Journal of Advances in Medicine and Medical Research

Volume 35, Issue 23, Page 60-68, 2023; Article no.JAMMR.108442
ISSN: 2456-8899
(Past name: British Journal of Medicine and Medical Research, Past ISSN: 2231-0614, NLM ID: 101570965)

Evaluation of Serum Leptin Levels and Some Anthropometric Parameters among Women of Reproductive Age in Port Harcourt, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. Author HAW designed the study, Author ESB wrote the protocol and Author MHI wrote the first draft of the manuscript. Authors HAW and MHI managed the analyses of the study. Authors KNE and OI managed the literature searches and Author KNE performed the statistical analysis. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JAMMR/2023/v35i235283

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/108442

Original Research Article

Received: 29/08/2023
Accepted: 04/11/2023
Published: 09/11/2023

ABSTRACT

Aim: To evaluate and correlate the levels of leptin levels and some anthropometric parameters among women of reproductive age in Port Harcourt.
Study Design: The population of women of reproductive age in Port Harcourt Local Government Area was sampled. The subjects were selected using simple random technique.
Methodology: The study involved 150 subjects, who were within the age bracket of 20 and 60 years, who had given their informed consent to participate in this study, and were without chronic

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condition or undergoing any medical treatment or procedure. The anthropometric parameters, such as body mass index (BMI), Waist-to-Hip ratio (WHR) were obtained using appropriate techniques. Three milliliters (3ml) of venous blood was collected into plain bottles for the assay of leptin (using ELISA technique).

Results: The mean values of the BMI and WHR were 28.72 ± 10.31kg/m2 and 0.83 ± 0.22 respectively. These were above the reference ranges. Leptin (3.56 ± 0.93ng/ml) was within the reference range.The results also show that the BMI and WHR correlated positively with the leptin levels. Also, BMI,WHR and leptin values increased with age.

Conclusion: There was positive correlation between leptin levels and all the anthropometric parameters showing that there might be a tendency of the population under study to be over weighted and obese. It is recommended that these parameters be monitored in women of reproductive age as part of the assessment of their health status.

Keywords: Anthropometric measurements; leptin levels; reproductive age women; Port Harcourt.

1. INTRODUCTION

"Anthropometric parameters serve as simple parameters that can provide valuable health information. Anthropometric indices are important clinical parameters which can be easily assessed at a low cost" [1]. "The proven link between anthropometric indices and leptin has immense public health implications. Anthropometric measurements are non-invasive, easy to apply, and inexpensive techniques which help to evaluate body composition of all ages" [2]. Measurements of some anthropometric indices will be guidance for the growth and development of the future adult life.

"However, leptin, a polypeptide hormone, secreted in concentrations proportional to body fat mass, plays an important role in several physiological functions like energy homeostasis, immunity, and reproduction, with possible implication in other conditions (such as hepatic steatosis, depression etc.)" [3,4,5]. "Leptin is required to maintain normal body weight, as it lowers food intake and increases energy expenditure" [3].

"Obese individuals, however, might express high serum leptin concentrations but fail to properly control food intake and regulate the body's energy reserve, thus exhibiting leptin resistance. Moreover, high leptin levels that fail to regulate insulin secretion might suggest leptin resistance at the pancreatic β-cell level" [5].

Anthropometric measurements and indices such as waist circumference (WC), hip circumference (HC), mid arm circumference (MAC), body mass index (BMI), waist to hip ratio (WHR) and waist to height ratio (WHtR) are used as simple standard measures to assess obesity and body fat levels worldwide [6,7,8]. Both serum leptin and anthropometric parameters are used to assess obesity. Thus, it would be of value if both these parameters were compared as parameters to assess obesity and related disorders.

"There is a dearth of studies on the anthropometric parameters and leptin in our population. In other words, not much has been established with regards to anthropometric indices and leptin in Women of reproductive age living in Port Harcourt. Some of these anthropometric parameters, like waist circumference in African populations have not been properly defined due to lack of appropriate data, and therefore, it has been recommended that the cut-off points derived from European population groups are used for African subjects [9]. It is possible that there may be differences particularly in the interpretation of Waist Circumference values as there seems to be a lack of universally accepted site for measuring Waist Circumference and also the large variation of Waist Circumference optimal cut-off being affected by age, sex, race, and ethnicity; and so also with other anthropometric parameters such as BMI, which has been observed to not be sensitive to Women" [10,11].

This study, therefore, set out to evaluate the serum leptin levels and some anthropometric parameters in different age groups of reproductive women living in Port Harcourt, Nigeria.

2. MATERIALS AND METHODS

2.1 Study Population

The population of women of reproductive age in Port Harcourt Local Government Area is 281 [12]. Sample size was determined using GPower 3.1.9.2, at power of 0.8, effect size 0.5 and alpha

error probability of 0.05. Total sample size was 128, but this study adopted a sample size of 150.

2.2 Study Area

The samples were taken from Creek Road Market, Borokiri, Port Harcourt Local Government Area of Rivers State.

2.3 Population Size

A sample size of 150 apparently healthy women of reproductive age subjects between the ages of 20-60 years were used. A well-structured questionnaire was used to gather relevant information (such as age, Weight, Height, BMI, Waist Circumference, Hip Circumference, WHR, etc) from each subject after a written informed consent had been obtained from them.

2.4 Data Collection

Demographic data and clinical history were obtained using structured questionnaires. Body weight, height, waist circumference (WC), hip circumference (HC) were measured while body mass index (BMI) and waist to hip ratio (WHR) were calculated in all study subjects.

2.5 Criteria for Sample collection

All non-diabetic obese subjects had initial fasting plasma glucose (FPG) screening test done with Accu-check active glucometer to aid in the selection of subjects with normoglycaemia alone.

2.6 Sample Collection

3 mls of venous blood sample under aseptic procedure from the cubital fossa of each subject after an overnight fast of at least 8 hours was taken into a plain specimen bottle for serum leptin analysis using an enzyme linked immunosorbent assay (ELISA) method. The test was carried out and interpreted according to the manufacturer's instructions.

Reagents: Human LEP (Leptin) ELISA kit manufactured by ELK biotech, Denver, USA. Lot: 20365084741, Expiry Date: 30.11.2023, Mindray MR96A.

2.7 Anthropometric Measurements

Measurement of Height (H) in meters (m) as described by Ononamadu et al. [13] was carried out in subjects without wearing head gear and shoes standing in an erect position with both feet flat on the platform at the base against a graduated height scale (Seca stadiometer) to the nearest 0.5 centimeters (cm).The arms were by the sides and the head was oriented in the Frankfort horizontal plane with the subject looking straight at a distant object while the reading was taken against the vertical at the level of the vertex. Measurement of Weight (W) as described by Lee et al. [14] was measured with the subjects standing on a standardized weighing scale (Seca Weighing Scale) that was placed on an even horizontal hard surface to the nearest 0.1 kilogram (kg). Body Mass Index (BMI) as described by Ononamadu et al. [13] was calculated as the weight of subjects in kilogram divided by square the value of the height of the same subject in meters and recorded in kilogram per square meter (kg/m^2). Measurement of Waist Circumference (WC) as described by WHO [15] was measured using a flexible non stretch measuring tape at a point halfway between the lower margin of the lowest palpable rib and the top of the iliac crest with the tape parallel to the floor to the nearest 0.1 cm with the subject standing in a relaxed position with feet closed together and arms at the side. Measurement of Hip Circumference (HC) as described by WHO [15] was carried out on the subjects using a flexible non stretch measuring tape at a point around the widest portion of the buttocks with the tape parallel to the floor and the subject standing in a relaxed position with feet apposed together,arms at the side and body weight evenly distributed. Waist to Hip Ratio (WHR) as described by Lee et al. [14] was calculated by dividing the measured waist circumference of a subject by the measured Hip circumference of the same subject.

2.8 Statistical Analysis

The data generated from this study were analyzed using Statistical Package for Social Sciences (SPSS) version 25 (SPSS Inc. Chicago Illinois). Results were expressed as mean ± standard deviation (SD) and frequency (%), and presented in tables and charts as appropriate. Comparison of parameters with p-values less than or equal to 0.05, was considered statistically significant.

3. RESULTS

3.1 Demographic Characteristics of Subjects

The demographic data collated indicated a significant difference between the age interval of subjects (P=0.131). There was significant difference in tribe, with Ijaw tribe having the

highest frequency of 85. There was significant difference in the level of education of subjects as seen in the Table 1 as very few subjects have attained tertiary education. There was significant difference in the income status of subjects (P<0.001). There was significant difference in marital status of subjects (P= 0.033) and their parity as shown in Table 1.

3.2 Results of Anthropometric Parameters among the Subjects

The number of subjects with BMI of 18.5-24.9 (normal weight), 25-29.9 (overweight) and 30 & above (obese) were 39, 50 and 61. This showed no significant difference in the number of subjects in the different categories (P=0.089). The number of subjects with waist-to-hip ratio of "<0.81" and "0.81 and above" were 55 and 95 respectively showing a significant difference in the number of subjects (P=0.001). The waist circumference of subject with "<88 cm" and ">88 cm" results were 63 and 87 respectively showing a significant difference in number of subject (P=0.021) while the hip circumference of subjects with "<98 cm" and ">98 cm" were 5 and 145 respectively,also showing a significant difference in the number of subjects (P=0.001).This is reflected in Table 2.

3.3 Results of the Mean Values of Anthropometric Measurements with Leptin Values among Subjects

The mean values of Body Mass Index, Waist-to-Hip Ratio, Leptin, Waist Circumference and Hip Circumference among the subjects were 28.72±10.31 Kg/m^2, 0.83±0.22, 3.56±0.93 ng/ml, 94.40±8.05 cm and 113.96±5.38 cm respectively. This is shown in Table 3.

Table 1. Demographic characteristics of subjects

Subjects	Frequency	Prevalence	p-value	X^2-value
Age Interval				
a. 20 - 29	18	10	0.131	5.311
b. 30 – 39	32	17		
c. 40 – 49	60	51		
d. 50 - 59	40	22		
Tribe				
a. Ijaw	85	57	0.033	8.522
b. Ikwerre	42	28		
c. Ogoni/Eleme	05	03		
d. Igbo	18	12		
Occupation				
a. Business/Traders	150	100	-	-
Level of Education				
a. Primary	78	52	0.013	5.443
b. Secondary	55	37		
c. Tertiary	10	07		
d. None	07	04		
Religion				
a. Christianity	145	97	<0.001	10.153
b. Islam	05	03		
Income Status				
a. Low	140	94	<0.001	9.903
b. Middle	10	06		
c. Upper	0	-		
Marital Status				
a. Single	20	30	0.033	8.522
b. Married	87	58		
c. Divorced	25	17		
d. Widowed	18	12		
Parity				
a. Nullipara	21	14	0.001	5.443
b. Multipara	92	61		
c. Primipara	37	25		

Table 2. Comparison of anthropometric parameters among the subjects

Anthropometric Parameter	Number	Prevalence	p-value	X^2-value
Body Mass Index (kg/m^2)				
<18.5	-			
18.5-24.9	39	26	0.089	4.840
25-29.9	50	33		
30 & above	61	41		
Waist Circumference				
≤ 88	63	42	0.021	4.443
> 88	87	58		
Hip Circumference				
≤ 98	5	3	0.001	6.931
> 98	145	97		
Waist-to-hip ratio				
<0.81	55	37	0.001	10.667
0.81 & above	95	63		

Table 3. Mean ± SD of anthropometric parameters / leptin levels in the subjects

Parameter	Mean ± SD	Reference Values
Body Mass Index (kg/m^2)	28.72 ± 10.31	18.5-24.9
Waist-to-hip ratio	0.83 ± 0.22	<0.81
Leptin (ng/ml)	3.56 ± 0.93	0.5-15.5
Waist Circumference	94.40 ± 8.05	≤88 cm
Hip Circumference	113.96 ± 5.38	≤48 cm

3.4 Comparison of Parameters according to Age Groups

The BMI for subjects within age ranges (years) of 20-29, 30-39, 40-49, 50-59, were 24.41±3.52, 27.52±3.46, 33.29±5.31, 33.75±2.71 respectively. There was a significant difference in BMI (P<0.001) among the different age ranges. The WHR for the age ranges were 0.82±0.03, 0.82±0.03, 0.85±0.03, 0.85±0.02 respectively showing a significant difference in WHR (P<0.001). The leptin levels (ng/ml) for subjects in the different age ranges were 2.19 ± 0.96, 2.84 ± 1.00, 6.03 ± 5.15, and 4.81 ± 2.67 respectively. There was a significant difference in the leptin levels (P<0.001) as shown in Table 4.

There was a positive correlation of leptin levels and the anthropometric parameters as shown on Fig. 1 and Fig. 2.

4. DISCUSSION

This work assessed the levels of leptin and some anthropometric parameters among female residents of reproductive age in Port Harcourt. The study involved 150 female subjects within the ages of 20 and 60 years. From the results, 33% of the subjects were overweight. This finding is similar to the findings reported by Ghose, [16] in the South-East, Nigeria. This may be due to the fact that obesity has been reported to be higher among urban dwellers than in rural

Table 4. Comparison of anthropometric parameters according to age groups

	BMI (kg/m^2)	WHR	Leptin (ng/ml)
A (20-29)	24.41 ± 3.52^a	0.82 ±0.03^a	2.19 ±0.96^a
B (30-39)	27.52 ± 3.46^b	0.82 ±0.03^a	2.84 ±1.00^a
C (40-49)	33.29 ± 5.31^c	0.85 ±0.03^b	4.03 ±5.15^b
D (50-59)	33.75 ± 2.71^c	0.85 ±0.02^b	4.81 ±2.67^b
p-value	<0.001	<0.001	<0.001
F-value	24.169	8.415	8.989
Remarks	S	S	S

Values with different superscripts are significantly different from each other (P≤0.05)

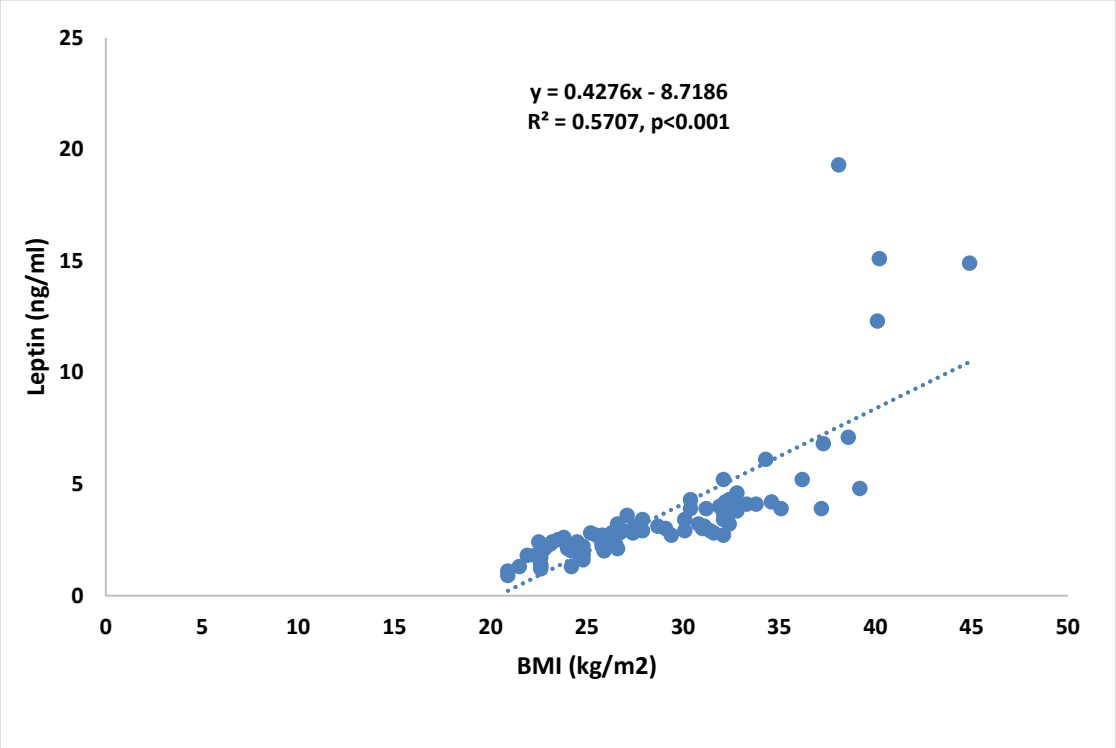

Fig. 1. Correlation plot of leptin versus BMI

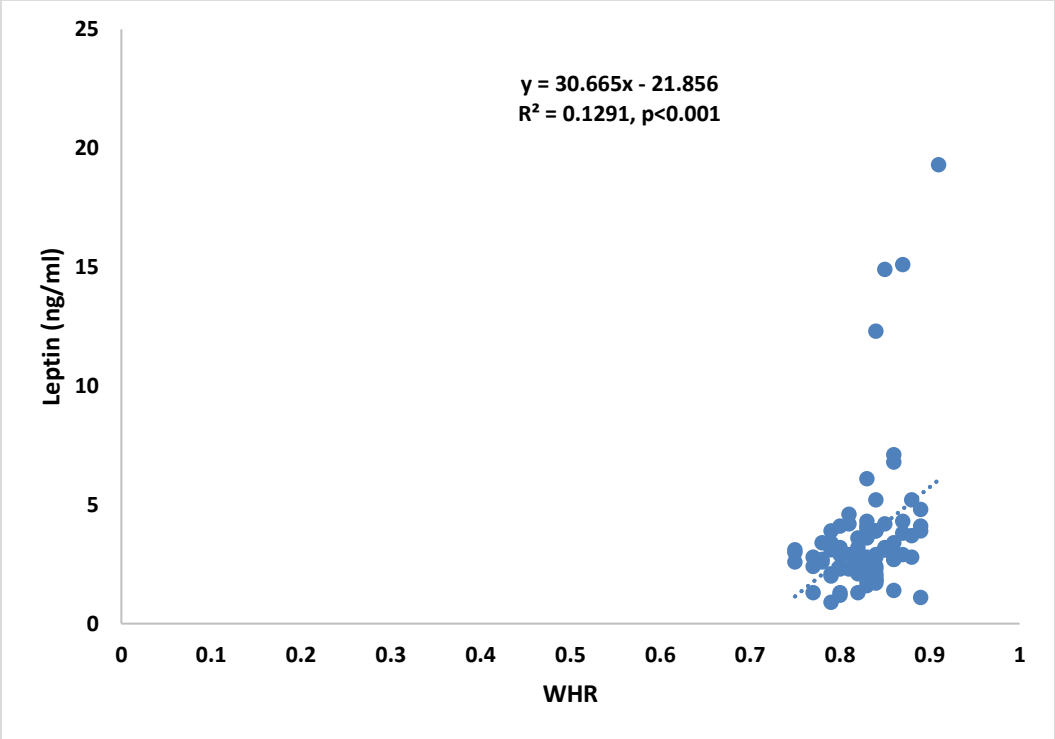

Fig. 2. Correlation plot of leptin versus WHR

dwellers, occasioned by the introduction of processed foods and its increased consumption [16].

The results also indicates that there was no statistical difference in the number of subjects in the different classes of BMI (P=0.089). Again, the mean BMI for the subjects in this study was higher than the WHO reference range for healthy classification indicating that the subjects in this study are regarded as obese. This may be due to changes in the dietary pattern among the subjects, which has been reported to be an important underlying factor for the increasing prevalence of overweight/obesity and associated complications, especially among women [16]. Sedentary lifestyle has also been reported to be a significant factor for obesity and associated complications [17]. This is seen in the lifestyle of these women in the market. This finding agrees with the work of Onyeji & Sanusi [18], who reported a similar finding among women of reproductive age in South-East, Nigeria.

From the study, the number of subjects who had WHR above the reference range was significantly more than the number of subjects whose WHR were below the reference range (P=0.001). The WHR has been reported to be higher in females, as well as higher among urban dwellers. This is linked to the dietary and lifestyle changes in our society. Our findings indicates that truncal obesity is common among the study subjects. This finding agrees with the work of Tagbo et al. [19].

The results from this study indicate that the mean BMI and WHR of the subjects were above the reference limits. However, the mean values of leptin levels were within the reference range. These findings indicate that the increased anthropometric parameters are not as a result of hyperglycaemia because the subjects were initially screened for normal fasting blood sugar level and none recruited for this study are diabetic. However, our observation indicates that majority of the subjects are obese which might be due to unhealthy eating habits as seen among market women and a high level of sedentary lifestyle lacking exercises as reported in the Niger Delta region of Nigeria [20]. Though, some studies shows that women in developing countries largely experience raised BMI as a sign of beauty and affluence, which contributes to obesity [21].

The mean values of BMI, WHR and leptin levels significantly increases with age as observed in this study. This may be due to physiological weight gain that result from increase in body fat [22]. This finding agrees with the report of Low et al. [21], which stated that body weight of women increases with age, and this weight gain might contribute to obesity and other complicated factors.However, this disagrees with the study by Liuzzi et al. [23] which stated that Leptin levels in the subjects under study did not relate with age.This study also revealed a positive correlation between leptin and BMI, WHR implying that these anthropometric parameters increases with the levels of leptin.But this contradicts the study where leptin was found to correlate directly with BMI and inversely with WHR [23] and corroborates the study by Houjeghani et al. [24] which showed that serum level of leptin correlated with BMI and WHR of patients with polycystic ovarian syndrome. Hence, these parameters be assessed in women of reproductive age, in order to provide some useful health information for women's health.

5. CONCLUSION

This study evaluated the levels of leptin and some anthropometric parameters in women of reproductive age in Port Harcourt. The mean levels of BMI and WHR of the subjects were above the reference range while the leptin levels were within reference ranges. These results indicate a prevalent obesity among the subjects, but not necessarily as a results of raised blood sugar. The results also show that the BMI and WHR all correlated positively with the leptin level, indicating that leptin may affect these anthropometric parameters. Our findings also show that BMI, WHR and Leptin values increased with age.Hence ,the need to be assessed in women of reproductive age, as they may provide some useful health information for maintaining a better health status of women within this age brackets.

ETHICAL APPROVAL

Ethical approval was obtained from the Health Research and Ethics Committee, Rivers State Hospitals Management Board, Rivers State referenced RSHMB/RSHREC/2022/030.

CONSENT

As per international standards or university standards, patient(s) written consent has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Egbe EO, Asuquo OA, Ekwere EO, Olufemi F, Ohwovoriole AE. Assessment of anthropometric indices among residents of Calabar, South-East Nigeria. Indian Journal of Endocrinology and Metabolism. 2014;18(3):386-389.
2. Karakaş S, Tellioğlu A, Dişcigil G, Karul AB, Türkmen M. Relationships between anthropometric measurements, leptin and IGF-1 levels in Turkish healthy newborns. Journal of Clinical and Experimental Investigations. 2015;6(3):214-219.
3. Ramos-Lobo AM, Donato JJ. The role of leptin in health and disease. Temperature (Austin). 2017;4(3):258-291.
4. Cernea S, Both E, Huţanu A, Şular FL, Roiban AL. Correlations of serum leptin and leptin resistance with depression and anxiety in patients with type 2 diabetes. Psychiatry Clinical Neuroscience. 2019; 73(12):745-753.
5. Cernea S, Both E., Fodor A. The association of anthropometric parameters with markers of insulin and leptin secretion and resistance in type 2 diabetes mellitus. Revista Romana de Medicina de Laborator. 2020;28(3):299-314.
6. Casadei K, Kiel J. Anthropometric Measurement. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022.
   PMID: 30726000.
7. Akpinar E, Bashan I, Bozdemir N, Saatci E. Which is the best anthropometric technique to identify obesity: Body mass index, waist circumference or waist-hip ratio? Coll Antropol. 2007;31(2):387-93.
   PMID: 17847914.
8. Lee BJ, Yim MH. Comparison of anthropometric and body composition indices in the identification of metabolic risk factors. Sci Rep. 2021;11:9931-9934.
9. Crowther NJ, Norris SA. The Current Waist Circumference Cut Point Used for the Diagnosis of Metabolic Syndrome in Sub-Saharan African Women Is Not Appropriate. PLoS ONE. 2012;7(11): e48883.
   DOI: 10.1371/journal.pone.0048883
10. Ross R, Neeland IJ, Yamashita S, Shai I, Seidell J, Magni P, et al. 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. 2020;16(3): 177-189.
    DOI: 10.1038/s41574-019-0310-7
11. Guerra RS, Amaral TF, Marques EA, Mota J, Restivo MT. Anatomical location for waist circumference measurement in older adults: A preliminary study. Nutr Hosp. 2012;27(5):1554-61.
    DOI: 10.3305/nh.2012.27.5.5922
    PMID: 23478705.
12. Kelechi AM. Perceived health implications of infertility among women of reproductive age in Port Harcourt metropolis of Rivers State. International Journal of Innovative Medicine & Medicinal Plants Research. 2022;10(1):18-26.
13. Ononamadu CJ, Ezekwesili CN, Onyeukwu OF, Umeoguaju UF, Ezeigwe OC, Ihegboro GO. Comparative analysis of anthropometric indices of obesity as correlates and potential predictors of risk for hypertension and pre hypertension in a population in Nigeria. Cardiovascular Journal of Africa. 2017;28(2):92–99.
14. Lee JW, Lim NK, Back TH, Park SH, Park HY. Anthropometric indices as predictors of hypertension among men and women aged 40–69 years in the Korean population: The Korean genome and epidemiology study. British Medical College of Public Health. 2015;15:140–146.
15. World Health Organization (WHO). Waist circumference and waist–hip ratio: Report of a WHO expert consultation, Geneva: World Health Organization; 2011.
16. Ghose B. Nutritional transition in South Asia: The emergence of non-communicable chronic diseases. F1000 Research. 2015;4(8):28-48.
17. Okoh M. Socio-Demographic correlates of overweight and obesity among women of reproductive age in Nigeria. African Journal of Reproductive Health. 2013; 17(4):66-76.
18. Onyeji GN, Sanusi RA. Prevalence of overweight and obesity among women of reproductive age in south-east Nigeria. Nigerian Journal of Nutritional Sciences. 2018;39(2):73-81.
19. Tagbo SO, Abebe D, Oguoma VM. Overweight and obesity among non-

pregnant women of reproductive age in Nigeria: Findings from the 2008-2018 Nigerian Demographic and Health Survey. Public Health. 2021;198:348-357.

20. 20..Alikor CA, Nwafor CE. The prevalence and Predictors of generalised obesity in a rural farming community in the Niger Delta Region of Nigeria. The Nigerian Health Journal. 2016;16(3):1-10.
21. Low S, Chin MC, Deurenberg-Yap M. Review on epidemic of obesity. Annals Academy of Medicine Singapore. 2009; 38(1):57-59.
22. Rezende FAC, Ribeiro AQ, Priore SE, Franceschinni SCC. Anthropometric differences related to genders and age in the elderly. Nutricion Hospitalaria. 2015; 32(2):757-764.
23. Liuzzi A, Savia G, Tagliaferri M, Lucantoni R, Berselli ME, Petroni ML, De Medici C, Viberti GC. Serum leptin concentration in moderate and severe obesity: relationship with clinical, anthropometric and metabolic factors. International Journal of Obesity. 1999;23(10):1066-1073.
24. Houjeghani S, Gargari BP, Farzadi L. Serum leptin and ghrelin levels in women with polycystic ovary syndrome: correlation with anthropometric, metabolic, and endocrine parameters. International Journal of Fertility & Sterility. 2012;6(2): 117.

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