

Participation in Different Types of Sports and its Effects on BMI for Healthy Life among Primary School Children Aged 8–13 Years in Dar es Salaam, Tanzania

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Abstract

Childhood and adolescent overweight and obesity have been found to affect the performance in school children. This study sought to find out the effects of involvement in different types of sports on BMI among primary school children aged 8–13 years in Dar es Salaam, Tanzania. A cross-sectional analytical research design was used to study overweight and obesity in primary schools in Dar es Salaam. The target population was 150,000 children aged 8–13 years. Stratified random and quota sampling were used to select 1,781 children. Weight and height were taken for BMI which was then subjected to WHO-BMI for-age-and-gender percentile rank standards to determine health status. It was found that, there was statistically significant difference in the mean BMI scores between children who reported to participate in sports and those who reported not to do so at $p = 0.027$. Children who participated in football, cricket and netball had significantly lower mean BMI than those who participated in sports such as swimming, chess, tennis and table tennis at $p = 0.001$. There was a statistically significant difference in mean BMI scores amongst children who reported different frequencies of PE classes at ($p = 0.001$). It was also revealed that, children who were involved in sports/physical activity that lasted for at least 20 minutes during after-school hours had relatively lower mean BMI than those who had no time for sporting after school. It was concluded that, for a healthy BMI, children should be involved in high intensity physical activity sports and be allowed to participate in after-school physical activities.

Keywords: Body Mass Index, healthy living, Overweight, Participation in sports,

1. Introduction

Overweightness and obesity have been implied as factors in poor academic performance among elementary and high school-aged students (Freeman *et al.*, 2014). Several studies (Burkhalter & Hillman, 2011; Hollar *et al.*, 2010; Yates *et al.*, 2012,) have attributed early childhood and adolescent obesity to poor performance in school. Nevertheless, sedentary lifestyle among children is increasing and has been linked to the development of obesity and other non-communicable diseases (IOTF, 2010). In fact, rapid urbanisation, technological advancement and dramatic lifestyle changes experienced by people in African cities are among risk factors associated with the overweight and obesity epidemic (Ojiambo *et al.*, 2012; Muthuri *et al.*, 2014; Tremblay *et al.*, 2011).

Considerable researches have documented a positive relationship between levels of physical activity, overweightness and obesity, on the one hand, and academic achievement, on the other hand. These researches range from correlation studies (Franz & Feresu, 2013), to longitudinal studies demonstrating improved body weight and class performance grades after physical activity interventions among student populations over several years (Hollar *et al.*, 2010). The findings on the effects of sports and related physical activity on overweightness and obesity and academic performance has put substantial pressure on school owners to maximise academic performance with less time on highly effective physical activity (CDC, 2011). Different sports offer different levels of physical activity intensities. This study, therefore, sought to determine the effect of different sports on BMI among primary school children aged 8 – 13 years in Dar es Salaam, Tanzania.

2. Methodology

2.1 Research design and sample

This study used a cross-sectional analytical research design. The sample comprised 1,781 school children that were obtained using stratified random and quota sampling methods. Stratification was conducted based on location, type of school, and gender whereby each of the three districts, Kinondoni, Ilala, and Temeke, formed sub-populations. In each district, private schools and public schools and in each school, male and female pupils formed strata from which study participants were randomly selected. Because the number (n) of private schools was smaller than that of public schools, quota sampling was deployed to ensure that the fraction of the sampled participants from each category reflected the actual population representation.

The study used BMI on percentile ranks as a criterion for classifying children into the predetermined body-weight categories, namely, underweight, healthy weight, overweight, and obese. Children with BMI within the 5th percentile or below were classified as underweight; those with BMI above the 5th but below the 85th percentiles were classified as healthy; those between the 85th and 95th percentiles were classified as overweight; and the ones above the 95th percentile were classified as obese. Therefore, the height and weight measurements were taken and used to compute the children's BMI which were then translated into weight status using the World Health Organisation (WHO) age and gender specific percentile ranks (WHO, 2011). The study involved 32 schools, 12 of which were private and 20 were public owned. There were 1028 (58%) females and 753 (42%) males. The average age of the participants was 10.5 +/- 2.5 years.

2.2 Data Collection methods

A normative survey was conducted whereby anthropometric measurements were taken and questionnaire and interview were used to gather self-reported physical activity during involvement in different sports.

Stature

Height was measured using stadiometer (Leicester-21400, CECA, UK). Participants were asked to remove shoes and headscarf and undo their hairstyle and hairstyle accessories (where applicable) before stepping onto the stadiometer placed on a flat floor along the wall. The pupils were advised to keep their heels together, feet flat on the stepping board of the stadiometer, and to inhale deeply, hold the breath, and maintain an erect anatomical posture. The head was positioned in such a way that the angle of the eye and the opening of the external auditory meatus were in a horizontal line. Height measurement was then carefully read to the nearest 0.1 cm.

Weight

Weight was determined using a digital weighing scale (7841-Medscale Bluetooth, SOEHNLE). Measurements were taken with each pupil in light clothing and without shoes and socks. Weight was carefully read when the point readings stabilised and was recorded to the nearest 0.1 kg.

Questionnaire

A self-administered structured physical activity questionnaire was adopted and modified from the international physical activity questionnaire for children (IPAQ-C) (Booth, 2002). The physical activity questionnaires for children (PAQ-C) were modified by adding questions which were contextually relevant and/or deleting some items that seemed irrelevant.

Interview

An interview guide was used to gather information that would parallel or triangulate the one collected by questionnaires. The guide was adopted from PAQ-C and SAPAC (Weston *et al.*, 2006) from the physical activity.

2.3. Data Analysis

Data obtained were analysed, coded, and entered into Statistical Package for Social Sciences (SPSS) programme version 19.0. Frequencies, means, percentages, and standard deviations were calculated and presented in tables whereas inferential statistics were tested by an independent t-test and a value $p < 0.05$ was considered as significant in the testing of the hypotheses.

3.0 Findings

3.1 Participation in sports and mean BMI of Primary School Children aged 8-13 years

The mean BMI of the children who reported to have had participated in sports and of those who reported to have not done so were computed for comparison. The results show that, children who reported to have participated in sports scored a lower mean BMI ($\bar{x} = 18.09$, $SD = 4.19$) than those who reported to have not to have done so ($\bar{x} = 19.03$, $SD = 3.81$). To determine the magnitude of difference in these mean BMI, an independent t-test was conducted. The results are as presented in Table 1:

Table 1. Descriptive data and t-value for mean BMI of the children by participation in sports

| Participation in sports | N | \bar{x} | SD | t | df | Sig |
|-------------------------|------|-----------|---------|--------|------|------|
| Yes | 1683 | 18.0912 | 4.18745 | -2.240 | 1769 | .027 |
| No | 88 | 19.0288 | 3.80631 | | | |

Table 1 shows that, there was a statistically significant difference in the mean BMI scores between children who reported participating in sports and those who reported otherwise at [t (1769) = -2.240, p = 0.027]. These results suggest that, children who did not participate in sports were at higher risk of becoming overweight or obese than those who participated in sports.

3.2 Participation in different sports and mean BMI of Primary School Children aged 8-13 years

To determine whether there were differences in weight status of the children who participated in different sports, their mean BMI scores were computed. The results show that, children who participated in cricket scored the lowest mean BMI (\bar{x} =16.98, SD = 2.8) whereas children who participated in swimming scored the highest mean BMI of (\bar{x} =18.85, SD=3.68).

To establish the magnitude of the differences in mean BMI amongst children who reported to participate in different sports, a one-way ANOVA was conducted and results presented in Table 2.

Table 2. One-way ANOVA for children’s mean BMI by type of sport they reported to participate in

| | Sum of Squares | df | Mean Square | F | Sig. |
|----------------|----------------|------|-------------|-------|------|
| Between Groups | 416.054 | 6 | 69.342 | 4.051 | .000 |
| Within Groups | 29422.281 | 1719 | 17.116 | | |
| Total | 29838.335 | 1725 | | | |

Table 2 shows that, children who participated in soccer, cricket and netball had significantly lower mean BMI than those who took part in swimming, chess, tennis and table-tennis at [F (6, 1719) = 4.051, p < 0.001]. Further, a post hoc test (Tukey HSD) was conducted to find the magnitude of differences between groups and results presented in Table 3:

Table 3. Tukey HSD for children’s mean BMI by type of sport they reported to participate in

| Sport | Tennis | Swimming | Soccer | Chess | Cricket | Ready |
|----------|---------|-----------|----------|----------|---------|----------|
| Netball | -.51636 | -1.01788* | .17799 | -.97670 | .84879 | -.78732 |
| Tennis | | -.50152 | .69435 | -.46035 | 1.36515 | -.27096 |
| Swimming | | | 1.19587* | .04117 | 1.86667 | .23056 |
| Soccer | | | | -1.15470 | .67080 | -.96531 |
| Chess | | | | | 1.82550 | .18938 |
| Cricket | | | | | | -1.63611 |

Table 3 shows that, there was significant difference in the mean BMI scores between children who participated in netball and swimming (-1.01788, $p = 0.009$) and between soccer and swimming (1.19587, $p = 0.001$), The findings imply that, children who took part in netball and/or soccer recorded significantly lower risk of overweight and obesity than those who got involved in swimming. Participation in other sports such as tennis, cricket and chess did not differ significantly.

3.3 Number of Physical Education classes with or without sports after school and the mean BMI among **Primary School Children aged 8-13 years**

Based on Physical Education classes, the mean BMI of the children who reported to have had PE classes without sports after school and those who reported to have had no PE classes but had sports after school per week were computed for comparison. The results show that, children who had PE classes once in a week scored a higher mean BMI ($\bar{x} = 18.93$, $SD = 3.27$) than those who reported to have had PE classes three times per week ($\bar{x} = 17.29$, $SD = 1.21$). The study also found that, children who reported to have had no PE classes but had sports after school scored a relatively lower mean BMI of ($\bar{x} = 17.88$, $SD = 4.48$).

To determine the magnitude of differences in the mean BMI scores of the children who reported different numbers of PE lessons with or without sports after school, a one-way ANOVA was conducted. Table 4 presents the results:

Table 4. One-way ANOVA of the mean BMI of Primary School Children aged 8-13 years by frequency of PE classes with or without Sports after School

| | Sum of Squares | df | Mean Square | F | Sig. |
|----------------|-----------------------|-----------|--------------------|----------|-------------|
| Between Groups | 331.129 | 4 | 82.782 | 4.807 | .001 |
| Within Groups | 30587.104 | 1776 | 17.222 | | |
| Total | 30918.233 | 1780 | | | |

The findings show that, there was a statistically significant difference in the mean BMI scores amongst children who reported different frequencies of PE classes at [$F(4, 1776) = 4.807$, $p = 0.001$]. Moreover, a Tukey-HSD post hoc test was conducted to find out exactly where the difference existed. The results are presented in Table 5:

Table 5. Tukey HSD post hoc tests for the difference in mean BMI among children who reported different number of PE lessons per week with or without Sports after School (SC)

| Number of PE classes | One PE class | | Two PE class | | Three PE classes | |
|----------------------|--------------------|------|--------------------|------|--------------------|------|
| | \bar{x} df (I-J) | Sig. | \bar{x} df (I-J) | Sig. | \bar{x} df (I-J) | Sig. |
| No PE but SC | -1.05611* | .001 | -.44402 | .495 | .58073 | .989 |
| One PE no SC | | | .61209 | .374 | 1.63683 | .665 |
| Two PE no SC | | | | | 1.02475 | .919 |

It was found that, children who reported to have had no PE classes (from public schools) scored significantly lower mean BMI scores than those in private schools who reported to have had only one PE class per week (-1.05611, $p = 0.001$). However, the difference in mean BMI between children who reported to have had no PE lessons but had sports after school (all were from public schools) decreased with increase in number of PE lessons without sports after school in private schools such that, children in private schools who reported to have had three PE lessons per week had no statistically significant difference in the mean BMI scores with those in public schools at (0.58073, $p = 0.989$). These results suggest that, to the children in private schools who had no other active physical activity inside and outside of school, their BMI slightly decreased with increasing number of PE lessons. It also implies that, children's involvement in sports after school has more impact on children's BMI than a single school PE class.

To find out whether there was any association between the number of PE lessons per week among those who had PE classes and the mean BMI of the children, a Pearson product moment correlation was computed. The results are presented in Table 6:

Table 6. Pearson product moment correlation of the mean BMI of the Primary School Children aged 8-13 years by number of PE lessons they participated in

| | | Mean BMI | Frequency of PE lessons |
|----------|---------------------|----------|-------------------------|
| Mean BMI | Pearson Correlation | 1 | .052* |
| | Sig. (2-tailed) | | .028 |
| | N | 1781 | 1781 |

*Correlation is significant at the 0.05 level (2-tailed).

Table 6 shows that, there was no association between the number of PE classes and the mean BMI scores of the children who reported different numbers of PE lessons ($r = 0.052$, $p = 0.028$). This suggests that, PE-related physical activities were not

intensive enough to influence strongly the children's body weight compared to other physical activities.

4.0 Discussion

Different types of leisure activities, for instance, structured and unstructured sports, also appear to influence the overall daily levels of physical activity (Spinks *et al.*, 2006). Therefore, sports serve as an excellent opportunity for physical activity and schools should, thus, provide an all-inclusive sports culture and infrastructure to promote them (HAKK, 2011). The findings of this study found that, children who reported to have participated in sports had significantly lower mean BMI ($p = 0.027$) than those who did not do so. In this regard, the study findings suggest that, children who did not participate in sports were at higher risk of becoming overweight or obese than those who partook in sports. Concurrently, it was further established that, participation in sports clubs significantly contributes to increased levels of physical activity among 15-year-olds (*ibid.*). Therefore, schools should have ample space and allocate adequate time for sports-related activities. After all, lower levels of physical activity in school children are associated with adiposity, overweight and obesity (Onywera *et al.*, 2011; Wachira, 2014).

Furthermore, the findings of this study show that, children who participated in more active sports such as netball and soccer had relatively lower mean BMI ($p < 0.001$) than those who took part in less active sports such as swimming. Children who participated in swimming differed significantly with those in netball at ($p = 0.009$) and in soccer ($p = 0.001$), implying that, children who played soccer and netball had a lower risk of becoming overweight or obese than their counterparts in swimming. Similarly, Weintraub *et al.* (2008), who compared the mean BMI scores of children who participated in different sports, found that, children who participated in soccer group had significant decreases in body mass index z scores at 3 and 6 months of participation and showed significant increases in total daily moderate, and vigorous physical activity at 3 months than children who participated in volleyball. Therefore, participation in active sports is a significant factor that can be used to reduce overweight and obesity in children and, thus, improve learning ability.

Considering the amount of time children spend in school, the school set-up provides an excellent opportunity to influence them positively to embrace a more active lifestyle (HAKK, 2011). In this regard, Physical Education lessons constitute one

of the most recommended interventions for increasing the physical activities of children and adolescents (Maria *et al.*, 2012). The findings of this study show that, children who reported to have had no PE lessons at all (from government schools) but had sports after school scored significantly lower mean BMI ($p = 0.001$) than their counterpart who reported to have PE lessons in their schools (private schools) but had no time for sports after school.

The study also reveal that, children in public schools who had no physical education classes but had sports after school hours still had significantly lower mean BMI than those in private schools who had one PE class per week but had no sports after school ($p = 0.001$). However, the difference in the mean BMI of the children in public primary schools who had sports after school but no PE classes those in private schools who reported two or more PE classes was not significant ($p = 0.989$). Maria *et al.* (2012) found that children, especially boys, were more active outside of PE lessons than during the lessons. Indeed, normal PE classes that use sports will side-line the majority who have to wait or cheer others who are playing. These findings of this study imply that, the PE-related physical activities were not intensive enough to influence strongly the children's body weight.

Though Wachira (2014) recommended that, PE provided at school constitutes an ideal way to encourage activity and develop fitness among children, how much are the benefits depend on the duration and intensity of the activity in question. In addition, HAKK (2011) observed that, in many schools in Kenya, PE lessons are often used to teach other examinable subjects. This study did not examine the implementation of PE curriculum in Tanzania, which need to be done; nevertheless, children from public primary schools reported no PE classes at all and, instead, reported to have been involved in sports after school. Those in private schools, who reported to have not been involved in sports after school, on the other hand, had PE classes that employed PA that was not significant in influencing the body weight in so far as the BMI was concerned.

In line with the findings, Datar, Sturm and Magnabosco (2004) carried a study on physical education in elementary school and body mass index. The study found that, normal physical education classes had no significant effect on overweight or at-risk-for-overweight or obese children. Nevertheless, Datar, Sturm and Magnabosco (2004) recommended that, expanding physical education programmes in schools, from the form in which they existed to a more active and compulsory one would be

an effective intervention for combating obesity in the early years among children.

5.0 Conclusions

Generally, it was revealed that, the mean BMI and, thus, percentile rank affiliation of the children differed depending on the type of sport in which the child was involved. Involvement in netball and soccer showed higher impact on children's BMI than participation in other sports. Moreover, sports-related physical activities accrued in Physical Education classes were less significant in influencing children's BMI than after-school sport activities. Therefore, children's involvement in sports after school is an important physical activity for their health. The study also established that, improving health (BMI) and, thus, academic performance, required schools with little time for sports to involve children in high intensity physical activity sports such as soccer, netball, swimming and tennis. Furthermore, children should be given time for sporting activities during after-school hours.

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