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BMI A HEALTH POINTER- A PROSPECTIVE STUDY OF APPARENT HEALTHY STUDENTS OF DORBEN POLYTECHNIC ABUJA

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ABSTRACT

Body mass index (BMI) along with waist circumference measurement points where the fat accumulates on the body. BMI is a good measure of general adiposity therefore the aim of this research was to highlight a commonplace fact on Nigerians eating habits with its link on health status, through BMI assessment. The researchers measured fasting blood sugar (using the principle of glucose oxidase method), lipid profile, (using semi-automated enzymatic analyzer and phosphotungstate precipitation method), BMI and associated anthropometric parameters in apparent healthy students, to scale the health status in prospect. The results revealed most increased in value of BMI (28.15 kg/M^2), Fasting Blood Sugar (5.19 mg/dl), Blood pressures (120.67: 81.67), and Waist Circumference (37.43 inches), were all in the overweight category. In the lipid profile (Mg/dl), most increased in value were Triglyceride (109.14), Total Cholesterol (160.29), Very low density lipoprotein (21.83), in the overweight however Lower Density Lipoprotein (125.85), was in underweight. High Density Lipoprotein (28.00) in normal and overweight. The result was significantly different only in the BMI at P<0.01, for underweight and 0.001 for overweight compared with the normal weight. BMI has correlation with all the parameters measured. From the results, trend in the development of risk factor for cardiovascular diseases, obesity and diabetes are farsighted BMI scale.

KEYWORDS: BMI; Associated anthropometric parameter; fasting blood sugar; lipid profile; health status in prospect.

INTRODUCTION

Body Mass Index (BMI) is a number calculated from a person's weight and height which points to the health status of individual(s). It is defined as the weight in kilograms, divided by the square of the height in meters (Kg/M^2) (Hu, 2008). BMI is a health pointer and can serve as a scale to measure health. Although BMI does not measure fat directly, but research has shown that BMI correlates well to direct measurement of body fat, such as underwater weighing, skinfold thickness measurement and dual energy X-ray absorptiometry (Mei *et al.*, 2002: Garrow and Webster 1985). The disadvantage of the others is that they either need highly trained personnel or is expensive. Hence a good index.

The index is good for recognizing trends within sedentary or overweight individual because there is smaller margin for errors. The general correlation is particularly useful for consensus data, regarding obesity or various other diseases because it can be used to build semi accurate representation from which a group can be calculated and solution can be stipulated or the RDA (recommended Dietary Allowance).

Obesity is the condition of having too much body fat. It has been linked to life-threatening diseases including diabetes mellitus, heart problems, and some forms of cancer (NIH Heart, Lung, And Blood Institute, 1998: World Health Organization, 2000). It is a public health problem due to its increasing prevalence (Flegal, *et al.*, 2000) and its associations with higher morbidity and mortality from multiple diseases (NIH Heart, Lung, And Blood Institute, 1998: World Health organization, 2000).

The correlation between the BMI number and body fatness is fairly strong; however the correlation varies by sex, race and age which may necessitate adjustment (Prentice and Jebb, 2001).

Justification

Many previous studies have suggested significant effects of body weight, height, cholesterol, pulse rate, BMI, different skin fold, obesity, nutrition, smoking, oral contraceptive use, menopausal status, stress and physical activity on blood pressure (Badaruddoza, 2000: Sidhu *et al.*, 2004: Badaruddoza *et al.*, 2008: Badaruddoza *et al.*, 2008: Badaruddoza and Hundal, 2009: Badaruddoza, 2009). In Nigerians pupils, many seem to be oblivious of their health as it relates to eating and accordingly are predisposed to obesity and diabetes (Wale, 2013). Statistics indicate that sizable number of emerging youths might be facing challenges of obesity and its attendant health conditions in the near future Iwalola, 2015). Taking that into account, the present study focused on BMI; males and females of Dorben Polytechnics Bwari Abuja. This research would play a fundamental role in wellness crusade. In line with this, we thoughtfully advocate for healthy lifestyles and good nutrition practices within every community.

The primary objectives of the current study are

(i) To describe the relationship and correlation between the classes of BMI, blood pressure, anthropometric measurements and metabolic variables.

(ii) To compare the three population groups via BMI classification and find out the significant predicators for CVD (cardiovascular disease) in the subjects.

METHODOLOGY AND MATERIALS

Human Subjects

A total of 132 students of both males and females were involved, the students are apparently healthy. The students were examined for their health status by medical team of the Polytechnics and those found with any ailment(s) were excluded. They were orally informed about the research, interviewed, counsel conducted afterward. Thereafter informed consent was obtained from all subjects. The research received the endorsement of the school ethical committee before the commencement of the work. The randomly selected students were grouped on the basis of BMI.

Anthropometric Measurement

Waistline measurement: this was measured directly against the skin, the individual breathed out normally, and then the tape was snug, without compressing the skin. In this position the waist was horizontally halfway between the lowest rib and the top of the hipbone. This was approximately, in line with the belly button. In this position, measurement of the waist to the nearest 0.5 cm (1/4 inch) was taken (HEART AND STROKE FOUNDATION, 2008). Measurement was taken three times for each individual and the average of the three was used.

BMI Measurement

The heights were measured by portable stadiometer to the nearest 0.1cm, weight by a battery operated scale to the nearest 0.1kg, systolic and diastolic blood pressures on the left arm in each subject in a supine position with a sphygmomanometer (Cacosson Products, England) measured, afterward recorded. Body Mass Index (BMI) was calculated by using their height (m^2) and weight (kg). On the basis of BMI, all participants were divided into three groups that is underweight whose BMI was less than 19 kg/m^2, normal who's BMI was between 19 and 26 kg / m^2 and overweight who's BMI was more than 26 kg /m^2. Waist Circumference was used as an indicator of a central pattern of adiposity. Readings taken three times for each individual and the average of the three was used.

Fasting Blood Sugar Determination

After a twelve-hour fast, Blood samples were collected through a finger prick and fasting blood sugar estimated on glucometer by glucose oxidase method in the morning.

Lipid profile testing

Following a twelve-hour fast, venous blood samples were taken from all the participants in the morning. Total cholesterol and triglyceride concentrations were determined with a semi-automated enzymatic analyzer (RA 50, semi-auto chemistry analyzer, Bayer's India Ltd, India). HDL- cholesterol serum level was measured by using phosphotungstate precipitation method. Standard statistical calculations were also made. The results were expressed as mean and deviation calculated to the nearest two place of decimal.

Statistical Analyses

Data were presented as means ± standard deviation (SD); the multiple comparisons of the mean values were carried out using one-way ANOVA with LSD post-hoc test. SPSS of statistic 20 package was used. Significance was considered at p-values less than 0.05, 0.01 and 0.001.

Values are expressed as Mean ±Standard Deviation: values bearing ** and*** show significant at $P<0.01$ and 0.001 respectively.

RESULTS

The results of the present study were presented in tables 1, 2 and 3. Table 1 showed the characteristics population. In this table 1, the mean characteristics of the population under study were: Age (26.38), Body Mass Index (22.95), Waist Circumference (34.21inches), Fasting Blood Sugar (4.71 mg/dl), Systolic Blood Pressure (115.37 mmHg) and Diastolic Blood Pressure (76.85 mmHg). Table 2 presents the classification of the population according to their weight, Body Mass Index and the fasting blood sugar. In this Table 2, the decreased in the value of BMI (18.48 kg/M^2) of the underweight category is significantly different with the value of the BMI (22.22 kg/M^2) of the normal weight at $p<0.01$ however the value of the BMI (28.15 kg/M^2) of the overweight increased significantly at $p<0.001$. The glucose concentration (4.40 mg/dl) of the underweight decreased compared with the concentration of the normal weight (4.53 mg/dl), however the glucose concentration (5.19 Mg/dl) of the overweight increased as compared with the normal weight. There were no significant difference in concentration of glucose in both underweight and overweight compared with the concentration of glucose of the normal weight category at $P>0.05$. Waist Circumference value (32.45 inches) of the underweight is lower while the value of the overweight is higher (37.43 inches), compared with the value of the Waist Circumference of normal weight (32.73 inches). The both values were not significant compared with the normal weight value (p>0.05). The blood pressure in systolic and diastolic value of both underweight (115: 79.5 mmHg) and overweight (120.67: 81.67 mmHg), increased compared with the value of the normal weight (110.40: 69.38 mmHg). They underweight and overweight blood pressure were not significantly different compared with the blood pressure of the normal weight. The table 3 presents the lipid profile concentration. The concentration of triglyceride (97.50:109.14 Mg/dl), total cholesterol (134.57:160.29 Mg/dl), low density lipoprotein cholesterol (125.85:110.7 Mg/dl), very low density lipoprotein cholesterol (19.50:21.83 Mg/dl) in the underweight and overweight are higher than the normal weight of their respective parameters - triglyceride (90.80 Mg/dl), total cholesterol (88.83 Mg/dl), low density lipoprotein cholesterol (42.67 Mg/dl), very low density lipoprotein cholesterol (18.16 Mg/dl). There were no significant difference in all at p>0.05. In the high density lipoprotein cholesterol concentration, the underweight value (24.00 Mg/dl) is decreased compared with the concentration of normal weight (28.00 Mg/dl), the concentration of the overweight value (28.00 Mg/dl) is the same compared with normal weight. There were no significant difference in all at p>0.005).

Table 1: Patient characteristics.

Subjects	Dorben Polytechnic Students
Age (years)	24.38
Gender	male and female
BMI (kg/m2)	22.95±1.36
WC (cm)	34.21±2.93
FBS (mg/dl)	4.71±0.87
SBP (mmHg)	115.37±7.82
DBP (mmHg)	76.85±6.22

Table 2: Relationship between the BMI, anthropometry and fasting blood sugar (Classification based on World Health Organization WHO, 1998 and Pi-Sunyer, 2000).

Weight classification of participant	No	Body Mass index (Kg/m2)	Fasting Blood Sugar (mg/dl)	Blood pressure (mmHg)		Waist Circumference (inches)
				Systolic	Diastolic	
Underweight (18.5Kg/m^2)	34	18.48±0.08**	4.40 ±0.71	115±8.26	79.5±6.00	32.45±2.60
Normal weight BMI (18.5 –24.9) Kg/m^2	46	22.22± 1.50	4.53±0.95	110.40±6.82	69.38±6.67	32.73±2.66
Over weight (25.0 – 29.9 Kg/m^2)	54	28.15±2.50***	5.19±0.95	120.67±8.39	81.67±6.00	37.43±3.51

Values are expressed as mean ± standard deviation, value bearing ***p and **p was significant at p = 0.001 and 0.01 respectively.

Table 3: Relationship between the BMI, and fasting lipid profile (Mg/dl) (Classification based on World Health Organization WHO, 1998 and Pi-Sunyer, 2000).

Weight classification of participant	No	BMI (Kg/m^2)	TAG	T-C	HDL	LDL	VLD L
Underweight (18.5Kg/m^2)	34	18.48 ±0.08**	97.50 ±10.00	134.57 ±9.04	24.00 ±10.23	125.85 ±14.5	19.50 ±4.72
Normal weight BMI (18.5 –24.9) Kg/m^2	46	22.22 ± 1.50	90.80 ±16.00	88.83 ±18.09	28.00 ±6.01	42.67 ±14.03	18.16 ±5.63
Over weight (25.0 – 29.9 Kg/m^2)	54	28.15 ±2.50***	109.14±2 .70	160.29 ±30.4	28.00 ±6.10	110.7 ±18.74	21.83 ±3.62

Values are expressed as mean ± standard deviation, value bearing ***p and **p was significant at p = 0.001 and 0.01, BMI (Body Mass Index), TAG (triglyceride) T-C (Total Cholesterol), HDL (High Density Lipoprotein Cholesterol), LDL (low Density Lipoprotein Cholesterol) and VLD L (Very Low Density Lipoprotein Cholesterol)

DISCUSSION

A healthy life style might result to a longer lifespan, it is clear that the relative importance of non-communicable diseases will increase (Panz and Joffe, 2010). This situation is a result of demographic change, increasing urbanization (WHO 1998), and associated changes in risk-factor levels, such as, obesity, metabolic syndrome and physical inactivity- all of these point on BMI.

Where the fats accumulate is paramount in risk factor assessment of non-communicable diseases. In this present study, assessment of BMI and other anthropometric parameters was carried out to see how well it correlates with the Fasting blood biochemical parameter (sugar and lipid profile) and blood pressure so as to make reference to the health status of studied groups, in the long range. The BMI increased from the underweight through overweight category. The significant changes in the BMIs (underweight and overweight) represents sharp demarcation in the categories of the value of BMI of the studied population (Table 2 and 3). There was a patterned increased in the trend of BMI hence it formed a scale that possessed pointer. The blood pressure and waist circumference in the underweight and overweight category are not significantly different from the value in their corresponding normal weight category. This may be inferred from the population understudy being apparently healthy. However there was an increase in trend showing waist circumference increases alongside the weight category. This increase was in the same trend with BMI which inferred a positive correlation with BMI. (Table 2). The blood pressure in the underweight and overweight category, showed increase from the normal weight category (Table 2). The value of blood pressure in overweight category correlate positive with the BMI of the overweight however the value in underweight correlates negatively with BMI of the underweight. This may depict that increasing or decreasing BMI above or below the normal range has a negative effect on blood pressure in the long range. In a similar research, Queen Mary University of London (2017), reported that BMI and blood pressure in particular led to heavier and bigger hearts, which increases the risk of heart problems, including heart attacks The increase or decrease, if continues uncontrolled in the blood pressure, seen in this study in both underweight and overweight category may indicate risk factor for hypertension, and subsequently may precipitate into cardiac failure, cardiovascular disease and stroke in the long run. A report elsewhere showed that raise BMI value is an established risk factor for ischaemic heart disease, stroke and carcinomas (Whitlock *et al.*, 2009). This shows that the BMI scale can point to the cardiovascular risk factors.

Fasting blood Sugar is used in screening or/and diagnosing diabetes mellitus in human subjects. Persistent hyperglycaemia is diagnostic of diabetes. The increase in concentrations of fasting blood sugar is in similar trend with BMI value, showing a positive correlation. Though the under underweight fasting sugar concentration has nearly the same value, this may be due to the apparent healthiness of subjects and it is possible the development of hypoglycaremia may be influenced by other factors, though it was not investigated. Still no significant changes were observed, because all the different categories were within the normal range. This is attributable to the students exercise habits. The changes in fasting blood sugar from the underweight category through the overweight category in studied subject is in similar trend with BMI values of the studied group, hence can be scaled on BMI to point on health status. If the Fasting Blood sugar increase as BMI increases up to the risk state, diabetes may develop and subsequently other diabetic complications. Accordingly Meigs et al., (2003), reported that higher BMI increased the rate to progress from NGT to IFG and/or IGT. In a study by Jauch-Chara and colleagues, low body weight was associated with increased risk to develop IGT from NGT (Jauch-Chara et al., 2011). This is possible in distant time. It has been reported that Diabetes is a component cause of several other important and often lethal diseases, both non-communicable diseases such as cardiovascular diseases and renal diseases and communicable diseases such as pneumonia, bacteraemia and tuberculosis, which have considerable impacts on morbidity and mortality (Hall *et al.,* 2011). In another study, BMI and waist circumference were higher in subjects with abnormalities of glucose metabolism compared to NGT (Kuhl *et al.*, 2005). This is in agreement with the present study where higher BMI and Waist Circumference correlated with the metabolic syndrome of the present research. Lipid profile is often used to determine cardiovascular health in individuals at risk and the disorders are risk factors for cardiovascular diseases (Ravi, 2015). The lipid profile concentrations of the three weight categories in Table 3 of the participants, though are within the normal range, reflect a trend. The increased in lipid profile concentration of Triglyceride, Total Cholesterol, Low Density Lipoprotein Cholesterol, Very Low Density Lipoprotein of the overweigh category is in similar trend with the value of BMI in the overweight category of the studied population, which showed it correlated positively. However increased in concentration of the afore-mentioned lipid profile in in the underweight category is in similar trend but negatively correlated with the BMI in the underweight category. This shows that BMI has both positive and negative correlation with afore–mentioned lipid profile. The decreased in concentration of High Density Lipoprotein Cholesterol in the underweight category showed positive correlation with the value of BMI in the underweight category as both decreased in this category. The non-change in the overweight category showed no correlation with the BMI under the same category. This may again be due to their exercise habit. The correlations between BMI and lipid profiles have been previously suggested (Jong, *et al.*, 2002: Margolis *et al.*, 1996: Flodmark *et al.*, 1994). The decreasing and increasing of BMI value might reflect the tendency to increasing dyslipidaemia value in near future. Increasing evidence suggests that blood pressure with anthropometric and biochemical parameters such as total cholesterol, triglycerides, high-density lipoprotein, and low density lipoprotein predict prospective cardiovascular risk (Distiller, 2014). Hence the findings may assist in placing on the BMI scale, of those at high risk of cardiovascular disease, dyslipidemia, and metabolic disorders.

Since the BMI agrees with the Waist circumference in the present finding (Table 2), it is would be a reference point for health status. Thus deferent gauges of BMI have demonstrated a pointer on the health status of the population studied in consideration of fasting blood sugar and lipid profile as a measure of metabolic syndrome. The progressive trend in a consortium of metabolic risk factors can be shown on BMI and scaled to futuristically decide the onset of diabetes, heart disease, stroke, and certain cancers

CONCLUSION

Health is the greatest gift. A healthy outside, starts from inside, by extension healthy BMI with its associated anthropometric parameters starts from the biochemical parameters (in the normal reference range) such as Fasting blood sugar and lipid profile, which are in concordance with the studied population. Stroke an avoidable deteriorating health, was pointed in prospect on the BMI scale in this work. The research revealed relationship of BMI with risk factor in the measured parameters (Blood pressure, Waist Circumference Fasting Blood Sugar and lipid profile), though the studied groups are within the normal range but a distant point can be seen. Overweight is one of the most important modifiable risk factors in the pathogenesis of type 2 diabetes. The mechanism by which overweight and obesity engenders insulin resistance is inadequately understood however a positive correlation is assumed to exist between BMI and fasting blood sugar level with lipid profile. This again is revealed in the studied group. Weight gain precedes the onset of diabetes (Vittal *et al.*, 2014). Global epidemic obesity is rapidly becoming a major public health problem in the world and is on the rise. In many population of adolescence, the average BMI has been rising by a few percent per decade, thus fueling the concern about the effects of increased adiposity on health (WORLD HEALTH ORGANIZATION, 2015). The research has addressed the relevance of BMI as a health pointer.

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