Original Research Article

Assessment of Body Mass Index of In-School Adolescents in Calabar Municality Local Government Area of Cross River State, Nigeria

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A B S T R A C T

This research assessed the body mass index of in school adolescents in Calabar municipality Local Government Area of cross River State, Nigeria. A total of 454 adolescents (10-19 years) consisting of 218 males and 236 females were randomly selected from 7 study schools in the Local Government Area. A semi-structured questionnaire was used to collect data on background information of the adolescents concerning the topic. Anthropometric measurements (weight and height) of the adolescents were obtained, and used to calculate the Body Mass Index (BMI). Their BMI were categorized into obesity, overweight, normal and thinness using the International Obesity Task Force (IOTF) reference and the WHO BMI classification for adolescents up to 19 years. The data obtained were analyzed using Statistical Package for Social Sciences (SPSS), version 20. The prevalence of overweight, obesity and underweight among adolescents were 7.7%, 1.1% and 32.8% respectively. The prevalence of obesity among the adolescents in private was 2.1% compared to the 0.0% in the public schools. On the other hand, public school had a high percentage of underweight adolescents; 106(65.4%) while the private school had 56(34.5%) of the total underweight adolescents. There was a higher prevalence of overweight and obesity among females than among males, with the chi square showing a statistically significant value of p<0.05. Unhealthy BMI is creeping into the population with underweight and overweight dwelling side by side though the prevalence of underweight(32.8%) is higher, measures should be taken to tackle this issue from both ends as either way constitute a serious health challenge.

Introduction

The disparities in the body mass index of adolescents across the population overtime are a cause of concern as unhealthy body mass index has become a prevailing condition. The increase in the percentage of children and adolescents obese overtime is not just an indication of the morbidity and mortality increase among the population but also a health indicator for the measurement of the health of the entire population being that obesity have been shown to be highly associated with non-communicable

disease(NCDs) such as type 2 diabetes, hypertension and ischemic heart disease both in longitudinal and cross sectional overweight and obesity in Nigerian population (HMR, 2014). Adolescents represent approximately 20 % of the world's population and most (~84 %) are living in developing or emerging countries (Melaku *et al.,* 2015). The World Health Organisation describes obesity as a global epidemic and as such the need to assess the prevalence and to find the factors responsible so as to implement timely interventions (Bengalorkar *et al.,* 2012). The consequences of underweight on the other hand are as grievous as that of overweight, for example, Amenorrhea (complete cessation of menses) occurs in 2 to 5% of women of reproductive age, and 40% of female athletic groups such as dancers, skaters, cheerleaders, gymnasts, cross-country runners and oligomenorrhea (irregular menstrual cycles) or amenorrhea increases the risk of bone loss and musculoskeletal injury in premenopausal women (NEDA, 2016). Obesity (a result of high body mass index) cuts across all ages and nations, it is said to be one of the leading cause of mortality and morbidity in both developed and developing countries (Adedayo *et al.,* 2013). It is a major health problem and there is an increasing trend of underweight and obesity among individuals in countries around the world (Medline plus, 2015).

Under-nutrition has far reaching consequences, especially in girls. If their nutritional needs are not met, they have high risk of mortality as a result of pregnancy and childbirth and they are more likely to give birth to low birth weight infants. Furthermore, in all adolescents, short stature resulting from chronic under-nutrition is associated with reduced lean body mass and deficiencies in muscular strength and working capacity (Esimai and Ojofeitimi, 2015).

Adolescence obesity, which occurs most of the time due to untreated childhood obesity is said to be on the increase worldwide, in developing countries especially in the urban population as such emerging as a major health issue (IJO, 2012). Over years there has been substantial increase in childhood and adolescents overweight and obese in developed countries with 23.8% in boys and 22.6% in girls and in developing countries as well, from 8.1% to 12.9% in boys and from 8.4% to 13.4% in girls as at 2013 (Lancet, 2014). Another report in 2013, has it that 42 million people under the age of 5 were overweight or obese (considering its role in adolescence obesity), obesity which was said to be a high income problem is now on the increase in the low and middle income countries, particularly in the urban setting; out of these 42 million reported, 31million are living in the developing countries (WHO, 2016). In developing countries, obesity has been reported to be 30% higher than that of developed countries (Medicentre, 2015).

In Nigeria, data on the prevalence of overweight and obesity among adolescents are few (Ojotetimi, 2011), as cited by Mustapha and Sanusi (2013) in their study of obesity among school children, however, a prevalence of 18% among school children has been reported in Nigeria (Sebanjo *et al.,*, 2011). Ben-Bassey *et al.,* reported over all prevalence rates of overweight and obesity in urban and rural area as 3.7% and 0.4% respectively and 3.0% and 0.0% among children 10-19 years in Eti-osa Local Government Area of Lagos state (Mustapha and Sanusi, 2013). In Cross River state, a prevalence rate of obesity and overweight of 1.7% and 6.8% respectively was reported by Ansa *et al.,* in 2007 (Mustapha *et al.,*, 2013). Being that obese and overweight children and adults are likely to stay obese into adulthood and more likely to develop non communicable diseases like diabetes and cardiovascular diseases at a younger age, overweight and obesity as well as their diseases are preventable, and this

prevention needs high priority as reported by the World Health Organisation journal on Global Strategy on diet, physical activity and Health (WHO, 2016).

According to Joseph Okoghenun's report on poverty and paradox of obesity in Nigeria, has it that the president of the Nutrition Society of Nigeria(NSN), professor NgoziNnam, a professor of public health nutrition blamed the trend of obesity among the poor on over reliance on carbohydrates such as yam, rice, garri (cassava produce), among others. She further explained lack of information on nutrition as one of the major contributing factors, she cautioned that something should be done about this: government should sponsor sensitization programmes on nutrition (Okoghenun, 2015). In his report, he added that will be years when obesity among the poor will be a double jeopardy for Nigeria to handle, as the poor do not have the financial wherewithal to seek medical care when they are faced with non-communicable diseases (NCDs) (Okoghenun, 2016).

An overview of the centre for disease control (CDC) facts on childhood obesity has it that; childhood obesity has more than doubled in children and quadrupled in adolescents in the past 30 years. The percentage of children aged 6-11years in united states who were obese increased from 7% in 1980 to nearly 18% in 2012, similarly, the percentage of adolescents aged 12-19 years who were obese increased from 5% to nearly 21% over the same period, in 2012, more than one third of children and adolescents were overweight or obese (Ogden, Carroll and Elegal, 2014).

It is in view of these context of rise in prevalence of obesity and overweight in the urban settings of developing countries that this study is conducted to assess the prevalence among adolescents in Calabar municipality: an urban setting in cross river, Nigeria (a developing country) to determine their knowledge on the relationship between high body mass index and non-communicable diseases, also to compare the findings with other studies conducted on the topic; especially with that of Ansa *et al.,* in Cross River State.

Materials and Methods

Study area

This study was conducted from January to September, 2016 in Calabar Municipality Local Government Area of Cross River State, Nigeria. It is an urban setting, the capital city of Cross River State. It was the capital of Southern Protectorate of Nigeria and lost that to Lagos in 1904. It is one of the earliest sits of local government administration in the Eastern Region up to 1952 under the ordinance of 1950 (CRSMI, 2006). It lies between latitude 04^0 15' and 5^0 15N and longitude $8^0$15' and 8^0 25'E. It has an area of $331.551km^2$ with a population of 179,392 at the 2006 census. The postal code of the area is 540. The Municipality is bounded in the North by Odukpani Local Government Area in the North-East by the great Kwa River, it Southern Shores are bounded by Calabar River and Calabar South Local Government Area (NIPOST, 2012). It plays a dual role; the capital city of Cross River State and the headquarters of Southern Senatorial District.

The ethnic groups form the indigenous population; these are the Quas and the Efiks. However, due to its cosmopolitan status there abound people from all parts of the state and Nigeria in the city. By virtue of its location along the water front, the Efiks embraced Western culture early through their trade with the Europeans. Fishing was another occupation identified with them, while the Quas on the other hand occupy the bulk of the hunter land of Calabar where farmers, traders

and blacksmiths were found, moreover due to the tremendous transformation undergone by the area with improved social amenities, recreational facilities, industries, and others, occupation of the resident had tilted from fishing and farming to civil service, public service company workers amongst other occupations. It is made up of 10 wards and numerous villages with the current Chairman; Mr. Etim Donatus Henry who is running the administration affairs of the area (CRGIA, 2014).

Subjects selection

A total number of four hundred and fifty four (454) in school adolescents (aged 10 - 19) was selected from five wards out of the 10 wards in the study area using systematic sampling technique.

Ethical consideration

A letter of introduction and ethical clearance was received from the department of Public Health; University of Calabar, copies were made and send to the principals of the selected schools. The rudiments of the research were explained to volunteered participants with their verbal consent and a signed letter of consent from their parents before data collection. The participants were assured of confidentiality of information. Benefits of the research were shared and equity sustained throughout the research period.

Instruments and materials for data collection

The questionnaire

A semi structured questionnaire (made up of closed and open ended questions) was used to collect data on the knowledge and perception of the participants about the subject of interest.

Materials for data collection

To take the anthropometric measurement, the following materials were used:

Weighing scale; to measure the weight of participants

Height scale; to take height measurements of participants

The body mass indexes of participants were assessed to help identify underweight and obese individuals.

Methods for data analysis

Data collected from the field were analysed using the Statistical Package for Social Sciences (SPSS) software application version 20 for proper analysis. The analysis was both descriptive and analytical as data will be presented in percentages on frequency tables and figures where applicable to analyse the view of participants on questions of interest.

Results and Discussion

Result of the study shows that of the 454 respondents, 218 (48%) were males while 236 (52%) were females. The mean age of the respondents was 14.3years (Table 1). Out of the 454 participants, 229(51.2%) were from Private Schools and 225(48.8%) were from Public/Government Schools. Out of the 454 participants, 100 (22.0%) were from J S 1, 118(26%), from J S 2, 123(27.1%) were from S S 1 while 113(24.9%) were from S S 2, distribution by age when grouped into interval showed that the 13-15 interval had the highest participants with 265(58.5%), 16-18 had 105(22.4%), 10-12 had 79(17.4%) while 19 had 8(1.8%) participants. Table 1 shows the section A part of the questionnaire which covers the demographic information of the respondents.

On the question of knowing what BMI is, 160(35.2%) answered yes while 293(64.5%) answered no to this question.

On the scored questions, a rank was made according to the scores of the participants; no knowledge level (0) 45 (9.9%) of the students reported that they have no knowledge of BMI, 240(52.9%) indicated low knowledge level (1-3), 148 (32.6%) of the participants indicated moderate level of knowledge (4-6) and 21(4.6%) of students shows high knowledge level (7-10) see (pie-chart 1).

The responses to the answers given on questions about knowledge are shown in table 2. From the table, it is seen that out of the 454 participants only 160(35.24%) had previous idea on what BMI is. On the factors that affects BMI, 219(48.2%) of the 454 respondents agreed that poor nutrition can affect the BMI of an adolescent, 148(32.5%) said the socioeconomic status of the parents is a major factor, 193(42.5%) said that the environment also plays a role, 133(29.2%) said that gender is a major factor, 135(29.7%) reported that fast food meals is a major factor, 196(43.17%) said that illness is a major factor while 213(46.9%) reported that family background is the outstanding factor.

Risk factors and effect of unhealthy BMI

Selected questions on risk factors and complications of BMI either underweight or obesity were asked and the participants gave their view on the questions. Out of the 454 participants, 222(48.9%) (the highest response for the question) said that sickness can cause underweight while 169(37.2%) (lowest response) reported that puberty is a major risk factor, on high BMI, 179(39.4%) identified gender as a factor while 192(42.3%) said that food is a major factor. On the effects of low BMI, 188(41.4%) agreed that underweight will lead to stunted growth while 171(37.7%) reported that delayed puberty is a major effect

of underweight, for high BMI, 208(45.8%) indicated that aggressiveness is a major effect while 170(37.8%) said that learning problems is the most prevalent effect of obesity (Table 3).

Table 3 shows the frequencies and percentages for the positive responses given to the questions out of the total number of responses.

Prevention of unhealthy BMI

Section D covered suggested points for prevention and control of unhealthy BMI among adolescents. Questions were asked on this and the answers given were analysed and the analysis showed that respondents recommended increase sleep hours as a means of controlling underweight than any other means (204 respondents out of 454) while for high BMI, 265(58.4%) recommended that more exercise will prevent obesity. Table 4 shows responses with the highest recommendation on selected categories (Table 4). An open ended question was asked on the safest way of preventing the prevalence of obesity and the responses given on this is shown on a histogram (histogram 1).

BMI by gender of participants

Showing BMI by gender, out of the 236 females assessed, 28 were overweight while 61 were underweight and 5 obese while 142 had healthy body mass index. For the 218 males assessed, 7 were overweight and 101 were underweight none was obese, whereas 110 maintained a healthy body mass index (Table 2).

BMI by socioeconomic status of parents

To analyse this variable, figures were assigned in ranks to the three socioeconomic classes; low, moderate and high socioeconomic status of parents.

Table.1 Demographic characteristics of respondents

s/n	Variables	Group	Frequency n=454	Percentage (%)
1	Gender	Male	218	48.0
		Female	236	52.0
2	School	Private	229	51.2
		Public	225	48.8
3	Class	J S 1	100	22.0
		J S 2	118	26.0
		S S 1	123	27.1
		S S 2	113	24.9
4	Age(years)	10-12	79	17.4
		13-15	265	58.5
		16-18	102	22.4
		19	8	1.8

Average age =14.5 mean for age=5.32, mode=6.00 and median =6.0
Source: Result from field

Table.2 Knowledge of BMI

Variable	Category	Female F(%)	Male F(%)	Total F(%)
Do you know what BMI is?	Yes	83(51.8)	78(45.75)	160(100)
	No	153(52.2)	140(47.7)	293(100)
	Total	**236(51.9)**	**218(48.0)**	**454(100)**
The ratio of weight to height	Yes	67(28.3)	59(25.0)	126(100)
	No	169(77.5)	159(72.9)	218(100)
	Total	**126(27.7)**	**328(72.2)**	**454(100)**
Fat content of the body	Yes	45(50.5)	44(49.4)	89(100)
	No	191(52.47)	174(47.8)	364(100)
	Total	**236(51.9)**	**218(48.0)**	**454(100)**
Test to determine the weight of the body	Yes	48(43.2)	68(61.2)	111(100)
	No	188(54.8)	155(45.1)	343(100)
	Total	**236(51.9)**	**218(48.0)**	**454(100)**
Ever tested?	Yes	105(51.9)	97(48.0)	202(100)
	No	131(52.1)	121(48.2)	251(100)
	Total	**236(51.9)**	**218(48.2)**	**454(100)**

Table.3 Risk factors and effects of unhealthy BMI

Variable	Category	Positive Response F(%)	Total F(%)
What do you think can cause underweight?	Obsessive exercise	189(41.0)	454(100)
	Puberty	169(37.2)	454(100)
	Sickness	222(48.9)	454(100)
	Excess carbohydrate	184(40.5)	454(100)
What are the risk factors for obesity?	Gender	179(9.4)	454(100)
	Ethnicity	130(28.6)	454(100)
	Wealthy family	139(30.6)	454(100)
	Excess food	192(42.3)	454(100)
What are the effects of underweight?	Stunted growth	188(41.4)	454(100)
	Compromised immune system	179(39.4)	454(100)
	Delayed puberty	171(37.7)	454(100)
What are the effects of obesity?	Learning problems	170(37.8)	454(100)
	Aggressiveness	188(41.4)	454(100)
	Depression	208(45.8)	454(100)
	Hypertension	176(38.8)	454(100)

Table.4 Section D: prevention of unhealthy BMI

Variable	Category	Positive Response F(%)	Total F(%)
How would you prevent underweight?	Increase sleep hours	204(44.9)	454(100)
	Increase calorie	186(41.0)	454(100)
	Reduce exercise	153(33.8)	454(100)
How would you prevent obesity?	More exercise	265(58.4)	454(100)
	Reduce food intake	246(54.2)	454(100)
	Abstinence from fast food meals	251(56.3)	454(100)

Table.5 BMI by gender, school type, age and socioeconomic status

Variables	Category	Underweight F(%)	Healthy F(%)	Overweight F(%)	Obese F(%)	Total F(%)	P-value
Gender	Male	101(46.3)	110(50.5)	7(3.1)	0(0.0)	218(100)	
	Female	61(25.8)	142(60.1)	28(11.8)	5(2.1)	236(100)	0.000
	total	**162(35.7)**	**252(55.5)**	**35(7.7)**	**5(1.1)**	**454(100)**	
School	Private	56(24.2)	148(64)	22(9.5)	5(2.1)	231(100)	
	Public	106(47.5)	104(46.6)	13(5.8)	0(0.0)	223(100)	0.000
	Total	**162(35.7)**	**252(55.5)**	**35(7.7)**	**5(1.1)**	**454(100)**	
Socioeconomic Status of parents	Low	92(82.8)	19(17.1)	9(8.1)	0(0.0)	111(100)	
	Average	56(22.6)	162(65.5)	26(10.5)	1(0.4)	247(100)	
	High	14(14.5)	71(73.1)	9(9.3)	4(4.1)	96(100)	0.000
	Total	**162(35.5)**	**252(55.5)**	**35(7.7)**	**5(1.1)**	**454(100)**	
Age	10-12	27(36.9)	48(60.7)	4(5.0)	0(0.0)	79(100)	
	13-15	140(52.8)	154(58.1)	21(7.9)	3(1.1)	265(100)	
	16-18	45(44.1)	48(47.0)	10(9.8)	1(0.9)	102(100)	
	19	5(62.5)	2(25)	0(0.0)	1(12.5)	8(100)	
	Total	**162(35.5)**	**252(55.5)**	**35(7.7)**	**5(1.1)**	**454(100)**	

Fig.1 Pie chart 1 showing the knowledge level of participants

No knowledge	45(9.9%)
Low knowledge (1-3)	240(52.9%)
Moderate knowledge (4-6)	148(32.6%)
High knowledge (7-10)	21(4.6%)
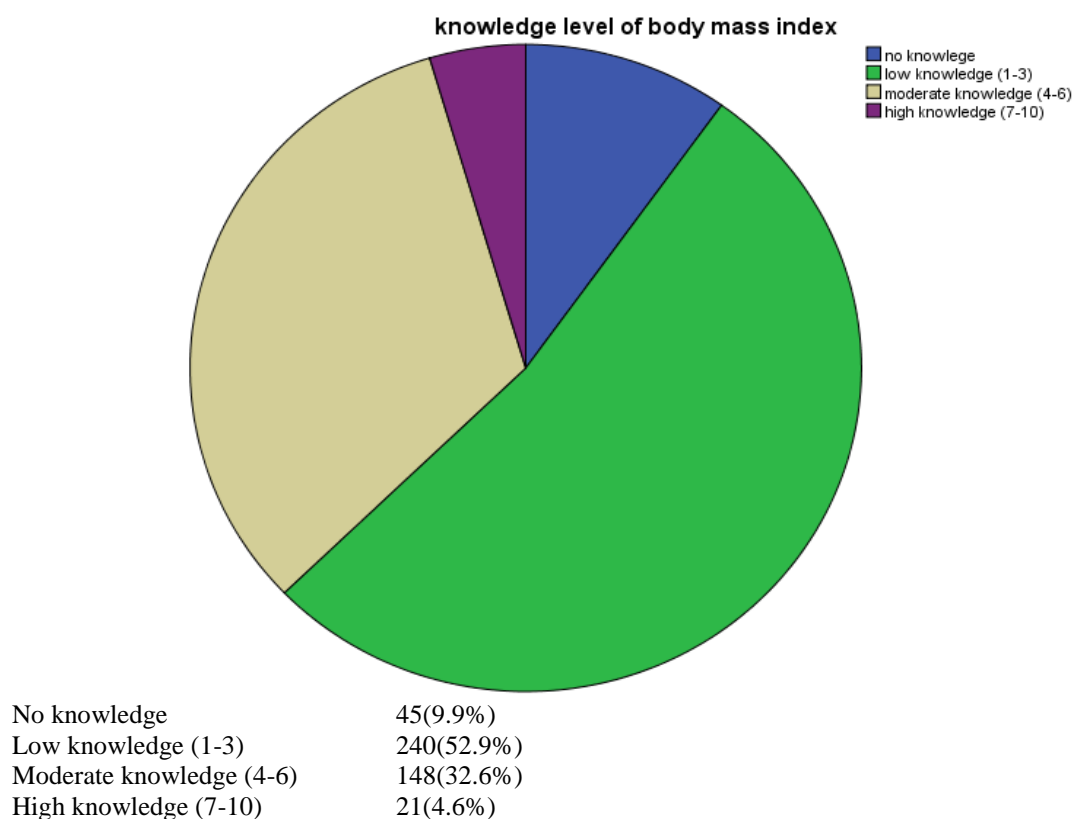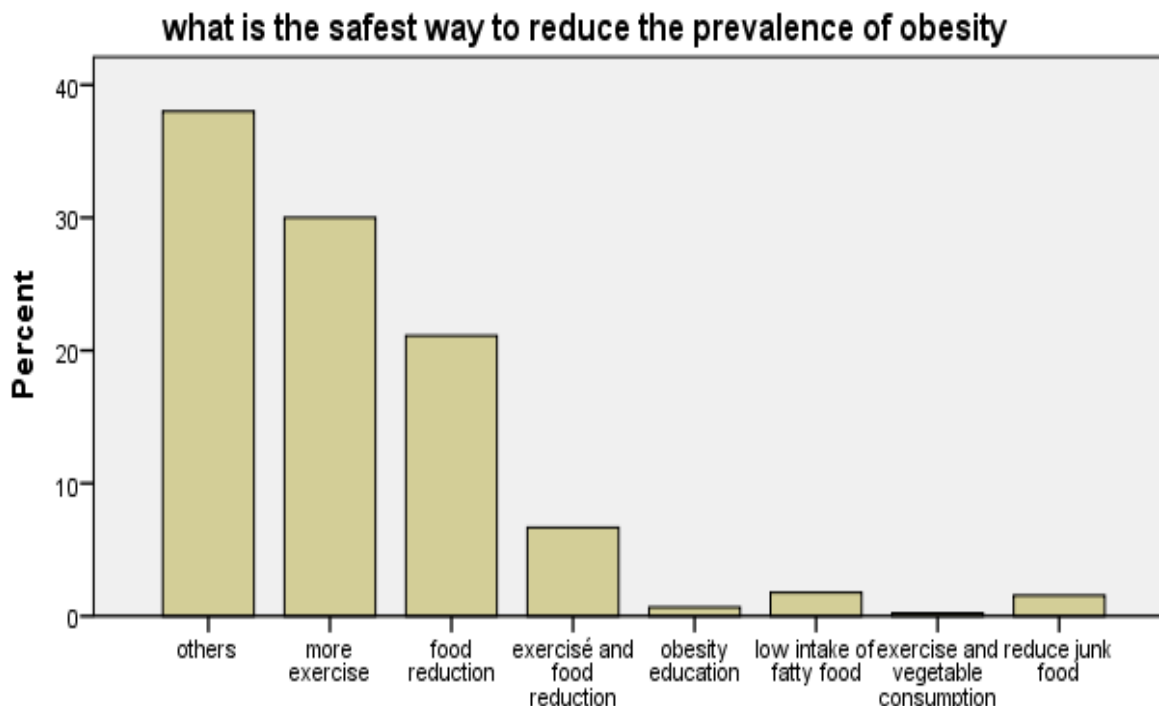
When analysed, the result showed that participants with low socioeconomic parents were a total of 111 and out of this, 92 were underweight while 19 where healthy, for moderate socioeconomic status, out of 247 participants, 56 were underweight, 162 were healthy, 26were overweight while 1 was obese. Whereas for high socioeconomic status, out of 96 participants, 14 were underweight, 71 were healthy, 9 were overweight and 4 were obese.

BMI by schools of participants

The research also compares the BMI of participants in private schools to those in public schools. Of the 454 participants, 229(51.2%) were from private owned school while 225(48.8%) were from public/government owned schools. Of this, the public schools in total had 106 underweight students, 104 healthy students, 13 overweight students and no obese student while the private owned school had a total of 56 underweight students, 148 healthy students, 22 overweight and 5 obese students.

Relationship between sex and obesity

Null hypothesis (Ho): There is no significant relationship between sex and high body mass index

Alternate hypothesis (Ha): There is a significant relationship between sex and high body mass index

For this variable, out of the 236 females assessed, 28 were overweight while 60 were underweight and 5 obese while 143 had healthy body mass index. For the 168 males assessed, 7 were overweight and 89 were underweight none was obese, whereas 122 maintained a healthy body mass index. From the chi square test, (p=0.00), i.e. p<0.05, therefore we reject the null hypothesis and

accept the alternate hypothesis which states that; There is a significant relationship between sex and high body mass index.

The study shows the body mass index of participants with a prevalence of underweight of 32.8%, overweight of 5% and 1% obesity among in-school adolescents in Calabar municipality Local Government Area of Cross River State, Nigeria. In Cross River state, a prevalence rate of obesity and overweight of 1.7% and 6.8% respectively was reported by Ansa *et al.,* in 2007 (Mustapha *et al.,*, 2013), in comparing this with the results, it shows that there has been a decrease in the prevalence of overweight and obesity from 1.7% and 6.8% respectively in 2007 to 5% and 1% respectively in 2016. The result shows a higher prevalence of underweight of 32.8% compared to 1% of obese adolescents among the population.

The study also assessed the prevalence of underweight among the population and it was discovered that the prevalence of underweight [162(35.7%)] was more than that of overweight [35(7.7%)] and obesity [5(1.1%)). This result of high prevalence of underweight among adolescents agrees with Esimai and Ojofeitimi's work where they mentioned that one of the major global health problems faced by developing countries today is under nutrition which is a factor for underweight (Esimai and Ojofeitimi, 2015).

The issue of gender and high body mass index assessed in this study is in line with an article in the World Health Organisation's journal on body mass index of adolescents where it was stated that the drastic increase in the prevalence of overweight and obesity calls for an assessment and rapid action to reduce the rates. In developed countries, an increase of 23.8% for boys and 22.6% for girls and in developing countries, 8.1% to 2.9% increase in boys and from 8.4% to13.4 in girls has

been reported (WHO, 2014), showing that girls always have higher BMI than boys.

In conclusion, Body mass index is the simple index that indicates the ratio of weight to height of an individual in kilograms per metres square. It is an objective method for measuring the anthropometric features of an individual. This method is effective for both adolescents and adults. The issue of unhealthy BMI cuts across various populations and is more prevalent in developing countries where obesity and underweight dwells side by side. The research has been able to expose the various risk factors of this problem and identify the major issue with it. The necessity to start sensitization on unhealthy BMI cannot be underestimated as the health status of adolescents serves as a health indicator for the entire population reasons being that they are the future adults of any population

Acknowledgement

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