Physical Activity and Cardiovascular Disease Risk Factors in Urban School Children

Abstract
Although the clinical signs of cardiovascular disease (CVD) are not evident until adulthood, many of the risk factors have their roots in early childhood. The aim of this study was to examine physical activity levels (PA) and the incidence of CVD risk factors in a small population of primary school children in Dublin. Risk factors measured included overweight/obesity, blood lipids, blood pressure (BP), physical fitness and PA levels. Over a quarter of the group were overweight/obese (n=29, 28%). Despite relatively good fitness levels, PA levels were low with less than a quarter of the group (n=44, 46%) participating in the recommended 1 hour/day. Fewer girls reported spending >1hour/day at PA compared to boys (n=14 v n=30). Six children had elevated cholesterol levels and five children had high-normal BP values. Sixteen children demonstrated clustering of CVD risk factors and in those who were inactive the risk was greater. Our data suggest that in children as young as 15 years significant risk factors already exist. Furthermore, the low level of PA in girls provides a target for health promotion programmes.

Introduction
It is widely accepted that many of the risk factors for cardiovascular disease (CVD) have their roots in early childhood and persist into adulthood. While there is a genetic component to the disease process, lifestyle also plays an important role. Physical inactivity, poor physical fitness, fat intake, blood pressure (BP) and an adverse lipid profile are all risk factors. Examining the relationship between these lifestyle parameters and CVD risk factors in children is vital to determine if lifestyle modifications during childhood and adolescence could lower CVD risk. Currently there is a lack of national reference values for children for these important health indicators. The aim of this study was to examine the incidence of CVD risk factors in children, and any relationship there may be between these risk factors and physical activity (PA) levels. Our results will provide an indication of the health status of children today. By identifying those at risk, appropriate lifestyle modifications can be made in an attempt to reduce their risk of developing CVD in later life.

Methods
Healthy school children from randomly selected primary schools volunteered to participate in the study between summers 2005-2007. Written informed consent was obtained from both the child and a parent/guardian and each child underwent a medical examination prior to participation. Height and weight were measured using a wall-mounted stadiometer and electronic scales. Lean body mass was measured by bioelectrical impedance analysis using a Tanita lean body mass scales (Model TBF-538). Information on dietary intake was not included in this study. Pubertal assessment was performed according to Tanner to ensure all children were pre-pubertal. Medical BP monitor. Subjects provided a fasting blood sample to measure total cholesterol (TC), high-density lipoprotein (HDL-c), low-density lipoprotein (LDL-c), triglycerides (TG), C- reactive protein (CRP) and HbA1c. Physical activity (PA) was subjectively measured using a Modified Activity Questionnaire. Approval for the study was obtained from the Research Ethics Committee of SJH/AMNCH.

Results
102 children (50 boys) aged 10-12years participated in the study. Demographics are shown in table 1. Using age- and gender-specific BMI cut-off values proposed by the International Obesity Task Force, 16% of boys were considered overweight and a further 6% obese, while values for girls were 31% and 4% respectively. The incidence of overweight or obesity for the group as a whole was 28% (boys 22%, girls 35%).

Table 2 shows blood lipid profiles, BP, physical fitness and PA for the two groups. High blood lipid concentrations were defined according to the American Academy of Paediatrics. Six children (3 boys) had total cholesterol (TC) and triglycerides (TG) above the 95th percentile for age, and C-reactive protein (CRP) values ranged from 0.1 to 5.9mg/L and values correlated significantly with BMI (0.36, p<0.01), VO2max (-0.43, p<0.001). PA (r=-0.28, p<0.05) and number of CVD risk factors (0.37, p=0.000). Four children (2 boys) had CRP values greater than 3mg/L, which the American Heart Association considers the cut off value for higher CVD risk in adults. Mean (SEM) percentage of group, BMI, body mass index, VO2max, maximum oxygen consumption, PA, physical activity, TC, total cholesterol, CRP, C-reactive protein, systolic and diastolic blood pressure. *p<0.05, ** p<0.01, *** p<0.001.

Discussion
We aimed to examine PA levels and the incidence of CVD risk factors in a small group of primary school children in Dublin, Ireland. Risk factors measured included overweight/obesity, blood lipids, BP, physical fitness and PA levels. The health benefits of a physically active lifestyle in adults are well documented. In children associations have been shown between regular PA and reduced overweight/obesity and biological CVD risk factors.
of PA is especially difficult in children. We used the modifiable activity questionnaire, which has been validated in adolescents, as a subjective measure of PA. As children in this study were slightly younger, we administered the questionnaire jointly in an effort to record more reliable information. While questionnaires fail to capture spontaneous, unplanned activity, they provide the only feasible means of assessing PA in a large cohort. Consequently, we included children in 1-hour/day PA. While it appears reasonable to compare with this, on closer inspection only 46% of the group actually participated in the recommended 1-hour/day and this value varied considerably (30% vs. 63%) between groups. Comparing results by studies addressing fitness levels have used field-based tests as estimates of aerobic fitness. Therefore it is difficult to address fitness levels in Ireland have changed over the last 10-20years. CRP is thought to be associated with the development of CVD in adults. Studies have also demonstrated that childhood CRP, according to the American Heart Association guidelines, in adults CRP values <1mg/L indicate low risk of developing CVD, values between 1-3mg/L indicate average risk and values >3mg/L indicate high risk. – In keeping with this we found a significant positive correlation between CRP and number of CVD risk factors (r=0.37, p<0.001). Risk factors are often present in the same individual and this clustering is associated with an increased risk of CVD. Clustering of risk factors is therefore thought to be a better measure of cardiovascular disease risk than individual risk factors alone. In this study we defined clustering as having three or more of the following risk factors: overweight/obesity, elevated TC, elevated BP, decreased physical fitness and decreased PA. We found evidence of clustering in 16% of our group. These children had significantly higher mean BMI and PA levels compared to the rest of the group. A recent study involving European children have reported similar results with 15% of 9year olds showing clustering of CVD risk factors. It is known that children participating in a healthier cardiovascular profile not only during these years but also later in life.

Our study group showed VO2max values similar, if not slightly higher, than those recently reported for European age-related peers. Direct measures of VO2max have not been previously reported in Irish children. Studies addressing fitness levels have used field-based tests as estimates of elite fitness. Therefore it is difficult to assess if fitness levels in Ireland have changed over the last 10-20years.

In conclusion, we have shown that in children as young as 10years significant CVD risk factors exist. Furthermore, one in six showing clustering of these risk factors. Of particular note was the greater risk of clustering in children exercising for less than 30mins per day. As CVD risk factors are known to track into adulthood, our data provides support for preventive programs aimed at children, in particular targeting young girls where participation in regular physical activity is low.


