American Journal of Nursing Science
2025, Vol. 14, No. 4, pp. 57-67
https://doi.org/10.11648/j.ajns.20251404.11

Research Article

Dietary Consumption Patterns and Development of Hypertension Among Rural and Urban Population of Kisii County, Kenya

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Abstract

Hypertension, a primary component of cardiovascular diseases, has been a major cause of morbidity and mortality worldwide because individuals are not able to prevent risk factors to its development. Rising cases of hypertension in Sub Saharan Africa have been attributed to undiagnosed, untreated and inadequately treated hypertension. The prevalence however varies based on rural and urban population residences and risk factors. The risk of developing hypertension is associated with diet composed of high content of saturated fats, salt and trans-fats, low fruit and vegetable intake. Limited studies have been done to compare diet uptake and development of hypertension in rural and urban areas in order to have specific, targeted prevention measures. This study therefore called for the need to determine dietary consumption patterns and development of hypertension among urban and rural populations of Kisii County. The methodology entailed residents aged 30-69 years, from urban and rural population of Nyaribari Chache Sub County, Kisii County who were sampled resulting in 490 respondents. Random sampling technique was used and all who met the inclusion criteria were interviewed. Statistical Package for Social Scientists (SPSS) Version 21 was used to analyze data. Results from the study indicated that te prevalence of hypertension for the sampled population was 44.668%; for urban 43.598% and 44.134% for rural. Frequency of fruit consumption ($p=0.002$) and fruit servings ($p=0.018$) in a typical week, amount of salt intake ($p=0.006$) and significance of salt levels ($p=0.032$) were statistically significant. The population also depicted a poor diet uptake of only one fruit in a typical week (25.7% urban, 30.5% rural), a prior indicator of the existence of a relationship between the predictor and the predicted variables. The study therefore concludes and recommends that residents residing in rural populations should be empowered with knowledge on prevention, early detection and management practices of hypertension which will result in a healthy lifestyle.

Keywords

Hypertension, Diet, Rural, Urban, Kisii, Kenya

1. Introduction

Hypertension is defined by the World Health Organization (WHO) as a systolic and diastolic blood pressure equal to or above 140 and 90 mmHg respectively or someone one who is under hypertensive medication (WHO, 2021). However, re-

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Received: 2 May 2025; **Accepted:** 19 May 2025; **Published:** 19 August 2025

cent guidelines based on the American Heart Association and the American College of Cardiology taskforce on clinical practice define hypertension as a systolic and diastolic blood pressure equal to or above 130 and 80 mmHg respectively [1].

Hypertension, a primary component of cardiovascular diseases, has been a worldwide serious cause of morbidity and mortality [2]. Globally, hypertension prevalence in 2018 was 26% for over 18 year's old adults [3]. Trends from 1975 to 2015 show an overall increment from 594 million to 1.13 billion hypertensive cases respectively [4, 5]. Globally, hypertension is also reported to account for disability adjusted life years (DALYs) of 3.7%, an equivalent of 57 million DALYs (WHO, 2019).

Although there has been increasing focus to tackle hypertension, there still lacks clear indicators and strategies targeted for different populations making up these low and middle income settings [6]. Additionally, little information is available on the prevalence of hypertension in both urban and rural areas. Also, very limited studies have been done to compare the prevalence and risk factors in rural and urban areas [7]. In order to have specific, targeted prevention and curative measures, there is a need to identify rural-urban differences in the prevalence or disease burden and risk factors for these diseases. This study was therefore determined to investigate the dietary consumption pattens and development of hypertension as a comparison of urban and rural population in order to design appropriate interventions specific for each population.

Lack of baseline data on dietary practices and development of hypertension in rural and urban population is a key challenge in developing targeted intervention measures. Published information on prevalence of hypertension as a result of dietary intake which compares urban and rural areas and identification of their respective risk factors in Kenya is inadequate.

Hypertension pathogenesis is specific to primary (essential) or secondary hypertension [8]. Primary hypertension which occurs to 95% of hypertension cases is mostly experienced in the fifth and sixth decade of life. Increased obesity and salt intake with a strong correlation with family history have shown a relationship with essential hypertension [9].

Hypertension is responsible for a large proportion of cardiovascular diseases. It has a complex process of pathology in the blood vessel walls over a protracted period of time. Cholesterol and fatty acids are deposited in the inner part of the lumen of the medium sized and arteries, the large sized blood vessel. These deposits, known as plaques, result in an irregular nature of the inner surface of the blood vessels thus narrowing the lumen. The vascular system especially the arteries then become less pliable. Ultimately, the plaque may rapture and triggering blood clot formation which if it happens in the coronary artery, it leads to heart attack and if in the brain, it results in stroke [10].

The risk of developing hypertension is associated with diet with high content of saturated fats, salt and trans-fats [11]. Development of hypertension is also linked with low fruit and vegetable intake. Additionally, consumption of processed foods and other high energy foods which are highly concentrated with sugar and fats predisposes one to obesity which increases the risk of developing hypertension [10]. High sugar consumption has also been associated with unfavorable blood lipids and elevated blood pressure [12]. Studies have also indicated that high intake of processed meat increases the chance of developing hypertension majorly due to excessive salt intake [3].

With the advancement of age, behavioral risk factors to hypertension tend to be high in rural areas compared to urban; highest among them being alcohol and tobacco use and low fruit and vegetable consumption. In metabolic risk factors, they have been reported to be high in urban compared to rural areas.

2. Materials and Methods

The study involved a descriptive cross-sectional design.

Those in the study population who gave informed consent and were between thirty and sixty-nine years of age were included in the study while those in the study population, who did not give informed consent, were cognitively impaired were excluded from the study.

Independent variable included variables related to study population's lifestyles risk factors such as dietary intake, tobacco. Additionally, this entailed considering socio-demographic characteristics such as age, occupation, monthly income, sex, residence, and marital status. The rate of consumption was also evaluated through a risk assessment analysis by finding the length and type of food eaten. A biometric analysis was done to assess their status and potential likelihood of developing hypertension and checking the prevalence of risk factors among the respondents.

The outcome variable was hypertension.

The study was conducted in a rural and urban population of Nyaribari Chache, Sub County. The county was purposively selected because it has the key characteristics of urban and rural areas, vital for the study and evidence from Demographic and Health Indicator Survey 2 (DHIS-2) indicate an increasing upsurge of hypertension prevalence.

The study population consisted of residents aged 30-69 years of age in Nyaribari Chache Sub County. This entailed a sample from an urban and rural population who satisfied the inclusion criteria and were willing to participate in the study. The study population was 420 households.

The WHO STEPs design for Non-Communicable Disease Surveillance was used and household individuals were selected in each age category with a 10 years age interval, from 30 to 69 years.

3. Results

3.1. Socio-demographic Factors

In overall, 497 respondents both from urban and rural population took part in the current study as outlined in Table 1. Mean age of study participants was 47 (±12) years; 46 (±12) years in urban and 48 (±12) for rural populations.

Majority of the respondents were female; urban (58.2%) and rural (62.1%). Most of the respondents were currently married (77.5% in urban and in rural). A larger proportion of study participants (37.5% in urban and 36.7% in rural) had only completed primary school education while the least (7.9% in urban and 7.7% in rural) had no formal schooling. By the time the study was conducted, majority (77.1% in urban and 65.7% in rural) of the respondents were self-employed majorly farming of tea plantation. Monthly income for the respondents ranged from 7,000 to above 100,000. Those who earned between 0-7000 were (34.5% in urban and 48.5% in rural) as shown in Table 1.

Additionally, all the respondents were Kisii of which 328 and 169 were sampled from urban and rural population respectively.

Table 1. *Socio-demographic characteristics of the study population in Kisii County.*

		Urban		Rural	
		Frequency (N)	**(%)**	**Frequency**	**(%)**
Residence		328	65.8	169	34.2
Age	30-34	63	19.3	28	16.5
	35-39	64	19.3	25	15.3
	40-44	38	11.6	15	8.8
	45-49	36	11	26	15.3
	50-54	39	11.9	15	8.8
	55-59	27	8.3	26	15.3
	60-64	33	10.1	12	7.1
	65-69	28	8.6	22	12.9
Village	Nyaura	162	49.4	50	29.6
	Kiamabundu	37	11.3	16	9.5
	Nyanchwa	58	17.7	12	7.1
	Nyamware	42	12.8	58	34.3
	Boronyi	29	8.8	33	19.5
Sex	Male	137	41.8	64	37.9
	Female	191	58.2	105	62.1
Marital Status	Never Married	35	10.7	20	11.8
	Currently Married	261	79.6	131	77.5
	Separated	10	3	5	3.0
	Divorced	10	3	0	0
	Widowed	12	3.7	13	7.7
	Informal schooling	26	7.9	13	7.7
	< Primary School	74	22.6	40	23.7
Highest Education Level	Finalized Primary School	123	37.5	62	36.7
	Finalized SecondarySchool	76	23.2	40	23.7
	Finalized Tertiary level	29	8.8	14	8.3

		Urban		Rural	
		Frequency (N)	(%)	Frequency	(%)
Main working status over last 12 months	Government Employee	16	4.9	8	4.7
	Self Employed	253	77.1	111	65.7
	Unemployed (Able to work)	59	18.0	50	29.6
Estimated Range of monthly income	0-7,000	113	34.5	82	48.5
	7,000-20,000	81	24.7	43	25.4
	20,000-100,000	14	4.3	11	6.5
	Refused to respond	120	36.6	33	19.5

3.2. Diet Intake

Of the respondents, 28.7% and 27.8% of the respondents in urban and rural areas respectively ate only one fruit in a typical week. Similarly, majority of the respondents 55.8% and 49.7% in urban and in rural respectively had only one fruit serving per week. Majority of the respondents; 63.7% and 47.3% in urban and rural areas respectively ate vegetables daily in a typical week. Similarly, majority of the respondents 65.5% and 58.6% in urban and rural areas respectively had only one vegetable serving per week.

Regarding salt intake, 24.1% in urban and 19.5% in rural areas respondents sometimes added table salt to their meals before intake. However, majority (60.4% and 52.1% of urban and rural respondents) reported to never consume processed food with high salt. Significance of low salt intake to their health was considered very important by majority of the respondents (60.7% and 74.6% in rural and urban areas respectively). Most of the interviewed respondents considered excess intake of salt in the diet to affect health as shown in Table 2 below.

Table 2. *Diet Consumption characteristics of the respondents.*

		Urban		Rural	
		Frequency (N)	%	Frequency (N)	%
Fruit consumption in a typical week	0	43	13.1	28	16.6
	1	94	28.7	47	27.8
	2	78	23.8	22	13.0
	3	32	9.8	19	11.2
	4	6	1.8	5	3.0
	5	9	2.7	2	1.2
	6	11	3.4	1	0.6
	7	55	16.8	45	26.6
Fruit servings per week	0	33	10.1	23	13.6
	1	183	55.8	84	49.7
	2	72	22	27	16.0
	3	16	4.9	17	10.1
	4	24	7.3	18	10.7
	0	19	5.8	12	7.1

		Urban		Rural	
		Frequency (N)	%	Frequency (N)	%
Days eaten vegetables per week	1	8	2.4	2	1.2
	2	3	0.9	11	6.5
	3	12	3.7	5	3.0
	4	11	3.4	3	1.8
	5	9	2.7	4	2.4
	6	57	17.4	52	30.8
	7	209	63.7	80	47.3
	0	19	5.8	12	7.1
Vegetable servings per week	1	77	23.5	32	18.9
	2	215	65.5	99	58.6
	3	12	3.7	17	10.1
	4	5	1.5	9	5.3
Frequency of adding salt to food before or during consumption	Always	22	6.7	21	12.4
	Often	13	4.0	7	4.1
	Sometimes	79	24.1	33	19.5
	Rarely	77	23.5	31	18.3
	Never	137	41.8	77	45.6
Consume processed food with high salt intake	Always	11	3.4	11	6.5
	Often	9	2.7	5	3
	Sometimes	66	20.1	32	18.9
	Rarely	44	13.4	33	19.5
	Never	198	60.4	88	52.1
Amount of salt intake	Far too much	10	3	4	2.4
	Too much	32	9.8	14	8.3
	Just the right amount	129	39.3	74	43.8
	Too little	129	39.3	61	36.1
	Far too little	28	8.5	16	9.5
Significance of salt levels	Very important	199	60.7	126	74.6
	Somewhat important	82	25	17	10.1
	Not at all important	8	2.4	2	1.2
	Don't know	39	11.9	24	14.2
Excess salt affects health	Yes	257	78.4	136	80.5
	No	40	12.2	13	7.7
	Don't know	31	9.5	20	11.8

3.3. Prevalence of Hypertension Among Study Population of Kisii County

Hypertension cases were determined based on the Seventh (7^{th}) Joint National Committee on Detection, Evaluation and Treatment of Hypertension [1].

The study therefore classified Normal Blood Pressure with systolic of <120 and diastolic of <80, Elevated Blood pressure of systolic pressure of 120-129 and diastolic pressure of <80, Hypertension Stage One (1) of systolic pressure of 130-139 or a diastolic pressure of 80-89, Hypertension Stage Two (2) with a systolic pressure of >140 or diastolic pressure of >90 and Hypertensive crisis with a systolic pressure of >180 and/or diastolic of >120.

106 (32.3%) and 60 (35.5%) respondents had normal blood pressure in urban and rural areas respectively. Those who were diagnosed with elevated blood pressure were 79 (24.1%) and 30 (17.8%) in urban and rural areas respectively. Generally, there were more normal cases than hypertensive cases of hypertension stage 1, stage 2 and hypertension crisis in both populations. Hypertension prevalence was slightly more in rural than in urban areas.

Generally, most respondents were categorized as having normal blood pressure and least cases were those categorized among the High Blood Pressure (Hypertension) stage 2. Higher cases were also reported for those who were in hypertensive crisis stage; these were advised to consult their doctors or visit the referral hospital immediately. The description is indicated in Table 3, Figures 1 and 2 below.

Table 3. *Hypertension categories characteristics among the respondents.*

Blood Pressure Category (Systolic/Diastolic count in mmHg)	Urban	Urban%	Rural	Rural%	Total
Normal Blood Pressure (<120/<80)	106	32.3	60	35.5	166
Elevated Blood Pressure (120-129/<80)	79	24.1	30	17.8	109
Hypertension Stage 1 (130-139/80-89)	57	17.4	30	17.8	87
Hypertension Stage 2 (>140/>90)	30	9.1	20	11.8	50
Hypertensive Crisis (>180/>120)	56	17.1	29	17.2	85

The prevalence of hypertension was determined to be 44.668%. For urban areas, it was 43.598% while in rural slightly higher with the prevalence was 44.134%.

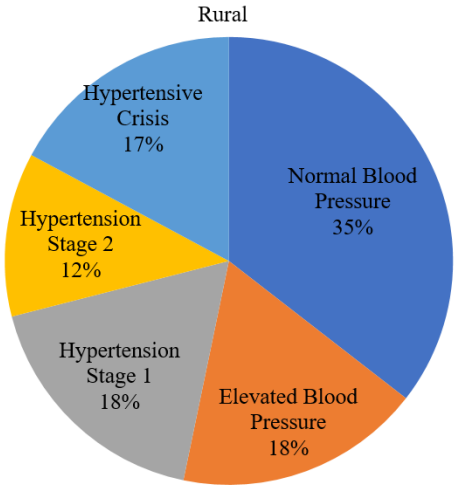

Figure 1. *Pie Chart showing percentage of hypertension categories among rural residents.*

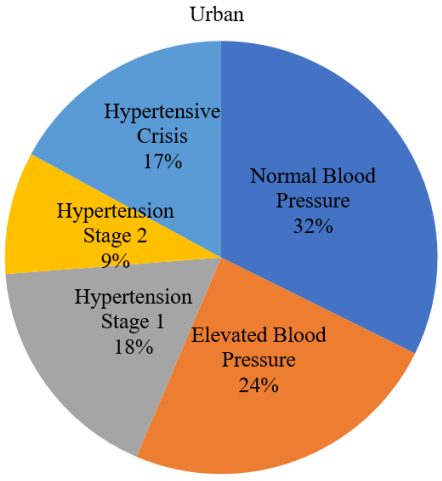

Figure 2. *Pie Chart showing percentage of hypertension categories among urban residents.*

3.4. Bivariate Analysis of Diet Consumption and Hypertension Prevalence

A bivariate analysis on diet consumption indicated that

frequency of fruit consumption and fruit servings in atypical week (p=0.002), (p=0.018) respectively, amount of salt intake (p=0.006), significance of salt levels (p=0.032) were statistically significant. Days someone consumed vegetable servings per week (p=0.365), consuming processed food with high salt intake (p=0.060) and frequency of salt seasoning on cooking food (p=0.200) were not statistically significant.

Those who had low fruit intake in a typical week had the highest record of hypertensive cases. Further, those who had only one (1) fruit serving per week reported the highest cases of hypertension 111 (50.0%). Many of the respondents had a high intake of vegetables in a typical week. Of vegetable servings, highest hypertension cases were reported on those who had only 2 serving in a typical week 139 (62.6%) as shown in the Table 4 below.

Table 4. *Bivariate analysis on diet intake.*

		Hypertension Prevalence		
Variables	**Category**	**Yes**	**No**	**Chi square test, df**
Frequency of fruit consumption in a typical week	0	43 (19.4%)	28 (10.2%)	χ2=22.988 df=7 P=0.002*
	1	57 (25.7%)	84 (30.5%)	
	2	55 (24.8%)	28 (10.2%)	
	3	23 (2.3%)	6 (2.2%)	
	4	9 (4.1%)	12 (4.4%)	
	6	6 (2.7%)	6 (2.2%)	
	7	29 (13.1)	71 (25.8%)	
Fruit servings per week	0	36 (16.2%)	20 (7.3%)	χ2=11.865 df=4 P=0.018*
	1	111 (50.0%)	156 (56.7%)	
	2	40 (18.0%)	59 (21.5%)	
	3	13 (5.9%)	20 (7.3%)	
	4	22 (9.9%)	20 (7.3%)	
Vegetables servings per week	0	17 (7.7%)	14 (5.1%)	χ2=4.314 df=4 p=0.365
	1.	44 (19.8%)	65 (23.6%)	
	2.	139 (62.6%)	175 (63.6%)	
	3.	13 (5.9%)	16 (5.8%)	
	4.	9 (4.1%)	5 (1.8%)	
Adding salt to meals	Always	57 (25.7%)	98 (35.6%)	χ2=6.267 df=5 p=0.281
	Often	5 (2.3%)	7 (2.5%)	
	Sometimes	43 (19.4%)	43 (15.6%)	
	Rarely	26 (11.7%)	28 (10.2%)	
	Never	90 (40.5%)	97 (35.3%)	
Frequency of salt seasoning in cooking food	Always	17 (7.7%)	26 (9.5%)	χ2=5.987 df=4 p=0.200
	Often	6 (2.7%)	14 (5.1%)	
	Sometimes	44 (19.8%)	68 (24.7%)	
	Rarely	56 (25.2%)	52 (18.9%)	
	Never	99 (44.6%)	115 (41.9%)	
Consume processed food with high salt intake	Always	10 (4.5%)	12 (4.4%)	χ2=9.029 df=4 p=0.060
	Often	5 (2.3%)	9 (3.3%)	

Variables	Category	Hypertension Prevalence		Chi square test, df
		Yes	No	
Amount of salt intake	Sometimes	32 (14.4%)	66 (24.0%)	$\chi2$=14.469 df=4 p=0.006*
	Rarely	41 (18.5%)	36 (13.1%)	
	Never	134 (60.4%)	152 (55.3%)	
	Far too much	12 (5.4%)	2 (0.7%)	
	Too much	20 (9.0%)	26 (9.5%)	
	Just the right amount	82 (36.9%)	121 (44.0%)	
	Too little	93 (41.9%)	97 (35.3%)	
	Far too little	15 (6.8%)	29 (10.5%)	
Significance of salt levels	Very important	146 (65.8%)	169 (65.1%)	$\chi2$=8.778 df=3 p=0.032*
	Somewhat important	36 (16.2%)	63 (22.9%)	
	Not at all important	8 (3.6%)	10 (3.7%)	
	Don't know	32 (14.4%)	31 (11.3%)	

3.5. Bivariate Analysis of Residence of Respondents and Hypertension Prevalence

A bivariate analysis was conducted on residence of respondents (p=0.504) and found not to be statistically significant. To compare the prevalence of hypertension between rural and urban population among residents aged 30-69 years in Nyaribari Chache Sub County, prevalence of hypertension was more in rural areas than urban areas which were randomly sampled. 185 (67.3%) of 328 of urban respondents had no hypertension compared to 143 (64.4%) who were hypertensive. In rural areas, 90 (32.7%) had normal blood pressure compared to the 79 (35.6%) of the 169 rural respondents had hypertension as shown in Table 5.

Table 5. *Bivariate analysis on residence of respondents.*

Presence of high blood pressure				
Residence	**Yes**	**No**	**Totals (Residence)**	**Chi square, Odds Ratio and Relative Risk**
Urban	143 (64.4%)	185 (67.3%)	328	p=0.504, $\chi2$=0.447, df=1, OR=1.135 Rural, 0.881 Urban RR=1.072 Rural, 0.933 Urban
Rural	79 (35.6%)	90 (32.7%)	169	
Total (Hypertensive)	222 (100%)	275 (100%)	497	

4. Discussion

4.1. Prevalence of Hypertension

Findings from this study reveal high prevalence of 44.134% among rural population in Kisii County than the urban (43.598%) population with a general prevalence of 44.668% among adults aged 29 to 69 years based on the Classification of the Seventh Joint National Committee on Detection, Evaluation and Treatment of Hypertension [1].

This is in line with other findings that indicated a hypertension prevalence ranging from 19% to 48% [13]. However, other studies done by [14-16], have reported a lower prevalence compared to prevalence reported in this study.

A study in southern Nigeria also indicated a similar higher prevalence of hypertension in rural areas [17]. The study

demonstrated 44.3% prevalence in rural as compared to 27.5% in the urban with a p value of less than 0.001. Contrasting this is a study done in Ghana which indicated a higher prevalence in urban than rural areas [18]. Similar prevalence studies have also indicated a higher urban prevalence than rural areas [19, 20].

These studies that have been done in Sub Saharan Africa indicate difference in prevalence between urban and rural population which could be an indicator of lifestyle differences for instance physical inactivity and diet intake trends in these populations [21-23].

This difference in hypertension prevalence could also be due to socio-demographic differences and also age differences among respondents.

In rural areas, those who were hypertensive were highest among the following hypertension classifications; stage one (1) hypertension followed by hypertensive crisis and finally stage 2 hypertension; 30 (17.8), 29 (17.1%) and 20 (11.8%) respectively. 90 (53.3%) out of 169 respondents in rural areas had normal blood pressure. Among urban residents, it was highest among the following hypertensive groups; hypertension stage 1, hypertensive crisis and finally hypertension stage 2; 57 (17.4%), 56 (17.1%) and 30 (9.1%) respectively.

Most respondents had normal blood pressure in rural and urban populations. Comparatively, the study is contrary with one done elsewhere in India [24] and Mali [25] which indicates a higher prevalence in urban areas compared to rural areas.

4.2. Dietary Intake

Regarding dietary intake, it was noted that the lower the fruit and vegetable intake resulted in increased hypertension (p=0.002). This is in line with other studies done by [26-29]. However, contrary studies have also indicated that those who consume fruits and vegetables and are generally vegetarians reported a high prevalence of hypertension [20]. The results indicate a general lower intake of fruit compared to five or more fruit serving as recommended by the WHO. In other studies, it has been indicated that high fruit intake reduces the prevalence of hypertension development [30].

Similarly, those who had no fruit, consumed processed food with high salt and thought the amount of salt affects their health were found to be significant to development of hypertension. All these, compose unhealthy diet and eating habits which are and modifiable behavioral risk factor for hypertension development and agrees with [31].

5. Conclusions

The study concludes that in Kisii County, residents in rural population have highest prevalence of hypertension. Further, hypertension stage 1, hypertensive crisis and hypertensive stage 2 is the order of hypertensive cases in urban and rural areas from highest to the lowest. In overall, those with normal blood pressure are more than those with the three classifications of hypertension.

The study also concludes that most of the respondents who maintained a poor diet of low to no fruit and vegetable intakes are from the rural population and report a higher prevalence of hypertension. This is below the required WHO standard guideline, high salt consumption and consumed food high in saturated fat despite having the knowledge that excess salt could affect their health was also seen in the respondents particularly from rural areas.

6. Recommendations

The study recommends the following to rural residents of Kisii County through the Ministry of Health, National Government and non-governmental supporting partners and stakeholders: Perform mass campaigns on benefits of healthy lifestyle including healthy diet intake and physical activity in order to reduce the burden of hypertension.

Abbreviations

DALYs	Disability Adjusted Life Years
MmHg	Millimeters of Mercury
SPSS	Statistical Package for Social Scientists
STEPs	WHO Approach to NCD Risk Factor Surveillance
WHO	World Health Organization

Conflicts of Interest

The authors declare no conflicts of interest.

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Biography

Alex Ontiri Ondieki is a Public Health professional with over a decade of experience in health care. He has worked with Kisii University, Kisii County Government (Ministry of Health), Planned Parenthood Global among other oldest & largest health and medical giant organizations. He is also the founder and Executive Director for HECOWENA, a health organization in Kenya that deals with Training and Research in the health sector. He has an MPH in Epidemiology and Disease Control from Kenyatta University and currently completing his PhD in Public Health. He has conceptualized, co-designed, led and implemented various high impact health initiatives and programs on infectious and non-infectious diseases, tribal health in remote geographies, reproductive and sexual health, palliative care, women's health and technology-based innovations, with a focus on primary health care and health system strengthening.

Research Field

Alex Ontiri Ondieki: Epidemiology, Public Health, Community Health, Occupational Health and Safety.
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