Contributory Risk Factors for Hypertension in Adolescent Offsprings of Hypertensive Fathers Attending a Tertiary Hospital in Lagos

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ABSTRACT

BACKGROUND: Studies have shown hypertension and its complications to be important causes of hospital admission, morbidity and mortality. The young hypertensive patients are more predisposed to higher frequency of undetected hypertension. Male sex and family history of hypertension is a significant non-modifiable risk factor cardiovascular diseases especially hypertension. A genetic influence and familial blood pressure patterns have been well established and are recognized in adolescents. Family studies have demonstrated that at least 20% to 40% of the blood pressure variance in the population are due to familial factors. Offsprings of hypertensives have higher blood pressure values that track in the upper percentiles than their peers whose parents are normotensive. Parental history of hypertension is known to influence the blood pressure of offsprings. Contributory risk factors such as school stress, the use of caffeine containing drugs, tobacco smoking, excessive alcohol intake, obesity and sedentary lifestyle might contribute to the increase in prevalence of hypertension in adolescents.

OBJECTIVE: The aim of the study was to determine relationship between blood pressure pattern and contributory risk factors for hypertension among adolescents whose fathers were hypertensive.

METHODS: The survey employed a descriptive cross-sectional analytical study. The study subjects were adolescent offsprings of hypertensive fathers and the controls were adolescents offsprings of normotensive parents attending Lagos University Teaching Hospital (LUTH), Idi Araba, Lagos.
A modified WHO STEPS surveillance instruments questionnaire was used to collect data.

RESULTS: Among the adolescents whose fathers were hypertensives, 45.3% were current drinkers of coffee, and 76.7% were users of caffeine containing drugs while among the controls, 35.1% were drinkers of coffee and 52.8% were current users of caffeine containing drugs (P. value < 0.05). Among adolescents whose fathers were hypertensives, 5.4% were smokers; while non of the adolescents in controls were smoking (P. value < 0.05). Among adolescents of hypertensive fathers, 21.1% had a BMI of between 25.0 – 29.9kg/m2 while 16.4% of the controls had a BMI of between 25.0 – 29.9kg/m2. BMI of greater than 30.09kg/m2 was found only in 1.6% of controls (P. value < 0.05).

CONCLUSION: The study demonstrated that the use of caffeine drugs, alcohol, overweight and school stress were contributory risk factors identified to be associated with the development of hypertension in adolescents.

Keywords: Hypertension, adolescents, blood pressure, offsprings,contributory, risk factors, fathers

INTRODUCTION

Hypertension is emerging as an important health problem throughout the world. Epidemiological, clinical and pathological studies on the continent of Africa, have shown that High Blood Pressure (HBP) indeed, is the most common cardiovascular and the most common non-communicable disease in Africa [1,2]. Studies in Nigeria by the expert committee on non communicable diseases put the prevalence of HBP in Nigeria at 11.2% with rates in rural and urban communities of 9.8% and 14.6% respectively.[1] Preventive measures on at risk adolescents might lead to a reduction in the current HBP prevalence in adult. Lifestyle modification can be instituted in pre-

hypertension if there is early detection and risk factors for hypertension are identified.[1] Adolescents are persons in the age group of 10-19 years, usually in secondary school or in out of school vocation.[3] Male sex and family history of hypertension is a significant non-modifiable risk factor cardiovascular diseases especially hypertension. In Nigeria, the prevalence of hypertension in adolescents at 95th percentile for males and females combined were 3.2% for systolic blood pressure and 4.1% for diastolic blood pressure [4]. The most common causes of death being heart disease, cerebrovascular disease and renal disease. Morbidity figures and burden of disease secondary to HBP in Nigeria is very significant[5]. Adolescents are clearly the group at risk of beginning smoking cigarette and drinking of alcohol[6]. Other risk factors for hypertension in adolescents include school stress (systolic blood pressure increased during school week than during weekend or holiday,[7] heavy alcohol consumption,[8,9] Obesity, [10]peer pressure[6], lack of exercise[6], drugs such as caffeine may cause transient rise in blood pressure[11]. Blacks have been shown to develop HBP at an earlier age as well as a higher prevalence of target organ damage.[12] The epidemic of childhood obesity, the risk of developing left ventricular hypertrophy, and evidence of the development of atherosclerosis in children would make the detection of and intervention in childhood hypertension important to reduce long term health risks.[11,13] The young hypertensive patients are more predisposed to higher frequency of undetected hypertension.[14] Hypertension during adolescent period has been shown to be an independent risk factor for hypertension in adulthood.[15] Identifying at risk adolescents is the first step in modifying or preventing these risk factors. Acute emotional stress temporarily elevates blood pressure. This is the basis of the "white coat hypertension" noticed in some patients. Oke[16] in his study on "white coat" effect on blood pressure of Nigeria hypertensives, found white coat hypertension to be a significant factor in the management of Nigerian hypertensives. School stress may also have a significant influence of blood pressure of adolescents, Jenny et al[17] in their study on the effect of school stress found day time SBP higher during 24-hour readings obtained during a school week than measurements performed during weekend or holiday. Studies have shown that adolescent obesity rates are increasing.[17] The increasing prevalence of obesity along with increasing sedentary life styles, has given rise to an increase in hypertension among adolescents.[18] It has also been noted that obese adolescents reduce their SBP at night time significantly less than their lean counter parts.[17] The prevalence of hypertension in young and middle aged with high BMI was more than individuals with normal BMI.[19] A BMI of ≥ 25 correlates closely with increased blood pressure.[20] Weight gain is associated with increased blood pressure and increased incidence of hypertension.[21] Deposition of excess fat in the upper part of the body (a waist circumference of ≥34 inches in women or ≥39 inches in men is associated with the risk of hypertension.[22]

Tobacco use is the single most preventable cause of death and disease in the United States. [23]

Male sex and family history of hypertension is a significant non-modifiable risk factor cardiovascular diseases especially hypertension.

A genetic influence and familial blood pressure patterns have been well established and are recognized in adolescents. Family studies have demonstrated that at least 20% to 40% of the blood pressure variance in the population are due to familial factors. Offsprings of hypertensives have higher blood pressure values that track in the upper percentiles than their peers whose parents are normotensive. Parental history of hypertension is known to influence the blood pressure of offsprings . Contributory risk factors such as school stress, the use of caffeine containing drugs, tobacco smoking, excessive alcohol intake, obesity and sedentary lifestyle might contribute to the increase in prevalence of hypertension in adolescents. Everyday more than 3,000 adolescents in the United States use tobacco for the first time.[23] More than 8.5 million adolescents between the ages of 12 and 17 years, representing 42% of this age group, have tried cigarette smoking, and 11 percent of high school seniors smoke at least 10 cigarettes daily.[24] The mean age of initial tobacco use is 10.7 years for boys and 11.4 years for girls. Adolescents are clearly the group at greatest risk of beginning smoking. If current patterns of smoking behaviour continue, an estimated 6.4 million of today's children can be expected to die prematurely from smoking-related including hypertension disease[25] Because adolescents smoke cigarettes for a particular reason (to fit into a group, to lose weight, to appear older), in their minds, smoking serves a function.[10] Alcohol is used by more young people than tobacco.[26] In 2007, alcohol use among high school students was 45% while 26% of high school students reported episodic heavy or binge drinking.[7] Physical activity reduces the risk of premature mortality in general, and of coronary heart disease, hypertension, colon cancer, and diabetes mellitus in particular.[27] Regular physical activity in childhood and adolescence improves strength and endurance, helps build healthy

bones and muscles, helps control weight, reduces anxiety and stress, increases self-esteem and may improve blood pressure and cholesterol levels.[28]
Positive experiences with physical activity at a young age help lay the basis for being regularly active thought life.[28] The clinical and epidemiological interests generated by hypertension have been in the adult population. However, evidence abound that the pathophysiology of hypertension begins in childhood. Identifying at risk adolescent is the first step in modifying or preventing these risk factors for hypertension (positive history of hypertension in fathers, smoking, alcohol, school stress, peer pressure, obesity). Intervention is most effectively accomplished with an integrated family-oriented approach rather than patient centred approach.[6] In Nigeria, there is insufficient data on adolescent hypertension and its environmental risk factors. This study was based on determining the relationship between the blood pressure and environmental risk factors in adolescents whose fathers are hypertensive.

SUBJECTS, MATERIALS AND METHODS

The study population were adolescents (aged 10-19 years) whose fathers were hypertensive and attending Lagos University Teaching Hospital. The study population was divided into two comparable groups A and B. Group A, the subjects comprised of comparable number of male and female offsprings of hypertensive fathers while Group B, the controls, was made up of age and gender matched offsprings of normotensive fathers. The subjects were recruited through their hypertensive fathers who attended the cardiology, and nephrology, medical out patient, NHIS/Family Medicine clinics, that primarily manage adult hypertensives at Lagos University Teaching Hospital. The controls were recruited through normotensive parents who attended family medicine clinic/NHIS/staff for other medical conditions.
Descriptive cross-sectional analytical survey of 369 (group A) and 373 (group B) patients were selected by consecutive sampling. Ethical approval was obtained from Lagos University Teaching Hospital Ethical Committee and informed written consent was obtained from each subject prior to inclusion into the study. Confidentiality of all information obtained from respondents was assured by safely and securely storing the questionnaires. Questionnaire was designed and adapted for use in this study based on WHO steps instrument for surveillance approach to chronic disease risk factor.[29] The questionnaire was used to collect social and demographic data, knowledge of hypertension and its risk factors, lifestyle and risk behavior.

DATA ANALYSIS

All data generated were entered into a standard proforma. The statistical analysis was done using EPI info software version 3.3.2 Continuous variable was expressed as mean S.D (Standard Deviation) and categorical variable as percentage. Differences in categorical variable were assessed by chi-square

RESULTS

Table 1: Socio-demographic characteristics of subjects and control

Socio-demographic variable	Study group		Control group		X^2	df	p-value
	F (n=369)	%	F (n=373)	%			
Age (year)							
10 – 13	37	10.0	39	10.4			
14 – 16	174	47.2	173	46.4	0.06	2	0.97
17 – 19	158	42.8	161	43.2			
Total	369	100	373	100			
Mean+SD	15.9 ± 2.1		15.9 ± 2.1				
Gender							
Male	226	61.2	101	27.1			
Female	143	38.8	272	72.9	86.48	1	<0.001
Total	369	100	373	100			
Religion							
Christianity	212	57.5	292	78.3			
Islam	157	42.5	81	21.7	36	1	<0.001
Total	369	100	373	100			
Education							
No formal	7	1.9	-	-			
Primary	2	0.5	-	-			
Secondary	287	77.8	192	51.5	73.74	3	<0.001
Tertiary	73	19.8	181	48.5			<0.001*
Total	369	100	373	100			

*Fisher exact p -value

Table 1 shows the total study population was made up of 742 adolescents comprising of 369 subjects and 373 controls. The age range of the total population was between 10-19 years with a mean of 15.9 ± 2.1 for both subjects and controls, P = 0.97. Thirty-seven of the subjects and thirty nine of the controls were within the age group of 10-13 years, one hundred and seventy four of the subjects and one hundred and seventy three of the controls were within the age group of 14-16 years while one hundred and fifty eight of the subjects and one hundred and sixty one of the controls were within the age group of 17-19 years. There were 226 males and 143 females among the subjects while in the control group there were 101 males and 272 females. Majority of subjects (57.5) practiced Christianity and similarly, majority of the controls (78.3) also practiced Christianity. About Ninety eight percent of the subjects

had basic formal education; primary (0.5%), secondary (77.8%) and tertiary (19.8%); while all the controls have basic formal education; secondary (51.5%) and tertiary (48.5%). This was significant, P – value <0.001

Table 2: Caffeine use among subjects and controls

Caffeine use	Study group		Control group		X^2	df	p-value
	F (n=369)	%	F (n=373)	%			
Coffee							
Drink coffee	167	45.3	131	35.1	13.48	2	0.001
Do not drink coffee	196	53.1	222	59.5			
Stopped drinking coffee	6	1.6	20	5.4			
Total	**369**	**100**	**373**	**100**			
Caffeine containing drugs							
Take caffeine	283	76.7	197	52.8	53.45	2	<0.001
Do not caffeine	83	22.5	151	40.5			
Stopped taking caffeine	3	0.8	25	6.7			
Total	**369**	**100**	**373**	**100**			

Table 2 depicts the use of caffeine and caffeine containing drugs. Among the subjects who drank coffee, (45.3%) were current drinkers, while (1.6%) were ex-drinkers. Among the controls, (35.1%) were current drinkers, (5.4%) were ex-drinkers while (59.3%) were not drinking coffee. (P – value <0.05). Among controls, (52.8%) used caffeine drugs, (6.7%) had stopped taking caffeine drugs while (40.5%) were not taking caffeine drugs (P-value <0.05).

Table 3: Tobacco use among subjects and controls

Tobacco use	Study group		Control group		X^2	df	p-value
	F (n=369)	%	F (n=373)	%			
Tobacco smoking							
Smoke tobacco	20	5.4	-	-	18.93	1	0.001
Do not smoke tobacco	349	94.6	373	100			
Total	**369**	**100**	**373**	**100**			
Daily smoking	**(n=20)**						
Smoke daily	2	10.0					
Do not smoke daily	18	90.0					
Total	**20**	**100**					
Age at first smoking (year)	**(n=20)**						
11	4	20.0					
12	4	20.0					
13	4	20.0					
14	6	30.0					
15	2	10.0					
Total	**20**	**100**					

Table 3 highlights the 20 subjects that smoked tobacco; 2 (10%) smoked daily while the remaining 18(90%) did not smoke daily. For the current smokers, ages at first smoking were 11 years, 12 years, 13 years, 14 years and 15 years for 4(20%), 4(20%), 4(20%), 6(30%) and 2(10%) subjects respectively.

Table 4: Alcohol intake among subjects and controls

Alcohol intake	Study group		Control group		X^2	df	p-value
	F (n=369)	%	F (n=373)	%			
Alcohol intake							
Take alcohol	31	8.4	25	6.7	0.54	1	0.46
Do not take alcohol	338	91.6	348	93.3			
Total	**369**	**100**	**373**	**100**			
Frequency of drinking	**(n=31)**		**(n=25)**				
Daily	1	3.2	-	-	10.57	4	0.03
5 – 6 days per week	3	9.7	-	-			0.01*
1 – 4 days per week	2	6.4	-	-			
1 – 3 day per month	3	9.7	10	40.0			
Less than once in a month	22	71.0	15	60.0			
Total	**31**	**100**	**25**	**100**			
Number of drinks per day	**(n=31)**		**(n=25)**				
1	11	35.5	10	40.0	0.28	2	0.87
2	12	38.7	10	40.0			
Do not know	8	25.8	5	20.0			
Total	**31**	**100**	**25**	**100**			
Number of drinks per occasion	**(n=31)**		**(n=25)**				
1	4	12.9	-	-	12.28	3	0.01
2	-	-	5	20.0			0.03*

In Table 4, 31(8.4%) subjects that drank alcohol out of which 35.5% had one drink per day, 38.7% had two drinks per day and the remaining 25.8% could not recall the number of drinks per day. The largest number of drinks had on a single occasion was one and three for 12.9% and 6.5% of the subjects respectively while 80.6% of the subjects did not know the largest number of drinks per occasion. (P-value <0.05).

3	2	6.5	5	20.0
Do not know	25	80.6	15	60.0
Total	**31**	**100**	**25**	**100**

Table 5: Physical activity among subjects and controls

Physical activity	Study group		Control group		X^2	df	p-value
	F (n=369)	%	F (n=373)	%			
Physical exercise							
Engage in exercise	220	59.6	338	90.6	93.91	1	<0.001
Do not engage in exercise	149	40.4	35	9.4			
Total	**369**	**100**	**373**	**100**			
Number of days of exercise	**(n=2d20)**		**(n=338)**				
1 – 3	177	80.5	283	83.7	6.29	3	0.10,
4 – 5	30	13.6	45	13.3			0.11*
6 – 7	2	0.9	5	1.5			
Don't know	11	5.0	5	1.5			
Total	**220**	**100**	**338**	**100**			
Participation in sport							
Participate in sport	164	74.5	263	77.8	0.62	1	0.43
Do not participate in sport	56	25.5	75	22.2			
Total	**220**	**100**	**338**	**100**			
Days of sport per week	**(n=164)**		**(n=263)**				
1 – 3	117	71.3	223	84.8	11.89	3	0.01
4 – 5	33	20.1	25	9.5			
6 – 7	5	3.1	5	1.9			
Don't know	9	5.5	10	3.8			
Total	**164**	**100**	**263**	**100**			

*Fisher exact p_value

Table 5 reveals that among the 59.6% of the subjects that engage in physical exercise, 80.5% had it for 1-3 days, 13.6% had it for 4-5 days while 0.9% had it for 6-7 days. Up to three-quarter of the subjects participated in sports with 71.3% performing sporting activities 1-3 days per week, 20.1% performed it for 4-5 days per week while 3.1% performed it for 6-7 days per week. However, 5.5% could not recall the number of days of sports per week.

Table 6: History of school stress

School work	Study group		Control group		X^2	df	p-value
	F (n=369)	%	F (n=373)	%			
Thinking about school work							
Think school work causes stress	159	43.1	171	45.8	0.46	1	0.50
Do not think school causes stress	210	56.9	202	54.2			
Total	**369**	**100**	**373**	**100**			
Aspect that is most stressful							
Academic	96	60.4	96	56.1	6.81	4	0.15
Social	10	6.3	10	5.9			
Envir onmental	44	27.6	50	29.2			
Others	3	1.9	-	-			
Don't know	6	3.8	15	8.8			
Total	**159**	**100**	**171**	**100**			

Table 6 depicts the 43.1% of the subjects who considered school work as stressful, 60.4% of them regarded academics as most stressful. Social and environmental were regarded as most stressful by 6.3% and 27.6% subjects respectively. The ratio of those who considered school work as stressful to those who did not in study and control groups was approximately 1:1. In addition, both groups considered academic as most stressful.

Table 7: Anthropometric measurement among subjects and controls

Anthropometric measurement	Study group		Control group		X^2	df	p-value
	F (n=369)	%	F (n=373)	%			
BMI (mg/m^3)							
< 18.5	8	2.2	33	8.8	23.48	3	<0.001
18.5 – 24.9	283	76.7	273	73.2			<0.001*
25.0 – 29.9	78	21.1	61	16.4			
≥ 30.0	-	-	6	1.6			
Total	**369**	**100**	**373**	**100**			
Mean BMI	23.3 ± 2.3		22.3 ± 2.8				
Student's t statistic = 4.97, p-value = 0.00							
Waist circumference$_{Male}$ (cm)							
≤ 102	226	100	101	100			
Total	**226**	**100**	**101**	**100**			
Mean	75.0 ± 8.2		69.8 ± 11.4				
Student's t statistic = 4.64, p-value = 0.00							

Waist circumference$_{Female}$ (cm)				
≤ 88	140	97.9	261	96.0
>88	3	2.1	11	4.0
Total	**143**	**100**	**272**	**100**
Mean	72.7 ± 9.7		75.5 ± 7.3	
Student's t statistic = 3.30, p-value = 0.001				
Waist-to-hip ratio$_{Male}$				
≤ 1	226	100	101	100
Total	**226**	**100**	**101**	**100**
Mean	0.92 ± 0.06		0.90 ± 0.05	
Student's t statistic = 2.80, p-value = 0.01				
Waist-to-hip ratio$_{Female}$				
≤ 0.8	18	12.6	104	38.2
>0.8	125	87.4	168	61.8
Total	**143**	**100**	**272**	**100**
Mean	0.86 ± 0.06		0.82 ± 0.08	
Student's t statistic = 5.53, p-value = 0.00				

*Fisher exact p-value

Table 7 Showed that among the adolescents with history of hypertension in their fathers, 21.1% had a BMI of 25.0-29.9, 76.7% had a BMI of 18.5-24.9 while 2.2% had a BMI less than 18.5. The mean BMI for subjects and controls were 23.3±2.3 and 22.3±2.8 respectively (P-value <0.05). Mean male waist circumference for subjects and controls were 75.0±8.2 and 69.8±11.4 respectively (P-value <0.05). Among the females, 97.9% had waist circumference of less than or equal to 88cm. 2.1% had greater than 88cm Mean female waist circumference for subjects and controls were 72.7±9.7 and 75.5±7.3 respectively. (P-value <0.05). Waist-to-hip ratio in both male subjects and controls were less than 1. Mean waist-hip ratio for subjects and controls were 0.92±0.06 and 0.90±0.05 respectively. P-value <0.05. Waist to hip ratio in female subject show that 12.6% had less than or equal to 0.8 and 87.4% had greater than 0.8. Mean female waist hip ratio was 0.86±0.06 for subjects and 0.82±0.08 for controls. P-value <0.05. This shows that females have more tendencies to develop central obesity than male.

Table 8: Correlations between blood pressure and anthropometrics among subjects and controls

Variable	Correlation coefficient (r)					
	Diastolic blood pressure			Systolic blood pressure		
	Study	Control	Total	Study	Control	Total
Weight	0.27	0.22	0.28	0.53	0.22	0.41
Height	0.17	0.1	0	0.41	0	0.17
BMI	0.22	0.27	0.30	0.41	0.25	0.35
Waist circumference	0.22	0.39	0.28	0.50	0.50	0.47
Hip circumference	0.14	0.22	0	0.32	0.35	0.22
Waist-to-hip ratio	0	0.17	0.28	0.1	0	0.22

BMI - Body mass index

Table 8 highlights mild correlation (0.28) between weight and DBP and moderate correlation (0.41) between weight and SBP. There was no correlation between height and diastolic blood pressure but there was mild correlation between both DBP and SBP with BMI (0.30 and 0.35 respectively).

There was mild correlation (0.28) between waist circumference and DBP while there was moderate correlation (0.47) between waist circumference and SBP. There was no correlation between hip circumference and DBP, while there was mild correlation (0.22) between hip circumference and SBP. There were mild correlations (0.28 and 0.22 respectively) between waist to hip ratio and DBP and SBP.

Table 8b: Associations BMI and diastolic blood pressure among subjects and controls

Variable	Diastolic blood pressure (mmHg)												
	Study group							Control group					
	Frequency (%)				X^2	df	P	Frequency (%)				X^2	df	P
	≤80	81-89	90-99	TOTAL				≤80	81-89	90-99	Total			
BMI (kg/m^2)														
<18.5	6 (75.0)	2 (25.0)	-	8 (100)	8.36	4	0.08	33 (100)	-	-	33 (100)	10.71	6	0.10
18.5 – 24.9	230 (81.3)	49 (17.3)	4 (1.4)	283 (100)				263 (96.2)	5 (1.8)	5 (1.8)	273 (100)			
25.0 –	52	23	3	78				56	5	-	61			

29.9	(66.7)	(29.5)	(3.8)	(100)		(91.8)	(8.2)		(100)		
≥ 30.0	-	-	-	-		6 (100)	-	-	6 (100)		
Total	**288**	**74**	**7**	**369**		**358**	**10**	**5 (1.3)**	**373**		
	(78)	**(20.1)**	**(1.9)**	**(100)**		**(96.0)**	**(2.7)**		**(100)**		

*Fisher exact p

Table 8b highlight associations between BMI and diastolic blood pressure. For BMI range of between 25.0-29.9, 52 subjects had DBP of less than or equal to 80, 23 had DBP of between 81-89mmHg and 3 had DBP of between 90-99mmHg.

Table 9: Associations between BMI, and systolic blood pressure among subjects and controls

Variable	Systolic blood pressure (mmHg)											
	Study group Frequency (%)				X^2	Df	P	Control group Frequency (%)			X^2	df	P
	<120	121-139	140-159	Total				<120	121-139	Total			
BMI (kg/m²)													
<18.5	6 (75.0)	2 (25.0)	-	8 (100)	39.15	4	0.00	33 (100)	-	33 (100)	55.42	3	<0.001 <0.001*
18.5 – 24.9	175 (61.8)	107 (37.8)	1 (0.4)	283 (100)				248 (90.8)	25 (9.2)	273 (100)			
25.0 – 29.9	36 (46.2)	31 (39.7)	11 (14.1)	78 (100)				51 (83.6)	10 (16.4)	61 (100)			
≥30.0	-	-	-	-				-	6 (100)	6 (100)			
Total	**217 (58.8)**	**140 (37.9)**	**12 (3.3)**	**369 (100)**				**332 (89.0)**	**4 (11.0)**	**373 (100)**			

*Fisher exact p

TABLE 9 highlights the associations between BMI and systolic blood pressure. Among subjects with BMI of 25.0-29.9, 36 had SBP of less than 120mmHg, 31 had SBP of 121-139mmHg, and 11 had SBP of between 140-159.

Table 10: Associations between social history and diastolic blood pressure among subjects and controls

Social history	Diastolic blood pressure (mmHg)												
	Study group Frequency (%)				X^2	df	P	Control group Frequency (%)				X^2	df	p
	≤80	81-89	90-99	Total				≤80	81-89	90-99	Total			
Coffee use														
Yes	119 (71.3)	46 (27.5)	2 (1.2)	167 (100)	11.35	4	0.02	131 (100)	-	-	131 (100)	96.20	4	<0.001
No	164 (83.7)	27 (13.8)	5 (2.6)	196 (100)				212 (95.5)	10 (4.5)	-	222 (100)			
Stopped	5 (83.3)	1 (16.7)	-	6 (100)				15 (75.0)	-	5 (25.0)	20 (100)			
Total	**288 (78.0)**	**74 (20.1)**	**7 (1.9)**	**369 (100)**				**358 (96.0)**	**10 (2.7)**	**5 (1.3)**	**373 (100)**			
Caffeine drug														
Yes	210 (74.2)	68 (24.0)	5 (1.8)	283 (100)	13.37	4	0.01	192 (97.5)	5 (2.5)	-	197 (100)	71.23	4	<0.001
No	76 (91.6)	5 (6.0)	2 (2.4)	83 (100)				146 (96.7)	5 (3.3)	-	151 (100)			
Stopped	2 (66.7)	1 (33.3)	-	3 (100)				20 (80.0)	-	5 (20.0)	25 (100)			
Total	**288 (78.0)**	**74 (20.1)**	**7 (1.9)**	**369 (100)**				**358 (96.0)**	**10 (2.7)**	**5 (1.3)**	**373 (100)**			
Tobacco use														
Yes	10 (50.0)	8 (40.0)	2 (10.0)	20 (100)	13.65	2	0.001 0.03*	-	-	-	-	0	0	0
No	278 (79.7)	66 (18.9)	5 (1.4)	349 (100)				358 (96.0)	10 (2.7)	5 (1.3)	373 (100)			
Total	**288 (78.0)**	**74 (20.1)**	**7 (1.9)**	**369 (100)**				**358 (96.0)**	**10 (2.7)**	**5 (1.3)**	**373 (100)**			

Alcohol intake														
Yes	26 (83.9)	4 (12.9)	1 (3.2)	31 (100)	1.33	2	0.52 0.37*	25 (100)	-	-	25 (100)	1.12	2	0.57 1.00*
No	262 (77.5)	70 (20.7)	6 (1.8)	338 (100)				333 (95.7)	10 (2.9)	5 (1.4)	348 (100)			
Total	**288 (78.0)**	**74 (20.1)**	**7 (1.9)**	**369 (100)**				**358 (96.0)**	**10 (2.7)**	**5 (1.3)**	**373 (100)**			
Physical activity														
Yes	185 (84.1)	33 (15.0)	2 (0.9)	220 (100)	12.29	2	0.002 0.002*	323 (95.6)	10 (3.0)	5 (1.5)	338 (100)	1.62	2	0.45 0.76*
No	103 (69.1)	41 (27.5)	5 (3.4)	149 (100)				35 (100)	-	-	35 (100)			
Total	**288 (78.0)**	**74 (20.1)**	**7 (1.9)**	**369 (100)**				**358 (96.0)**	**10 (2.7)**	**5 (1.3)**	**373 (100)**			

TABLE 10 shows associations between social history and diastolic blood pressure.

Among the 167 subjects taking coffee, 71.3% had a DBP of less than or equal to 80mmHgm 27% had DBP of between 81-89mmHg and 1.2% had a DBP of 90-99mmHg. P value <0.05. Among the 283 subjects using caffeine drugs, 74.2% had DBP of less than or equal to 80mmHg, 24% had DBP of 81-89mmHg and 1,8% had DBP of between 90-99, while among the 151 that did not take caffeine drug; most, 96.7% had DBP of less than or equal to 80mmHg, 3.3 had DBP of between 81-89 while None had DBP of between 90-99mmHg. There was significant association between caffeine and DBP. P value <0.05. Among the 20 subjects smoking tobacco, 50% had DBP of less than 80mmHg, 40% had DBP of between 81-89mmHg and 10% had DBP of between 90-99mmHg. There was significant association between tobacco use and DBP in subjects. P value <0.05. Among the 220 subjects who engaged in exercise 84.1% had DBP of less than or equal to 80mmHg, 15% had DBP of between 81-89mmHg and 0.9% had DBP of 90-99mmHg. There was significant association between physical activity and DBP. P value <0.05.

Table 11: Associations between social history and systolic blood pressure among subjects and controls

Social history	Systolic blood pressure (mmHg) Study group Frequency (%)				X^2	df	p	Control group Frequency (%)			X^2	df	p
	<120	121-139	140-159	Total				<120	121-139	Total			
Coffee use													
Yes	81 (48.5)	77 (46.1)	9 (5.4)	167 (100)	15.21	4	0.004	121 (92.4)	10 (7.6)	131 (100)	5.64	2	0.06
No	132 (67.3)	61 (31.1)	3 (1.5)	196 (100)				196 (88.3)	26 (11.7)	222 (100)			
Stopped	4 (66.7)	2 (33.3)	-	6 (100)				15 (75.0)	5 (25.0)	20 (100)			
Total	**217 (58.8)**	**140 (37.9)**	**12 (3.3)**	**369 (100)**				**332 (89.0)**	**41 (11.0)**	**373 (100)**			
Caffeine drug													
Yes	156 (55.1)	117 (41.3)	10 (3.5)	283 (100)	6.90	4	0.14	177 (89.8)	20 (10.2)	197 (100)	2.24	2	0.33
No	59 (71.1)	22 (26.5)	2 (2.4)	83 (100)				135 (89.4)	16 (10.6)	151 (100)			
Stopped	2 (66.7)	1 (33.3)	-	3 (100)				20 (80.0)	5 (20.0)	25 (100)			
Total	**217 (58.8)**	**140 (37.9)**	**12 (3.3)**	**369 (100)**				**332 (89.0)**	**41 (11.0)**	**373 (100)**			
Tobacco use													
Yes	4 (20.0)	12 (60.0)	4 (20)	20 (100)	26.37	2	0.00	-	-	-	0	0	0
No	213 (61.0)	128 (36.7)	8 (2.3)	349 (100)				332 (89.0)	41 (11.0)	373 (100)			
Total	**217 (58.8)**	**140 (37.9)**	**12 (3.3)**	**369 (100)**				**332 (89.0)**	**41 (11.0)**	**373 (100)**			

Alcohol intake													
Yes	20 (64.5)	10 (32.3)	1 (3.2)	31 (100)	0.48	2	0.79	25 (100)	-	25 (100)	3.31	1	0.07 0.09*
No	197 (68.3)	130 (38.5)	11 (3.3)	338 (100)				307 (88.2)	41 (11.8)	348 (100)			
Total	**217 (58.8)**	**140 (37.9)**	**12 (3.3)**	**369 (100)**				**332 (89.0)**	**41 (11.0)**	**373 (100)**			
Physical activity													
Yes	152 (69.1)	63 (28.6)	5 (2.3)	220 (100)	23.84	2	0.00 0.00*	297 (87.9)	41 (12.1)	338 (100)	0.06	1	0.03 0.06*
No	65 (43.6)	77 (51.7)	7 (4.7)	149 (100)				35 (100)	-	35 (100)			
Total	**217 (58.8)**	**140 (37.9)**	**12 (3.3)**	**369 (100)**				**332 (89.0)**	**41 (11.0)**	**373 (100)**			

Table 11 shows association social history and systolic blood pressure. Among the subjects who took coffee, 48.5% had a SBP of less than 120mmHg, 46.1% had SBP of between 121-139mmHg and 5.4% had SBP of between 140-159mmHg. Among the subjects who took caffeine drugs, 55.1% had SBP of less than 120mmHg, 41.3% had SBP of between 121-139mmHg and 3.5% had SBP of between 140-159mmHg. Among the subjects who took tobacco, 20% had SBP of less than 120, 60% had SBP of between 121-139mmHg and 20% had SBP of between 140-159mmHg;. There was significant association between tobacco use and systolic blood pressure. P value <0.05.

Among the subjects who drank alcohol, 64.5% had SBP of less than 120mmHg, 32.3% had SBP of between 121-139 and 3.2% had SBP of between 140-159mmHg. There was no statistical significance. P value <0.05. Among the subjects who engage in physical activity, 69.1% had SBP of less than 120mmhg, 28.6% had SBP of between 121-139mmHg and 2.3% had SBP of between 140-159mmHg.

DISCUSSION

This study examined environmental and anthropometric risk factors of hypertension in adolescents whose fathers were hypertensive. The prevalence of hypertension observed in this research was 3.3% for systolic blood pressure and 1.9% for diastolic blood pressure among subjects. The systolic value in this study is similar with the prevalence reported by Akinkugbe[4], where 3.2% and 4.1% was documented for systolic and diastolic blood pressure respectively. The early age at first smoking (11years) might also account for the high prevalence. This age is earlier than the report from national centre for chronic disease prevention and Health promotion[30], in which American youth age 13-17 try their first cigarette. Appropriate intervention to modify their life styles is required. The prevalence of tobacco smoking was found to be 5.4% among subjects but zero in controls. This was far lower than the prevalence of tobacco use in developed countries like United States of America[31] where a prevalence of 23% was found among high school students. This is also far lower than another study done by American Medical Association[24] which revealed 42% of adolescent smoke tobacco. Tobacco is associated with cardiovascular diseases including hypertension[6]. The high prevalence of caffeine drug use (76.7%) in this study may also contribute to the elevated blood pressure level found. Among the subjects and controls, current caffeine drinkers were 45.3% and 35.1% respectively. The study done by Gregory BL[11] had implicated transient Blood Pressure from caffeine consumption. This might have resulted in the blood pressure rise in this study. The prevalence of alcohol in subjects and controls was 8.4% and 6.7% respectively. This was lower than 26% found high school students in United States[32]. This reported figure may drop with the advent of the new laws governing United States, including prohibition of alcohol purchase by youth under age of 21years and public advertisement and drinking. However, figures from Nigeria may start to rise on account of the receptive policies of the government to encourage investment of such companies in Nigeria. Body mass index correlates positively more with systolic blood pressure (0.35) than diastolic pressure (0.30). None of the subjects was obese; although controls have 1.6 % being obese. This is much lower than the result of Fotooh[19]. WHO found 31.2 % as obese and 36.6 % as over weight in young persons. In contrast, this study showed 21.1% and 16.4% as overweight in the study and control groups respectively.

Among the subjects and control, the prevalence of overweight was 21.1% and 16.4% respectively. The study by Lurbe E[18] had shown that obesity occurs with increasing sedentary lifestyle and result in increase blood pressure. Fotooh[19] and Carghron[20] had corroborated this in their study that BMI correlates

closely with elevated blood pressure. The lower BMI in this study may explain why the prevalence of adolescent hypertension is lower than that of developed world. The prevalence of school Stress was found to be 43.1% and 45.8% among subjects and control respectively. Jenny F et al[17] had reported that school stress resulted in daytime systolic blood pressure higher during 24-hour reading during school week when compared with weekend or holiday. Among the subjects, 59.6% engaged in exercise. Oladipupo et al[27] and CDC[28] demonstrated that physical activity reduces risk of hypertension, improves strength and endurance and reduce cholesterol levels.

CONCLUSION

The study demonstrated that the use of caffeine drugs, alcohol, overweight and school stress were risk factors identified to be associated with the development of hypertension in adolescents.

Among the adolescents whose fathers were hypertensives, about half were current drinkers of coffee while three-quatre were users of caffeine containing drugs. Also, 5.4% were smokers and 21.1% had a BMI of between 25.0 – 29.9kg/m2

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