IOSR Journal of Pharmacy and Biological Sciences (IOSR-JPBS)
e-ISSN:2278-3008, p-ISSN:2319-7676. Volume 13, Issue 4 Ver. V (Jul – Aug 2018), PP 01-06
www.iosrjournals.org

Assessment of Nutritional Statusamong Adult Males of North-Eastern Nigerian Origin.

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Abstract:*In a quickly globalising world, social media trends are on the rise. Virtual realities are taking over what used to be real-time physical experiences. The advancements in technology and overall standards of living is also altering lifestyle choices and consequent health outcomes across populations. Being underweight was considered a serious public health problem and assisted in managing nutritional status in crises situations. However, recent trends show that being overweight has also become a problem. To maintain a balance between the two extremes is the task facing all peoples today. It is against this background that this paper seeks to understand the anthropometric dimensions of young Nigerian males of North-eastern origins.*

Date of Submission: 25-07-2018 Date of acceptance: 12-08-2018

I. Introduction

Nutritional status is the extent to which an individual is experiencing under nutrition or over nutrition, or is in a state of nutrition balance. Nutritional status is a major determinant of current health status and future health outcomes for individuals and households throughout the life cycle and, in the case of pregnant women, a determinant of health for the foetus and the new born (Gibson 1990). Nutrition assessment is an in-depth evaluation of both objective and subjective data related to an individual food and nutrient intakes, lifestyle and medical history (Bender and Bender, 2005). Food availability and distribution usually constitute a huge problem in developing countries. This is because a lot of social-economic-cultural factors play significant role in food production, availability and consumption. An individual's nutritional status is determined by a combination of factors including genetic predisposition to certain conditions, patterns set down during foetal growth and development, past and current pattern of physical activity, and past and current food intake. Optimum nutritional statuses are ideal for healthy living, though trends may suggest an increase in overweight and obese persons among populations.

Overweight and obesity are a growing concern among populations worldwide and are emerging as amajor public health problem. Obesity is associated with significant comorbidities and health problems such asdiabetes mellitus, hypertension, coronary artery disease,orthopaedic problems, skin fungal infections and negativeself-esteem (Deckelbaum& Williams,2001). The consequences of obesity are likelyto be worse in the developing countries where healthfacilities to manage the condition and its complicationsare scarce. Based on the data reported by Popkin, Richards andMontiero(1996), The prevalence of obesity in the developing countries ranges from 7 per cent to 10 per cent. The increase in the prevalence of obesity and overweight may be attributed to modifications in the peoples' way of life to embrace western cultures, rapid urbanization and more sedentary lifestyles. Being overweight or obese can be determined through estimations of a person's body proportions using anthropometry.

Anthropometry is considered to be an important tool for assessing nutritional status of individuals or of the community. Hence, measurements like stature, sitting height, weight and indices based on these measurements developed by different scholars have been extensively used to define the extent of malnutrition(Adak, Gautam&Gharami, 2006). There are many anthropometric measures that are useful in assessing the nutritional status of a population including Body Mass Index (BMI) and Cormic Index (CI).

Body mass index (BMI) or Quetelet Index is a statistical measure of the weight of a person scaled according to height. It was invented between 1830 and 1850 by the Belgian polymath AdolpheQuetelet during the course of developing "social physics". It is a practical anthropometric parameter generally accepted as the most useful way to measure the body fat in adult below the age of 70years and it is defined as the individual's body weight divided by the square of their height (Adeyemi, Komolafe&Abioye, 2009). The formula universally used in medicine produce a unit of measure of kg/m^2. Body mass index can be accurately calculated using the formula below.

$$\text{Body Mass Index} = \frac{\text{WEIGHT (Kg)}}{\text{Height}^2\,(\text{m}^2)}$$

BMI is meant to be used as a simple means of classifying sedentary (physically inactive) individuals with an average body composition (WHO Technical Report Series, 1995). For these individuals, the current value settings are as follows: a BMI of 18.5 to 25 may indicate optimal weight; a BMI lower than 18.5 suggests the person is underweight while a number above 25 may indicate the person is overweight; a BMI below 17.5 may indicate the person has anorexia or a related disorder; a number above 30 suggests the person is obese while values over 40 are considered morbidly obese (Adeyemi, Komolafe&Abioye, 2009). The basis for this BMI classification stems from observational and epidemiological studies which relate BMI to risk of morbidity and mortality (Gordon & Doyle, 1988, Hamm, Shekele&Stamler, 1989, Lindsted, Tonstad&Kuzman, 1991, Roberts, 1999).

Cormic index is an anthropometric index that defines the concept of body shape. The name CormicIndex was assigned by the Congress International de Sciences Anthropologies et Ethnologiques to define a ratio of sitting height to stature (Obikili, 1993). Cormic index is the most bi-variate index for shape which measures the relative height of the trunk and lower limb and it varies between individuals and groups (Adeyemi, Komolafe&Abioye, 2009, Ukwuma, 2010). Stature is a composite of linear dimension and a major indicator of general body size and of bone length (Ghosh &Bandyopadhyay, 2005). It is the linear measurement of the distance from the floor or standing surface to the top of the skull.
Mathematically, Cormic index is expressed as:

$$\text{(SITTING HEIGHT/STATURE) X 100}$$

There is a racial or ethnic variation in the mean cormic index and has applications as a valid means to study body size in many populations. Data exist for Africans, Australian aborigines, Europeans and Indo-Mediterranean populations. Africans have proportionally longer legs in general with cormic index value around 51% (0.51). Asians and far Eastern populations have proportionally shorter legs with cormic index of 53-54% while Australian Aborigines who are relatively long legged exhibited low mean cormic index ratio of 0.48±0.02 (48%) ranging from 0.41-0.54 (41-54%) (Pheasant, 1986, Norgan, 1994, Woodruff & Duffield, 2002).

These differences observed in people of varying backgrounds are due to the determining factors which grossly include age, genes, environment and lifestyle. Cormic Index is constant for well-nourished, healthy children younger than 5 years of age but declines throughout childhood because leg length increases faster than trunk length during pre-pubertal growth. Among Nigerian populations, Cormic Index were observed to be 49.1 among Ibo boys (Obikili, 1993), 49.9 and 50.5 for male and female subjects respectively in a North Central population (Adeyemi, Komolafe&Abioye, 2009), while it was 48.6 and 47.9 for male and female subjects respectively in a South-eastern population (Ukwuma, 2010).

Correlations between BMI and Cormic Index have been used to investigate nutritional status in populations.In a certain study, the BMI and cormic index were significantly correlated with $r = 0.45$ ($P < 0.001$) for the men and $r = 0.56$ ($P<0.001$) for the women (Pheasant, 1986). In a similar study involving 349 adults (187 males and 152 females) Australian Aborigine, the BMI and Cormic Index were significantly correlated. The correlation coefficient r obtained was 0.43 ($P > 0.001$) for males while the value obtained for females was $r = 0.37$ ($P<0.001$). These Australian Aborigines exhibited low mean sitting height/stature ratio of 0.48 ± 0.02 (48%) ranging from 0.41 – 0.54 (41 – 54%) that is they are relatively long legged (Norgan, 1994).Also, linear regressioncoefficient of BMI on Cormic Index fortribal groups in India was 13.68 **f** 3.3 ($t=4.14$, $p < 0.000$), and the correlationcoefficient (r **f** standard error) was 0.16 **f** 0.02 showing poor nutritional status (Adak, Gautam&Gharami, 2006). BMI is known to be highly correlated with both fat and fat-free mass, although these associations may vary with age, sex and ethnicity (Norgan, 1990).Age has a direct impact on body size, shape and composition (Collins, Duffield & Myatt, 2000). Adults tend to loose fat free mass (FFM) and increase fat mass (FM) with age and these changes may alter the functional significance of BMI at different ages.

Nutritional status of individuals usually relate to underlying tendencies of ill-health especially when people are overweight or obese. Overweight and obesity are abnormal or excessive fat accumulation that may impair health. Overweight and obesity are now on the rise in general which is attributable to improved lifestyles which tend to be less stressful and more sedentary. These conditions expose people to life threatening health conditions. According to WHO (2007), both obesity and underweight have been associated with diseases. Obesity has been associated with several non-communicable diseases such as hypertension, diabetes and lipid

disorders as well as with increased morbidity and mortality among adults. On the other hand, underweight is associated with infections such as tuberculosis.

Knowledge of the nutritional status of a community is necessary to have a comprehensive idea about its development process, since under-nutrition is one of the major health problems in developing countries. It is reported that the basic causes of under-nutrition and infections in developing countries are poverty, poor hygienic conditions and little access to preventive health care (WHO, 1990). To the best knowledge of the authors, data on the nutritional status of North-eastern male population does not exist and this is what the present study is poised to achieve.

II. Methods

Design: The descriptive survey design was employed to achieve the objectives of the present study According to Cohen, Manion and Morrison (2011), descriptive survey research sets out to describe and to interpret what is, gathers data at a particular point in time with the intention of describing the nature of existing conditions or identifying standards against which existing conditions can be compared, or determining the relationships that exist between specific events.

Study Location and Population: The study location was the College of Health Technology, Ningi (CHTN), Bauchi State. Bauchi is a state in the North-eastern Nigerian geopolitical zone. The state is multi-tribal including Hausa, Fulani, Hausa-Fulani, Jarawa, Karai-Karai, Duguri, Babanbo, Warjawa, Kanuri, Warjinci, Boyawa, Buzu, Karkabau, Fym, Fa-awa, Kanuri among others. The predominant religion is Islam while the people are mainly farmers who keep animals (cattle, sheep, donkeys, camels and goats) or grow plants (wheat, maize, sorghum, cassava, groundnut, bambaranut, dates, sugarcane, water melon, tomatoes). The people lead nomadic pastoral lifestyles which involve walking long distances on foot. Thus, movement of people from place to place is mainly by walking even though the use of motorcycles, motor vehicles and animals (donkeys, camels, bull carts and horses) is still prevalent. The students of CHTN Bauchi State are predominantly Muslims from different Nigerian states, but with a majority of them being indigenes of North-eastern states including Bauchi, Gombe, Bornu, Adamawa, Taraba and Jigawa.Most of the students are from rural communities that are characterized by poor socio-economic status. While some students are accommodated within the school facilities, others live in neighbouring communities from where they transport themselves to the school for classes.

Sample and Sampling Techniques: The population for the study consisted allstudents of the College of Health Technology, Ningi, Bauchi State. The sample for the study consisted of 150 male students representing 10 per cent of all students who were enrolled in the institution between 2010 and 2011. This is in line with the assertion of Nwana (1990) that 10 per cent of the population serves as a good sample, if the population runs into a few thousands.

Method of data collection

Anthropometric measurements: this involved the measurement of height, sitting height and weight of the students which was used for calculating the Body Mass Index – BMI and Cormic Index of the students. Anthropometric data and other bio-social informationwere collected by the researcher to avoid interobserver variability. Standing and sitting heights were measured using a Stadiometer Model ZT 120. All measurements were taken to the nearest 0.1 centimetres (cm). The measurement of stature was conducted following anthropology protocols as prescribed by *Anthropometric Indicators Measurement Guide* and *Anthropometric Standardization Reference Manuall* (Lohman, Roche &Martorell, 1988; Bruce, 2001, 2003). Height was measured with subjects standing barefoot, heels together, arms at sides, legs straight, and shoulders relaxed. The subjects` heads were positioned in a horizontal Frankfort plane or such that their eyes were looking straight forward, without lifting their chin. Just before taking the measurement, subjects were asked to take a deep breath and hold it. The head piece was lowered to the highest point of the head, ensuring that hair was compressed.The weight of the subjects was measured using a bathroom scale (HANSON) with subjects lightly clothed and barefooted. The researchers assisted the students to stand erect on the scale. Readings were taken to the nearest 0.1 kg using standard procedures (WHO, 1995).

Statistical Analysis

The Statistical Package for Social Sciences (*SPSS, Version 16.0*) was used for data analysis. Descriptive statistics was used to present anthropometric variables. Body Mass Index and Cormic index were calculated for each individual followed by calculation of central tendency viz. mean and standard deviation for each measurement per state. The Pearson correlation analysis was used to measure the strength of the relationship between the variables. A p value of <0.05 (two-tailed) was considered as significant.

III. Results

The results are presented in tableswith brief interpretation of its content.

Table 1:General Characteristics of male North-eastern subjects

Tribe	Age	Weight (Kg)	Height (M)	Sitting Height	Subischial Leg Length
Hausa	24.176	66.963	168.671	78.600	90.071
Fulani	24.435	67.352	167.978	78.713	89.265
Hausa-Fulani	25.500	68.275	167.375	78.200	89.175
Karai-Karai	22.250	67.725	168.275	78.600	89.675
Jarawa	24.100	68.420	168.950	78.430	90.520
Kanuri	25.286	68.229	172.329	77.771	94.557
Others	27.364	67.718	169.518	78.873	90.645

Table 1 shows the distribution of age, weight, height, sitting height and Subischial Leg Length according to tribe.

Table 2:Mean values of age, height, sitting height, subischial leg length, weight cormic index and BMI

	N	Minimum	Maximum	Mean	Std. Error of Mean	Std. Deviation
Age	150	20.00	55.00	24.56	0.46	4.87
H	150	150.60	185.00	168.90	0.66	6.95
SH	150	70.50	88.00	78.58	0.32	3.34
SLL	150	70.80	106.70	90.32	0.53	5.59
W	150	44.00	76.00	67.50	0.34	3.61
CI	150	40.69	55.05	46.55	0.17	1.74
BMI	150	16.07	33.37	23.49	0.28	2.94

Table 2 shows the mean values for age, height, sitting height, subischial leg length, weight cormic index and BMI. The mean age for all subjects was 24.56±0.46 years, mean SLL was 90.32±0.53cm, mean weight was 67.50±0.34, and mean CI was 46.55±0.17 while the mean BMI was 26.18±0.21. Study subjects showed very long legs which is characteristic of Africans and consequently, they have low cormic index values. The BMI ranged from 20.2 to 30.86, with an average of 26.18±0.21. This could indicate that the study subjects are possibly overweight.

Table 3:Nutritional Status of Adult Males of North-eastern Nigerian Origin

	N	Minimum	Maximum	Mean	Std. Error of mean	Std. Deviation
CI	150	40.69	55.05	46.55	.17	1.74
BMI	150	16.07	33.37	23.49	.28	2.94

Table 3 shows the standardized BMI for the purpose of determining nutritional status as ranging from 16.07 to 33.37, with an average of 23.49±0.28. This indicates that the population is of optimal weight and probably healthy.

Figure 1: General Nutritional Status of the Respondents

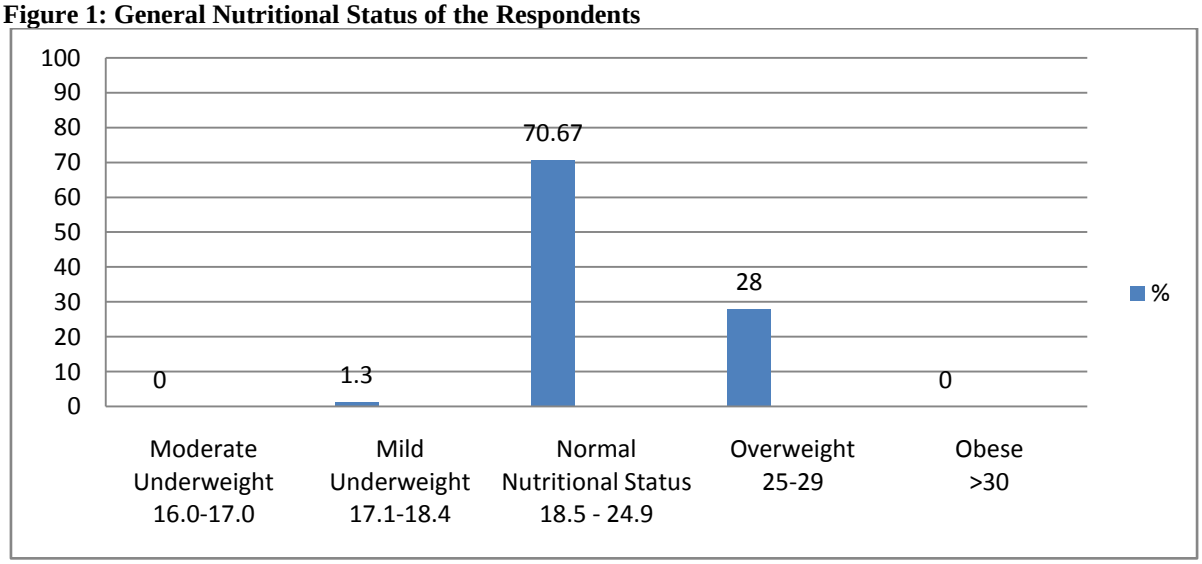

Figure 1 shows that 106 (70.67 %) of the respondents have a normal nutritional status while 42 (28 per cent) and 2 (1.3%) of the respondents were overweight and mildly underweight respectively.

Table 4:Correlation between BMI and Cormic Index

		CI	BMI_{Std}	BMI
CI	Pearson Correlation	1	.705(**)	.327(**)
	Sig. (2-tailed)		.000	.000
BMI_{Std}	Pearson Correlation	.705(**)	1	.901(**)
	Sig. (2-tailed)	.000		.000
	N	150	150	150

** Correlation is significant at the 0.01 level (2-tailed).

Table 4 shows a significant, positive Pearson correlation coefficient obtained for BMI (r = 0.327, p = 0.000), BMI_{Std}(r = 0.705, p = 0.000) and CI (0.327). This implies that there is a direct relationship between CI and BMI and BMI_{Std} such that when CI increases, so does BMI and $BMI_{Std.}$ There is a stronger between BMI_{Std} and CI than with BMI, while there is a significant, near perfect relationship between BMI and BMI_{Std}(r = .901, p = 0=.000).

IV. Discussion

BMI and CI are the major and the most common bivariate indices of shape and the most common body size descriptor(Norgan, 1994, Adeyemi, Komolafe&Abioye, 2009).Body Mass Index (BMI), is a significant determinant of nutritional status (FANTA, 2003).In the present study, the mean BMI was 23.49±0.28 while the mean CI was 46.55±0.17. Study subjects showed long legs which is characteristic of Africans and consequently, they have low Cormic index values. BMI ranged from 16.07to 33.37, with an average of 23.49±0.28. This indicates that the study subjects are of a normal nutritional status. This is a plausible outcome, consistent with the expectation that individuals of a north-eastern Nigerian origin would not be overweight due to the active kind of life attributed to the region. The people are predominantly farmers and the pastoral lifestyles common among them permits them engage in daily physical activities. This has been identified as a source of staying healthy and avoiding deadly diseases. A previous study reported an inverse association between BMI and physical activities inwomen (Lahti-koski, Pietnen, Heliovaara, &Vartiainem, 2002). This implies that BMI reduced with increased levels of physical activities. Similarly,certain studies have asserted thatpeople who are physically active on a regular basis are lesslikely to gain weight (Schmitz et al, 2000; Drøyvold et al,2004; Kimm et al, 2005; Besson et al, 2009).

Sedentary lifestyles which are common among urban dwellers in more developed settings are not observed in these parts. Previous studies had reported that people who reside insubsistence societies typical of our study location are believed tohave very active lifestyles (O'Keefe, Vogel, Lavie and Cordain, 2010). The population studied reportedly trek some kilometres daily to attend classes, feed livestock, fetch water and carry out other daily needs. Preference for outdoor games accounts for physical exercise in the rural dwellers preventing them from becoming obese and hence maintaining adequate blood pressure and nutritional status. Other sociocultural practices encourage outgoing for male persons especially and hence they tend to keep fit and stay healthy. There is a noteworthy assertion relating communities similar to North-East Nigeria, which presumed that there exists a scarcity of non-communicablediseases such as heart disease and diabetes (Gurven, Jaeggi, Kaplan, and Cummings, 2013). This was not explored in the current research though it seems plausible and demands further research.

The results above also revealed that 28% of the total study population were overweight (figure 1). This finding is not surprising and aligns with global trends in obesity. The situation is greater in developed nations where it is considered an epidemic compared to the poorer nations like Nigeria. Considering that all the subjects were students at the time of the study, it is possible that some of them embraced modernistic approaches towards physical activities which is mostly sedentary. Still, this might be an indicator of future weight related health challenges in the future. It is safe to mention that some of the students were required by school policy to reside within the school compound. This provision might have contributed towards limiting physical activity. It is not conclusive, however, that residing within school campuses is a factor among overweight students. It is recognised that other factors as genetics and socio-economic status might portend greater risks than place of residence. Despite the assumption that the fundamental cause of obesity and overweight is an energy imbalance between calories consumed and calories expended, there are more recent consideration which may suggest differently (WHO, 2017).Gurven et al (2013) suggests that overconsumption of food may be more to blame for the upsurge in obesity than diminished energy expenditure. They argue that where a person's calorie intake surpasses their propensity to exert them, the person becomes overweight. This has formed the basis for many weight loss programs whereby people limit foods consumed based on quantity or the composition of the foods.

In our study location, there are slim chances that this area has food in excesses due to reduced agricultural activities, droughts, desertification and armed militancy.

V. Conclusion

In the past, underweight was considered a serious public health problem and has assisted in managing nutritional status in crises situations. Today, overweight has also become a problem. To maintain a balance between the two extremes is the task facing the developed world today. Trends also suggest that the more developed a nation is, the higher the likelihood of having more overweight people among the populace. Social activities are less physical and less personal.

It is necessary to explore innovative approaches to incentivise healthy lifestyles such as physical activities and healthy diets. Health education is an important activity which can help young people learn more about staying healthy. School-based feeding programs (where this exists) must take into cognisance what impact food types can have. Proper orientations have to be given; that in regions where poverty is predominant, being the fat one does not suggest health or wellbeing. It might be an indicator of far worse health challenges to come.

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*Ukwuma M C "Assessment of Nutritional Statusamong Adult Males of North-Eastern Nigerian Origin.." IOSR Journal of Pharmacy and Biological Sciences (IOSR-JPBS) 13.4