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Pattern and Determinants of Waist Circumference Percentiles Amongst Apparently Healthy Adolescents In Uyo South-South Nigeria: A Descriptive Study

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ABSTRACT

Despite the usefulness of waist circumference in determination of central adiposity, there is no national reference values for Nigerian adolescents. This study therefore aims to give a representation of the waist circumference percentile values amongst adolescents in Uyo, South- South Nigeria.

It was a cross sectional community based study, done between December 2017 1nd April 2019, amongst adolescents aged 10 to 18 years. The waist circumference of the adolescents was measured mid way between the iliac crest and the lower border of the last palpable rib.

The mean waist circumference for males was 42.95 plus or minus(use the symbol) 3.62, while that of females was 45.01 plus or minus 13.99.

There was a significant association between gender, age, socioeconomic class and waist circumference.

It is recommended that waist circumference should be routinely measured amongst adolescents because of its correlation with visceral adiposity.

INTRODUCTION

Adolescence is a critical developmental period associated with significant changes in body composition as well as rapid growth.[1,2] This developmental period typically spans between the ages of 10-19 years.[1] Worldwide, it is estimated that the population of adolescent is about 1.2billion.[3] Hormones during adolescence increase fat deposition in tissues predisposing to obesity and metabolic syndrome.

Waist circumference measurements in adolescents is an easy and simple anthropometric parameter that highly correlates with visceral adiposity and may be a better indicator of obesity than BMI.[4] Waist circumference

greater than the 90th percentile for age and sex defines obesity with potential increased risk of metabolic syndrome characterized by diabetes mellitus and cardiovascular diseases.[5]

Despite the widespread use of waist circumference, there is no uniformly accepted protocol for its measurement; resulting in a variety of techniques being employed in different settings.[6] The United States National Institute of Health guidelines specify that waist circumference should be measured directly above the superior border of iliac crest,[7] while World Health Organisation (WHO) and Health Canada recommend that measurements should be taken at the mid-point between the superior border of the iliac crest and the lower margin of the last palpable rib.[8,9] However; recommendations for research purposes advocate measurements at the umbilicus.[10]

Variations in the anatomical location used in the measurement of waist circumference can potentially affect its utility for risk assessment.[6]

The first tables for waist circumference in children in the US was first published by Fernandez and his colleague in 2004, other countries also have reference data for waist circumference values of children in their environment.[11-14] Variation in these reference ranges have shown that waist circumference is influenced by ethnicity.[14] Similarly, waist circumference percentile values are also known to vary with age, gender and socio-economic class.[15,16]

Despite the usefulness of waist circumference in determination of central adiposity, there is no national reference values for Nigerian Adolescents.[17] This is of grave concern as most classification of Nigerian adolescents into centrally obesed adolescents or normal children use Caucasian values. This study therefore aims to give a representation of the waist circumference percentile values amongst adolescents in an urban setting in south-south Nigeria.

METHODOLOGY

This study was conducted amongst adolescents attending both public and private secondary schools in Uyo, Akwa- Ibom state Nigeria, between December and April 2019. Children aged between 10-18years of age whose parents gave consent, and who themselves assented for the study were recruited.

Participant information (age, sex , sociodemographic data) were obtained using standardized questionnaires. The socio-economic status of the participants was determined using Oyedeji classification. Waist circumference was measured to the nearest 0.1cm with a flexible inelastic tape, using the WHO method (i.e using an inelastic tape placed midway between the superior border of the iliac crest and the lower margin of the last palpable rib) for the measurement of waist circumference.

All data obtained were arranged into tables and analyzed with SPSS version 21, statistical significance was set at p values of < 0.05.

ETHICAL APPROVAL

Ethical approval for the study was obtained from the university of Uyo Teaching Hospital ethics committee. Approvals were also obtained from the ministry of education and respective school principals. Informed consent was obtained from their parents and assent from the children recruited.

RESULTS

Table 1: Age and Sex Distribution of the Participants

Variable	**Frequency (%)**	**Frequency (%)**	**Frequency (%)**
Age group	Male	Female	Total
10 years	32(4.4)	48(4.9)	80(4.7)
11 years	55(7.6)	66(6.7)	121(7.1)
12 years	79(11)	88(9)	167(9.8)
13 years	80(11.1)	132(13.5)	212(12.5)
14 years	110(15.3)	183(18.7)	293(17.2)
15 years	113(15.7)	171(17.4)	284(16.7)
16 years	119(16.5)	165(16.8)	284(16.7)
17 years	90(12.5)	97(9.9)	187(11)
18 years	42(5.8)	31(3.2)	73(4.3)
Total	720(100)	981(100)	1701(100)

Table 2: Waist circumference value ranges of adolescents according to ages and gender

Variable	Waist Circumference	Confidence interval	
Age	Mean +SD	95% C. I	X^2(p value)
11 years	66.52+7.57	65.19-67.85	2.29(0.025)
12 years	70.15+8.02	63.03-77.28	
13 years	67.24+6.24	66.39-68.08	
14 years	68.87+6.52	66.12-69.61	
15 years	69.43+5.22	68.83-70.04	
16 years	71.02+4.99	70.44-71.60	
17 years	71.61+5.42	70.62-72.18	
18 years	72.62+5.82	71.25-73.98	
Gender			
Male	42.59+3.62	1.35-3.47	4.46(0.001)*
Female	45.01+13.99	1.48-3.34	
WC in percentile			
5^{th} percentile	56.79+5.11	55.60-57.99	76.66(0.001)*
25^{th} percentile	63.01+1.63	62.84-63.18	
50^{th} percentile	67.04+0.83	66.96-67.12	
90^{th} percentile	71.94+2.16	69.01-72.10	
Obese	84.44+6.77	77.00-81.40	

Table 3: Factors influencing waist circumference changes

Variable	**25^{th} percentile**	**50^{th} percentile**	**90^{th} percentile**	**Above 90^{th} percentile**	**Total**	X^2(p value)
Socioeconomic class						
1	123(28.6)	94(24.7)	189(28.3)	74(42)	480(29)	33.36(0.001)*
2	124(28.8)	131(34.4)	199(29.8)	54(30.7)	508(30.7)	
3	135(31.4)	102(26.8)	168(25.2)	32(18.2)	437(26.4	

					)	
4	44(10.2)	49(12.9)	103(15.4)	15(8.5)	211(12.8)	
5	4(0.9)	5(1.3)	8(1.2)	1(0.6)	18(1.1)	
Intake soft drink/day	289(67.2)	222(58.3)	402(60.3)	109(61.9)	1022(61. 8)	13.81(0.13)
Once or twice	105(24.4)	106(27.8)	173(25.9)	41(23.3)	425(25.7)	
Daily	36(8.4)	53(13.9)	92(13.7)	26(14.8)	207(12.6)	
Birth weight/Kg						
2.5-3.9	83 (19.3)	86 (22.6)	123 (18.4)	42 (23.9)	334 (20.1)	13.97(0.12)
≥ 4	27 (6.3)	23 (6.0)	48 (7.2)	17 (9.7)	115 (7.0)	
Can't recall	320 (74.4)	272 (71.4)	496 (74.4)	117 (66.5)	1205 (72.9)	
Physical exercise						
Daily	192(44.7)	177(46.5)	275 (41.2	65(36.9)	709 (42.9)	13.08(0.04)*
3 times/week	163(37.9)	120(31.5)	256(38.4)	63(35.8)	602(36.4)	
< 2 times/week	75(17.4)	84(22.0)	136(20.4)	48(27.3)	343(20.7)	
Gender						
Male	212(49.3)	172(45.1)	267(40.0)	52(29.5)	703(42.5)	22.98(0.00 1)*
Female	218(50.7)	209(54.9)	400(60)	124(70.5)	951(57.5)	
Number of feeds/day						
1	206(47.9)	207(54.3)	327(49.0)	88(50.0)	828(50.1)	
01-Mar	188(43.7)	149(39.1)	290(43.5)	77(43.8)	704(42.6)	
3-5 or more	36 (8.4)	25 (6.6)	50 (7.5)	11(6.2)	122(19.1)	

Table 1 shows the demographic characteristics of the participants. The male : female was 1:1.4. Participants that were 14years and older constituted a larger proportion of the study.

Table 2 shows the relationship between waist circumference and sociodemographics. There was a steady increase in the waist circumference after 14 years of age. This was statistically significant. Similarly, the waist circumference values of the females were significantly higher than those of their male counterpacts.

Table 3 shows the factors affecting the waist circumference distribution of the participants. Higher socioeconomic class, physical inactivity, and reduced meal frequencies were significantly associated with higher waist circumference values. There was no association between birth weight, soft drink consumption and waist circumference percentile.

DISCUSSION

This study was a cross sectional study that assessed the waist circumference values of apparently healthy adolescents in selected secondary schools in Uyo, South-South Nigeria. The mean waist circumference values of the adolescents studied (for each age group) were consistently lower than those of their counterparts in similar studies in Kuwait, Britain, Latin America ,and Spanish children.[12,18-20] These differences might be due to racial and genetic variation that is known to occur with waist circumference.[21] It might also reflect some variations in dietary intake and physical activity levels which are factors known to affect waist circumference.[17] The waist circumference values for adolescents increased significantly after 14 years of age. This might be due to the growth spurt that occurs around this period in adolescence, with associated increased fat deposition around the trunk. This may have some clinical correlation with blood pressure variation, hence the need for further monitoring of this anthropometric measure during this period.[22,23] The mean waist circumference values were significantly higher for females compared to males. Similar findings have been reported in previous studies.[17,24] However, this is in contrast to what was observed amongst adolescents in a study done in Kuwait where males had significantly higher waist circumference compared to females.[18] These observed differences might be due to genetic factors which have already been aluded to play a role in variation of waist circumference. It is however worthy of mention that the lysophospholipase gene which is known to cause increase deposition of fats has more significant expression in females compared to males, and hence a greater waist circumference reading is expected in females.[25]

There was a significant association between social economic class and waist circumference. The possible explanation for this might be due to the fact that in our environment, adolescents that belong to the high socioeconomic class are exposed to more sedentary lifestyles and more calorigenic diets as a manifestation of affluence. This might increase their risk of increased truncal fat deposition.[26] There was no association between soft drink consumption , birth weight and waist circumference values. The cross sectional nature of this study might have masked the growth related changes that probably would have been discernable if a longitudinal follow up of the participants was done. Interestingly, this could be an area for future research.

CONCLUSION

Adolescent waist circumference in our environment is much lower than their Caucasian counterparts and could be varies with sex, age, and socioeconomic status of parents. Routine measurement of waist circumference is thus advocated as increased waist circumference percentile values is correlated with risks of hypertension and diabetes.

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