

Anthropometric Relation of Neck and Waist Circumference in Overweight and Obese Nigerian Subjects: Implication for the Fashion Industry.

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Abstract

Introduction: In the local tailoring industries in Nigeria, it is generally assumed that the waist circumference is twice the neck circumference. Whether this is true for obese and overweight people is unknown. **Objective:** This study investigated the anthropometric relationship of the neck circumference to the waist circumference in overweight and obese people and its use in the clothing industry. **Subjects and Methods:** A sample size of 557 volunteers between 18 to 50 years was recruited for the study from the three campuses of the University of Port Harcourt. 391 were overweight (males=218, females=173) and 166 were obese (males=63, females=103). The neck and waist circumferences of volunteers were taken at the upper neck circumference (UNC), middle neck circumference (MNC), lower neck circumference (LNC) and upper waist circumference (UWC), middle waist circumference (MWC) and lower waist circumference (LWC) respectively. The Body Mass Index of the participants were determined after their weights and heights were measured to enable us categorize them into overweight and obese. The data obtained were analyzed with the aid of Microsoft Excel statistical tools. **Results:** Overweight males had UNC =37.83cm, UWC =83.69cm, MNC =37.72cm; MWC=85.79cm, LNC =38.43cm, LWC =86.37cm. Overweight females had UNC =33.64cm, UWC=78.02cm, MNC =33.64cm, MWC= 83.09cm, LNC =34.71cm, LWC=83.09cm. Obese males had UNC =40.15cm, UWC=93.87cm, MNC =40.12cm, MWC= 97.95cm, LNC =40.85cm, LWC =97.82cm. Obese females had UNC =35.07cm, UWC =90.86cm, MNC= 35.29cm, MWC =97.29cm, LNC =36.01cm, LWC =100.72cm. Pearson's correlations(r) of the different regions of the neck and waist for overweight and obese subjects were determined. **Conclusion:** The correlation between the neck and waist circumference is weak in both overweight and obese. No subject has a waist circumference that is exactly twice the neck circumference. Estimation of waist circumference from the neck circumference will result in clothes that are not fitted.

Keywords: Neck, waist, circumference, Overweight, Nigerians.

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Introduction

Anthropometry has wide application in forensics, biological anthropology, clinical medicine, design of prosthetics and clothing as it tends to give predictive correlation between various body parts essential for diagnosis and design. We had earlier presented a paper on the anthropometric relationship of the neck circumference to waist circumference in non-obese subjects and its implication for the fashion industry.^[1] In similar manner, we find it necessary to evaluate overweight and obese subjects as the population of these group of persons are increasing by the day. Overweight is defined as body mass index (BMI) between 25 and 29.9 kg/m² while obesity is defined as BMI \geq 30 kg/m². According to World Health Organization, WHO (2018), 1.9 billion adults, 18 years and older are overweight

and 650 million of these figure are obese as at 2016.^[2] The trends of obesity have tripled worldwide since 1975. Overweight and obesity is not peculiar to adults but also common in adolescents and children, and over 340 million children and adolescents were overweight or obese in 2016. Clothing fashion like all other aspects of fashion changes very quickly. It is not associated with one group or an area of the world but is spread out throughout the world wherever people can communicate freely with one another. Getting body measurements is a significant part of sewing in the fashion industry as it would determine if the clothing would fit into the individual. Many body measurements with respect to the fashion industry include; neck, waist and hip measurements as well as other necessary parts of the body. Awareness of the correlations of these body parts is also essential in tailoring. These have resulted in the belief that the neck circumference is twice the waist circumference and

that fitness of clothes can be determined by using this correlation. Several authors have made good contributions in their studies with respect to the relationship between the neck and the waist circumference, and as a predictive measure to health and disease.^[3-9]

In our previous study of Nigerians with normal weight, we found that the waist circumference is not exactly twice the neck circumference. However, there was a very strong positive correlation between the upper waist circumference and upper neck circumference. Whether this is applicable to overweight and obese individuals is not known as there are various types of distributions of body fat such as central obesity, gynaeoid obesity etc. Therefore the objective of the study is to determine what relationship exist between neck and waist circumferences and what part of the region of the neck and waist best correlate with one another in overweight and obese individuals. The information arising from this investigation would be of importance to fashion designers, aesthetic anatomists, and medical anthropologists and also provide quantitative information that will ensure a better customer service in the fashion industry.

Subjects and Methods

Simple random sampling method was used to recruit volunteers from the three campuses of the University of Port Harcourt. Individuals with physical deformities were excluded from the study. A sample size of 557 subjects participated in this study with age range of 18 to 50 years. 391 of them (218 males & 173 females) were overweight, while 166 (63 males & 103 females) were obese. All volunteers gave written informed consent before they participated in the study. The BMI of each subject was used to classify who is obese or overweight. Those with BMI \geq 25-29.99 kg/m² were considered overweight and those with BMI \geq 30 kg/m² as obese. A weighing scale and stadiometer was used to determine the weight and height of the participants. The procedures for measurement were in line with standard anthropometric procedure recommended by World Health Organization. The neck circumference was measured with an inelastic measuring tape in three regions- the upper part, just above the laryngeal prominence; the middle part, on the laryngeal prominence; and the lower part, below the laryngeal prominence. The waist circumference was taken at three parts- upper part, below the last rib and just above the umbilicus; the middle part, on the umbilicus; and the lower part, below the umbilicus. To

ensure increase accuracy, all measurements were taken three times and the average recorded. The data was analyzed with the aid of Microsoft excel. Pearson's coefficient was used to determine its significance and correlation.

Ethical Approval

Ethical approval was sought from the College Research Ethics Committee, College of Health Sciences, University of Port Harcourt and was granted approval.

Results

Table 1: Neck and waist circumference based on sex for overweight subjects

Parameter	Sex	No. of subjects	Mean	SEM	SD
UNC	M	63	40.15	0.39	3.07
	F	103	35.07	0.24	2.5
MNC	M	63	40.12	0.35	2.8
	F	103	35.29	0.25	2.57
LNC	M	63	40.85	0.38	2.99
	F	103	36.01	0.25	2.56
UWC	M	63	93.87	1.08	8.55
	F	103	90.86	0.87	8.87
MWC	M	63	97.95	1.2	9.5
	F	103	97.29	1.05	10.67
LWC	M	63	97.82	1.44	8.92
	F	103	100.72	1.06	10.74

SEM: standard error of mean, SD: standard deviation, UNC: upper neck circumference, MNC: middle neck circumference, LNC: lower neck circumference, UWC: upper waist circumference, MWC: middle waist circumference, LWC: lower waist circumference

Table 2: Neck and waist circumference based on sex for obese subjects.

Parameter	Sex	No. of subjects	Mean	SEM	SD
UNC	M	218	37.83	0.15	2.17
	F	173	33.64	0.17	2.21
MNC	M	218	37.72	0.14	2.13
	F	173	33.64	0.17	2.21
LNC	M	218	38.43	0.15	2.23
	F	173	34.71	0.17	2.17
UWC	M	218	83.69	0.48	6.34
	F	173	78.02	0.48	6.34
MWC	M	218	85.79	0.49	7.2
	F	173	83.09	0.57	7.53
LWC	M	218	86.37	0.43	6.28
	F	173	83.09	0.57	7.53

SEM: standard error of mean, SD: standard deviation, UNC: upper neck circumference, MNC: middle neck circumference, LNC: lower neck circumference, UWC: upper waist circumference, MWC: middle waist circumference, LWC: lower waist circumference

Table 3: Statistical analysis of the neck and waist circumference in obese subjects irrespective of sex

Parameter	Pearson correlation value(r)	Calculated t-score for r	t	Critical t-score at 0.05 level	Inference
UNC vs UWC	0.47	6.84	1.96	1.96	Positive correlation is weak but significant (p< 0.05)
MNC vs MWC	0.29	3.84	1.96	1.96	Positive correlation is weak but significant (p< 0.05)
LNC vs LWC	0.11	1.41	1.96	1.96	Not significant (p>0.05)
UNC vs MWC	0.36	4.97	1.96	1.96	Positive correlation is weak but significant (p< 0.05)
UNC vs LWC	0.16	2.08	1.96	1.96	Positive correlation is weak but significant (p< 0.05)
MNC vs LWC	0.13	1.73	1.96	1.96	Not significant (p>0.05)
MNC vs UWC	0.38	5.23	1.96	1.96	Positive correlation is weak but significant (p< 0.05)
LNC vs MWC	0.24	3.21	1.96	1.96	Positive correlation is weak but significant (p< 0.05)
LNC vs UWC	0.32	4.27	1.96	1.96	Positive correlation is weak but significant (p< 0.05)

Table 4: Statistical analysis of the neck and waist circumference in overweight subjects irrespective of sex

Parameter	Pearson correlation value(r)	Calculated t-score for r	Critical t-score at 0.05 level	Inference
UNC vs UWC	0.50	11.2	1.96	Positive correlation is weak but significant (p< 0.05)
MNC vs MWC	0.11	7.07	1.96	Positive correlation is weak but significant (p< 0.05)
LNC vs LWC	0.07	1.41	1.96	Not significant (p>0.05)
UNC vs MWC	0.39	8.41	1.96	Positive correlation is weak but significant (p< 0.05)
UNC vs LWC	0.17	3.31	1.96	Positive correlation is weak but significant (p< 0.05)
MNC vs LWC	0.12	2.4	1.96	Positive correlation is weak but significant (p< 0.05)
MNC vs UWC	0.46	10.15	1.96	Positive correlation is weak but significant (p< 0.05)
LNC vs MWC	0.25	5.19	1.96	Positive correlation is weak but significant (p< 0.05)
LNC vs UWC	0.38	8.13	1.96	Positive correlation is weak but significant (p< 0.05)

Discussion

The relationship between different parts of the body is one of the bases for predictive anthropometry and its applications in diagnosis and prosthetic designs. Our investigation revealed the correlation between the neck and waist circumference in obese individuals is very weak. No volunteer had waist circumference that is exactly twice the neck circumference. The best correlation value of 0.50 was between the upper neck circumference (UNC) and upper waist circumference (UWC) for overweight. The implication is that depending on the neck circumference to determine the waist in overweight and obese individuals may result in design of poorly fitted clothes.

There seems to be an influence in the way fat is distributed in overweight and obesity and predictive anthropometry. For example in central obesity there is accumulation of fat around the abdomen and upper body region, a situation that could lead to corresponding increase in waist circumference while in gynaecoid obesity there is accumulation of fat in hip and lower body region. These factors may affect accurate anthropometric prediction of the ratio of the neck circumference to that of the waist circumference. The assumption that the waist circumference is twice that of the neck circumference which is a common belief in the tailoring profession is therefore not applicable to overweight and obese individuals. As already noted in our earlier publication,^[1] some authors have platonically investigated this subject and have documented some reports.^[10-13] While James et al.^[14] reported a positive, strong and significant relationship between a person's waist and neck, the contrary was reported by Claire et al.^[15] The study by Ben-Noun et al,^[16] had established that the best cut off levels for neck circumference in overweight was ≥ 37 cm while females have it between 33.64cm and 34.71cm. The neck circumference for obese males in our study ranges between 40.12cm and 40.85cm while that for females lie between 35.07cm and 36.01cm. These findings are much similar to those of Ben Noun and associates.^[17]

Conclusion

In conclusion, the waist circumference is not twice the neck circumference in overweight and obese individuals. The relationship between the neck and waist circumference is very poor in obese compared to overweight subjects. However, in both groups, the upper neck circumference and upper waist circumference have the highest correlation. Using the predictive assumption that the neck circumference is twice the waist circumference in the design of clothes for

obese and overweight subjects could result in poorly fitted clothes.

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