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Original Research Article

Distribution of cardiovascular disease risk factors between hypertensive and normotensive adults in Garissa County, Kenya

Abdihakim M. Osman*, Harun M. Kimani, Mary W. Gitahi

Department of Family Medicine, Community Health and Epidemiology, Kenyatta University, Nairobi, Kenya

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***Correspondence:**
Dr. Abdihakim M. Osman,
E-mail: inashaafi@gmail.com

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ABSTRACT

Background: Cardiovascular diseases (CVDs) are diseases affecting the heart and the blood vessels. Globally hypertension is the leading cause of cardiovascular disease and premature death, affecting 26% of the world population with prevalence expected to rise to 29% by 2025. The main study outcome was the distribution of cardiovascular disease risk factors. Secondary outcomes were the knowledge and socio-economic factors and their impact on distribution of cardiovascular disease risk factors.
Methods: This was a retrospective case control study. Information regarding the sociodemographic, cardiovascular disease risk factors, knowledge and socioeconomic factors were collected from 140 adult patients (70 hypertensives and 70 normotensives) seeking outpatient services in Garissa County, Kenya. The 95% confidence limit was used and findings whose $p \leq 0.05$ was considered statistically significant.
Results: Majority of the participants were aged >65 years (28.6%), followed by 56-65 years (24.3%) with a range of 25-75 years and were mainly male (57.1%), had attained at least a primary school education level (39.3%) and employed (53.6%). The prevalence of increased cardiovascular disease risk factors (>3 CVD risk factors) was 72.1% among the study participants with the hypertensive arm having 14.9% higher prevalence. There was statistically significant association between BMI and knowledge with distribution of cardiovascular disease risk factors ($p=0.01$) and ($p=0.05$) respectively.
Conclusions: The hypertensive arm had marginally higher cardiovascular disease risk factors. High BMI and low knowledge were both associated with increased cardiovascular disease risk factors. Prospective studies with larger sample size and encompassing more counties are recommendable.

Keywords: Distribution of CVD risk factors, Hypertensive arm (cases), Normotensive arm (controls)

INTRODUCTION

Cardiovascular diseases are diseases affecting the heart and the blood vessels. Hypertension is the leading cause of cardiovascular complications and death.[1] Other CVDs include stroke, heart failure, coronary artery disease and mostly come as complication of hypertension.[2] Hypertension continues to cause an increasing burden on the health systems worldwide more so in sub-Saharan Africa.[3] Globally, the prevalence of hypertension is at 26%. In Kenya approximately 25% of adults aged (18-69) are hypertensive.[4]

Danger with CVD like hypertension is that it is a “silent killer” (no obvious signs). At present, according to the 2015 stepwise study, in Kenya, 25% of the population aged 18-69 years were estimated to be hypertensive and 50% are pre-hypertensive. This is likely to be an underestimate given the silent nature of the disease and the fact that 70% of Kenyans rely on traditional healers.[4]

Risk factor modification is the cornerstone in preventing hypertension and its complications.[5] It is recommended for borderline/mild hypertensive cases (According to WHO criteria in 1978, borderline hypertension is defined as systolic blood pressure between 140 and 159 mmHg and/or diastolic blood pressure between 90 and 94 mmHg). It includes limiting alcohol intake, eating healthy diet with less salt and cholesterol, maintaining healthy weight, regular physical activity. If the pressure is not managed by the afore-mentioned measures, one is advised to use anti-hypertensive agents.

To date, majority of the research is based on localized studies that are not generalizable to rural areas and little is known about the factors that might influence knowledge and disease complications in these settings. Garissa has therefore been selected because of the very few studies conducted in the county owing to the very few tertiary institutions. In addition, the preference for traditional and cultural practices within the area often impedes health seeking behaviors and offers an alternative but ineffective remedy. The study will provide the policy makers with grounds to make informed decisions regarding measures to curb hypertension. It will also improve the available literature on the topic more so for Garissa in which very few research has been undertaken if any.

METHODS

Study area and site

This was a hospital based retrospective case control study conducted in Garissa County, Kenya between the months of June and August 2023. Garissa County Referral Hospital, Iftin Subcounty Hospital and Medina Hospital were used as the study centers. Study subjects were recruited from the outpatient department (OPD) of the said hospitals.

Study population

Adult hypertensive and normotensive individuals aged (25-75 years) living in Garissa County and seeking outpatient services in Garissa County Referral Hospital, Iftin Subcounty Hospital and Medina Hospital during the study period.

Inclusion and exclusion criteria for cases

Patients diagnosed with hypertension (defined as systolic BP above 140 mmHg and/or diastolic BP above 90 mmHg as diagnosed by physician or those on antihypertensives). They were limited to participants who had hypertension for at least 6 months.

However, the following were excluded from the hypertensive population: i) known cases of secondary hypertension; ii) pregnant mothers falling in the recommended study age brackets.

The controls included patients seeking out-patient services with no known history of hypertension (including history of antihypertensive medication) and whose pressure was normal on the day of data collection.

Both genders were eligible, but the participant had to sign a written informed voluntary consent for participation. Known cases of secondary hypertension were not invited to participate because the basis for their hypertension is kidney disease, endocrine disorders among others and not CVD risk based. Pregnant mothers were excluded because of possibility of having hypertension due to pregnancy (eclampsia and pre-eclampsia) and not necessarily CVD risk based.

Sampling magnitude and selection method

The main study outcome was the distribution of CVD risk factors. Fleiss formula (1981) was used to calculate the target sample size. From literature, the proportion of those exposed to the risk factors in the control group =24%.[6] Expected odds ratio of 2.8 or greater and statistical power was set at 80%. Equal cases and control (i.e. R=1) were considered and least sample size of 69 patients was estimated. However, to factor in destroyed questionnaires and refusal to participate, a 10% was added to make approximately 76 participants in each arm.

Because of the limited research and scant literature from the region, Garissa County was chosen through purposive sampling. Simple random sampling technique was used to recruit 70 hypertensives and 70 normotensives (excluding defaulters and destroyed questionnaires) from the outpatient departments of the aforementioned hospitals. Eligible patients aged 25-75 years seeking care in the hospital during the study period formed the framework from which the sample was collected. Participants were matched by sex and age group.

Study methods

Approval to conduct research was sought and obtained from Kenyatta University (KU) graduate school. Ethical clearance from KU ethical review committee (KU/ERC) vide reference number PKU/2572/11698 as well as research permit from NACOSTI. Permission from Garissa County Department of Health and voluntary informed consent from the study participants. Data was collected using an interviewer administered questionnaire which was tested and standardized before the main study.

Willing participants upon fulfilling the set inclusion criteria were issued with consent forms and taken through the consent process.

Any ambiguity, clarification or question thereof was addressed. Upon satisfaction and giving the voluntary informed consent to participate, the participant was enrolled into the study.

Statistical analysis

Coding of the questionnaire was done before recording to ensure privacy. The coded questionnaires were then entered and stored in a data system by the principal investigator. Data verification was done again by the principal researcher to ensure proper coding and correct data entry. It was then entered into IBM Statistical Package for Social Sciences (SPSS) version 23. Summary data analysis was done with categorical variables such as level of education, employment status summarized by calculating proportions. Knowledge level was computed and presented as percentage (of the sum of the questions answered correctly over the total questions enquired in a given section). Inferential statistics was then done with association between cardiovascular disease risk factors and socio-economic factors as well as knowledge being determined by use of chi squared test or fisher's exact test of association. The statistical association was tested at the 95% CI. $p \leq 0.05$ was considered as significant. Only BMI and knowledge were statistically significant at the bivariate level. The outcome variable (CVD risk factors) was dichotomized into low (≤3 CVD risk factors) and high (>3 CVD risk factors) and binary logistic regression analysis was done to determine independent predictors of CVD distribution between the hypertensive and normotensive arm. P values and odd ratios were used to establish the strength of association between the variables under investigation. Results were presented in tables as appropriate.

RESULTS

A total of 140 study participants were recruited into the study (70 hypertensives and 70 normotensives). Table 1 shows the sociodemographic and clinical characteristic of the respondents.

Table 1: Socio demographic characteristics of study population.

Socio demographic characteristic	Group		
	Case, N (%)	Control, N (%)	Total no.
Age (years)			
25-35	4 (5.7)	4 (5.7)	8
36-45	13 (18.6)	13 (18.6)	26
46-55	16 (22.8)	15 (22.8)	31
56-65	17 (24.3)	19 (24.3)	36
>65	20 (28.6)	19 (28.6)	39
Gender			
Female	30 (42.9)	30 (42.9)	60
Male	40 (57.1)	40 (57.1)	80
Family history of hypertension			
Yes	39 (55.7)	35 (50.0)	74
No	31 (44.3)	35 (50.0)	66
Co-morbidity diabetes			
Yes	30 (42.9)	21 (30.0)	51
No	40 (57.1)	49 (70.0)	89
BMI			
<18	5 (7.1)	10 (14.3)	15
20-25	10 (14.3)	30 (42.9)	40
25-30	35 (50.0)	16 (22.8)	51
31-35	15 (21.4)	10 (14.3)	25
> 35	5 (7.1)	4 (5.7)	9
History of smoking			
Yes	12 (17.1)	7 (10.0)	19
No	58 (82.9)	63 (90.0)	121
History of alcoholism			
Yes	7 (10.0)	3 (4.3)	10
No	63 (90.0)	67 (95.7)	130
Exercise per week			
0-3 times	55 (78.6)	44 (62.8)	99
3-5 times	9 (12.8)	20 (28.6)	29
> 5 times	6 (8.6)	6 (8.6)	12
Control of salt in diet			
Yes	9 (12.9)	24 (34.3)	33
No	61 (87.1)	46 (65.7)	107
Control of fat in diet			
Yes	14 (20.0)	17 (24.3)	31
No	56 (80.0)	53 (75.7)	109

The two arms were matched for age and gender. Majority of the participants were aged >65 years at 28.6%, followed by 56-65 years (24.3%) with a range of 25-75 years and were mainly male (57.1%). Most patients had negative diagnosis of diabetes with 57.1% in the cases and 70.0% in the control. BMI range (25-30) recorded highest frequency in the cases but the controls recorded (20-25) as the highest frequency. The study recorded low alcoholic history with 10.0% in the cases and 4.3% in their control counterparts. Low exercise frequency was reported with only 8.6% having recorded (>5 times/week) in both groups. For the cases, only 12.9% controlled salt in their diet while 20.0% regulated their dietary fat levels. Regarding the controls, only 34.3% controlled salt in their diet while 24.3% regulated their dietary fat level (Table 1).

Distribution of CVD risk factors

Both the modifiable and non-modifiable CVD risk factors which could potentially increase the susceptibility of one to hypertension and other cardiovascular diseases were considered in the study.

The following were the CVD risk factors considered in the study: i) non-modifiable risk factors: advanced age (>55 years), positive family history of hypertension, diabetic comorbidity; ii) modifiable risk factors: increased BMI (>25), positive smoking and/or alcoholic history, reduced exercise frequency (0-3) a week, lack of dietary control (salt and fat).

Participants with 3 or less risk factors were considered to have low while their counterparts with >3 were considered to have high (increased) CVD risk factors. The distribution of CVD risk factors among the study participants is shown in Table 2.

Most patients had high (increased) CVD risk factors (>3) at 72.1%. The hypertensive arm reported higher CVD risk factors relative to the control. High BMI (>25) and positive history of smoking were associated with increased CVD risk factors among the hypertensive population (Table 2).

Table 2: Distribution of CVD risk factors among the study subjects.

Socio demographic characteristic	CVD risk factors			
	>3 CVD risk factors (High CVD risk factors) (n=101)		≤3 CVD risk factors (Low CVD risk factors) (n=39)	
	Case, N (%)	Control, N (%)	Case, N (%)	Control, N (%)
Age (years)				
>55	31 (30.7)	19 (18.8)	6 (15.4)	19 (48.7)
≤55	27 (26.7)	24 (23.8)	6 (15.4)	8 (20.5)
Family history of hypertension				
Yes	36 (35.6)	32 (31.7)	3 (7.7)	3 (7.7)
No	22 (21.8)	11 (10.9)	9 (23.1)	24 (61.5)
Diabetic comorbidity				
Yes	30 (29.7)	18(17.8)	0 (0)	3 (7.7)
No	28 (27.7)	25 (24.8)	12 (30.8)	24 (61.5)
BMI				
>25	51 (50.5)	20 (19.8)	4 (10.3)	10 (25.6)
≤25	7 (6.9)	23 (22.8)	8 (20.5)	17 (43.6)
History of smoking				
Yes	11 (10.9)	3 (3.0)	1 (2.6)	4 (10.2)
No	47 (46.5)	40 (39.6)	23 (59.0)	11 (28.2)
History of alcoholism				
Yes	5 (4.9)	3 (3.0)	2 (5.1)	0 (0)
No	53 (52.5)	40 (39.6)	10 (25.7)	27 (69.2)
Exercise frequency per week				
0-3 times	48 (47.5)	31 (30.7)	7 (17.9)	13 (33.3)
>3 times	10 (9.9)	12 (11.9)	5 (12.8)	14 (35.9)
Control of salt in diet				
Yes	53 (52.5)	34 (33.7)	8 (20.5)	12 (30.7)
No	5 (4.9)	9 (8.9)	4 (10.3)	15 (38.5)
Control of fat in diet				
Yes	52 (51.5)	37 (36.6)	4 (10.3)	16 (41.0)
No	6 (5.9)	6 (5.9)	8 (20.5)	11 (28.2)

Table 3 shows the socio-economic factors (determinants) among the study population.

Majority of the cases attained primary education at 44.3% while majority of the controls attained secondary level of education (35.7%). The control arm recorded higher income with >5 USD at 55.7% compared to the 32.9% reported by the cases. Majority of the study subjects were rural dwellers at 38.6% and 37.1% for the cases and controls respectively. The control group had better access to tap water (54.3%) compared to the 45.7% reported by the cases. The cases recorded relatively lower access to 3 meals a day (31.4%) in comparison to the 55.7% registered by the control arm (Table 3).

Table 4 shows the level of knowledge on hypertension among the study subjects.

Generally, 65.7% of the normotensive population had good knowledge on hypertension compared to 28.6% reported by their hypertensive counterparts. The control arm recorded better knowledge regarding risk factors (57.1%) in comparison to the 22.9% reported by the cases. In summary, the normotensive arm had better knowledge on hypertension (54.3%) in contrast to the 28.6% recorded by their hypertensive counterparts (Table 4).

Table 3: Socio economic determinants among the study participants.

Socio economic characteristic	Group		
	Case, N (%)	Control, N (%)	Total, N (%)
Level of education			
Primary	31 (44.3)	24 (34.3)	55
Secondary	20 (28.6)	25 (35.7)	45
Tertiary	19 (27.1)	21 (30.0)	40
Employment			
Not employed	32 (45.7)	33(47.1)	65
Employed	38 (54.3)	37 (52.9)	75
Daily income			
≤1USD	17 (24.3)	14 (20.0)	31
2-5 USD	30 (42.8)	17 (24.3)	47
>5 USD	23 (32.9)	39 (55.7)	62
Residence			
Rural	27 (38.6)	26 (37.1)	53
Peri urban	21 (30.0)	21 (30.0)	42
Urban	22 (31.4)	23 (32.9)	45
Access to tap water			
No	38 (54.3)	32 (45.7)	70
Yes	32 (45.7)	38 (54.3)	70
Access to constant 3 meals a day			
No	26 (37.2)	18 (25.7)	44
Often	22 (31.4)	13 (18.6)	35
Yes	22 (31.4)	39 (55.7)	61

Table 4: Knowledge regarding hypertension among study subjects.

Knowledge	Group		
	Case, N (%)	Control, N (%)	Total, N
General knowledge on hypertension			
Inadequate	50 (71.4)	24 (34.3)	74
Adequate	20 (28.6)	46 (65.7)	66
Knowledge on modifiable risk factors			
Inadequate	54 (77.1)	30 (42.9)	84
Adequate	16 (22.9)	40 (57.1)	56
Knowledge on complications of hypertension			
Inadequate	55 (78.6)	53 (75.7)	108
Adequate	15 (21.4)	17 (24.3)	32
Overall knowledge			
Low	50 (71.4)	32 (45.7)	82
High	20 (28.6)	38 (54.3)	58

Table 5 shows the association between sociodemographic and CVD risk factors.

The cases had 8.4 times higher odds of having increased BMI compared to the control group and there was statistically significant association between increased BMI and increase in the associated CVD risk factors (OR=8.379, 95% CI: 3.108-22.584, $p<0.05$). The hypertensive arm had 3.121 times higher odds of having positive history of smoking compared to their normotensive counter parts. However, this was not significant at the 95% CI. There was no significant statistic association between other sociodemographic characteristics and CVD risk factors (Table 5).

Table 6 shows the association between socio-economic and CVD risk factors.

There was no statistically significant association between socio-economic and CVD risk factors (Table 6).

Table 5: Association between socio-demographic characteristics and CVD risk factors among the study population.

Selected CVD risk factor	>3 CVD factors (n=101)		OR (CI)	P value
	Case, N (%)	Control, N (%)		
Age (years)				
>55	31 (63.3)	18 (36.7)	1.595 (0.720-3.534)	0.249
≤55	27 (51.9)	25 (48.1)		
Positive family history of hypertension				
Yes	36 (52.9)	32 (47.1)	0.563 (0.237-1.338)	1.191
No	22 (66.7)	11 (33.3)		
Diabetic comorbidity				
Yes	30 (62.5)	18 (37.5)	1.488 (0.672-3.296)	0.326
No	28 (52.8)	25 (47.2)		
BMI > 25				
Yes	51 (71.8)	20 (28.2)	8.379 (3.108-22.584)	0.000
No	7 (23.3)	23 (76.7)		
Positive history of smoking				
Yes	11 (78.6)	3 (21.4)	3.121 (0.813-11.970)	0.144*
No	47 (54.0)	40 (46.0)		
Positive alcohol history				
Yes	5 (62.5)	3 (37.5)	1.258 (0.284-5.576)	1.000*
No	53 (57.0)	40 (43.0)		
Low exercise frequency (0-3 times a week)				
Yes	48 (60.8)	31 (39.2)	2.323 (0.853-6.327)	0.094
No	8 (40.0)	12 (60.0)		
Lack of/don’t control salt in diet				
Yes	53 (60.9)	34 (39.1)	2.806 (0.867-9.086)	0.077
No	5 (35.7)	9 (64.3)		
Lack of/don’t control fat in diet				
Yes	52 (58.4)	37 (41.6)	1.405 (0.420-4.701)	0.579
No	6 (50.0)	6 (50.0)		

Table 6: Association between socio economic and CVD risk factors among the study participants.

Socio-economic factors	> 3 CVD factors (n=101)		OR	P value
	Case, N (%)	Control, N (%)		
Education				
≤Secondary	43 (58.1)	31 (41.9)	1.110 (0.456-2.698)	0.818
Tertiary	15 (55.6)	12 (44.4)		
Employment				
Not employed	29 (56.9)	22 (43.1)	0.955 (0.434-2.101)	0.908
Employed	29 (58.0)	21 (42.0)		
Daily income				
≤5 USD	43 (60.6)	28 (39.4)	1.536 (0.650-3.627)	0.327
>5 USD	15 (50.0)	15 (50.0)		
Residence				

Continued.

Socio-economic factors	> 3 CVD factors (n=101)		OR	P value
	Case, N (%)	Control, N (%)		
Rural/peri urban	43 (58.9)	30 (41.1)	1.242 (0.517-2.986)	0.628
Urban	15 (53.6)	13 (46.4)		
Access to tap water				
No	36 (54.5)	30 (45.5)	0.709 (0.306-1.642)	0.421
Yes	22 (62.9)	13 (37.1)		
Constant 3 meals in a day				
No/often	43 (60.6)	28 (39.4)	1.535 (0.650-3.627)	0.3274
Yes	15 (50.0)	15 (50.0)		

Table 7 shows the influence of knowledge on CVD risk factors.

Generally, low knowledge was associated with increased CVD risk factors. There was statistically significant association between low overall knowledge on hypertension and increased CVD risk factors (OR=2.628, 95% CI: 1.011-6.830, p=0.043) (Table 7).

Independent predictors of distribution of CVD risk factors among the study subjects is as shown in Table 8.

Increased BMI was associated with increased CVD risk factors, and this was significant at the 95% CI (OR=0.153, 95%CI: 0.053-0.447, p=0.01). Additionally, decrease in knowledge on risk factors and overall knowledge on hypertension were both associated with statistically significant increase in CVD risk factors (OR=0.069, 95% CI: 0.007-0.650, p<0.05) and (OR=12.454, 95%CI: 0.915-169.521, p=0.05) respectively (Table 8).

Table 7: Influence of knowledge on distribution of CVD risk factors among the study subjects.

Knowledge	>3 CVD factors (n=101)		OR (C.I)	P value
	Case, N (%)	Control, N (%)		
General knowledge on hypertension				
Inadequate	49 (71.0)	20 (29.0)	6.261(2.471-15.864)	0.000
Adequate	9 (28.1)	23 (71.9)		
Knowledge on risk factors of hypertension				
Inadequate	51 (64.6)	28 (35.4)	3.903 (1.423-10.702)	0.006
Adequate	7 (31.8)	15 (68.2)		
Knowledge on complications of hypertension				
Inadequate	48 (57.1)	36 (42.9)	0.933 (0.324-2.689)	0.898
Adequate	10 (58.8)	7 (41.2)		
Overall knowledge on hypertension				
Low	49 (62.8)	29 (37.2)	2.628 (1.011-6.830)	0.043
High	9 (39.1)	14 (60.9)		

Table 8: Independent predictors of distribution of CVD risk factors among the study population.

Selected CVD risk factor	Bivariate analysis		Multivariate analysis	
	Crude OR (95% CI)	P value	Adjusted OR (95% CI)	P value
BMI>25				
Yes	ref	0.000	0.153 (0.053-0.447)	0.001
No	8.379 (3.108-22.584)			
Knowledge on hypertension				
Inadequate	ref	0.000	0.069 (0.007-0.650)	0.019
Adequate	6.261 (2.471-15.864)			
Knowledge on risk factors				
Inadequate	ref	0.006	0.965 (0.902-1.031)	0.293
Adequate	3.903 (1.423-10.702)			
Overall knowledge on hypertension				
Low	ref	0.043	12.454 (0.915-169.521)	0.05
High	2.628 (1.011-6.830)			

DISCUSSION

Regarding the socio-demographic characteristics, using the cases (hypertensives) as the reference, the participants were matched for age and sex. Increased age was associated with increased prevalence of hypertension with >65 years recording highest frequency of 20 (28.6%). Similar trend has been documented by KORA- age 1 study with adults aged 65-75 years recording highest frequency.[7] This is due to the change in vascular system. With age, vessels get stiffer with consequent increase in blood pressure (physiology of aging).

The male gender recorded a marginally higher prevalence. This is in tandem with a study done in India in which men recorded a marginally higher prevalence (50.99%).[8] This indicates that any person (male or female) can acquire the disease (an almost equal predisposition).

Prevalence of family history of hypertension was 5.7% higher among the cases. The finding concurs with a study done in Sri Lanka in which the cases reported 4.9% higher prevalence of familial history of hypertension. This is explained by the fact that almost 30% of the variance in blood pressure is attributable to hereditary factors, with 65% variance in twin study and 25% in pedigree studies.[9]

Relative to the controls, the cases recorded higher prevalence of diabetic comorbidity. This corroborates well with findings in literature which reported increased co-existence of the two (metabolic syndrome).[10] This is attributable to the commonalities in their causes and risk factors.

The hypertensive (cases) had comparatively higher BMI. This concurs well with study done in Bomet, Kenya which reported 24.2% higher prevalence of obesity among the hypertensive population compared to their normotensive counterparts.[6] The increased weight can lead to build up of fat materials in the vessels and consequent increase in blood pressure. Moreover, obesity may cause overactivation of sympathetic nervous system, stimulation of the renin-angiotensin-aldosterone system, insulin resistance, alteration in adipose derived cytokines, and structural and functional renal changes.[11]

The prevalence of smoking was marginally higher in the cases relative to the controls. Similar finding has been reported by a Kenyan study which revealed an association between smoking and increased burden of hypertension.[12] The nicotine in tobacco stimulates the release of adrenaline and noradrenaline hormones with resultant increase in blood pressure.

The hypertensive arm reported higher prevalence of alcoholism. This augurs well with the findings in literature which revealed an association between alcohol use and increased risk of essential hypertension development.[13] Alcohol consumption causes increase in blood pressure through the renin-angiotensin-aldosterone system (RAAS). Alcohol increases the levels of renin which induces vasoconstriction and decreases renal elimination of fluids. The increased fluid levels and decreased vessel diameter causes resultant increase in blood pressure. Additionally, ethanol may cause vascular dysfunction through increase in the level of reactive oxygen species (ROS).[14]

Though not statistically significant, physical inactivity was more prevalent among the cases depicted by the 15.8% higher exercise frequency recorded among the controls. Similar findings have been reported by a study done among the Brazilian urban population which recorded 21.4% prevalence of hypertension among the inactive individuals compared to the 27.5% prevalence recorded among the active ones.[15] Physical inactivity is associated with weight gain which in turn increases risk of developing blood pressure.

Prevalence of dietary control was higher among the normotensive arm. A similar finding has been reported by a study done in Kenya in which the cases recorded 15.8% salt control in their diet compared to the 17.8% recorded in the control group.[6] Lack of dietary control and increased consumption of red meat, alcohol, dietary salt and junk food is associated with increased risk of developing hypertension. Conversely, increased intake of fruits and vegetables appears protective against the same.[16]

Generally, knowledge regarding hypertension was suboptimal in both groups. This concurs with the finding of a study done in Ashanti region, Ghana which revealed that 63% of the public have no good idea of what hypertension is.[17] Though not statistically significant, the control group had relatively better knowledge. This is in concurrence with a Pakistani study that revealed better literacy in the normotensive population compared to their hypertensive counterparts.[18] The relatively higher knowledge in the control arm may have helped in combating the CVD risk factors especially the modifiable ones and hence possible protection from developing hypertension.

The control arm recorded marginally higher socio-economic status. This corroborates well with the findings by a Kenyan study in which the rich had a comparatively lower hypertension prevalence of 20.1% compared to the 28.2% prevalence in their poor counterparts.[4] A similar finding has been reported by a study done in Tanzania which revealed that 46.3% of the hypertensive burden is contributed by the poor.[19] Around 29.9% of the burden is contributed by the middle class and 23.8% of the burden is from the rich. The low hypertension prevalence among the rich can be explained by better access to basic health, sufficient reproductive health especially for women, increased access to better nutrition and balanced diet.

Higher BMI was associated with increased CVD risk factors, and this was significant at the 95% CI (OR=8.379, 95% CI: 3.108-22.584, $p<0.05$). This contradicts with a study done in China which associated obesity with reduced cardiovascular events and therefore reduced CVD death.[20] The contradiction may be attributable to the difference in the study methodology. The Chinese study had larger sample size (260,416) and longer study period (8 years).

Low knowledge on hypertension was associated with increased CVD risk factors and this was significant at the 95%CI (OR=2.628, 95% CI: 1.011-6.830, p=0.043). This corroborates well with findings by a scoping review which recommended knowledge and awareness as a way to reduce CVD development.[21]

Being a retrospective study, the major limitation was recall bias. To mitigate the shortcoming, the questions were repeated twice, and disruption minimized to enable the participant(s) to have best recall possible. Any form of bias was strictly restrained throughout the study.

CONCLUSION

Though not statistically significant, the cases (hypertensives) had higher CVD risk factors. Both arms recorded low knowledge regarding hypertension. However, the cases (hypertensives) recorded relatively lower knowledge. The hypertensive arm recorded marginally lower socio-economic status compared to the controls. High BMI and low knowledge were associated with increased CVD risk factors.

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