Predictors of Hypertension among Rural Women
The Case of Amagoro in Western Kenya

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Summary

BACKGROUND

Hypertension's association with other chronic illnesses such as cardiovascular diseases, Diabetes, cause common health burden to individuals and societies resulting to a significant loss of quality life-years. It is becoming a major health hazard with a national prevalence of 24.5% and a rural prevalence of 21.4%. In 2017, WHO ranked hypertension as the 12th leading cause of death in Kenya [3-7]

OBJECTIVE

Investigations to establish the predictors of hypertension amongst rural women, informed the researhers to interview residents of Amagoro Division, Busia County, in Western Kenya.

METHODOLOGY

A descriptive survey involving 260 women aged 15- 90 years drawn from various households in Amagoro Division predominantly *Tesos*. Cluster and proportional sampling was employed. Data was collected using a pre-tested structured questionnaire through face-to-face interviews. Weight, height, Waist Circumference (WC) and Hip Circumference (HC) measurements were taken. Body mass index was then computed as weight (kg)/height2 and waist-to-hip ratio was computed as WC/HC. Blood pressure measurements were taken twice and average recorded. Hypertension was defined by blood pressure ≥140/90mmHg or taking anti-hypertensive drugs.

RESULTS

The prevalence of hypertension was 22.3%. Age and household income emerged as the strongest independent risk factors ($p<0.05$). increased prevalence of hypertension with increasing BMI despite the fact that majority of participants had BMI below normal [28], marital status, gender, ethnicity, scarcity of formal employment, work frustrations, such as meger renumerations were all strongly associated. Suggestion that being disadvantaged in early and adult life may be associated with hypertension [40] was a reality. The concentrations of *homocysteine* including its metabolites were significantly higher in the hypertensive patients ($p<0.01$).

CONCLUSSION

All other factors being constant, aging and household income can predict the risk of hypertension in a population. The increasing prevalence with age could be due to elevated *homocysteine* levels which have been found to increase gradually with age. The concentrations of High *homocystein* level and stiffening of the arteries during ageing [10] could be used to explain the increasing prevalence of hypertension with age in this study. Those who spent 6 hours or more

resting are more likely to suffer from hypertension as opposed to those spending 1 to 3 hours (OR=3.74, p=0.354). Beside enthinicity being a factor, there was no association due to the fact that 91% came from the same ethnic grouping.

RECOMMENDATION

With rising life expectancy, hypertension intervention strategies should not target only the elderly but also young people to encourage them modify their lifestyle.

Key words: **blood pressure, hypertension, elderly, women, Kenya**

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Introduction

Hypertension is an elevated blood pressure characterized by a systolic blood pressure greater than (≥)140 mmHg or a diastolic blood pressure greater than (≥)90 mmHg or being on antihypertensive drugs [1]. Normal blood pressure is defined by a systolic blood pressure less or equals to (≤) 120 mmHg and a diastolic blood pressure less or equals to (≤) 80 mmHg [2]. This is usually shown as 120/80.

Hypertension or High blood pressure condition places a considerable health burden to individuals and society leading to a significant loss of quality life-years. It is also associated with other chronic illnesses such as cardiovascular diseases [3 - 5].

In Kenya, hypertension was becoming a major health problem with a national prevalence of 24.5% [6] and a rural prevalence of 21.4%. In 2017, WHO ranked hypertension the 12th leading cause of death in Kenya. A rural village in Madagascar reported a prevalence of 49.1% striking the authors to recommend an investigation into the predictors of hypertension in rural communities worldwide [7 - 9].

The onset of hypertension has been previously associated with both genetic and environmental factors. Physical activities, body weight or use of tobacco increased salt sensitivity and alcohol consumption, have all been linked to increased risk of the condition. Some studies have reported increased risk of hypertension in women especially those above 30 years of age while other studies suggest a higher prevalence in men [2-6, 11-14, 16 -18].

Other factors associated with hypertension include marital status, gender and ethnicity. In Kenya where the population was predominantly African, differences have been reported among ethnic groups. For example, the Kikuyus recorded higher prevalence of hypertension compared to Kalenjins. Excessive consumption of alcohol, employment status whereby there was scarcity of formal jobs and whenver one gets a formal employment, frustrations such as meger renumerations take tall oder. Level of education, higher body mass index (BMI) have all been strongly associated with hypertension.

Although recommended standards for a healthy lifestyle was established for certain risk factors, not all are applicable to every population. For instance a study conducted in rural western Kenya setting. showed increased prevalence of hypertension with increasing BMI despite the fact that majority of participants had BMI below normal [28]. A rural village in Madagascar reported a prevalence of 49.1% in a study that recommended worldwide investigation into the drivers of hypertension in rural communities [9].

The impact of the various risk factors was becoming complicated by emerging demographic trends in the world. Global improvement in the quality of life has led an increment in longevity [2]. The WHO stastics of 2018, placed an average life expectancy in Kenya at 66.7 years compared to 51 years in the year 2000. Life expectancy was in fact higher in female at (68.9 years) as opposed to their male counterparts at (64.4 years). Thus aging is becoming a major risk factor whose impact on world health is becoming a challenge [5, 14, 17, 29 - 31]

In assumption of a report that, the impact of various risk factors could be in relation to ethnicity [23] and gender [14, 15, 18] among other moderating factors it was important to establish whether age was posing as a key predictor of hypertension in rural women now that Kenyans are experiencing higher longevity than ever before [29]. This study therefore investigated

the prevalence of hypertension and its associated risk factors among rural women of Amagoro Division in Western Kenya.

Materials and Methodology

Study Design

A descriptive survey was conducted in Amagoro division in Busia County, Western Kenya where quantitative data was collected from the participants. The dependent variable was hypertension and the independent variable was predictors for hypertension

Sample Frame

The sample frame for the survey was the households of Amogoro Division. In total, Amagoro Division has 12,478 households. Its administrative headquarters is in Amagoro town. The division has nine administrative locations, namely; Okuleu, Kokare, Amoni, Osajai, Kocholia, Kamolo, Kamuriai, Amagoro and Akadetewai. The inhabitants of Amagoro division were predominantly Tesos. The division had a population of 56,207 (29, 843 female and 26, 364 male) and an area of 114.3 square kilometers. It had a total of 12, 478 households [32].

Sample Size

The study involved a survey in which 260 women aged 15 to 90 years participated. The women were drawn from various households in Amagoro Division. For the fact that a number of risk factors are diet related, only one female volunteer was sampled in each household as this would have provided a survey on how these risk factors are distributed per household since it is women who prepare food for their respective households.

The sample size was calculated according to the formula adopted from Fox, Hunn and Mathers [33] namely:

$$N = P (100\%-P) / (SE)\ 2.$$

N = Desired sample size;
P = Prevalence of hypertension in rural Kenya of 21.4%.
SE = the confidence interval of 5% divided by 1.96.

In this case the SE = 2.55
and therefore N = 259.
A total of 260 households participated in the study.

Sampling Procedure

Clustered and proportional sampling procedures were employed. Initially, Amagoro was clustered into nine locations. Out of the nine locations, three locations were selected on the basis of their geographical distribution. Osajai is located in the far northern part of Amagoro Division. Amagoro location is in the central part while Kamolo is in the southern part whereas the northern part tends to be hilly, largely rural and inhabited by the Tesos and neighbouring the Sabaot ethnic communities.

The villages in the central part are much closer to administrative and commercial urban centres with a cosmopolitan lifestyle. This central part is largely inhabited by the Teso community. The southern part comprises plains. Just like the northern part, it is generally inhabited by the Teso and the neighboring Luhya community. The sampling process took into the account that ethnic differences in the north and south as well as the cosmopolitan composition of the central parts of Amagoro generated some slight variations in lifestyle which in turn could affect risk for hypertension posed by lifestyle.

Once respective locations had been identified, proportional sampling was applied to select the respective households per location for inclusion in the study. This was justified by the fact that some locations had more households than others. The final distribution of the 260 households relative to the population of households across the three locations was as follows.

The total population of households in the three locations selected for the study was 4470 constituted as follows:

1. Osajai had 1125 households
2. Kamolo 1589 households
3. Amagoro 1753 households respectively.

Consequently, out of the 260 households in the sample, 65 households were selected from Osajai with another 102 and 93 from Amagoro and Kamolo respectively. From each household, only one female participant was selected.

Data collection tools

Data was collected using a structured questionnaire. The questionnaire had two sections. The first section targeted demographic information such as age, ethnicity,

marital status, educational background, socio-economic status, employment status and whether the participant had already been diagnosed with hypertension among others.

The BMI status was computed as weight (kg) divided by height (m)2 . The weight was measured using a balance scale (Camry Model: BR 9012, Germany). Height was measured using a tape measure in centimeters then converted into metres. The WHR is the ratio of waist circumference to the hip circumference. The circumference of the waist and hip measurements were taken using a non-stretchable tape (Gessate, Milan, Italy). Blood pressure was measured using an automatic blood pressure monitor (Omron M2 device; Omron Healthcare Co. Bing Duong Province, Vietnam).

Data collection

A structured questionnaire was used to collect data by way of face-to-face structured interviews between the participant and the research assistants. Trained research assistants visited participants in their homes from where they interviewed them and took measurement for weight, height, waist circumference, hip circumference and blood pressure.

Anthropometric Measurements

Height was measured using a tape measure that was stuck on a flat wall. The respondent was requested to stand on a flat surface and a wooden headrest placed on the head to allow measurement to be taken at the point perpendicular to the top of her head. Height was then recorded to the nearest cm with the respondent's feet together, heels against the wall and knees straight. Participants were requested to step onto the scale with the feet a stride, standing still with face forward and arms straight on the side. Weight was taken after the respondent took off excessive clothing using a bathroom scale after calibrating to zero. The weighing scale was placed of a firm horizontal surface.

WHR

Waist circumference was taken at the point of umbilicus using a non-stretchable tape measure tired around the waist. The waist circumference was recorded to the nearest 0.5 cm. a reading above 88 cm was considered abnormal. Hip circumference was taken using a non-stretchable tape around the widest part to of bottom and hips and recorded to the nearest 0.5 cm.

Blood Pressure Measurement

Blood pressure measurements were taken twice: one at the beginning of the interview and one at the end.

Data Analysis

For the purposes of data analysis, age was categorized into four (≤24 years, 25-44 years, 45-64 years, ≥ 65 years), marital status into five (single/never married, married monogamous, married polygamous, divorced/separated and widowed), ethnicity into three (Teso, Luhya, others), highest education level into five (never gone to school, primary incomplete, primary complete, secondary incomplete, secondary complete, college), employment status into four (unemployed, self-employed, informally employed, formally employed), household size into three (1to 3 members, 4 to 6 members and ≥7 members), time lived in Amagoro division into five (≤ 5 years, 6-10 years, 11-15 years, 16-19 years, ≥ 20 years), household average monthly income into three (KES ≤ 3000, 3001-6000, > 6000), type of the house of the respondent into three (grass thatched; iron sheet roofed, block or brick wall; iron sheet roofed, mud wall), main fuel type used for cooking into three (firewood, charcoal, gas), main fuel used for lighting into two (kerosene, electricity/solar), main water source for domestic use into three (river or dams, boreholes or wells, tap water), time spent reclining into three (1-3 hours, 4-6 hours, 7-10 hours), total physical activity (< 20 MET hours/day, 21-40 MET hours/day, ≥41 MET hours/day), body mass index into two (18.50- 24.99 kgm-2, ≥ 25 kgm-2),waist circumference into two (≤ 88 cm, > 88 cm), waist to hip ratio into two (≤ 0.80 cm, > 0.80 cm).

Body mass index (BMI) as a measure of nutritional allowing participants to be classified as

1. Underweight (BMI < 18.5)
2. Normal weight (BMI of 18.5-24.9)
3. Overweight (BMI of 25.0-29.9)
4. Obesity (BMI ≥ 30) [6].

Waist-to-hip ratio was then computed by dividing the waist circumference by the hip circumference and WHR > 0.80 was considered abnormal. Blood pressure was computed by calculating the average of the measurement that had been taken at the start of

the interviews and at the end of it. Individuals with a blood pressure ≥140/90 mmHg or on drugs to treat hypertension were considered hypertensive.

Data was analyzed using the Statistical Package for the Social Sciences version 23.0. The data was characterized using descriptive statistics and results presented in absolute frequencies, percentage and mean including standard deviation. Blood pressure was compared with independent variables using a chi-square analysis and the magnitude of the associations analyzed using the Bivariate and Multivariate logistic regression. The adopted level of significance was 5%.

Ethical Approval

This study was conducted with the approval of Kenyatta National Hospital and University of Nairobi Ethics, Research and Standards Committee. Informed consent was sought from each participant. Participation was on voluntary basis and women, residing permanently in the household who understood the questions and agreed to participate were included. The exclusion criteria were being ill and inability to communicate.

Results

A total of 260 female participants aged between 15 to 90 years drawn from Amagoro division participated in this study. The mean age of the participants was 37.08±14.83 years with only 7 participants being 15 and 17 years of age.

Prevalence of Hypertension

The overall prevalence of hypertension in this population was 22.3% (58 participants). The remaining 39.2% (102 participants) had normal blood pressure whereas 38.5% (100 participants) were pre-hypertensive. The systolic blood pressure of the population (n=260) ranged between 91 and 216 mmHg with a mean of 125.91±17.94 mmHg while the diastolic blood pressure ranged between 59 and 132 mmHg with a mean of 79.33±11.05.

Socio-Demographic Characteristics of the Respondents

From the participants sampled about a half (51.5%) were aged between 25 and 44 years, 23.1% aged 45 to 64 years while 18.8% aged 24 years and below *(Table 1)*. Almost 3% aged below 18 years while 6.5% aged 65 years and above. Most (57.3%) of these women had lived in Amagoro for 20 years or more.

Majority (75%) of women sampled were in a monogamous relationship, 15.5% polygamous marriage while those never married at all were 6.2%. Divorced or separated and those widowed each formed 1.9% of the sampled women.

Most (91.2%) of these women were from the Teso community while other communities including Luhya formed the remaining 8.8%. Majority 63.5% of these women never went to school or went but never completed primary school. Although about 17.7% of the women completed primary school, this figure reduced as they transited to secondary and tertiary level.

Majority (54.2%) of women sampled belonged to household comprising of 4-6 members. About 29.5% belonged to households with seven members while 16.2% belonged to households with 1-3 members. Majority of these women lived in grass thatched houses (50.4%), cook mainly using firewood (96.9%), used kerosene as the main fuel for lighting (96.%) and fetched water from boreholes or wells (67.3%).

Table 1: *Description of the Socio-Demographic Characteristics of the Respondents*

Variable	Categories	Frequency n (%)
Age	≤ 24 years	49 (18.8)
	25-44 years	134 (51.5)
	45 to 64 years	60 (23.1)
	≥ 65 years	17 (6.5)

Table 1: *Description of the Socio-Demographic Characteristics of the Respondents*

Variable	Categories	Frequency n (%)
Duration lived in Amagoro	5 years and below	35 (13.8)
	6 to 10 years	32 (12.3)
	11 to 15 years	24 (9.2)
	16 to 20 years	19 (7.3)
	20 years and above	149 (57.3)
Marital status	Single (never married)	16 (6.2)
	Married (monogamous)	195 (75)
	Married (polygamous)	39 (15.5)
	Divorced/Separated	5 (1.9)
	Widowed	5 (1.9)
Ethnicity	Teso	237 (91.2)
	Luhya	17 (6.5)
	Others (Kikuyu, Sabaot, Nubi, Luo,Ugandan)	6 (2.3)
Highest level of education	Never gone to school	35 (13.5)
	Primary incomplete	130 (50)
	Primary complete	46 (17.7)
	Secondary incomplete	18 (6.9)
	Secondary complete	28 (10.8)
	College	3 (1.2)
Number of household members	1 to 3 members	42 (16.2)
	4 to 6 members	141 (29.6)
	More than 6 members	77 (29.6)

Economic Characteristics of the Respondents

Approximately 51.9% of the sampled women were unemployed, 25% self-employment, 22.7% informally employed and only 0.4% were formally employed *(Table 2)*. Consequently, the household average monthly income was found to be relatively low with majority (77.3%) earning not more than KES 3,000, 15.0% earning KES 3001 to 6,000 while only a few (7.7%) had an average household income above KES 6,000.

Approximately one half (50.4%) of the population lived in grass-thatched houses, 13.8 % in iron sheet roofed, block or brick wall and 35.8% in iron sheet roofed with mud walls. Their main source of fuel for cooking was firewood which was used by 96.9% of the participants, 2.3% used charcoal while 0.8% gas. Majority used kerosene for lighting (96.5%), boreholes and wells were the main source of water for domestic use (67.3%). About twenty percent (21.9%) fetched their water from rivers or dams while 10.8% relied in tap water.

Table 2: *Description of the Economic Characteristics of the Respondents*

Variable	Categories	Frequency n (%)
Employment status	Unemployed	135 (51.9)
	Self employed	65 (25)
	Informally employed	59 (22.7)
	Formally employed	1 (0.4)
Household average monthly income	3000 and above	201 (77.3)
	3001 to 6000	39 (15.0)
	6001 and more	20 (7.7)
Type of house of respondent	Grass thatched	131 (50.4)
	Iron sheet roofed, block or brick wall	36 (13.8)
	Iron sheet roofed, mud wall	93 (35.8)
Main fuel type used for cooking	Firewood	252 (96.9)
	Charcoal	6 (2.3)
	Gas	2 (0.8)
Main fuel used for lighting	Kerosene	251 (96.5)
	Electricity/solar	9 (3.5)
Main water source for domestic use	River or dams	57 (21.9)
	Boreholes or wells	175 (67.3)
	Tap water	28 (10.8)

Distribution of Participants According to Lifestyle-related Factors and Nutritional Status

With regard to sedentary behavior, majority (59.6) of the sampled women spent less than four hours resting, 25.8% four to six hours while 14.6% more than six hours resting (*Table 3).* All the women were physically active, 26.5% reporting less than 20 MET hours/day, 45.4% at 21 to 40 while 28.1% reported 41 and above. Majority never consumed alcohol (66.9%) nor smoked cigarettes (99.2%).

Nutritional status varied among women, majority (76.9%) had a normal body mass index while 23.1% had excessive weight (overweight/obese). Amongst the women sampled, 85.8% had a normal waist circumference although majority (69.6%) had an abnormal waist to hip ratio while 30.4% recorded a normal ratio. In addition, 76.9% of women maintained a normal body weight.

Table 3: *Respondents Lifestyle and Nutritional Status*

Variable	Categories	Frequency n (%)
Sedentary behavior (hours)	1 to 3	155 (59.6)
	4 to 6	67 (25.8)
	7 to 10	38 (14.6)
Total physical activity (MET hours/day)	< 20	69 (26.5)
	21 to 40	118 (45.4)
	≥ 41	73 (28.1)
Alcohol consumption	Yes	86 (33.1)
	No	174 (66.9)
Cigarette smoking	Yes	2 (0.8)
	No	258 (99.2)
Body mass index (kgm-2)	18.50 to 24.99	200 (76.9)
	≥ 25.00	60 (23.1)
Waist circumference (cm)	≤ 88 cm	223 (85.8)
	> 88 cm	37 (14.2)
Waist to hip ratio	≤ 0.80	79 (30.4)
	> 0.80	181 (9.6)

Relation Between Demographic and Socio-Economic Characteristics of The Participants With Hypertension.

Age, duration lived in Amagoro division and level education showed a significant relationship with hypertension ($p<0.05$) while marital status, ethnicity, employment status, household size, type of the house lived in, main fuel for cooking, main fuel for lighting and main source of water for domestic use showed no significant relationship with hypertension ($p>0.05$) *(Table 4).*

Table 4: *Respondent's Socio-Demographic Factors in Association with Hypertension*

Variable	Categories	Blood pressure status		Chi-square
		Non-hypertensive	Hypertensive	
Age	≤ 24 years	48	1	0.000s
	25 to 44 years	107	27	
	45 to 64 years	40	20	
	≥ 65 years	7	10	
Duration lived in Amagoro	< 20 years	97	14	0.001s
	≥ 20 years	105	44	
Marital status	Never married	14	2	0.26
	Married	182	52	
	Divorced/widowed/ separated	6	4	
Ethnicity	Teso	186	51	0.397
	Luhya	11	6	
	Others	5	1	
Level of education	Never been to school	21	14	0.028s
	Primary incomplete	104	26	
	Primary complete	40	6	
	Secondary/college	37	12	
Number of household members	1 to 3 members	28	14	0.119
	4 to 6 members	110	31	
	≥ 7 members	64	13	

Relation between Economic Characteristics of the Participants with Hypertension

The variables that showed significant relationship with hypertension was average household monthly income ($p<0.05$). Employment status, type of house lived in, main fuel for cooking, main fuel for lighting and main source of water for domestic use showed no significant association with hypertension ($p>0.05$) *(Table 5).*

Table 5: *Respondents Economic Factors in Relation to Hypertension*

Variable	Categories	Blood Pressure status		Chi-square
		Non-hypertensive	Hypertensive	
Employment status	Unemployed	109	26	0.454
	Self employed	49	16	
	Formally/informally employed	44	16	
Monthly income	KES 3000 and below	163	38	0.038s
	KES 3001 to 6000	27	12	
	KES 6001 and above	12	8	
Type of house	Grass thatched	107	24	0.289
	Iron sheet roof, brick/ block wall	26	10	
	Iron sheet roof, mud wall	69	24	
Main fuel for cooking	Firewood	197	55	0.512
	Charcoal/gas	5	3	
Main fuel for lighting	Kerosene	195	56	0.693
	Solar/electricity	7	2	
Main source of water for domestic use	River/dams	44	13	0.836
	Boreholes/wells	135	40	
	Tap water	23	5	

Relationship between Lifestyle and Nutritional Status with Hypertension

Sedentary behavior showed significant association with hypertension ($p<0.05$) *(Table 6).* Physical activity, BMI, waist circumference and waist-to-hip ratio did not show any significant relationship with hypertension ($p>0.05$).

Table 6: *Respondent's Lifestyle and Nutritional Status' Relationship with Hypertension*

Variable	Categories	Blood Pressure status		Chi-square
		Non-hypertensive	Hypertensive	
Sedentary behavior	1 to 3 hours	129	26	0.007s
	4 to 6 hours	43	24	
	7 to 10 hours	30	8	
Physical activity (MET hours/day)	≤ 20	90	28	0.869
	21 to 40	54	15	
	≥ 41	58	15	
BMI (kg/m2)	Normal	151	49	0.121
	Overweight / obesity	51	9	
Waist circumference (WC)	≤ 88 cm	177	46	0.110
	> 88 cm	25	12	
Waist to hip ratio (WHR)	≤ 0.80 cm	62	17	0.840
	>0.80 cm	140	41	
Alcohol consumption	Yes	68	18	0.710
	No	134	40	
Cigarette smoking	Yes	1	1	0.340
	No	201	57	

Effects of Respondents Social-Economic Factors on Hypertension

Binary logistic regression analysis showed that older participants were more likely to suffer from hypertension than the young *(Table 7).* Respondents aged 24 years and below were less likely to suffer from hypertension as opposed to those aged between 25 to 44 years who were 12 times more likely to suffer from hypertension. Respondents aged between 45 to 64 years were 24 times more like while those 65 years and over were 68.6 times more likely to suffer from hypertension as compared to those aged below 24 years. Respondents above 64 years of age were almost three times likely to suffer from hypertension (OR=2.86) compared to those aged between 25 and 44 years. Similarly, respondents who had lived in Amagoro for over 20 years were almost three times (OR=2.90, p=0.002) likely to suffer from hypertension that those who had been there for fewer number of years. Although the association was not significant, those participants who went to secondary school and above were two times less likely to suffer from hypertension compared to those who never went to school. Participants with household average monthly income above KES 6000 per month were more likely (OR=2.86, p=0.032) to suffer from hypertension as opposed to those with an income of KES 3000 and below.

Those who spent 6 hours or more resting are more likely to suffer from hypertension as opposed to those spending 1 to 3 hours (OR=3.74, p=0.354).

Table 7: Binary Logistic Regression for Social-Demo-Economic Factors and Hypertension

Variable	Categories	p-value	Odds Ratio (95% CI)
Age	24 years and below (reference)	-	1.00
	25 to 44	0.016	12.11(1.6-97.74)
	45 to 64	0.002	24.00 (3.08-186.75)
	65 years and above	0.000	68.57 (7.57-620.89)
Duration lived in Amagoro	Below 20 years (reference)	-	1.00
	20 years and above	0.002	2.90 (1.50-5.63)
Level of education	Never been to school	0.132	2.06 (0.80-5.26)
	Primary incomplete	0.513	0.77 (0.35-1.68)
	Primary complete	0.161	0.46 (0.19-1.36)
	Secondary/college (reference)	-	1.00
Household average monthly income	KES 3000 and below (reference)	-	1.00
	KES 3001 to 6000	0.099	1.91 (0.89-4.10)
	KES 6001 and above	0.032	2.86 (1.09-7.48)
Sedentary behavior	1 to 5 hours (reference)	-	1.00
	6 hours and above	0.354	3.74 (0.23-60.72)

Variables that showed significant association ($p < 0.05$) with hypertension at bivariate analysis were subjected to a multivariate logistic regression analysis [12].

Multivariate Logistic Regression Analysis with Regard to Hypertension

Age and a higher household average monthly income showed significant association with hypertension ($p<0.05$) (Table 8). Respondents aged 65 years and above were 96 times ($p<0.05$) more likely to suffer from hypertension than those aged 24 years and below. Respondents with average household income of KES 6000 per month were almost four times (OR= 3.88, $p<0.05$) more likely to suffer from hypertension as opposed to those with KES 3000 or less.

Table 8: *Multivariate Logistic Regression in Relation to Hypertension*

Variables	Categories	p-value	Adjusted Odds Ratio (95% CI)
Age	≤ 24 years (reference)	-	1.00
	25 to 44	0.023	11.19 (1.39-90.32)
	45 to 64	0.006	20.07 (2.34-172.31)
	≥ 65 years	0.001	96.32 (7.17-1294.52)
Duration lived in Amagoro	< 20 years (reference)	-	1.00
	≥ 20 years	0.144	1.86 (0.81-4.26)
Level of education	Never been to school	0.458	0.58 (0.13-2.47)
	Primary incomplete	0.871	0.93 (0.37-2.32)
	Primary complete	0.510	0.65 (0.19-2.32)
	Secondary/college (reference)	-	1.00
Average monthly income of the household	≤ KES 3000 (reference)	-	1.00
	KES 3001 to 6000	0.159	1.88 (0.78-4.54)
	≥ KES 6000	0.029	3.88 (1.15-13.02)
Sedentary behavior	1 to 5 hours (reference)	-	1.00
	≥ 6 hours	0.271	5.13 (0.28-94.13)

Discussion

Prevalence of Hypertension and Associated Factors

The prevalence of hypertension among women of Amagoro was 22.3%. A prevuois national survey conducted among the 47 counties in Kenya reported an overall hypertension prevalence of 24.5% [6]. A prevalence of 29.4 % was reported in an urban slum of Kibera [34], among rural women 44.5% was recorded [16].

Socio-Demographic and Economic Characteristics of the Participants in Relation to Hypertension

In the study 36.6% of the women had completed basic primary school education and above as opposed to approximately 60% of the respondents in a nationwide survey [6]. However that nationwide survey included both male and female respondents [6]. The women were generally active above the threshold set by the World Health Organization (WHO) minimum of 150 minutes throughout the week of moderate-intensive activity [35]. Majority accumulating more than 20, MET hours per day. This high level of activity was attributed to the fact that farming was the main economic activity in the area and women spent most of their time in the farms digging [36].

Previous reports regarding marital status and hypertension remain inconsistent and dependent on gender [37]. For instance a study on African-Americans found that men who were never married had a higher risk [20] while another study reported a higher prevalence among single women and less common among single men as opposed to the married [22]. Married, cohabiting and previously married women were reported to be vulnerable to hypertension [37].

This study showed no association between ethnicity and hypertension risk possibly due to the fact that about 91% came from the same ethnic grouping. A separate study conducted in Kenya found differences in prevalence of hypertension among Kikuyus and Kalenjins [23]. Other studies have also reported some association between ethnicity and hypertension [17, 21, 22].

Despite lack of association among women of Amagoro, a previous study showed that employed women were less likely to develop hypertension than the homemakers [25]. Additionally, job constraints had been showed to increase the risk of hypertension in women [38]. Lack of association between hypertension and employment among women of Amagoro could possibly be because most of them were unemployed [36].

This study reported similar findings with regard to the level of education [26, 27] although some study found no association [18]. Other studies reported association only in women and not men [26, 27].

Lifestyle and Nutritional Status in Relation to Hypertension

In a study conducted in Southern India [17] did not find any association between physical activity and hypertension. Other studies recorded contrary findings as regards to BMI [6, 12, 18, 28], alcohol consumption and use of cigarette [6] although nearly all women did not smoke cigarettes in this study.

Independent Risk Factors for Hypertension among Women of Amagoro

The strongest independent risk factors associated with hypertension among women of Amagoro was;

1. Households' average monthly income
2. Age.

Respondents who earned the highest (KES $\geq$ 6000) were more likely to suffer from hypertension than those earning the least ($\leq$ KES 3000).

A previous national survey reported that, hypertension prevalence increased with improved wealth status; individuals from the richest households had higher hypertension 29.0% compared with those from the poorest households 19.4% [6].

Material resources which could be linked to income have been found to be positively associated with hypertension [39]. It was suggested that being disadvantaged in early and adult life may be associated with high blood pressure [40]. On the contrary other studies have associated low income levels to higher

prevalence of hypertension [41, 42]. Khan and Manzoor [43] did not find as significant relationship and a separate study found elevated blood pressure levels in low as well as in high-income groups [44].

The elderly (≥ 65 years) women were found to be more likely to suffer from hypertension that the young (≤ 24 years). This finding is in agreement with similar studies linking advancing age with increased prevalence of hypertension [2, 5, 10, 18, 30, 31] although a separate study conducted in Kenya showed a higher prevalence among younger age groups compared to the older groups [16].

The increasing prevalence with age could be due to elevated homocysteine levels which have been found to increase gradually with age [31, 45] but much more in patients aged 65 years and above [31]. The concentrations of *homocysteine* including its metabolites were significantly higher in hypertensive patients ($p<0.01$). High *homocystein* level [45] and stiffening of the arteries during ageing [10] could be used to explain the increasing prevalence of hypertension with age in this study.

In a society where life expectancy is rising, hypertension intervention strategies should be targeted not only on the elderly but also on young people to encourage them modify their lifestyle in order to prevent age-related risks that trigger hypertension [5]. For instance, home-based health education and restricting dietary salt intake have been proposed to prevent development of hypertension [46]. More resources should also be allocated to cater for the ageing population. Regular screening, management and treatment of hypertension should specifically be targeted to this vulnerable group of women.

Conclusion

Ageing and higher income were the strongest independent risk factors for hypertension among rural women of Kenya. With rising life expectancy, hypertension intervention strategies should target the elderly. More resources should therefore be allocated to cater for the ageing population. Strategies such as regular screening, management and treatment of hypertension should specifically be targeted to this vulnerable group of women. In addition lifestyle modifications should also be advocated among young people in order to prevent age-related risks that trigger hypertension. Health education should be offered to the women in order to sensitize them on the risk factors and the need for lifestyle change.

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