Original Research Article

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

ABSTRACT

Aim: To evaluate and correlate the levels of leptin 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 samples were taken from Creek Road Market, Borokiri, Port Harcourt within the period of .November,2022 to March, 2023.

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 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 have been several studies on anthropometric parameters and leptin in different parts of the world. This includes study by Chigbu & Aja [9] in Southeast Nigeria proposing prevalence with BMI in 1st trimester alone as 10.7%. However not much has been established with regards anthropometric indices and leptin in Women of reproductive age living in Port Harcourt. For instance, values 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 [10]. In fact, there may be obvious differencs particularly in the interpretation of Waist Circumference value as there seems to be a lack of universally accepted site for measuring Waist Circumference and the large variation of Waist Circumference optimal cut-off also affected by age, sex, race, and ethnicity; and so also with other anthropometric parameters as observed in even BMI which is noted not to be sensitive to Women[11,12] Again, in Africa, most work on this is limited by its design (retrospective) and small sample size which was recorded in Benin to be 323 [13].

Hence evaluating the serum leptin levels and some anthropometric parameters in different age group 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 281,120 [14]. Using the Yamani formula to calculate the sample size, we have:

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

where n= sample size, N= population of women of reproductive age in Port Harcourt = 281, 120 and e= error margin= 0.05. From the formula, n= 40 women.However, this study used a sample size of 150 subjects.

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: 3mls 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) as described by Ononamadu*et al.*[15] was carried out.Measurement of Weight (W) as described Lee *et al.* [16] was carried out on the subjects.Calculation of Body Mass Index (BMI) as described by Ononamadu*et al.* [15*]* was done.Measurement of Waist Circumference (WC) as described by WHO[17] (2011)was carried out and measurement of Hip Circumference (HC) as described by WHO [17] was carried out on the subjects.Then, calculation of Waist to Hip Ratio (WHR) as described by Lee *et al.* [16] was done.

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 Table1 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.

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		

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"<88cm" and ">88cm"results were 63 and 87 respectively showing a significant difference in number of subject (P=0.021) while the hip circumference of subjects with"<98cm" and ">98cm" were 5 and 145 respectively,also showing a significant difference in the number of subjects (P=0.001).This is reflected in Table 2.

Table 2: Comparison of Anthropometric Parameters among the Subjects

Anthropometric Parameter	Number	Prevalence	p-value	X^2-value	Remark
Body Mass Index (kg/m^2)					
<18.5	-				
18.5-24.9	39	26	0.089	4.840	NS
25-29.9	50	33			

30 & above	61	41			
Waist Circumference					
≤ 88	63	42	0.021	4.443	S
> 88	87	58			
Hip Circumference					
≤ 98	5	3	0.001	6.931	S
> 98	145	97			
Waist-to-hip ratio					
<0.81	55	37	0.001	10.667	S
0.81 & above	95	63			

3.3 Results of the mean values of anthropometricmeasurements 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±10.31Kg/m^2, 0.83±0.22, 3.56±0.93ng/ml, 94.40±8.05cm and 113.96±5.38cm respectively.This is shown in Table 3.

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	≤88cm
Hip Circumference	113.96 ± 5.38	≤48cm

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 Figure 1 and Figure 2.

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)

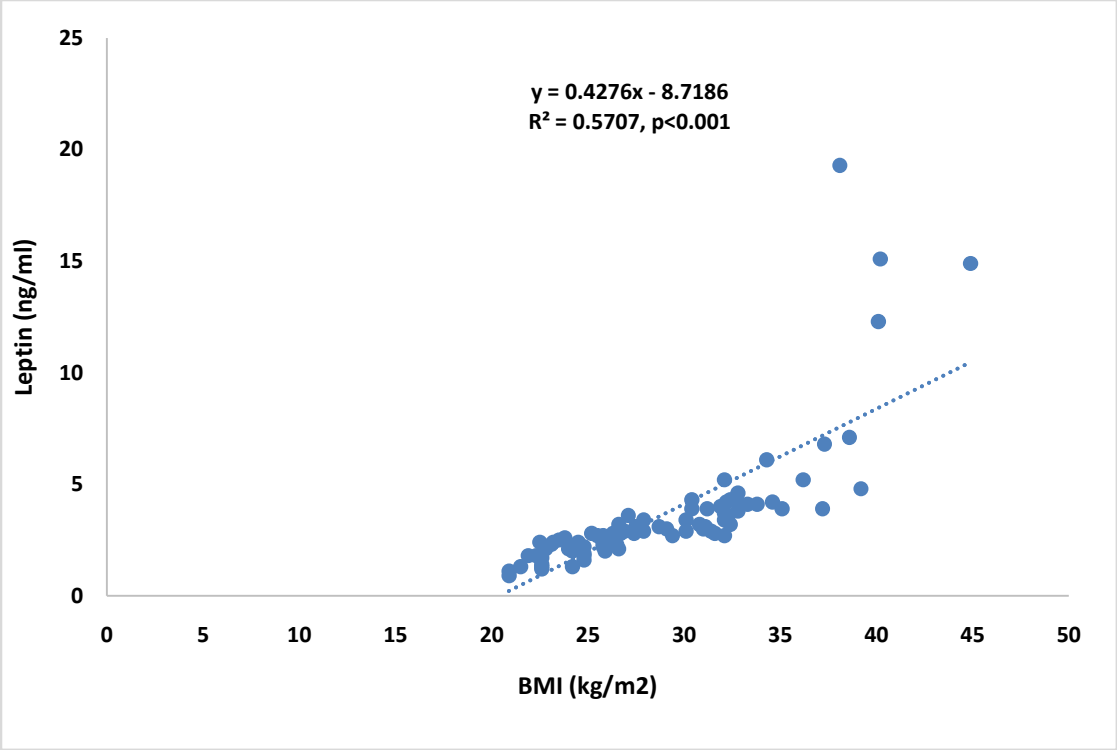

Figure 1: Correlation Plot of Leptin versus BMI

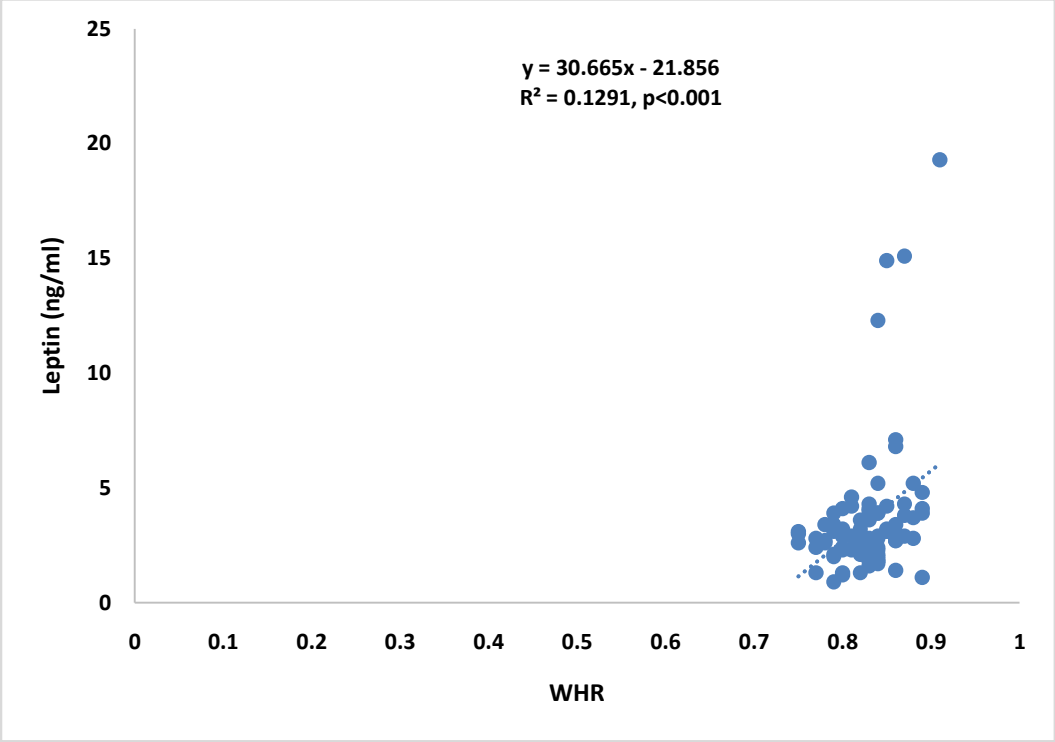

Figure 2: Correlation Plot of Leptin versus WHR

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, [18] 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 dwellers, occasioned by the introduction of processed foods and its increased consumption[18].

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[18]. Sedentary lifestyle has also been reported to be a significant factor for obesity and associated complications [19].This is seen in the lifestyle of these women in the market. This finding agrees with the work of Onyeji& Sanusi [20], 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*.[21] .

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 [22] . Though, some studies shows that women in developing countries largely experience raised BMI as a sign of beauty and affluence, which contributes to obesity [23].

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 [24]. This finding agrees with the report of Low *et al*.[23], which stated that body weight of women increases with age, and this weight gain might contribute to obesity and other complicated factors.The study also revealed a positive correlation between leptin and BMI, WHR implying that these anthropometric parameters increases with the levels of leptin. 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.

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