ejpmr, 2017,4(7), 110-117

SJIF Impact Factor 4.161

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

Research Article

ISSN 2394-3211

EJPMR

CORRELATION OF SERUM CHOLESTEROL, ELECTROLYTES, AND BODY MASS INDEX WITH CARDIOVASCULAR STATUS OF SELECTED ADULTS IN BAYELSA STATE NIGERIA.

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Article Received on 03/05/2017 **Article Revised on 24/05/2017** **Article Accepted on 14/06/2017**

ABSTRACT

This study investigated the correlation of serum cholesterol, electrolytes, age and body mass index, with cardiovascular status of selected adults in Bayelsa State. The study subjects comprises, 94 males and 86 females between the ages of 20 to 70years selected randomly. The parameters measured where blood pressures, pulse rate, body mass index, serum cholesterol, serum electrolytes and mean arterial blood pressure. The auscultatory, palpatory, venipuncture, weight and height, and flame photometry methods were employed in this study. The analysis from the results indicate mean ± standard deviation of blood pressure(mmHg) ,pulse rate (bpm),body mass index (kg/m2),cholesterol (mmol/L), electrolytes (mEq/L), and mean arterial pressure(mmHg) to be 141.84±17.49, 87.29±11.64, 81.00±9.41, 28.02±4.65 5.31±1.56, 140.88±4.88, 3.37±0.46 and 105.47±12.88 respectively for male subjects and 133.90±17.16mmHg, 83.10±10.77bpm,27.01±4.56kg/m2,4.94±1.55mmol/L, 141.79±5.19mqE/L, 3.37±0.52mEq/L and 99.75±12.50mmHg for SBP, DBP, HR, BMI, CHOL., Na+, K, and MAP for the female subjects respectively. The systolic and diastolic blood pressure were significantly higher in males than their female counterpart. There was a positive correlation between the body mass index, serum cholesterol, and pulse rate of the male and female subjects with their blood pressures. The mean arterial pressure was significantly higher in males than the females ($p<0.00$).The systolic, diastolic and mean arterial blood pressure of the male and female subjects was significantly correlated with their age. The mean electrolytes (Na+) of the female subjects correlated with age significantly in Bayelsa State. Findings from this study reveals an increase in the blood pressures of both middle and older aged adults of the male and female subjects in Bayelsa State which may be due to lack of exercise, consumption of cholesterol rich foods etc. We recommend that more research be done with calcium inclusive and their Physiological status on other vital organs such as the heart and the liver.

Key Word: Electrolyte, blood pressure, correlation, mean arterial pressure and pulse rate.

INTRODUCTION

Cholesterol is a steroid from animal products usually found in the blood, nerve fibers, and other organs of the body. One of the physiologic functions of cholesterol include its role in forming many hormones to keep the cell membrane insoluble in water and in forming bile salts. Cholesterol is synthesized by the liver from saturated fat in the diet. The richest dietary sources includes liver, whole milk, egg yolk, beef, pork as well as hereditary, and various metabolic conditions such as type III diabetes, can influence individual level of cholesterol. Hence high cholesterol level usually leads to an in-build of excess cholesterol level by macrophages that cannot be easily metabolized thereby creating an early beginning for the formation of artheromatous plaque. (Bronner et al 1993).The build-up of plaque or fatty deposits develop in arterial walls over a period of time harden and narrow arteries and restrict blood flow to the heart and vital organs in the body. When a diet contains too much cholesterol especially saturated fat on a regular basis, serum cholesterol is elevated which is a major contributing factor to coronary heart disease. Increased dietary sodium is a major contributing factor to the current epidemic of cardiovascular disease. High dietary salt intake accounts for about 70% of increased blood pressure among (Natesan *et al.,* 2014). The relationship between serum cholesterol and blood pressure have resulted in different conclusions from many studies due to differences in the design of various studies and differences in age, level of risk factors, sex and geographical locations.Hjermann *et al.,* in (1978) from his study also observed a positive intercorrelation between blood pressure and serum cholesterol among normotensive men. Outcome from most investigators pointed out that excessive intake of dietary saturated fat with regards to cholesterol usually elevate the serum cholesterol level creating an avenue for the genesis of cardiovascular diseases (Kwiterovich and Ye 2000)

((Harvey et al 1988). It has been proposed that the low density lipoprotein cholesterol in particular account for about 60% of total cholesterol in the blood and is usually taken up by macrophages. At high cholesterol levels, the macrophages take up more cholesterol than necessary and due to their inability to metabolize them from cells formation result leading to an early stages of plaque formation within the intima of blood vessels (Go relic *et al*., 1997, Bronner et al 1995, and War low et al 1996). Hypertension, obesity, increased sodium concentration are important risk factors to the development of stroke in many patients that are detected only after a stroke have occur (Hassan *et al.*, 2015).

Aim of this Study

The present study is aimed at determining the cardiovascular status of selected adults in Bayelsa State and to ascertain the possible relationship "between' blood pressure, age. Body mass index and serum cholesterol.

Study Objectives

To determine the mean values of serum cholesterol levels, electrolytes, body mass index, blood pressure and heart rate of adults in Bayelsa state

MATERIALS AND METHOD

Materials for Serum Cholesterol determination

1 Kernel International cooperation (Taiwan) Multi check Machine
2 Cholesterol test strip
3 puncturer's tip adjusted to the best depth of skin penetration
4 A sterile swab for cleansing of the thumb and a sterile lancet inserted into the puncturer's tip
5 Code number check strip
6 Male and Female subjects' voluntary participant blood

Materials for Blood Pressure Determination

1 A mercurial Sphygmomanometer (Acuson England) and a stethoscope was used to determine the blood pressures after about ten minutes rest twice from the left arm while the mean of the two measurement were taken. The pulse rate was also taken after the voluntary participant had been interviewed**.** (John *et al.*, 1982).

Research tools for Weight and Height

The weight of the subjects were measured in kilograms using Youngkang Zhezhong hospital scale balance for weight and a calibrated meter rule for height measurement after the removal of heavy outer garments and shoes. The body mass index (BMI) was calculated as weight /square of the height (kg/m^2). Obesity was define according to WHO technical report with cut point of body mass index: Non-obese subjects ($BMI<30kg/M^2$) and obese subject ($BMI>30kgM^2$) Ender et al (2004).

RESULTS AND DISCUSSION

Table 1: Mean Values for Male and Female Subjects

Parameters	Males(N=94)	Females (N=86)	Anova Significance (p<0.05)
Age/Years	46.25±13.91 (20-70)	43.24±13.55 (20-70)	0.11 Not significant
Weight (kg)	80.57±13.68	73.33±13.71	≠0.00
Height (m)	1.70±0.05	1.65±0.06	≠0.00
BMI (kg/m2)	28.02±4.65	27.01±4.56	0.10 Not significant
SBP (mmHg)	141.84±17.49	133.90±17.16	≠0.01
DBP (mmHg)	87.29±11.64	82.67±11.22	≠0.01
Pulse (bpm)	81.00±9.41	83.10±10.77	0.07 Not significant
MAP (mmHg)	105.47±12.82	99.75±12.50	≠0.01
CHOL (mmol/L)	5.31±1.56	4.94±1.55	0.06 Not significant
Na+ (mEq/L)	140.88±4.88	141.79±5.19	0.58 Not significant
K+ (mEq/L)	3.37±0.46	3.37±0.52	0.75 Not significant

NB: Results are given as mean ± standard deviation and range in parenthesis
≠ Significant

Table 2: Categorization of Male Subjects According to Age Group with other Parameters

Parameters	n=44 18-44 years (young adults)	n=39 45-64 years] (middle age adults)	n=11 >64 years (older adults)	Anova Significance (p<0.05)
Weight (kg)	79.00±13.86	83.81±12.95	75.36±13.97	0.11 Not significant
Height (m)	1.70±0.049	1.70±0.05	1.66±0.02	≠0.037
BMI	27.26±4.65	29.07±4.41	27.33±5.17	0.18 Not significant
SBP (mmHg)	134.52±12.34	147.80±19.54	150.00±17.13	≠0.00
DBP (mmHg)	82.96±8.71	90.69±11.57	92.55±16.32	≠0.00
Pulse (BPM)	78.14±9.41	83.44±8.50	83.83±10.00	≠0.02
MAP	100.14±8.91	109.73±13.50	111.70±16.04	≠0.00
CHOL (mmol/L)	5.16±1.56	5.46±1.58 (2.60-8.80)	5.36±1.62 (3.10-8.70)	0.69 Not significant
Na+ (mEq/L)	141.11±3.90	141.18±5.89	138.91±4.44	0.36 Not significant
K+ (mEq/L)	3.39±0.46	3.32±0.49	3.46±0.36	0.62 Not significant

NB: Results are given as mean ± standard deviation and range in parentheses.≠ Significant

Table 3: Classification of Body mass index (kg/m2) with other parameters for Male subjects (WHO 2012)

Parameters	<18.5 Underweight n=2	18.5-24.9 NORMAL n=23	25.0-29.9 Overweight n=36	>30 Obese n=33	Anova Significance (p<0.05)
SBP (mmHg)	135.50±6.36	129.70±13.08	143.36±19.09	149.03±14.41	0.00 ≠Significant
DBP (mmHg)	74.00±16.97	88.36±19.09	87.42±9.85	92.67±10.58	0.00 ≠Significant
Pulse (BPM)	92.00±15.56	74.48±4.16	82.08±7.88	83.70±11.08	0.00 ≠Significant
MAP	94.50±13.44	96.91±11.32	106.07±12.02	111.46±11.35	0.00 ≠Significant
CHOL (mmol/L)	4.75±0.07	4.82±1.50	5.36±1.68	5.63±1.48	0.27 Not significant
Na+ (mEq/L)	141.00±1.41	140.96±5.24	141.42±4.71	140.24±5.04	0.80 Not significant
K+ (mEq/L)	3.90±0.57	3.40±0.41	3.27±0.47	3.42±0.46	0.19 Not significant

NB: Results are given as mean ± standard deviation and range in parenthesis
≠ Significant

Table 4: Classification of Serum Cholesterol with other parameters for male subjects (NHLBI 2007)

Parameters	Desirable (<5.1)mmol/L	Borderline High (>5.1-6.1)mmol/L	High (>6.1)mmol/L	Anova Significance p<0.05
Age/Years	44.35±14.94	47.91±11.79	48.20±13.78	≠0.01
Weight (kg)	76.00±12.63	81.34±10.46	87.90±15.10	≠0.00
Height (m)	1.70±0.04	1.69±0.04	1.70±0.06	0.43 Not significant
BMI	26.43±4.51	28.81±4.05	30.22±4.54	≠0.00
SBP (mmHg)	135.07±12.88	146.30±13.45	150.20±23.00	≠0.00
DBP (mmHg)	83.72±10.01	91.30±6.68	90.16±15.73	≠0.01
Pulse (BPM)	78.65±8.37	80.30±8.80	85.96±10.20	≠0.02
MAP	100.83±10.38	109.64±8.54	110.17±16.96	≠0.00
Na+ (mEq/L)	139.39±4.26	141.91±4.80	142.68±5.34	≠0.01
K+ (mEq/L)	3.48±0.48	3.36±0.38	3.17±0.43	≠0.02

NB: Results are given as mean ± standard deviation and range in parenthesis
≠ Significant

Table 5: Categorization of Female subjects according to age group with other parameters

Parameters	n=51 18-44 years (young adults)	n=26 45-64 years(middle age adults)	n=9 >64 years (older adults)	Anova Significance (p<0.05)
Weight (kg)	74.24±13.33	75.54±13.44	61.78±12.32	≠0.02
Height (m)	1.65±0.06	1.65±0.07	1.60±0.06	≠0.01
BMI(Kg/m2)	27.21±4.60	27.56±4.54	24.31±3.89	0.16 Not significant
SBP (mmHg)	128.41±15.43	141.96±14.83	141.67±21.98	≠0.01
DBP (mmHg)	79.43±11.22	88.58±7.76	84.00±13.44	≠0.00
Pulse (BPM)	82.02±12.51	84.85±7.96	78.11±6.20	0.53 Not significant
MAP(mmHg)	95.76±12.07	106.37±9.40	103.22±14.67	≠0.00
CHOL (mmol/L)	4.90±1.66	5.20±1.48	4.39±1.01	0.38 Not significant
Na+ (mEq/L)	140.00±3.87	144.69±5.23	148.56±7.49	≠0.00
K+ (mEq/L)	3.47±0.47	3.23±0.60	3.23±0.44	0.09 Not significant

NB: Results are giving as mean ± standard deviation and range in parenthesis
≠ Significant

Table 6: Body Mass Index (Kg/M2) Classifications with other Parameters for Female Subjects (WHO, 2012).

Parameters	<18.5 Underweight n=1	18.5-24.9 Normal n=30	25.0-29.9 Overweight n= 35	>30 Obese n=20	Anova Significance (p<0.05)
SBP (mmHg)	145.00±0.00	129.43±18.63	132.06±16.01	143.25±13.89	≠0.02
DBP (mmHg)	78.00±0.00	80.37±10.18	81.11±12.47	89.10±8.35	≠0.03
Pulse (BPM)	82.00±0.00	84.37±10.95	81.14±10.29	84.65±11.60	0.58 Not significant
MAP	100.33±0.00	96.72±11.88	98.10±13.20	107.15±9.70	≠0.02
CHOL (mmol/L)	4.60±0.00	4.85±1.67	4.76±1.44	5.39±1.58	0.52 Not significant
Na+ (mEq/L)	150.00±0.00	142.57±5.70	140.20±4.46	143.00±5.00	0.05 Not significant
K+ (mEq/L)	3.30±0.00	3.40±0.44	3.51±0.59	3.10±0.42	≠0.03

NB: Results are giving as mean ± standard deviation and range in parenthesis
≠ Significant

Table 7: Relationship between Serum Cholesterol and other Parameters for Female Subjects (NHLBI, 2007)

Parameters	Desirable(<5.1) mmol/L	Borderline high (>5.1-6.1) mmol/L	High (>6.1)mmol/L	Anova Significance p<0.05
Age/Years	42.20±14.58 (20-70)	47.60±12.03 (30-70)	42.75±10.79 (27.00-63.00)	0.39 Not significant
Weight (kg)	70.27±12.59	72.60±8.98	84.50±15.88	≠0.00
Height (m)	1.60±0.06	1.65±0.07	1.65±0.06	≠0.01
SBP (mmHg)	131.69±18.16	134.00±11.77	141.38±16.59	0.13 Not significant
DBP (mmHg)	81.53±11.69	81.93±9.36	87.31±10.55	0.18 Not significant
Pulse (BPM)	83.31±10.40	82.73±11.89	82.69±11.66	0.97 Not significant
MAP(mmHg)	98.25±13.05	99.29±9.11	105.33±12.36	0.13 Not significant
Na+ (mEq/L)	140.84±5.21	143.93±4.70	143.06±4.99	0.06 Not significant
K+ (mEq/L)	3.48±0.55	3.33±0.42	3.06±0.35	≠0.01

NB: Results are giving as mean ± standard deviation and range in parenthesis
≠ Significant

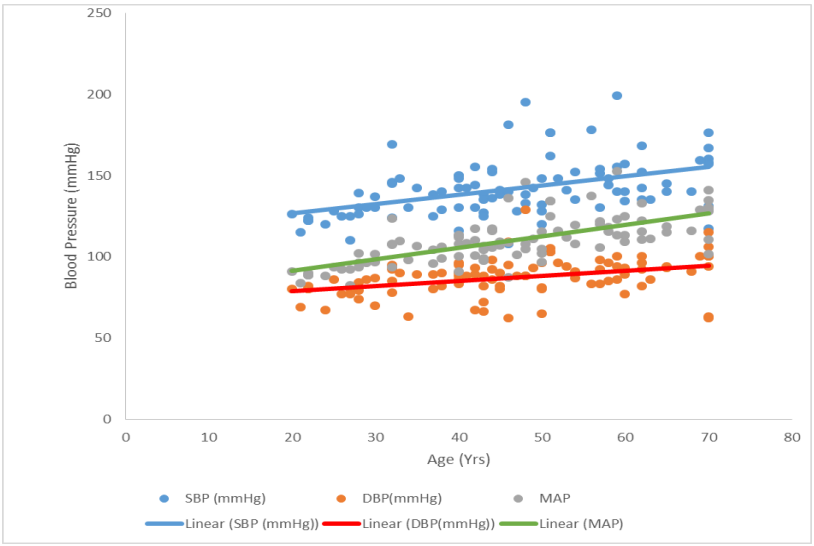

Figure1: Correlation Plot of Age vs Blood Pressure of Male Subjects

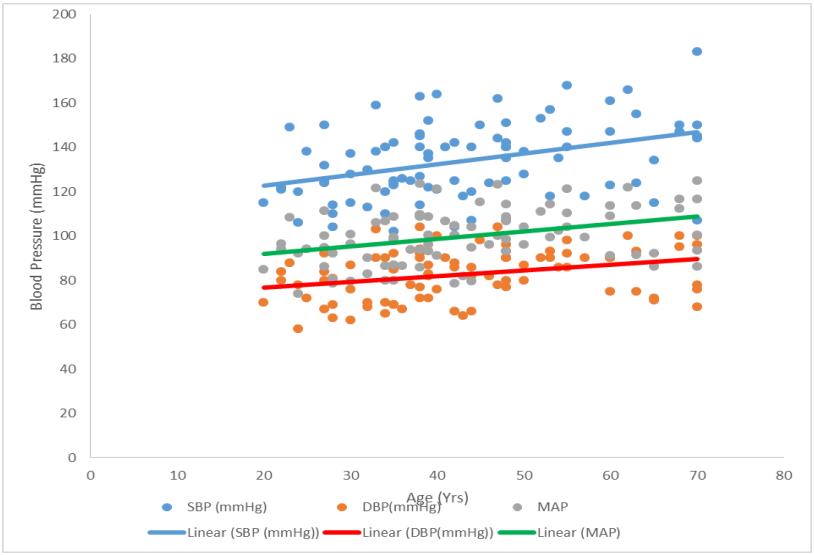

Figure 2: Correlation Plot of Age vs Blood Pressure for Female Subjects

(r=.384) (p<.000)

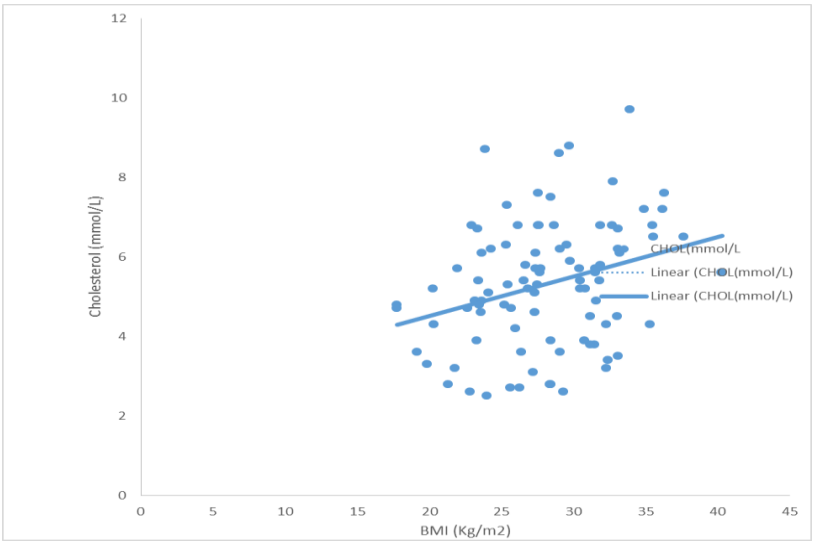

Figure 3: Body Mass Index and Cholesterol for Male Subjects

(r=.29) (p<.00)

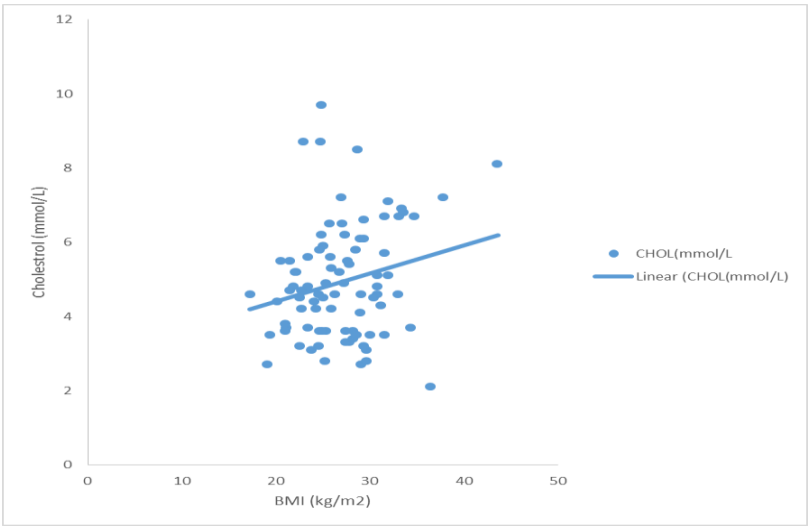

Figure4: Body Mass Index vs Cholesterol for Female Subjects

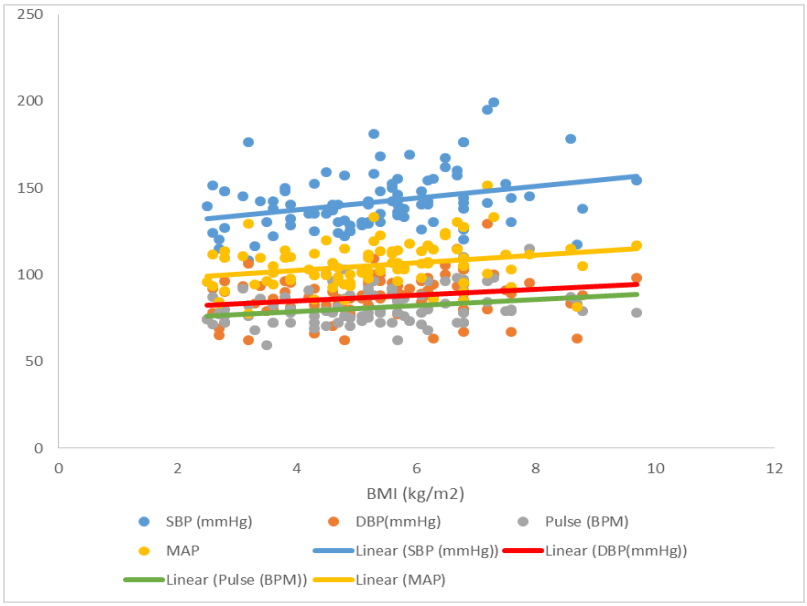

Figure 5: Body Mass Index vs SBP, DBP, MAP and Pulse rate for male Subjects (r=.45,.43,.47,.29) (p<.00,.00,.00,.00)

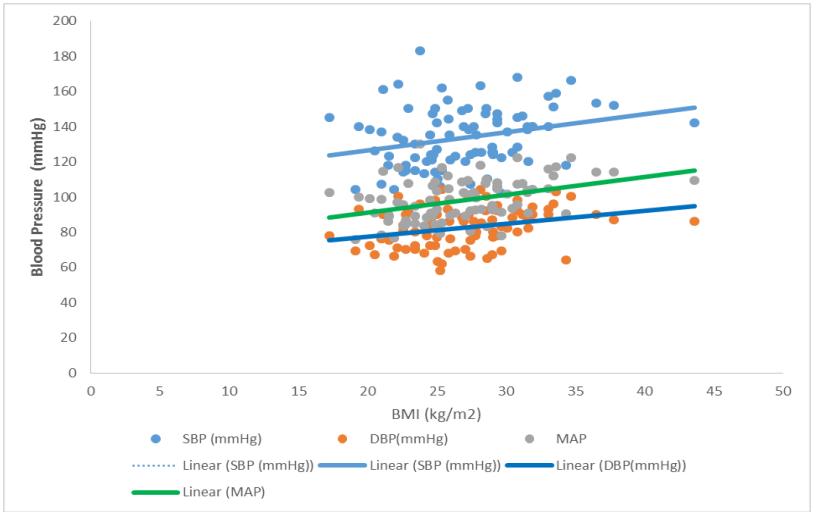

Figure 6: Body Mass Index vs SBP, DBP and MAP for Female Subjects (r=.27, .29, .30) (p<.01, .01, and .01)

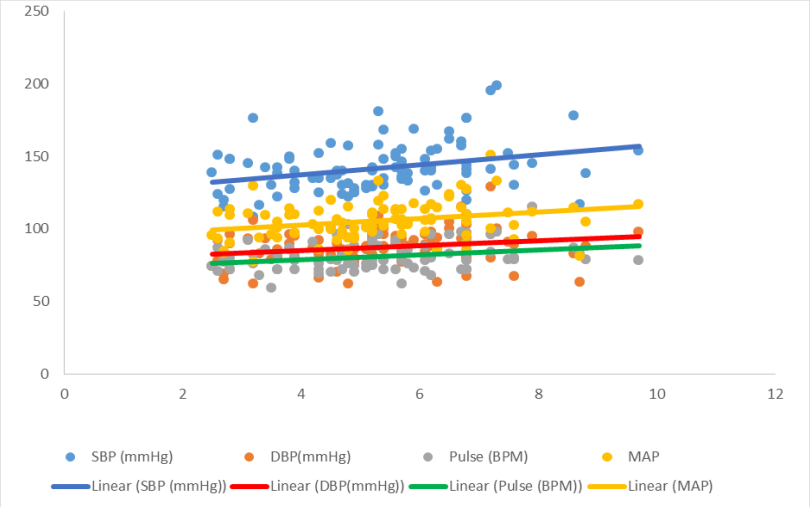

Figure 7: Cholesterol vs SBP, DBP, MAP and Pulse Rate for Male Subjects (r=.30, .22, .27, .28) (p<.00, .03, .01, .01)

DISCUSSION

The result of the present study indicate that the mean systolic and diastolic blood pressure of the middle and older aged adults were found to be statistically higher compared to the younger adults (0.00).(Ovuakporaye *et al* 2016 and Oni *et al* 2008).This increase in blood pressure with age occurs as a result of the arteries becoming stiffer due to formation of plaque within the intima of the blood vessels that create an abnormally high systolic blood pressure (Michael *et al* 2011).The study reveal a positive correlation between the body mass index of the male and female subjects with their blood pressures, mean arterial pressures, and pulse rate This is consistent with the work of Oni *et al* and Alagoa *et al* (2014 and 2013) respectively in the Niger delta university teaching hospital with regard to the effect of body mass index on hypertension. Body mass index is a very important factor that must be monitored by individuals and nutritionist in other to control hypertension. Our findings also observed a positive correlation between serum cholesterol, blood pressure, mean arterial pressure and the pulse rate of the male subjects. A sustained increased in blood pressure is a public health challenge because of its high frequency and concomitant risk of cardiovascular and renal diseases (Kearney *et al* 2005).Hypertension has contributed extensively to the burden of cardiovascular diseases and Several risk factors are increasing in their frequencies among population in develop countries. An increased body mass index, aging, and serum cholesterol is among the risk factors of high blood pressure as re-observed by this study (Victor et al 2011). This increase in blood pressure may be due to lack of exercise, aging, consumption of food rich in cholesterol such as miracle foods etc. The male subjects tend to have a significant serum cholesterol values than their female counterpart which may also be a contributing factor to the differences in their blood pressures. Furthermore, there was a significant correlation between the body mass index and cholesterol level of the male and female subjects ($p<0.00$).Schroder *et al (*2003) in his studies also observed a significant, direct association of body mass index with serum cholesterol ($p<0.01$).The study also shows a significant increase in the body mass index of the middle age male and female subjects compared to the younger and older age adults. This is also consistent with the work of Alagoa *et a*l (2013) with regard to some risk factors among hypertensive client in southern Nigeria that the middle age adult is a known risk factor for the development of obesity and is highly associated with it risk factors for hypertension. The sodium ion concentration has a positive correlation with blood pressure of the female subject's i.e.as the sodium ion concentration increases, their blood pressure rises along with a decrease in the potassium ion concentration level (Umar et al 2013).There was no positive significant correlation between the sodium and the potassium ions with the blood pressure of the male subjects. An observation from this study shows that the obese male subjects had significant blood pressures and pulse rate compared to the underweight and normal subjects while the obese female subjects had significant blood pressures and potassium ion concentration respectively. We observe a non-significant difference between the body mass index of the male and female subjects with no positive correlation in relation to their age. This is contrary to the observation of Joffa et al (2013) with regards to the body mass index of indigenous Nigerian population in the Niger Delta region.

CONCLUSION

We have observed from this study a positive correlation between age, body mass index, and serum cholesterol with blood pressure of adult subjects in Bayelsa State which are contributing factors to the development of cardiovascular diseases.

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