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Anthropometric Assessment of Nutritional Status and Growth of 10 - 20 Years Old Individuals in Benin City (Nigeria) Metropolis

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Abstract: Anthropometric assessment of the nutritional status and growth of 2,012 randomly selected males and females between the ages of 10 - 20 years was carried out by cross-sectional method in Benin City Metropolis. Anthropometrical indices considered were weight, height and arm circumference. Percentile values (10th, 50th, 90th) which represent the growth standards of males and females were established from this study. Comparisons were made by comparing the 50th centile curves for height and weight of males and females obtained from this study with those of the WHO/NCHS standards. The results of the comparison revealed that the 50th centile curves of subjects from Benin City consistently lagged behind those of WHO/NCHS standards for all the anthropometric variables considered, except the 50th centile curve of females for height which showed that the 50th centile curve of females from Benin City compared favourably with the WHO/NCHS standards, and do not fall below them. The interrelationship between the various anthropometric variables revealed that the correlation coefficients for males and females respectively were: Age and Weight (0.99 and 1.0), Age and Arm circumference (0.95 and 0.99), Height and Arm circumference (0.91 and 0.97) and,(0.97 and 0.98) for Weight and height. The age of puberty was determined from this study to be 15.5 years for females and 18 years for males.

Key words: Growth standard, anthropometric assessment, nutritional status

Introduction

In many developing countries of the world where malnutrition is prevalent, there is hardly any large scale data on nutritional status of the people. Most often, data from only small scale surveys are available which often may be of limited use to planners. Shamssain (1989) reported that in addition to clinical and food composition data, anthropometric studies can provide reliable information needed by both nutrition planners and administrators.

Studies on growth and nutritional status have been well documented in developed countries (Vimleshseth *et al.*, 1979; Gupta and Saxena, 1977; Jelliffe, 1966). Prazuck *et al.* (1989) reported that there is a dearth of information relating to the anthropometric evaluation of West African Adolescents. Same studies on growth have been carried out in some part of Nigeria, Toriola (1990) in Ile-Ife; Ogunranti (1987, 1986), Didia and Ogunranti (1986) in Port Harcourt; Esiet *et al.*, 1984 in Calabar; Oyemade and James (1981) in Lagos; Janes (1974) and Morley *et al.* (1968) in Ibadan; Collins *et al.*, 1962 in Pankshin and Ecoma (1959) in Nsukka. Although these studies are worth mentioning, most of them focused on pre-school children and it is important to note that no extensive growth study for Benin City has been published.

Thus, this study was initiated to:
(i) Provide data which can serve as a growth reference standard for Nigerian children and adolescent using Benin City as a case study,
(ii) assess the growth pattern and nutritional status of children and adolescents using anthropometric indices of heights, weight, and arm circumference with age by comparing the 50th centile curve obtained from the study with WHO recommended standards (functional indicators for malnutrition),
(iii) determine the inter-relationship among the anthropometric variables being measured.

Materials and methods

Demography of summary site: The data utilized for this study were collected by visiting seventeen educational institutions, which comprised primary, secondary and tertiary institutions in the different zones within the boundary of Benin City. This was necessary to obtain authentic records of students as well as their management without suspicion or refusal as the Teacher were very helpful including enlightening parents who may be apprehensive. Benin City is the capital of Edo State, Nigeria. Benin City, according to the State Office of Statistics was estimated to having a population of 904,077 in 1994, out of which 184,613 (20.42%) represents the population of people within the age bracket of 10 - 20 years.

Procedures of study: The study sample consisted of randomly selected 975 males (48.46%) and 1037

Table 1: Distribution of weights, heights and arm circumference

Age/Yrs	Weight/KG Mean ± S.D.		Height/CM Mean ± S.D.		Arm CIR. /CM Mean ± S.D.		n
			Measurements of males according to various ages				
10.0	27.45	3.45	135.47	6.36	17.32	1.43	33
10.5	27.96	3.47	137.60	6.63	17.27	0.97	25
11.0	30.34	5.57	140.33	7.83	18.19	2.01	40
11.5	31.93	9.95	141.46	8.60	18.11	3.10	31
12.0	33.64	7.22	145.85	9.56	18.71	2.17	43
12.5	33.36	6.13	145.10	8.83	18.81	2.17	35
13.0	35.33	7.91	148.02	10.5	18.89	1.96	47
13.5	35.61	7.36	149.06	9.86	18.65	2.06	18
14.0	38.64	8.20	154.77	10.6	20.19	2.28	47
14.5	42.39	9.70	158.25	9.79	20.90	3.15	38
15.0	44.11	10.0	160.24	12.1	21.03	2.60	58
15.5	46.52	9.61	163.96	10.7	21.98	2.92	27
16.0	49.32	9.04	166.87	8.11	22.44	2.61	56
16.5	49.55	9.70	166.76	7.86	22.56	3.16	34
17.0	52.13	10.4	168.18	10.0	23.20	2.94	50
17.5	51.86	7.76	169.71	7.84	23.10	2.13	21
18.0	57.01	8.76	173.34	9.15	24.38	2.42	31
18.5	56.59	9.18	170.78	7.28	24.45	2.01	21
19.0	60.91	18.2	171.31	7.28	25.88	4.50	23
19.5	60.16	8.54	171.09	5.89	25.55	2.45	22
20.0	59.88	6.38	174.19	5.30	25.73	2.53	25

females (51.54%), consisting 2,012 subjects in all and representing 1.09% of the population of the age group that was covered by the study. The study (cross-sectional method) was designed in such a way that subjects from all socio-economic classes were represented. Since time and resources made it obligatory to study the subjects from educational institutions rather than from the community, it was necessary to choose particular schools that consisted of subjects from all socio-economic groups as reflected in Benin City to reduce bias.

Specially designed questionnaires were used to elicit information from the participating subjects about their age, sex, date of birth, family/personal background, medical history, socio-economic and nutritional status, family size, parents occupation and educational status. The questionnaires were kept anonymous as well as confidential in order to encourage good response.

The ages of the subjects attending primary schools were obtained from the schools register while those subjects attending secondary and tertiary institutions quoted their respective ages. It is worthy of note to state here that it was only those subjects whose birth days were ±3 months from the date of observation were included in this study. When any discrepancy was suspected or noted from the information supplied on the questionnaire by any subject, such subject was excluded from the study. It was for this reason that the proposed plan of covering 2500 subjects in this study

could not be achieved.

On completion of the questionnaire, anthropometric measurements of weight, height and arm circumference were undertaken (and recorded in their respective questionnaires) using standard techniques as required by WHO, for anthropometric parameters. The subjects were weighed without shoes but with only school uniform on, using a bathroom scale, which was regularly balance-checked (adjusted) before each weighing. Weights for males had 0.7kg subtracted from their weights and 0.2kg from those of females to account for the weights of the school uniform (obtained as averages of measured uniforms for each category).

Standing height was measured on portable wooden measuring board with a movable wedge foot piece and a ruler detachable head piece used as a pointer. The measuring board was calibrated in centimeters. The subjects were measured bare-footed in the supine position and the readings were recorded in the nearest 0.1cm.

Arm circumference was measured by using a narrow width flexible tape at the mid-point of the upper arm, and the readings recorded to the nearest 0.1cm. The same techniques and anthropometric devices were used throughout the study period to ensure uniformity.

Data preparation and analysis: The various anthropometric measurements of weight, height and arm circumferences were extracted from the

Table 2: Distribution of weights, heights and arm circumference measurements of females according to various ages

Age/Yrs.	Weight/KG Mean ± SD	Height/CM Mean ± SD	Arm CIR./CM Mean ± SD	n
10	30.98±7.79	138.95±7.29	19.13+2.88	30
10.5	30.33±7.58	139.86±7.67	18.65±2.28	35
11.0	35.14±7.47	145.14±8.47	19.40±4.30	34
11.5	37.93±9.60	149.03±8.88	20.62±3.34	32
12.0	40.68±9.15	151.85±7.58	21.13±2.70	40
12.5	40.04±8.69	152.00±9.57	21.10±2.65	27
13.0	42.33±10.48	156.10±9.60	21.40±2.66	66
13.5	46.12±10.11	157.03±8.04	22.16±2.30	30
14.0	44.30± 7.97	157.48±6.72	22.10±2.09	46
14.5	49.46±8.35	160.17±7.52	23.07±2.50	29
15.0	50.44±5.67	162.99±5.67	23.51±4.76	61
15.5	51.88±5.67	164.54±5.11	23.95±2.19	40
16.0	50.96±7.66	162.34±5.91	23.84±2.44	83
16.5	52.29±7.40	163.60±6.30	23.83±2.49	37
17.0	53.15±6.14	163.76±6.38	24.12±2.13	57
17.5	53.01±8.18	161.98±5.44	24.79±2.19	28
18.0	51.46±3.88	163.33±5.07	24.25±1.52	22
18.5	54.47±38	163.02±6.52	24.51±2.11	23
19.0	55.50±8.49	162.35±4.59	24.91±2.41	30
19.5	56.74±7.07	164.04±6.59	24.50±1.64	26
20.0	55.98±7.94	165.34±4.71	24.86±2.41	25

n = Sample Size.

administered questionnaires and were then compiled on age basis. The data for males were compiled separately from those of females.

Statistical analysis were performed using SPSS to compute the means, standard deviations, percentile values for height - for - age, weight - for - age, and arm circumference - for - age. Percentile curve (10th, 50th, 90th) were plotted for the various anthropometric parameters. Comparison were made between the 50th percentile curve of male and females obtained from those with those of WHO/National Centre for health Statistics (NCHS) recommended standards.

Results and Discussion

The analytical results for the distribution of the means and standard deviations of weight, heights and arm circumferences of males and females according to ages are presented in Table 1 and 2.

It revealed that females have larger values for weight and arm circumference from 10 to 17.5 years as well as larger values for height from 10 to 15.5 years than males. Thereafter, the males then overtook the females in values for the respective anthropometric variables and maintains this lead up to the 20th year in this study. The probable reason for this female ascendency could be attributed to the fact that on the average, girls began their adolescent growth spurt (which shoots up their growth rate) at an earlier age than do the boys (Shamssan, 1991;

Didia and Ogunranti, 1986; Eveleth and Tanner, 1976; Tanner, 1961).

The interelationships between the various anthropometric variables were also computed. This indicated that the correlation coefficients for variables were Ages and Height (0.89 for male and 0.98 for females); Age and weight (0.94 for males and 0.98 for females); and 0.95 in males and 0.99 in females for Age and Arm circumference. Others were weight and height (0.97 for males and 0.98 for females); Height and Arm circumference are 0.91 for males and 0.97 for females, and 0.99 (males) and 1.0 (females) for Weight and Arm circumference.

Percentile values (10th, 50th, 90th) which represented the growth standard computed for males and females are shown in Table 3 and 4. The 50th centile curves for height and weight obtained from this study were compared with the 50th centile curves for weights and heights of males and females of the WHO/National Centre for Health Statistics (NCHS)recommended standards. The results show that there was a general trend towards a drop in the weight of males and females. The only exception was the 50th centile curve for height of females, which reveal that the curve obtained from this study compared favourably with the WHO/NCHS standards and that it did not fall below the recommended standards.

It could thus, be deduced from this study that a high degree of relationship exists between Weight and Arm

Table 3: Percentile values for weight, height and arm circumference for males

Ages/ yrs	Weight			Height			A.M.C		
	10th	50th	90th	10th	50th	90th	10th	50th	90th
10	23.70	27.30	32.30	127.80	137.00	142.30	15.50	17.00	19.23
10.5	23.90	28.80	33.00	128.80	138.00	145.40	15.65	17.00	19.00
11	23.30	29.80	37.80	130.10	140.25	148.95	16.00	17.63	20.98
11.5	23.30	28.30	48.90	129.60	142.00	154.60	6.70	16.25	20.40
12	24.30	33.30	44.30	131.80	146.00	159.40	16.35	18.25	22.60
12.5	26.30	31.30	43.80	137.00	143.50	157.50	16.38	18.50	22.25
13	26.70	34.30	45.70	135.00	146.00	159.80	16.75	18.75	21.85
13.5	26.00	33.55	48.70	138.45	146.90	165.22	16.70	18.38	21.68
14	29.10	37.30	49.30	140.36	154.00	165.90	16.95	19.50	23.50
14.5	31.20	42.30	54.55	143.90	158.35	172.55	17.45	20.25	25.05
15	32.20	44.30	57.40	142.45	162.15	177.00	18.23	21.00	24.33
15.5	33.70	49.30	59.30	146.08	164.00	178.36	17.50	23.25	25.30
16	38.00	49.30	60.60	158.40	166.50	178.02	18.93	22.50	25.83
16.5	44.70	49.80	63.60	155.40	164.00	172.70	20.45	23.25	27.35
17	39.30	51.55	64.10	155.20	167.30	180.17	19.03	23.45	26.45
17.5	41.10	51.30	61.46	160.36	169.80	179.16	19.45	23.75	25.50
18	42.30	28.30	68.70	157.40	174.00	184.60	20.60	24.50	27.15
18.5	43.30	59.30	71.70	161.64	171.20	180.54	22.05	24.50	27.05
19	40.00	57.30	67.30	159.60	173.90	178.12	21.85	25.25	29.41
19.5	49.30	59.80	72.70	162.51	171.25	179.86	22.50	25.00	29.20
20	51.90	59.30	70.50	167.52	173.80	180.92	22.25	25.50	29.65

Table 4: Percentile values for weight, height and arm circumference for females

Ages /YRS.	Weight			Height			A.M.C		
	10TH	50TH	90TH	10TH	50TH	90TH	10TH	50TH	90TH
10	23.80	28.80	40.80	127.30	139.50	147.90	16.00	18.38	23.25
10.5	22.80	28.80	37.00	130.60	138.00	151.20	16.65	18.50	20.50
11	25.30	34.80	46.30	131.10	140.25	146.50	16.75	19.63	26.63
11.5	27.60	35.80	53.65	135.30	148.50	160.70	17.65	19.00	24.18
12	30.80	39.80	52.60	141.10	153.00	160.00	18.00	20.50	24.50
12.5	29.20	38.30	55.00	137.80	151.00	167.20	17.50	21.25	24.25
13.00	30.80	40.30	56.80	144.00	156.00	167.00	18.50	21.00	25.25
13.5	34.80	45.80	59.80	148.56	159.25	170.00	19.25	22.00	25.50
14	35.50	46.00	59.80	148.00	160.00	170.00	20.00	22.00	25.50
14.5	38.80	49.80	59.80	147.50	162.50	168.00	20.00	22.75	26.25
15	40.00	48.80	61.60	156.00	163.20	170.70	20.50	22.75	27.00
15.5	44.80	51.55	59.70	154.90	166.00	170.00	21.33	23.50	27.40
16	41.20	50.80	59.80	154.70	162.50	171.18	20.60	23.75	26.80
16.5	33.30	49.80	61.80	147.70	167.75	176.10	18.13	22.38	27.00
17	45.80	52.80	60.00	155.90	164.00	178.08	21.25	23.75	27.55
17.5	41.60	52.80	65.20	153.80	163.30	169.10	22.00	24.75	28.10
18	42.00	53.00	64.80	151.50	163.50	171.50	22.00	24.50	28.90
18.5	45.20	54.80	64.80	151.80	164.00	172.40	21.95	24.00	28.10
19	46.00	55.00	65.00	152.00	164.00	172.00	22.00	24.25	27.00
19.5	48.80	67.10	67.10	155.70	164.00	171.15	22.50	24.50	27.13
20	50.00	59.00	67.50	156.00	165.00	172.50	22.50	24.50	27.40

circumference, Weight and Age, Age and Arm circumference, Weight and height and to a lesser degree for Height and Arm circumference, and Age and height for males and female respectively. A closer look at the results revealed that the Weight and Arm circumference are most dependent on each other, hence are mutually associated to a very high degree. Age and Arm circumference, and Weight and height are

also highly mutually associated but to a slightly lesser degree than weight and Arm circumference.

The age of puberty from this investigation was observed to be 15.5 years for female and 18 years for males. It was also observed to be 15 years for females and 17 years for males in contemporary Nigerian children from Port-harcourt (Ogunranti, 1986).

Results obtained from the comparison with WHO/NCHS standards are a good reflection of the growth and nutritional status of the subjects in Benin City. The observed drop in the 50th centile curve obtained from this study might be attributed to nutritional and socio-economic factor rather than genetic factors. This is because previous researchers (Esiet,1984; Janes, 1974; Banik *et al.*, 1973; Tanner, 1961), had reported that studies carried out on individuals of African Origin but residing in developed countries have growth standards comparably or even highs than those of WHO/NCHS standards. The lower values obtained from this study is suggestive of the need for the improvement in the nutritional status and growth of the subjects from Benin City.

An interesting result of this study is the comparison curve of females for height. The results revealed that female subjects from Benin City have growth patterns comparable to WHO/NCHS standards. A possible reason for this could be attributable to the adolescent growth spurt and also that height is much less affected by nutritional and socio-economic factors than does weight.

The information emanating from this study confirms the results obtained by earlier researchers (Shamssain, 1991, 1989; Prazuck *et al.*, 1989). But in contrast with Ogunranti (1986) report in Port Harcourt for subjects within the age group of 4 - 18 years, which showed that contemporary Nigerian children have growth standards higher than WHO/NCHS recommended standards.

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