Body Weight Perception and its Relationship with Anthropometric Indices of Undergraduate Students in Port Harcourt, Nigeria

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ABSTRACT

Background to the study*: Influences from the media has increased the consciousness of young adults about their body weight and size. The aim of the present study was to evaluate body weight perception and its relationship with anthropometric indices of undergraduate students in Port Harcourt.*
Material and methods*: The study involved a total of 600 undergraduate students aged 18-35 years (including 249 males and 351 females). Body weight perception was assessed using a structured questionnaire. The anthropometric indices (weight, height, waist, hip and shoulder circumference and foot length) of each subject were measured using standard methods while the ratios were calculated.*
Results and discussion*: The average BMI of undergraduates was 23.66±0.13kg/m^2. There was no significant gender difference in BMI, hip circumference and foot length. Waist circumference and waist-to-hip ratio were significantly higher in males while waist-to-height ratio was significantly higher in females. There was significant correlation between BMI and hip circumference, shoulder circumference and waist circumference but no significant correlation exists between BMI and foot length. The incidence of obesity amongst undergraduates in Port Harcourt was as low as 3.3% using the measured BMI even when only 1.5% admitted being obese. The actual BMI classified overweight was 25.7% as against perceived overweight of 19.8%. Only 56.3% perceived themselves to be within the normal weight whereas up to 67.5% were actually normal weight. The incidence of underweight was 3.5% but as many as 22.3% of undergraduates perceived they were underweight.*
Conclusion*: In conclusion, there is a similarity between actual BMI and perceived BMI amongst undergraduates. Using both the actual and perceived BMI classifications, more of the males were within the underweight and normal weight classes whereas overweight and obesity were commoner in the females. Although there was gender similarity in BMI, waist-to-height ratio was significantly higher in females whereas waist-to-hip ratio was significantly higher in males. Waist-to-height ratio therefore was more useful in assessing abdominal size in females while waist-to-hip ratio was more*

useful in assessing abdominal size in young adult males. Amongst the anthropometric indices, foot length was a poor tool in assessing body weight.

Key words: *Body weight perception, anthropometric indices, undergraduate students.*

INTRODUCTION

Body weight is a sum total of the physiological composition of the body including; fluids, muscle, bone and fats. Despite the contributions of muscle and bone mass to body weight, it is the sum of body fat that determines the adverse health conditions associated with obesity (1). Body weight alone could not account for the whole body fat since people who are tall or athletic would have more of bone or muscle mass. An estimate of the body fat is provided by Body mass index (BMI); however, the actual percentage body fat can be determined more appropriately using specific methods (2,3). Anthropometric indices are weight-related measurements of the body used either to assess the nutritional status of individuals or as a tool in predicting the likelihood of certain diseases including hypertension and diabetes mellitus (4). Studies in different regions of the world have drawn a connection between how healthy a person would be with his/her body size (5,6,7). Abnormal weights are also known to trigger psychological problems such as anxiety, low self-esteem and depression especially amongst young people (8,9).

Although, BMI is commonly used to assess body weight, in some instances people with normal BMI might have localized obesity especially in the abdomen, hip or trunk which still predisposes them to adverse health conditions. Therefore, a clear knowledge of the connection between anthropometric parameters and adverse health conditions would improve the role of weight management either as a preventive or as a therapeutic measure. Factors such as level of physical activity, nutrition, certain medications and genetic make-up can to a great extent influence body weight (10,11,12,13,14,15). High risk of abnormality in body weight may also be associated with some developmental defects. This is because there are critical periods within which any insult or alteration in development could ultimately predispose to abnormal weight later in life. For instance, malnutrition in the prenatal period could lead to obesity later in life (16). Other critical periods include; adolescence, pregnancy and immediate post-partum period (13,17,18). BMI relates body weight (kg) with height (m) and is represented mathematically; BMI = Weight (kg)/ height^2 (m^2).

Using the BMI scale, individuals are classified thus; underweight (below 18.5kg/m^2), normal weight (18.5-24.9kg/m^2), overweight (25.0 – 29.9kg/m^2) and obese ($\geq$ 30.0kg/m^2) depending on the number obtained when their BMI is calculated (19,20).

Body weight perception refers to the personal assessment of one's weight as 'underweight' or 'normal weight' or 'overweight' irrespective of actual BMI. It could be described as an individual's estimate of body image with all of the accompanying feelings, attitudes and thoughts concerning weight, size, shape and appearance (21). The way an individual perceives his/her weight is largely determined by factors such as age, media, family, gender, peers, ethnicity (19) and even career or job. Therefore, an individual's perception of his/her weight determines whether or not to lose or gain

weight. This in effect would influence their choice of weight control behavior and the success or failure of these behaviors relies largely on the actual weight.

Results from the present study will provide data on the anthropometric parameters of undergraduates and by inference, young adults in Port Harcourt. It will serve as a basis to apply appropriate weight control behaviors directed not only at controlling the BMI but also specific body parts. The aim of this study is to evaluate the relationship between blood pressure, blood glucose and anthropometric indices of undergraduate students in Port Harcourt. The study objectives include; to determine the values of anthropometric parameters, blood pressure and blood glucose and to compare their gender variations, to evaluate the perceived body weights and to correlate body mass index (BMI) with other anthropometric parameters, blood pressure and blood glucose.

MATERIALS AND METHODS

This cross sectional study was conducted between July 2019 and February 2020. A total of 600 students (including 249 males and 351 females) were randomly selected from three tertiary institutions in Port Harcourt; University of Port Harcourt, Rivers State University and Captain Elechi Amadi Polytechnic. Apparently healthy undergraduate students aged of 18-35 years who gave consent to participate were included in the study. Undergraduates who were currently taking medications or those that are drug addicts were excluded from the study. The height of each subject was determined using a height measurement scale with the subject standing erect without shoes and recorded to the nearest meter (m). Body weight (in kg) was determined using a weighing scale with the subject standing on the scale without shoes. The measured weight and height of each subject was thereafter used to calculate the BMI (kg/m^2).

Waist circumference was measured while the subject was standing by placing an inelastic plastic fiber tape around the trunk at mid-point between the costal margin and the iliac crest just after expiration (22) and recorded in meters (m). Hip circumference was measured while the subject was standing by placing the tape around the hip at the area of maximum extension of the buttocks. At an erect position with both arm adducted, the shoulder circumference was measured by placing the tape around the widest part of the shoulder. Shoe size was determined using a meter rule. First the foot was placed on a clean sheet of paper and the circumference traced with a pencil. Then the longest distance and the width between the widest points on the tracing were measured and recorded in cm. The waist-to-hip ratio and waist-to-height ratio were respectively calculated. Structured questionnaires were administered to the study participants to obtain information on demographic details and body weight perception. Body weight perception was assessed using the questionnaire where the subject was asked to describe his/her weight. Responses were rated on a 4-point scale: 1; underweight, 2; Normal weight, 3; overweight 4; obese. These were recorded as perceived BMI.

Ethical approval for the study was obtained from the university of Port Harcourt ethics and research management committee (UPH/CEREMAD/REC/MM67/007). The study was well explained to the participants and each participant gave oral and written consent. There was no foreseen risks and discomfort expected by participating in this research. The participants at any point in time could decide to withdraw without any consequences. The results were analyzed using SPSS version 23.0. Data were presented in tables and graphs. Continuous variables were expressed as mean ± SEM.

Comparison of variables was analyzed using One Way Analysis of Variance (ANOVA) at the confidence limit of 95%. Difference between variables was considered statistically significant at $p<0.05$.

RESULTS AND DISCUSSIONS

Table 1; Anthropometric parameters of undergraduates

Parameters	**Total (600)**	**Male (249)**	**Female (351)**
BMI (kg/m^2)	23.66± 0.13	23.37 ± 0.17	23.87 ± 0.18
Height (m)	1.68 ± 0.00	1.74 ± 0.01*	1.65 ± 0.01
Waist circumference (m)	0.74± 0.00	0.75 ± 0.00*	0.73 ± 0.00
Hip circumference (m)	0.94± 0.00	0.94 ± 0.00	0.94 ± 0.00
Shoulder circumference (m)	0.85± 0.00	0.91 ± 0.00*	0.81 ± 0.00
Foot length (m)	0.25± 0.00	0.26 ± 0.00	0.25 ± 0.00
Waist-to-hip ratio	0.78± 0.00	0.80 ± 0.00*	0.77 ± 0.00
Waist-to-height ratio	0.44± 0.00	0.43 ± 0.00	0.44 ± 0.00*
Shoulder-to-waist ratio	1.16± 0.00	1.21 ± 0.01*	1.12 ± 0.01

Values are Mean ± SEM. *Significant gender difference ($p<0.05$).

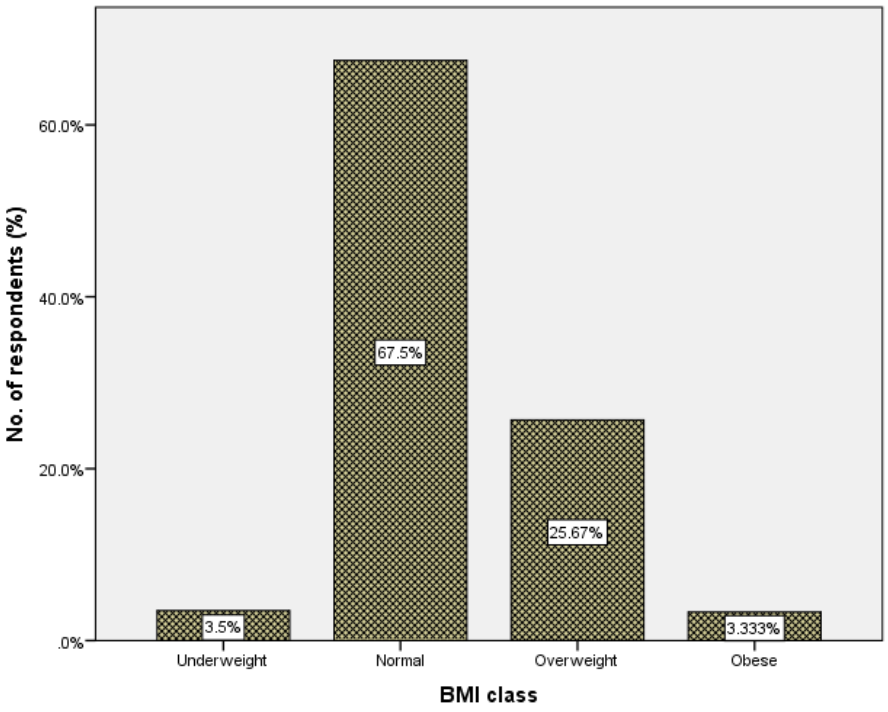

Fig. 1 BMI classes of respondents

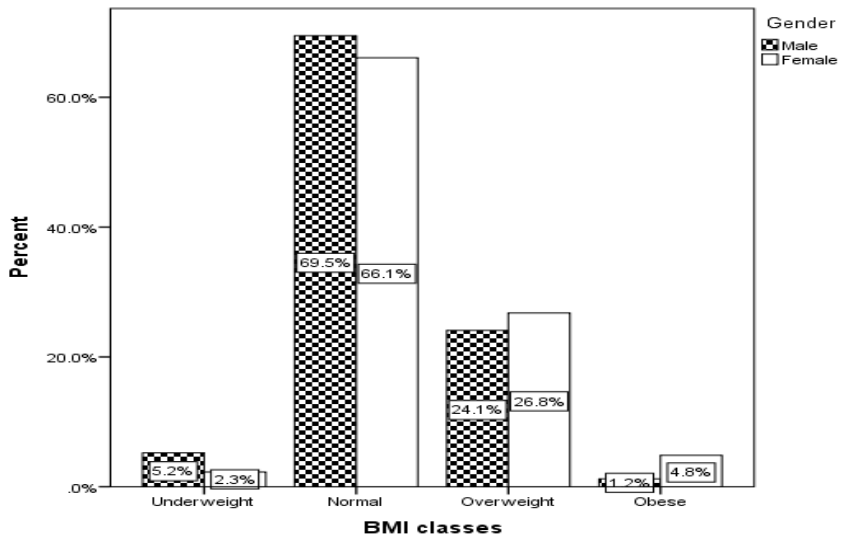

Fig. 2 Gender differences in BMI classes

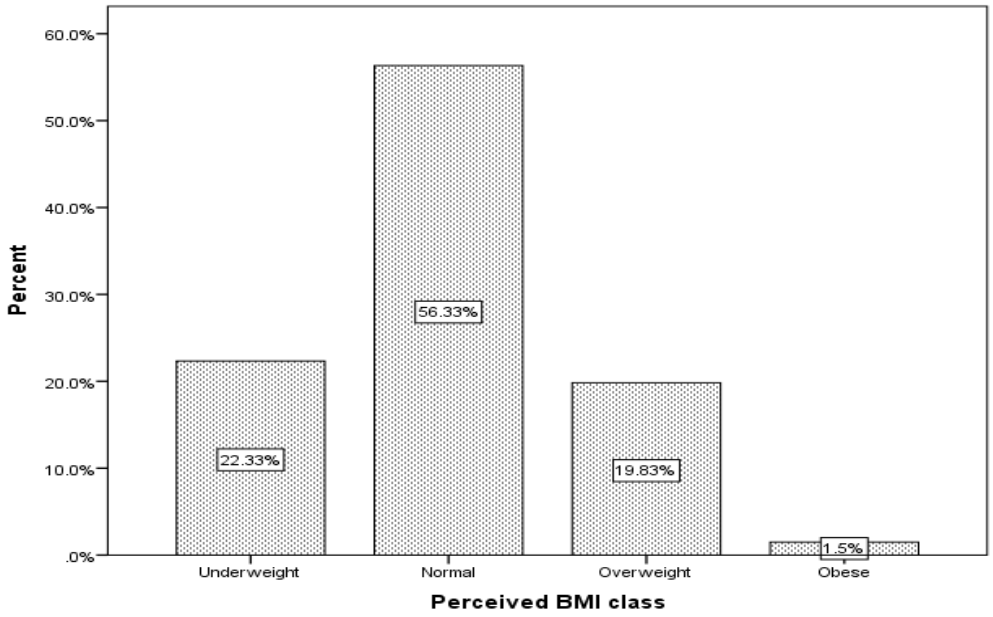

Fig. 3 Body weight perception of respondents

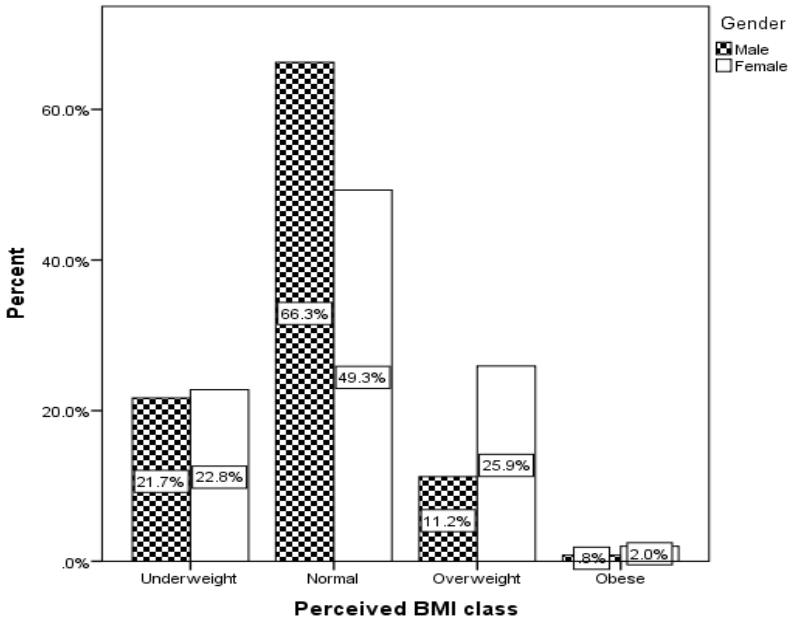

Fig. 4 Gender differences in body weight perception

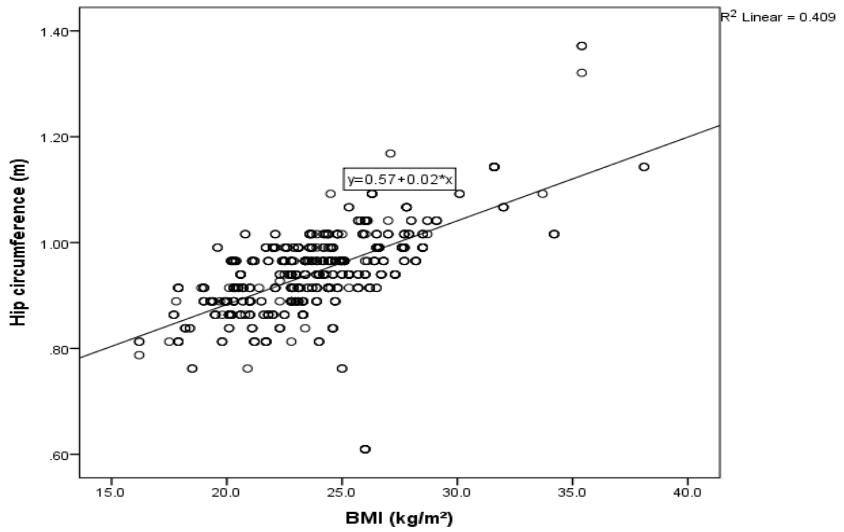

Fig. 5 Correlation between Hip circumference and BMI

(Significant correlation at $p < 0.01$, Pearson's)

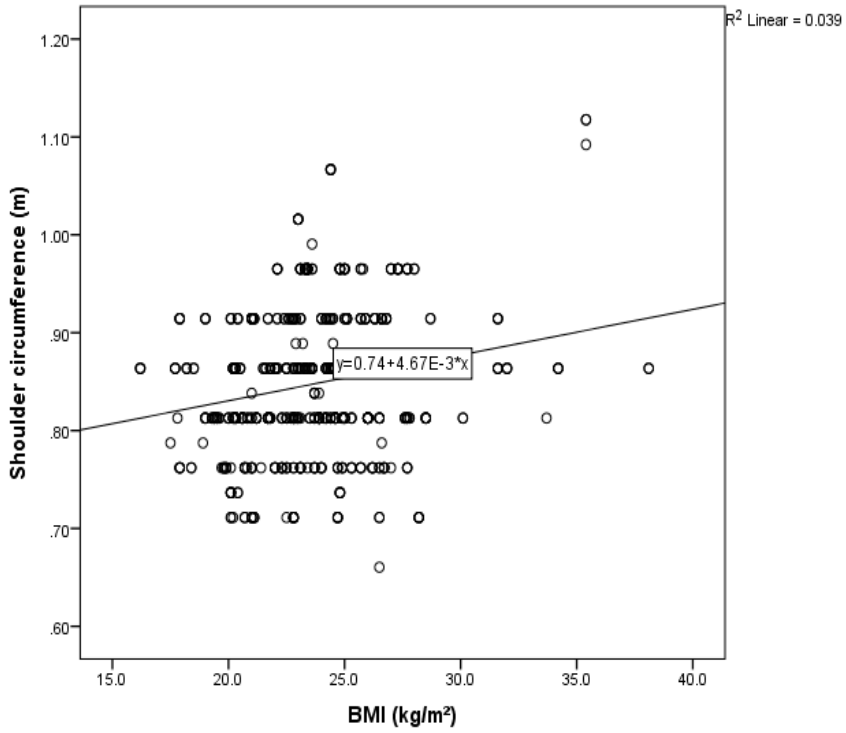

Fig. 6 Correlation between shoulder circumference and BMI

(Significant correlation at $p< 0.01$, Pearson's)

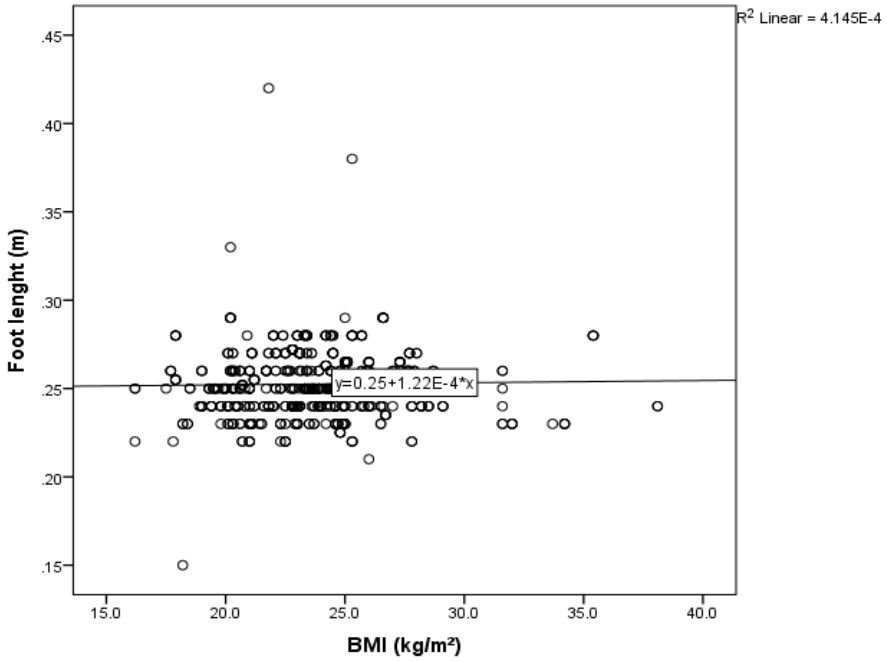

Fig. 7 Correlation between Foot length and BMI
(No significant correlation at $p< 0.01$, Pearson's)

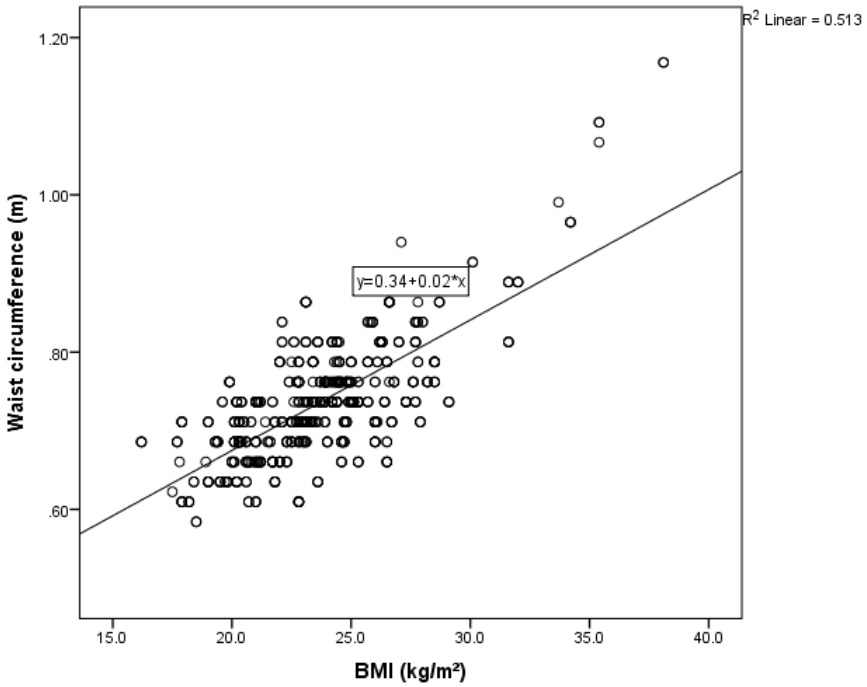

Fig. 8 Correlation between Waist circumference and BMI
(Significant correlation at $p < 0.01$, Pearson's)

DISCUSSION

The present study showed no significant gender differences in age, BMI, hip circumference and foot length (Table 1). However, the waist circumference, shoulder circumference, waist-to-hip ratio and shoulder-to-waist ratio were significantly higher in males. The visceral pattern of fat distribution is commoner in males causing an increased waist circumference in post-pubertal males (23,24) partly due to higher dietary fat uptake by their abdominal viscera (25). Increased abdominal size is associated with increased risk of cardio-metabolic conditions which have been reportedly higher in men (26,27). Even though, males have higher waist circumference as reported in the present study, non-pregnant females are usually more mindful of their abdominal size and would promptly apply measures like exercise and dieting to control it (28). The present study showed that waist-to-height ratio was significantly higher in females (Table 1). A higher waist-to-height ratio would make the abdomen to appear bigger and a perception of higher waist circumference as seen in females. Despite having similar BMI, the males were generally taller than the females indicating that the females might have more localized fats. Therefore waist-to-height ratio could be a better anthropometric index in assessing abdominal size especially in young women since it is a measure of the distribution of fat in the body (29). Conversely, waist-to-hip ratio was significantly higher in males and could also be a useful tool in assessing abdominal size in males. There was significant correlation between BMI and hip circumference, shoulder circumference and waist circumference but no significant correlation exists between BMI and foot length (Figs. 5, 6, 7 and 8). The incidence of obesity amongst undergraduates in Port Harcourt was as low as 3.3% using the measured BMI which is

similar to other studies in developing countries (30) even when only 1.5% admitted being obese. Studies in more developed countries indicate higher obesity prevalence in both adults and adolescents (31,32). The actual BMI classified overweight was 25.7% as against perceived overweight of 19.8%. Only 56.3% perceived themselves to be within the normal weight whereas up to 67.5% were actually normal weight. The incidence of underweight was 3.5% but as many as 22.3% of undergraduates perceived they were underweight. This means that a greater number of those who perceived themselves to be underweight were actually within normal weight. The present study also showed that more females were both overweight and obese whereas more males were underweight and normal weight (Table 2). A similar trend was reported by Osunkwo *et al*., 2021 (33) in Benue state, Nigeria. Results also showed that more females perceived that they were overweight and obese while more male were within normal weight.

BMI has been associated with waist circumference in other studies (34). Weight management should not only be aimed at achieving normal BMI but also in reducing obesity in different body parts considering that BMI alone may not be a good tool in assessing the cardio-metabolic risk associated with increased adiposity in adults (Ross *et al*., 2020).

In conclusion, there is a similarity between actual BMI and perceived BMI amongst undergraduates. Using both the actual and perceived BMI classifications, more of the males were within the underweight and normal weight classes whereas overweight and obesity were commoner in the females. Despite similarity of BMI, waist-to-height ratio was significantly higher in females whereas waist-to-hip ratio was significantly higher in males. Waist-to-height ratio therefore was more useful in assessing abdominal size in females while waist-to-hip ratio was more useful in assessing abdominal size in young adult males. Amongst the anthropometric indices, foot length was a poor tool in assessing body weight.

REFERENCES

1. Bray, G. A (2004). Medical consequences of obesity. *J Clin Endocrinol Metab*.; 89 (6): 2583-9.
2. De Lorenzo, A., Bianchi, A., Maroni, P., Iannarelli, A., Di Daniele, N., Iacopino, L., & Di Renzo, L (2013). Adiposity rather than BMI determines metabolic risk. *Int J Cardiol.*; 166 (1): 111-7.
3. Kryst, Ł., Żegleń, M., Wronka, I., Woronkowicz, A., Bilińska-Pawlak, I., Das, R., Saha, R., Das, S., & Dasgupta, P (2019). BMI and adiposity based approach to obesity: the need for ethnic specificity. A reply to Kapoor et al. (2019). *J Biosoc Sci*.; 51(4): 622-623.
4. Peltzer, K., & Pengpid, S. (2012). Body weight and body image among a sample of female and male South African university students. *Gender & Behaviour*.; 10 (1): 4509-4522.
5. Al-Goblan, A. S., Al-Alfi, M. A., Khan, M. Z., (2014). Mechanism linking diabetes mellitus and obesity. *Diabetes Metab Syndr Obes*.; 7: 587-91.
6. Nwafor, A., Mmom, F. C., Obia, O., Obiandu, C., Hart, V. O., and Chinko, B. C. (2015). Relationship between Blood Glucose and Body Mass Index and Coexisting Prehypertension and Prediabetes among Rural Adults in Niger Delta Region, Nigeria. *British Journal of Medicine and Medical Research*. 9 (7): 1-12.

7. Jiang, S. Z., Lu, W., Zong, X. F., Ruan, H. Y., Liu, Y., (2016). Obesity and hypertension. *Exp Ther Med*.; 12 (4): 2395-2399.
8. McElroy, S. L., & Keck, P. E. Jr. (2012). Obesity in bipolar disorder: an overview. *Curr Psychiatry Rep*.; 14 (6): 650-8.
9. Sarwer, D. B., & Polonsky, H. M. (2016). The Psychosocial Burden of Obesity. *Endocrinology and metabolism clinics of North America*, *45*(3), 677–688.
10. Ness-Abramof, R., & Apovian, C. M. (2005). Drug-induced weight gain. *Drugs Today (Barc).*; 41(8): 547-55.
11. Jakicic, J. M. (2009). The effect of physical activity on body weight. *Obesity (Silver Spring).*; 17 Suppl 3: S34-8.
12. Obia, O., Ogwa, C. O., Ojeka, S. O., Ajah, A. A., and Chuemere, A. N. (2016). Effect of honey on the body weight of glibenclamide treated alloxan induced diabetic. *Journal of Apitherapy.* 1 (1): 33-35.
13. Kostovski, M., Tasic, V., Laban, N., Polenakovic, M., Danilovski, D., & Gucev, Z (2017). Obesity in Childhood and Adolescence, Genetic Factors. *Pril (Makedon Akad Nauk Umet Odd Med Nauki).*; 38(3): 121-133.
14. Sha, J. C. M., Kurihara, Y., Tsuji, Y., Take, M., He, T., Kaneko, A., Suda-Hashimoto, N., Morimoto, M., Natsume, T., Zahariev, A., Blanc, S., Hanya, G (2018). Seasonal variation of energy expenditure in Japanese macaques (Macaca fuscata). *J Therm Biol*.; 76: 139-146.
15. Schlaff, R. A., Baruth, M., Deere, S. J., Boggs, A., Odabasic, A (2020). Associations between prenatal diet quality and gestational weight gain. *Nutr Health*.; 26(1): 13-18.
16. Manuel-Apolinar, L., Rocha, L., Damasio, L., Tesoro-Cruz, E., & Zarate, A. (2014). Role of prenatal undernutrition in the expression of serotonin, dopamine and leptin receptors in adult mice: Implications of food intake. *Molecular Medicine Reports*, 9: 407-412.
17. Amorim, A. R., Rössner, S., Neovius, M., Lourenço, P. M., & Linné, Y (2007). Does excess pregnancy weight gain constitute a major risk for increasing long-term BMI? *Obesity (Silver Spring).*; 15(5): 1278-86.
18. Hildén, K., Hanson, U., Persson, M., & Fadl, H (2016). Overweight and obesity: a remaining problem in women treated for severe gestational diabetes. *Diabet Med*.; 33(8): 1045-51.
19. Bhurtun, D. D., & Jeewon, R (2013). Body Weight Perception and Weight Control Practices among Teenagers. *ISRN Nutr*.; 2013: 395125.
20. www.euro.who.int › nutrition › a-healthy-lifestyle › body-mass-index-bmi. Accessed 2019.
21. Wang, Y., Liu, H., Wu, F., Yang, X., Yue, M., Pang, Y., Li, X., Ma, J., Zhou, G., Gong, P., Liu, M., & Zhang, X. (2018): The association between BMI and body weight perception among children and adolescents in Jilin City, China. *PLoS ONE* 13(3): e0194237.
22. Patnaik, L., Pattnaik, S., Rao, E. V., & Sahu, T (2017). Validating Neck Circumference and Waist Circumference as Anthropometric Measures of Overweight/Obesity in Adolescents. *Indian Pediatr*.; 54(5): 377-380.
23. Nedungadi, T. P., & Clegg, D. J. (2009). Sexual dimorphism in body fat distribution and risk for cardiovascular diseases. *J Cardiovasc Transl Res.;2*(3), 321-7.
24. Schorr, M., Dichtel, L. E., Gerweck, A. V., Valera, R. D., Torriani, M., Miller, K. K., Bredella, M. A. (2018). Sex differences in body composition and association with cardiometabolic risk. *Biol Sex Differ*.; 9(1): 28.

25. Nauli, A. M., & Matin, S (2019). Why Do Men Accumulate Abdominal Visceral Fat? *Front Physiol*.; 10: 1486.
26. Kahn, H. S., Bullard, K. M (2016). Beyond Body Mass Index: Advantages of Abdominal Measurements for Recognizing Cardiometabolic Disorders. *Am J Med*.; 129(1): 74-81.e2.
27. Goossens, G. H., Jocken, J. W. E., Blaak, E. E (2021). Sexual dimorphism in cardiometabolic health: the role of adipose tissue, muscle and liver. *Nat Rev Endocrinol*.; 17 (1): 47-66.
28. Long, Z., Huang, L., Lyu, J., Xia, Y., Chen, Y., Li, R., Wang, Y., & Li, S. (2022). Trends of central obesity and associations with nutrients intake and daily behaviors among women of childbearing age in China. *BMC women's health*, *22*(1), 12.
29. Aguilar-Morales, I., Colin-Ramirez, E., Rivera-Mancía, S., Vallejo, M., & Vázquez-Antona, C. (2018). Performance of Waist-To-Height Ratio, Waist Circumference, and Body Mass Index in Discriminating Cardio-Metabolic Risk Factors in a Sample of School-Aged Mexican Children. *Nutrients*, *10*(12), 1850.
30. Poobalan, A., & Aucott, L. (2016). Obesity Among Young Adults in Developing Countries: A Systematic Overview. *Current obesity reports*, *5*(1), 2–13.
31. Hills, A. P., Andersen, L. B., & Byrne, N. M (2011). Physical activity and obesity in children. *Br J Sports Med*.; 45 (11): 866-70.
32. Wright, S. M., & Aronne, L. J (2012). Causes of obesity. *Abdom Imaging*.; 37(5): 730-2.
33. Osunkwo, D. A., Nguku, P. M., Mohammed, A., Umeokonkwo, C. D., Kamateeka, M., Ibrahim, M., Kefas, I. B., Abolade, O. S., Nwokeukwu, H. I., & Zoakah, A. I (2021). Prevalence of obesity and associated factors in Benue State, Nigeria: A population-based study. *Ann Afr Med*.; 20(1): 9-13.
34. Ross, R., Neeland, I. J., Yamashita, S., Shai, I., Seidell, J., Magni, P., Santos, R. D., Arsenault, B., Cuevas, A., Hu, F. B., Griffin, B. A., Zambon, A., Barter, P., Fruchart, J. C., Eckel, R. H., Matsuzawa, Y., Després, J. P (2020). Waist circumference as a vital sign in clinical practice: a Consensus Statement from the IAS and ICCR Working Group on Visceral Obesity. *Nat Rev Endocrinol*.; 16(3): 177-189.