



## **Anthropometric Indicators in Diet and Physical Activity**

**R. N. Ativie<sup>1\*</sup>, E. I. Ekhoje<sup>2</sup>, O. A. Udi<sup>3</sup>, O. C. Okezue<sup>1</sup>, U. A. Ezugwu<sup>1</sup>  
and N. V. Ibe<sup>1</sup>**

<sup>1</sup>*Department of Medical Rehabilitation, Faculty of Health Sciences and Technology, University of Nigeria, Enugu Campus, Enugu, Nigeria.*

<sup>2</sup>*Department of Physiology, Faculty of Basic Medical Sciences, College of Medical Sciences, Edo University, Iyamho, Edo State, Nigeria.*

<sup>3</sup>*Department of Basic Medical Science, College of Natural and Applied Sciences, Achievers University, Owo, Ondo State, Nigeria.*

### **Authors' contributions**

*This work was carried out in collaboration between all authors. Author RNA designed the study, authors EIE and OAU monitored the protocol and wrote the first draft of the manuscript. Authors OCO and UAE performed the statistical analysis and author NVI managed the literature searches. All authors read and approved the final manuscript.*

### **Article Information**

DOI: 10.9734/AJARR/2018/v2i116192

#### Editor(s):

(1) Dr. Nadia Sabry El-Sayed El-Gohary, Associate Professor, Department of Medicinal Chemistry, Faculty of Pharmacy, Mansoura University, Egypt.

#### Reviewers:

(1) Arthur Chuemere, University of Port Harcourt, Nigeria.

(2) Lei Feng, Suining Central Hospital, China.

(3) Brijesh Mukherjee, Hi-tech Medical College, India.

Complete Peer review History: <http://www.sciencedomain.org/review-history/26615>

**Original Research Article**

**Received 19 June 2018**

**Accepted 08 September 2018**

**Published 11 October 2018**

### **ABSTRACT**

Lifestyle patterns which include diet, level of physical activity, alcohol consumption, smoking and stress are capable of having both positive and negative effect on various health indicators such as anthropometric, cardiovascular and metabolic parameters of body physiology. This study was aimed at investigating the relationship between diet, physical activity and anthropometric indicators [Weight (Wt.), Height (Ht.), Body Mass Index (BMI), Waist and Hip circumferences (WC, HC) and Waist-Hip ratio (WHR)]. Three hundred and seventy five (375) young adults with a mean age of  $21.61 \pm 2.168$  years were selected using the convenience sampling technique. International physical activity questionnaire and food frequency questionnaire were used to collect information on their physical activity level and dietary intake respectively, following which selected anthropometric

indices (Wt, Ht, BMI, WC, HC and WHR) were measured. Statistical measure of association (correlation) and differences in mean were obtained for variables using the spearman rank and one-way analysis of variance (ANOVA) respectively. Results revealed a higher dietary intake in males than females with a statistically insignificant association between BMI, HC, WC and dietary intake. However, there was a positive significant association between dietary intake and WHR dietary intake; and BMI. Result also revealed a negative association between HC, WC and physical activity though statistically insignificant. Proper nutritional habits and improved physical activity levels can positively influence anthropometric variables of health.

*Keywords: Body Mass Index; diet; physical activity; waist-hip ratio.*

## 1. INTRODUCTION

Technological developments in societies have resulted in more comfortable and less physically demanding lifestyles. By this, Physical activity has become one of the most significant components of a healthy lifestyle [1]. With Physical activity levels decreasing among young people across the globe, less than one-third have been estimated to be sufficiently active to meet up with the requirements for healthy living [2]. Despite findings that optimisation of diet is Jermaine, daily-to-routine exercise (physical activity) have been established to improve good health, lowering of blood pressure, checkmating excessive body fat, and improving glucose metabolism [3]. Available evidences suggest that modifying the level of physical activity and daily diets can decrease the occurrence of the different risk factors associated with increased BMI. Using the anthropometric measures, an individual's health status can be calculated from his/her Weight, BMI [4].

Using the anthropometric measures, an individual's health status can be calculated from his/her Weight, Height, BMI, Waist and Hip, circumferences, etc. for instance, A BMI between 26 and 30 is considered overweight and greater than 30 is classified as obese [5]. Being a chronic disease characterised by abnormal or excess fat accumulation in adipose tissue [6,7], Obesity impairs health and has been shown to be independently associated with cardiovascular diseases, specifically coronary heart disease and stroke. In developing countries like Nigeria, globalisation and urbanisation have brought about rapid changes in lifestyle, which has negative consequences among which is decreased physical activity associated with a rise in non-communicable diseases (cardiovascular disease, diabetes mellitus, cancer and chronic lung disease) which are becoming increasingly significant causes of disability and premature death [8].

Prevention of excess weight gain relies on the maintenance of energy balance, whereby energy intake equals energy expenditure (physical exercise) over a long term. For adults, this means maintaining a relatively stable weight across life stages, including the reproductive years, in contrast to the average progressive gain of 0.5 to 1 kg per year commonly observed in US adults [9]. Physical activity has been listed as one of the major health indicators for Healthy People 2020 [10]. Studies have shown Low levels of physical activity to be associated with obesity and weight gain. This occurs in the context of an automated and automobile-oriented environment which includes television viewing and other sedentary activities although more of the evidence relates to children [11,12]. It is generally known that Proper nutrition is important to physical fitness, because energy expenditure depends on nutrition. If the diet is inadequate, the fitness level will drop. Overweight, underweight, and weak individuals will have below average fitness levels [12].

Physical fitness is achieved via physical activity, and the physical activity itself results in breakdown of molecules which causes decrease in mass whereas the resultant weight gain can be explained to be from muscle hypertrophy through anabolic excessive compensation seen when the body recovers. This can result from enhanced glycogen storage in the muscles or through or increased muscle proteins hence exercise can stimulate an individual's appetite [3]. A combination of genetic susceptibility, reduced physical activity level, and excessive food consumption is the most common cause of obesity.

Endocrine disorders, genes, mental disorders and some medications also can also result in obesity but in few instances. The view that obese people eat little yet gain weight due to a slow metabolism is not generally supported. On average, obese people have greater energy

expenditure than their thin counterparts due to the energy required to maintain an increased body mass. The energy requirements of obese individuals to maintain their body mass is more than that of a normal weight or underweight individuals hence it is not generally supported that obese individuals exhibit slow metabolism which makes them eat little and still gain weight.

Ayelet in 2014 carried out a study on the 'Level of Physical Activity and Anthropometric Characteristics in Old age' [3]. Their findings indicated a clear negative association between level of physical activity, weight, waist circumference, and BMI values in both genders. The more active a person was, the lower the values of these parameters [3]. In a similar vein, Dina in his 2010 study, revealed an increase in the prevalence of overweight and obesity, as well as in physical activity level and dietary intake of normal weight and overweight/obese adolescents [4]. Particularly, Dina noticed a higher mean in overweight/obese rates for males than females, suggesting an increased trend with age in males at 28% (11 years) and 30% (14–17 years). Current study will explore the relationship between physical activity level, dietary intake and anthropometric indices among young adults. Study will ascertain known relationships between diet, physical activity and selected anthropometric parameters amongst young adults [4].

## 2. METHODOLOGY

### 2.1 Scope of Study

Study was conducted at the University of Nigeria, Enugu Campus, South-East Nigeria.

### 2.2 Study Design

Study employed the cross-sectional approach to research design for reason that data was collected at one point in time from available subjects in a particular location; targeting a population of young adults of age range 18-30 years who were resident at the University of Nigeria, Enugu Campus and environs.

### 2.3 Sample and Sampling Technique

Using the Taro Yamane's relation of sample size calculation, three hundred and seventy five (375) young adults with a mean age of  $21.61 \pm 2.168$  years were conveniently drafted as follows;

$$n = N / (1 + Ne^2)$$

Where n = sample size

N = population size

e = sampling error

^ = raised to the power of

For the purpose of this study, N = 6000

$$n = 6000 / (1 + 6000 \times 0.05^2)$$

$$= 6000 / (1 + 6000 \times 0.0025)$$

$$= 6000 / (1 + 15)$$

$$= 6000 / 16$$

$$= 375.$$

Study utilised a convenience sampling technique, which is a type of non-probability sampling technique, giving room for subjects' recruitment based on their willingness to participate.

### Selection Criteria:

Selection of subjects for participation was spelt by;

### Inclusion Criteria:

- i. Young adults in University of Nigeria Enugu Campus.
- ii. Young Adults within the ages of 18 to 30 years
- iii. Young Adults who are willing to participate

### Exclusion Criteria:

- i. Adults below 18 years
- ii. Adults above 30 years
- iii. Pregnant women
- iv. People on special diet
- v. People on exercise programmes.

### 2.4 Materials for Data Collection

Materials used for the study include;

- i. Questionnaire (International Physical Activity Questionnaire and Food Frequency Questionnaire) was used to access the level of physical activity and frequency of food intake of participants.
- ii. Measuring tape: a non-elastic measuring tape for measuring hip and waist circumference.
- iii. Weighing balance (Harson, Model H89) was used to measure participants' weight.
- iv. Stadiometer (Leaidal Medical Limited, RGZ-160) was used to measure participants' height.

## **2.5 Ethical Approval**

Ethical approval was obtained from the University of Nigeria Health research ethics committee. Subjects' informed consent was obtained prior to investigation, just after the procedure and purpose of the research was clearly explained to them. Participants' privacy was maintained by using code numbers instead of names in the data presentation, whilst keeping the records confidential. Only data obtained from this study is presented and reported.

## **2.6 Procedure**

### **2.6.1 Assessment of physical activity level**

The International Physical Activity Questionnaire (IPAQ) short form was used to assess habitual Physical Activity (PA) level. IPAQ has been tested and reported to have acceptable test-retest reliability and criterion validity [13]. Participants were asked the number of days they did vigorous PA, moderate PA (excluding walking) and walking as well as the number of hour and minutes per day they did the three types of activities in the last seven days respectively. These activity categories were treated separately to obtain the activity pattern (by multiplied by their estimated intensity in METs) and summed to get the overall estimate of PA in a week. One MET represents the energy expended while sitting quietly at rest and is equivalent to 3.5ml/kg/min of  $VO_2$ . The MET intensities used to score IPAQ were vigorous (8METs), moderate (4METs) and walking (3.3METs).

### **2.6.2 Dietary assessment**

Food Frequency Questionnaire (FFQ) was used to determine the weekly dietary intake of participants. Questions were framed to access the frequency of food items as, 'never consumed' (0), 'rarely (less than once per week occasionally (1-2 times a week), 'regularly' (more than 3 times a week) and "daily" (7 times a week).

The questionnaire concentrated on 13 food items commonly consumed by most people, namely: Grains and cereals such as rice (cooked or fried), common starchy food such as cassava (Eba, Fufu, Gari), yam and irish potatoes. Foods like legumes, nuts, green leafy vegetables, non-leafy vegetables, fruits, sugar, milk, milk products, chicken red meat, fish, bread, non-alcoholic drinks and alcohol. Score for each food item was calculated in percentage based on responses to the questions on frequency of consumption.

### **2.6.3 Anthropometric assessment**

Following guided standards from the International Society for Advancement of Kinanthropometry (ISIAK), anthropometric assessments for Heights and weights (to the nearest decimal place) were respectively obtained with metre rule and bathroom scale. BMIs of participants were then calculated from obtained heights and weights using; weight (kg)/height ( $m^2$ ). From these BMI values, normal weight, WHO standards for overweight and obesity formed the criteria for body weight determination [2].

Using a non-elastic measuring tape, Waist and hip circumferences (WC and HC) were obtained at the level of the umbilicus and greater trochanter. Waist/Hip ratios (W/H) were obtained from calculated values of WC and HC; and categorised based on the WHO's stipulated criteria [2]. Values were measured and recorded to the nearest 0.1 cm. W-H ratio < 0.95 was categorised as normal, with those  $\geq$  0.95 as undesirable for men. For women, W/H < 0.85 was categorised as normal, with those  $\geq$  0.85 taken as undesirable. This categorization was done in accordance with to the WHO's standards [2].

## **2.7 Statistical Approach**

Data Analysis and presentation were performed with the statistical package for social sciences application (SPSS Version 21), using charts and tables. Whereas, differences in mean for obtained variables was checked with the One-way Analysis of Variance (ANOVA), statistical measure of association (correlation) was performed with the spearman rank equation. P-values < .05 were taken to as statistically significant.

## **3. RESULTS**

Association between variables was performed with the spearman correlation. Descriptive statistics was used to analyse the demographic data.

From Table 1, 190(50.7%) of the respondents were male, while 185(49.3%) were females. Here, 23(5.6%) were underweight, with 286(73.9%) being normal while 43(14.7%) and 23(5.8%) falling respectively as overweight and obese. Again, 324(86.7%) of respondents had normal WHR, while 51(13.3%) were centrally

**Table 1. Socio-demographic data of sampled subjects**

Variables		Frequency (n)	Percentage
Gender	Male	190	50.7
	Female	185	49.3
	Under weight	23	5.6
BMI(kg/m <sup>2</sup> )	Normal	286	73.9
	Overweight	43	14.7
	Obessed	23	5.8
Waist-hip ratio	Normal	324	86.7
	Centrally obesed	51	13.3
	Physical activity level	Low	75
Medium		228	60.8
High		72	19.2
Dietary intake	Low dietary intake	16	4.3
	Moderate dietary intake	304	81.0
	High dietary intake	55	14.7

obese. 75(20%) had low Physical activity level with 228(60.8%) and 72(19.2%) showing moderate and high Physical activity levels respectively. 16(4.3%) of respondents also had low dietary intake with 304(81.0%) and 55(14.7%) showing medium and high dietary intakes respectively.

**Table 2. Correlation between physical activity and anthropometric parameters using spearman Rank's**

Variables	r	p
Body mass index(kg/m <sup>2</sup> )	0.119	0.022*
Hip circumference(cm)	0.027	0.599
Waist circumference(cm)	0.062	0.234
Waist-HIP ratio	0.355	0.001*

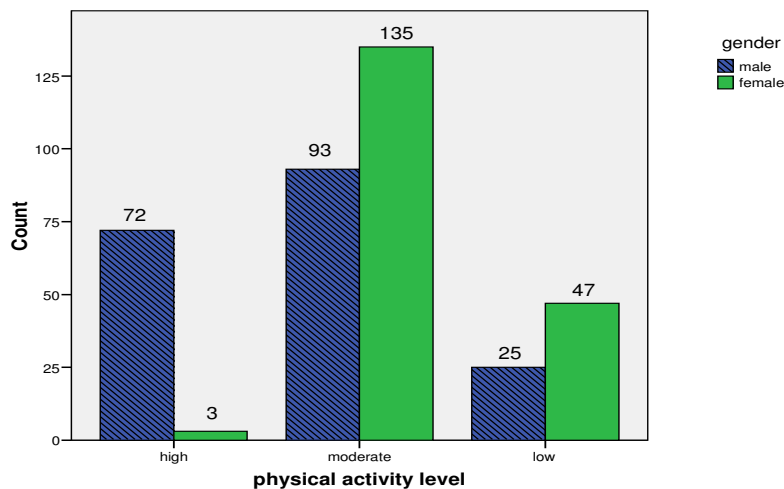
\*=significant at  $p < .05$

Table 2 shows a positive correlation between physical activity and body mass index of young adults. Here, r-value and p-value were 0.119 and 0.022 respectively.

**Table 3. Correlation between physical activity and dietary intake using spearman rank's**

Variables	Physical activity R- value	P- value
Dietary intake	-0.025	0.631

From Table 3 r-value and p-value for the relationship between Physical activity and diet of young adults are seen to be -0.025 and 0.631 respectively. This implies a negative relationship between the two variables. ANOVA returned an insignificant outcome as  $p = 0.631$ .



**Fig. 1. Gender distribution of levels of physical activity in respondents**

Fig. 1 shows the physical activity level of respondents by genders. The figure reveals that 72 (out 190 males) engaged in low physical activity, while 93 and 25 of them engaged in moderate and high physical activity respectively. Of the 185 sampled Females, 3 of them engaged in low physically activity with 135 and 47 of them being moderate and high in physical activity level respectively. This shows that majority of the studied individuals are physically active, especially the male folks. Showing frequency of BMI for both genders. As shown, 9 males were underweight with 169 having normal weight. Nine (9) were overweight with 3 of them being obese. Fig. 2 also shows that 20 of the 185 females were obese with 14 of the being underweight,

117 having normal weights, and 34 overweight. This signifies that majority of the individuals have normal body mass index.

Fig. 3 reveals that out of 190 sampled males, 180 were normal, while 10 of them were centrally obese. In the female category, 144 were normal with 41 centrally obese.

From Fig. 4, it is seen that of the 190 sampled males, 10 had low dietary intake with 162 and 18 showing moderate and high dietary intake respectively. It is also seen that of the 185 female participants, 6 had low dietary intake with 142 and 37 having moderate and high dietary intake respectively.

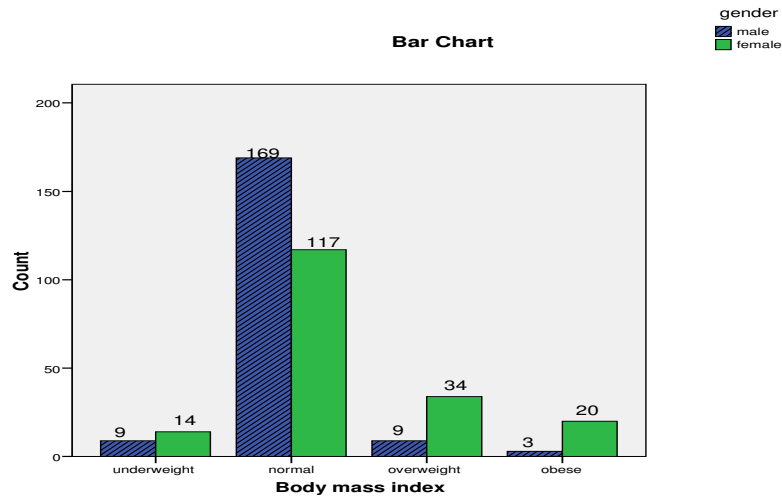


Fig. 2. Changes in BMI by gender in respondents

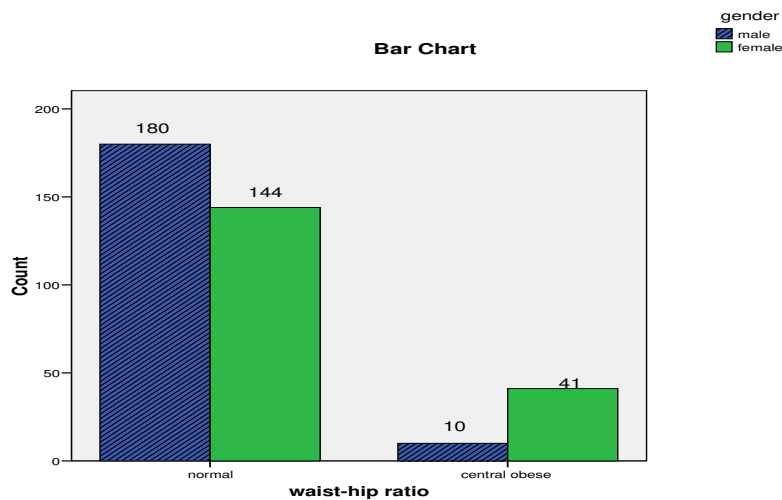
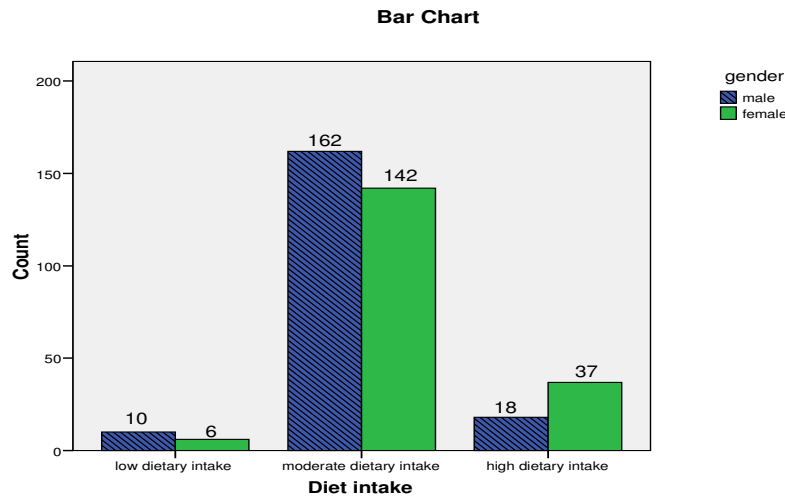


Fig. 3. Changes in Hip-waist ratio by gender in respondents



**Fig. 4. Dietary intake by gender**

#### 4. DISCUSSION

This study related physical activity level, dietary intake, and anthropometric indices among young adults in the University of Nigeria, Enugu Campus. A total of 375 subjects participated in the exercise; 190 males and 185 females. From the studied individuals, 286(73.9%) had normal weight, 23(5.6%) were underweight, 23(5.80%) and 43(14.7%) were respectively obese and overweight. Result also showed that 325(86.7%) of sampled individuals had normal waist-hip ratio, while 50 (13.3%) were centrally obese. It was also seen that 75(20%) of the participants had low physical activity level, with 228(60.8%) and 72 (19.2%) respectively showing moderate and high levels of physical activity. The study also revealed that 16(4.3%) had low dietary intake.

##### 4.1 Relationship between Dietary Intake and Body Mass Index of Young Adults

ANOVA returned a statistically significant result, while  $r=0.043$ . This implies a negative relationship, and corresponds with findings of Togo et al, 2001 who found no associations between body mass index and food intake patterns [8]. Palmer in 2009 also found no relationship between eating frequency and weight in either loss or maintenance interventions.

##### 4.2 Relationship between Dietary Intake and Hip Circumference of Young Adults

Study showed an insignificant, negative relationships between dietary intake and hip

circumference as  $r = 0.138$  and  $p = -0.078$ ). This implies that dietary intake does not have any significant association with hip circumference. Scars literature exists to support this.

##### 4.3 Relationship between Diet and Waist Circumference of Young Adults

No statistically significant result was seen between dietary intake and waist circumference of young adults as  $p = 0.318$ .  $r$  also returned -0.052, implicating a negative relationship between the two variables. This is in contrast with the findings of Maruf in 2012 who reported that there is a relationship between the different food types and waist circumference. This disparity may have been traced to the fact that this research work studied the association between dietary intake and waist circumference, while the above mentioned work focused on the association between selected food types and waist circumference.

##### 4.4 Relationship between Diet and Waist-HIP Ratio of Young Adults

Study showed a positive relationship between dietary intake and waist-hip ratio of young adults with  $r = 0.161$ . ANOVA proved significant also as  $p = .02$ . This is in line with Kelishadi et al's findings of 2016 reported a significant relationship between eating frequency with generalised and central obesity.

#### **4.5 Relationship between Physical Activity and Body Mass Index of Young Adults**

Study proved significant with  $p = 0.22$ , with positive relationship between physical activity and body mass index of young adults as  $r = 0.119$ . This means that physical activity level influences the body mass index of young adults, supporting the view of the findings in the previous studies. Thus, establishing a crucial role for physical activity and energy expenditure in obesity prevention. In addition, several studies have shown that physically active people are less likely to gain weight if they are so engaged on regular basis.

#### **4.6 Relationship between Physical Activity and HIP Circumference of Young Adults**

No relationship was seen between physical activity and hip circumference of young adults. ( $r=0.027$ ,  $p=0.599$ ). This means there were no existing correlations between the two variables; even though no literature currently supports this.

#### **4.7 Relationship between Physical Activity and Waist Circumference of Young Adults**

No significant relationship was seen between physical activity and waist circumference of young adults ( $r=0.062$ ) and ( $p=0.234$ ). This means that physical activity level of young adults does not have effect on waist circumference. This finding is different from the findings of Maruf et al in 2012 who found out that physical activity is negatively correlated with waist circumference [5].

#### **4.8 Relationship between Physical Activity and Waist-HIP Ratio of Young Adults**

A significant relationship was seen between physical activity and waist-hip ratio of young adults ( $r=0.355$ ) and ( $p=0.001$ ). This signifies that physical activity level of young adults has a role to play in the waist-hip ratio. This result supports the findings of Maruf who found a significant relationship between physical activity and waist-hip ratio [5].

#### **4.9 Relationship between Physical Activity and Dietary Intake of Young Adults**

This study also shows that there is no significant relationship between physical activity and diet frequency of young adults. ( $r=-0.025$ ) and ( $p=0.631$ ). This implies that physical activity level of young adults has no association with dietary intake of young adults.

### **5. CONCLUSION**

Male population has more physical active and BMI, with higher dietary intake than their female counterparts. Study also established through spearman ranks' correlation that, Dietary intake has no relationship with body mass index, hip circumference and waist circumference. However, its relationship with the waist-hip was positive for young adults Physical activity was also shown to have a relationship with BMI and waist-hip circumference in young adults.

### **6. RECOMMENDATIONS**

More studies with the more sophisticated approach are recommended. Since findings were neither based on cause and effect nor even on longitudinal observation (need for longer term studies) but merely descriptive and correlative. Interventional trials are also strongly recommended to provide more definite findings.

### **COMPETING INTERESTS**

Authors have declared that no competing interests exist.

### **REFERENCES**

1. Orhan O. The relationship between physical activity level, body mass index and body fat percentage in urban and rural elementary school students. Educational Research and Reviews. 2015;10(1):69.
2. World Health Organization (): Obesity: preventing and managing the global epidemic. Report of a WHO Consultation. WHO Technical Report Series 894. Geneva; 2000. Available:[www.who.int/trs/WHO\\_TRS\\_894.pdf](http://www.who.int/trs/WHO_TRS_894.pdf) (Accessed 27/07/2012 AJPARS Vol. 4, Nos. 1 & 2, June 2012, pp. 8 – 14.)
3. Ativie RN, Ubom RE, Taofeek AO, Ossai RN, Odigie OM, Igweh JC, Adedoyin RA. Impacts of 10 weeks interval and



- continuous exercise training on selected anthropometric, cardiovascular and metabolic indicators of overweight and obese females. *Journal of Applied Life Sciences International*. 2018;16(4):1-12.
4. Puska P, Waxman A, Porter D. World health organization global safety on diet. *Physical Activity*. 2006;4(1):8–14.
  5. Toeller M, Buyken AE, Heitkamp G, Cathelineau G, Ferriss B, Michel G. Nutrient intakes as predictors of body weight in European people with type 1 diabetes. *International Journal of Obesity Related Metabolic Disorder*. 2001;25: 1815–22.
  6. World Health Organization. Obesity: preventing and managing the global epidemic. Report of a WHO Consultation. WHO Technical Report Series 894. Geneva; 2012. Available:[www.who.int/trs/WHO\\_TRS\\_894.pdf](http://www.who.int/trs/WHO_TRS_894.pdf) (Accessed 27/07/2012 AJPARS Vol. 4, Nos. 1 & 2, pp. 8 – 14.)
  7. Croll JK, Neumark-Sztainer D, Story M, Wall M, Perry C, Harnack L. Adolescents involved in weight-related and power team sports have better eating patterns and nutrient intakes than non-sportinvolved adolescents. *J Am Diet Assoc*. 2006;106: 709–717.
  8. Adedoyin RA, Mbada CE, Balogun MO, Adebayo RA, Martins T, Ismail S. Obesity prevalence in adult residents of ile-ife, Nigeria. *Nigeria Quarterly Journal of Hospital Medicine*. 2009;19(1):63-68.
  9. Lewis CE, Jacobs DR Jr, McCreath H, Kiefe CI, Schreiner PJ, Smith DE, Williams OD. Weight gain continues in the 1990s: 10-year trends in weight and overweight from the CARDIA study: coronary artery risk development in young adults. *Am J Epidemiol*. 2000;151:1172–1181.
  10. US Department of Health and Human Services. *Healthy People 2010: Understanding and Improving Health*. Boston, MA: Jones and Bartlett Publishers; 2001.
  11. Epstein LH, Saelens BE. Behavioural economics of obesity: Food intake and energy expenditure. In: Bickel WK, Vuchinich RE, eds. 2000;12(4):134-190.
  12. Taylor AH, Cable NT, Faulkner G, Hillsdon M, Narici M, van der Biz AK. Physical activity and older adults: A review of health benefits and the effectiveness of interventions. *J Sports Sci*. 2004;22: 703–725.
  13. Craig CL, Marshall AL, Sjostrom M, Bauman AE, Booth ML, Ainsworth BE. International physical activity questionnaire; 12-country reliability and validity. *Medicine and Science in Sports and Exercise*. 2003;35(8):1381-1395.

© 2018 Ativie et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

*Peer-review history:*  
*The peer review history for this paper can be accessed here:*  
<http://www.sciencedomain.org/review-history/26615>