subjects were 202 Finnish girls who were 10-13 years old at baseline. Bone area (BA), BMC, and BMD of the total body (TB), total femur (TF), femoral neck (FN), and lumbar spine (L2-L4) were assessed by DXA. Scores of LTPA were obtained by questionnaire. Girls were divided into 4 groups (consistently low physical activity (G_{LL}), consistently high (G_{HH}), and changed from low to high (G_{LH}), and from high to low (G_{HL}) during 7 years of follow-up.

Results: At baseline, no differences were found in BA, BMC, and BMD among the groups in any of the bone sites. Compared to the G_{LL} group, the G_{HH} group had higher BMC (11.7% in TF and 12.9% in FN; $p<0.05$), and BMD at the TB (4.5%), TF (12.2%) and FN (11.2%) (all $p<0.05$) at the age of 18. Those in the G_{LH} group also had higher BMC at each site (8.5-9.4%, $p<0.05$), and higher BMD in TB (5.4%), TF (8.9%) and FN (7.9%) than that of G_{LL} (all $p<0.05$) at the age of 18.

Discussion: Our results suggest that long term leisure time physical activity has a positive effect on bone mass gain in schoolgirls. In addition, girls whose physical activity increases during adolescence may also benefit from bone mass gain.

Secular Trends in Established and Novel Cardiovascular Risk Factors in Welsh 12-13 Year Olds: a Comparison Between 2002 and 2007

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Background: Examining secular trends provides us with an insight into the apparent surge in cardiovascular disease (CVD) risk factors. Our study presents a current and comprehensive examination of secular trends in established and novel CVD risk factors among Welsh adolescents from 2002 to 2007.

Methods: We examined CVD risk factor data from two cross-sectional studies. The first study (73 participants; aged 12.9 ± 0.3 years) was completed during Sept-Oct, 2002. The second study (90 participants; aged 12.9 ± 0.4 years) was conducted from Sept-Oct, 2007. Measurements included body mass index (BMI), waist circumference (WC), physical activity (PA), physical fitness (PF), diet, total cholesterol (TC), high-density-lipoprotein cholesterol (HDL-C), low-density-lipoprotein cholesterol (LDL-C), triglyceride (TG), fibrinogen (Fg), and high-sensitivity C-reactive protein (hs-CRP).

Results: In boys only, mean BMI and WC decreased between 2002 and 2007, but this was not significant ($p \geq .05$). Generally, there were significant improvements in mean PA and PF levels, lipid profile, Fg and hs-CRP ($p < .05$). In 2002, 42.8 per cent of boys, and 34.2 per cent of girls, were overweight or obese; in 2007, this was 23.7 per cent and 28.9 per cent for boys and girls, respectively. More adolescents in the earlier cohort exceeded the recommended levels for lipids. This was also true for Fg and hs-CRP.

Discussion: To our knowledge, this is the only study to examine established and novel CVD risk factor trends in Welsh schoolchildren. Despite our finding that overweight continues to be widespread in Welsh 12-13 year olds, we did not identify an increased prevalence in our later cohort. Overall, our data presented a positive trend in lipid profile, as well as Fg and hs-CRP. These improvements may be linked to improved physical activity and fitness levels observed in the 2007 cohort.

The Success of a General School-Based Physical Activity Intervention on Bone Mineral Content Depends on Pubertal Stage but not on Gender

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Background: It is not clear whether sensitivity of bone to physical loading varies for different pubertal stages and among genders. We therefore performed a randomised controlled trial in children of both gender and different pubertal stages to determine whether a school-based physical activity (PA) program during a full school-year influences bone mineral content (BMC) and whether there are differences in response for boys and girls before and during puberty.

Methods: Twenty-eight 1st and 5th grade classes were cluster randomised to an intervention (INT, 16 classes, n=297) and control (CON; 12 classes, n=205) group. The intervention consisted of a multi-component PA intervention including daily physical education during a full school year. Each lesson was predetermined, included about ten minutes of jumping or strength training exercises of various intensity and was the same for all children. Measurements included anthropometry (height and weight), tanner stages (by self-assessment), and BMC for total body, femoral neck, total hip and lumbar spine using dual-energy X-ray absorptiometry (DXA). PA was assessed by accelerometers initially, at midtime and at the end of the intervention period. Bone parameters were normalized for gender and tanner stage (pre- vs. puberty). Analyses were performed by a regression model adjusted for gender, baseline height, change in weight, average PA, post-intervention tanner stage, baseline BMC, and cluster.

Results: 275 (72%) of 380 children who initially agreed to have DXA measurements had also post-intervention DXA and PA data. Mean age of prepubertal and pubertal children at baseline was 8.74 ± 2.07 and 11.13 ± 0.60 years, respectively. 64/144 girls and 86/131 boys were prepubertal at the end of the intervention. Compared to CON, children in INT showed statistically significant increases in BMC of total body (adjusted z-score differences: 0.110; 95%-CI 0.042 to 0.178), femoral neck (0.136; 95%-CI 0.014 to 0.257), and lumbar spine (0.110; 95%-CI 0.028 to 0.191). Importantly, there was no gender*group, but a tanner*group interaction consistently favoring prepubertal children.

Discussion: Our findings show that a general, but stringent school-based PA intervention can improve BMC in elementary school children. Pubertal stage, but not gender seems to determine bone sensitivity to physical activity loading.

Children's Physical Activity and Behaviour during School Recess over Time: The A-CLASS Project

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Background: Recess is an important location for promoting physical activity and positive play behaviours to elementary school children. Little research, however, has documented changes in these behaviours over time yet such information may enhance the development of appropriate interventions in this context. This study investigated changes in physical activity and play behaviours over time.

Method: Eight-five children (38 boys, 47 girls) from 8 schools had their physical activity and play behaviour assessed during recess using the System for Observing Children's Physical Activity and Relationships during Play (SOCARP; Ridgers et al., in press). Trained assessors observed children during 36 and 39 recess periods in the summer and winter terms, respectively (40 days total). All students were observed twice approximately 4 months apart. SOCARP enables the simultaneous observation and recording of children's physical activity levels, social group sizes, activity types and social interactions during play. Differences in the variables across time were assessed using repeated measures (time x gender) analyses of variance.

Results: Boys spent proportionally more playtime in moderate-to-vigorous physical activity (MVPA), vigorous physical activity (VPA), large groups, sports activities, and antisocial behaviours than girls. Girls spent proportionally more playtime standing, in small groups, active playground games, sedentary activities, locomotion and pro-social behaviours. Significant time effects were found for standing, active playground games, and physical and verbal antisocial behaviour. Time spent standing and incidents of physical antisocial behaviour increased across time. Meanwhile, participation in active playground games and incidents of antisocial verbal behaviour decreased.

Discussion: The gender differences in physical activity, group size and activity type are consistent with previous recess research. It is a concern, however, that engagement in active playground games significantly decreased, with greater decreases observed in girls than boys. Comparatively, engagement in sedentary activities increased in girls, supporting the findings of Pellegrini et al. (2004). This may partly be attributable to seasonal influences, though the results suggest that active playground games are being replaced by more sedentary alternatives. Interventions may be required to facilitate and encourage active behaviours during recess in this age group, particularly during the winter term.

Comparison of Physical Activity Level during Structured and Unstructured Activities in Children and Adolescents

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Background: For intervention purposes, it is important to determine if children and adolescents are more active in structured activity (SA) versus unstructured activity (UA). The purpose of this investigation was to determine 1) whether participants were more active during SA or UA during a simulated after school program and 2) if there was a gender difference in activity levels.

Methods: Participants were 108 children, 6-15 years old (59% female, 79% White). Physical activity (PA) intensity levels were assessed using the Actical accelerometer and classified as sedentary (SED), light (LPA), moderate (MPA), vigorous (VPA), or moderate-to-vigorous (MVPA) based on the Evenson et al. (2008) cut-points. Participants engaged in two after school program visits, low activity and high activity. Visits consisted of snack time, SA time, homework time, and UA time. Repeated measures ANOVA was used to examine differences between SA and UA and gender differences.

Results: During the low activity visit, participants spent more time in SED and LPA during SA compared to UA ($p < 0.01$). During the high activity visit, participants spent more time in SED, VPA, and MVPA in SA than UA (20.5 vs. 17.8 min for MVPA, respectively) ($p < 0.01$). Boys were more active than girls (20.1 vs. 16.2 min MVPA) during UA for the high activity visit.

Discussion: In an after school program setting, children and adolescents obtained more activity during UA than SA in a low activity setting. However, they obtained more activity during SA than UA in a high activity setting. Boys and girls may respond differently to programs involving SA versus UA, which researchers and practitioners should consider when designing programs.

Changes in Fundamental Movement Skills, Physical Activity, and Percent Body Fat Following a Group-Randomised Trial in 9-10 Year Old Children: The A-CLASS Project

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Background: Physical activity interventions conducted in UK children are sparse. This study evaluated the effectiveness of a 12-month intervention to increase physical activity, prevent excess body fat gain, and improve fundamental movement skills among 9-10 year old children.

Methods: 152 children (58% response; 41% male), average age 9 years 8 months, were recruited from 8 primary schools in areas of high deprivation. Children were randomised by school to one of four conditions: a bi-weekly high-intensity physical activity after-school club (HIPA; n=36); a bi-weekly multi-skill (fundamental movement skill) after-school club (FMS; n=37); a behaviour-modification programme (PASS; n=45); or a control-comparison (CON; n=34). Outcome measures were assessed at baseline, 9 months and 12 months (post-test) and included 8 fundamental movement skills, measured using video-analysis and process-orientated measures; percent total body fat, determined by means of dual-energy x-ray absorptiometry (DEXA); and moderate-to-vigorous physical activity (MVPA), assessed by accelerometers over 7 days. Intervention effects were calculated using ANCOVA techniques, with baseline scores as the covariate. Findings were checked for both practical relevance and statistical significance.

Results: *Fundamental movement skills:* At post-test, compared with controls, children in the FMS group significantly improved competence in locomotor (adjusted mean difference (AMD) = 2.52; 90% CI: 1.65 to 3.38, $P < 0.01$) and object-control skills (AMD=3.14; 2.08 to 4.19, $P < 0.01$), whilst HIPA also enhanced competence in locomotor skills (AMD=1.28; 0.35 to 2.19, $P = 0.024$). *Body fat:* After adjusting for changes in maturation, no intervention effects on percent total body fat were observed compared to control. *Physical activity:* No group differences were found for MVPA, which increased from baseline to mid-test but fell sharply at post test in all conditions.

Discussion: Multi-skill after-school clubs can improve fundamental movement skills, though skill competence gains were not associated with increased participation in physical activity or lower percent body fat. A subsequent follow up study is warranted to assess long term impact. After-school clubs and behaviour-modification programmes may need to be combined, or supplemented by other intervention strategies (e.g. nutrition), to facilitate positive changes in body composition and increased participation in habitual physical activity.

A School-Based Physical Activity Program Increases Fitness and Decreases Adiposity in Primary School Children (KISS): A Cluster-Randomized Trial

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Background: Childhood obesity and physical inactivity are increasing dramatically worldwide with detrimental effects on fitness, cardiovascular health and quality of life. Schools provide an ideal setting for preventive interventions. We therefore conducted a randomised controlled trial to determine whether a school-based physical activity (PA) program during a full school-year improves body composition, fitness, cardiovascular health, PA and quality of life in primary school children.

Methods: Twenty-eight classes from two of 26 provinces in Switzerland were cluster randomized to the intervention (16 classes, n=297) and control (12 classes, n=205) groups. The intervention consisted of a multi-component PA intervention including daily physical education. Primary outcomes included body fat (skinfold thickness), aerobic fitness (shuttle run test), PA (accelerometry), and quality of life (questionnaires). Children and parents in the control group were not aware of the existence of an intervention group. Analyses were done according to intention to treat.

Results: Of 502 children, we analysed primary endpoints for 251-469 (50-93%) for whom we had data after the intervention. Compared with controls, children in the intervention group showed statistically significant decreases in the sum of four skinfolds (adjusted difference -2.10mm; 95%-CI -3.48 to -0.90), and significant improvements in aerobic fitness z-score (adjusted difference 0.22; 95%-CI, 0.01 to 0.42) and moderate-vigorous PA at school (adjusted difference 14; 95%-CI, 5 to 23). Quality of life and total PA did not change.

Discussion: body composition, aerobic fitness, moderate-vigorous PA in school, and cardiovascular risk factors can be significantly improved in primary school children by a multi-component PA intervention with compulsory elements within one school-year. Implementation of such a program may help to improve health and fitness of our children, and also improve health later in life by reducing cardiovascular and other diseases.

Moving Hong Kong: An Uphill Struggle

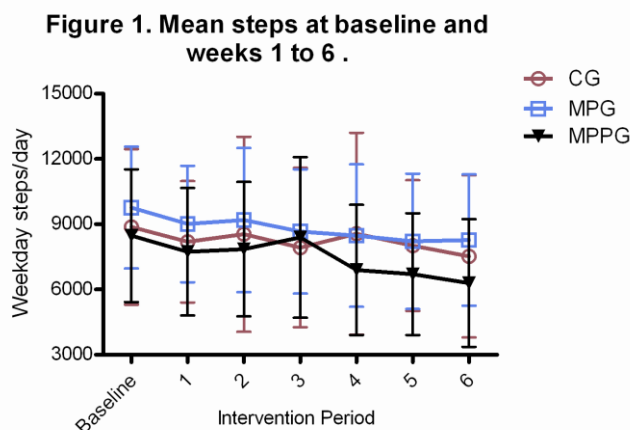
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Background: Previous research has shown prompts such as pedometers and point of choice messages are effective ways of increasing walking behavior in adults and overweight children.^{1,2,3} This randomized controlled trial tests the effectiveness of prompting walking with point-of-choice messages and pedometers in Chinese primary school children.

Methods: Six randomly selected Government primary schools were randomized to a control (CG), a message prompt (MPG) or message and pedometer prompt (MPPG) group. 466 children aged 10.7±1.5 (51% boys) were recruited from Grades 4, 5 and 6. Ethical approval was given by the University Human Ethics Committee and informed consent obtained from parents. Baseline assessment of weekday steps was completed (sealed NL-800 pedometer).prior to a 6-week intervention. A new message was displayed on a poster at 'points-of-choice' around the MPG and MPPG schools (e.g., exits to the playground) each of the 6-weeks. Messages were chosen following message testing in this population and had either cardiovascular or calorific outcomes and varied by specificity. The MPPG were given an additional unsealed pedometer (YAMAX SW200) as a prompting device. The CG were asked to maintain normal activity behavior. Daily steps were recorded for 6-weeks in all groups (sealed NL-800 pedometer). A data exclusion criteria of <1,000/day and >30,000/day and < 2 days/week was set.² ANOVA with repeated measures was used to assess changes in weekday steps.

Results: 321 met the inclusion criteria (CG n=114; MPG n=108; MPPG n=99). RM ANOVA showed no main effect of group, but a main effect of time ($F(6, 1908)=17.943$, $p < .001$, $\eta^2=.053$) and an interaction ($F(6,1908) = 2.846$, $p < .001$, $\eta^2=.018$). Follow up analyses demonstrated that the MPPG declined in comparison to the CG and MPG in weeks 4 and 5, and declined in comparison to the MPG in week 6 (see figure 1).



Discussion: Our results show that prompting walking using point-of-choice messages and pedometers is ineffective in Hong Kong children. The intervention

was based on the America on the Move model, a highly successful intervention in the USA. More in-depth consideration of the HK context is needed for design of future interventions.

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The Exercise Intensity at Lactate Threshold and Maximal Fat Oxidation (Fatmax) do not Coincide in Adolescent Boys or Girls

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Background: The intensity that elicits maximal fat oxidation (Fatmax) may be important when considering exercise prescription for health. Fatmax appears to be dependent on physical maturation, but the control mechanisms for the rapid decline in fat oxidation at exercise intensities above the Fatmax are not completely understood. Lactate threshold (LT) and Fatmax coincide in adults when group statistics are used possibly reflecting an inhibitory effect of reduced cellular pH on fat uptake into mitochondria. This has yet to be shown in young people. The current study examined the agreement between LT and Fatmax in adolescent boys and girls.

Methods: Following an overnight fast, LT and Fatmax were measured in 12 girls and 11 boys (age 14(0.3) years). Peak oxygen uptake ($\dot{V}O_2$) was measured subsequently (45(5) and 56(6) mL/kg/min respectively). LT was defined as the first increase above baseline and Fatmax was the relative exercise intensity (% peak $\dot{V}O_2$) at which maximal fat oxidation rate (MFO) occurred using individual polynomial models. LT and Fatmax were compared using Student's paired t-tests, limits of agreement (LoA), and Pearson's correlation.

Results:

Variable	Girls (n=12)	Boys (n=11)	Combined
MFO (mg/LBM/min)	4.6(1.1)	6.3(1.7) ^a	5.5(1.6)
Fatmax (% peak $\dot{V}O_2$)	34(7)	42(9) ^a	38(9)
LT (% peak $\dot{V}O_2$)	38(8) ^b	41(8)	39(8)
Bias \pm RE (% peak $\dot{V}O_2$)	-4 \pm 6	1 \pm 9	-2 \pm 8
95% LoA (% peak $\dot{V}O_2$)	-18 to 9	-18 to 21	-18 to 15
Adjusted r^2	0.36 ^c	0.08	0.26 ^c

Mean(SD); Adjusted r^2 - Fatmax vs. LT; a – between sex difference ($P \leq 0.05$);

b – LT > Fatmax ($P = 0.03$); c – $P \leq 0.05$

Discussion: For the boys, LT and Fatmax coincided when group statistics were used, but LT was at a higher intensity than Fatmax for the girls. However, 95% limits of agreement confirmed large differences in LT and Fatmax for both boys and girls. Both MFO and Fatmax were higher in boys than girls. These results suggest that the lactate response to exercise in adolescents may not influence fat oxidation in the same way as in adults. Direct manipulation of the lactate response to exercise is required to substantiate these initial findings.

Relationship between Metabolic Dysfunctions with Physical Activity and Dietary Intake in Late Pubertal Adolescent Girls with Type 1 Diabetes

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Background: At puberty, Type 1 diabetes (T1D) and female gender can lead to metabolic dysfunctions which represent potential risk factors for long-term complications. The involvement of behavioural factors like diet and physical activity in these metabolic dysfunctions remains unclear.

Methods: Therefore, we examined the possible relationship between macronutrient dietary intake (4-days diary) and/or habitual physical activity (MAQ validated questionnaire) with metabolic profile in 19 T1D postmenarcheal girls (15.9 ± 0.3 years old) compared with 19 healthy siblings. T1D girls were on a conventional insulin regimen, consisting of both rapid and long-acting insulin analogues. Metabolic profile analysis involved body composition measures (triceps and subscapular skinfolds, waist and hip circumferences) and blood venous samples collection after a 12-h overnight fast.

Results: Compared to healthy controls, T1D girls suffered from an excess weight with greater fat mass, an altered glycaemic control and a high insulin resistance risk (higher levels of plasma glucose, insulin, serum leptin and higher waist-to-hip ratio), as well as from dyslipidemia (higher LDL-C and apolipoprotein B levels, lower HDL-C and apolipoprotein A1 levels). Serum adiponectin levels were not increased in T1D adolescent girls vs. healthy controls. This result differs from those in T1D adults whose increased adiponectin levels are considered to be a protective mechanism against microvascular complications. Quantity and quality of dietary macronutrient intake were comparable in T1D and healthy girls. The T1D girls with the poorest metabolic profile and the greatest weight excess were those having the healthiest diet with more protein and less glycemic index carbohydrate intakes. Physical activity levels were lower in T1D girls compared with healthy controls (e.g. for intense activities: 1.8 ± 0.7 vs. 2.3 ± 0.4 h.week⁻¹). These lower activity levels were associated with a poorer metabolic profile (lower adiponectin, HDL-C and apolipoprotein A1 levels; higher waist-to-hip ratio).

Discussion: Collectively, these data suggest that dietary intake is probably unable to explain the dramatic alteration in metabolic profile in T1D adolescent girls. However, these patients are much less involved in regular physical activity than healthy peers and this is associated with excessive abdominal adiposity, dyslipidemia and low adiponectin levels. Consequently, physical activity should be considered as an important therapeutic adjunct in paediatric Type 1 diabetes care.

Immediate Post Exercise Effects on Caloric Intake and Macronutrient Preferences in Normal Weight and Overweight pre-Pubertal Children

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Background: To the best of our knowledge, the effect of different types of physical activity (e.g. aerobic, anaerobic, resistance) on appetite and food choices was not previously studied in obese children. Understanding the effect of exercise on appetite and food choices may help us optimize exercise training interventions and select the best exercise protocols for this population. Therefore the aim of the present study was to examine the immediate effect of three different types of popular exercise activities on food intake and preferences in normal weight and overweight children.

Methods: Forty- four (22 overweight) age and gender matched, pre-pubertal children participated in four separate visits. All performed 3 typical, 45 min, aerobic, indoor resistance and swimming exercise sessions and a control visit (no exercise). A similar buffet lunch was served immediately after each visit to both groups. The total caloric intake and relative consumption of carbohydrates, fat and protein were recorded.

Results: In the normal weight children, total caloric intake was reduced following exercise. This difference reached statistical significance only following the resistance-type exercise (19.4 ± 1.7 versus 14.0 ± 1.4 kcal/kg in control and resistance exercise, respectively; $p < 0.008$). The different types of exercise were associated with increased relative consumption of carbohydrate and decreased consumption of fat. In contrast, in the overweight children, total caloric intake was increased following exercise. This increase reached statistical significance following the swimming exercise session (18.5 ± 1.5 versus 23.0 ± 2.4 kcal/kg in control and swimming exercise, respectively; $p < 0.02$). All types of exercise lead to a significant increase in the relative consumption of proteins in the overweight children. Finally, the total caloric intake was significantly greater in the overweight children following the control (i.e. no exercise), and all types of exercise sessions. After normalization of the total caloric intake to body mass, this difference remained significant only following the swimming practice (15.9 ± 1.6 versus 23.0 ± 2.4 kcal/kg in normal weight and overweight, respectively; $p < 0.04$).

Discussion: Food intake and preferences are different in normal weight and obese children in response to exercise. Understanding the complicated relationship between exercise, appetite, and food choices may help us to optimize exercise interventions for this unique population, and to select the best exercise protocols to achieve a desired energy balance.

Physical Activity, but not Dietary Calcium, is Positively Associated with a Bone Microstructure and Strength in Adolescents: An HR-pQCT Study

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Background: Physical activity (PA) has beneficial effects on bone strength and structure during growth. Further, dietary calcium (Ca^{2+}) may modulate the bone mass response to PA. However, no studies have examined the link between PA, Ca^{2+} intake and bone microstructure. Recently, this has become possible with the advent of a high-resolution pQCT (HR-pQCT; 82 μm ; Scanco Medical™). Therefore, we undertook a cross-sectional study to examine the contribution of PA and dietary Ca^{2+} to: i) bone strength and ii) bone microstructure in adolescents, using HR-pQCT.

Methods: We assessed the distal tibia at the 8% site in 279 adolescents (146 boys; age 16.6 ± 1.6 yrs; height 173.0 ± 7.8 cm; weight 66.2 ± 14.5 kg and 133 girls; age 17.0 ± 1.7 yrs; height 162.8 ± 6.9 cm; weight 58.1 ± 10.6 kg). We assessed PA (min/day) using the PAQ-HS and dietary Ca^{2+} (mg) intake using a guided 24-hour recall. Our primary bone outcome was bone strength index [BSI, $\text{mg}^2/\text{mm}^4 = \text{total area (ToA; mm}^2) \times \text{total density (ToD}^2; \text{mg}/\text{cm}^3) / 10,000$]. We also assessed cortical density (CoD, mg/cm^3), cortical thickness (CortTh, mm), trabecular density (TrD, mg/cm^3) and trabecular number (TbN, 1/mm). We used multiple regression to evaluate the contribution of PA and Ca^{2+} to bone outcomes after adjusting for ethnicity, maturity (Tanner Stage), weight (kg) and tibial length (mm).

Results: PA was a significant predictor of BSI in both boys and girls, accounting for 15% and 11% of the variance, respectively ($p < 0.05$). ToD, rather than ToA contributed most significantly to greater BSI in both sexes ($p < 0.05$). In girls, PA was a significant predictor of TrD and TbN ($p < 0.05$). PA was not significantly associated with TrD or TbN in boys or CoD and CortTh in either sex. Ca^{2+} was also not a significant predictor of any bone outcomes in either sex. There was also no interaction effect for PA x Ca^{2+} on bone outcomes.

Discussion: Our results that support a positive, but sex-specific role, for PA in bone strength and compartment-specific microstructure, are novel. We were not able to denote a positive role for Ca^{2+} alone, nor did it modulate the effect of PA on bone microstructure and strength. A purposely designed multi-factorial intervention trial is needed to confirm these observations.

Bone Mineral Accrual from Childhood to Young Adulthood

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Background: The principle cause of osteoporotic fractures is reduced bone mass, which result from age-related bone loss and/or failure to achieve optimal peak bone mass (PBM). Weight-bearing physical activity during growth has been shown to play a pivotal role in optimizing bone mineral acquisition. However, the actual age when maximal bone mass is reached is still disputed. The purpose of the study was to describe the accretion of bone mineral at the total body (TB), lumbar spine (LS), total proximal femur (TH) and the femoral neck (FN), and to identify the age of attainment of peak bone mass (PBM) at each site.

Methods: 75 males (M) and 89 females (F) were selected from the Saskatchewan Pediatric Bone Mineral Accrual Study (PBMAS); participants had at least 3 bone measures in childhood and at least one measurement in adulthood. The study design allowed for a developmental age range of 8 to 27 years of age. Data were aligned on peak height velocity (PHV) to control for maturation.

Results: TB PBM was reached by 7 years post PHV (chronological age (CA) of 18.8 and 20.5 years for females and males respectively). At the LS and TH, PBM was reached 5 years post PHV for females (CA of 16.8 years) and males (CA about 18.5 years). Peak BMC at the FN was reached by 3 years post PHV (CA 14.8 years for females and 16.5 for males). In the 2 years around PHV, 22 % of the adult TBBMC was accrued in both genders, and 39% was accrued in the 4 years surrounding PHV. The values for LS were 27% and 45%, for TH 26% and 45% and FN 22% and 33% for accrual in the 2 and 4 years around PHV, respectively.

Discussion: Seven years after the occurrence of PHV, PBM had been reached at all sites. Our results indicate that approximately 40% of adult bone mineral is laid down during the four year window surrounding the age of peak linear growth (PHV), thereby providing an opportunity for a modifiable lifestyle factor like physical activity to potentially optimize peak bone mineral accrual.

Skeletal Age Assessed With Fels and TW3-RUS Methods Among Adolescent Basketball Players

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Background: Skeletal maturity tends to be advanced for chronological age in adolescent male athletes (Peña Reyes et al. 2004) being soccer the most reported sport (Malina et al. 2007, Figueiredo et al. 2009).

Methods: Skeletal ages were assessed with the Tanner-Whitehouse III radius-ulna-short bone (TW3-RUS) and Fels methods in a sample of 62 basketball players 13.9 to 16.0 years of age.

Results: Consistent with other data (Malina et al. 2007, Figueiredo et al. 2009), skeletal age (SA) was, on average, in advance of chronological age (CA) considering both methods (CA, 15.1 yrs; SA TW3-RUS, 15.4 yrs; SA Fels, 16.6 yrs), and the skeletal ages derived from Fels method are consistently in advance of the ages obtained by the TW3-RUS method. Of specific relevance, 19 boys (14.4 – 16.0 years of age) were classified as skeletally mature with TW3-RUS method compared to only 3 boys (14.5 – 15.7 years of age) with the Fels method. In sequence by maturity status categories *late*, *on time*, *early*, *mature*, respectively, the following trends were noted: SA Fels (1; 18; 40; 3), SA TW3-RUS (7; 30; 6; 19). The Spearman rank-order correlation (0.67, $p < 0.001$) and Kappa coefficient (0.55 ± 0.13 [CI 0.29–0.80]) indicate moderate agreement between maturity classification based on the two methods of SA assessment.

Discussion: The discrepancy verified between the two methods relates, in part, to several factors: a) the greater specificity and discrimination of criteria of the Fels method in the later stages of skeletal maturation, b) use of both long and round bones with the Fels method in contrast to only the long bones in the TW3-RUS method, c) different methods used to assign skeletal ages to specific maturity assessments. Further, skeletal maturity is assigned at a skeletal age of 16.5 years with the TW3-RUS method compared to 18.0 years with the Fels method. The TW3-RUS and Fels methods yield different skeletal ages. Significantly more boys are classified as skeletally mature with the TW3-RUS method than with the Fels method. These observations may have implications if using “bone age” to validate chronological ages among youth participants in national or international competitions.

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Clinical Exercise Testing in Children with Metabolic Disease and other Neuromuscular Disorders

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Background: Although the value of exercise tests in neuromuscular disorders (NMD) have been acknowledged for several decades, the role of exercise as a diagnostic or therapeutic tool in patients with a metabolic disease (MD) and other NMDs, is relatively under researched. Therefore, the aim of the current study was to report the results of exercise tests in children with a diagnosed MD or NMD. This information might be helpful for clinicians in the diagnosis and management of these disorders.

Methods: Thirteen patients (9 boys, 4 girls, age 5-15 yrs) with a definite diagnosis of MD or NMD were included in this retrospective study (GSD1a, GSD3, GSD7, MCAD (2x), SCAD, MADD (2x), ketothiolase deficiency, mitochondrial myopathy, Becker dystrophinopathy (2x) and hypokalemic episodic paralysis). The results of nine children who were referred for exercise testing (3 girls, 6 boys, age: 12.3±3.8 years) in whom no diagnosis of an inherited MD or NMA could be made, were considered as the clinical control group. Cardiopulmonary exercise test (CPET) to determine the peak oxygen uptake (VO_{2peak}) and peak work load (W_{peak}) and a prolonged exercise test (PXT; 90-minutes at 30% of W_{peak}) were performed. During exercise respiratory gas-exchange and heart rate were monitored, and blood was drawn at set time points for biochemical analysis (e.g. CK, ammonia, lactate, acylcarnitine, FFA, and glucose). Urine was collected during and up to 3 hours for examination (e.g. organic acids, purines, pyrimidines, and myoglobin).

Results: Several characteristics in our patient group were observed, which reflected the differences in pathophysiology of the various disorders. For example high ammonia levels and no increase in lactate in GSD-7, increased acylcarnitines in MADD, and a severely impaired VO_{2peak} in mitochondrial myopathy.

Discussion: During exercise, the muscular system and metabolic pathways are stressed and pathophysiologic features might appear that are not observable at rest. We found various characteristics in our patient group, that reflect the differences in pathophysiology of the different disorders. CPET and PXT seem valuable instruments that can be of assistance in diagnosing patients with MD or NMD. Moreover exercise testing can help regarding the assessment of functional capacity in these patients.

Physical Fitness among Children with Intellectual Disabilities

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Background: Related to health, physical fitness includes cardiorespiratory fitness, muscular strength and endurance, body composition, and flexibility. Current data on the physical fitness of persons with intellectual disabilities are poor, but clearly underlined a lower level of physical fitness than in ordinary population and a higher prevalence of obesity [Chaiwanichsiri2000, Fernhall1993]. The purpose of this study was to investigate health-related fitness among intellectual disabilities children.

Methods: Currently, 67 children (14.24±1.48years) schooled in specialized establishments in the RhTMne-Alpes region (France), were included in the study. The Eurofit battery was used for physical fitness evaluations. For anthropometric measurements we added waist circumference measurement (WC), and we used a bio-impedance-meter [Bodystat[®]1500] to assess % fat mass (%FM).

Results: The Table 1 showed the results for the physical fitness test according by gender. Among participants, only 65% of the children have completed successfully the aerobic running test (heart rate >180 bpm). According to the VO₂max threshold indicative of cardiovascular health [Ortega05], 60% of children have a major risk of developing cardiovascular diseases. Significantly highest FM and WHTR have been found among less active girls (respectively: $r = 0.56-0.66$, $P < 0.05$, $n=19$). Unlike for boys: no significant relationship between those items were found (respectively: $r = 0.34$, $P < 0.1$; $r = 0.1$, $P = 0.63$, $n=24$). According to the International threshold for BMI, 5.97% of children were found obese and 23.88% were overweight. Forty three percent of children had an excess of fat mass, among them 31% who have an abdominal fat accumulation.

	Boys N=38;	mean ± SD	Girls N=29;	mean ± SD
BMI (kg.m-2)	21.60 ± 4.37		20.27 ± 4.14	
Fat mass (%FM)	19.69 ± 9.31		22.53 ± 8.67	
Sit-ups for 30s (number)	14.18 ± 5.31 *		10.62 ± 4.75 *	
Balance (%)	76% unbalance		69% unbalance	
Standing broad jump (cm)	142.50 ± 38.64 a		115.72 ± 32.83 a	
sit-and-reach (cm)	9.29 ± 13.75 a		11.50 ± 10.12 a	
plate tapping (sec)	17.82 ± 5.48		21.46 ± 7.05	
10*5 meters shuttle run (sec)	21.31 ± 2.96 #		24.52 ± 7.74 b	
	N=24;	mean ± SD	N=19;	mean ± SD
shuttle run test 20 m (level)	4.41 ± 1.56 *		3.07 ± 1.70 #	
VO ₂ max (ml/kg/min)	40.39 ± 3.95 *		39.21 ± 4.40 (NS) #	

aP<0.001, bP<0.05 [Ortega05] *P<0.001, #P<0.05 [Léger&Cazorla2008]

Discussion: This study showed a high level of obesity and a low level of cardio-respiratory fitness. That might worsen restriction of participation and health troubles among this specific public. Tests were difficult and could be very stressful for some children; this complicated the running of the study. Nevertheless, those results were important to aware professionals and supported the necessity to adapted physical activity. Adapted Physical Activity might engaged children with intellectual disabilities in healthy lifestyle, which have a major role on obesity prevention.

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Aerobic Capacity is Decreased in Children and Adolescents with Cerebral Palsy

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Background: The current available evidence regarding maximal aerobic capacity in children and adolescents with cerebral palsy might be obsolete due to changing intervention programs and is based on a small group. Therefore, the purpose of this study was to describe the aerobic capacity (VO_{2peak} (in ml/kg/min)) in contemporary children and adolescents with cerebral palsy (CP) using a graded exercise testing protocol to exhaustion.

Methods: Twenty four ambulatory children and adolescents with CP (8 girls, 16 boys; mean age 11.9 years, SD 2.9) classified at Gross Motor Function Classification System (GMFCS) level I or level II and 336 typically developing children (age 4-18 years) were included. All children performed a progressive exercise test on a treadmill with respiratory gas-exchange analysis. The results were compared with normative values for age and gender-matched Dutch controls. Moreover, differences between GMFCS level I and II were studied.

Results: VO_{2peak} of boys with CP was significantly lower (44.7 ± 7.1 ml/kg/min) than that of typically developing controls (51.7 ± 1.2 ml/kg/min). There was also a significant difference between the girls with CP (36.4 ± 7.6 ml/kg/min) and their typically developing controls (44.7 ± 0.3 ml/kg/min). There was no significant difference in VO_{2peak} between boys classified at GMFCS I (44.6 ± 6.3 ml/kg/min) and GMFCS II (45.1 ± 9.0 ml/kg/min). The VO_{2peak} among girls classified at GMFCS I and GMFCS II was not significantly different as well, $41.0 (\pm 7.8)$ ml/kg/min and $33.6 (\pm 6.7)$ ml/kg/min respectively ($P > 0.05$).

Discussion: The results show that the aerobic capacity of contemporary children and adolescents with CP, who are classified at GMFCS level I or II is significantly lower than that of typically developing controls. Furthermore, there was no significant difference in VO_{2peak} between children and adolescents with CP, classified at GMFCS level I or II. These values are, however, higher compared to previously reported values in the literature for children and adolescents with CP.

Cardiopulmonary Exercise Test Characteristics of Children with End-Stage Renal Disease: Signs of an Acquired Myopathy?

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Background: Exercise capacity in adults with end-stage renal disease (ESRD) is low. In children with ESRD, there are only a few studies suggesting a reduced exercise capacity. The objective of this study was to evaluate the exercise response in children with ESRD.

Methods: Patients (13 boys and 7 girls; mean age 14.1 ± 3.4 years) on dialysis (11 haemodialysis and 9 peritoneal dialysis) from four paediatric dialysis centres participated in this study. Exercise testing was performed using a cardiopulmonary exercise test on a cycle ergometer to determine peak heart rate (HR_{peak}), oxygen uptake (VO_{2peak}), carbon dioxide production (VCO_{2peak}), Respiratory Exchange Ratio (RER_{peak}), ventilation (VE_{peak}) and work rate (W_{peak}).

Results: The mean HR_{peak} (168.67 ± 22.78 (range 131-201 beats/min) was significantly lower compared to reference values ($P < 0.001$). The RER_{peak} was 1.15 ± 0.15 (range 0.87-1.44). 85% of the patients showed a reduction in VO_{2peak}/kg of more than two standard deviations below normal. The data on the VO_{2peak} , VO_{2peak}/kg , VE_{peak} and W_{peak} were significantly reduced compared to reference values. Furthermore, the mean ventilatory threshold was 32.66 % of predicted VO_{2peak} , which is reduced as well. Ventilatory equivalent for oxygen (VE_{peak}/VO_{2peak}) tended to be higher in children with ESRD compared with reference values (37.9 ± 7.0 and 35.7 ± 2.4 ; $p = 0.18$). Ventilatory equivalent for carbon dioxide (VE_{peak}/VCO_{2peak}) was significantly higher in ESRD compared with reference values (32.6 ± 4.4 and 29.7 ± 2.4 ; $p = 0.012$). The average oxygen pulse (VO_{2peak}/HR_{peak}) was 8.03 ± 2.96 ml/beat which was $67.14 \pm 17.39\%$ of the predicted. No associations were found between exercise-related measurements and the time on dialysis or disease duration. The cardiopulmonary exercise test characteristics were comparable with children with inflammatory myopathies (Takken et al 2008 Arthr Rheum).

Discussion: Children with ESRD have a severely impaired exercise capacity which was comparable to children with myopathies. This impairment is probably caused by inflammation, uremia, anaemia and cachexia. Interventions targeting the exercise capacity seems indicated for pediatric ESRD patients.

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Association between Fitness, Different Indicators of Fatness, and Clustered Cardiovascular Diseases Risk Factors in Portuguese Children and Adolescents

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Introduction: Cardiorespiratory fitness (CRF) should be studied when analyzing the prevalence of CVD risk factors in youth population. Although an inverse association between obesity and levels of CRF has been suggested, there is little evidence showing an interaction between CRF and fatness in relation to CVD risk factors. Abdominal fat and low CRF may both increase the risk of clustered CVD risk. It may therefore be of value to describe the independent association of these traits in relation to clustering of CVD risk factors.

Objective: The aim of the present study was (1) to investigate the relationship between CVD risk factors, CRF and three different indicators of fatness, and (2) investigate if these relationships are independent by each other.

Methods: This study was carried-out at Porto, Portugal, with children and adolescents aged 10-16 years-old of both genders (491 children, 223 boys and 268 girls). Standardized metabolic risk scores (MRS) were computed for six CVD risk factors. Multiple linear regression and Univariate Analysis of Variance – GLM were used and level of significance was set up at $p \leq 0.05$ using SPSS 15.0.

Results: Fitness was associated with clustering risk factors. Fit youngsters presented a better profile for each of risk factors analyzed isolated. Belonging to the unfit category increased the risk of having high MRS ($B = .158$; $p < 0.05$) but when models were adjusted for each of the fatness indicators, the relationship between fitness and MRS disappeared.

Discussion: Both fitness and fatness are associated with clustered risk factors by different pathways.

Impact of The Home Environment on Metabolic Syndrome and Other Physiological Variables

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Background: Growing evidence suggests that our environment affects the development of various diseases. This study examined the influence of the home environment on blood profiles, percent body fat, blood pressure and the metabolic syndrome (MetS) in adolescents.

Methods: Three hundred sixty-five adolescents (10-16 yrs) agreed to have a fasting blood sample drawn in addition to measures of body composition and blood pressure. A MetS cluster score was derived by calculating the sum of the sample-specific z-scores from the percent body fat, glucose, high-density lipoprotein cholesterol (negative), triglyceride, and systolic blood pressure. An inventory of physical activity and media equipment was made in each household. Physical activity equipment density (PED) and media equipment density (MED) was calculated by summing the number of physical activity and media items present in the home environment, respectively and dividing by the total number of locations in the home. Generalized estimating equations were used to identify significant ($p < 0.05$) relationships between the home environment (e.g., PED, MED) and the MetS and other physiological variables.

Results: We observed that as PED decreased there was a significant increase in insulin ($\beta = -0.25$, $p = 0.03$), LDL ($\beta = -1.69$, $p < 0.01$), total cholesterol ($\beta = -1.90$, $p < 0.01$), homeostasis model assessment for insulin resistance (HOMA: $\beta = -0.06$, $p = 0.02$), and percent body fat ($\beta = -0.56$, $p < 0.01$). As MED increased there were significant increases in insulin ($\beta = 1.98$, $p = 0.03$), low-density lipoprotein cholesterol ($\beta = 8.99$, $p = 0.04$), HOMA ($\beta = 0.42$, $p = 0.03$), percent body fat ($\beta = 2.60$, $p = 0.05$), and MetS ($\beta = 0.84$, $p = 0.04$). Testing for interaction by sex revealed that males had negative associations between PED and insulin ($\beta = -0.36$, $p = 0.03$) and HOMA ($\beta = -0.08$, $p = 0.01$), while females had positive associations between MED and triglycerides ($\beta = 30.84$, $p = 0.01$) and MetS ($\beta = 1.68$, $p = 0.01$).

Discussion: The results of this study support the role of the home environment in the development of the MetS. Further research studies are needed to determine the contribution of the home environment on the development of cardiovascular and metabolic diseases.

Influence of Pubertal Development on Ghrelin in Young Swimmers: a Longitudinal Study

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Background: Ghrelin is an endogenous ligand for growth hormone (GH) secretagogue receptor. Ghrelin transfers information from the stomach to the hypothalamus and influences GH release in response to changes in energy homeostasis. The aim of our study was to examine the influence of regular high energy expenditure on ghrelin concentration in male swimmers advancing from prepubertal to pubertal maturation levels.

Methods: The study included 19 Estonian prepubertal swimmers (pubertal stage 1) aged between 10 and 12 years at the beginning of the study. The participants were at the pubertal stages 2 and 3, and at the pubertal stages 3 and 4 at the second and third year measurements, respectively. The swimmers had a training history of 2.6 ± 0.8 yrs and trained for 7.6 ± 1.5 hours per week for at least last two years. Swimmers were tested once a year during a two year study period. A venous blood sample was taken in the morning after an overnight fast for ghrelin measurement (RIA). Main anthropometrical parameters and peak oxygen consumption (VO_{2peak}) on the cycle ergometer were measured after a light breakfast. A self-assessment of pubertal development was performed (Tanner, 1962).

Results: Ghrelin concentration was decreased significantly only after the first year of measurement (1321.8 ± 446.4 ; 910.0 ± 343.6 and 900.6 ± 339.6 pg/ml respectively on the first, second and third year of measurement). VO_{2peak} was increased only after the first year of measurement (2.54 ± 0.45 , 3.07 ± 0.52 and 3.14 ± 0.50 l/min⁻¹ respectively). Ghrelin was correlated significantly with VO_{2peak} ($r > -0.503$; $p < 0.05$).

Discussion: Therefore, our results support the possibility that ghrelin may act independently during different stages of maturation in the presence of regular high energy expenditure in boys. In conclusion, ghrelin concentration was decreased at onset of puberty, while no further changes in ghrelin concentration were seen with advancing age and pubertal stage in young male swimmers.

Physical Characteristics of Young Handball Player Girls

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Background: The growth and development of youngsters is manifested as an integrated result of several factors, i. e. genetic, social and economic effects, respectively. Among them, we believe, one of the most important factors in the developmental process is regular physical activity and sport, maintaining advantageous effect on spontaneous changes.

Methods: In our present study we report on the characteristics of the physique of 10 to 15 year-old handball player girls (N=118). Subgroups were formed by menarcheal status: Group 1 with 70 premenarcheal girls and Group 2 with 48 postmenarcheal ones. Anthropometric measurements were taken following the suggestions of the IBP (Weiner and Lourie 1969). The physique was characterized by Conrad's growth type (1963) and by of Heath and Carter somatotyping method (1967). Body fat content was assessed by Pařízková's method (1977) and the Drinkwater and Ross (1980) body fractionation methods also was used. For biological age assessment the method of Mészáros and Mohácsi (1983) was used.

Results: Contrary to the previous Hungarian the menarcheal mean age of the studied handball player girls was 11,86, lower than that of reference data, they proved to be early-maturers. Pubertal girls' chronological age were higher than that of the prepubertal ones, though both groups tended to be older, biologically. Prepubertal girls were more linear and had lower musculo-skeletal developmental level. This phenomenon could be explained by the lower calendar age. Prepubertal girls had also lower skinfold measurements compared to pubertal ones. The single one percent, non-significant difference in fat content could be the result of the relatively large variance.

Discussion: By monitoring the secondary sex characteristics some of the prepubertal girls were near to menarche, so that the slight differences in body measurements could be easily understood. In this group of handball player girls we could not see the delaying effect of the sport training on the onset of menarche, that had been reported in several studies, before.

Family and Lifestyle Influences on Physical Activity and Body Mass Index in grade 3 (8 yr-old) Australian boys and girls: a cross-sectional study

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Background: School is unlikely to be the sole agent for change in a child's life and body mass index (BMI) and habitual practices in physical activity appear to be strongly influenced by socio-demographic factors. The purpose of this study was to investigate the impact of family and other non-school related factors on the physical activity and body mass index of children in their third year of primary school.

Methods: A survey was completed by parents of 564 children (51% female) aged 7 to 8 years who were recruited from primary schools in Canberra. The study is part of the Lifestyle of Our Kids, (LOOK) project. We used proxy reports of physical activity outside of school to estimate weekly physical activity patterns and height and weight of children provided BMI. Characteristics of children in the study and their parents are described by valid percent of each group (intervention or control) and compared using chi-square tests. Binary logistic regression was used to compute independent predictors of overweight or obesity as adjusted odds ratios and 95% confidence intervals.

Results: Using the Cole cutoff points for categories of body weight, more girls (26.1%) than boys (18.8%) $p = 0.046$ were overweight or obese. Parents with diabetes were over represented in the children categorised as overweight or obese (44.4%), compared with parents with diabetes in the normal weight children (18.8%), $p = 0.01$. More children watching in excess of two hours/day of electronic screens were overweight or obese (27.1%) compared with normal weight children (19.3%), $p = 0.02$. Odds ratio results were multiplicative showing that a girl, whose parents perceive they make decisions about how much food their child eats, and who daily watches in excess of two hours of electronic screens after school, has an odds ratio of 4.3 for being overweight or obese.

Discussion: Parents with diabetes should be counselled on family health issues as a means of family weight management. Families' priorities for physical activity should equally include limits to unproductive sedentary time. Behavioural nutrition principles should also be included in future health promotion strategies targeting healthy lifestyles in families.

Neuromuscular and Kinematic Differences in Squat Jump Between Adults and Children

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Background: It is well documented that performance of short duration anaerobic tasks, such as maximum jumping and particularly squat jump (SQJ) improves throughout childhood and adolescence. The purpose of the present study was to determine lower extremities biomechanical and electromyographical differences between prepubescent and adult males during squat jumps.

Methods: Twenty males (10 prepubescents, 10 adults) participated in this study. Prepubertal subjects were 9-11 years old (age: 9.9 ± 0.5 years) and adults were 19-27 years old (age: 24.5 ± 3.5 years). The instrumentation included a Vicon 612 motion analysis system for the 3-D kinematics and a force plate for the ground reaction forces (GRFs). The EMG activity of the lower limbs [vastus lateralis-(VL), gastrocnemius medialis-(GM), soleus-(SOL) and tibialis anterior- (TA) muscle was also recorded. All participants were asked to perform 5 maximal SQJ with 2 min rest interval in between. The following electromyographic, kinematic and kinetic variables were assessed: jumping height, EMG amplitude of agonist and antagonist muscles, knee angular velocity, knee angles during push-off, peak GRFs. Mean, standard deviation of the mean was assessed for all dependent variables. Student's unpaired t-test has been used to identify significant differences between the groups. ($p < 0.05$)

Results: Children's performance in SQ height was 15.0 ± 0.01 cm and this was significantly lower than the values achieved by adults (28.1 ± 0.03 cm, $p < 0.01$). In addition, children presented a longer push-off phase compared to adults (391 ± 54 vs. 345 ± 34 ms, $p < 0.05$) but less normalized peak GRFs during the propulsive phase (1.73 ± 0.3 vs. 1.93 ± 0.4 N/kg, $p < 0.05$). Concerning the EMG amplitude during the propulsive phase of SQJ, adults presented significantly higher values for VL, GM and SOL muscles. In contrast, co-activation level of TA was higher in children ($p < 0.05$). Regarding kinematics and knee joint, adults exhibited higher values of knee angular velocities just before toe-off compared to children (12.7 ± 1.2 vs. 9.9 ± 0.6 rad/sec, $p < 0.05$) and as a result adults extended their knees more before toe-off (13.9 ± 3 vs. $17 \pm 2^\circ$, $p < 0.05$).

Discussion: The lower achieved height, agonist activity and higher antagonist activity observed in children during SQJ could be attributed mainly to the children's immature neuromuscular system and learning factors.

Physiological and Perceptual Responses in Children during Variable-Intensity Exercise

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Background: Although the physiological and perceptual responses to graded and steady-state exercise have been studied in children much less is known about variable intensity exercise (VIE) responses. This study examined the physiological and perceptual responses during VIE in six children (1M/5 F; 12.8 ± 2.1 yrs).

Methods: After a graded exercise test to determine peak VO_2 and work rate, subjects performed two VIE sessions on separate days. VIE consisted of three, 12-minute exercise bouts with 3-4 minute rest periods. Intensity ranged from 25%-125% of peak work rate and varied every 20-30 seconds. Blood glucose and lactate were measured from capillary samples obtained pre-exercise and following each bout. HR and OMNI RPE were assessed at 6 and 12 min during each bout; pulmonary gas exchange measures (VO_2 and V_E) were averaged in 2 min intervals over the last 10 min of the second bout. A 2-way (day by time) ANOVA was used to analyze the data and pair wise intra-class correlations were calculated.

Results: At peak exercise, VO_2 was 1.89 ± 0.29 L/min, HR was 186 ± 16 bpm, RER was 1.17 ± 0.06 , and RPE was 7.8 ± 1.7 . There was no interaction or day effect for any of the VIE analyses. The following variables increased over time ($P < 0.05$): HR from 159 ± 18 to 170 ± 18 bpm; RPE from 2.6 ± 1.3 to 6.1 ± 2.7 ; V_E from 40.5 ± 9.6 to 45.3 ± 9.6 L/min; and, lactate from 1.3 ± 0.3 to 5.4 ± 1.9 mmol/L. Glucose was maintained between 87.2 ± 12.5 and 98.3 ± 8.2 mg/dl and VO_2 ranged from 1.32 ± 0.31 to 1.41 ± 0.30 L/min across days. Intra-class correlations for HR, V_E and VO_2 were high ($R \geq 0.83$; $P < 0.05$) whereas for the other measures the intra-class correlations were more varied ($R = 0.11$ to 0.89).

Discussion: A VIE protocol is a suitable type of exercise to study in children. That this type of exercise lends itself well to the intermittent and varied nature of sports participation further enhances its efficacy.

Early Phase Overshoot Strategy of Children when Self-Regulating Intermittent Walking and Running Intensity Using Target RPE

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Background: This investigation examined an early phase “overshoot” perceptual production strategy used by young girls to self-regulate intermittent walking and running treadmill intensity according to a target rating of perceived exertion (RPE). In an overshoot strategy, oxygen uptake (VO_2) and heart rate (HR) are greater during the first 3-6 min of a self-regulated aerobic exercise session (i.e. production trial) than during a graded exercise test (GXT; estimation trial) when compared at a reference RPE. After the early phase, VO_2 and HR decrease to levels congruent with the prescribed target RPE, being stable for the remainder of the production trial. An “overshoot” strategy has been identified for adults but not children.

Methods: Subjects were 12 girls, 10 to 12 yr old. The design employed an estimation-production paradigm using; (a) a peak GXT estimation trial and (b) separate intermittent walking and running self-regulated production trials presented in counterbalanced order. Treadmill speed was self-regulated during walking to produce a RPE of 3 and during running to produce a RPE of 6. The Children’s OMNI Walk/Run Perceived Exertion Scale was used. For each production mode, three, three minute bouts with one minute rest between bouts were performed. VO_2 and HR were compared between the GXT and each intermittent walking and running bout.

Results: For both walking and running, VO_2 and HR equivalent to the prescribed target RPE were higher ($p < 0.05$) during the first intermittent production bout than during the GXT (See Table). Neither VO_2 nor HR differed between the GXT and the second and third intermittent bouts.

Table: VO_2 ($\text{ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$) and HR ($\text{b} \cdot \text{min}^{-1}$) at reference RPE

Mode	Variable	Est	Production Bouts		
			1	2	3
Walk	VO_2	0.97	1.33*	1.02	0.90
	HR	129	151*	134	124
Run	VO_2	1.38	1.65*	1.32	1.34
	HR	154	174*	150	153

*Greater than Estimation (Est) ($p < 0.05$)

Discussion: Young female children employed an early phase perceptual “overshoot” production strategy to self-regulate intermittent bouts of treadmill walking and running using target RPEs. It is proposed that such a production strategy is an in-task perceptual/cognitive calibration process, perhaps functioning as a teleoanticipation feedback loop.

Fitness Levels of Urban and Rural Kenyan Children: Emerging Evidence of the 'Physical Activity Transition'?

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Background: Fundamental changes to built and social environments are changing physical activity behaviour patterns. Kenyan's are admired globally as being active and fit, producing a disproportionate number of elite endurance athletes. However, there is a paucity of information on the fitness level of Kenyan children. An emerging physical activity transition in Kenya may lead to a less active lifestyle, making it important from a public health perspective to begin to monitor fitness levels among Kenyan children. Early evidence of the physical activity transition may be seen by comparing urban and rural dwelling populations.

Methods: Kenyan children (n=179) took part in this study. Fitness measures (grip strength, sit-and-reach flexibility, and 20 m shuttle run) were performed on children aged 9-12 years from two urban (Nairobi) and two rural (Rift Valley) schools.

Results: Both male and female rural Kenyan children had higher running speeds (males 11.7 vs 10.7; females 11.2 vs 9.8 km/hr), aerobic fitness (males 52.6 vs 47.8; females 49.7 vs 44.5 ml/kg/min) and percentile rankings (males 74% vs 48%; females 79% vs 42%) than urban Kenyan children ($p<0.001$). Grip strength was higher in all urban children ($p<0.05$) compared to rural children. Pooled data from all Kenyan children were lower compared to Canadian children. Rural Kenyan girls were more flexible than urban Kenyan girls ($p<0.001$) and similar to Canadian girls.

Discussion: These data indicate that aerobic fitness is much higher in rural-dwelling Kenyan children than urban dwelling Kenyan children. Using age and sex-specific z-scores to normalize the findings, rural male and female children score higher on average than any other country where data are available. Urban Kenyan children rank about average compared to internationally available data. Urban Kenyan children are slightly stronger than rural Kenyan children but are not strong compared to Canadian children, even after correcting for differences in body weight.

Rural Kenyan children have very high aerobic fitness and low grip strength compared to urban Kenyan children. Whether these data provide evidence of a "physical activity transition" requires further study.

This research was supported by a grant from the Canadian Institutes of Health Research.

Establishing Maximal Oxygen Uptake in Young People during a Ramp Cycle Test to Exhaustion

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Background: A ramp cycle test to exhaustion has become a standard protocol for determining $\dot{V}O_{2\max}$ in young people, yet its validity in establishing a 'true' maximum remains to be established. This study tested the hypotheses that: 1) secondary criteria traditionally used to verify a $\dot{V}O_{2\max}$ in children can result in the acceptance of a 'sub-maximal' $\dot{V}O_{2\max}$ or falsely reject a 'true' $\dot{V}O_{2\max}$; and 2) the $\dot{V}O_{2\text{peak}}$ recorded during a ramp test in children is comparable to the $\dot{V}O_{2\text{peak}}$ achieved during supra-maximal testing.

Methods: Thirteen children (9-10 y) completed a ramp cycle test to exhaustion to determine their $\dot{V}O_{2\text{peak}}$. After 15 min recovery, the participants performed a supra-maximal cycle test to exhaustion at 105% of their ramp test peak power.

Results: Compared to the $\dot{V}O_{2\text{peak}}$ during the ramp test, a significantly lower $\dot{V}O_2$ was recorded at an RER of 1.00 ($1.293 \text{ L}\cdot\text{min}^{-1}$ [SD 0.265] vs. $1.681 \text{ L}\cdot\text{min}^{-1}$ [SD 0.295], $P<0.001$, $n=12$), and at a heart rate of 195 beats $\cdot\text{min}^{-1}$ ($1.556 \text{ L}\cdot\text{min}^{-1}$ [SD 0.265] vs. $1.721 \text{ L}\cdot\text{min}^{-1}$ [SD 0.318], $P<0.001$, $n=10$) and at 85% of age predicted maximum ($1.345 \text{ L}\cdot\text{min}^{-1}$ [SD 0.228] vs. $1.690 \text{ L}\cdot\text{min}^{-1}$ [SD 0.284], $P<0.001$, $n=13$). Of the three children who failed to reach the 195 beat $\cdot\text{min}^{-1}$ criterion, a clear plateau-like profile in $\dot{V}O_2$ at exhaustion was noted in two of these participants. Likewise, six children failed to reach the blood lactate criterion of $\geq 6 \text{ mM}$, two of which showed a clear plateau-like behaviour in their $\dot{V}O_2$ profile at exhaustion. Supra-maximal testing yielded a $\dot{V}O_{2\text{peak}}$ that was not significantly different from the ramp test ($1.615 \text{ L}\cdot\text{min}^{-1}$ [SD 0.307] vs. $1.690 \text{ L}\cdot\text{min}^{-1}$ [SD 0.284], $P=0.090$, respectively), despite exercising at a higher power output (127 vs. 120 W).

Discussion: The use of secondary criteria to verify a maximal effort in young people during ramp cycling exercise may result in the acceptance of a 'sub-maximal' $\dot{V}O_{2\max}$ or falsely reject a 'true' $\dot{V}O_{2\max}$ score. As supra-maximal testing elicits a $\dot{V}O_{2\text{peak}}$ similar to the ramp protocol, thus satisfying the plateau criterion, it is recommended that the use of such tests should be adopted as *the* appropriate method of confirming a 'true' $\dot{V}O_{2\max}$ in healthy young people.

XXVth International Symposium of Pediatric Work Physiology.

Poster presentations
Session #1
Wednesday September 30th
12:30 p.m. – 2:00 p.m.

The Anaerobic-to-Aerobic Power Ratio in Children With Juvenile Idiopathic Arthritis

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Background: The evidence-base for the prescription of exercise for children and adolescents with JIA is rather small, and is merely based on 3 small randomized controlled trials. A rationale for the variability in exercise therapy is a lack of understanding as to whether exercise training should be more focussed on aerobic or anaerobic exercise, or a combination of these energy systems. A tool that might offer valuable information whether the exercise limitation of the child with JIA is more anaerobic or more aerobic in nature is to calculate the ratio of anaerobic to aerobic power. Therefore, the aim of this study was to examine the Anaerobic-to-Aerobic Power Ratio in children with Juvenile Idiopathic Arthritis (JIA) compared to healthy peers.

Methods: Sixty-two patients with JIA (mean age: 11.9±2.1 years, range 7.2-15.9) with varying severity of disease and fifty healthy children (mean age: 12.1±2.1, range 8.4-15.9) participated in this study. Anaerobic power was measured using the Wingate Anaerobic Exercise Test (WAnT). Aerobic power was measured using a cardiopulmonary exercise test (CPET). The power ratio was calculated as the ratio between the anaerobic mechanical power and aerobic mechanical power in Watts.

Results: Mean anaerobic-to-aerobic power ratio and peak anaerobic-to-aerobic ratios in children with JIA were 1.98±0.51 and 3.28±1.15, respectively. Compared to healthy children these differences were not statistically significant (p=0.52 and p=0.99, respectively). The differences in these ratios were not statistically significant when corrected for age, height and body mass. Statistical analyses showed no significant difference between disease-onset types of JIA, for mean anaerobic-to-aerobic power ratio and peak anaerobic-to-aerobic ratio, respectively. Furthermore, there was no significant difference in the development of the power ratios between children with JIA and healthy controls, or between girls and boys.

Discussion: This cross-sectional study suggests that the development of the anaerobic-to-aerobic power ratio is not statistically different in children with JIA compared to healthy peers. Physical training of the anaerobic capacity through interval training, next to aerobic exercise training seems warranted in the exercise therapy programs of children with JIA.

Muscle Energetics Changes in Prepubescent Boys and Adults: a Quantitative ³¹P-MRS Analysis

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Introduction: Although ³¹Phosphorus-Magnetic Resonance Spectroscopy (³¹P-MRS) measurements can provide quantitative estimate of ATP turnover and proton handling in vivo, no study has been devoted so far to the analysis of maturation on these parameters. This information is essential to determine a reliable muscle bioenergetics profile in childhood. The purpose of this study was to investigate whether the development from childhood to adulthood may affect ATP synthesis rates from each pathway during muscle activity.

Methods: Seven prepubescent boys (11.7 ± 0.6 yr) and ten men (35.6 ± 7.8 yr) performed finger flexions at 0.7 Hz against a weight adjusted to 15% of their maximal voluntary strength for 3-min, followed by a 15-min of recovery. Metabolic changes were recorded at 4.7 T (Bruker, Biospec), using ³¹P-MRS. During the exercise, the rate of ATP synthesized from the net breakdown of PCr was determined from the rate of PCr decrease while glycolytic flux was calculated taking into account rates of proton consumption and production. Oxidative capacity was assessed as previously described by Walter et al. (1999) from the rate of PCr recovery.

Results: The total ATP turnover scaled to volume and power output ratio was identical in both groups i.e., 127.4 ± 55.7 mM ATP.min⁻¹.(W/dm³)⁻¹ in children and 124.2 ± 33.08 mM ATP.min⁻¹.(W/dm³)⁻¹ in adults. However, the relative oxidative contribution was significantly higher in children (45 ± 11 %) than in men (28 ± 11 %, $P < 0.05$) whereas the relative contribution from PCr breakdown was reduced in children (14 ± 2.5 %) as compared to men (24 ± 5 %, $P < 0.05$). On the contrary, the relative glycolytic flux was similar whatever the age.

The recovery phase also disclosed differences regarding the rates of proton efflux (6.2 ± 2.4 vs. 3.9 ± 1.9 mM.pH unit⁻¹.min⁻¹, in boys and men respectively) and PCr recovery which was significantly faster in boys than in men (k_{PCr} : 1.3 ± 0.5 vs. 0.7 ± 0.4 min⁻¹; V_{max} : 38.3 ± 15.5 vs. 23.3 ± 10.7 mM.min⁻¹, $P < 0.05$ respectively in boys and men) .

Discussion: In the present study, we demonstrated a significant increased oxidative cost of exercise in boys compensated by a reduced PCr breakdown. These changes could explain the higher fatigue resistance previously reported during high-intensity intermittent exercises.

Is there a Relative Age Phenomenon in Elite Female Ice Hockey?

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Background: The relative age phenomenon in sport, or the association of success in sport and being born earlier in a selection year, has been studied in a variety of sports including men's ice hockey (at least 11 studies), but not in women's ice hockey. The purpose of this study was to determine if a relative age effect is present in elite women's ice hockey.

Methods: Female ice hockey players from the University of Alberta (n = 95 players, age=21.2±2.8 years, 1999-2006 seasons) were interviewed for date of birth (DOB), which was coded for each player by quarter of the year: 1=first quarter (born Jan. 1-Apr. 2), 2 (Apr. 3-July 2), 3 (July 3-Oct. 1), or 4 (Oct. 2-Dec. 31). Players completed on-ice skating performance tests included speed, 6.10 m acceleration, Corner S-Turn agility, and Modified Repeat Sprint Skate (MRSS). Off-ice fitness tests included 40-yard dash, vertical jump, push-ups, sit-ups, and the Leger test (to estimate $\text{VO}_{2\text{max}}$). Canadian Interuniversity Sport (CIS) and Canada West (CW) rankings for 2004-2006 pre-seasons were included in a cross-tabs/Chi square analysis to determine if being ranked or not was related to relative age (quarter of birth). ANOVAs (SPSS Mac Version 10.0) were run to determine if there were significant differences in on-ice tests of skating performance and off-ice fitness tests by relative age.

Results: Those born in the first quarter of the year were significantly faster on speed, acceleration, agility, and MRSS tests and had better aerobic fitness (based on MRSS drop-off times) and better off-ice speed (40-yard dash) than those born in the fourth quarter ($p<0.05$). However, there were no significant differences in relative age between players with CIS or CW rankings and those who were not ranked (Pearson Chi square = 2.868, $p=0.412$ and 3.283, $p=0.350$; respectively).

Discussion: There appears to be a relative age effect in elite women's ice hockey as evidenced by significant differences in fitness and skating performance characteristics. However, CIS and CW rankings do not differ by relative age, and may reflect years of skating experience and competitive play in addition to fitness levels and skating performance measured in non-competitive situations.

Physical Activity Levels of Hungarian Children during School Recess

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Background: School recess provides an opportunity for school children to engage in physical activity. However, studies have primarily been conducted in Western Europe and North America. No such data exists for Eastern European countries. The aim of this study was to determine the physical activity levels of Hungarian children during recess.

Methods: One hundred and fifteen children (71 boys, 44 girls, 12% overweight) aged 9-12 years from 3 schools returned signed informed parental consent and were recruited in to the study. Physical activity was quantified using uni-axial accelerometry for 5 consecutive days (3 week days, 2 weekend days). The accelerometer was worn mounted on the right using a fitted elastic belt during all waking hours except for water-based activities. Epoch length was set at 5 seconds. The time spent in sedentary, light, moderate (MPA), and vigorous physical activity (VPA) during school recess was determined using existing age-appropriate cut-points (Freedson et al., 1997). One hundred and eleven children had complete recess data for at least 2 weekdays, and were included in the analyses. Analyses of variance were used to assess gender differences in the physical activity variables.

Results: Boys engaged in significantly more light ($30 \pm 5.9\%$; 27.5 ± 5), MPA ($16.9 \pm 5.2\%$; $13.1 \pm 3.4\%$) and VPA ($7.5 \pm 4.6\%$; $4.1 \pm 2.8\%$) than girls during recess, respectively ($p < 0.05$). Girls engaged in significantly more sedentary activity than boys ($55.3 \pm 8.4\%$; $45.6 \pm 11.2\%$; $p < 0.05$). On average, boys engaged in MVPA for 18.9 minutes compared to 13.1 minutes for the girls during recess.

Discussion: These results are consistent with previous recess studies that have shown boys are more active than girls in this context (Ridgers et al., 2005; Sarkin et al., 1997). However, accumulated MPA and VPA during recess was lower than previous studies (Ridgers et al., 2005; Ridgers & Stratton, 2005). This may be explained by the differences in the recess context between Hungary and Western European countries. Since sedentary activity accounted for the largest proportion of recess, interventions may be needed to promote physical activity during the school day.

Comparison of Physical Activity Pattern Obtained by Uni- or Tri-Axial Accelerometers

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Background: The aim of this study was to compare physical activity patterns (PAP) obtained simultaneously by a uniaxial accelerometer and a triaxial accelerometer in adolescents in free living condition.

Methods: Sixty-two subjects, aged 13-16 years old, were recruited to participate to this ancillary study as a part of the Healthy Life-style in Europe by Nutrition in Adolescence Cross-Sectional Study (HELENA-CSS). All subjects wore simultaneously an uniaxial accelerometer (Actigraph, Shalimar, CA) and a triaxial accelerometer (RT3, Stayhealthy Inc., Monrovia, CA) on the waist during seven consecutive days. Accelerometer data output was expressed as counts per minute. The threshold for categorising level of physical activity (PA) for uni/triaxial accelerometer counts were: 0–400 and 0-40 counts·min⁻¹ sedentary activity, 401–1900 and 41-950 counts·min⁻¹ for light activity, 1901–3918 and 951-3410 counts·min⁻¹ for moderate activity, > 3918 counts·min⁻¹ and > 3410 for vigorous activity. Then, PAP from uni/triaxial accelerometer were calculated by converting accelerometer data output in percentage of time spent at sedentary, light, moderate and vigorous PA per day.

Results: The differences of PAP (calculated by subtracting the RT3 - from the Actigraph PAP data) between the uniaxial accelerometer and the triaxial accelerometer were small and non-significant for total PAP. Similarly, absolute differences of PAP at sedentary, light, moderate and vigorous PA level were small: $-2.1 \pm 1\%$, $-1.4 \pm 1.7\%$, $0.6 \pm 0.5\%$, $0.02 \pm 0.09\%$ respectively. The equivalence test showed that PAP obtained by uni and triaxial accelerometers were equivalent ($p < 0.001$).

Discussion: There were no differences in time spent at different PA intensity levels assessed by either uni or triaxial accelerometers. This suggests that the choice of accelerometer is of little relevance for the assessment of PA pattern during free living conditions.

Waist-to-Height Ratio and Body Mass Index as predictors of Cardiovascular Risk in Youth

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Background: Previous research has suggested that waist-to-height ratio (WHTR) may display a stronger relationship with cardiovascular disease risk than body mass index (BMI) in children and adolescents. The primary objective of this study was to examine the predictive value of WHTR and BMI for determining the probability of having unhealthy levels of total serum cholesterol (TC) or systolic blood pressure (SBP) in children and adolescents.

Methods: Data from subjects (for TC analysis: $N = 2,300$, males = 1174, females = 1126; for SBP analysis: $N = 1848$, males = 964, females = 884) who were part of the National Health and Nutrition Examination Survey (2003-2004) were analyzed. Participants were stratified into four age groups (G1 = 6- to 8-year-olds (for TC analysis only); G2 = 9- to 11-year-olds; G3 = 12- to 14-year-olds; G4 = 15- to 17-year-olds). Two-by-two boxes were developed for the risk levels of both TC ($\geq 200 \text{ mg}\cdot\text{dL}^{-1}$) and SBP ($\geq 90^{\text{th}}$ percentile) against WHTR (≥ 0.50) and BMI ($\geq 85^{\text{th}}$ percentile) for each age group. Positive [= true positives/(true positives + false positives)] and Negative predictive values [= true negatives/(true negatives + false negatives)] were calculated from the two-by-two boxes for each respective age group.

Results: Table 1: Positive and Negative predictive values (%) of WHTR and BMI for determining high TC levels

Group	Positive Predictive Value		Negative Predictive Value	
	WHTR	BMI	WHTR	BMI
G1	9.4	8.9	93.0	92.9
G2	16.4	14.9	88.2	87.2
G3	8.8	8.4	92.8	92.6
G4	17.3	16.8	94.1	93.7

Table 2: Positive and Negative predictive values (%) of WHTR and BMI for determining high SBP values

Group	Positive Predictive Value		Negative Predictive Value	
	WHTR	BMI	WHTR	BMI
G2	5.3	5.2	96.8	96.9
G3	7.4	7.4	98.2	97.9
G4	5.9	5.9	97.7	97.7

Discussion: The results demonstrated that WHTR was a slightly better predictor (positive and negative) of high TC levels compared to BMI and that no difference was noticed in the predictability of high SBP levels from WHTR or BMI. However, an unhealthy WHTR or BMI value in youth may not be the best predictor of cardiovascular risk due to the low positive predictive values.

Exercise Intensity During a Recreational Climbing Clinic for Youth 12-17 years of Age

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Background: Rock climbing has increased in popularity over the last 15 years, with indoor rock wall gyms opening up all over the United States. Physiological demands of rock climbing require both aerobic and anaerobic fitness, with the metabolic cost comparable to moderate to vigorous physical activity (MVPA) (Sheel, 2004). One study found that adult recreational climbers achieved 70–72% of their $\text{VO}_{2\text{peak}}$ (Rodio et al., 2008). For youth, climbing may be a viable option for decreasing risk of overweight and overweight by keeping them active using a past time they enjoy.

Purpose: To determine whether rock climbing in inexperienced youth attending a climbing clinic has the cardiorespiratory fitness potential of other physical activities.

Methods: Thirteen participants (nine males and four females; mean age = 14.7 ± 1.8 years) were taught to safely climb on an indoor ~11m rock wall for 2 hours/day for 4 days. Height and weight were measured; the BMI was calculated ($19.4 \pm 2.9 \text{ kg/m}^2$). Heart rate (HR) monitors were placed on participants at the beginning of each climbing session; HR was recorded every 10 minutes. Average activity heart rate (AHR), maximum heart rate (MHR), total time on activity, and activity choice were recorded. Paired-sample t-tests were used to determine whether MHR and AHR differed by day of activity.

Results: MHR did not differ by day of the clinic ($p > 0.01$). However, due to a longer introductory instruction period, AHR was significantly lower on Day 1 than on Days 2-4 ($p < 0.01$). The highest HRs achieved during climbing-related activities ranged from 130-211 bpm.

Discussion: AHR in this study did not differ between days 2-4 (range = 101-148 bpm), and the exercise intensity was light to moderate. However, participants were all active for the full 2 hours during the 4 days of the climbing clinic. The duration of the activity is long enough to meet US Department of Health and Human Services recommendations, but the intensity of the activity did not meet MVPA guidelines. Participating in climbing on a regular basis, with the concurrent skill development, may increase the intensity of this activity in youth climbers.

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Reduced Physical Activity Level and Cardiorespiratory Fitness in Children with Chronic Diseases

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Background: There is increasing evidence that regular physical activity (PA) during childhood reduces multiple health risk factors and predispose to PA during adult life. Several studies investigated the PA and cardiorespiratory fitness (CRF) in children with different chronic diseases, such as obesity (OB), type 1 diabetes mellitus (T1DM), or juvenile idiopathic arthritis (JIA); however no study compared these three conditions with healthy subjects. We aimed to compare PA level and CRF in children with different chronic diseases, such as T1DM, OB and JIA, with healthy controls (HC).

Methods: This was a cross-sectional study including 209 children (mean age: 10.1 ± 0.2 yr, OB: $n=45$, T1DM: $n=48$, JIA: $n=31$ and HC: $n=85$). There was no gender difference between groups. We assessed PA level during at least 4 days (mean: 6.3 ± 1.1) using an Actigraph accelerometer and CRF by measuring the peak oxygen consumption (VO_2max) during a maximal treadmill test. Subjects with JIA did not have an acute flare.

Results: Children with chronic diseases had reduced total daily PA counts (T1DM 497 ± 54 cpm, $p=.003$; JIA 518 ± 28 , $p<.001$, OB 590 ± 25 , $p=.003$) and CRF (T1DM 41.9 ± 1.4 $\text{ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$, $p=.045$; JIA 39.3 ± 1.7 , $p=.001$, OB 41.7 ± 1.2 , $p=.020$), compared to HC (668 ± 35 cpm; 45.3 ± 0.9 $\text{ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$, respectively). Patients with JIA had also significantly lower PA counts than OB. Only 60.4% of HC, 51.6% of OB, 38.1% of JIA and 38.5% of T1DM children met the recommendation of 60 minutes of MVPA per day. Physical activity level was inversely related to age in all groups. Low CRF fitness was associated with female gender ($R=0.206$, $p=.003$), high percentage of fat ($R=-0.162$, $p=.019$) and low daily physical activity ($R=0.221$, $p=.015$).

Discussion: Obesity, T1DM and JIA in children are associated with reduced PA level and CRF. As the benefits of physical activity on health have been well demonstrated during growth, it should be encouraged in children with chronic diseases to prevent a reduction of CRF and the development of co-morbidities. Physical activity prescription should be adapted to the child's capacity and fear.

Differences in Perceived Environmental Features, Physical Activity, and BMI according to Socioeconomic Status

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Background: The purpose of this study was to analyze the relative strength of associations between PA, BMI and several characteristics of the built environment within SES groups.

Methods: The sample of this study comprised 599 girls, ranging 13-17 years-old. Physical Activity was assessed by a questionnaire developed by Telama et al (2007). Environmental Neighbourhood Perception was assessed using the environmental module of the IPAQ study and Socioeconomic status (SES) was established by maternal education level. Girls were grouped into low, middle or high SES group.

Results: Regardless the continuous or categorical PA scores, girls assigned to higher SES group were significantly ($p \leq 0.05$) more active than their peers. A significantly ($p < 0.05$) greater proportion of high SES level girls agree that “there are many four-way intersections in my neighbourhood”; that “I see many people being physically active in my neighbourhood”; and that “there are many interesting things to look at while walking in my neighbourhood” compared to low SES level counterparts. No other significant differences were found. Multivariate analysis showed that while connectivity is significantly associated with higher SES level, the social support and aesthetics are more likely associated to middle SES level but not associated to high SES. Furthermore, our findings showed an association between PA with high SES group but not for the middle SES group.

Discussion: The study showed that should be considered that different neighbourhood characteristics might be differently associated with different SES backgrounds.

Relations between Academic Achievement and Physical Fitness Level in Portuguese School Children

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Background: Several studies have reported positive associations between fitness levels and physical activity levels and academic achievement in children and adolescents. The aim of this study was to verify the relation between academic achievement and physical fitness levels, in a Portuguese sample of school children aged 11 to 13 years old.

Methods: The sample comprised 248 adolescents (107 girls – 43.1%), aged 11 to 13 years old (mean=11.37±0.99 years) from two basic schools in the North of Portugal (Guimarães). Children who were enrolled in grade 6 during the 2007/2008 academic year were used. Fitness levels were assessed with the Fitnessgram test battery (20m shuttle run, curl-up, push-up and sit and reach). Z scores by age and sex were computed for all fitness tests. Z scores of the individual tests were summed to construct a clustered fitness score, and individuals with more than 1 standard deviation in this score were defined as fit. Academic achievement was measured using the national exams of Mathematics and Portuguese Language, mandate by the Portuguese Ministry for Education. Children were classified as passing or not passing at either exams or at least in one of the exams. Weight and height were objectively measured and BMI was computed and defined according to Cole et al (2000) cut off points. Age, gender and school socio-economic status (eligible for benefit A, B or not eligible) were extracted from the school administrations records systems. School socio-economic status was used as a proxy measure of family socio-economic status. Binary Logistic Regression model were constructed to evaluate the strength of the association between fitness levels and the odds of passing at least in one of the exams.

Results: After adjustments for age, gender and school socio-economic status, fit children were more likely to pass in at least one of the exams (OR=3.28, 95%CI:1.44-7.18, p<0.05).

Discussion: Among Portuguese children, there was a significant positive relation between physical fitness and Mathematics and/or Portuguese Language academic achievement.

Effects of Attending Elevated Level School Physical Education in 7-to-11-year-old Boys

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Background: Physical activity might influence growth by three mechanisms: (a) regular exercise draws on caloric stores and competes with the energy demands of growth for available nutrients; (b) physical activity is a potent stimulus for the production of secondary growth factors; (c) muscle activity creates local stresses that trigger musculo-skeletal growth. The aim of the longitudinal study of four years was to analyse differences in growth patterns, age-related changes in body fat and physical performance in schoolchildren taking part either in normal or in elevated level physical education at school.

Methods: Nine data collection sessions were carried out between 2002 and 2006 in 18 schools. The sample consisted of 521 non-athletic volunteer boys (PE =116, contrast = 405). The inter-group differences between mean height, body weight, body mass index, relative body fat content, mean scores in 30m dash, 400m run, and standing long jump as well as the patterns of change with age were analysed in this comparison. Between-observation differences were tested by repeated measures ANOVA. In case of a significant F-test Tukey's post-hoc tests were used. Age dependence was also studied by linear regression analysis.

Results: The between-group differences in mean height were not significant, but the slope of height increase with age was significantly greater in the PE boys. The PE boys were significantly lighter through all the nine observations and the slope of age-related weight increase was statistically faster in the group of contrast subjects. Both the BMI means and percent body fat means were consistently and significantly greater in the contrast group and faster increases were found in the group of the less active boys. The mean physical performances of the PE boys were consistently and significantly better. Their slopes of increase were statistically different.

Discussion: It is not merely a theoretical aspect among the possible solutions that a rearrangement of the physical education classes (such as employing only 6 sessions but of 90min duration each for a 10-day education cycle) could be more effective since in this way the passive times arising from the necessary organisational tasks would become shorter and the active ones longer.

Association between Fitness, Physical Activity Components and Percent Body Fat in Liverpool Schoolchildren Aged 9-10 Years: The A-CLASS Project

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Background: Reported associations between aerobic fitness, physical activity (PA) and body fatness in children vary, perhaps owing to methodological differences and the use of insensitive methods. This study examined associations between calorimetry derived aerobic fitness, PA components measured using ActiGraph accelerometers, and, percent body fat (%BF) measured by dual-energy x-ray absorptiometry (DXA) in Liverpool schoolchildren.

Methods: Thirty-nine boys and 58 girls (age mean 9.7, SD 0.3) provided at least 9 hours of accelerometry-derived habitual PA information on a minimum of 3 weekdays and 1 weekend day. Data were analysed using individually calibrated activity count thresholds for PA at $4\text{km}\cdot\text{h}^{-1}$ (PA^4) and $8\text{km}\cdot\text{h}^{-1}$ (PA^8), and a sedentary threshold of 100 counts per minute (cpm). Maximal oxygen uptake ($\text{VO}_{2\text{peak}}$) was assessed using a discontinuous incremental treadmill exercise test to volitional exhaustion. DXA was used to measure %BF. Partial correlations (adjusted for maturity) evaluated the strength of relationships between variables. Multiple regression analyses were used to analyse independent associations of PA components and $\text{VO}_{2\text{peak}}$ with %BF.

Results: Body fat reference curves (McCarthy et al., 2006), suggest 60.3% of girls and 51.3% of boys were overfat or obese ($\geq 85^{\text{th}}$ centile). Approximately 76% of girls and 77% of boys participated in at least 60 daily minutes of $\text{PA}^{\geq 4}$. In both boys and girls $\text{VO}_{2\text{peak}}$ was significantly and inversely correlated with %BF (boys: $r=-0.797$, $p<0.001$; girls: $r=-0.665$, $p<0.001$). In boys PA^4 , PA^8 and cpm were significantly and positively correlated with $\text{VO}_{2\text{peak}}$ ($r>0.3$, $p<0.05$), and negatively correlated with %BF (PA^4 : $r=-0.274$, $p=0.053$; PA^8 : $r=-0.263$, $p=0.061$; CPM: $r=-0.399$, $p<0.05$). In girls $\text{VO}_{2\text{peak}}$ significantly correlated with PA^4 ($r=0.223$, $p<0.05$) and sedentary time ($r=-0.250$, $p<0.05$), and %BF significantly and inversely correlated with PA^4 ($r=-0.284$, $p<0.05$). Regression analysis showed only $\text{VO}_{2\text{peak}}$ significantly predicted %BF in boys (standardised $\beta=-0.859$) and girls (standardised $\beta=-0.73$).

Discussion: In boys, body fatness was inversely related to aerobic fitness, moderate and high intensity activity, and total PA. In girls, body fatness was inversely related to aerobic fitness and moderate intensity activity. Independent associations with %BF suggest aerobic fitness is an important risk factor for overfat in Liverpool children.

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Normalization of Stroke Volume for Body Composition During Maximal Cycle Exercise in Highly Trained Adolescents

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Background: Evidence exists in the literature to suggest that when matched for training volume, there is a reduced cardiac adaptation to exercise in adolescent females compared to males due to circulating androgens. To explore this issue, this study compared stroke volume (SV) responses to progressive maximal upright cycle exercise in 12 highly-trained boys (age 14.6 \pm 0.6 years) and 13 girls (14.6 \pm 0.6 years) recruited from professional football club academies in the United Kingdom.

Methods: Fat free mass (FFM) was estimated by air displacement plethysmography. Subjects pedaled at 60 rpm to exhaustion with 3-minutes stages of 35 W load increments with standard measures of gas exchange variables. SV was estimated by Doppler interrogation of aortic flow velocity.

Results: Peak $\dot{V}O_2$ was significantly ($p < 0.05$) greater in the boys (57.4 \pm 4.8 mL kg⁻¹ min⁻¹) than the girls (43.5 \pm 3.4 mL kg⁻¹ min⁻¹). Furthermore, maximal cardiac output was significantly ($p < 0.05$) greater in the boys (18.2 \pm 3.1 L min⁻¹) than the girls (15.2 \pm 1.9 L min⁻¹). No significant gender differences were observed in maximal heart rate (boys: 188 \pm 12 bpm, girls: 189 \pm 12 bpm). Maximal absolute SV was significantly greater ($p < 0.05$) for the boys compared to the girls (boys: 97 \pm 17 mL and girls: 80 \pm 9 mL); when normalizing for body surface area, these significant ($p < 0.05$) differences remained (boys: 59.1 \pm 8.2 versus girls: 50.5 \pm 5.4 mL m⁻²). When adjusting maximal SV for FFM, the difference became less ($p = 0.058$), (boys: 1.90 \pm 0.32 versus girls: 1.70 \pm 0.18 mL kg⁻¹). Furthermore, when normalizing maximal SV for FFM^{0.5}, these differences also remained ($p < 0.05$), (boys: 13.5 \pm 2.0 versus girls: 11.6 \pm 1.2 mL kg^{-0.5}).

Discussion: Gender differences in maximal cardiac output in trained adolescents are explained by maximal SV. These gender differences in absolute, maximal SV were not eliminated, however, when adjusted for markers of body composition. This suggests that cardiac characteristics may contribute to gender differences in maximal cardiac output and SV.

The Effect of Early Childhood Gymnastics on Subsequent Bone Density and Strength

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Background: Elite gymnastics training during childhood and adolescence has consistently been shown to increase areal bone density but its effect on bone structure and estimated strength are unknown; furthermore, it is unknown if these same effects are seen in young recreational and pre-competitive gymnasts. Therefore, the purpose of this study was to assess the effect of childhood (4-6 years of age) gymnastics participation on bone density and strength.

Methods: 72 children (22 gymnasts and 50 active controls) between the ages of 4 and 6 were recruited (mean age 4.65 yrs) and followed for 3 years. Peripheral quantitative computed tomography (pQCT) was assessed in the third year of the study. pQCT outcomes at the 4% and 65% sites of the non-dominant radius were assessed. Independent T-tests were used to assess group differences in background characteristics. ANCOVA's were used to assess group differences in total bone area (BA), total bone mineral density (BMD) and bone strength (BSI) at the 4% site and cortical BA, cortical BMD and bone strength (SSI_p) at the 65% site while controlling for height (ht), weight (wt), physical activity (PA), sex and age.

Results: There were no differences between groups with regard to height, weight, and PA ($p>0.05$). There were also no differences in total and cortical BMD, cortical BA and SSI_p ($p>0.05$); however, gymnasts were found to have significantly greater absolute total BA and BSI at the 4% site ($p<0.05$). When controlling for age, sex, ht, wt, and PA gymnasts were found to have greater total BA and BSI than active control children ($p<0.05$).

Discussion: It appears that participation in recreational and pre-competitive gymnastics in early childhood may increase bone strength and bone area at the distal radius. Therefore, it is suggested that children participate in gymnastics at an early age to increase bone strength at this site. This is important because the distal radius is the most common site of childhood and adult osteoporotic fractures.

Physique, Body Composition and Running Performance in 6- and 7-Year-Old Cypriot and Hungarian Boys

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Background: Most discussions of physical activity refer to the estimated level of child habitual physical activity that is the level of physical activity that characterises the lifestyle of the individual or group. The aim of the study was to compare some selected human biological characteristics of Cypriot and Hungarian boys aged between 5,51 and 7,50 years.

Methods: The subjects were volunteer kindergarten and schoolboys (n=94 in Cyprus and 105 in Hungary). Written consents of their parents were collected. Physique was described by the metric and plastic indices of Conrad. Body composition was estimated by the anthropometric calculations of muscle and fat masses. Both indicators were expressed in a percentage of body weight. Physical performance was assessed by the times of 800m run.

Results: The Hungarian children were slightly taller and heavier than their Cypriot counterparts in both age groups. The physique character of the Hungarian children was more leptomorphic than that in the Cypriot sample, but the overall indicator of the bone-muscle development did not differ significantly. There were no significant inter-nation differences between the relative fat and muscle masses, but the prevalence of overweight and obese boys was higher in among the Cypriot boys. The within group variability of relative body fat content, and also in the running performance was marked and irrespective of age in both samples. The Hungarian boys performed moderately better in the 800m run test.

Discussion: Between nation size and physique variability can be attributed to the anthropological differences, the body composition and physical performance attributes refer to the lifestyle characteristics. The higher than 25% prevalence of overweight and obese boys is a real social problem and also a great challenge in both countries. The kindergarten or school physical education cannot be the solution alone. The low level of physical capability is in harmony with the hypoactive lifestyle during early childhood. The economic differences are obvious the life standard of the Cypriot society is higher. For the higher life standard, nevertheless, does not refer healthier lifestyle in the young generations.

Relationship of Socio-Cultural Factors with Physical Activity, Body Fat and Physical Fitness in Preschool Children

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Background: Childhood obesity is increasing dramatically worldwide and prevalences differ among countries, even within Europe. Physical activity (PA) has been shown to contribute to relative changes in body fatness and to increases in fitness. The prevalence of obesity and physical inactivity is especially increased in children of low socioeconomic status or with a migrant background. Little is known about the influence of the large socio-cultural environment and individual socio-cultural parameters on physical activity in young children. Therefore, the purpose of this study was to investigate the impact of socio-cultural factors on physical activity of preschool children.

Methods: 655 preschool children (mean age of 5.13 ± 0.6 years, 49.9% girls) from 40 urban preschools in French and German speaking parts of Switzerland with a high migrant prevalence (74%) were investigated. PA was assessed by accelerometers (counts per minute, cpm), body composition by skin fold thickness (sum of triceps, biceps, subscapular & suprailiac, mm), and by bioimpedance, and overall fitness by the performance in an obstacle course (seconds).

Results: Total physical activity (PA) differed substantially between the French (696 ± 157 cpm) and the German (776 ± 171 cpm) part of Switzerland ($p < 0.0001$) and slightly between migrant and Swiss children (mean difference 30 ± 170 cpm, $p = 0.08$), while parental socioeconomic status (education and work load) had no effect on total PA. The same pattern was seen for moderate-to-vigorous and vigorous PA. The differences in PA parameters were more pronounced after adjustment for all parental socio-cultural parameters and for parental BMI. BMI and body fat were higher and physical fitness lower in the French compared to the German region (all $p \leq 0.04$).

Discussion: Even within the same country, differences in the large socio-cultural and demographic environment seem to play an important role in determining PA of young children. This effect seems to be even more pronounced than the effect of individual socio-cultural factors and persists after adjustment for these parameters and anthropometric measures.

Differences in Eating Habits between Swiss and Migrant Preschool Children

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Background: Changes in nutrition contribute to the increased prevalence of childhood obesity which is especially pronounced in migrant children. However, little is known about the role of migrant status on eating habits in young children. Therefore, our objective was to assess differences in eating habits between Swiss and migrant preschool children.

Methods: Forty kindergarten classes in two Swiss cantons were randomly selected. Of the initial 655 children, 577 (mean age of 5.1 ± 0.6 years, 49% girls) with 73% of migrant background fulfilled a food frequency questionnaire (FFQ). This semi-qualitative FFQ contained general questions about eating habits and also assessed the intake of different categories of food. For the analysis we grouped together some questions of the FFQ, according to 5 messages developed by the Swiss Society for Nutrition based on factors implicated in childhood obesity: 1. "drink water" (decreasing the intake of sweet beverages), 2. "eat fruit and vegetables", 3. "eat regularly", 4. "make clever choices" (reducing fat and sweet products), 5. "turn your screen off when you eat". Thereby, we used the mean of the respective variables of the FFQ for each message. Body composition was assessed by bioimpedance and aerobic fitness by the 20m shuttle run test.

Results: Migrant children had a slightly higher BMI (15.8 ± 1.6 kg/m²) and a higher fat mass (4.4 ± 1.5 kg) compared to Swiss children (15.5 ± 1.3 kg/m² and 3.9 ± 1.1 kg; $p=0.08$ and <0.0001 , respectively), but no difference in endurance ($p=0.3$). They also had a higher intake of sweet beverages ($p=0.02$), ate less fruits ($p<0.0001$), but an equal amount of vegetables ($p=0.2$). Furthermore, they omitted more frequently breakfast ($p<0.0001$) and consumed more fat ($p<0.0001$), but not sweet ($p=0.2$) products. The intake of main meals and snacks in front of TV (both $p<0.0001$) were increased in migrant children. However, these differences did not explain the differences in body fat.

Discussion: Differences in eating habits between Swiss and migrant preschool children hint to an important role of migrant status, even at this young age. However, none of the differences by itself does explain the increase in adiposity found in migrant children.

Bone Mineral Values, Insulin-Like Growth Factor-1, and Sex Hormones in Adolescent Female Athletes

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Background: Puberty is a period for increased bone adaptation to mechanical loading due to the velocity of bone growth and endocrine changes at this time. The aim of this study was to determine the relationships of bone mineral density (BMD) and content (BMC) at femoral neck and lumbar spine with insulin-like growth factor-1 (IGF-1) and sex hormones in pubertal female athletes.

Methods: The participants were 80 healthy adolescent girls aged 13-15 years. Athletic girls were rhythmic gymnasts (n=23) and swimmers (n=24) who have participated in their selected sports at least for the last two years. Control group (n=33) consisted of the girls, who took part only in compulsory physical education classes at school. BMD and BMC at femoral neck and lumbar spine were measured using DXA. Venous blood samples to determine the concentration of IGF-1, IGF binding protein-3 (IGFBP-3), estradiol, and progesterone, were drawn after an overnight fasting at early follicular phase and analyzed in duplicate on Immunolite 2000 (DPC, Los Angeles, CA, USA).

Results: After adjusting for age, body height, and body mass, the relationships between BMD variables, IGF-1, and IGF-1/IGFBP-3 remained significant ($r=0.46-0.60$; $p<0.05$) in rhythmic gymnasts group but not in swimmers or controls. BMD at femoral neck and lumbar spine were also related to estradiol levels ($r=0.45-0.60$; $p<0.05$) only in rhythmic gymnast group. Only BMC at femoral neck remained associated with IGF-1/IGFBP-3 molar ratio in rhythmic gymnasts group after adjusting for age, body height, and body mass. Progesterone was not associated with BMD variables in pubertal female athletes.

Discussion: Relationships between estradiol and IGF-axis indicate that increase in IGF-1 and IGFBP-3 may have affected measured BMDs in rhythmic gymnasts due to the increases in sex hormones. We conclude that BMD correlated with IGF-1, IGF-1/IGFBP-3 molar ratio, and estradiol in pubertal rhythmic gymnasts.

Sibling Clustering in Physical Fitness. A Study in Calanga, A Rural Region of Mozambique

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Background: Poor living conditions may limit the extent of genetic expression in somatic and functional phenotypes, especially physical fitness. This is very clear in African countries, and more so in families with very low income living in challenging environments. We aimed (1) to determine familial clustering in different physical fitness components and (2) to estimate its genetic component (maximum heritability, h^2) in African children.

Methods: We sampled 330 subjects (174 males and 156 females) aged 7 to 17 years, belonging to 132 families from Calanga, a rural locality in Mozambique. Physical fitness was assessed with the following tests: sit-and-reach (SR), standing long jump (SLJ), flexed arm hang (FHA), hand grip (HG), 1-mile run (1M), curl-ups (CU), and shuttle run 10x5 meters (SHR). Correlations were used to estimate sibling clustering, and genetic factors were computed using a variance components approach within a maximum likelihood framework. All computations were adjusted for height, weight, age, sex, age², age³, sex*age, sex*age² as well as a physical activity score. S.A.G.E., a statistical package for Genetic Epidemiology, was used in all analyses.

Results: Correlations within each fitness component were low: brother-brother (between -0.01 and 0.25), sister-sister (between -0.19 and 0.45) and brother-sister (between -0.02 and 0.39). The genetic component in each fitness component was: SR, $h^2=0.41\pm0.16$, $p=0.01$; SLJ, $h^2=0.60\pm0.14$, $p=0.001$; FHA, $h^2=0.18\pm0.20$, $p=0.37$; CU, $h^2=0.09\pm0.13$, $p=0.59$; HG, $h^2=0.19\pm0.13$, $p=0.16$; SHR, $h^2=0.07\pm0.15$, $p=0.63$; 1M, $h^2=0.49\pm0.14$, $p=0.001$.

Discussion: (1) familial aggregation was higher between sisters than between brothers or siblings of opposite gender; (2) moderate genetic factors were found in flexibility, aerobic capacity and explosive strength; (3) variance between siblings in the other phenotypes were mostly explained by environmental factors that may be related to family subsistence activities. In addition unfavorable health and nutritional stressors may explain the low importance of genetic factors.

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Oxygen Uptake Efficiency Slope (Oues) in Children: A Narrative Review

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Background: The VO_{2peak} is strongly influenced by the patients' motivation, the selected exercise protocol, and the experience of the tester to determine the peak during exercise. Therefore, exercise performance at submaximal exercise might be more representative. Baba et al. (1996) introduced the Oxygen Uptake Efficiency Slope (OUES) in attempt to develop an objective and independent submaximal measure of cardiorespiratory reserve.

Methods: A literature search (up to January 2009) without language restrictions was performed within the following electronic databases: PubMed, Cochrane Library, Embase, Web of Science, Cinahl, PsycINFO, Scopus, and MEDLINE.

Results: Five studies examined the OUES in healthy children between 6 and 18 years of age. Bland–Altman plots comparing measured VO_{2peak} with estimated VO_{2peak} predicted from OUES, however, showed large limits of agreement. OUES at 90% of exercise duration did not differ from OUES at 100% in healthy children. Slightly, but significantly, lower OUES values were obtained for the first 75% of exercise¹². One study examining protocol dependency and did not find significant differences in OUES, VAT, or VO_{2max} values obtained with two different protocols for treadmill exercise testing. Studies examining the relationship between OUES and anthropometric variables found that OUES was strongly correlated with BSA, height, weight, FFM, and age. Physical training induced significant improvements in VO_{2peak} , OUES, and VAT in a large number of cardiac patients^{27,29}. Patients with MM also showed higher OUES values following aerobic exercise therapy, while no significant increases were demonstrated in heart rate restricted VO_2 ²¹. Strong correlations were found between OUES (both submaximal and maximal) and maximal indices of VO_{2max} and VO_{2peak} . Comparisons with other submaximal parameters revealed that OUES is strongly correlated with the VAT.

Discussion: OUES appears to be a reproducible measure of that does not require maximal exercise. Despite the strong correlations with VO_{2peak} and VO_{2max} , OUES appears not interchangeable with these maximal parameters of cardiorespiratory function.

Insulin Sensitivity Predicts the Blood Pressure Response During Acute Exercise in Children and Adolescents: The European Youth Heart Study

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Background: Primary hypertension increases the risk of experiencing cardiovascular diseases such as myocardial infarction, stroke, end-stage renal disease, and peripheral vascular disease. Unfortunately, subjects with higher blood pressure (BP) in childhood also tend to have elevated BP later in life. Raised BP response during exercise independently predicts future hypertension and associates to left ventricular hypertrophy, endothelial dysfunctions and atherosclerosis. We hypothesized that cardiovascular disease (CVD) risk factors, including fractions of serum cholesterol, triglycerides, insulin resistance and body fatness will influence BP response during acute exercise.

Methods: A cross sectional study of randomly selected Danish 3rd grade children and 9th grade adolescents. Exercise systolic blood pressure (SBP) was measured with a Hawksley random-zero sphygmomano-meter at the end of the last fully completed workload when performing a maximal graded aerobic fitness test on a bicycle ergometer. The workload was increased every third minute until exhaustion. Four different test protocols were applied. The initial and incremental workload was set to 20, 25, 40 and 50 Watt for 3rd grade children weighing less than 30 kg, 3rd grade children weighing more than 30 kg, 9th grade adolescent girls and 9th grade adolescent boys, respectively. Examined CVD risk factors were HDL- and LDL-cholesterol, triglyceride, HOMA score and BMI. Multiple linear regressions were used to test the association between risk factors and exercise SBP when controlling for potential confounding factors.

Results: When examining the effect of each single risk factor individually, HOMA score and triglyceride were positively related to exercise SBP ($p=0.004$ and $p=0.034$, respectively), whereas HDL-cholesterol was inversely related to exercise SBP ($p=0.091$). When adding the three variables in the same model, HOMA score remained significantly related to exercise SBP ($p=0.011$), whereas triglyceride and HDL-cholesterol no longer reached significant/borderline significant associations ($p=0.218$ and $p=0.206$, respectively).

Discussion: This study indicates that insulin sensitivity is related to the blood pressure response during acute exercise at an early stage in life in children and youth. This gives rise to concern, especially since raised BP response during exercise independently predicts future hypertension and cardiovascular diseases.

Differences Between Self-Reported vs Objectively Measured Weight and Height, among Azorean Adolescents.

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Background: To compare Body Mass Index (BMI) values from self-reported weight and height with BMI values from objectively measured weight and height, in a sample of Azorean adolescents.

Methods: The sample comprised 1211 adolescents (726 girls), aged 16.12 ± 0.97 who participated in the Azorean Physical Activity Health Study II. BMI was computed from both self-reported and objectively measured weight and height. The Bland & Altman method was used to evaluate agreement between self-reported and objectively measured variables, 95% limits of agreement were used.

Results: All self-reported variables were correlated ($p < 0.001$) with the paired objectively measured variable (i.e. weight vs self-reported weight; height vs self-reported height and BMI vs self-reported BMI), in both genders. Spearman's correlations ranged from 0.92 to 0.97. In girls the mean difference between weight and self-reported weight was 0.43 ± 2.32 , the mean difference between height and self-reported height was -0.02 ± 0.02 and the mean difference between BMI and self-reported BMI was 0.62 ± 1.11 , corresponding figures for boys were 0.59 ± 1.26 , -0.02 ± 0.03 and 0.58 ± 3.07 , respectively. In the Bland & Altman weight plots, 5.09% of girls and 6.39% of boys were outside the 95% limits of agreement. In the Bland & Altman height plots, 3.99% of girls and 5.98% of boys were outside the 95% limits of agreement. Corresponding figures for Bland & Altman BMI plots were 5.37% for girls and 6.18% for boys. Among girls, 69.7% were classified has normal weight; 24.4% overweight and 5.8% obese, when BMI was objectively measured. Corresponding figures for self-reported BMI were 75.8%, 19.8% and 4.4%, respectively. In boys, 69.9% were classified has normal weight; 21.9% overweight and 8.2% obese, when BMI was objectively measured; corresponding figures for self-reported BMI were 75.8%, 19.8% and 4.4%, respectively, Cole et al (2000).

Discussion: Among Azorean adolescents, measures of self-reported weight and height are not accurate and may lead to misclassification of BMI categories and underestimate obesity prevalence.

Comparison of Different VO_{2max} Equations in the Prediction of the Metabolic Syndrome in Portuguese Adolescents

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Background: Several studies have reported negative associations between cardiorespiratory fitness (VO_{2max}) and Metabolic Syndrome (MS) in adolescents. The aim of this study is to compare different VO_{2max} equations in the prediction of MS in Portuguese adolescents.

Methods: The sample comprised 389 adolescents (224 girls – 57.6%), aged 12 to 17 years old (mean=14.33±1.64 years) from one secondary school in the North of Portugal. Capillary blood samples of participants were taken from the earlobe after at least 12 h of fasting in order to obtain values of plasmatic total cholesterol, glucose, HDL-cholesterol, LDL-cholesterol and triglycerides. Blood pressure was measured (two measures after 5 min rest and with 5 min between measures). Z scores by age and sex were computed for all risk factors. HDL Z-Score was multiplied by minus 1. MS was constructed by summing the z scores of all individual risk factors. The shuttle run test from the Fitnessgram Battery was used to determine VO_{2max} using 6 different equations (Leger et al, 1988; Barnett et al, 1993; Matsuzaka et al, 2004; Ruiz et al, 2008). Six Linear Regression models were fitted to access regression coefficients and standard errors [β (SE)] predicting MS.

Results: VO_{2max} was negatively and significantly associated with MS with the equations of Matsuzaka A' [β = -0.071 (0.029), p=0.015] and Matsuzaka B' [β = -0.075 (0.031), p=0.015] equations. VO_{2max} was negatively but not significantly associated with MS with the Leger [β = -0.015 (0.024), p=0.534], Barnett A' [β = -0.063 (0.061), p=0.092], Barnett B' [β = -0.041 (0.049), p=0.405] and Ruiz' [β = -0.056 (0.036), p=0.116] equations.

Discussion: Among Portuguese adolescents, the use of different VO_{2max} equations leads to different associations with MS.

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The CEMHaVi Program: Control, Evaluation, and Modification Lifestyles in Obese Children.

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Background: Obesity in children has increased dramatically in recent years. Because of its adverse health consequences there is an urgent need for population based interventions aimed at prevention. CEMHaVi (Control, Evaluation, and Modification of Lifestyles), is a unique two year health-wellness program of physical activity and health education for obese youth. Findings of this study represent results at one and two years follow-up.

Methods: Thirty-seven physician referred subjects participated in the study, nineteen girls (12.7 ± 3.1 years) and eighteen boys (12.2 ± 2.8 years). Intervention consisted of a unique program of physical activity, including a variety of games that were specifically selected to be enjoyable, maintain interest, and motivate subjects to adhere. Activity sessions were offered one time per week, two hours each session, for 24 months. A health education program was offered one time each month, one hour per session. Different parameters were assessed before and after the intervention.

Results: Findings of the study suggest a significant improvement ($p < 0.05$) in fitness and health knowledge in children and adolescents (Table 1). It was observed at the same time that obesity was significantly reduced from 31.2 to 30 $p < 0.05$.

Table 1: Results at one year ($n = 37$) and two years ($n = 7$)

	T 0	T + 1	T + 2
BMI (kg/m^2)	31.2 ± 7.8	$30 \pm 8.1^*$	$30 \pm 7.3^*$
Fat mass (kg)	31.8 ± 4.6	$28.8 \pm 6.4^*$	$28.5 \pm 6.6^*$
Fat Free Mass (kg)	67.4 ± 3.6	$71.6 \pm 6.4^*$	$71.7 \pm 6.9^*$
Balke Test ($ml.kg.min^{-1}$)	21.5 ± 3.9	$25.7 \pm 3.6^*$	$27.2 \pm 3.8^* \dagger$
Health knowledge (/20)	10.9 ± 2.8	$13.4 \pm 3.5^*$	- -

* Significant difference between T 0 & T + 1, or T 0 & T + 2 (Friedman test; $p < 0.05$)

[†] Significant difference between T + 1 & T + 2 (Friedman test; $p < 0.05$)

Discussion: From the study results it was concluded that a multidisciplinary program of exercise and health education in obese children and adolescents reduced BMI and improved body composition, fitness and health knowledge.

XXVth International Symposium of Pediatric Work Physiology.

**Poster presentations
Session #2**

**Thursday October 1st
12:30 p.m. – 2:00 p.m.**

Calibration of the Actiheart Accelerometer for the Prediction of Activity Energy Expenditure in Children with Chronic Disease

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Background: Accurate assessment of activity energy expenditure (AEE) is necessary for further research and improved understanding of the health impact of physical activity in healthy children and children with chronic diseases. Several different accelerometry systems exist for the estimation of AEE during activities of daily living. Recently we have found that prediction equations for AEE for healthy children were not valid for children with chronic disease. Therefore, the purpose of this study was to develop an AEE prediction equation for the Actiheart accelerometer in children with chronic disease.

Methods: In this study 68 children, aged 8-18 years with different types of chronic disease (Juvenile Arthritis (n=10), Hemophilia (n=10), Dermatomyositis (n=9), neuromuscular disease (n=17), Cystic Fibrosis (n=9) or Heart Disease (n=8)) participated in an activity testing session which consisted of a resting protocol (20 minutes), working on the computer, sweeping, hallway walking, steps and treadmill walking at three different speeds (6 min/activity). During all activities AEE was measured with indirect calorimetry (IC) using a portable metabolic gas analyzer (Cortex Metamax). During all activities the participants wore an Actiheart on the chest. Resting EE and resting heart rate (RHR) were measured during the resting protocol. Heart rate above sleep (HRaS) was calculated as: $HRaS = 0.4195 \times RHR + 27.4$.

Results: Regression analysis revealed the following prediction equation for children with chronic disease: $AEE (J/min/kg) = 3.352 \times HraS [bpm] + 0.639 \times gender \times HraS + 0.059 \times activity\ counts - 20.305$ ($R^2=0.653$; $SEE=73.9$). This equation gives a non-significant mean difference of -2.8 J/min/kg (95%CI: -21 to 15.4) for the prediction of AEE from the Actiheart, instead of a mean difference of 51.8 J/min/kg ($P<0.05$) using the model of Corder et al (2005) in healthy children. Bland-Altman plots showed a good agreement between measured AEE (IC) and predicted AEE for the new Actiheart equation, with no mean error (0 J/min/kg; 95%CI: -147.4 to 147.4 J/min/kg).

Discussion: These results demonstrate that Actiheart is valid in the use of AEE determination when using the new prediction equation for groups of children with chronic disease. Future research should determine the need for disease specific AEE prediction equations.

Effect of the SocioEconomic Status on Preschool Daily Life

S. Vale, R. Santos, L. Miranda, P. Silva, and J. Mota

University of Porto, Portugal

Background: The prevalence of paediatric obesity has increased significantly in the last decades, in most countries, as well as in Portugal. Early infancy is a period of rapid weight gain and screen time (ST) is a form of sedentary behaviour that may increase obesity risk by decreasing energy expenditure and/or increasing energy intake, and both may contribute to the development of overweight among children. The purpose of this cross-sectional study was to analyze the effect of socioeconomic status (SES) in preschool daily life.

Methods: The sample comprised 251 preschool healthy children (122 girls) aged from 2.5 to 5.5 years old. Physical activity was assessed with accelerometers (MTI actigraph). The highest school education achieved by either mother or father was used to define social class. Screen Time was characterized using the American Academy of Paediatrics guidelines recommending limiting children's total time to no more than 2 hours per day. Body Mass Index (BMI) was used to define overweight and obesity from the references established by International Obesity Task Force.

Results: We found a ST prevalence of 40%. We didn't find statistically significant differences between SES in BMI and Active Time. However, children with higher SES ($p < 0.073$) showed higher active time than low SES. Low SES was significantly higher in ST compared with high SES ($p = 0,000$). A logistic regression adjusted for age, sex, BMI, sleep time and active time was used to show that children with low SES and medium SES had odds ratio, 4.3 and 2.4 higher than high ST compared with normal ST.

Discussion: Since ST patterns are established at early age, it's prudent to limit it. Parents or others guardians have a key role to determine the active play opportunities and limit ST since they have a large responsibility in determining how preschool children spend their time. Further studies are necessary to explore and clarify this relationship between SES, physical activity, obesity and risk behaviors, in young po

Relevance of Social-Suupport and Enjoyment in the Amount of Physical Activity of Portuguese Students

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Background: Youth Physical Activity is best described as a profile rather than a single entity, and such profiles are characterized as a complex matrix of behaviors that take place in a range of social contexts, each with its own set of physiological, psychological, and sociological determinants and outcomes. Therefore, the purpose of this study is to evaluate the relevance of psychosocial correlates, such as social-support and enjoyment, on moderate to vigorous physical activity controlling for the gender and age on Portuguese students.

Methods: The participants of this study were 203 high school adolescents (125 girls and 78 boys), with a mean age of 14.99 ± 1.55 . The MTI Actigraph activity monitor was used to obtain objective data on youths' physical activity behavior during 7 consecutive days. A conceptual diagram of the YPAP Model core illustrating the association and direction of reinforcing and predisposing factors on physical activity was used. The fit indices of the YPAP model were analyzed through structural equation modeling (SEM) using AMOS (version 17.0).

Results: The current study documented a significant positive direct effect of social support on moderate to vigorous physical activity ($\beta=.46$, $p<.05$). It was also found an indirect effect of social support on moderate to vigorous physical activity through an adolescent's enjoyment of physical activity. A significant relationship was observed between social support for physical activity and enjoyment of physical activity ($\beta=-.47$, $p<.05$). Another significant pathway was observed between an adolescent's enjoyment of physical activity and their moderate to vigorous physical activity ($\beta=.21$, $p<.05$).

Discussion: Previous research has provided evidence supporting the utility of the YPAP model, but this is the first study to thoroughly investigate the model fit in Portuguese youth. This study provided further clarity on the relationships between social-support, enjoyment, and physical activity. Social-support as a relevant correlate in the model, managed to attenuate the gender differences on moderate to vigorous physical activity amount.

Body Composition and Nutrition in Active and Non-active Pre-school Children

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Background: Overweight and fatness have been recognized as risk factors to health, as civilization pathology in the developed world. They arise mainly from a lack of sufficiently intense habitual physical exercise, and usually associate with dietary habits wrong both quantitatively and qualitatively. The latter develop conforming essentially to the family way of life and in particular nutrition. The main goal of the present pilot study was to describe the relationships between some anthropometric variables and lifestyle characteristics in preschool children.

Methods: Data collections were carried out in Budapest kindergartens (N=366 boys). Boys were grouped by the difference of their organised physical activity levels. Namely: active group (two soccer trainings in a week, n=167), and non-active (n=197). Anthropometry was carried out conforming to the recommendations of the International Biological Program (Weiner and Lourie 1969). We measured height, body weight and seven of the skinfolds. Nutritional status was assessed by using body mass index (WHO 2000) and relative body fat fraction by Parízková (1961). Questionnaires were filled in by the parents. Differences between the means were tested by *t*-test for independent samples at the 5% level of random error.

Results: Body weight, BMI and fat percentage of the groups did not differ significantly. There were significant differences in height. Most of the dietary habits did not differ significantly. The parents of children are probably well informed about the nutritional principles, but the consumption of fish and wholegrain bread were missed, and children preferred fruits rather than vegetables. The lack of fast foods was depicted favourably.

Discussion: Urban active children with sufficient dietary habits are more prone to become healthy adults. The primary effects of establishing advantageous customs are based on parental life-style patterns. Statistical differences were not found in this early stage of life, but some tendencies could be demonstrated in body composition affected by the environmental factors.

Anaerobic and Aerobic Abilities of Children Between the Ages of 7 and 15 Years from a Rural Area, in the Light of Research from the Years 1986, 1996 and 2006

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Background: In 1986, 1996 and 2006 population research was conducted in the rural environment of Poland's Wielkopolska region. The main aim of this study was to ascertain the physical fitness of children in the 7-15 age range, in view of the dynamic social and economic transformation at the turn of the XX and XXI century in Poland. It was most important to determine the size and direction of motor and somatic changes of youth from a rural background as a basis to work out new physical education programmes, at an adequate level of physical fitness.

Methods: To research basic motor ability the following methods were used: anaerobic abilities: velocity 5m run with a 0.5 m run-up and vertical jump; aerobic abilities: efficiency - Montoye step-test. To estimate somatic development, height and body mass were used to measure BMI.

Results: The study was conducted at the Department of Theory of Sport at the University School of Physical Education in Poznań, Poland. Children who were randomly chosen from ten primary schools, aged 7.0 to 15.0 years, in the Wielkopolska region of Poland. The analysis of the accumulated data of somatic measurements seems to confirm a tendency to increased height and body mass in consecutive terms of research during the 20 years of observation. We observe increasing BMI. On the other hand, the measurement of motor performance had irregular trends. Anaerobic abilities increase from 1986 to 1996 and decrease from 1996 to 2006. Aerobic abilities had irregular trends and tended to decrease in two decades.

Discussion: The study showed that growth of somatic and motor parameters changed similarly but not in every case. This could be as a result of many different developmental factors and susceptibility to their influence on the observed individuals. The effect of the research could provide an important basis on which to prepare new physical education programmes. The new programme should show increased physical activity among youth and lead to a more healthy generation, able to develop pro-health habits for better adult and later life.

Walking Levels of Portuguese Youngsters. A Multilevel Analysis

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Background: Walking is one of the most basic physical activity behaviors. We assume that it is highly prevalent in Portuguese children and adolescents. We therefore wanted (1) to describe walking levels of youngsters during 5 consecutive days, and (2) investigate the impact of gender, age, TV viewing, sports participation and BMI using a multilevel model.

Methods: Portuguese youngsters of both gender (n=160 subjects; age=13.43±1.17 years) from the region of Oporto, north of Portugal, were sampled and monitored during Fall. BMI was calculated using Weight (kg)/Height² (m). Walking was monitored consecutively for 5 days [Thursday (Th), Friday (Fr), Saturday (Sa), Sunday (Su) and Monday (Mo)] using the OMRON Walking Style II®. Questions were asked about formal sports participation (SP), and number of minutes of TV viewing (MTVV). Statistical analysis include a multilevel approach (repeated observations nested within subjects), and Deviance statistic (DS) as a test for the quality of different sequential models with increased complexity (i.e., adding predictors).

Results: On average, mean minutes of HTVV per day=169.19, and 63% practiced formal sports. A 3rd degree polynomial (wave like individual trajectories) was the best fitting model (DS=15168.8, #parameters=14) for walking levels during the 5 days showing a substantial decline in the week-end and an increase on Mo (Mean steps/day: boys: Th=14790; Fr=13351; Sa=8233; Su=5432; Mo=10946; girls: Th=10464; Fr=10561; Sa=6299; Su=3676; Mo=8690). Age, MTVV, BMI, and SP did not show any significant effect (p>0.05) on walking levels. On the contrary, gender was a significant predictor (p<0.05) favoring boys in all days.

Discussion: (1) daily walking of Portuguese youngsters showed a marked decline in the week-end; (2) mean steps in the week-end are rather low; (3) boys have greater walking levels; (4) TV viewing, sports participation and BMI did not show any significant effect in walking patterns of boys and girls. Interesting and challenging activities should be promoted during week-ends so that boys and girls may increase their physical activity levels.

Does Maturational Timing Compromise Bone Mineral Content in Adulthood?

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Background: Achieving a higher bone mass in adulthood may reduce the incidence of fracture and the development of osteoporosis in old age. The adolescent growth period is a critical period for optimizing bone development. The role of maturation on optimizing bone development is controversial. An early onset of puberty may expose males and females to estrogen earlier, providing bones with a greater sensitivity to mechanical loading. This enhanced sensitivity may enhance bone mineralization and thus increase bone strength and serve a protective function for bone development. However, the time prior to puberty is associated with a heightened responsiveness to osteogenic stimulation. The question that is often asked is does the duration of osteogenic stimulation prior to the onset of maturation override the effects of the hormonal influx during puberty. Therefore, the purpose of this study was to examine the long term relationship between the onset of maturation and adult bone mineral content (BMC).

Methods: Participants consisted of 230 individuals (110 males, 120 females) from the Pediatric Bone Mineral Accrual Study. Participants were classified by maturational category (based on age of peak height velocity) into early, average and late maturers. BMC was assessed during adolescence and in adulthood using dual energy x-ray absorptiometry. Hierarchical multilevel models were constructed to show the independent development of BMC by maturity group whilst controlling for body size and composition.

Results: There was no significant difference in the development of adult BMC between maturational groups ($p>0.05$) after accounting for the independent effects of growth, sex, body size and composition.

Discussion: In this group of healthy participants maturational timing did not significantly compromise young adult BMC. However, bone strength is multifaceted and the effects of maturation may extend beyond bone mineralization.

Profiling Physical Fitness of Children and Adolescents as a Function of Sports Participation

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Background: Although recurrent, the topic of profiling is of great importance not only for the sport scientist and coach, but also for the physical educator and parents. Moreover, if profiles are dependent on sports participation, reflecting selection and response to training, then we may have a strong case for a complete agreement with the suggestion made by Strong et al (1996) concerning the health importance of moderate-to-vigorous participation in physical activity. The aim of this presentation is to describe a multivariate profile of physical fitness of children and adolescents of both genders according to their sports participation (SP) status.

Methods: The sample comprised 386 children and adolescents, aged 8,42 to 16,86 years old from Juazeiro do Norte, a northeast region of Ceará State in Brazil (SP, boys, n=62, girls, n=83; Non SP, boys, n=149, girls, n=83). Physical fitness was assessed with the following tests: 10x5m shuttle-run (SR), standing long jump (SLJ), handgrip (HG), 12 minute run (12M), trunk lift (TL), sit-up's (SU), push-up's (PU). Data quality control was assessed by means of a test-retest procedure using intraclass correlation coefficients (R). A multivariate analysis of covariance was used to test for differences in fitness profiles in males and females according to sports participation, using age as a covariate.

Results: Reliability estimates for all fitness items were good ($0,78 \leq R \leq 0,96$). Within each gender results are significantly different. Girls: Wilk's $\Lambda = 0,85$; $p < 0.001$; Boys: Wilk's $\Lambda = 0,93$, $p < 0.026$. In girls, explained variance attributable to sports participation in physical fitness multivariate profiles was 15%, and in boys only 7.5%. In boys, the most relevant fitness differences ($p < 0,05$) was due to SU, PU, SLJ and 12M run. In girls, main differences ($p < 0,05$) were found in PU, SLJ and HG.

Discussion: Even after controlling for age, and the low value of explained variance sports participation induces different physical fitness profiles in children and adolescents. These differences may be due to selection and response to training. These results indicate the relevance of the implementation of sports participation in youth. This even more important in regions with poor environments in terms of nutrition, health conditions, and sports oriented activities.

Perceptions of Physical Activity and Parental Role Modelling in Muslim Families- A Qualitative Approach

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Background: The effective promotion of PA is based on an understanding of the interaction between the physical and social environment (Hesketh et al. 2005). Social relationships and social support are key aspects that encourage positive health behaviours (Quick et al. 1996). The social cognitive theory of behaviour points to the importance of model learning from parents' behaviour and of receiving encouragements from significant others (Andersen and Wold, 1992). The perceptions of parents from ethnic groups and the influence of their religion/cultural beliefs upon their children's PA behaviour are under researched. This study aimed first to explore Muslim parent-child relationship with regards to PA behaviour and second to identify potential gender differences for PA behaviour mediated through parents' support among Muslim families.

Method: A qualitative research design included in depth interviews with each parent and their children to examine attitudes, determinations and barriers to PA. Four families who were mostly inactive and reflected similarities in terms of community background, age, and religion participated in this study. Each selected family unit was complete with between 1 and 3 children (aged 8-16), a mother and father.

Results: Children believed that their parents' attitude about PA was positive and they perceived their parents to be physically active with the exception of two children. Parents' perceptions differed from their children as they mostly believed that they were not good role models because they were not physically active enough. Only one parent believed that she set a good example for her children by doing exercise. Girls were not motivated or were restricted to be physically active by cultural activities, studies, household commitments and weather conditions, whereas boys were physically active regardless of weather conditions or studying. This may partly be explained by the fact that none of the boys were expected to do chores and suggesting that only girls in the household help with housework.

Discussion: This study suggested that girls found it difficult to engage in physical activities due to the expectations from them to do household chores and other cultural/religious barriers. Further Muslim parents did not act as positive role models for their children; even though they encourage them verbally and provide transport and other facilities.

Characterization of Short Running Intermittent Exercises at Maximal and Supramaximal Velocities and Continuous Running Exercises at Moderate Velocities in Children

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Background: The aim of the study was to compare children's cardiorespiratory responses during continuous and intermittent running sessions.

Methods: Twenty-two 9-11 year-old children (9 boys and 12 girls) first performed a maximal graded test to determine peak oxygen uptake (peakVO₂), peak heart rate (peakHR) and maximal aerobic velocity (MAV). Then, they randomly completed five running sessions. The first intermittent session included 5 sets of short high-intensity (from 100 to 130% of MAV) runs with exercise/recovery sequences lasting 10/10s (HIE_{10/10}) and the second one with exercise/recovery sequences lasting 20s/20s (HIE_{20/20}). Each set and rest intervals between sets lasted 3 min. The third intermittent session comprised 3 sets of sprint and jump exercises with exercise/recovery sequences lasting 5/15s (HIE_{5/15}). Each set and rest intervals between sets lasted 5 min. The continuous training sessions included 2*10 min running bouts with 5-min recovery between each set. Intensity was set at 80% of MAV for the first session (CE₈₀) and 85% for the second one (CE₈₅). During all sessions, VO₂ and HR were measured with a portable system (Cosmed K4b², Rome, Italy) and time spent at peakVO₂ (tpeakVO₂) was calculated.

Results: Mean values for peakVO₂, peakHR, and MAV were: 56.2±6.7 ml.kg⁻¹.min⁻¹, 216±7 bpm, and 11.8±1.1 km.h⁻¹, respectively. Mean VO₂ and mean HR for each session, expressed as percentage of peakVO₂ and peakHR, were significantly higher in CE₈₀ (72.4±5.5 and 83.5±3.8%, respectively) and CE₈₅ (76.1±5.9 and 87.2±3.7%, respectively) than in the intermittent sessions (p<0.001). HIE_{10/10} and HIE_{20/20} showed a significant higher mean VO₂ (55.1±4.6 and 59.1±9.3%, respectively) than HIE_{5/15} (50.7±6.7%). Time spent at peakVO₂, expressed as percentage of total exercise time, was significantly longer in CE₈₅ (46.3±28.2%, p<0.01) compared to intermittent sessions, and in CE₈₀ (32.2±25%, p<0.05) compared with both HIE_{10/10} (14.6±11.5%) and HIE_{5/15} (7.9±9.4%). However, no significant differences were observed for means VO₂, HR and tpeakVO₂ between HIE_{10/10} and HIE_{20/20} on the one hand, and between CE₈₀ and CE₈₅ on the other hand.

Discussion: in children, adequate combinations of continuous versus intermittent exercises can be used to improve, at a comparable level, their aerobic fitness.

Positively Impacting Children's Physical Self-Perceptions - but how? Results from the A-CLASS Project: A Group-Randomised Trial in Primary School Children

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Background: Cross-sectional research has found a positive relationship between physical activity and physical self-perceptions in children, but experimental research is sparse¹. This study aimed to explore the effects of three interventions on physical-self perceptions in 9-10 year-old children.

Methods: 152 Children were recruited from eight primary schools in areas of low socioeconomic status. Schools were randomly-assigned to either bi-weekly high-intensity physical activity (HIPA) or multi-skill (FMS) after-school clubs; a behaviour-modification programme (PASS); or a control-comparison group (CON). 135 Children completed the Children and Youth Physical Self-Perception Profile (CY-PSPP) at baseline, 9- and 12-months post-test, and were included in the final analysis (HIPA, n=32; FMS, n=32; PASS, n=40; CON, n=31). Intervention effects on CY-PSPP scales were analysed by gender using ANCOVA's, with baseline scores as the covariate. Results were checked for statistical and practical significance.

Results: *Boys:* Compared to CON, at 9- and 12-months post-test participation in FMS and HIPA were associated with higher perceptions of sports competence, condition, and physical self-worth; HIPA elevated perceptions of strength, and, FMS increased perceived body attractiveness. PASS was associated with more positive perceptions of sports competence, condition, body attractiveness, strength and physical self-worth compared to CON at 9- but not 12-months. *Girls:* In comparison to CON, there were no positive intervention effects on CY-PSPP subscales, whilst all interventions were associated with more negative perceptions of body attractiveness.

Discussion: In boys, after-school clubs may provide a means to augment physical self-perceptions, irrespective of activity mode. After-school clubs did not enhance physical self-perceptions in girls, which may be a result of mixed gender sessions, particularly if girls assessed competence by means of social comparison with boys. Interventions may have raised self-presentation awareness during a period of physical maturation and associated increases in body fat², which may explain lower perceptions of body attractiveness in girls. Behaviour-modification programmes do not appear to positively impact physical self-perceptions. Experimental trials are needed to determine appropriate interventions for girls. Future researchers should include qualitative methods to explore the mechanisms of change in self-perceptions.

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Comparing Physical Activity Levels between Multi-Skills Games and Exergaming in an After-School Club

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Background: Exergaming has been used as a stimulus for physical activity (PA) in home and community settings, though few comparisons have been made to organised multi-skill settings. This study compared the PA levels of children attending a multi-skills games and exergaming after-school club over 4 weeks.

Methods: Five boys and 5 girls (age mean 9.1, SD 0.6 years) attended a five-week after-school club, where children engaged in step-powered exergaming and multi-skill games. Children were randomly assigned to either session at the start of the club, which lasted 25 minutes. Children then participated in the other session following 5 minutes seated rest. PA was quantified using heart rate telemetry and uniaxial accelerometry. Heart rate thresholds of 50-74% heart rate reserve (HRR) and $\geq 75\%$ HRR represented moderate-to-vigorous intensity PA (MVPA) and vigorous intensity PA (VPA), respectively. Mean counts per epoch (CPE) data were obtained from accelerometers. Week 1 involved familiarising children with the protocol. Five children attended all sessions, and their data were used in the session (multi-skills, exergaming) by week (2-5) repeated measures analysis of variance.

Results: Significant week main effects for VPA and CPE were found ($p < 0.05$). Children engaged in more VPA during week 2 ($35.9 \pm 20.3\%$) than 3 ($3.2 \pm 8.2\%$; $p < 0.01$), with CPE greater during week 3 (180.4 ± 25.6) than 4 (128.7 ± 21.3 ; $p < 0.05$). The week x session interaction for MVPA and CPE were significant ($p < 0.05$). MVPA during step-powered exergaming significantly decreased between week 3 ($41 \pm 22.4\%$) and 4 ($0.5 \pm 1.1\%$), and was significantly lower than the multi-skills games ($41.3 \pm 6.9\%$) during week 4. For CPE, step-powered exergaming significantly decreased between week 2 (252.9 ± 149.7) and 4 (85.8 ± 63.1), and was significantly lower than the multi-skills games (171.7 ± 39.1) during week 4.

Discussion: Step-powered exergaming stimulates PA in after school settings, though this was lower than activity promoted by multi-skills games. Decreases observed in MVPA and VPA provisionally indicate there may be a novelty effect associated with such an intervention, with further research warranted in a larger sample to determine this issue.

Validation of Accelerometry as a Measure of Physical Activity Energy Expenditure in Children with Chronic Disease

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Background: Objective measures of physical activity are needed for children with chronic disease in order to better understand the dose relationship between physical activity and health outcomes. The purpose of this study was to assess the validity of existing energy expenditure (EE) prediction equations (based on healthy children and youth) for measuring physical activity via accelerometry in children ages 7 to 18 years with chronic disease.

Methods: Children diagnosed with juvenile arthritis (JA), haemophilia, dermatomyositis (JDM), inherited muscle disease (IMD), cystic fibrosis (CF), and congenital heart disease (CHD) completed one testing session consisting of 6 physical tasks. Tasks included a 20 minute resting energy expenditure protocol, computer work, sweeping, hallway walking, stair stepping, and treadmill walking at 3 speeds (6 min/activity). EE was measured by indirect calorimetry (the criterion method) using a portable gas analyzer and was predicted from Actical and Actigraph (7164) accelerometer counts using equations from Freedson and Puyau. Agreement between predicted and measured EE was determined using the intraclass correlation coefficient (ICC).

Results: 122 children with chronic disease participated (20 JA, 18 haemophilia, 28 JDM, 26 IMD, 19 CF, 11 CHD). Mean age was 12.8 years (± 3.0), height 156 cm (± 16.5), weight 49.2 kg (± 17.3 kg), and BMI 20.1 kg·m⁻² (± 5.1).

TASK	Criterion EE (METS)	Predicted EE _{Actical} (METS)	Predicted EE _{Actigraph} (METS)	ICC _{2,1actical}	ICC _{2,1actigraph}
Resting EE	1.6 (0.65)	0.29 (0.18)	1.6 (0.26)	0.06	0.39
Computer	1.89 (0.76)	0.28 (0.12)	1.61 (0.27)	0.06	0.41
Sweeping	3.63 (1.46)	0.61 (0.29)	1.70 (0.32)	0.09	0.28
Hallway walk	4.75 (1.54)	1.15 (0.28)	2.27 (0.45)	0.03	0.15
Stairs	4.25 (1.30)	0.76 (0.16)	1.91 (0.38)	0.03	0.10
Treadmill 1	4.09 (1.32)	0.92 (0.23)	1.97 (0.45)	0.05	0.10
Treadmill 2	5.06 (1.66)	1.19 (0.31)	2.36 (0.54)	0.05	0.10
Treadmill 3	6.75 (2.42)	1.50 (0.48)	2.85 (1.00)	0.05	0.16

Discussion: These preliminary results suggest poor agreement between EE predicted from Actical or Actigraph accelerometers when compared to measured EE in children with chronic disease. More accurate prediction equations are needed to assess physical activity levels in children with chronic disease.

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Contribution of Anaerobic Tests to Distinguish Late Adolescent Basketball Players by Competitive Level

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Background: Anaerobic performance has not received much attention in the context of growth- and maturity-related variation in functional capacities of adolescent basketball [BB] players. The Wingate [WanT] test and two field tests of anaerobic capacity [140-m line drill, 7-sprints] show only modest association in late adolescent BB players (Carvalho et al., 2008). The present study examines the validity of these anaerobic tests to discriminate adolescent BB players by competitive level.

Methods: The sample included 107 BB players of contrasting status: local level (n=75, 15.0±0.6 yrs, 172.6±8.4 cm, 63.3±10.6 kg) and elite (n=38, 15.3±0.4 yrs, 187.8±7.2 cm, 77.5±11.8 kg). Stature, weight and dimensions needed to estimate total and fat-free leg volumes (TLV, FFLV; Jones & Pearson, 1969) were measured. In addition to squat and countermovement jumps (Bosco et al., 1983), anaerobic assessments were collected on three different occasions: 30-s WanT (Bar-Or, 1987), 7-sprint test (Bangsbo, 1994) and the 140-m line drill (Apostolidis et al., 2004; Hoffman et al., 1999). Analyses of covariance (controlling for age, height, weight) were used to test the effect of competitive level on morphological and functional variables. The level of significance was set at 5%.

Results: The two groups of BB players differed significantly in chronological age (CA), height and body mass (p<0.01). Controlling CA, elite players had larger TLV and FFLV (p<0.01), but lower limb muscle power did not differ. Elite players obtained better performances in the 7-sprint and 140-m line drill protocols (p<0.01), but absolute anaerobic peak and mean power did not differ between groups.

Discussion: Although concurrent assessments of anaerobic performance showed a substantial overlapping variance, the field-protocols discriminated local and elite adolescent BB players. Additional research is needed to distinguish players by position using the variables of the current study and also allometrically scaled anaerobic peak and mean power.

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Skeletal Maturation and Body Size of 14-15 Years-Old Portuguese Male Basketball Players

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Background: It is important to consider information regarding maturity and body size among young athletes engaged in intensive training programs, given the significance of maturity-associated variation in body size. This study considers skeletal maturity relative to chronological age, and body size of national-level, regional-level and local-level Portuguese Basketball players aged 14-15 years of age.

Methods: Sample included 109 basketball players from the under-16 national training centers ($n=38$), representing regional-level team ($n=31$) and from Portuguese midlands local-level clubs ($n=40$). Stature, body mass and skeletal maturity (Fels method) were assessed. Stature and masses were compared to US reference values, and with skeletal age and were contrasted by level of play. The players were also classified as late, average and early maturers based of differences between skeletal and chronological age, with the average category including boys with skeletal ages within ± 1 year of chronological age. Mean skeletal age was in advance of mean chronological age in 78% of the sample, being 8 subjects (7%) skeletally mature, and were not included when calculating differences between skeletal and chronological age.

Results: This sample of young basketball players was located largely above the 50th centile of the reference data for stature ($n=90$; 83%) and masses ($n=94$; 86%). Between 62% and 66 % mean statures ($n=68$) and masses ($n=72$), respectively, of early maturers and skeletally matured boys were above the 50th centile of the reference data. Among national-level players 71% was above the 95th centile of the reference data for stature and all above 75th reference data for mass. Among local-level players, the percentages of average and early maturing boys were equal at 27% ($n = 11$) and 70% ($n = 28$) respectively. Among regional-level players, the percentages of average and early maturing boys were 26% ($n = 8$) and 74% ($n = 11$) respectively, while among national-level players the percentages of average and early maturing boys were 13% ($n = 5$) and 68% ($n = 26$) respectively. Seven national-level players (19%) and one local-level were skeletally matured.

Discussion: The present comparative analyses confirmed that 14-15 years-old basketball players tend to be higher, heavier and early mature boys than general population age-group. Additionally, data highlighted the maturity-associated variation in body size among young players engaged in organized basketball training programs. Studies following-up young athletes should consider body size and maturation associated variation, as well as injuries associated to training and competition exposure.

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Endurance Performance and HRV Data of Young Swimmers

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Background: According to our assumption the performance level, and presence of overtraining in young swimmers manifests in heart rate, heart rate variability and in physical and physiological performance parameters measured in swimming pool and lab. The aim of the study was to analyse characteristics of body composition, the level of endurance performance, and HRV data of young top level swimmers.

Methods: Nineteen 12-16 year-old highly trained swimmers were grouped by gender and by their long and short burst swimming performance. HR, SDNN, RMSSD, pNN50, HF, LF and LF/HF data were measured at rest and calculated by Polar Night Vision belt. For estimation of body composition Drinkwater and Ross method (1980) - percentages of bone, muscle, fat and residual - was applied. The exercise was a continuous running test performed on a treadmill by using „vita maxima” (all out) testing protocol. Physical and cardiac performance were determined while swimming 50 m and 1000 m by Team Polar belt.

Results: Gender differences were not found in physical performance, HRmax, VEmax, R. The boys had significantly greater value of VO₂max/kg x min (65/ 6,9 ml/kg x min) than that of the girls (58.4/4.2 ml/kg x min). Significantly greater value of body mass relative bone mass was found in boys, while muscle proportion of all children was greater (43-44%), than that of the normal population. The mean values of body mass relative body fat content was almost 25% in both group, which is the threshold of overweight. Great values of standard deviation was found in resting HRV data, which made it impossible to recognize typical symptoms of over shot. These HRV data were not suitable for select long burst and short burst type activity.

Discussion: Validate the method of HRV measurement for endurance trained sportsmen is necessary. Deviation from normal values of HRV data would show us reliably early warning signs of overtraining. Long and short burst activity is still not a factor for selection of athletes in this age.

XXVth International Symposium of Pediatric Work Physiology.

Poster presentations

Session #3

Friday October 2nd

12:30 p.m. – 2:00 p.m.

Bone Responses to a Ten-Month Season of Soccer Training in Adolescent Girls: Effect of Menstrual Status

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Background: Studies in adult females engaged in soccer competition have shown a weak prevalence of the symptoms of the premenstrual syndrome compared to aerobic activities and sports characterized by aesthetics. But there is no relevant information as regards such dysfunction in adolescent players. These hormonal disorders are usually linked to deficiency in bone tissue. The aim of this study was to assess the bone status of 32 elite soccer players during a ten-month season taking into account their menstrual (dys) function.

Methods: After monitoring the prevalence of dysmenorrhea by mean of a questionnaire an oligomenorrheic group (OM : 10 / 32) and a regularly menstruated group (RM : 22 / 32) were constituted. Body composition, bone mineral content and density of lumbar spine (L1-L4), femoral neck (FN) and whole body (WB) were measured by DXA at baseline, 3 months and 8 months. Bone ultrasound properties using an UBIS 3000 device and the bone microarchitecture characterized by fractal analysis of texture were assessed at the calcaneus. Statistical analyses were performed, using Student T test and ANOVA with repeated measurements.

Results: There was no difference between groups concerning the age, body weight and height. At baseline (B) and each visit, there were no difference in OM compared to RM even if OM displayed a trend toward less fat (B: 19.8 vs. 21.6 %), and higher lean mass (B: 46.4 vs. 44.3 kg). OM displayed higher but non significant WBBMD and L1-L4 BMD than RM. Fat mass continued to decrease ($p<0.001$) and lean mass to increase ($p<0.01$) for the period of training. BMD's, Hmean and dom BUA had significantly increased ($p<0.001$) in each group for the period of study, but SOS and NonD BUA did not change. The endocrine status of the subjects did not influence these changes.

Discussion: Ten months of Intensive soccer training in adolescent girls result in an improvement of bone characteristics and properties as observed in other activities and in body composition as well. In the present study the menstrual dysfunction does not alter these bone responses.

Physical Development and Prevalence of Obesity of Latvian Children in the 20th and at the Beginning of the 21st Century

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Background: During the last 15 years the amount of adipose children has increased in most of the European countries. The purpose of the research was to determine changes in nutritional level of Latvian children aged 5-12 in the 20th and 21st century and to compare them to similar data in other countries.

Methods: The research material - body height, mass, circumferences and BMI was composed of the data taken from the most significant studies of Latvian schoolchildren in the 20th century compared to the data today.

Results: Analyzing the changes of body height, weight and BMI values we concluded that there were no significant changes of BMI values in Latvian schoolchildren (both in boys and girls), BMI values even had a tendency to decrease. It was concluded that there was no tendency for adiposity in Latvian schoolchildren at the end of the 20th century. The BMI values in 6 years old schoolchildren (both in boys and girls) have started to increase at the beginning of the 21st century caused by faster body mass increase in comparison to body height increase (by the data of 2007).

Discussion: Comparing Latvian schoolchildren BMI values to the WHO BMI growth standards, we can see significant differences - primary school children BMI (50-th percentile) equals the WHO BMI growth standards, but the rest of the percentiles values are significantly different.

Comparing Several Regression Equations That Predict VO_{2peak} Using the 20-m MSRT in Lisbon Elementary School Children

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Background: Several regression equations have been developed to predict cardiovascular fitness (CVF) based on the 20-m multistage shuttle-run test (MSRT) for children and youth. The aim of this study was to compare the validity of previously reported equations as predictors of CVF in Lisbon healthy elementary school children, by measuring the VO_{2peak} during the actual MSRT performance.

Methods: Ninety subjects, 45 boys and 45 girls aged 8-10 years, performed the MSRT and their VO_{2peak} was measured in field using a portable gas analyzer (K4b², Cosmed, Italy). Height and weight were measured and %fat was estimated from skinfold thickness. The total laps (TL) completed were recorded and used to calculate maximal speed (MS), and used as predictors in the equations.

Results: Using Bland-Altman analytical approach, there were differences between measured and predicted VO_{2peak} . The FITNESSGRAM's reports had the smallest mean difference (d) ($ml \cdot kg^{-1} \cdot min^{-1}$) between measured and the estimated values (1.84), but also had the highest range ($ml \cdot kg^{-1} \cdot min^{-1}$) between upper and lower limits of agreement (LA) (28.6) and the highest slope (1.20) meaning that the equation overpredicted VO_{2peak} in unfit participants and underpredicted VO_{2peak} in fit participants. The lowest slope (0.44) and the lowest range between LA (22.23) were observed using the equation of Fernhall et al (1998). The comparison using the equation of Leger et al (1988) provided a reasonably large d (4.69), one of the highest ranges between LA (27.08) and the second uppermost slope (1.04). The equation of Matsuzaka et al (2004) including MS showed higher d (5.38) than the equation using TL ($d=4.23$). From the 3 equations of Barnett et al (1993), the equation including skinfold and MS showed the highest d (6.07) but the smallest range between LA (24.09).

Discussion: Previously reported equations might be unsuitable for Lisbon healthy elementary school children. We suggest that the FITNESSGRAM's software reports or the equation of Fernhall et al (1998) maybe the most appropriate, however, they still yield unsatisfactory accuracy. Our findings suggest that published equations predicting VO_{2peak} from MSRT may provide reasonable group estimates, but poor individual predictions of VO_{2peak} .

Effects of a Physical Activity Intervention Study in Obese/Overweight Children Adipose Tissue

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Research Center in Sports Sciences, Health Sciences and Human Development (CIDESD) and Department of Sports Science of Polytechnic Institute of Bragança, Portugal

Background: The worldwide increase of obesity in children claim for urgent measures in several instances. One of the keys measures is to increase the children habitual physical activity (PA). The propose of this study is to analyze the effects of an PA intervention program in the children adipose tissue.

Methods: 24 obese/overweight children with 10.29 ± 2.00 years of age (6.92 to 13.89) of both gender participated in a intervention PA program during 9 months. They were evaluated at the beginning, after 4 months, and at the end of the program in weight, height a skinfolds (triceps, subscapular, suprailiac, and calf). The changes were analysed in a hierarchical linear model with HLM 5 having the sum of skinfolds as dependent variable. Children were classified as obese / overweight according to the IOTF cut-off values (Cole et al., 2000).

Results: At baseline sum of skinfolds had an estimate mean value of 92.01 mm. The hierarchical linear model shows a significant and positive effect of the intervention program, that is, there was a decrease of 9.6 mm in the sum of skinfolds between which observations. Between the baseline and the second observation 30% changed from overweight to norm weight and 8.3% from obese to overweight. Between the second and the last observations only one child changed from obese to overweight.

Discussion: The results indicate a positive effect of the PA intervention program in the reduction of adipose tissue in obese/overweigh children.

The Copenhagen School Child Intervention Study (CoSCIS). Effect on Physical Activity, Physical Fitness and Motor Performance

A. Bugge, B. Hermansen, K. Froberg, and LB. Andersen

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Background: Many children do not meet current recommendations of physical activity (PA) and studies have shown that cardio-respiratory fitness (CRF) has decreased among the least active children in the past decades. As low PA and CRF are related to development of fatness and life-style diseases, these changes may be a threat to the health of the up-coming adult population. The variance in PA among children is caused by a number of factors including the children's motor performance (MP) ability. The objective of this study was therefore to examine the long-term effects of a school-based intervention aiming at increasing PA on CRF, PA and MP.

Methods: A 4 year controlled intervention study with 7-years follow-up. 18 schools in two different local communities of Copenhagen (n=695 at baseline (mean age 6.74 yr), 606 at 4-years follow-up (mean age 9.45 yr) and 513 (mean age 13.35 yr) at 7-years follow-up). One local community (intervention-group) implemented an intervention consisting of an increase from 2 to 4 weekly physical education (PE) lessons from preschool class to 3rd class, supplementary training of the PE teachers and an upgrading of PE and playing facilities. All measurements were performed at baseline (preschool class) and at follow-ups in 3rd grade and 7th grade. Physical activity was measured using MTI-accelerometers for four consecutive days. Maximal cardio respiratory fitness (VO₂max) was directly measured during a maximal progressive treadmill running test. Motor performance was assessed by the KTK-test.

Results: No difference was found between groups during the first three years in PA and MP, and long term effects are not yet analyzed. Intervention-group showed a more favorable development in VO₂max over the 7 years compared to control-group.

Discussion: The discrepancy between effects on PA and VO₂max could be caused in part by lack of accuracy in the measurements of PA. In danish children especially biking and swimming which is not captured by the MTI-accelerometers could cause bias.

Correlations of Motor Skills and Measurement of Fitness and Fatness. The Copenhagen School Child Intervention Study

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Background: Children's motor skills may affect the activity pattern of the child and thereby influence the level of physical fitness and fatness. Studies have shown low motor skills in 10-15% of Danish preschool children. Low motor skills may lead to lack of physical activity, reduced physical fitness and enhanced fatness, all important risk factors in developing lifestyle-related diseases.

Methods: Children from two different communities of Copenhagen participated in the Copenhagen School Child Intervention Study. 695 children participated at baseline (mean age 6.74 yr) while 513 children participated at follow-up (mean age 13.35 yr). All measurements were performed both at baseline (preschool class) and at follow-up in 7th grade. Intravenous blood samples were taken after an overnight fast. Sum-of-4-skinfolds were used as a measure of body-fatness. Cardio-respiratory fitness (VO₂-max) was directly measured during a maximal progressive treadmill running test and motor skills was measured by the KTK-test. Correlations between motor skills and fatness and correlations between motor skills and fitness were analyzed using a two-tailed Pearson's correlations test.

Results: Significant correlation between motor skill scores and fitness and between motor skill scores and fatness was found on baseline measurements. The level of motor skills at baseline significantly predicted the level of fitness and fatness in 7th grade. Lower level of motor skill scores at baseline was associated with higher level of fatness and lower fitness in 7th grade.

Discussion: Higher motor skills in 6-year-old children, enhances physical fitness and prevents fatness in 13-year-old children. Improving motor skills could be an important intervention tool in preventing developments of risk factors for life style related diseases in the upcoming adult population and should therefore be a high priority factor in public health care policy.

Investigating Multidimensional Correlates of Adolescents' Health-Related Exercise Knowledge and Understanding

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Background: Health-related exercise (HRE) provides a context for delivering a number of lifetime activities and is an essential element of the Physical Education (PE) curriculum (Cale, 2000; Fairclough, Stratton & Baldwin, 2002). There is a need for the correlates of young people's HRE knowledge and understanding to be better understood, as this knowledge has the potential to influence young people's lifestyles and levels of physical activity participation. Therefore the purpose of this study was to explore the contribution of multidimensional correlates of adolescents' HRE knowledge and understanding.

Methods: Two hundred and seventy nine Year 8 and 9 children (77 boys, 202 girls; aged 12-14 years) from three schools in the North West of England participated in this study. All youths completed 10 multi-choice HRE questions based on the knowledge and understanding requirements of the English PE National Curriculum (DfEE/QCA, 1999). Various environmental, psychological, behavioural and biological predictor variables were also measured. To analyse the data a forward prediction model was employed, utilising a simple best fit model. A two-level (pupil, school) multilevel structure was used to assess the impact of the predictor variables on knowledge and understanding of HRE.

Results: HRE knowledge and understanding was significantly predicted by sex [.522 (.193)], Perceived PE Worth [.265 (.106)] and socio-economic status [SES; -.038 (.013)]. In addition, BMI and number of students per school were retained as they significantly improved the fit of the model.

Discussion: The results suggest that HRE knowledge and understanding is greater in girls, compared to boys and in schools with lower SES. In addition, scores are superior in pupils who have higher perceptions of the worth of PE classes. It is plausible that having more positive predispositions toward PE leads to enhanced engagement, learning, retention and understanding of information. The gender difference may relate to the hypothesised advanced performance of girls on cognitive tasks and female PE teachers' emphasis on HRE messages. The prominence of social marketing interventions and strategies aimed at lower SES populations may have influenced the inverse association with SES. Pedagogical strategies are required to enhance boys' HRE knowledge and understanding and pupils' Perceived PE Worth, as PE classes firstly need to be enjoyable educational experiences for cognitive learning to occur.

Cale L. (2000). *European Journal of Physical Education*, 5, 158-168.

DfEE/QCA (1999). *Physical Education. The National Curriculum for England*. London: DfEE/QCA.

Fairclough S, Stratton G & Baldwin G. (2002). *European Physical Education Review*, 8, 69-84.

Changes in Spontaneous Food Intake Following a 6-month Training Program in Children Accompanied or not by a Calcium Supplementation

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Background: There is actually no consensus regarding the impact of physical activity level on macronutrient selection. The aim of this study was to analyze the potential changes in nutritional behaviors (nutritional status, energy and macronutrient intake) in Romanian children after 6 months of a physical activity program and calcium supplementation.

Methods: Dietary Energy Intakes (DEI) and macronutrients were assessed using a four-day dietary recall in 226 children (9.6 ± 0.8 years). 160 children were randomly allocated to active (n=80) or non active groups. In each group, subjects received either calcium-phosphate (n=40), or a placebo powder for 6 months. The active group participated in a physical activity program, one hour, 2 times/week in addition of physical education.

Results: At baseline there was no difference between groups as regards energy, nutrient intake and the caloric intake for macronutrients that were balanced compared to the daily recommended allowance (Carbohydrates: 50.02 ± 4.95 %, Proteins: 14.02 ± 2.03 %, Lipides: 35.98 ± 4.35 %). Over 6 months, anthropometrical parameters (height, weight, BMI, lean mass) had significantly increased for all groups but there were no differences between groups. In all groups, both the nutritional intake for all macronutrients and the energy intake increased (AEJ for Active group was 8711 ± 2049 kJ/j, for nonActive was 8865 ± 1677 kJ/j). The Active group presented a negative balance (-520 Kcal) whereas the Non-active group maintained a positive one (+302 Kcal). No difference was observed between boys and girls.

Dicussion: In the present study, the lack of difference concerning the spontaneous nutritional habits due to a change in activity level and/or calcium supplementation might be explained by the fact that 1) activity was not enough intensive, and calcium supplement was not necessary; or 2) the organism does not respond spontaneously to a change in activity and calcium intake.

Introducing the Canadian Assessment of Physical Literacy

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Background: For monitoring, surveillance and evaluative purposes a simple measure of physical activity or fitness is generally accepted to be the primary assessment of healthy active living for children and youth. This measure alone, even if done using robust direct measures, is insufficient to adequately assess the impact or desired outcomes of a quality physical education, community sport, or active living program. We propose what really needs measured is physical literacy, an aggregate indicator composed of four domains: fitness; motor skill development; physical activity behaviour; and awareness, knowledge and understanding of the importance of physical activity.

Methods: This project aimed to develop a new assessment protocol – the Canadian Assessment of Physical Literacy (CAPL). Funding, input and support was sought from multiple partners. The goal was not to invent new tests, but rather package existing (and some new) tests together to arrive at a comprehensive test battery that would assess the essence of what quality physical education, sport or active living programs aim to achieve. Initial test development relied on literature searches, meetings with experts and practitioners, feasibility testing, pilot testing and progressive revisions. The CAPL includes measures of body composition; aerobic fitness; strength; flexibility; locomotor and object control skills; objective physical activity assessment; and several psychosocial and cognitive measures. Feasibility and pilot testing was done on children aged 10-12 years in schools, sport and recreation settings.

Results: Funding and partnership support was received from multiple groups and stakeholders. Initial testing indicates that the CAPL is feasible to administer in a classroom, sport or recreation environment and that it is well received by children, teachers, and sport and recreation leaders.

Discussion: The substantial financial assistance from multiple partners suggests there is widespread support for an assessment instrument to measure physical literacy. Researchers, physical educators, coaches, and athletes support the four domains included in the CAPL. Three versions of the CAPL, from minimal to optimal test batteries, have been developed and tested. Future work will establish aggregate and domain scoring systems and criterion-referenced standards. It is hoped that others will use the CAPL and assist in its refinement and eventual widespread use.

Age, Sex and Body Mass Index Differences in Health-Related Physical Fitness in Portuguese Children. Preliminary Results from the Maia County Study

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Background: Maia county growth, development and health is a study aimed to describe human growth, motor performance, physical activity, metabolic health, and postural problems in children and their families. This is an epidemiological and intervention study aiming at a compromise between a diversity of educational and health goals, involving local educational government, city hall policies, and health authorities. This report aims to present the overall design of the research as well as some preliminary data from a pilot study to assess age, sex and body mass index influences in health-related physical fitness (HRPF) of children.

Methods: A random sample of 959 children (477 girls and 482 boys) aged 6 to 10 years belonging to 1st cycle of basic schooling from the Maia county, north of Portugal was used. Prevalence of overweight and obesity was estimated using body mass index (BMI) based cut-off points suggested by Cole et al. (2000). HRPF was evaluated with the Fitnessgram test battery (curl-up, push-up, trunklift and 1-mile run-walk). Multiple regression was used and all data analysis was done in SPSS 17.

Results: Overall, 24.3% were overweight (females=22.6%; males=25.9%) and 26.7% were obese (females=27.3%; males=26.1%). In all physical fitness tests, with the exception of trunk-lift and curl-up, boys are fitter than girls (in push-up, $p<0.001$; 1-mile run-walk, $p<0.001$). On average, physical fitness levels increases with age ($p<0.001$), but push-up and 1-mile run-walk levels decreased significantly with BMI ($p<0.001$).

Discussion: Normal weight boys and girls are fitter than those who are overweight and obese. Higher overweight and obesity trends across age demand caution in designing physical activity and nutrition interventions with these children in their school settings. Physical education programs should target children who are mostly at risk, especially girls with lower cardiorespiratory fitness and upper-body strength.

Physical Activity Levels of Portuguese Children. An Analysis Based on Hierarchical Linear Modeling

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Background: Physical activity (PA) has a positive impact on children's health. There is a compelling evidence of its decrease. In addition, there is evidence of independent relevance of several correlates of PA levels in children. Integrating subjects in environmental contexts are seldom studied. The present report uses an approach based on Hierarchical Linear Modeling (HLM) to identify the influence of individual and contextual based determinants in children's PA.

Methods: A cross-sectional study was carried out in the city of Amarante, northern Portugal, in 2006. A sample of 2801 children of both gender (1341 females and 1460 males) belonging to 1st cycle of basic schooling was used. Weight and height were measured and BMI was calculated. PA was assessed with the Godin & Shephard questionnaire (Met's/15'/week). School environment and available infrastructures were classified in three categories. HLM 6.06 software was used in all computations.

Results: Data showed good-to-excellent reliability (Height: $0.998 \leq R \leq 1.000$, Weight: $0.999 \leq R \leq 1.000$, PA: $0.706 \leq R \leq 0.952$). Schools explain 26% of PA total variance. When modeling individual characteristics, PA increased with age (6.29 ± 2.24 Met's/15'/week) and boys are more active than girls (11.58 ± 4.08 Met's /15'/week). BMI showed no significant association with PA ($p=0.119$). When using schools contexts, those placed in higher socio-economic contexts have a significant effect in PA levels (5.82 ± 2.88 Met's/15'/week), but children with higher socio-economic status have lower PA (-4.15 ± 1.56 Met's/15'/week).

Discussion: Hierarchical modeling is a useful tool and way of bringing together subjects and contexts when assessing determinants of PA levels. PA increases with age, and boys are more active than girls. BMI has no relevant impact in children PA. In addition, schools context is a strong positive predictor of higher levels of PA, but a negative effect was found for children's socioeconomic status.

Assessment of Muscular Performance in Teenagers after a Lower Extremity Fracture

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Introduction: Many authors have described deleterious effects of lower limb immobilization, and have speculated that altered muscle strength may not be fully recoverable. The aim of this study was to assess muscle strength and power performances 18 months after a lower limb fracture, in children and adolescents compared to healthy controls.

Methods: This was a cross-sectional prospective study including 39 teenagers (14.2 ± 0.3 years) that sustained a lower limb fracture, and 39 matched healthy controls (14.3 ± 0.3 years). Strength and power performances of the injured and non-injured leg were assessed 18 months after the fracture with a single-legged vertical jump test on a force platform.

Results: Strength performances in injured teenagers were similar among both lower limbs. We found a significant difference between the injured and non injured legs for muscular power (respectively 5.90 ± 0.22 W.Kg⁻¹ vs 6.47 ± 0.27 W.Kg⁻¹ $p < 0.004$ for mean power and 11.25 ± 0.39 W.Kg⁻¹ vs 12.14 ± 0.44 W.Kg⁻¹ $p < 0.001$ for peak power). However, the limb symmetry index was superior to 90% for muscular power, which is considered as normal. There was no significant difference between injured teenagers and healthy controls for strength and power performances. However, limb asymmetries above 15% for muscular strength and power were more frequent in injured patients (between 13 to 28%) than in non injured children and adolescents (between 0 to 8%).

Discussion: This study demonstrates that the muscular weakness due to immobilization is recoverable 18 months after a lower limb fracture in children and adolescents. However, a larger percentage of injured teenagers have limb asymmetries greater than 15% for strength and power, compared to non-injured controls.

On the Determinants of an Active Lifestyle for The Adolescents of Madrid

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Background: Much evidence exists regarding the risk of a sedentary lifestyle in the development of some illnesses. An active attitude during adolescence has a powerful influence on both the current health of the adolescent and their future health. The purpose of this study is to understand the relation between the level of physical activity (PA) and various bio-psycho-social variables.

Methods: After obtaining a written consent of the parents the subjects, 266 boys and 288 girls between 13 and 17 years old were randomly selected from 35 educative centres, belonging to 16 of the 21 districts of Madrid. These subjects completed a survey containing the Modifiable Activity Questionnaire for Adolescents[1] and were measured with anthropometric techniques [2].

Results: The chi-square test was firstly applied finding the following association with the PA: gender ($p = 0.000$), peer's PAL ($p = 0.000$), Spanish origin of father ($p = 0.000$) and mother ($p = 0.000$), participation in organized PA ($p = 0.000$), father's PAL ($p = 0.001$), socioeconomic status ($p = 0.008$), overweight ($p = 0.010$) and scholastic performance ($p = 0.035$). To model the effect of each variable on the rest of variables, a binary logistic regression analysis was done. The variables that had the greatest influence on the PA were as follows, in order of importance: gender, organized PA participation, Spanish father's origin, overweight, videogames time, peer's PA and mother's PA.

Discussion: Only two (gender and father's origin) of the seven determinants of the PA are not modifiable. Therefore when considering the other variables an opportunity exists for changing the lifestyle of the adolescents and hence influencing the present and future public health. Nevertheless, it should be noted that the main action should be done in the familiar surroundings encouraging the parents to be active, giving nutritional education and information about the dangers of the abuse of screen time.

1- Aaron, D.J., Kriska, A.M. 1997: Medicine and Sciences in Sport and Exercise, 29 (6) [Supplement], S79-S82.

2 - Cordente et al. Revista Española de Salud Pública, 2007: 81 (3), 308-317.

Dose Related Association of Total Physical Activity and Health-Related Physical Fitness in Adolescent Boys

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Background: Although the relationship between physical activity (PA), physical fitness and health are justified by scientific research, further studies focusing on the dose-response relationship between PA and various health components especially in children and adolescents are on the priority list. The aim of the study was to determine the relationships between total volume of daily PA and health-related physical fitness of adolescent boys.

Methods: The participants of this cross-sectional study were 135 healthy adolescent boys aged 15 years. The modified International Physical Activity Questionnaire (IPAQ) was used to estimate the frequency, intensity, and duration of PA. In respect to the amount of total PA, the subjects comprised three groups: high PA (n=41), moderate PA (n=52), and low PA (n=42). Physical fitness was measured by means of the following tests: Roufier exercise test (cardiovascular fitness); vertical jump (power of legs' muscles); modified push-up (arms and trunk muscle strength and endurance); and sit-and-reach test (flexibility). Body composition was measured using bioelectrical impedance analysis (BIA).

Results: No significant differences were found between the groups with different PA levels in anthropometrical and body composition parameters. Physical fitness tests' results were significantly different between the groups, except for Roufier test. The significant correlations of total PA were found with muscle strength and endurance, and flexibility ($r=0.28-0.32$; $p<0.05$), but not with cardiovascular fitness and body composition in adolescent boys.

Discussion: The evidence of dose-response relationship of total PA and health-related physical fitness in schoolchildren is lacking. Andersen and Mechelen (2005) report that total PA of children has no significant relationship with cardiovascular fitness, but has significant weak correlations with other health-related physical fitness components. We conclude that greater volume of total PA indicates better physical fitness tests results. Total PA correlates significantly with muscle strength and endurance, and flexibility, but not with cardiovascular fitness and body composition in healthy adolescent boys.

Implications of Obesity on Postural Development in Primary School Children

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Background: The problem of obesity has become a global concern, specially the increase in childhood. There are recent studies suggesting an association between obesity and musculoskeletal pain but consequences of childhood obesity on musculoskeletal structure and function have been sparsely studied. This cross-sectional study pretends to contribute to a better understanding of the implications of childhood obesity on the development of the postural musculoskeletal system.

Methods: 168 children aging between 6 and 11 years (50.3% boys and 49.7% girls) were examined on sagittal and posterior plane photographs in usual upright standing posture. Reflective markers were placed on tragus of the ear, acromions and lateral posterior iliac crests, right greater trochanter, head of fibula, and lateral malleolus. A projecting reflective marker was placed on the spinous process of C7. Anthropometrics measures of weight, height, and BMI were determined. Photographs were analyzed using SAPO desktop - software for postural analysis. Logistic regression analysis was computed for determination of predictors of *poor* and *normal posture*. Independent variables entered in the regression models included anthropometrics factors, age and gender.

Results: Children were grouped on *normal weight* (62.2%), *overweight* (24.4%) and *obese* (13.3%), according with BMI values. There were found more obese and overweighted girls (41.1%) than boys (30.5%). On the other hand, boys had higher value of *poor posture* (53.7%) than girls (50.0%). Relating posture with BMI, the *overweight* children had the lowest value of poor posture (45.0%) against 59,1% on *obese* and 52,9% on *normal weight*. The logistic regression model revealed that height was a significant predictor of poor posture ($p=0.03$).

Discussion: Obesity impact on the development of the growing child's musculoskeletal system is still poorly understood. Newer longitudinal studies will be needed to understand the impact of obesity on the musculoskeletal system. The results of our study suggest that overweight and higher height can play an import role on the development of poor posture.

Exercise Capacity in Pediatric Patients with Inflammatory Bowel Disease: A Pilot Study

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Background: Inflammatory bowel disease (IBD) consists of Crohn's Disease (CD) and Ulcerative Colitis (UC). Low fitness levels (estimated peak oxygen uptake; $\text{VO}_{2\text{peak}}$) have been observed in adults with CD. However, no data are available for exercise capacity in pediatric patients with IBD. Therefore, the aim of the current pilot study was to determine aerobic and anaerobic exercise capacity in youth with IBD. We also investigated whether there were differences between patients with CD and UC.

Methods: Eighteen patients with IBD in remission (mean disease duration 3.1 ± 2.5 years) from the pediatric gastroenterology clinic of McMaster Children's Hospital who were referred for exercise testing were included in this study. Nine patients with CD (age: 14.6 ± 1.8 yrs) and nine patients with UC (13.3 ± 2.9 yrs) participated in this study. Aerobic exercise capacity (peak mechanical power: W_{peak} and $\text{VO}_{2\text{peak}}$) was measured using a graded cycling test following the McMaster protocol. Anaerobic exercise capacity (peak power, PP and mean power, MP) was measured using the Wingate anaerobic cycling test (WAnT). $\text{VO}_{2\text{peak}}$ values were compared with reference data from our laboratory. W_{peak} and WAnT values were compared with data from Bar-Or & Rowland (Pediatric Exercise Medicine).

Results: W_{peak} , $\text{VO}_{2\text{peak}}$ ($\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$), $\text{VO}_{2\text{peak}}$ (L/min), and PP were significantly lower compared to reference values, and were respectively 89 ± 18 , 76 ± 13 , 72 ± 20 and $89 \pm 16\%$ of predicted. MP was not significantly lower compared to reference values. There were no significant differences in any of the exercise parameters between patients with CD and UC. No correlation was found between exercise parameters and disease duration, nor were there any gender differences.

Discussion: We found that aerobic exercise capacity (W_{peak} and $\text{VO}_{2\text{peak}}$) and aspects of anaerobic exercise capacity (PP) were lower in pediatric patients with IBD compared to reference values. Exercise capacity did not depend on disease type, but suggests that physical activity promotion is warranted in this population.

Effect of Combined Exercise and Dietary Intervention on Metabolic Risk Factors in Obese Adolescents

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Background: The alarming progression of obesity among children and adolescents is accompanied by a marked increase in the frequency of cardiovascular risk factors clustered under the term Metabolic Syndrome (MS). Interventions based on physical activity combined or not with diet restriction have proved their beneficial effects in terms of body composition and physical fitness. Few however have explored the impact of such programs on the obesity-related metabolic complications (dyslipidemia, insulin resistance and hypertension). The aim of this study was to assess the effects of a 12-week intervention of physical activity and dietary restriction on the metabolic syndrome prevalence among obese adolescents.

Methods: 20 obese adolescents aged 12-16 years old were boarded into a Children Medical Institution where they followed 12 weeks of a physical activity program combined with dietary restriction and nutritional education. Anthropometric characteristics, metabolic measures and biochemical analyses were performed in all subjects before and after the intervention. Insulin resistance was estimated using the homeostatic model assessment (HOMA) index. The metabolic syndrome was detected thanks to the adapted definition proposed in pediatric populations by Chen et al. (2005).

Results: Weight ($p<.001$), Body Mass Index ($p<.001$), Waist Circumference ($p<.05$), Hip Circumference ($p<.001$) and percentage of Fat Mass ($p<.001$) were all significantly improved. Based on the metabolic detection thresholds proposed by Chen et al. (2005), 50% of the sample presented the syndrome before the intervention against 30% by the end. Except for obesity, prevalence of the MS components (insulin resistance, dyslipidemia and hypertension) all decreased thanks to the intervention. Among all the metabolic concentrations under study, only the insulin one significantly decreased with the intervention ($p<.05$). The HOMA index was also reduced (2.29 ± 1.27 to 1.58 ± 0.57 , $p<.05$).

Discussion: 12 weeks of a supervised physical activity and dietary program lead to body composition improvements among obese adolescents. Such programs lead to decreased prevalence of the metabolic syndrome and of its components in obese adolescents. However, those decreased prevalence are not accompanied by significant metabolic profile modifications, which questions once more the use of dichotomic definitions of the syndrome, based on thresholds.

Effect of Age on the Energetic Cost of Walking in Obese Females

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Background: A higher energy cost of walking (C_w) has been observed in obese compared to lean persons, which could lead to a lower engagement of this people in exercise. Few studies have been interested in the effect of age on C_w and have shown that, in lean individuals, children have a higher C_w than adults. Differences in body dimensions, changes in neuromuscular activity or efficiency of muscle contraction with growth and maturation are factors likely to explain a decrease in the C_w from childhood to adulthood. To our knowledge, no study has confronted the economy of walking between obese adolescents and adults. Hence, the aim of this work was to compare C_w between obese adolescent and adult females.

Method: 13 obese adolescent girls (14.39 ± 1.81 years old, BMI $\geq 97^{\text{th}}$ percentiles of the national curves) and 9 obese women (58 ± 7.75 years old, BMI $\geq 30 \text{ kg.m}^{-2}$) were recruited. Body composition was assessed by DXA. Metabolic parameters were measured, thanks to a breath-by-breath portable indirect calorimeter (K4b²), during 4 minutes of walking at 1, 1.2 and 1.5 m.s^{-1} . Net C_w ($\text{mlO}_2.\text{kg}^{-1}.\text{m}^{-1}$ and $\text{mlO}_2.\text{kgLBM}^{-1}.\text{m}^{-1}$) was calculated as $\text{VO}_2 - \text{VO}_{2\text{standing}} / \text{speed}$.

Results: Body fat percentage and BMI were not significantly different between obese adolescents and adults ($44.15 \pm 7.30 \%$ vs $40.71 \pm 6.13 \%$; $37.71 \pm 8.05 \text{ kg.m}^{-2}$ vs $32.12 \pm 3.75 \text{ kg.m}^{-2}$ respectively). Obese adolescents presented a significantly higher C_w at 1.5 m.s^{-1} than their older counterparts ($0.16 \pm 0.02 \text{ mlO}_2.\text{kg}^{-1}.\text{m}^{-1}$ vs $0.10 \pm 0.04 \text{ mlO}_2.\text{kg}^{-1}.\text{m}^{-1}$; $0.27 \pm 0.05 \text{ mlO}_2.\text{kgLBM}^{-1}.\text{m}^{-1}$ vs $0.17 \pm 0.07 \text{ mlO}_2.\text{kgLBM}^{-1}.\text{m}^{-1}$). There was no significant difference for the others speeds. Ventilation (VE , l.min^{-1}) was significantly higher in adolescents than in adults for all speeds especially at 1.5 m.s^{-1} .

Discussion: Obese adolescent girls are less economic than older counterparts at the highest speed. This could be associated with a lowest breathing pattern in adolescents which is expressed by a greatest VE in this population. However, there was no significant difference of C_w for walking speeds which are closed to previously reported optimal walking speeds.

Determining Calcaneal Broadband Ultrasound Attenuation in Elite Youth Soccer Players

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Background: Quantitative Ultrasound (QUS) has emerged as an attractive technology in determining biological maturity. The principle behind QUS relates to the speed that ultrasound waves pass through bone, or the loss of energy by attenuation mechanisms such as scattering and absorption, in proportion to both the physical density and structural properties of the target skeletal tissue. This can be measured by determining Broadband Ultrasound Attenuation (BUA), measured in dB/MHz. Advantages of using QUS are the simplicity of the scans, a lack of ionizing radiation and potential field based application (Halaba and Pluskiewicz, 2004). There is a dearth of norm-referenced data relating to QUS, particularly in elite youth sports populations. The aim of this preliminary study was to determine normative BUA values for elite youth soccer players.

Methods: Seventy-three boys, all elite youth soccer players, were recruited from six sequential age groups. BUA was determined using the CUBA bone ultrasound analyser (McCue Ultrasonics Ltd, Winchester). This device is a valid and reliable measure of BUA in youth populations (Mughal et al. 1997). BUA measurements were taken at the right calcaneus. Appropriate sized footplates were inserted depending on foot length.

Results:

Group	Age (yr)	N	Range	Calcaneal BUA (dB/MHz)
Under 9	8.8 (0.2)	11	37-65	51.64 (8.07)
U10	9.7 (0.3)	9	51-76	63.33 (7.45)
U11	10.8 (0.2)	13	40-79	61.69 (12.05)
U12	11.9 (0.1)	12	36-94	61.75 (15.02)
U13	12.8 (0.1)	12	67-96	84.42 (11.40)*
U14	13.9 (0.1)	16	61-134	85.25 (18.85)*

Table 1. Calcaneal BUA (dB/MHz) determined by age group (all values mean(± s.d.))

*significant difference with U9, U10, U11, U12 groups ($p < 0.01$)

Discussion: Older players had significantly higher BUA than their younger counterparts. This may imply a 'trigger point' whereby BUA accelerates, commensurate with the most rapid period of growth for these youth athletes. Mean BUA scores of the elite players were generally higher than those previously reported (Mughal et al. 1997). These findings suggest a greater skeletal maturity in elite youth athletes, echoing previous literature. The use of QUS provides a safe and effective measure of skeletal architecture in youth populations. This enables a more direct determination of biological maturity than predictive anthropometric techniques. This information could be used in applied youth sports settings to determine training-related "windows of opportunity," associated with biological maturity (Johnson, 2009).

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Hip Geometry in Prepubertal Active Girls under Calcium Supplementation: a One Year of Follow-Up Study

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Background: Physical activity (PA) during growth has a positive influence on bone mineral accrual and potentiates the calcium supplementation effects (Ca) on this accretion. However, the effects of PA on geometrical characteristics acquisition during the prepubertal period are not well understood. To our knowledge, there is no study on hip structural responses to dietary calcium supplementation in young girls. The purpose of this study was to investigate the effects of lifestyle variables (PA and Ca) on hip geometry in prepubertal girls in a one-year randomized double-blind placebo controlled study.

Methods: 113 prepubertal girls (9.9 ± 1.2 yr) were randomly allocated to take powder products (800 mg) containing calcium phosphate (Ca+) or placebo (Ca-) on a daily basis for 1yr. The group was composed of 63 training (PA+ ; 7.3 ± 4 hr.wk⁻¹) and 50 non active (PA- ; 1.2 ± 0.8 hr.wk⁻¹) children. The final experiment concerned 4 groups : (PA+, Ca+ ; n =12), (PA+, Ca-, n = 41), (PA-, Ca+, n = 10) and (PA-, Ca-, n = 21). Bone mineral density (BMD) was determined by DXA at different sites. Hip Structural Analysis (HSA) software was used to analyze bone structural parameters at the femoral neck. Bone age was calculated and daily spontaneous calcium intake was assessed in each subject by a food frequency questionnaire.

Results: BMD gains were significantly higher in (PA+, Ca+) than in other groups at the total body, lumbar spine and femoral neck. There was no difference between the other groups. Except for the sub periosteal and the endocortical widths, all the HSA parameters (CSA, CSMI, Z modulus, cortical thickness and Buckling Ratio) were significantly higher in active girls at baseline and 1yr later. Nevertheless, the annual gains of these parameters were the same in each groups.

Discussion: In conclusion these data suggest that 1) PA positively affects hip geometry in prepubertal girls and 2) the calcium supplementation increases the effects of physical exercise on bone mineral acquisition but not on the femoral neck geometry parameters during prepuberty.

The Effect of Anaerobic Exercise on Salivary Cortisol, Testosterone and Immunoglobulin (A) in Boys Aged 15- 16 years

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Background: This study investigated the effect of repeated bouts of short-term, high-intensity cycling exercise on the salivary cortisol, testosterone and immunoglobulin (A) concentrations of 15-16 year old boys.

Methods: Seventeen apparently healthy schoolchildren (aged 15.5 ± 0.4 years) participated in this study. Stature was measured to the using a portable stadiometer (Holtain Ltd, Crymych, Pembrokeshire, UK). Body mass (BM) was recorded using a Phillips electronic scale (HP 5320). Skinfold measurements were taken with Harpenden skinfold calipers (John Bull, British Indicators Ltd, Bedfordshire, UK). The protocol was performed in triplicate; and triceps and subscapular thicknesses were used to estimate percent body fat (%BF). Fat free mass (FFM) was calculated using the equation $BM - (\%BF \times BM/100)$. For maturation status, the participants were given a gender-specific questionnaire and asked to complete this in private. All participants completed 6 x 8 secs sprints, interspersed with 30 secs recovery intervals on a cycle ergometer. Participants were harnessed to the ergometer so that they remained seated during the exercise. Toe clips were used to prevent the feet from slipping off the pedals. Using the passive drool method, salivary samples were taken before, and five minutes after, exercise.

Results: The group mean for peak power output was 723.1 ± 180.3 watts. One pre exercise association: fat free mass and salivary testosterone (SalT) ($p = 0.02$); and one post exercise association: average mean power output and SalT ($p = 0.03$) were identified. There were significant changes ($p \leq 0.05$) in both SalT and SalC, five mins after high intensity exercise. No significant differences ($p > 0.05$) were recorded for SIg(A).

Discussion: There are few data relating to young people that have examined the effect of repeated bouts of exercise on the immune system. Children playing in uninhibited conditions, frequently exhibit a pattern of short bursts of intense activity interspersed with varying intervals of lower intensity activity. Therefore, an enhanced knowledge of the young body's response to such behaviour would be of value. The increases in SalT and SalC reported in this study confirm that repeated bouts of short-term, high-intensity exercise produces significant physiological hormonal responses in adolescent boys, but does not affect mucosal immune function.

Lipoprotein(a) in Healthy Welsh Schoolchildren Aged 12-13 Years

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Background: The aim of this study was to examine established and novel cardiovascular disease (CVD) risk factors in a cohort of disease-free young people. Specifically, we determined the lipoprotein(a) (Lp(a)) concentrations in schoolchildren aged 12 -13 years in South Wales, as well as the percentage of children exhibiting values in excess of $30 \text{ mg}\cdot\text{dL}^{-1}$. We also identified the number of children who had combined elevated levels of Lp(a) and low-density lipoprotein (LDL-C), or Lp(a) and fibrinogen (Fg).

Methods: Participants comprised 100 boys and 108 girls; aged 12.9, SD 0.3 years. Barefoot stature was measured to the nearest 0.001 metre using a portable stadiometer (Holtain Ltd, Pembrokeshire, UK). Body mass was recorded to the nearest 0.1 kg using a Phillips electronic scale (HP 5320). Blood samples were collected between 9am and 10.30am, and following an overnight fast. LDL-C concentration was calculated by the Friedewald formula. Fibrinogen concentration was determined according to the method of Clauss and using the ACL Futura analyzer (Instrumentation Laboratory Company, Lexington, MA). Lp(a) concentration was measured by an immunoturbidimetric method using the Cobas Mira analyser (Roche Diagnostics, Basel, Switzerland). The laboratory analytical variance for the measurement of Lp(a) and Fg were 6% and 1.6%, respectively.

Results: No significant gender differences were identified for any of the measured variables. Twenty six percent of the schoolchildren exceeded the published criterion threshold ($30 \text{ mg}\cdot\text{dL}^{-1}$) for Lp(a). Of those identified as having elevated levels of Lp(a), 60% reported CVD in a close family member. Three schoolchildren had combined elevated Lp(a) and LDL-C; 31 had combined elevated Lp(a) and Fg.

Discussion: Elevated levels of both Lp(a) and LDL-C are considered to have the greatest detrimental influence on health status. In our cohort, two boys and one girl demonstrated this combination. The combination of Lp(a) and Fg was more prevalent, with 15% exhibiting this condition. It is debatable whether changes in lifestyle patterns, namely physical activity and diet, have a significant effect on Lp(a) levels; however, the combined detrimental influence of Lp(a) and LDL-C, or Lp(a) and Fg, in children and young people, could be reduced with appropriate lifestyle intervention.

The Influence of Training and Exercise Mode on the Oxygen Uptake Kinetics of Prepubertal Girls

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Background: Few studies have investigated the influence of training on the oxygen uptake kinetics of prepubertal children. Those that have generally report no influence. However, single transitions, pooling of data from both sexes and the prescription of work rates as a percentage of peak VO_2 require these results to be considered with caution. This study addressed these issues and furthermore the controversy surrounding the importance of exercise mode specificity.

Methods: Eight trained (TC, 11 ± 0.7 y, mean training = 8 ± 2.5 hrs/week) and eight untrained girls (UTC, 11 ± 0.6 y) completed an incremental test on the cycle (CE) and arm crank (ACE) ergometers to determine individually and mode specific work rates at $40\%\Delta$ which were subsequently used for repeat transitions. Breath-by-breath gas exchange variables and the concentration of deoxy[haemoglobin+myoglobin] ([HHb]) were assessed continuously. Averaged VO_2 responses were modelled using a single exponential with a time delay until the onset of the slow component.

Results: Anthropometry did not differ with training status and nor did peak values regardless of exercise mode. The TC had a significantly faster VO_2 tau (25 ± 3 s) during ACE than UTC (37 ± 6 s, $P = 0.000$). There was no difference in VO_2 tau during CE (TC, 25 ± 5 ; UTC, 25 ± 7 s). The TC's [HHb] tau (15 ± 4 s) was faster than UTC's (28 ± 9 s) during CE.

Discussion: This is the first study to report training induced adaptations in the oxygen uptake kinetics of prepubertal girls, emphasising the importance of exercise mode specificity. The differences in the VO_2 tau may be related to differences in muscle fibre type distribution patterns that occur naturally between arms and legs and that result from endurance training. This is the first study to report [HHb] kinetics and the influence of training on them. The faster [HHb] tau during ACE in untrained children may be indicative of a mismatch between oxygen delivery and utilisation which thereby requires a faster oxygen extraction to meet the demand.

What anthropometric Index is the Best Predictor for Clustered Metabolic Risk in Children?

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Background: To determine which anthropometric screening tool is the best predictor for a clustered metabolic risk in nine-year-old Norwegian children. The six anthropometric variables available in the present study were: waist circumference (WC), body mass index (BMI), WC to height ratio (WCHR), ponderal index (PI), conicity index (CI) and waist to hip ratio (WHR).

Methods: A population-representative group of 227 rural Norwegian children (boys: 111, girls: 116, age 9.3 ± 0.3 years, body mass: 32.6 ± 6.5 kg, height: 137.1 ± 5.8 cm, VO_{2peak} : 49.9 ± 7.5 ml·kg⁻¹·min⁻¹) served as subjects. A z-score ($z = [\text{value} - \text{mean}] / \text{SD}$) by sex was computed for the following five biological cardiovascular disease risk factors: the homeostasis model assessment, triglycerides, systolic blood pressure, the total cholesterol to high density lipoprotein cholesterol ratio and peak oxygen uptake.

Results: From simple comparison of Pearson correlation coefficients, WC was the best anthropometric variable in predicting the clustered metabolic risk for both sexes (boys: $r = 0.54$, $p < 0.01$, girls: $r = 0.74$, $p < 0.01$). Also, for BMI (boys: $r = 0.51$, girls: $r = 0.71$), WCHR (boys: $r = 0.43$, girls: $r = 0.68$) and PI (boys: $r = 0.42$, girls: $r = 0.65$), there was a significant correlation between the single anthropometric variable and the clustered metabolic risk for both sexes (all; $p < 0.01$). For CI, the correlation coefficients was 0.22 for boys ($p < 0.05$) and 0.54 for girls ($p < 0.01$). Finally, for WHR, only boys showed a significant correlation to the clustered metabolic risk (boys: $r = -0.31$, girls: $r = 0.004$). Furthermore, for WC, BMI, WCHR, PI and CI, the correlation to the clustered metabolic risk was substantially stronger for girls than for boys.

Discussion: In the present study, WC and BMI were the most appropriate indices in predicting CVD risk factor status for both sexes. Also WHR and PI showed a good correlation to the clustered metabolic risk in children. WC may be preferential as a screening tool to identify high-risk children, as it is simpler, cheaper and does not require measurement of children's body mass.

Associations Between Physical Activity Level, Cardiorespiratory Fitness and Cardiovascular Diseases Risk factors among Obese Children and Their Mother

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Background: The aim of this study was to compare physical activity, cardiorespiratory fitness and cardiovascular diseases (CVD) risk factors among obese children and their mother.

Methods: This was a cross-sectional study including 36 pre-pubertal obese children (female 40%, age 9.6 ± 1.2 yr) and their mother (39.1 ± 5.5 yr). Data were also compared to 95 healthy children (9.7 ± 0.2 yr). Measures included: physical activity by accelerometer (Actigraph); cardiorespiratory fitness (VO₂max); body mass index (BMI); whole body fat by DXA; blood pressure (BP); fasting blood lipids, glucose, insulin, HOMA-IR and high-sensitive C-reactive protein (hs-CRP) levels.

Results: Sixty percent of mothers were overweight and 27% were obese. Compared to healthy children, obese subjects had significantly lower physical activity count and VO₂max. Compared to mothers, obese children had similar VO₂max (35.3 ± 8.4 vs 35.9 ± 6.6), body fat (42.9 ± 5.0 vs 43.8 ± 7.2), systolic BP (111.0 ± 12.2 vs 117.4 ± 11.9), lipid profile and hs-CRP. Obese children had significantly higher physical activity count (496.2 ± 157.0 vs 402.8 ± 136.8) and spend more time at moderate to vigorous intensities than mothers. However, their insulin level, HOMA-IR and hypertension rate (27 vs 4%) were significantly higher than mothers.

Discussion: Pre-pubertal obese children have higher risk of hypertension and insulin resistance than mothers, however their physical activity level remains increased. They have similar VO₂max, body fat, and blood lipids than mothers. Therapeutic interventions focusing on mother's lifestyle changes might be interesting approaches to prevent the spread of CVD in obese children.

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Somatotype of Adolescents Athletes from National Center “Sideporte” in Guatemala

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Background: To develop the sports and increase level of competition was created “SIDEPORTE” in Guatemala, the athletes received an scholarship, they live in the National Center, practice their sports in the morning and academics in the afternoon.

Methods: 94 athletes were studied by Somatotype (28 females (F), 66 males (M)), 11 sports (Athletics, Boxing, Chess, Cycling, Fencing, Judo, Karate Do, Roller Skate, Shutting, Tennis, Weight Lifting) June 2008, age (F) 12.76 to 17.25 and (M) 11.97 to 17.21 years. The anthropometrics data was like used for analysis of somatotype described with the method of Heath-Carter using the technique like Anthropometry Illustrated for WD Roos, RV Carr and JEL Carter (Turnpike Electronic Publication Inc. 1999). We tested % Fat by Bioimpedance (BI), Sexual Maturity by pubic hair (PH).

Results: Mean values for females were: 15.1 years (SD 1.1), weight 55.3 kgs (SD 8.2), height 155.7 cms (SD 7.3), % fat BI 30.5 (SD 6.5), Somatotype Mesomorphic endomorph I = 5.6 (SD 1.2), II = 4.3 (SD 1.0), III = 1.6 (SD 1.1), BMI 22.7 (SD 2.4) kgs/mts², by pubic hair (PH) 5 grade V, twelve grade IV, and others ≤ grade III. The mean results in males were: age 15.1 years (SD 1.2), weight 57.3 Kgs (SD 13.5), height 162.1 cms (SD 8.7), % Fat BI 16.4 (±1SD 6.1), Somatotype Endomorphic mesomorph I = 3.2 (SD 1.5), II = 4.8 (SD 1.3), III = 2.6 (SD 1.3), sexual maturity by Pubic hair (PH) 19 grade V, 30 grade IV, others ≤ grade III and seven grade I.

Discussion: the Somatotype analysis in adolescents females athletes are Mesomorphic endomorph and males athletes are Endomorphic mesomorph, and the sexual maturity most ≥ de III PH, seven grade I, % of Fat higher in females than males in normal range. Discussion like others studies we found more mesomorph males and endomorph females and differences between sports.

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