ASSOCIATION BETWEEN BMI, BLOOD PRESSURE AND AGE AMONG FULANI ETHNIC POPULATION OF JAMA’ARE

Idris Tela Abdu, Magaji Garba Taura, Musa Habibu Modibbo, Lawan Hassan Adamu, Saad Datti, Abdullahi Yusuf Asuku

Department of Anatomy, Faculty of Medicine, Bayero University Kano, Kano State, Nigeria

Correspondence to: Idris Tela Abdu (gwtel4u@gmail.com)

DOI: 10.5455/ijmsph.2014.120420143    Received Date: 06.01.2014    Accepted Date: 12.04.2014

ABSTRACT

Background: Body mass index (BMI) is an important tool in medical diagnosis. With increase cases of obesity, hypertension and cardiovascular diseases especially in advanced ages especially in developing countries, documentation of relevant data would provide an essential roadmap in checkmating these health problems.

Aims & Objective: The study was designed to determine the association of blood pressure, BMI, and age among the Fulani ethnic population of Jama’are Bauchi state Nigeria.

Materials and Methods: The study was conducted in retrospective in General hospital Jama’are, Jama’are in Bauchi state, Nigeria. A total of one hundred and eighty (180) records of Fulani ethnic population comprised of 77(43%) females and 103(57%) males age range 5-65 years were collected from June to December, 2013. The subjects were divided into six different groups to study age trend with respect to blood pressure and BMI. The mean and standard deviation of the data were calculated and one-way analysis of variance (ANOVA) followed by post hoc (Tukey post hoc test) multiple comparison tests were carried out using Minitab (version 16) statistical software. This was followed by two samples t-test to find sexual dimorphism in the mean BP, BMI, height, and weight. Correlation analysis was also carried out between the age, BP and BMI.

Results: The mean blood pressures of the population were 118.55 ± 20.64 and 80.00 ± 14.14 for systolic blood pressure (SBP) and diastolic blood pressure (DBP) respectively. The normal, underweight, obese, and overweight of the BMI range of the population were 66 (47.8%), 47 (26.1%), 18 (10.0%) and 29 (16.1%) respectively. The correlation coefficient between BMI, SBP, DBP and age were 0.65, 0.276 and 0.092 where (P >0.05) except for BMI and DBP (r = 0.225, P = 0.002).

Conclusion: Although variable degrees of correlations exist between age, BMI and blood pressures, there was no statistically significant association between age, BMI and blood pressures, except for BMI and DBP.

Key Words: Age; Body Mass Index (BMI); Blood Pressure; Fulani; Jama’are

Introduction

The global estimation of death caused by high blood pressure among middle, and old-age adults in developing countries was about 7.1 million. This amounts to about 13% of the world’s mortality rate. About 62% of cerebrovascular diseases and 49% of ischaemic heart diseases were caused by suboptimal BP (systolic 115 mm Hg). Overweight and obesity increase the tendency of high BP, coronary heart diseases, ischaemic stroke, type II diabetes mellitus and certain cancers. About 58% of the global cases of diabetes mellitus and 21% of ischaemic heart diseases were caused by BMI above 21 kg/m². The hypertension and other cardiovascular diseases, together with infection and malnutrition are on the increase in developing countries. The prevalence of hypertension was found to be more among men than women in a study conducted among senior citizens of Delhi, India. Separate studies conducted in Ethiopia and Vietnam, revealed that hypertension was significantly more prevalent among men than women. Relationship between BMI and BP has long been established and being used as a subject of epidemiological research. Positive association BMI and BP had also been reported among Asian populations. Relationship between the prevalence of hypertension and age had been studied and higher incidence was reported among the elderly people in Bangladesh and India. Increased cases of obesity; hypertension and cardiovascular diseases especially in developing countries are quite alarming. There is the need to have combine efforts of medical and allied medical sciences to provide modalities to curb the threats of these menaces. Provision of global database from across all the ethnogeographical locations on BMI, BP and age as they vary with cultures would serve as a valuable tool in designing a proper roadmap to achieve this goal. This study aims at finding the association between BMI, BP and age in Fulani ethnic population of Jama’are.

Materials and Methods

A total of one hundred and eighty (180) records of Fulani ethnic population comprised of 77(43%) female and 103
(57%) male age ranging 5-65 years were collected after obtaining ethical approval from the authorities of the General hospital Jama’are, between June and December 2013. The data comprised of biodata and clinical records of patients attending the hospital for medical checks up. The biodata included the age, sex, height, tribe, and locality, while the clinical data included the blood pressure and body weight. The data was divided into six different groups to study age trend with respect to blood pressure and BMI. The BMI was calculated as the weight in kilograms divided by height in meters (kg/m²). It was then summarized and categorized into underweight, normal, overweight and obese in accordance with the WHO recommendation.[8]

Statistical Analysis

The analyses of the data were carried out using Minitab (version 16) statistical software. Means and standard deviations of the height, weight, BMI, systolic and diastolic blood pressures were calculated and differences between means separated by One-Way ANOVA, followed by post hoc (Tukey post hoc test) multiple comparison tests was also carried out between the age groups. Two samples t-test was carried out to find sexual dimorphism in the BP, BMI, height, and weight. Correlation analysis was also carried out between the BMI, age, systolic and diastolic BP. The value of BMI was calculated, and summarized into age groups in order to assess BMI-based nutritional status and recommended cut off points of the Fulani ethnic population.

Results

Table 1 gives the one-way ANOVA with the post-hoc multiple comparison tests for the height, weight and BMI respectively. The highest mean of the height was 166.11 cm ± 16.16, which was found in 26-35 years while the least mean height 130.40 cm ± 34.94 which was also found in the under 16 years age groups respectively. The ANOVA results indicated statistically significant difference in the mean height of all the six age groups [F= (3, 174) = 4.85, P<0.001]. The post-hoc test showed that the age groups 16-25, 26-35 and 36-45 years were statistically significant different in their mean comparison with the age groups. The result of 16-25 years age group was [F= (3, 174) = 4.85, P= 0.002] while age group 26-35 years as [F= (3, 174) = 4.85, P< 0.001] and age group 36-45years as [F= (3, 174) = 4.85, P = 0.003] respectively. The mean weights of the age groups were highest among the age groups 26-35 years and 46-55 years which were displayed as 60.04 kg ± 10.85 and 60.04 kg ± 18.71 respectively. The ANOVA test showed that there was statistically significant difference [F= (3, 174) = 5.11, P < 0.001] in the mean weights of the age groups. The post-hoc test indicated that the mean weights were only significant in the 26-35 and 46-55 years age groups respectively. The statistically significant difference in the mean weight of the age group 26-35 years was [F= (3, 174) = 5.11, P = 0.001] and that of the 46-55 years age group was [F= (3, 174) = 5.11, P = 0.012] respectively. The highest mean of the BMI (26.77 kg/m² ± 10.48), of the age groups was found in the under sixteen (<16) years age group while the least mean of the BMI (21.34 kg/m² ± 4.89) was recorded in 16-25 years age group. A one-way ANOVA test did not show statistically significant ([F= (3, 174) = 1.95, P = 0.089] difference in the mean BMI between in all the age groups.

Table 2 shows the mean blood pressures of the population with respect to their age groups. The highest mean systolic blood pressure was recorded among the age groups 26-35 yrs and under sixteen (<16) yrs age groups as 118.55 mm Hg ± 20.64 and 111.00 mm Hg ± 12.45 respectively. The results further revealed that the highest mean diastolic blood pressure (80.00 mm Hg ±14.14) was recorded among the 36-45 years age group while the least mean value (75.56mmHg ±6.67) of the DBP among the 46-55 and 46-55 years age groups respectively. The one-way ANOVA test for the blood pressures did not show statistically significant difference among the age groups. The value for the SBP was F [(5, 174) = 0.42, P = 0.834] and that of the DBP was F [(5, 174) = 0.50, P = 0.774] respectively.

Sexual dimorphism in height, weight and BMI was displayed [Table 3]. The means heights for the male and female subjects were 161.80 cm ± 19.50 and 162.40 cm ±16.30 respectively. The results showed no statistically significant difference in the mean heights (P = 0.806) between the genders. The mean weight for the males was (59.01 kg ± 12.70) and for the females was 53.65 kg ± 7.07. This showed there was statistically significant difference in the mean weights (P<0.001) of the genders. The BMI for the male subjects showed higher value (23.00 kg/m² ± 5.31) than that of their female counterparts (20.91±4.93). This disparity in the means justified the statistically significant difference in the mean BMI (P = 0.007) between the genders.

The classification of BMI into different categories of nutritional status was displayed [Figure 1]. Out of the 180 records, 47.8% were normal, 26.1% underweight, 16.1% obese and 10.0% overweight respectively.
on one hand, the height declined towards advanced age. This initial increase in the mean height could be as a result of natural growth phenomenon which associates with age. The result was similar with the findings of Mungerphy et al.\textsuperscript{10} which stated that the initial increase in the height could be due to improvement of socioeconomic condition and better nutrition among the younger subjects. However, the decrease in height observed might result due to decrease in bone growth which also associates with demineralization in advanced ages. Similar result was obtained by Aiken\textsuperscript{10} who reported that loss of collagen between spinal vertebrae causes the spine to bow and the height to shrink. There was also proportionate increase in the mean body weights with the ages till the age of 26-35 years, thereafter the weights showed an inconsistence decline in the advanced age groups. It is also evident that the heights of 16-26, 26-35, and 36-45 years age groups were statistically significant, this was not surprising as the height blooming periods are found within these ages. The initial increase in the body weight might not be unconnected with increase physical activities which usually associate with that age groups and which leads to rapid muscular and bone growth there by resulting into higher body mass. This result was similar with the reports of Verma et al.\textsuperscript{11} who stated that increase in the body weight till middle age might be as a result of fat accumulation from the younger age following the larger appetite which might lead to high energy intake and relatively less energy expenditure due to lesser involvement in physical activities and partly due to bones gradual demineralization. The statistically significant difference in the mean weights of the age groups 26-35 years might not be farfetched from the reports of Verma et al.\textsuperscript{11} however the statistically significant difference showed by 46-55 years could be due sedentary life usually observed in these age range as a result of old age. The mean BMI of the age groups in the present study showed disproportionate values with advancing age groups. There was also no statistically significant difference in the mean BMI. The highest BMI value was recorded among the under sixteen (<16) age group. 

### Table 1: One-way ANOVA with post-hoc multiple comparison (Tukey) test for BMI among different age groups

<table>
<thead>
<tr>
<th>Variables</th>
<th>Age Groups (Years)</th>
<th>&lt;16</th>
<th>16-25</th>
<th>26-35</th>
<th>36-45</th>
<th>46-55</th>
<th>56-65</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height (cm)</td>
<td>130.40 ± 161.16 ± 166.11 ± 162.35 ± 152.44 ± 157.00 ± 4.85*</td>
<td>34.94</td>
<td>18.12*</td>
<td>16.16*</td>
<td>15.90*</td>
<td>10.65*</td>
<td>9.85</td>
<td></td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>40.60 ± 53.97 ± 60.04 ± 55.91 ± 60.00 ± 54.33 ± 9.12*</td>
<td>12.90</td>
<td>8.10</td>
<td>10.85*</td>
<td>9.03</td>
<td>18.71*</td>
<td>15.95*</td>
<td></td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>26.77 ± 21.34 ± 22.19 ± 21.51 ± 25.51 ± 22.72 ± 1.95*</td>
<td>10.48</td>
<td>4.89</td>
<td>5.00</td>
<td>4.08</td>
<td>6.01</td>
<td>9.65</td>
<td></td>
</tr>
</tbody>
</table>

Values are expressed in Mean ± SD. *P<0.05; **P<0.001

### Table 2: One-way ANOVA test for blood pressure among different age groups

<table>
<thead>
<tr>
<th>Variables</th>
<th>Age Groups (Years)</th>
<th>&lt;16</th>
<th>16-25</th>
<th>26-35</th>
<th>36-45</th>
<th>46-55</th>
<th>56-65</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBP (mmHg)</td>
<td>111.00 ± 116.83 ± 118.55 ± 112.61 ± 116.67 ± 117.00 ± 0.42*</td>
<td>12.45</td>
<td>21.16</td>
<td>20.64</td>
<td>13.13</td>
<td>15.81</td>
<td>5.77</td>
<td></td>
</tr>
<tr>
<td>DBP (mmHg)</td>
<td>75.56 ± 75.86 ± 77.89 ± 80.00 ± 75.56 ± 76.67 ± 0.50*</td>
<td>6.67</td>
<td>13.76</td>
<td>14.88</td>
<td>14.14</td>
<td>6.67</td>
<td>5.77</td>
<td></td>
</tr>
</tbody>
</table>

Values are expressed in Mean ± SD. *P<0.05

### Table 3: Two-sample t-test for height, weight and BMI among genders

<table>
<thead>
<tr>
<th>Variables</th>
<th>Male</th>
<th>Female</th>
<th>T-value</th>
<th>CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height (cm)</td>
<td>n=103</td>
<td>n=77</td>
<td>162.40 ± 16.30</td>
<td>161.80 ± 19.50</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>n=103</td>
<td>n=77</td>
<td>53.65 ± 7.07</td>
<td>59.01 ± 12.70</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>n=103</td>
<td>n=77</td>
<td>20.91 ± 4.93</td>
<td>23.00 ± 5.31</td>
</tr>
</tbody>
</table>

Values are expressed in Mean ± SD. *P<0.05; CI: 95%

### Table 4: Two-sample t-test for mean blood pressure among genders

<table>
<thead>
<tr>
<th>Variables</th>
<th>Male</th>
<th>Female</th>
<th>T-value</th>
<th>CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBP (mmHg)</td>
<td>n=103</td>
<td>n=77</td>
<td>113.40 ± 18.9</td>
<td>119.44 ± 19.50</td>
</tr>
<tr>
<td>DBP (mmHg)</td>
<td>n=103</td>
<td>n=77</td>
<td>72.60 ± 15.1</td>
<td>81.1 ± 12.30</td>
</tr>
</tbody>
</table>

Values are expressed in Mean ± SD. *P<0.05; CI: 95%

### Table 5: Correlation matrix of BMI, Blood Pressure and Age

<table>
<thead>
<tr>
<th>Variables</th>
<th>BMI (Kg/m²)</th>
<th>SBP (mmHg)</th>
<th>DBP (mmHg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI (Kg/m²)</td>
<td>0.061</td>
<td>0.225*</td>
<td>0.521*</td>
</tr>
<tr>
<td>SBP (mmHg)</td>
<td>0.225*</td>
<td>0.521*</td>
<td>0.031</td>
</tr>
<tr>
<td>Age (years)</td>
<td>0.092</td>
<td>-0.018</td>
<td>0.031</td>
</tr>
</tbody>
</table>

*P<0.05

Figure 1: BMI among Fulani ethnic groups of Jama’are

Table 5 shows the correlation matrix of the age, BMI and blood pressure. The results showed variable degrees of correlations between them. Although weak positive correlation exists in virtually all the matrices [except for age vs. SBP (r = -0.018, P = 0.813)] on one hand, correlations between BMI and DBP (r = 0.225, P = 0.002) and that of DBP and SBP (r = 0.521, P<0.001) were on another hand stronger and statistically significant compared to all the remaining matrices.

### Discussion

There was a trend of gradual increase in the mean height from the youngest age (<16) till the age of 26-35 years [Table 1]. The height declined towards advanced age. This initial increase in the mean height could be as a result of natural growth phenomenon which associates with age. The result was similar with the findings of Mungerphy et al.\textsuperscript{10} which stated that the initial increase in the height could be due to improvement of socioeconomic condition and better nutrition among the younger subjects. However, the decrease in height observed might result due to decrease in bone growth which also associates with demineralization in advanced ages. Similar result was obtained by Aiken\textsuperscript{10} who reported that loss of collagen between spinal vertebrae causes the spine to bow and the height to shrink. There was also proportionate increase in the mean body weights with the ages till the age of 26-35 years, thereafter the weights showed an inconsistence decline in the advanced age groups. It is also evident that the heights of 16-26, 26-35, and 36-45 years age groups were statistically significant, this was not surprising as the height blooming periods are found within these ages. The initial increase in the body weight might not be unconnected with increase physical activities which usually associate with that age groups and which leads to rapid muscular and bone growth there by resulting into higher body mass. This result was similar with the reports of Verma et al.\textsuperscript{11} who stated that increase in the body weight till middle age might be as a result of fat accumulation from the younger age following the larger appetite which might lead to high energy intake and relatively less energy expenditure due to lesser involvement in physical activities and partly due to bones gradual demineralization. The statistically significant difference in the mean weights of the age groups 26-35 years might not be farfetched from the reports of Verma et al.\textsuperscript{11} however the statistically significant difference showed by 46-55 years could be due sedentary life usually observed in these age range as a result of old age. The mean BMI of the age groups in the present study showed disproportionate values with advancing age groups. There was also no statistically significant difference in the mean BMI. The highest BMI value was recorded among the under sixteen (<16) age
group while the lowest among the age group 36-45 years. The higher value of BMI among the youngest age could be attributed to the higher body mass to height ratio which usually is common with the younger ages or as explained by Verma et al.[11] while the lower values obtained in the subsequent age groups could also be due to increase in height relative to body mass ratio. This trend was similar to the studies of Kapoor and Tyagi[12] which reported that body weight and BMI decline in advanced age. However, the no statistically significant difference in BMI observed across the age groups might be explained perhaps by the corresponding increase of the body height with weight which is part of the normal growth process.

The secular trend of blood pressure in Table 2 indicated no statistically significant relationship between BP and age. This could be attributed generally to the cultural and the nutritional habit of the Fulanis who are nomadic that survive on the starchier foodstuff with less protein that reduces the tendency of cardiovascular diseases which could lead to higher BP. The present study contradicted the earlier studies by Percy et al., which indicated that high BP is associated with age.[13-15]

Sexual dimorphisms in the mean height, weight and BMI between the genders were displayed in [Table 3]. There was no statistically significance difference in the mean height between the genders. However, statistically significance difference was observed in the mean weight and BMI. This significant variation could be linked to different occupational lifestyles which usually associate the males in the struggle to cater for the families as part of the cultural and moral obligations while the females enjoyed sedentary life of purdah with little hard work that could build their body mass when compared to their male counterpart. This result contradicted the reports of Adamu et al.[16] which reported that there was no statistically significance sexual dimorphism in the BMI.

Table 4 of the present study shows a statistically significant difference in both mean systolic and diastolic blood pressure among males and females. The sexual dimorphism in the BP might arise due to prolong physical activities with little rest associated with the nomads in which male Fulanis were more involved compared to their female counterpart that remained at home (purdah). The result was similar with the studies of Kusuma et al.[17] which found that men possess higher BP levels than females.

Table 5 shows correlation matrix between age, BMI and diastolic BP. Generally there were weak positive correlations in matrix except for the correlation between the age and SBP which showed weak negative correlation. Also the correlation between the BMI and DBP and that of between the SBP and DBP were in addition of being stronger statistically significant. These results contradicted the reports of Mungreiphy et al.[9] which found significant correlation between age, BMI and BP and those of Gupta et al.[18] which found significant associations between BMI and BP Indian populations. These contradictions were perhaps due to difference in geographical location, nutritional habits, socioeconomic activities and socio-cultural background between Fulani and Indian ethnic populations.

**LIMITATIONS**

The sample size used for this study was small compared to some studies where large volume of data was used.

**Conclusion**

The younger Fulani populations are at the higher risk of obesity owing to the higher BMI value. There were statistically significant differences in mean BPs between the genders but the differences were statistically significant when the mean BPs were compared with the ages. Although the variable degrees of correlations exist between the age, BP and BMI, no statistically significant association was obtained between them except for the BMI and DBP.

**ACKNOWLEDGEMENT**

The authors wish to extend their appreciations to the management of General Hospital Jama’are for their immense contribution in providing the necessary cooperation and to the subjects who painstakingly took time out of their numerous schedules to volunteer with the needed information.

**References**

4. Gupta R, Guthpa S, Gupta VP, Prakash H. Prevalence and determinants of hypertension in the urban population of Jaipur in...


Source of Support: Nil

Conflict of interest: None declared