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RESEARCH ARTICLE

# Dietary Practices and Risk of Hypertension among Adults Attending Nakuru Level 5 Hospital, Kenya: A Cross-Sectional Study

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## ABSTRACT

Hypertension is a major cause of cardiovascular morbidity and premature mortality. Statistics indicate that prevalence and gaps in awareness, treatment, and control are high in Kenya. Diet, in particular sodium and potassium balance, general quality, and intake of fruits and vegetables, is a preventive and controlling factor that can be manipulated. The study was a descriptive cross-sectional study among adults. A total of 215 respondents were selected through systematic random sampling. A semi-structured questionnaire was used to measure the frequency and daily servings of fruits and vegetables, as well as salt-related behaviors. A 24-hour recall was used to assess the intake of macro- and micronutrients. The analysis of data was done using SPSS v26 and descriptive statistics and chi-square tests on associations. Among 215, only 5.1% had normal BP; 18.6% elevated; 52.6% stage 1; 23.7% stage 2. Vegetables were eaten most days; fruit 3–4 days/week; daily fruit was rare. Portions favored vegetables (4–5/day) over fruit (2–3/day). Energy and fibre were low; ~half exceeded fat ceilings. Mean sodium exceeded targets (men 2,310 mg; women 2,220 mg); potassium adequacy ~20%. About 76% often/always added salt during cooking; ~13% added at the table; label reading 3.7% and low-sodium purchases 7.4%. Fruit days/week ($p=0.001$), vegetable servings/day ($p<0.001$), and several salt-related practices ($p \leq 0.024$) associated with stage. Conclusion: Hypertension is a high burden, and the dietary habits of the study participants are low fibre, excess sodium, low potassium, and key micronutrient consumption mixed with a high dietary intake of vegetables and low frequency of fruits. Recommendations: Push high-fibre foods that contain high potassium (leafy greens, legumes, whole grains, an apple a day); introduce systematic deficit of sodium (measured salt, less use of stock cubes/processed foods, label literacy); part of clinic workflow integration (minimal diet screening, counselling); and food-environment support (canteen defaults, access to produce).

**Keywords:** *Hypertension; Dietary practices; Fruit and vegetable intake; Sodium–potassium balance; Kenya.*

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# INTRODUCTION

Hypertension is one of the major causes of cardiovascular morbidity and premature mortality in the world, with an estimated 1.28 billion adults aged 30-79 years having it. Awareness, treatment, and control strategies are not optimal, especially in low- and middle-income countries (LMICs) where the majority of the cases are diagnosed (World Health Organization [WHO], 2023). Kenya faces a high rate of hypertension, with a national survey showing a prevalence of 24.5%. Recent studies also find that care gaps and inequalities continue across all groups (Mohamed et al., 2018; Okutse & Athiany, 2025). These patterns show how important it is to focus on lifestyle changes, especially diet, to prevent and manage hypertension.

Diet clearly affects blood pressure in several ways. Excess sodium intake increases BP in a dose-responsive manner. High amounts of potassium initiate natriuresis and vasodilation. WHO recommends intake of ≤ 2,000 mg/day and ≥ 3,510 mg/day of sodium and potassium, respectively, among adults (WHO, 2019; WHO, 2023). Recent studies have consistently shown that the Dietary Approaches to Stop Hypertension (DASH) diet, a diet rich in fruits, vegetables, whole grains, legumes, nuts, and low-fat dairy and low in saturated fat and sodium, is very helpful in lowering blood pressure. These recommendations are supported by meta-analyses and guidelines on hypertension (Filippou et al., 2020; Charchar et al., 2024; Mancia et al, 2023; Isnaini et al., 2025; McCaskill, 2025).

The local food environment determines the feasibility and compliance with cardio-protective diets. In sub-Saharan Africa, including Kenya, urbanization and the nutrition transition have increased access to processed and packed foods, whereas affordability and availability of fruits throughout the year have limited fruit intake (Popkin, 2001; De Matteis et al., 2025; Wiertsema et al., 2021). Audits in Kenya also indicate that there is limited sodium labelling on packaged foods- roughly a third of products carry sodium labelling- which restricts the options available for consumers to choose foods with lower sodium content (Ndanuko et al., 2021). This interaction between these structural facts and household-level choices (e.g., discretionary salt in the kitchen, stock cubes, cooking fats) allows actual sodium and potassium exposure to be determined, which may then nullify the predicted health benefits of supposedly healthier foods when the preparation habits introduce salt or saturated fat. This study focused on the dietary practices as a risk factor of hypertension among adults attending Nakuru County Teaching and Referral Hospital.

# METHODS

## *Study Design and Setting*

The study employed a cross-sectional descriptive design and was conducted at the Nakuru County Teaching and Referral Hospital (Level 5), located in Nakuru County, Kenya. The hospital serves as a major referral and teaching facility within the region. The study targeted patients attending the outpatient clinic during the data collection period.

## *Study Population and Eligibility Criteria*

The study population consisted of adult men and women aged 18 years and above attending the outpatient clinic. Participants who had been previously diagnosed with hypertension were included.

Exclusion criteria comprised individuals who were too ill to participate safely and those with documented mental disabilities that interfered with the ability to give informed consent or provide reliable self-reports.

## *Sample Size Determination*

The sample size was calculated using Cochran's formula for a single proportion (Cochran, 1977), based on a prevalence of 23.8% (Mwenda et al., 2018). The initial sample size obtained was 278 participants. After applying the finite population correction, the adjusted sample size was 218, and an additional 10% was added to account for possible non-response, resulting in a final target sample of 241 participants.

## *Sampling Procedure*

A systematic random sampling technique was employed to identify study participants. Every third patient on the daily outpatient clinic register was selected for inclusion. In cases where a selected patient declined participation or withdrew, the next willing patient was recruited to maintain the sampling interval.

## *Data Collection Instrument and Procedure*

Data were collected using a semi-structured questionnaire designed to capture socio-demographic characteristics, dietary habits, and lifestyle factors. The tool included a 24-hour dietary recall, daily fruit and vegetable servings, and salt-use behavior. The questionnaire was pre-tested at Naivasha County Referral Hospital among 10% of the total sample size. Feedback from the pre-test was used to refine and validate the data collection instrument. Standardized local household measures and portion-photo guides were used to estimate the quantities of food consumed.

### *Data Management and Analysis*

Data were cleaned and coded in Microsoft Excel 2013 and later exported to Statistical Package for the Social Sciences (SPSS) version 26.0 for analysis. Dietary data from the 24-hour recall were analyzed using NutriSurvey software to determine macronutrient and micronutrient intake. Descriptive statistics were used to summarize participant characteristics. The Chi-square test was applied to assess associations between dietary practices and stages of hypertension. A significance level of $p < 0.05$ was considered statistically significant.

### *Ethical Considerations*

Ethical clearance for the study was obtained from the Kabarak University Research Ethics Committee (KUREC) (Approval Reference: KUREC/001/41/07/24). A research permit was granted by the National Commission for Science, Technology and Innovation (NACOSTI) (Permit No.: NACOSTI/P/24/39105). Authorization was also obtained from the Nakuru County Teaching and Referral Hospital Administration. All participants provided written informed consent after receiving full information about the study's purpose and procedures. Confidentiality was maintained by assigning codes to responses and securely storing data on a password-protected drive accessible only to the principal investigator. Participants were informed of their right to decline or withdraw at any time. Any cases of elevated blood pressure identified during data collection were immediately referred to clinic staff for follow-up and management.

## RESULTS

### *Socio Demographic and Economic Characteristics*

A total of 215 participants were included in the study. The majority (54.0%) were female. The mean age was 45.8 ± 11.3 years; the majority of the age group was 30–49 years (63.7%), and the ≥50 years (50–64: 27.0%; ≥66: 7.4%). Educational level was high: 47.9% had completed secondary school and 45.1% had college/university, with 7.0% having primary or less. Most were 76.7% currently married, and 76.3% of the participants were working (government 14.4%, non-government 23.3%, self-employed 38.6%), with 10.7% unemployed, 7.4% retired, and 5.6% homemakers. 27.4% had a household monthly income of Ksh 30,001–50,000, and 24.7% had an income of Ksh 50,001–70,000, as shown in Table 1.

**Table 1**:

*Demographic and Economic Characteristics of Study Participants*

| | | N (215) | |
|---|---|---|---|
| **Variables** | **Category** | **n** | **%** |
| Gender | Female | 116 | 54.0 |
| | Male | 99 | 46.0 |
| Age | 18 - 29 years | 4 | 1.9 |
| | 30 - 49 years | 137 | 63.7 |
| | 50 - 64 years | 58 | 27.0 |
| | ≥66years | 16 | 7.4 |
| | Mean ± SD | 45.8 ± 11.3 | |
| Education level | No formal schooling | 4 | 1.9 |
| | Less than primary school | 2 | **0.9** |
| | Primary school completed | 9 | 4.2 |
| | Secondary school completed | 103 | 47.9 |
| | College/University completed | 97 | 45.1 |
| Marital Status | Never married | 18 | 8.4 |
| | Currently married | 165 | 76.7 |
| | Separated | 5 | 2.3 |
| | Widowed | 13 | 6.1 |
| | Cohabitating | 14 | 6.5 |

| | | | |
|---|---|---|---|
| Employment Status | Government employee | 31 | 14.4 |
| | Non-government employee | 50 | 23.3 |
| | Self-employed | 83 | 38.6 |
| | Homemaker | 12 | 5.6 |
| | Retired | 16 | 7.4 |
| | Unemployed | 23 | 10.7 |
| Household Monthly Earnings | ≤ 10,000 | 8 | 3.7 |
| | 10,000 - 30,000 | 39 | 18.1 |
| | 30,001 - 50,000 | 59 | **27.4** |
| | 50,001 - 70,000 | 53 | 24.7 |
| | ≥ 70,001 | 35 | 16.3 |
| | Don't Know | 21 | 9.7 |

## *Blood Pressure Categorization*

The majority (76.3%) of the participants had hypertension (Stage 1, 52.6%, Stage 2, 23.7%), 18.6% were elevated, and 5.1% were normal. There was a similar distribution across the sexes for Stage 1 (54.5% vs. 50.9%), Stage 2 (24.2% vs. 23.3%), elevated (17.2% vs. 19.8%), and normal (4.0% vs. 6.0%), indicating no large sex differences in BP categories in this cohort, as shown in Table 2.

**Table 2**:

*Blood Pressure Categorization by Sex of Study Participants*

| BP Category | Male (n=99) | | Female (n=116) | | Total (n=215) | |
|---|---|---|---|---|---|---|
| | N | % | N | % | n | % |
| Normal | 4 | 4.0 | 7 | 6.0 | 11 | 5.1 |
| Elevated | 17 | 17.2 | 23 | 19.8 | 40 | 18.6 |
| Stage 1 Hypertension | 54 | 54.5 | 59 | 50.9 | 113 | 52.6 |
| Stage 2 Hypertension | 24 | 24.2 | 27 | 23.3 | 51 | 23.7 |

## *Dietary Practices*

The participants consumed vegetables more frequently than fruits. Vegetables were mostly (57.0%) consumed daily, 17.0% consumed 6 days/week, and 0.7% consumed 5 days /week. In comparison, fruits were mostly consumed 3 to 4 days/week: 31.3% and 34.0% respectively, and daily intake of fruits was rare (3.9%). Vegetables were consumed almost every day of the week, whereas fruits were eaten 3-4 days/week, as shown in Figure 1.

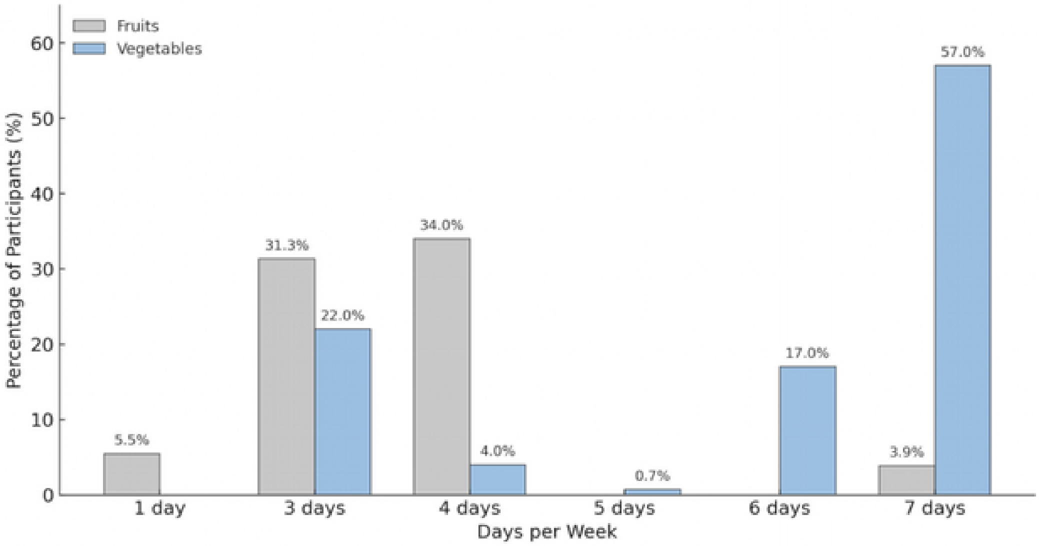

**Figure 1**: *Weekly Consumption of Fruits and Vegetables*

## *Vegetables and fruits servings/day*

Vegetable portions skewed higher than fruit. The majority of participants had 4-5 vegetable servings/day (42% and 26% respectively), with 20% having 3 servings. In contrast, fruit intake was at 2–3 servings/day (32% and 36%), with less than half of that at 4–5 servings (14% and 6%). Overall, vegetables were consumed in larger daily amounts than fruits, as shown in Figure 2.

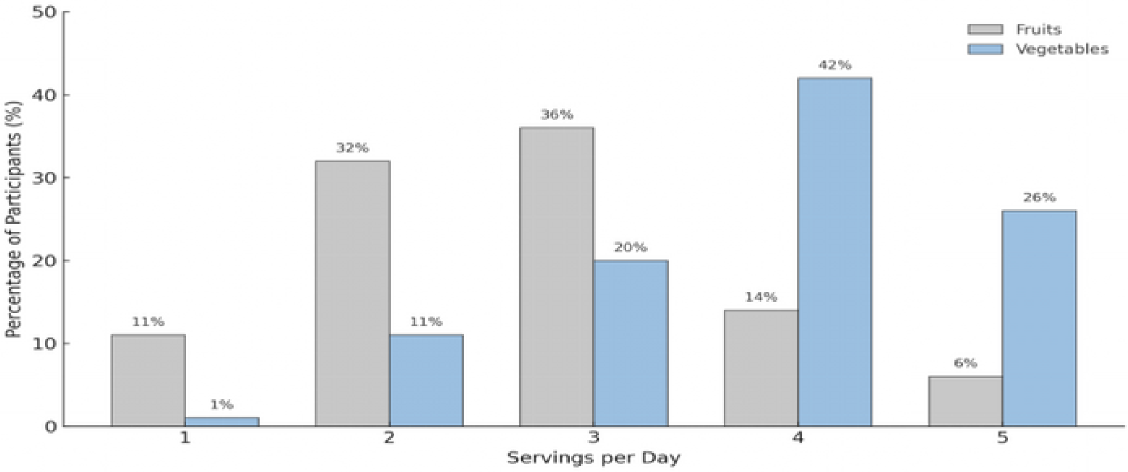

**Figure 2**: *Daily Fruit and Vegetable Servings*

## *24-hour Recall and Salt Related Behavior*

Energy intake was below recommendations for most participants; only 11.0% of men and 8.2% of women met energy targets. Protein adequacy was average (65.5% men, 61.7% women; means 57.8 g men, 53.2 g women). Slightly more than half were within the total fat upper limit (≤83 g men, ≤67 g women), being adequate 58.0% and 54.2%, respectively. 46.0% of Men and 41.7% of women met the targets of carbohydrates (men 276 g vs. target 276 g; women 255 g vs. target 250 g). 28.4% of men and 24.7% of women met the RDA for fibre, with mean intakes of approximately 20.2 g (men) and 17.5 g (women) compared to goals of ≥30 g and ≥25 g, respectively, as shown in Table 3. The mean sodium intake for both males (2,310 mg) and females (2,220 mg) exceeded the recommended safe limit of <2,000 mg. There were low (20%) adequacy levels for potassium for both males and females. There were low adequacy levels of calcium and magnesium (men 24.1%/women 22.0% calcium, men 31.3%/women 29.5% magnesium). 68.4% of men met the RDA of iron compared to women (48.5%) because women have a greater need. Zinc adequacy was <50% (men 44.3%, women 41.0%). In the case of vitamins, approximately 36-38% met vitamin A, approximately 40-45% met vitamin C, and approximately 30% met folate; vitamin B6 was adequate at approximately 50%. It had the lowest level of vitamin D (men 6.1%, women 5.0%) as shown in Table 4.

**Table 3**:
*Mean Energy and Macronutrients Intake by Sex*

| Nutrient | Participant's intake (Mean ± SD) | | RDA | | Adequate (%) | |
|---|---|---|---|---|---|---|
| | Male | Female | Male | Female | Male | Female |
| Energy (kcal) | 1,890 ± 510 | 1,720 ± 480 | 2,500 | 2,000 | 11.0 | 8.2 |
| Protein (g) | 57.8 ± 18.9 | 53.2 ± 18.0 | 60 | 50 | 65.5 | 61.7 |
| Fat (g) | 61.2 ± 22.0 | 54.0 ± 19.8 | ≤83 | ≤67 | 58.0 | 54.2 |
| Carbohydrate (g) | 276 ± 74 | 255 ± 70 | 313 | 250 | 46.0 | 41.7 |
| Fiber (g) | 20.2 ± 7.0 | 17.5 ± 6.1 | ≥30 | ≥25 | 28.4 | 24.7 |

**Table 4**:

*Mean Micronutrient Intakes of Participants*

| Nutrient | Participant's intake (Mean ± SD) | | RDA | | Adequate (%) | |
|---|---|---|---|---|---|---|
| | Male | Female | Male | Female | Male | Female |
| Sodium (mg) | 2,310 ± 710 | 2,220 ± 690 | <2,000 | <2,000 | 35.7 (safe) | 38.4 (safe) |
| Potassium (mg) | 2,540 ± 880 | 2,420 ± 860 | ≥3,510 | ≥3,510 | 20.2 | 19.4 |
| Calcium (mg) | 805 ± 270 | 790 ± 265 | 1,000-1,200 | 1,000-1,200 | 24.1 | 22.0 |
| Magnesium (mg) | 250 ± 80 | 230 ± 72 | 400–420 | 310–320 | 31.3 | 29.5 |
| Iron (mg) | 12.1 ± 3.9 | 10.8 ± 3.7 | 8 | 18 (19–50) 8 (≥51) | 68.4 | 48.5 |
| Zinc (mg) | 7.9 ± 2.4 | 7.3 ± 2.1 | 11 | 8 | 44.3 | 41.0 |
| Vitamin A (µg RAE) | 640 ± 245 | 610 ± 225 | 900 | 700 | 38.2 | 35.9 |
| Vitamin C (mg) | 67 ± 25 | 62 ± 24 | 90 | 75 | 45.2 | 40.1 |
| Folate (µg) | 300 ± 95 | 280 ± 88 | 400 | 400 | 32.8 | 29.6 |
| Vitamin B6 (mg) | 1.2 ± 0.4 | 1.1 ± 0.4 | 1.3–1.7 | 1.3–1.5 | 52.0 | 47.1 |
| Vitamin D (µg) | 5.1 ± 2.1 | 4.7 ± 2.0 | 15–20 | 15–20 | 6.1 | 5.0 |

## *Behavioural and Perceptual Patterns Related to Salt*

Salt consumption practices showed that although 76.3% of the participants indicated that they always or often added salt when cooking, only 12.6% indicated that they regularly added salt at the table. The majority (64.7%) of subjects ate processed salty foods occasionally, and 81.9% perceived their salt consumption was just right.

The majority (95.4%) of the participants were aware of the health problems associated with excessive salt intake and thought reduction of salt to be important (98.6%). Nevertheless, few (3.7%) were reading labels, 7.4% buying low-salt options; these results imply that there is high awareness and some adoption of effective salt-reduction practices is still lacking, as shown in Table 5.

**Table 5**:

*Behavioural and Perceptual Patterns Related to Salt*

| Variables | Category | N (215) | |
|---|---|---|---|
| | | n | % |
| Frequency of adding salt or salty sauce to food during or before eating | Always | 1 | 0.5 |
| | Often | 26 | 12.1 |
| | Sometimes | 129 | 60.0 |
| | Rarely | 54 | 25.1 |
| | Never | 5 | 2.3 |
| Frequency of adding salt or salty seasonings during cooking or food preparation at home | Always | 70 | 32.6 |
| | Often | 94 | 43.7 |
| | Sometimes | 41 | 19.1 |
| | Rarely | 10 | 4.7 |
| Frequency of consuming processed foods high in salt | Often | 11 | 5.1 |
| | Sometimes | 139 | 64.7 |
| | Rarely | 59 | 27.4 |
| | Never | 6 | 2.8 |
| Perceived amount of salt or salty sauce consumed | Too much | 14 | 6.5 |
| | Just the right amount | 176 | 81.9 |
| | Too little | 20 | 9.3 |
| | Far too little | 4 | 1.9 |
| | Don't know | 1 | 0.47 |

| | | | |
|---|---|---|---|
| Importance of reducing salt intake in one's diet | Very important | 153 | 71.2 |
| | Somewhat important | 59 | 27.4 |
| | Not at all important | 3 | 1.4 |
| Belief that excessive salt consumption poses health risks | No | 10 | 4.7 |
| | Yes | 205 | 95.4 |
| Limits consumption of processed foods | No | 53 | 24.7 |
| | Yes | 162 | 75.4 |
| Looks at the salt or sodium content on food labels | No | 207 | 96.3 |
| | Yes | 8 | 3.7 |
| Buys low salt/sodium alternatives | No | 199 | 92.6 |
| | Yes | 16 | 7.4 |
| Uses spices other than salt when cooking | No | 122 | 56.7 |
| | Yes | 93 | 43.3 |
| Avoids eating foods prepared outside of a home | No | 113 | 52.6 |
| | Yes | 102 | 47.4 |
| Does other things specifically to control salt intake | No | 160 | 74.4 |
| | Yes | 55 | 25.6 |

## *Association between Fruit and Vegetable Consumption and Stages of Hypertension among Study Participants*

The number of days fruits were consumed per week was significantly associated with hypertension status ($\chi^2$ = 38.877, df = 15, p = 0.001); participants consuming fruits 4–5 days per week were more likely to present with stage 1 or stage 2 hypertension. Average vegetable servings/day showed a significant association ($\chi^2$ = 37.203, df = 12, p < 0.001), with the high number of vegetable servings (≥4 / day) being more prevalent in stage 1 and stage 2 hypertension. However, average daily fruit servings ($\chi^2$ = 14.928, df = 12, p = 0.245) and the number of days vegetables are consumed per week was not significantly related to hypertension stages ($\chi^2$ = 7.896, df = 12, p = 0.793) did not show a significant association. These results indicate that even though the frequency of the intake of the fruits determines the blood pressure status, the number of the vegetable servings per day is more correlated with the severity of hypertension, as shown in Table 6.

**Table 6**:

*Association Between Fruit and Vegetable Consumption and Stages of Hypertension among Study Participants*

| Variable | | Stages of hypertension | | | | | |
|---|---|---|---|---|---|---|---|
| | | Normal blood pressure | Elevated blood pressure | Stage 1 hypertension | Stage 2 hypertension | | |
| | | n % | n % | n % | n % | $X^2$ (df) | p-value |
| Number of days fruit is consumed in a week | 1 | 3 (33.3) | 2 (7.7) | 5 (5.0) | 0 (0.0) | 38.877 (15) | 0.001* |
| | 2 | 2 (22.2) | 6 (23.1) | 12 (12.0) | 2(4.3) | | |
| | 3 | 2 (22.2) | 9 (34.6) | 33 (33.0) | 13 (27.7) | | |
| | 4 | 1 (11.1) | 5 (19.2) | 39 (39.0) | 17 (36.2) | | |
| | 5 | 0 (0.0) | 2 (7.7) | 10 (10.0) | 12 (25.5) | | |
| | 7 | 1 (11.1) | 2 (7.7) | 1 (1.0) | 3 (6.4) | | |
| Average daily fruit servings | 1 | 2 (33.3) | 5 (21.7) | 7 (8.5) | 4 (8.5) | 14.928 ( 12) | 0.245 |
| | 2 | 2 (33.3) | 6 (26.1) | 31 (37.8) | 12 (25.5) | | |
| | 3 | 1 (16.7) | 6 (26.1) | 29 (35.4) | 21 (44.7) | | |
| | 4 | 1 (16.7) | 6 (26.1) | 9 (11.0) | 6 (12.8) | | |
| | 5 | 0(0.0) | 0 (0.0) | 6 (7.3) | 4 (8.5) | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Number of day's vegetables are consumed in a week. | 3 | 0(0.0) | 0 (0.0) | 1 (1.0) | 0 (0.0) | 7.896 (12) | 0.793 |
| | 4 | 0 (0.0) | 0 (0.00) | 5 (4.8) | 3 (6.0) | | |
| | 5 | 2 (20.0) | 6 (21.4) | 23 (21.90) | 11 (22.0) | | |
| | 6 | 4 (40.0) | 4 (14.3) | 18 (17.14) | 6 (12.0) | | |
| | 7 | 4 (40.0) | 18 (64.3) | 58 (55.2) | 30 (60.0) | | |
| Average daily vegetable servings | 1 | 0 (0.0) | 1 (5.0) | 0 (0.0) | 0 (0.0) | 37.203 (12) | 0.000* |
| | 2 | 2(100.0) | 3 (15.0) | 9 (12.0) | 2 (4.4) | | |
| | 3 | 0 (0.0) | 7 (35.0) | 15 (20.0) | 6 (13.3) | | |
| | 4 | 0 (0.0) | 7 (35.0) | 36 (48.0) | 17 (37.8) | | |
| | 5 | 0 (0.0) | 2 (10.0) | 15 (20.0) | 20 (44.4) | | |

**Statistically significant at p-value <0.05*

## *Salt-Related Dietary Practices and their Association with stages of hypertension among Study Participants*

A number of practices were found to be closely linked with hypertension status. Hypertension was correlated with the frequency of adding salt or salty sauce to food ($\chi^2$=26.023, df=12, p=0.011), with the majority of participants in Stage 1 and Stage 2 of hypertension reporting that they sometimes added salt. Limiting the consumption of processed foods was strongly associated with hypertension ($\chi^2$=14.885, df=3, p=0.002), as the majority (92.5%) of Stage 2 hypertensive participants reported practicing this as opposed to a smaller number of participants with normal blood pressure. The other practices that had a significant association with status of hypertension were the purchase of low-salt substitutes ($\chi^2$=9.655, df=3, p=0.022), using spices other than salt during cooking ($\chi^2$=9.47, df=3, p=0.024), avoiding foods prepared outside the home ($\chi^2$=22.672, df=3, p<0.001), and taking other actions to specifically control salt intake ($\chi^2$=18.605, df=3, p<0.001). In contrast, checking salt or sodium content on food labels was not statistically associated with hypertension (p=0.070) as shown in Table 7.

**Table 7***:*

*Salt-Related Dietary Practices and their Association with stages of hypertension among Study Participants*

| Variable | Category | Stages of hypertension | | | | | |
|---|---|---|---|---|---|---|---|
| | | Normal blood pressure | Elevated blood pressure | Stage 1 hypertension | Stage 2 hypertension | | |
| | | n % | n % | n % | n % | X$^2$ (df) | p-value |
| Frequency of Adding Salt to Food | Always | 0 (0.0) | 0 (0.0) | 0 (0.0) | 1 (1.9) | 26.023 (12) | 0.011* |
| | Often | 0 (0.0) | 4 (10.8) | 18 (15.8) | 4 (7.6) | | |
| | Sometimes | 8 (72.7) | 29 (78.4) | 69 (60.5) | 23 (43.4) | | |
| | Rarely | 3 (27.3) | 4 (10.8) | 23 (20.2) | 24 (45.3) | | |
| | Never | 0 (0.0) | 0 (0.0) | 4 (3.5) | 1 (1.9) | | |
| Limiting Processed Food Consumption | No | 6 (54.6) | 10 (27.0) | 33 (29.0) | 4 (7.6) | 14.885 ( 3) | 0.002* |
| | Yes | 5 (45.5) | 27 (73.0) | 81 (71.1) | 49 (92.5) | | |
| Checking Sodium Content on Food Labels | No | 11 (100.0) | 37 (100.0) | 111 (97.4) | 48 (90.6) | 7.061 (3) | 0.070 |
| | Yes | 0 (0.0) | 0 (0.0) | 3 (2.6) | 5 (9.4) | | |
| Buys low salt/ sodium alternatives | No | 11 (100.0) | 35 (94.6) | 109 (95.6) | 44 (83.0) | 9.655 (3) | 0.022*, |
| | Yes | 0 (0.0) | 2 (5.4) | 5 (4.4) | 9 (17.0) | | |
| Use of Non-Salt Spices in Cooking | No | 10 (90.9) | 21 (56.8) | 68 (59.7) | 23 (43.4) | 9.47 (3) | 0.024* |
| | Yes | 1 (9.1) | 16 (43.2) | 46 (40.4) | 30 (56.6) | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Avoidance of Foods Prepared Outside the Home | No | 10 (90.9) | 25 (67.6) | 63 (55.3) | 15 (28.3) | 22.672 (3) | 0.000* |
| | Yes | 1 (9.1) | 12 (32.4) | 51 (44.7) | 38 (71.7) | | |
| Other Salt-Reduction Practices | No | 10 (90.9) | 32 (86.5) | 90 (79.0) | 28 (52.8) | 18.605(3) | 0.000* |
| | Yes | 1 (9.1) | 5 (13.5) | 24 (21.1) | 25 (47.2) | | |

**Statistically significant at p-value <0.05*

# DISCUSSION

The sociodemographic profile of the study participants, predominantly middle-aged (mean 45.8 years), educated, and employed, aligns with hypertension detection patterns observed in Kenya and other LMICs. Age remains the strongest non-modifiable determinant of hypertension, and working adults are more likely to attend outpatient services where detection is higher. However, population-level awareness and treatment remain low, so clinic samples may overrepresent diagnosed individuals while many in the community remain undetected (WHO, 2023; Mohamed et al., 2018). Women represented 54% of participants, reflecting their higher healthcare utilization for chronic conditions, even when sex-specific hypertension prevalence is similar (Sikka et al., 2021; Gatimu et al., 2020). The socioeconomic profile of high school/tertiary education and middle-to-high income also reflects a group more likely to undergo screening, while still experiencing dietary and lifestyle exposures of urbanization that increase hypertension risk (Antignac et al., 2018).

The burden of elevated blood pressure was extremely high: only 5.1% had normal BP, while 76.3% were hypertensive (Stage 1: 52.6%, Stage 2: 23.7%). This is substantially higher than the national age-standardized prevalence of 24–25% (Mwenda et al., 2018). Clinic-based studies typically show increased hypertension prevalence because they include symptomatic, referred, or previously diagnosed individuals. Additionally, single-visit BP measurements may inflate estimates due to the white-coat effect, and clinical populations often reflect accumulated risk rather than early prevention (American College of Cardiology, 2018). Overall, the results suggest underlying population-level gaps in early screening, control, and lifestyle modification.

Vegetable consumption was frequent, with most participants eating vegetables 6–7 days per week, a slightly higher pattern than the national average of approximately five days per week. Fruit consumption remained inadequate, with a mean frequency of 3–4 days per week, consistent with findings from national surveys and urban dietary behavior research (Mwenda et al., 2018; Downs et al., 2022). Although good vegetable availability in urban markets may contribute to higher intake (Nyanchoka et al., 2022), frequency does not translate to adequate servings. Most participants failed to meet the recommended ≥5 servings/day, with vegetable intake far better than fruit intake. This imbalance aligns with global findings showing fruit intake is more limited by cost, perishability, and lower cultural prioritization (Temple & Steyn, 2011). Low intake of fruits and vegetables contributes significantly to hypertension and cardiovascular disease risk, and Aune et al. (2017) demonstrated a dose-response association between increased intake and reduced hypertension. The pattern observed here, therefore, reflects a preventable but pervasive risk factor for hypertension, suggesting the need for interventions that address affordability, access, and behavioral change.

Macronutrient analysis showed that energy and carbohydrate intakes were generally below recommendations. Low adherence to energy requirements, observed in only 11% of men and 8% of women, may partly reflect under-reporting, a known limitation in dietary assessment (Beverely et al., 2020). Still, inadequate energy and carbohydrate consumption could also reflect dietary shifts toward irregular eating, meal skipping, or restrictive weight management patterns common in urban environments (Santos et al., 2012). Perhaps most concerning was low fiber intake (20 g/day for men and 18 g/day for women), indicating a diet high in refined foods. Low fiber is strongly linked with cardiometabolic disease, impaired lipid metabolism, and hypertension (Anderson et al., 2009). Although protein intake was generally adequate, suggesting stable access to animal-source and legume foods (Wu, 2016), overall dietary balance remains insufficient to meet cardiovascular health protection thresholds.

Micronutrient intake results show a dietary pattern strongly associated with hypertension risk. Sodium consumption exceeded the WHO recommendation (<2000 mg/day) for both sexes (O'Donnell et al., 2014). In contrast, potassium adequacy was extremely low, with only about 20% of participants meeting recommended intakes. A poor sodium-to-potassium ratio is a well-established predictor of increased BP, as potassium promotes renal sodium excretion and vascular relaxation (O'Donnell et al., 2014). Similarly, calcium and magnesium adequacy levels were low (22–31%), both linked to protective cardiovascular effects and lower BP (Kaur et al., 2021). Notably, vitamin D adequacy was critically poor (5–6%), consistent with high deficiency rates reported in African urban populations and associated with hypertension and endothelial dysfunction (Wu et al., 2023). These micronutrient deficiencies reflect inadequate consumption of fruits, vegetables, dairy, and whole grains and indicate major modifiable diet-related hypertension drivers in this population.

Knowledge-practice gaps were clearly demonstrated in salt-related behavior. Despite more than 95% acknowledging that high salt intake poses cardiovascular risks, 76% reported always/often adding salt during cooking. Very few read sodium labels (3.7%) or purchased low-sodium alternatives (7.4%). This disconnect reflects a persistent barrier in behavior change interventions, where risk awareness alone is insufficient to modify deeply ingrained dietary habits (Chan et al., 2022). Additionally, 81.9% believed their sodium intake was appropriate, a finding supported by other studies showing inaccurate self-assessment due to hidden salt in processed foods (Yu et al., 2024). Therefore, improved behavioral counseling should include practical skill-building, such as identifying high-sodium foods and understanding labeling terminology to help translate awareness into action.

Interestingly, the association between fruit and vegetable intake and hypertension status exhibited reverse causality. Participants with Stage 1–2 hypertension consumed fruits more frequently and had higher vegetable servings compared to those with normal BP. Although this contradicts strong evidence supporting the protective effects of fruits and vegetables (Aune et al., 2017; Madsen et al., 2023), the explanation likely lies in dietary advice following diagnosis. Individuals with more advanced hypertension often receive counseling to modify food choices, thereby appearing to adopt healthier diets later in the disease trajectory (Mozaffarian et al., 2011). This was further supported by positive dietary behavior among hypertensive groups, including reduced processed food intake (p=0.002), purchase of low-salt foods (p=0.022), increased use of non-salt spices (p=0.024), and avoidance of food prepared outside home (p=0.001). Similar patterns have been shown in studies where disease severity strongly predicts lifestyle modification (Bhat et al., 2021; Rotich et al., 2019).

However, the lack of a significant association between reading nutrition labels and BP status (p=0.070) highlights minimal uptake of proactive self-management practices. Good health behaviors were mostly triggered after a hypertension diagnosis, demonstrating a reliance on reactive rather than preventive dietary strategies. This contradicts evidence showing that proactive dietary change reduces hypertension risk and delays progression (Aliasgharzadeh et al., 2022). The behavior patterns observed emphasize major opportunities for earlier intervention. Overall, although the study population showed high salt-risk awareness and post-diagnosis lifestyle shifts, the fundamental dietary risk factors, high sodium intake, inadequate potassium and fiber, and low fruit intake, remain poorly controlled. The findings demonstrate that multisectoral, food-environment-wide approaches are needed to support population-level prevention rather than treatment-driven change.

# Conclusion

1. The majority of adults attending Nakuru Level 5 Hospital present with elevated blood pressure, largely influenced by preventable dietary patterns characterized by excessive sodium intake, inadequate potassium and fiber consumption, and insufficient fruit intake.
2. Although individuals with diagnosed hypertension demonstrate some dietary improvements, behavior change is predominantly triggered after disease onset, indicating major gaps in proactive nutritional practices and translation of knowledge into daily dietary control.

# Recommendations

1. Integrate targeted dietary interventions into routine care, emphasizing practical skills such as reading food labels, reducing processed foods, and increasing consumption of potassium-rich and high-fiber foods to mitigate hypertension risk before disease progression.
2. Implement population-wide health promotion efforts that address food affordability, accessibility, and behavior change barriers to support early adoption of healthy diets and reduce dependence on treatment-driven lifestyle modifications.

# Conflict of Interest

The authors declare no conflict of interest.

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