Cardiovascular fitness of a pediatric population in Central Kampala, Uganda

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Abstract

The purpose of this study was to determine the cardiovascular fitness of pediatric population in central Kampala, Uganda. A stratified random sampling was used to select 1929 pupils aged 6-9 years in Wakiso and Mukono districts. A pre-experimental design was used to collect data on the cardiovascular fitness endurance using a 9-minute distance run/walk test. Pupils in day schools had significantly higher mean score (1538.02±309.09) for the 9-minute distance run/walk than those in boarding schools (1486.27±305.22). There was significant gender difference in cardiovascular fitness endurance with boys recording higher mean score (1591±356.76) than girls (1440.64±236.72). Majority (71%) of pupils met acceptable cardiovascular fitness endurance according to percentile norms set by American Association of Health, Physical Education, Recreation and Dance (AAHPERD). About 18.8% and 10.1% had weak and critical cardiovascular endurance status, respectively, which necessitated intervention. Pupils in day schools had better cardiovascular fitness endurance than those in boarding schools; and boys had better cardiovascular endurance compared to girls. There is need for surveillance of physical activity patterns of Ugandan children which may affect their cardiovascular fitness endurance.

Keywords: AAHPERD, cardiovascular fitness, school children, Uganda.

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Introduction

In order to maintain physical fitness, one needs to engage in regular moderate and vigorous physical activities. In ancient times, man’s survival basically depended on activities such as hunting and fishing which helped to maintain fitness. However, with the increase in mechanisation and advanced technology dependence on physical activity has gradually been replaced by cognitive ability and thus the necessity to acquire formal education. In Uganda, such education
has been geared towards attainment of cognitive skills at the expense of developing the psychomotor skills through subjects like Physical Education (Nsibambi, Waiswa, Mukiibi & Soita, 2005). Moreover, most pupils in urban schools carry extra home academic workload in form of homework (Natukunda, 2007). Consequently, time for active engagement in physical activity has been reduced to the extent that children’s health may be compromised. Indeed, the World Health Organisation (WHO) (WHO, 2009) noted the global concern on health implications of reduced physical activity across all age groups. Besides, many parents prefer schools that are far from their homes, thus necessitating use of motorised transport. This mode of transport is preferred, owing to insecure neighbourhood and potentially dangerous roads. Many pupils in urban areas commute using school buses, vans, motor cycles locally known as boda boda, private and public cars instead of walking (Natukunda, 2007).

Sedentary lifestyle also features prominently in Ugandan children’s leisure time and is characterised by increased use of electronic gadgets like radio, television, computers, internet and cell phones. It is observed that many children living in urban settings stay indoors most of the time and engage in such activities because of lack of spacious surroundings, insecure neighbourhood, poor surrounding and overly protective parents (Natukunda, 2007). These factors have to a great extent restricted active physical activity among children. A pernicious consequence of such lifestyle was documented by WHO (2009) as responsible for an increase in non-communicable disease, hence a global health challenge in the 21st century. Many diseases are lifelong problems that begin during childhood and surface clinically during adulthood (American College of Sports Medicine (ACSM) (ACSM, 2005). It is affirmed that physical inactivity increases the risk of certain cancers, type II diabetes, osteoporosis, low back pain, overweight, obesity, depression and cardiovascular diseases (Erdmann & McMillan, 2005; WHO, 2005; Goon, Toriola, Shaw, Amusa et al., 2011). Cardiovascular diseases result from failure of the body to deliver adequate oxygen and food nutrients and remove waste products like carbon dioxide efficiently (Rosser, 2005). Contrarily, cardiovascular fitness ensures efficient functioning of the body. There is a correlation between high level of cardiovascular fitness in childhood and reduced risk of developing hypertension and arteriosclerosis (Malina, 1999). Activities like brisk walking, jogging, running, free play, gardening, house hold chores are beneficial to the development, improvement and maintenance of cardiovascular fitness in children (Malina, Boudard & Bar-Or, 2004). Although there is an apparent reduction on pediatric physical activity reflected in activities done at school, increased use of motorised transport and engagement in passive free time activities which might have implications on cardiovascular fitness; there is hardly any study that has been conducted to assess the cardiovascular fitness of Ugandan children. Hence, this study aimed at determining the cardiovascular fitness of children in Central Uganda.
Methodology

Using a pre experimental design, 1929 (901 boys and 1028 girls) pupils aged 6-9 years attending day and boarding schools in Mukono and Wakiso districts in central Uganda were randomly selected to participate in the study. A stratified random sampling strategy based on sex, age and type of school was applied. A total of 4000 pupils were selected for the study. However, due to absenteeism, flu epidemic and bad weather, 1929 pupils participated. The Ugandan Ministry of Education and Sports approved the study and informed consent procedures. The head teachers of the participating schools granted permission for the study and signed consent forms. Only pupils who accepted to participate in the study and physically well were selected. The study involved ten research assistants; who were staff and students of Sport Science Department of Kyambogo University. They were trained for three days prior to the data collection, which involves measuring the distance runs.

The American Association of Health, Physical Education, Recreation and Dance (AAHPERD) (1980) test battery was used to determine cardiovascular fitness. The battery recommends a 9-minute run/walk for children below 12 years. The test procedure was explained to the participants; and a warm-up session was conducted prior to the testing. Each research assistant was assigned a number of pupils and was to record the distance covered by each pupil assigned to him or her. At the beginning of the test, pupils were made to stand on the starting point of a green and demarcated 400m track field. Upon blowing the whistle, they ran on the field for nine minutes and were encouraged to run so that they neither sit nor give up although walking was allowed. At the ninth minute the whistle was blown and each pupil had to remain at his or her respective place until the distance was recorded. The test results were recorded in meters in the data entry form. Later the results were converted to yards (1 yard is equivalent to 0.836 metres).

Data analysis

Data were analysed using frequencies, percentages, means and standard deviations and t-test for independent samples was used to determine the difference among participants according to type of school and gender. All statistical analyses were performed using SSPS version 15.0. The statistical significance was set at p< 0.05.

Results

Boys were slightly taller (1.27m±0.08) than girls (1.24m±0.07); and weighed 25.5kg±0.05 the same as girls (25.0kg±0.08). Pupils in day schools recorded higher mean score (1538.02±309.09) for 9-minute run/walk than those in boarding schools (1486.27±305.22). Thus, the null hypothesis was rejected.
implying that pupils in day schools had significantly higher mean scores thus better cardiovascular fitness than their counterparts in boarding schools (Table 1).

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<tr>
<th>Table 1: Mean and standard deviation score for 9-minute distance run/walk test#</th>
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<tr>
<td><strong>Variables</strong></td>
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<tr>
<td>Day</td>
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<tr>
<td>Boarding</td>
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<tr>
<td>Boys</td>
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<tr>
<td>Girls</td>
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</tbody>
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*statistically significant at p<0.05; (SD) = standard deviation; # Cardiovacular fitness (9-minute run/walk) determined according to AAHPERD (1980)

Boys recorded higher mean score (1591±356.76) than girls (1440.64±236.72), with a statistically significant (p=.000; p<0.05) gender difference (Table 1), thus, the null hypothesis was rejected indicating that boys had better cardiovascular fitness than girls. The individual scores of distance run of pupils were categorized according to the percentile norms set by AAHPERD (1980) in order to determine their cardiovascular fitness (Table 2). The battery recommends a remedial programme for all persons who score below the 25th percentile. Anyone scoring between 25th but below the 50th percentile is weak. Attaining the 50th percentile or above is regarded as having the desired level of fitness. Out of 1929 pupils, majority (1372; 71.0%) had the desired level of cardiovascular fitness, 363(18.8%) had weak cardiovascular fitness, while 194 (10.1%) had critical cardiovascular fitness (Table 2).

<table>
<thead>
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<th>Table 2: Cardiovascular fitness (9-minute run/walk) of pupils</th>
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<tr>
<td><strong>Percentile norms</strong></td>
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<td><strong>Variables</strong></td>
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<td>Day scholars</td>
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**Discussion**

The findings of this study indicated that day scholars had significantly higher mean scores and therefore better cardiovascular fitness than their counterparts in boarding schools. This may be because day scholars have a chance of walking longer distance to and from school than those in boarding schools who reside within the school premises. Brisk walking develops, improves and maintains cardiovascular fitness (Cherubini, 2008). Active commuting to school not only reduces inactive behaviour (passive commuting), but replaces it with a moderate-intensity activity (Alexander, Inchley, Todd, Currie, Cooper & Currie, 2005), helps to maintain healthy weight (Pizarro, Ribeiro, Marques, Mota & Santos,
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2013; Rowe, Thomas & Williams, 2011; Mendoza & Liu, 2014) and improved cardiovascular risk profiles (Lubans, Boreham, Kelly & Foster, 2011; Larouche et al., 2014; Larouche, Oyeyemi, Prista, Onywera, Akinroye & Tremblay, 2014), greater academic achievement (Martinez-Gormez et al., 2011) and reduced stress (Lambiase, Barry & Roemmich, 2010) in children and young people. Studies have reported higher levels of physical activity in children associated with active travel to school (Faulkner, Stone, Buliung, Wong & Mitra, 2013; Schoeppe, Duncan, Badland, Oliver & Curtis, 2013; Oliver et al., 2014), thus stressing the importance of active commuting to school in children. Also, there was a significantly higher mean score and therefore better cardiovascular fitness endurance among boys than girls. This finding concurs with (Armstrong & Welsman, 2011; Goon, Toriola & Shaw, 2006) reporting gender differences in fitness among school children and attributed it to the nature of physical activities they engage in. Gender difference in this fitness component is related to the cardiac functional capacity and body composition (Rowland, 1996). Boys generally have better cardiac functional capacity because they have relatively larger heart size. The larger the heart size the more blood that can be pumped to the working muscles and hence the better the capacity to perform aerobic activities. Secondly, boys have relatively more lean mass and therefore generate more energy to sustain endurance activities than girls who have comparatively more body fat (Malina, Bouchard & Bar-Or, 2004; Turley & Wilmore, 1997). The study further indicates that majority of pupils attained a desirable level of cardiovascular endurance. This suggests that most children still have the opportunity of engaging in aerobic activities such as playing and household chores during their free time which allows them to accumulate the 60 minutes recommended by WHO (2009) for maintenance of cardiovascular endurance.

Limitations

The limitations of the study should be considered in interpreting the findings. Firstly, in the absence of an objective measure of cardiovascular endurance, the 9-minute run/walk method was used to test for cardiovascular endurance; although this proxy measure of cardiovascular fitness has been widely used in field studies involving larger samples and its reliability coefficients (0.80-0.90) (Safrit, 1990) and validity coefficients (0.60-0.75) (Krahenbuhl, Pangrazi, Peterson, Burkett & Schnider, 1978) has long been reported in the literature. Additionally, our study did not seek to examine the correlates of cardiovascular fitness in the children, but to ascertain whether the children have a desirable level of cardiovascular endurance. Studies incorporating other variables such as body size and composition, physical activity level, haemoglobin concentrations and biological age known to affect cardiovascular endurance in children in this region are warranted. Notwithstanding, the strength of the study is that larger samples were used to measure the cardiovascular endurance of children in an
under-researched setting, thus providing a baseline data for future comparative studies, at least in Uganda.

**Conclusion**

Most pupils in this present study demonstrated a desirable level of cardiovascular fitness; and pupils attending day schools have desirable fitness status compared to those in the boarding schools. Boys had desirable cardiovascular fitness than girls. There is need to mount strategies to maintain and/or improve pupils’ fitness and safeguard them against preventable diseases and conditions that may threaten their future health. In this regard, the Ministry of Education and Sports in Uganda should adequately address factors hindering the teaching of quality PE in all schools. Also, parents and guardians should encourage and provide opportunities that enable children to engage in active physical activities in order to improve their cardiovascular fitness and health.

**Acknowledgement**

We thank the children who participated in the study and the headteachers of the participating schools for granting permission for the study in their schools. We also appreciate the research assistants for their role in data collection.

**References**


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