Age and cardiovascular risks in a market population in Southeast Nigeria

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Abstract

Background: Globally, cardiovascular risks constitute a heavy healthcare burden, affecting people of different ages in both the developed and the developing ones. Cardiovascular risks and differences in age have not been completely defined.

Objectives: This study was set out to evaluate the influence of age on the risks of cardiovascular disease in Awka, Nigeria.

Methodology: This was a cross-sectional study conducted in an unstructured market workers’ population. The subjects were classified according to their age and screened for cardiovascular risks. The cardiovascular risks were compared between the different age groups.

Results: The study subjects were 294. Females were 72.1% and males 27.9%. Their mean age was 43.13 ± 15.38 years, body mass index (BMI) 28.1 ± 6.0kg/m2, systolic blood pressure (SBP) 129.3 ± 23.7mmHg and diastolic blood pressure (DBP) 82.6 ± 14.7mmHg. Majority (98.6%) of the study subjects were Igbos, whereas only 1.4% were Hausas. Tobacco prevalence was 5.4%. Those in the age group of 50-59 years had the highest prevalence of tobacco use (37.5%), followed by those of 30-39 years (25.0%) and 60-69 years (25.0%), p=0.026. Thickened arterial wall had a prevalence of 27.2%. It was high, 42.5%, in those aged 50-59 years, followed by 25.0% in those 60-69 years, p<0.001. Nighttime sleep duration (NTSD)<4 hours had a prevalence of 5.4%. Those in the age groups of 30-39 years and 60-69 years had a prevalence of 37.5% of NTSD<4 hours, p=0.002. The prevalence of diabetes mellitus (DM) was 9.5%. The subjects in the age group of 50-59 years had the highest prevalence of DM of 50.0%, followed by 35.7% in those aged 60-69 years, p<0.001. The prevalence of GSM night use was 63.3%. In those aged 20-29 years it was high 25.8% but declined with increasing age, p=0.001. Underweight had a prevalence of 34.0% and occurred in 33.5% of the subjects aged 30-39 years, 50-59 years and 70-79 years. The prevalence of overweight was 28.8% and tended to decline with increasing age. However, obesity increased with age, and was high, 30.0%, in those in the age group of 30-39 years, but declined with increasing age, p=0.002. SBP had a prevalence of 41.5%. SBP of 32.8% was high among the subjects aged 50-59 years, increasing with age initially, p<0.001. The prevalence of DBP was 32.7%, and increased with age to peak at 50-59 years (31.3%), but declined at age >50-59 years, p<0.001. Cigarette smoking p=0.820, alcohol use, p=0.274, and seaster, p=0.210, had insignificant association with age.

Conclusion: The prevalence of tobacco use, thickened arterial wall, diabetes mellitus, systolic blood pressure and diastolic blood pressure was high among those in the age group 50-59 years, whereas nighttime sleep duration <4 hours, underweight and obesity was high among those aged 30-39 years. GSM midnight use was common among those aged 20-29 years in this study.

Keywords: Age, Tobacco, Thickened arterial wall, Diabetes mellitus, Hypertension, Nighttime sleep deprivation, Obesity.
Cardiovascular diseases (CVDs) are a group of disorder affecting the heart and its blood vessels. They are the leading cause of preventable deaths globally. Globally, there are estimated 485.6 million cases of CVD with majority of the deaths occurring in adults 75 years and above. World Health Organization (WHO) reported an estimated 17.9 million deaths from CVDs in 2019, representing about 32% of all global deaths. About three quarters of this CVD deaths occur in low and middle income countries. The cause is largely unknown but there are several modifiable and non-modifiable risks factors. The modifiable factors are behavioral risk factors such as tobacco use, sedentary life styles, excessive intake of alcohol, unhealthy diets. This behavioral risk factors culminate into overweight, obesity, hypertension, hypercholesterolaemia and diabetes mellitus etc. Age is a major modifiable and independent risk factor for CVDs. Aging is associated with a progressive deterioration of the physiological function of the body as well as structural changes which reduces the functional capacity of the heart leading to increased CVDs. The prevalence of CVDs has also been shown to increase in age in both men and women. The American Heart Association reported that the incidence of CVDs increases with age with approximately about 40% for ages 40-59 years, 75% for 60-75 years and ≥ 86% for individuals that are 80yrs and above. This translates to increased overall healthcare costs from CVDs as one ages. Age is also associated with increased likelihood of development of other risk factors like obesity and hypertension. The structural and functional changes in the heart result in diastolic, systolic and electrical dysfunctions including arrhythmias, functional and electrical defects results from oxidative stress, inflammation, apoptosis, myocardial deterioration and degeneration. An increase in reactive oxygen radicals is known to occur with the onset of advanced age and its linked to persistent inflammation and progression to chronic diseases such as CVDs. Increased production of proinflammatory markers such as IL-6, alpha-TNF and C-reactive proteins are hallmark of aged hearts. These inflammatory factors and other mediators result in cardiac remodeling leading to hypertrophy and fibrosis, both of which are significant structural changes that eventually lead to cardiac dysfunction in aging patients. Cardiometabolic functions and lifestyle behaviors may translate into different susceptibility to CVDs between older people and their younger counterparts. Identifying risk factors peculiar to different age groups including those older than 75 years will help promote individualized management strategies to reduce the risk of CVDs. The aim of this study therefore, was to evaluate the influence of age on cardiovascular risk factors.

Materials And Methods
The study population consisted of 294 subjects recruited from Eke Awka main market, Anambra State, Nigeria. The approval for this study was given by the management of the market and from ethics committee of Chukwuemeka Odumegwu Ojukwu University Teaching Hospital, Awka. The participants were informed of this study through a gong crier, instructed by the management leadership of the market. Each of the participants gave informed oral consent for this study. To them the objectives and aims of the study were explained. A questionnaire was used to collect data which addressed biodata, age, cigarette smoking, tobacco (snuff) use, alcohol use, night-time sleep duration, diabetes mellitus, seaster, GSM use at midnight.

Demographic and anthropometric data were collected. Weight (kg) and height (m) were taken and BMI was determined as weight/height² (kg/m²). Radial and brachial arteries were examined for thickening, and pulse rate was obtained. Blood pressure (mmHg) was recorded from the non-dominant hand in sitting position, after the subjects had rested for 10 minutes, using appropriate cuff size to cover about 80% of the
arm, and Accoson mercury sphygmomanometer. Three blood pressure readings were taken 5 minutes apart, and the average obtained.[11]

The variables were graded into groups as follows:

Smoking: 1) those who were smokers and 2) those who were non-smokers

Tobacco snuff use: 1) those who used tobacco snuff and 2) those who did not

Alcohol: 1) those who have positive alcohol history and 2) those who have not.

Arterial wall: 1) those who have thickened arterial wall and 2) those with normal arterial wall

Night-time sleep duration: A) >6 hours, B) 4 – 6 hours, C) <4 hours

Night vigil: 1) keeping night vigil and 2) no night vigil

The influence of age on the variables were compared between the groups for each variable, The association of age with the variables was determined. The potential risks evaluated in this study were: tobacco snuff, smoking, arterial wall thickening, alcohol, short night time sleep duration (<4hrs), seaster, BMI and hypertension.

Data Analyses
The data were analyzed using the Statistical Package for Social Sciences (SSPS Inc, Chicago, IL) version 17.0 statistical software. For continuous variables, mean values and standard deviations were calculated and the means compared using ANOVA or two sample t-test. Categorical variables were compared using the nonparametric tests Chi-square. The distribution and characterization of variables with age were analyzed using cross tabulation. All tests were two-tailed with P < .05 taken as statistically significant.

Definition of terms
Hypertension: SBP ≥140 mmHg and or DBP ≥90 mmHg[12]

Mild hypertension: SBP 140–159 mmHg and/or DBP 90–99 mmHg

Moderate hypertension: SBP 160–179 mmHg and/or DBP 100–109 mmHg;

Severe hypertension: SBP ≥ 180 mmHg and/or DBP ≥ 110 mmHg.

Body mass index: [13]

Underweight: BMI <18.5 kg/m²
Normal body weight: BMI 18.5 – 24.9 kg/m²
Overweight: BMI 25.0 – 29.9 kg/m²
Mild obesity: BMI 30.0 – 34.9 kg/m²
Moderate obesity: BMI 35.0 – 39.0 kg/m²
Severe obesity: BMI ≥40.0 kg/m²
Obesity: BMI ≥30.0 kg/m².

In this study Obesity was defined as BMI ≥30.0 kg/m².
The subjects who were found to have the risks of cardiovascular disease were counseled and advised to see clinicians in the hospitals.

Results
Sixteen of the 294 subjects smoked cigarette, showing a prevalence of smoking of 5.4%. Out of this number, those aged 30-39 years, 40-49 years and 50-59 years constituted 4(25.0%) each. However, this association between age and smoking was not significant, p=0.820 (Table 3).

Sixteen of the subjects used tobacco (Snuff), indicating a tobacco prevalence of 5.4%. Out of this number, those in the age group 50-59 years had the highest prevalence of tobacco use (37.5%), followed by those of 30-39 years (25.0%) and 60-69 years (25.0%). This association between age and tobacco use was significant, p=0.026 (Table 3).

Sixteen of the subjects used alcohol (Snuff), indicating a tobacco prevalence of 5.4%. Out of this number, those used tobacco, those in the age group 50-59 years had the highest prevalence of tobacco use (37.5%), followed by those of 30-39 years (25.0%) and 60-69 years (25.0%). This association between age and tobacco use was significant, p=0.026 (Table 3).

One hundred and twenty-four subjects used alcohol, showing a prevalence of alcohol use of 42.2%. Out of this number that used alcohol, the prevalence of alcohol use was high, 29.0%, among those in the age group 30-39 years, followed by 22.6% among those in 20-29 years. However, this association between age and alcohol use was not significant, p=0.274 (Table 3).

The number of subjects that had thickened arterial wall was 80, with a prevalence of 27.2% for
thickened arterial wall in this study. In these subjects with thickened arterial wall, the prevalence of thickened arterial wall was high, 42.5%, in those aged 50-59 years, followed by 25.0% in those 60-69 years. Thus, this association between age and thickened arterial wall was significant, p<0.001 (Table 3).

The subjects who had NTSD <4 hours was 16, showing a prevalence of 5.4% of poor night sleep in the study population. Those in the age groups of 30-39 years and 60-69 years had a prevalence of 37.5% of NTSD<4 hours. Expectedly, this association between age and NTSD was significant, p=0.002 (Table 3).

Twenty-eight subjects had DM, indicating a prevalence of 9.5%. The subjects in the age group of 50-59 years had the highest prevalence of DM of 50.0%, followed by 35.7% in those aged 60-69 years. This association between age and DM was significant, p<0.001 (Table 3).

Seaster during business hours was observed by 112 subjects showing a prevalence of 38.1% of seaster in this study. Those aged 30-39 years had the highest prevalence of 30.4% of lack of seaster during business hours, followed by 21.4% in those aged 20-29 years and 0.0% in those in 90-99 years. However, this association between age and seaster was not significant, p=0.210 (Table 3).

The use of GSM at midnight was observed in 186 subjects showing a prevalence of 63.3%. The prevalence found in those aged 20-29 years was high 25.8% but declined with increasing age. This association between age and GSM midnight use was significant, p=0.001 (Table 3).

The number of subjects who had underweight was 100, indicating a prevalence of underweight of 34.0%. The prevalence of underweight was 33.5% in subjects aged 30-39 years, 50-59 years and 70-79 years. One hundred and four subjects had overweight with a prevalence of 28.8% in this study; and this tended to decline with increasing age. However, obesity increased with age, and was high, 30.0%, in those in the age group of 30-39 years, but declined with increasing age. Expectedly, this association between BMI and age was significant, p=0.002 (Table 3).

SBP ≥140 was found in 122 subjects, showing a prevalence of 41.5% in this study. The prevalence of SBP of 32.8% was high among the subjects aged 50-59 years, increasing with age initially. Thus, this association between age and SBP was significant, p<0.001 (Table 3).

DBP ≥90 was observed in 96 subjects, indicating a prevalence of 32.7% in this study. DBP increased with age to peak at 50-59 years (31.3%), but declined at age >50-59 years. Expectedly, this association between age and DBP was significant, p<0.001 (Table 3).

### Table 1: Variables in study population (n=294)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean (standard deviation) years</th>
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<tbody>
<tr>
<td>Age</td>
<td>43.1 ± 15.9</td>
</tr>
<tr>
<td>Body mass index</td>
<td>28.1 ± 6.0</td>
</tr>
<tr>
<td>SBP</td>
<td>129.3 ± 23.6</td>
</tr>
<tr>
<td>DBP</td>
<td>82.6 ± 14.0</td>
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</table>

SBP=systolic blood pressure. DBP=diastolic blood pressure

### Table 2: Age distribution of study subjects

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<th>Age group (years)</th>
<th>Frequency</th>
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<td>30-39</td>
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<td>40-49</td>
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<td>50-59</td>
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<td>60-69</td>
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<tr>
<td>70-79</td>
<td>4.1</td>
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<tr>
<td>80-89</td>
<td>0.0</td>
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<tr>
<td>90-99</td>
<td>7.0</td>
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Table 3: Distribution and characterization of variables among subjects with varying occupations

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<th>40-49</th>
<th>50-59</th>
<th>60-69</th>
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<th>90-99</th>
<th>Chi square</th>
<th>df</th>
<th>LHR</th>
<th>p value</th>
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<td>4(25.0)</td>
<td>4(25.0)</td>
<td>2(12.5)</td>
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<tr>
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<td>24(19.4)</td>
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<td>14(12.9)</td>
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<td>(hrs) &gt;6</td>
<td>44(28.9)</td>
<td>36(23.7)</td>
<td>24(15.8)</td>
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<td>14(30.0)</td>
<td>10(36.7)</td>
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<td>10(5.5)</td>
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<tr>
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<td>48(25.8)</td>
<td>44(23.7)</td>
<td>36(36.4)</td>
<td>26(10.8)</td>
<td>2(1.1)</td>
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<td>23.826</td>
<td>&lt;0.001</td>
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<tr>
<td>18.5-24.9kg/m²</td>
<td>24(7.9)</td>
<td>18(20.9)</td>
<td>22(19.6)</td>
<td>16(14.3)</td>
<td>10(5.5)</td>
<td>2(1.8)</td>
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<td>SBP≥140+DBP≥90</td>
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<td>14(11.5)</td>
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<td>22(22.9)</td>
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<td>39.573</td>
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</table>

Discussion
Tobacco use is a major risk factor for CVDs. Its use is responsible for about 8 million death per annum and it is projected to be about 10 million in 2030.[14] It has been ranked as the leading cause of preventable death. The prevalence of cigarette smoking was about 5.4% in this study this is similar to the global adult tobacco survey report of 5.6%.[15] Aniwada et al also reported a similar finding of 6.6% in males and 6.3% in females in a study done in Nigeria.[16] However, this is lower than the global rate of 20.7% in 2015.[17] It is a risk factor for a wide range of diseases such as lung cancers, cardiovascular diseases, stroke and chronic respiratory diseases.[18,19] About 12.5% of the study participants between the ages of 20-29yrs were smoking while 25% each of ages 30-39, 40-49, and 50-59 were found to be smoking in this study. A study by Aniwada et al reported similar finding that those 25-34 years and ≥35 years were two times more likely to use any form of tobacco than the younger age groups 15-24 years.[16] This study was also supported by a study done in Nepal which showed that those in the age group of 36-49 years were 2.4 x more likely to use any form of tobacco than the younger age group 15-24years.[20] A study in Zaria, Nigeria also reported age to be associated with tobacco use.[21] Age of initiation of smoking is an important determinant of smoking behavior in later life. Global research has reported that tobacco smoking is usually initiated before 18years of age.[22] It is established that people who started smoking at a young age may end up being smokers in adulthood.[23] This trend increased at 30years and remained the same till 59years. The reasons for the high rate of smoking between the ages of 20-29yrs could be explained by effect of peer pressures, youthful exuberances and the increased urge to explore the environment. Peer pressure as a driving force for smoking has also been documented in other findings.[24,25] Another important reason among the youth may be that those whose parents smoke may likely go into
smoking. Smoking among family members have been documented to be a predictor of current smoking in some other studies.\textsuperscript{[25,26]} Those between the ages of 30 -59 years are probably apparently healthy to explore. However, this trend declined beyond 59 years. The reason for this is not far fetched because from about 60 years individuals have diseases such as hypertension, diabetes, atherosclerosis and other ailment that come with age to contain with and therefore, tend to modify their lifestyles.

Smokeless tobacco such as snuff is a known risk factor for cardiovascular disease.\textsuperscript{[27-29]} The prevalence of tobacco smoking in this study was 5.4%. This is slightly higher than the prevalence obtained from Demographic and Health survey reported prevalence of 2.6% in males and 1.9% female as smokeless tobacco users.\textsuperscript{[30]} No participant was recorded to be smoking tobacco (snuff) between ages 20-29 years. The traditional perception of our adolescents and young adults to snuff. It is believed that it is mostly for the elderly. The use of tobacco peaked at between 50-59 years and started declining again beyond 59 years probably as a means of lifestyle modification following diseases that come with aging. Smoking leads to plaque formation in the blood vessels, thickens the blood, and results in clot formation. This results to narrowing of vessels with resultant cardiovascular heart disease.\textsuperscript{[31]}

Alcohol is the most commonly abused psychoactive substances in the country.\textsuperscript{[24,32]} In this study, alcohol intake peaked between 20-39 years. This is expected as social life and peer influences are very high within these ages. However, Onodugo et al reported a higher peak of alcohol consumption among those aged 40-49 years followed by those 50-59 years old. This difference may probably be because of the differences in sample size. He used a sample size of 1411 which was by far higher than the 294 used in this study and this might have given a better representation of the alcohol consumption in the community. He also reported age as an important correlates of alcohol consumption.\textsuperscript{[33]} Heavy alcohol intake is an important cause of death and disability.\textsuperscript{[34]} There is also a complex association between alcohol and cardiovascular diseases.\textsuperscript{[35-37]} Observational studies have reported that alcohol consumption is positively associated with heart failure\textsuperscript{[35]} and hemorrhagic stroke.\textsuperscript{[36]} and atrial fibrillation.\textsuperscript{[37]} However, moderate consumption of alcohol lowers risks of cardiovascular disease and stroke.\textsuperscript{[35-37]}

Aging is associated with increases in wall thickness of medium and large sized arteries due to smooth vessel hypertrophy resulting to thickening of the intima medial layer.\textsuperscript{[38]} This is similar to what was observed in this study with peak in 50-59 years. However, the trend declined from age 60-79 years. Arterial wall thickening is a key factor in the progression of arterial disease and this creates an enabling environment for the formation of atherosclerosis.\textsuperscript{[39]}

Diabetes mellitus also increased with age in this study with peak at 50-59 years (50%) followed by 60-69 years. Other studies also reported increasing prevalence of diabetes with advancing age.\textsuperscript{[40,41]} Beyond the age of 70 years the prevalence dropped probably because diabetes mellitus being a chronic condition may have led to deaths beyond the age of 70 years. Over time, high blood sugar damages the blood vessels and nerves controlling the heart. This is worsened by other morbidities present in people with diabetes.

Sleep is an important physiologic process that helps to calm the nerves and keep us mentally alert. The sleep pattern tends to change with advancing age due to reduced levels of growth hormones and melatonin. This study showed a progressive decline in night time sleep (>6hrs) with age. Night time sleep deprivation acts as a stressor, activating the sympathetic pathway via the rennin-angiotensin-aldosterone pathway with resultant increase in central catecholamine which causes blood vessel constriction with consequent increase in the blood pressure resulting in hypertension.\textsuperscript{[42,43]} There was significant association between use of GSM night sleep and
sleep deprivation. GSM use was highest among participants between the ages of 20-29 years. This is the age when web exploration and social media use is highest. Most university and college students also fall into this group and are more likely to study at night with Global System for mobile communication. Intracellular concentration of magnesium decreases with poor sleep leading to arterial constriction.\textsuperscript{[44]} NTSD<4hrs was highest among those 30-39 years. This is probably because people at this age group are very energetic and are more likely involved in night activities.

In this study, obesity increased with age and was highest among the age group of 30-39 years but started to decline beyond 39 years of age. Stevens et al reported similar findings that relative risk of obesity was higher among those aged 30-44 years than among 65-74 years.\textsuperscript{[45]} the reasons for this might be due to increased consciousness of the potential risks of obesity and its role in the development of diabetes, hypertension, hypercholesterolemia as one ages. Secondly, the management of these conditions now compel them to aim at achieving better management through weight control programs such as dieting and exercise with resultant decline in weight as one moves beyond 40 years of age.

Both systolic and diastolic blood pressure increased with age, and peaked at 50-59 years in this study. Most of the risk factors reported in this study peaked between 50-59 years of age. The combined effects of age and other risk factors may have resulted in increase in blood pressure. Other similar studies supported similar findings.\textsuperscript{[46,47]}

Overall, age is an independent, non-modifiable risk factors in the development of CVDs. It also contributes to the development or worsening of most of other risk factors as seen in this study. Therefore, having an understanding of the mechanism that accelerates aging could slow the development of CVDs and enhance advancement into the management of CVDs.

**Conclusion**

The prevalence of tobacco use, thickened arterial wall, diabetes mellitus, systolic blood pressure and diastolic blood pressure was high among those in the age group 50-59 years, whereas nighttime sleep duration <4hours, underweight and obesity was high among those aged 30-39 years. GSM midnight use was common among those aged 20-29 years in this study.

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There was no conflict of interest declared by the authors.

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