



## **Waist to Hip Ratio and Intelligent Quotient; Any Association in a Sample of Nigerian Female Population?**

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### **Authors' contributions**

*This work was carried out in collaboration between both authors. Author LEO design the research, performed the data analysis, wrote the protocol while author BUM aided in the collection of data as a research assistant. The final manuscript was approved by both authors.*

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### **ABSTRACT**

The assumption that intelligence and waist-to-hip ratio are inversely correlated has been a subject of debate. The aim of the study is to assess the relationship between waist-top-hip ratio and intelligence quotient. A total of one hundred and fifty Nigerian women between the ages of 18 to 28 years volunteered for the study. A modified method of Stanford Binet test for intelligent quotient was administered together with the measurement of the waist circumference (WC) and hip circumference (HC) to determine the waist-to-hip ratio (WHR). In addition to assessing the relationship of WHR and IQ of the whole volunteers, the volunteers were further grouped into four categories based on WHR to evaluate how WHR relate to IQ in each group. The data obtained were analyzed using Pearson's correlation test and test of correlation value at 0.05 level of significance. The result of the present study shows that the average age, WC, HC, WHR, IQ and correlation value ( $r^2$ ) of the volunteers were 22.49 years, 72.17 cm, 96.51 cm, 0.75, 53.35, 0.0009 respectively. The Pearson correlation values were poor and insignificant ( $P = .05$ ) for

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all classes of WHR versus IQ. The study shows the correlation between WHR and IQ is poor and not significant and therefore does not support the assumption that WHR is inversely correlated to IQ.

*Keywords: Waist circumference; hip circumference; waist-to-hip ratio; intelligent quotient; anthropometric.*

## 1. INTRODUCTION

The debate of the relationship between the WHR and cognitive reasoning has been a subject of speculation with the general notion that curvy women had higher intelligence until Lassek & Gaulin [1] reported that low WHR correlates well with high IQ. The waist to hip ratio is an anthropometric parameter for evaluating fat distribution and body shape. It is the distance around the waist at its narrowest point divided by the distance around the hips and buttocks at their widest point. Studies have shown that waist to hip ratio are well correlated with how attractive a woman is rated [2,3,4,5] and an average WHR of  $0.68 \pm 0.04$  has been reported for very attractive females [6]. There are also numerous studies of the relation of WHR to fecundity and health in women [1,7,8] Attempts have also been made by researchers to use WHR to determine mental health, cognitive ability and intelligence [1,9]

Gottfredson [10] noted that Intelligence is the general mental capability of a person to understand his environment, reason, and plan, solve problems, think abstractly, comprehend complex ideas and learn quickly. Psychologists' measure intelligence using a range of tests called Intelligence quotient tests. Intelligent quotient rates one's cognitive ability and various forms of intelligent quotient test exist. Some require an individual to engage in reasoning in order to solve novel problems, which may be presented in verbal, numerical or diagrammatical form. Intelligent quotient is measured as the ratio of mental age to chronological age multiplied by 100. As already mentioned, there are studies that suggest low waist to hip ratio correlates with the high intelligent quotient and cognitive ability whereas others do not [1,9,10]. The proponents of low WHR to high IQ predicated their assumption on the content of the fats around the hip and buttock (gluteofemoral) region of the females. Gluteofemoral fats which directly contributes to WHR has been reported to contain poly unsaturated fatty acid such as omega 3- docosahexaenoic acid (DHA) essential for brain development. Because of the relationship between gluteofemoral fat and long chain polyunsaturated fatty acids, women with

lower waist to hip ratios are expected to have larger stores of these essential fatty acids chain that aid neurodevelopment [11,12,13,14]. From casual observation, African women are curvy, whether there is a correlation between WHR and IQ in Sub Sahara population, especially Nigeria is a matter of interest to us in this study. Thus the aim the study is to investigate if there is an association between WHR and IQ in a sample of Nigeria population

## 2. MATERIALS AND METHODS

The study was carried between March to September 2018 among one hundred and fifty volunteers resident in Port Harcourt Metropolis. These volunteers are active members of the University of Port Harcourt Friendship Centre. All of them had senior secondary school education, are able to read, write and express themselves in English language and each volunteer gave informed permission for the study. The age range was between 18 to 28 years as indicated in the bio-data form of participants. Waist and hip circumference of each volunteer was measured using standard anthropometric techniques as described by World Health Organization [15]. The waist and hip circumferences were measured using an inelastic tape. Before the measurements began, the volunteers were placed in the proper erect posture with their feet together and hand by the side such that the weight of the body was evenly distributed. The waist circumference was measured at the midpoint between the lower margin of the last palpable rib and the top of the iliac crest at the time of normal expiration. The volunteers were also asked to relax during the waist circumference measurement to reduce abdominal pressure. The hip circumference was measured around the widest portion of the buttocks. To reduce error, both circumferences were taken three times and the average recorded.

A modified method of Stanford Binet test was used to assess the intelligence of all volunteers. We adopted a nonverbal test to assess the intelligent capacity of volunteers to limit bias associated with pronunciation of English words.

The test assesses fluid reasoning, quantitative reasoning, visual-spatial processing and working memory knowledge in an environment that is conducive in other to assess their intelligence quotient. WHR was grouped into four groups and Pearson’s correlation test was used to determine the relationship between IQ and WHR at a significant level of 0.05.

### 3. RESULTS

The result of the study is shown in Tables 1-3. The average age of volunteers is 22.49±2.73 years; minimum and maximum test marks are 2.00 and 19.00 with an average of 12.96±2.99. The minimum and maximum waist circumferences are 57.00 cm and 97.00cm with an average of 72.17±8.65cm. Hip circumference

has a minimum and maximum value of 71.50cm and 125.00cm with an average of 96.51±10.50 respectively. The range of the WHR is 0.64-1.33 with an average of 0.75 ± 0.09. Intelligent quotient range is 9.00-90.00 with an average of 58.35±16.01 (see Table 2). On the whole, correlation between WHR and IQ is poor and not significant (r=0.03, r<sup>2</sup>=0.0009, P>0.05) (Tables 1 and 2).

The correlation test of WHR and IQ for each class is shown in Table 3. At WHR below or equal to 0.69 the IQ is 58.53, WHR class of 0.70 – 0.75 the mean IQ is 57.75, WHR class of 0.76-0.80 the mean IQ is at 69.7, WHR class of above 0.81 the mean IQ is 53.9. Pearson’s correlation for each class was poor and insignificant (p>0.05).

**Table 1. Descriptive statistics of evaluated parameters for all volunteers**

Parameter	Mean	SE	SD	Var	Min V	Max V
Age (yrs)	22.49	0.22	2.73	7.45	18.00	28.00
Test Marks	12.96	0.24	2.99	8.96	2.00	19.00
WC (cm)	72.17	0.71	8.65	74.89	57.00	97.00
HC(cm)	96.51	0.86	10.50	110.28	71.50	125.00
WHR	0.75	0.01	0.09	0.01	0.64	1.33
IQ (%)	58.35	1.31	16.01	256.47	9.00	90.00

Key WHR, Waist to hip ratio; WC, waist circumference; HC, Hip circumference; IQ, Intelligent quotient, SE, standard error of mean; SD, standard deviation; Var, variance, MinV, minimum value, MaxV, maximum value

**Table 2. Correlation test of WHR and IQ for all volunteers**

Parameter	Coefficient of determination (r <sup>2</sup> )	Correlation coefficient (r)	Calculated t score	Critical t score at 0.05 level	Inference
IQ vs WHR	0.0009	0.03	0.37	1.96	Correlation is very poor and not significant (p>0.05)

Key WHR, Waist to hip ratio; IQ, Intelligent quotient

**Table 3. Correlation test of WHR and IQ for class of WHR**

Class of WHR	Parameter	Mean 1Q	Correlation value (r)	Calculated t score	Critical t score at 0.05 level	Inference
≤0.69	WHR vs IQ	58.53	0.14	0.75	2.05	Correlation is very poor and not significant (p>0.05)
0.7-0.75	WHR vs IQ	57.75	0.07	0.56	2	Correlation is very poor and not significant (p>0.05)
0.76-0.8	WHR vs IQ	61.97	0.06	0.34	2.04	Correlation is very poor and not significant (p>0.05)
≥0.81	WHR vs IQ	53.9	0.26	1.14	2.1	Correlation is very poor and not significant (p>0.05)

Key WHR, Waist to hip ratio; WC, waist circumference; HC, Hip circumference; IQ, Intelligent quotient

#### 4. DISCUSSION

The study of WHR and IQ in the sampled Nigerian population does not reveal any inverse relationship as reported in some studies [1,9,16,17,18]. Dore et al., [16] in their study of the relationship between anthropometric measures of central obesity stated that waist circumference and waist-to-hip ratio is inversely related to cognitive function. They also showed the level of physical activity play a major role in the association of central obesity and cognitive ability. In a similar the study of central obesity and the aging brain, larger WHR was linked with neurodegenerative, vascular and metabolic processes that may affect brain structure resulting in cognitive decline and dementia [17]. Besides WHR, greater waist circumference, body mass index, central and total obesity have been shown to be negatively related to cognitive functions [18].

In the present study, the variation in WHR accounted for less than 0.1% of the observed differences in IQ performance. There was no consistent defined relationship between WHR and IQ as volunteers with WHR between 0.76-0.80 had the highest IQ compared to those with less than 0.6. The assumption that lower WHR is associated with increase IQ is not supported by the sample of Nigerians studied in this research. Our finding is in line with the result of the study by Kelly [10] of the University of Dayton Ohio, who investigated the relationship of WHR and IQ using a sample size of fifty one female college students and also included whether the relationship might be affected by variations in body image, locus of control, or self-efficacy. The study showed that there was no link between IQ and WHR but there is correlation between body image and WHR as well as body mass index (BMI).

The use of WHR as a measure for cognitive ability and intelligence in the sample of Nigerians may be difficult as the interplay of genetics and environmental factors play major roles in the shape, size and fat distribution of the body. Rahman *et al.* [19] noted that racial factor exist in body fat distribution and this could mainly be genetic factor. Environmental factors could include diet, life style, activity level etc. In Nigeria the common food mostly consumed have high content of carbohydrate which give rise to lot of fats in the body. The result is a near chubby and curvy stature for most in the middle class and high-class socioeconomic status.

#### 5. CONCLUSION

The study shows the correlation between WHR and IQ is poor and not significant and therefore do support the assumption that WHR is inversely correlated to IQ.

#### CONSENT

All volunteers gave written informed consent before they participated in the study

#### ETHICAL APPROVAL

Ethical approval was given by the Ethical Committee Biomedical Technology Unit University of Port Harcourt.

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#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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