DETERMINATION OF HEALTH STATUS OF SCHOOL CHILDREN IN A UNIVERSITY SCHOOL IN NIGERIA: A PILOT STUDY

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Abstract
The observed general decline in physical activity among children in a University Model School could increase the risk of health problems particularly, childhood obesity that has become a global risk factor for cardiometabolic diseases among children. Therefore, this study was conducted to determine the health status of children in a University Model School in Kwara State, Nigeria. Ex-post Facto research design was used. Purposive sampling was used to select all the 85 pupils in primary 4–6, aged 9 and below age 11 years who were present in school at time of the study. Standardized instruments: body weight scale, body height scale and non-elastic tape rule were used for measurements of body weight (in kg), height (in metre) and waist circumference (in cm) respectively. These data were used to compute body mass index and waist-to-height ratio using appropriate formulae. Informed consent was obtained from the school Head Teacher and the children's parents before the study was conducted. Data were analysed using mean and standard deviation for answering the research question and independent sample t-test for testing the hypothesis at 0.05 alpha level using SPSS 20.0. Finding of the study revealed that majority of the children were healthy. However, many of them especially the females were unhealthy: BMI for male (obesity n 2, 8.0%; obesity n 3, 12.0%), female (n 8, 14.0%; obesity n 18; 31.6%); high risk WC male (n 3, 12.0%), female (n 14, 24.6%); unhealthy WHtR male (n 5, 17.9%), female (n 20, 35.1%). There was significant difference in health status between male and female MD 9.00, $t(83) = 3.005$, $p < .004$. In conclusion, many of the children in University School, University of Ilorin have high total body fat and abdominal adiposity which might be associated with their level of physical activity. Therefore, urgent exercise intervention programme to improve the health status of the children is recommended.

Keywords: Children, body fat, Health, Physical activity

Introduction

The amount of daily physical activity is a basic determinant of energy expenditure, the proportion of body fat and fat-free mass. Insufficient utilization of energy consumed from food due to low level of physical activity leads to energy surplus and body fat accumulation. Excess accumulation of body is an important consideration for health status because it increases the risk of becoming obese.

Obesity is a non-communicable disease that has become a global health problem of both children and adults. Obesity increases the risk of other non-communicable diseases particularly cardiovascular and metabolic diseases and premature mortality (Ramya, Goutham & Pragyee, 2017).

Obesity is defined as a metabolic disorder characterised by chronic inflammatory and excessive accumulation of body fat, which is a health risk and contributes to development of diseases such as type 2 diabetes mellitus, hypercholesterolemia, arterial hypertension, cardiovascular disease, obstructive sleep apnea syndrome, musculoskeletal impairments and several types of cancers (Pereira-Lancha, Campos-Ferraz & Lancha, 2012; Litwin, 2014). This implies obesity is one of the causes of poor health status and may have implication for academic performance of children, their quality of life with a possibility of extending into adulthood. Modern lifestyle in which so much emphasis is placed on the use of technology such as Information Communication Technology (ICT) devices, time saving equipment for house chores, automobiles and lack of physically enhancing environment all contribute to increased sedentary behaviours in Nigeria and other parts of the world.

Heredity has been shown to have influence on physical activity level of individuals. Moore-Harrison and Lightfoot (2010) revealed that self-reported measures of physical activity in a Canadian fitness survey revealed that low correlations between heredity and physical fitness (0.08 – 0.38, n = 13,804) and a study of 1,364 Mexican-American families revealed only 9% hereditary effects of physical activity. Objectively measured physical activity level with the use of accelerometer however, indicated higher hereditary influence on physical activity. Mitchel, Rainwater, Hsueh and Stern (2003) reported 0.32 – 0.60 correlation between heredity and physical activity level of 631 Hispanic parents and 1,030 of their children. Also Kujula's study (2011) of 100 parents and their children found that physical activity level was likely to increase by 5.8% in the children if both of their parents were physically active. These studies thus suggests that individuals' heredity have significant influence on their physical activity level, physical fitness, health and wellbeing from childhood to adulthood.

Physical activity is a positive health behaviour that is confirmed to have overwhelming benefits regardless of age and physical abilities. Children who persistently participate in physical activity up to adulthood have reduced chances of falling ill, suffering disability from chronic diseases in later life due to improvement in their quality of life (Kujala, 2011). Despite these evidences, recent practices in Africa continue to undermine physical activity leading to increase in childhood sedentary (physical inactivity) resulting from adoption of technology by schools, parent and the society towards enhancement of academic performance and moral conduct of children (Dominic & Adu, 2018). As such, most children particularly those in urban locations like Ilorin, have abandoned their natural behaviour of moving around playfully to more regulated mode of movement that is environmentally induced. Many children now engage less in house chores, recreational physical activity and plays that are required for tissue, organ and systemic development and their overall wellbeing.

Regarding the health status of children, Kujala (2011) noted that randomized control trial studies prove physical activity induced minimal improvement in body weight of normal weight children and significantly decreased visceral fat of obese children. In addition, bone loading physical activity induced increase in bone mineral content and density in children accounting for strength development. The World Health Organisation (WHO, 1998) defined health status as a general term for the state of health of an individual, group or population measured against defined standards. Some

common standard for measuring population health status include Body Mass Index (BMI), Waist-to-Hip Ratio (WHR), Waist Circumference (WC) and Waist-to-Height Ratio (WHtR).

In children these measurements of health status have been used to evaluate growth rate, nutritional status, physical activity and chronic disease status. Moreover, environmental, genetic and cultural variations affect the accuracy of these measures in detecting health risks across races. Recently, studies have demonstrated that BMI underestimates body fatness in South Asian children and overestimates it in black African children (Nightingale, Rudnicka, Owen, Cook & Whincup, 2011; Nightingale, Rudnicka, Owen, Donin, Newton & Furness, 2013; Hudda *et al*., 2017). Ramya, Goutham and Pragyee (2017) reported that combination of BMI, WHR, WC and body fat measurements had high sensitivity (85 – 92% in boys; 73 – 87% in girls) and specificity (35 – 70% in boys; 47 – 63% in girls) in predicting the risk of pre-diabetes and hypertension of Indian adolescents 11 – 17 years old. Studies carried out in Nigeria revealed the prevalence of childhood obesity (most of them females) was 4.2% using BMI, while WHR revealed 37.2% (Sabageh & Ojofeitimi, 2013). Over three decades (1983 – 2013) study of childhood obesity mostly using BMI, indicated a prevalence rate of 0.0 to 2.8% in adolescents alone and 0.0 to 5.8% for both children and adolescents (Ejike, 2014). Ahmad, Ahmad and Airede (2013) noted that the highest prevalence of obesity 18%, among Nigeria children was reported by Owa and Adejuyigbe (1997) who combined the assessment of BMI, body fat mass, body fat mass percentage and upper arm circumference of 904 children aged 5 – 15 years. The outcomes of these studies suggests that adjustments for race or a combination of two or more measures of body composition as used in the Nigerian studies, ensures greater accuracy in assessing health status of children and adults. Most recent studies however, established that the WHtR is a more preferable solution to measurement of health status independent of age, gender and ethnicity (Browning, Hsieh & Ashwell, 2010; Ashwell, Mayhew, Richardson & Rickayzen, 2014; Fredriksen, Skar, Mamen, 2018). This discovery provides a new dimension towards easy and accurate measurement for monitoring obesity and accumulation of visceral adipose tissue, which can go a long way in recommendation of physical activity regimen for improving population health and wellness.

Statement of the Problem

Modern life generally exposes children to the factors that increase accumulation of body fat leading to overweight and obesity. This include the reduction in physical activity in school and at home, consumption of fast foods particularly, snacks with high caloric content and saturated fats and increase in screen-based activities (like using computer, television, electronic games and mobile phones) and other time saving appliances. Recent health status assessment of secondary school students in Ilorin Metropolis showed high prevalence of obesity and cardiometabolic disease risk and low compliance to the WHO recommendation for physical activity (Adeoye, Dominic & Yusuf, 2017). Since physical inactivity is inversely correlated with the risk of obesity and chronic diseases, it is expected that increasing physical activity right from primary school will go a long way in decreasing the prevalence of obesity among students in secondary school and by extension in adulthood. However, the researcher observed that diminished attention to physical activity in the University primary school and the distance pupils travel in vehicle to and from school increases

sedentary time and might have implication for their health and fitness. Therefore, the researchers assessed the BMI, WC and WHtR in order to ascertain the health status of school children in a University Model School and possibly initiate an intervention for improvements.

Study Objective

The objective of the study was to determine the health status of school children in a University Model School in Nigeria- A Pilot Study.

Research Question

What is the health status of school children in a University Model School in Nigeria as determined by their BMI, WC and WHtR?

Hypothesis

Ho_1: There is no significant difference in the health status of male and female children in University School, University of Ilorin.

Methodology

Ex-post facto research design was adopted. The population consisted of 320 pupils in the University Model School, Based on school attendance at the time of the study, purposive sampling was used to select all 85 pupils in primary four, five and six since they were closer to completing their primary education. Standardised instrument were used for data collection. This included body weight scale calibrated in kilogram (Kg) for measuring body weight, height scale calibrated in metres for body height and non-elastic tape rule calibrated in centimetre for measuring waist circumference. The study commenced by seeking permission from the school's Head Teacher and obtaining consent from the children's parents through informed consent form, which they took to their parents for permission. The researchers' phone number and email were written on the informed consent form which enabled some of the parents to make necessary clarifications about the study as well as easy access to the researchers during the study.

Data collection procedure required the participants to wear light clothes, bare footed and stand in anatomical position during the measurements. Data obtained from measurements of body weight, height and WC were used to calculate BMI and WHtR using the following formulae: BMI = $\frac{\text{weight (kg)}}{\text{height (m}^2\text{)}}$; WHtR = $\frac{\text{Waist}}{\text{height}}$. BMI cut-off for health was based on the recommendation of National Centre for Health Statistics in collaboration with the National Centre for Chronic Disease Prevention and Health Promotion growth chart (2000) for male and female children 2 to 20 years old, which suggests that: BMI of 5^{th} to 85^{th} percentile is healthy, 85^{th} to 95^{th} percentile is overweight and > 95^{th} percentile in obese. WC was based on (Bacopoulou, Efthymiou, Landis, Rentoumis & Chrousos, 2015) that for abdominal is ≥ 85^{th} percentile is the cut-off, WHtR cut-off was based on the findings of (Browning *et al.,* 2010; Ashwell *et al.,* 2014; Fredriksen *et al.,* 2018) that WHtR of 0.5 is indicative of high overall obesity and abdominal adiposity regardless of age, gender and ethnicity. Data were analysed using the Statistical package for Social Sciences (SPSS) and statistical analysis conducted were frequency, percentage, mean and standard deviation for answering the research question and independent sample t-test for testing the hypothesis at 0.05 alpha level.

Results

Research Question

What is the health status of school children in University Model School, in Nigeria as determined by their BMI, WC and WHtR?

Table 1: Body Mass Index Analysis of Health Status of Children in University School, University of Ilorin

Male (n = 28)						Female (n = 57)					
Age	**N**	**BMI**	**Percentile**	**RT**	**HS**	**Age**	**n**	**BMI**	**Percentile**	**RT**	**HS**
10.5 ± 1.8	23	18.6 ± 2.5	$5^{th} – 85^{th}$	N	H	9.7 ± 1.4	31	17.6 ± 1.5	$5^{th} – 85^{th}$	N	H
10.0 ± .0	2	19.4 ± .0	$85^{th} – 95^{th}$	O	U(R)	10.0 ±1.3	8	20.9 ± 1.4	$85^{th} – 95^{th}$	O	U(R)
10.0 ± .0	3	24.0 ± .5	$\geq 95^{th}$	Ob	VR	10.8 ± 1.2	18	29.0 ± 4.6	$\geq 95^{th}$	Ob	U(VR)

RT = Rating, N = Normal, O = Overweight, Ob = Obese, HS = Health Status, H = Healthy, U = unhealthy, R = Risky, VR = Very Risky

Table 1 shows the statistical analysis of BMI assessment conducted to determine the health status of school children (n = 85) in University Primary School. Percentile rank of BMI scores were determined based on age and gender of the children. Majority of the 23 (82.1%) male children with an average of 10.5 ± 1.8 years have normal BMI 18.6 ± 2.5 kg/m^2 that range from the 5^{th} - 85^{th} percentile, which is the rank for healthy BMI. The second group of male children 2 (7.1%), age 10.0 ± 0.0 years have overweight BMI 19.4 ± .0 kg/m^2 and in the percentile range of 85^{th} – 95^{th}, which means they are unhealthy and predisposed to risk of chronic disease. The third group of male children 3 (10.7%), aged 10.0 ± 0.0 years have obese BMI 24.0 ± .5 kg/m^2 with percentile $\geq 95^{th}$, which is not healthy and predispose them to very high risk of chronic diseases. For the female children, majority of them 31 (54.4%), aged 9.7 ± 1.4 years have normal BMI 17.6 ± 1.5 kg/m^2 with a percentile ranging from 5^{th} – 85^{th}; the second group of female children 8 (14.0%), aged 10.0 ±1.3 years have overweight BMI 20.9 ± 1.4 kg/m^2 in the 85^{th} – 95^{th} percentile and predisposed to risk of chronic diseases. The third group of female children 18 (31.6%), aged 10.8 ± 1.2 years have obese BMI 29.0 ± 4.6 kg/m^2 and above the 95^{th} percentile. This is also unhealthy with very high risk of chronic disease. This result implies that 63.5% of the children in University Model School have normal weight based on their BMI percentile rank while 36.5% are overweight and obese indicating unhealthy status. Majority of those who have unhealthy health status based on their BMI percentile are females (45.6%) with those overweight between 10.0 ±1.3 years and obese age 10.8 ± 1.2 years indicating that female children are prone to overweight and obesity as soon as they are approaching the age of 10 years and above.

Table 2: Waist Circumference (WC) Analysis of Health Status of Children in University Model School

Male					Female				
Age	n	WC	P	HSR	Age	N	WC	P	HSR
10.4 ± 1.7	25	63.2 ± 3.0	$\leq 85^{th}$	low	10.0 ± 1.4	43	65.1 ± 5.6	$\leq 85^{th}$	low
10.0 ± .0	3	71.0 ± .0	$> 85^{th}$	high	10.6 ± 1.4	14	80.4 ± 9.1	$> 85^{th}$	high

Key: HSR=Health Status Risk

Table 2 shows the WC analysis of children in University Model School. Majority of the males; 25 (89.3%), aged 10.4 ± 1.7 years were below the 85^{th} percentile, WC 63.2 ± 3.0 cm, which indicates healthy low risk of chronic disease. The 3 males in the minority (11.1%) aged 10.0 ± .0 years were above 85^{th} percentile, with WC 71.0 ± .0 indicating unhealthy and predisposing them to high risk of chronic diseases. For the

female, majority of them 43 (75.4%), aged 10.0 ± 1.4 years were below 85th percentile WC 65.5 ± 6.1 indicating healthy low risk of chronic disease. The remaining 14 (24.6%), aged 10.6 ± 1.4 years were above 85th percentile, indicating they are unhealthy and predisposed to high risk of chronic disease. This WC result also suggests the female children are more predisposed to risk of chronic disease than male.

Table 3: Waist-to-Height Ratio Analysis of Health Status of Children in University School, University of Ilorin

Both Gender (n = 85)				Male (n = 28)			Female (n = 57)		
Rating	**Mean ± SD**	**Freq**	**%**	**Mean ± SD**	**Freq**	**%**	**Mean ± SD**	**Freq**	**%**
Unhealthy	54.8 ± 4.8	25	31.6	50.9 ± .8	5	17.9	55.8 ± 4.8	20	35.1
Healthy	46.0 ± 2.0	60	68.4	47.0 ± 1.1	23	82.1	45.4 ± 2.2	37	64.9

The result in table 3 show WHtR analysis of health status of children in University Model School. This finding revealed that majority of the children 60 (68.4%) have healthy WHtR 46.0 ± 2.0 while 25 (31.6%) of them have unhealthy WHtR 54.8 ± 4.8. Considering the male children, majority 23 (82.1%) of them have healthy WHtR 47.0 ± 1.1 while 5 (17.9%) of them have unhealthy WHtR 50.9 ± .8. For the female children, majority also have healthy WHtR 45.4 ± 2.2. Again, this result shows that there are more unhealthy female children than the male children in University Model School.

Hypothesis Testing

There is no significant difference in the health status of male and female children in University School, University of Ilorin.

Table 4: t-*Test Analysis of Difference between Health Status of Male and Female Children in University School, University of Ilorin.*

Health Status	n	Mean ± SD	Mean Diff. (MD)	t	df	SED	Sig	η_2
Female	57	139.97 ± 2.71	9.00	3.005	83	2.99	.004	.31
Male	28	130.97 ± 1.26						

$p \leq 0.05$

Table 4 shows result of t-test analysis conducted to determine the difference between health status of male and female children in University School, University of Ilorin (n = 85). Finding from this test revealed that that on average, the female children have significantly higher body fat accumulation scores with Mean ± SD (139.97 ± 2.71) than male children Mean ± SD (130.97 ± 1.26). This showed a significant difference in health status MD 9.00, $t(83) = 3.005$, $p < .004$. Based on this, the stated hypothesis was rejected. The result also indicates a moderate amount of difference between the groups with a medium effect size η^2 .31. This results suggests that body fat mass of female school children in University Model School, predisposes than to higher risk of overall obesity and visceral adiposity than the male children.

Discussion

The objective of this study was to determine the health status of 85 school children in a University Model School with an average age of 10.2 years using common body composition methods (BMI, WC and

WHtR) for assessing body fat and abdominal adiposity known to cause several cardiometabolic diseases (such as obesity, cardiac disease, type 2 diabetes, hypercholesterolemia, arterial hypertension, cardiovascular disease, obstructive sleep apnea syndrome, musculoskeletal impairments and several types of cancers) that have recently become high among children (Donin *et al.*, 2013; Adeoye *et al.*, 2017; Ramya *et al*., 2017). Generally the findings of this study suggests that many of the children might be at risk of these diseases especially female children as they are approaching adolescent age. Males tend to have lower risk as they age while female have more adipose tissues as their ages increase needing attention to ensure their lifestyle are monitored.

Two of the methods of assessment used in this study, BMI and WC are age and gender dependent for children. BMI revealed that 31 (36.5%) of the children were unhealthy, among them, 21 (24.7%) were already having childhood obesity and mainly female children. Finding from WC assessment also indicated many of the children were having high risk of cardiometabolic diseases but the number was less 17 (20%) compared to the result for obesity using BMI. However, similar to BMI assessment majority of children with unhealthy WC which is an indicator of high abdominal adiposity were females. This finding corresponds with Adeoye e*t al.* (2017) that overweight and obesity was prevalent among school children in Ilorin Metropolis of Kwara State.

Another important fact noted in this study was that male children who were classified to be unhealthy (overweight and obese) were younger 10.0 ± 0.0 years than those who were healthy 10.5 ± 1.8 years. On the other hand, the unhealthy female children were older 10.0 ±1.3 to 10.8 ± 1.2 years. The researcher thus proposed two possible interpretations to this age difference in body fat and abdominal adiposity. First, it could be that more male children engaged in physical activity than the female or secondly, it could be a new trend that male children are becoming obese at a younger age than the female children. A more detailed study, possibly considering genetic influences as suggested by (Kujula, 2011) is required to explain this puzzling discovery.

The third method that was used for assessment of health status in this study is WHtR. Although this method is independent of age and gender (Browning *et al*., 2010; Mamen *et al.*, 2018), the researchers have separated the results by age in order to be able to establish properly its suitability in determining health status of obesity and abdominal adiposity in this population. Like the first two methods, WHtR revealed that many of the children 25 (31.6%) were unhealthy in both gender combined which is quite close to 21 obese children that was found using BMI. While it is noteworthy that BMI reports overall body fat with respect to height, WC reports abdominal adiposity and WHtR reports total body obesity and abdominal adiposity together. Therefore, this finding proves the suitability of WHtR in measuring health status in the children and was in line with previous studies that reported high rate of childhood obesity and risk of cardiometabolic diseases among children (Ahmad *et al.*, 2013; Ashwell *et al*., 2014; Mamen *et al.*, 2018). When examined by gender, WHtR also revealed that more female 20 (35.1%) were unhealthy than male 5 (17.9%). Hence, it is glaring that female children in University School, University of Ilorin were unhealthier compared to the male children.

The hypothesis that "there is no significant difference between the health status of school children in University School, University of Ilorin", was rejected because the *t*-test analysis indicated a

significant difference. The number of female children who were unhealthy far outnumber the unhealthy male children. As revealed by the effect size (η^2) of this study the magnitude of the difference in body fat accumulation between female and male children has gotten to average level. By implication, this study confirms the assertion of Dominic and Adu (2018) that the rate of total body fat accumulation as well as abdominal adiposity could increase as the children grow older if they are not exposed to movement behaviour that inculcates physically active lifestyle.This call for an intervention of physical activity programme and general lifestyle modification to ensure that these children grow up healthy and become healthy adults who perform efficiently in their live endeavours. The popular slogan "catch them young", need to be applied to give these children a life full of health and wellness.

Conclusion

Based on the finding of this study it was concluded that:

1. 63.5% of the children in University Model School have normal weight based on their BMI percentile rank while 36.5% are overweight and obese indicating unhealthy status.
2. Based on gender, majority of those who have unhealthy health status females (45.6%) with those overweight between 10.0 ±1.3 years and obese age 10.8 ± 1.2 years indicating that female children are prone to overweight and obesity as soon as they are approaching the age of 10 years and above.
3. As female increase in age they tends towards overweight and obesity while as male increase in age they reduce adipose tissue and have normal weight indicating physiological make-up implication.
4. The combination of BMI, WC and WHtR are suitable to determine obesity and abdominal adiposity but WHtR is more suitable since it can reveal the combined obesity and abdominal adiposity to determine health status.

Recommendations

Based on the findings of this study it is recommended that:

1. There should be regular assessment of health status of children in order to detect the risk of chronic diseases among them.
2. Despite the suitability of WHtR in detecting the combined total body obesity and abdominal adiposity, combination of other methods would bring about a better interpretation of results and a greater comparison of findings.
3. There is urgent need for an exercise intervention programme to increase physical activity lifestyle behaviour in order to reduce the risk of cardiometabolic diseases among children in University School, University of Ilorin.

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