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Canada

The cost of eating healthy in Kenya

Acknowledgements

The authors acknowledge the contributions made to this study by the participants from Isiolo, Kisumu and Nairobi counties. We are grateful to the County and Sub-county teams of Isiolo, Kisumu and Nairobi, colleagues at APHRC, as well as the field teams. The preparation of this report would not have been possible without funding support from the International Development Research Centre (IDRC). We also acknowledge the invaluable input from the Technical Advisory Committee (TAC) members that included:

Betty Samburu – Nutrition Officer MIYCN (UNICEF)
Dr. Catherine Karekezi – Technical Advisor (NCD Alliance Kenya)
Dr. Ephantus Maree – Head, Department of NCD (Ministry of Health)
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Zachariah Ndegwa - Head, National Diabetes Prevention and Control Program (Ministry of Health)

Preparation of this report would not have been possible without funding from the International Development Research Centre (IDRC) Canada, channelled through the African Population and Research Center (APHRC) as part of the Cost of Eating Healthy in Kenya Study.

Foreword

This report presents the key findings of the Cost of Eating Healthy Study (2019-2021). The study involved two components: quantitative secondary analysis using data from the nationally representative 2015/2016 Kenya Integrated Household Budget Survey (KIHBS) and primary data collected from the qualitative study conducted in 2020 in the Kenyan counties of Isiolo, Kisumu and Nairobi. The African Population and Health Research Center (APHRC) conducted the study and prepared this report. The Technical Advisory Committee, which included representatives from the Ministry of Health and health sector representatives from Nairobi County and Nairobi Metropolitan Services (NMS), also supported the study team. The opinions expressed in this report are those of the authors and do not necessarily reflect the views of the donor organization - International Development Research Centre (IDRC).

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Recommended citation

Wambiya, E., Osindo, J., Kisia, L., Ilboudo, P., and Mohamed, SF. 2021. The Cost of Eating Healthy in Kenya Study Report. African Population and Health Research Center (APHRC); Nairobi, Kenya.

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Abbreviation

AE	Adult equivalent
AIC	Akaike Information Criterion
APHRC	African Population and Health Research Center
ASALs	Arid and Semi-arid Lands
BIC	Bayesian Information Criterion
CI	Concentration Index
FAO	Food and Agriculture Organization
FAPU	Polyunsaturated fatty acids
FASAT	Saturated fatty acids
FGDs	Focus Group Discussions
GDP	Gross Domestic Product
HDI	Healthy Diet Index
HIC	High-Income Countries
IDIs	In-Depth Interviews
IDRC	International Development Research Centre
KES	Kenyan Shilling
KFCT	Kenya Food Composition Table
KIHBS	Kenya Integrated Household Budget Survey
KIIs	Key Informant Interviews
KNBS	Kenya National Bureau of Statistics
LMICs	Low And Middle-Income-Countries
NASSEP-V	National Sample Survey and Evaluation Program-V
NCDs	Non-communicable Diseases
NMS	Nairobi Metropolitan Services
NEC	Non-Essential Condiments
PCA	Principal Component Analysis
QUAIDS	Quadratic Almost Ideal Demand System
RR	Rate Ratio
SD	Standard Deviation
SSB	Sugar-Sweetened Beverages
USD	United States Dollar
WHO	World Health Organization

Executive Summary

Low and middle-income-countries (LMICs) are experiencing an epidemiological transition characterized by an increase in chronic non-communicable diseases (NCDs). At the same time, dietary behaviours have shifted from traditional diets to those containing increased saturated fats, salt and sugars. Promoting healthy diets has been identified as a key pillar in preventing diet-related chronic diseases. However, in many developing countries there is a dearth of knowledge on the patterns and drivers of healthy eating. Available evidence suggests a link between socioeconomic status and healthy diets, however the findings differ by context. Kenya is one of the fastest growing economies in sub-Saharan Africa. Recent surveys have reported an increasing burden of diet-related NCDs with some evidence of poor dietary practices among the population. The aim of this study was to estimate the patterns, costs, determinants, and socioeconomic inequalities associated with healthy eating in Kenya.

The study employed a mixed methods approach. Secondary data from the Kenya Integrated Household Budget Survey (KIHBS) 2015/2016, was used to assess the patterns, costs and socioeconomic inequalities by gender and residence, as well as to estimate the price and expenditure elasticities for commonly consumed foods in Kenya. Perceptions and drivers of healthy versus unhealthy food choices were also explored qualitatively through key informant interviews (KIIs), focus group discussions (FGDs) and in-depth interviews (IDIs). Healthy eating was measured through a healthy diet index (HDI) developed using WHO/FAO standard recommendations on healthy food consumption. Household-level expenditure on food was summarized using means and standard deviations. Ordinary least squares regression was used to assess factors associated with healthy diet consumption. Concentration index (CI) analysis was used to assess inequalities in healthy eating by gender and residence while price and expenditure elasticities were assessed using the Quadratic Almost Ideal Demand System (QUAIDS) method. Qualitative data was analyzed through thematic analysis.

The results show that a majority of Kenyans are not meeting the WHO/FAO healthy diet recommendations. The HDI score for Kenya was moderate with urban households having higher scores in comparison to rural households. Socioeconomic inequalities exist with healthy eating being more concentrated among households of higher socioeconomic status. The results also showed that food expenditures were sensitive to changes in disposable income, with food groups such as milk, cheese and eggs, fruits, and meat, fish and seafood being considered to be luxury foods. The evidence from this study on the cost of eating healthy and income-related inequalities is useful in informing the decision-making processes in policies for food pricing, food provision, food retailing, food trade and investment, in order to support families to make healthy food choices.

1. Introduction

The contribution of non-communicable diseases (NCDs) to morbidity and mortality in low-and-middle-income countries (LMICs) continues to increase, and this at a higher rate than that observed in high-income countries (Alleyne et al., 2013). Many LMICs are experiencing an epidemiological transition, described as a move from a high burden of infectious diseases, to a high prevalence of chronic and degenerative diseases (Gaziano et al., 2010, Gaziano, 2005, Yusuf et al., 2001). This transition is largely as a result of lifestyle changes, including shifts in dietary patterns, physical activity levels, tobacco use, and harmful use of alcohol over time (Bowry et al., 2015, Popkin et al., 2012). Herein, we focus on nutrition transitions and the shifts from more traditional diets to those high in saturated fats, trans-fats, sugar and salt as well as high in processed and refined foods that are low in fiber (Popkin, 2004).

As LMICs transition towards stronger economies, the prevalence and disease burden of diet-related NCDs is rapidly rising and, if left unchecked, the economic burden associated with NCDs for many of these countries which are still tackling infectious diseases, may reach unmanageable levels (Abegunde et al., 2007). Furthermore, as NCDs continue to affect individuals in the working-age range, these diseases may reduce their productivity and will likely adversely affect the attainment of growing and stable economies (Alleyne et al., 2013). Sugar-sweetened beverages (SSBs) such as carbonated soft drinks and fruit juices, high salt foods such as salty snacks and processed foods, and foods high in saturated and trans-fats are increasingly forming a significant proportion of diets for many people living in developing countries (Popkin et al., 2012, Popkin, 2004). High consumption of these food items has been associated with obesity and other chronic health conditions, including diabetes and cardiovascular diseases (Malik et al., 2010, Malik et al., 2006). More worrisome is the increasing consumption of these food items among children, which is likely to set them on an unhealthy life trajectory (He et al., 2008).

Promoting healthy diets has been identified as the key to preventing diet-related chronic diseases. In 2013, a Global NCD Action Plan was endorsed by the World Health Organization (WHO) to address the rising burden of NCDs globally (Organization, 2013). One of the strategies in this action plan is to ensure that people have access to and consume healthy diets. Different guidelines for healthy diets exist, providing a measure of overall dietary quality. For example, the Eatwell guide, NOVA classification, and healthy diet recommendations based on WHO and the Food and Agriculture Organization (FAO) guidelines (Jones et al., 2014, Slavin and Lloyd, 2012, Monteiro et al., 2018, Nishida et al., 2004). There is consensus that healthy diets, at the minimum, ought to be low in salt, sugar, and fat, especially trans-fats while also having other characteristics such as including at least five servings of fruits and vegetables a day. Some common, evidence-based interventions proposed to promote healthy diets include salt intake reduction, replacement of trans-fats with polyunsaturated fats, and promotion of public awareness about healthy diets. Despite these standards and guidelines, increasing evidence shows poor dietary practices continue to persist. While high-income countries (HIC) have reported diet-related NCDs as a chronic problem, more LMICs are reporting poor dietary practices and an increasing burden of these diseases (Ronto et al., 2018).

The transitioning of LMICs towards stronger economies has been accompanied by major shifts in dietary patterns towards more diversified diets, commonly referred to as the nutrition transition (Vorster et al., 2011, Popkin, 2002). Socioeconomic status is a major determinant of dietary patterns and evidence has shown that the economic limitations of people living in low-income populations may preclude adherence to recommended dietary guidelines (Temple et al., 2011, McDermott and Stephens, 2010). As a result, populations in low-resourced settings resort to unhealthy dietary habits leading to an increase in diet-related NCDs which further stresses the already burdened health systems in developing countries (Abegunde et al., 2007, Vorster, 2002). Such considerations are even more critical in a country like Kenya which has a rapidly growing population and is experiencing an increase in the proportion of urban dwellers (32%) of whom about 60% are estimated to live in urban informal settlements or slums (Candiracci and Syrjanen, 2007). Kenya has recently attained the rank of lower middle-income country from a low-income country (World Bank, 2017). This changing economic situation suggests that higher wealth or spending capacity may provide individuals the opportunity to consume more foods, including those that are healthy and unhealthy. An unhealthy diet is one of the key risk factors for the increasing burden of NCDs in Kenya (Mwenda et al., 2018, World Health Organization, 2016, Haregu et al., 2015). The Kenya STEPS survey for NCD risk factors (2015) found that only 6% of the population consumed the recommended fruit and vegetable intake (Mwenda et al., 2018).

The costing of healthy eating has been done in many developed settings. Rao et al. (2013b) conducted a meta-analysis of 27 existing studies from 10 high-income countries by comparing the cost of a healthy diet with the cost of an unhealthy diet. They found that the daily cost of a healthy diet consisting of foods rich in fruits, vegetables, fish, and nuts, is approximately USD 1.50 more per person per day compared to the least healthy diet (rich in processed foods, meats, and refined grains). Proteins had the most expensive difference per serving, with the healthier choice being USD 0.29 more than less healthy options.

There is a dearth of knowledge in this area in many developing countries. Without evidence on the drivers of healthy and unhealthy food consumption, their relative costs, and the drivers of those costs, governments, development organizations and agencies are ill-equipped to identify the key areas of concern, much less to respond effectively. Indeed, policies to tackle the diet-related NCDs require a greater understanding of the drivers of healthy and unhealthy food consumption in their contexts, the relative costs, and the drivers of these costs.

The aim of this study was to estimate the cost of healthy eating in Kenya. This study also explored how inequalities in terms of socioeconomic, gender, or residential differences influence healthy versus unhealthy food choices, allowing for the formulation and implementation of effective policies, and strategies in Kenya. The specific objectives of the project were to:

1. Assess the cost of healthy and unhealthy foods in Kenya.
2. Explore the socioeconomic inequalities in eating healthy and unhealthy foods in Kenya, including disparities by gender and area of residence.
3. Examine the factors that generate inequalities in eating healthy and unhealthy foods in Kenya.
4. Estimate the price and expenditure elasticities for healthy and unhealthy foods in Kenya.
5. Investigate the perceptions and drivers of healthy versus unhealthy food choices in Kenya.

2. Methodology

Study designs

The study utilized a mixed-methods approach. The quantitative study was a cross-sectional secondary data analysis using the 2015/2016 Kenya Integrated Household Budget Survey (KIHBS). The qualitative study used key informant interviews, focus group discussions and in-depth interviews to collect data among selected respondents.

Study contexts

Quantitative

The KIHBS is a nationally representative household survey which was conducted in 2015-2016. The survey is intended to provide integrated household survey data on a wide range of indicators in order to assess the progress made in improving the living standards of the population at both national and county level (Kenya National Bureau of Statistics (KNBS), 2018). The survey covered several topics such as agriculture, demographics, education, finances, food consumption, and health and was implemented across Kenya's 47 counties. The KIHBS collected information on food quantities consumed from purchases, own production, own stock and gifts over a seven-day recall period. It represented the most comprehensive and detailed dataset on food consumption ever collected in Kenya, making it the most appropriate dataset for our study. More information on KIHBS can be obtained from the Kenya National Bureau of Statistics (Kenya National Bureau of Statistics (KNBS), 2018).

Qualitative

The qualitative study was conducted in three counties: Nairobi, Kisumu, and Isiolo. Nairobi county represented the urban populations and interviews were done in Westlands and Embakasi sub-counties. Kisumu county represented the rural populations and interviews were conducted in Kisumu East and Seme sub-counties. Isiolo represented the arid and semi-arid lands (ASALs) and interviews were conducted in Isiolo Central and Garbatulla sub-counties.

Study populations

Quantitative

The KIHBS collected data at household and cluster level. The household tools were administered to household heads or their spouses (in instances where the household head was absent at the time of interview). Cluster level data was collected from business operators at a marketplace, and community key informants (knowledgeable members in the community).

Qualitative

The qualitative study was conducted among various key informants and community members. The key informants included individuals at the national and county level working in the following sectors: agriculture, education, finance, health, non-communicable diseases, nutrition, social protection and trade. Food outlet owners were interviewed as key informants within the communities. Residents in the community were also interviewed.

Sampling

Quantitative

The 2015/2016 KIHBS sample was drawn from the fifth national sample survey and evaluation program (NASSEP-V). A two-stage cluster sampling design was employed to select a representative sample. In the first stage, 2,400 (988 in urban and 1,412 in rural areas) clusters were selected and 16 households were selected in the second stage while a sub-sample of 10 households was conducted for the main KIHBS. The final sample therefore included 24,000 households comprising 14,120 rural and 9,880 urban households. Sampling weights were calculated for the dataset using selection probabilities of enumeration areas, clusters and households from the NASSEP-V master sample.

Qualitative

The study team purposively selected participants to provide information on the various perceptions and drivers of healthy eating. Participants for the In-depth Interviews (IDIs) and Focus Group Discussions (FGDs) were selected based on their residence and gender. Food outlet vendors were selected based on the location of their stalls and the category they represented. The categories were: supermarkets; shops/kiosks; vegetable/fruit stands/markets; restaurants/local food vendors; and, butcheries/fisheries. The key stakeholders were also identified based on their role in policy/decision making.

Data collection

Quantitative

The 2015/2016 KIHBS used a set of seven survey instruments: three main questionnaires, two diaries, one market questionnaire and one community questionnaire. The three main questionnaires were administered at household level while the market and community questionnaires were administered at cluster level. The questionnaires and the variables of interest in the study are presented below:

i. **Household members' information questionnaire** – used to collect information on demographics, education, occupation, health, child health and nutrition;

ii. **Household level information questionnaire –** used to collect information related to housing, water, sanitation and energy use, income, and food security;

iii. **Household consumption expenditure information questionnaire –** used to collect information related to purchases and consumption of food, non-food items and services in the household, expenses incurred by the households on foods, house rent, healthcare, education, household goods, insurance among other items;

iv. **Household purchases diary –** used to keep a record of food items purchased by members of the household over a seven-day period and administered to five diary households in each sampled cluster;

v. **Household consumption expenditure diary –** used to record food items consumed by the household members over a seven-day period and administered to five diary households in each sampled cluster;

vi. **Market questionnaire –** administered by supervisors to interview the business operators at a marketplace where most of the interviewed households reported making regular purchases. This questionnaire was used to collect prices of all goods and services available in the market to provide the information required to standardize units of measurement of commodities and purchases, as well as to provide additional cluster level data to compute average purchase prices for consumption items.

Qualitative

Data were collected through key informant interviews (KIIs), focus group discussions (FGDs), and in-depth interviews (IDIs). A total of 12 KIIs were held with stakeholders at the national and county level, and 30 KIIs were conducted among food outlet owners. A total of 10 FGDs and 42 IDIs were conducted with community members. An overview of the qualitative interviews conducted is shown in Table 1.

Table 1: Distribution of study participants and data collection methods

	National	Isiolo County		Kisumu County		Nairobi County	
		Isiolo Central sub-county	Garbatulla sub-county	Kisumu East sub-county	Seme sub-county	Westlands sub-county	Embakasi sub-county
Key Informant Interviews (KIIs)	7						
Government representatives		2		3		1	
Food Outlet Owners/Managers		5	5	5	5	5	5
Focus Group Discussions (FGDs)							
Residents		2	2	2	2	1	1
In-depth Interviews (IDIs)							
Residents		7	7	7	7	7	7

1. The numbers in parenthesis are the number of statements or items involved in that group or area.

Data management

Quantitative

Merging of data from the KIHBS with the Kenya Food Composition Table data

Data from the KIHBS was merged with the Kenya Food Composition Table (KFCT) data to obtain energy and nutrient information for each food item consumed. The 2018 Kenya Food Composition Tables (FAO, Ministry of Health, & Ministry of Agriculture and Irrigation, 2018) were used to obtain nutrient composition and energy information for foods consumed in the KIHBS survey. The KFCT lists the energy (Kcal) and nutrient compositions per 100g portions (fresh weights) for commonly consumed foods in Kenya.

Computation of household total aggregate consumption expenditure

The total aggregated consumption expenditure was used as a measure of socioeconomic status for households in the sample. This measure was computed as an aggregate measure of food and non-food consumption expenditures by the households following the best-practice guidelines provided by Deaton and Zaidi (2002). The food consumption component includes expenditures on food consumed from purchases, own production, own stock and gifts over a seven-day recall period. The non-food expenditure component included household expenditure information on house rent, water, electricity, gas, other cooking fuels and healthcare over the last one month as well as expenditure on clothing and footwear over the last three months. This category also included expenditures on education, household goods, furniture and fittings, communication, recreation and culture, insurance, finance products, new/second-hand motor vehicles and accessories, and miscellaneous expenses over the past 12 months.

Generation of adult equivalent age-sex ratio

The number of adult equivalents (AE) was used to adjust for the people for whom energy or food is available. This takes into account that food needs vary by age and sex and was calculated using the steps described by Smith and Subandoro (2007). First, an age-sex category was assigned for each individual in the sample; second, the number of household members in each age-sex category was calculated for each household; third, the number of household members in each age-sex category was then multiplied by an adult equivalent factor which is the energy requirement for the category divided by the energy requirement for adult males 30–60 years old (2,900 kilocalories). Finally, the number of adult equivalents was summed up at household level to obtain the total adult equivalents at household level.

Measures

Outcome

The outcome for this study was an adapted Healthy Diet Index (HDI) using the 2003 WHO/FAO expert recommendations on diet, nutrition and prevention of chronic diseases (Nishida et al., 2004) and the 2018 updated WHO healthy diet fact sheet (WHO, 2018). Nine dietary components were used to construct the composite HDI;

i. fruit and vegetable intake,

ii. total carbohydrate intake,

iii. total protein intake,

iv. total fat intake,

v. saturated fatty acids (FASAT) intake,

vi. polyunsaturated fatty acids (FAPU) intake,

vii. trans-fatty acids intake,

viii. total salt intake, and

ix. total dietary fibre intake.

We generated dummy variables for each of the above HDI dietary components. A value of 1 was allocated if the household met the healthy diet recommendations (Table 2).

Table 2: Dietary recommendations for HDI nutritional components

Dietary factor	Recommendations
Total fat	15–30%
Saturated fatty acids (SFAs)	<10%
Polyunsaturated fatty acids (PUFAs)	6–10%
Trans-fatty acids	1–2%
Total carbohydrates	55–75%
Free sugars	<10%
Protein	10–15%
Fruits and vegetables	≥400 g/day
Total dietary fibre	≥25 g/day
Salt intake	<5 g/day

Principal component analysis (PCA) was used to generate the composite HDI from the nutritional components. Before carrying out the PCA, a Bartlett test of sphericity (Bartlett, 1950) was conducted which tests the null hypothesis that the correlation matrix is an identity matrix, i.e. there is no relationship between the items used to construct the HDI (all diagonal terms are one and all off-diagonal terms are zero). The value of Bartlett's test of sphericity and its significance (10,985.617; p-value=0.000) indicated that all diagonal terms of the correlation matrix are not one and all off-diagonal terms are not zero. Put differently, the nine items used to compute the HDI were correlated. Furthermore, we assessed the number of components to be retained in the PCA using the Kaiser criterion (Kaiser, 1960), i.e. we extracted components with an eigenvalue greater than one. The Akaike information criterion (AIC), Bayesian information criterion (BIC), as well as the Scree test (Cattell, 1966) were used to visualize the number of components. The Scree test plots the eigenvalues in descending order of their magnitude against their component numbers and determining where they level off ("elbow" of the graph). We also used the Horn's Parallel Analysis (Horn, 1965, Dinno, 2009) for principal components to further determine the number of components to retain. Only components whose original eigenvalues were larger than the 95th percentile of the randomly generated eigenvalues were retained (Longman et al., 1989). The Kaiser criterion and Scree test indicated that four components explained 71.58% of variance (Figure 1). Furthermore, based on the parallel analysis (Figure 2), the first four components exhibited adjusted eigenvalues larger than the randomly generated eigenvalues. The components (four) that are not retained are marked with a hollow circle on the adjusted eigenvalues curve. Therefore, we retained four components to compute the HDI score.

Figure 1: Scree plot of eigen values after PCA

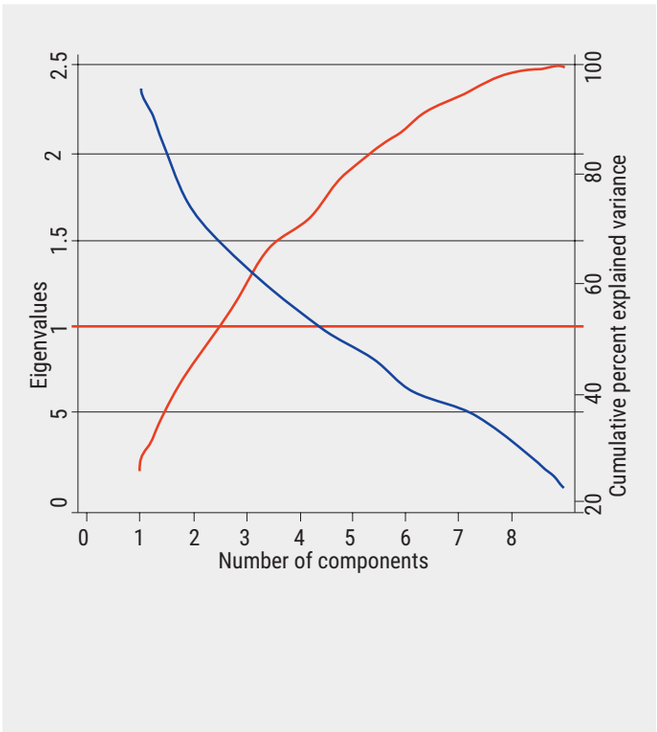
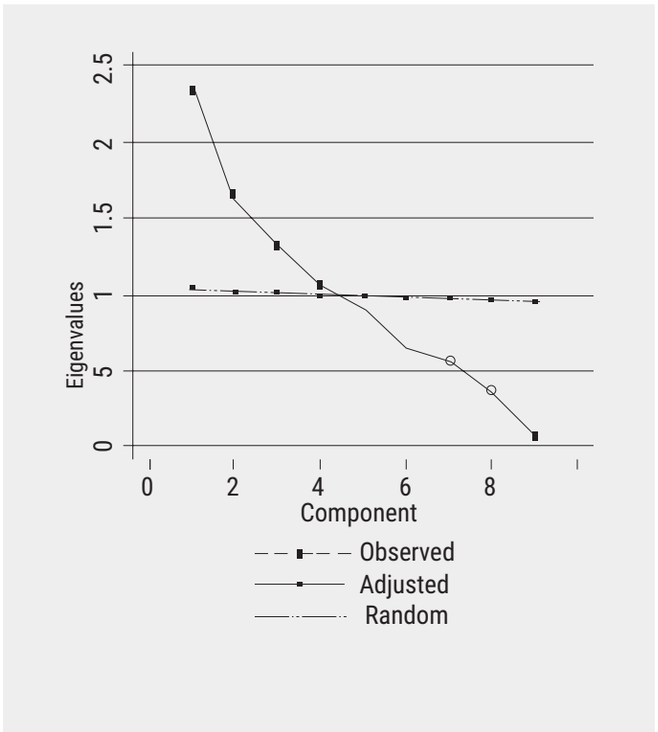


Figure 2: Scree plot of parallel analysis after PCA



Explanatory variables

Predictor variables included in the analysis were the household head's gender, age, education, marital status, religion, residence, socioeconomic status, and household size. Education level of the household head consisted of four categories: no education, completed primary, secondary and above, and other education. The other education category included informal education i.e., Madrasa. Marital status had two categories: in union (this included those married and cohabiting) and not in union (this included those separated/divorced, widowed and never married). Religion was grouped into four categories: Christians, Muslims, other religions, and no religion. Residence indicated whether the household was in a rural or urban area. Socioeconomic status was measured using the monthly per adult equivalent total consumption expenditure of the household measured as a continuous variable. The variable was categorized into quintiles i.e., poorest, poor, middle, rich, and richest.

Data analysis

Quantitative

Descriptive statistics

We described the sociodemographic characteristics of the study sample using frequencies and proportions. Proportions were used to summarize distributions of households meeting recommendations for each component of the HDI by gender and residence, and proportion tests were used to test significant differences. Means, 95% confidence intervals, minimum and maximum values, were used to summarize the overall HDI score, by gender and residence.

i. Assessing the cost of eating healthy in Kenya.

Total consumption expenditure on food was measured using annualized expenditure and expenditure per adult equivalent at household level. The costs were adjusted for inflation using the 2015 (period of the survey) and 2018 (latest available) World Bank GDP deflator estimates[1]. The USD-KES exchange rate was calculated as an average of the 2018 World Bank estimates to get a value of KES 101.288 for 1 USD. Means and 95% confidence intervals were used to summarize the adjusted annualized expenditure and expenditure per adult equivalents at household level by the HDI component categories. This was disaggregated by gender and residence and student's T-tests were used to assess significant differences in the expenditure between groups.

ii. Exploring socioeconomic inequality in eating healthy in Kenya by gender and residence

We used two approaches to measure socioeconomic inequality: the rate ratio (RR) and the concentration index *(CI)*. First we computed the rate ratio (RR) in the most-advantaged group (richest quintile) divided by the HDI in the most disadvantaged group (poorest quintile). The 95% confidence interval of the RR is estimated using the Delta method (Taylor first approximation). Then the *CI* was used to examine whether healthy versus unhealthy eating is evenly distributed across poorer and richer households, with respect to gender, and place of residence. To compute the *CI*, households were ranked by wealth quintiles beginning with the poorest in the population. A concentration curve (L(s)), was plotted that presents the cumulative percentage of the population ranked by wealth quintiles against their cumulative percentage of healthy and unhealthy eating (Allen et al., 2017, Moradi et al., 2013, O'donnell et al., 2007, Kakwani et al., 1997, Wagstaff et al., 1991, Wagstaff et al., 1989). The *CI* is computed between -1 and 1 with a negative value signifying that food expenditure is entirely concentrated among the poorest households while a positive index value implies that food expenditure tends to be concentrated among the richer households. When there is no inequality, the index will be zero. The *CI* is twice the area between the concentration curve (L(s)) and the diagonal, and it is given by the following formula:

$$CI = \frac{2}{\mu}\mathrm{cov}(FC_i, r_i), \qquad (1)$$

where μ is the mean of real food expenditure use; r_i is the fractional rank of the ith individual; FC_i is the wealth-related inequality in food consumption and cov are the covariates added into the model. Socioeconomic inequalities nationwide, by gender and residence, were presented as the *CI* value, standard error and p-value. The index was considered significant if p-value was < 0.05. Lorenz concentration curves were also presented.

iii. Determinants of healthy food consumption in Kenya

A multivariable linear regression model was fitted to assess factors associated with healthy food consumption in Kenya. Crude and adjusted marginal effects as well as standard errors were reported for each determinant. Variables were considered significant determinants if their p-value was < 0.05.

iv. Examining the factors that generate inequality in eating healthy in Kenya.

One key property of the *CI* is its decomposition into underlying determinants which explain socioeconomic inequalities in food consumption. This enables the impact of each determinant and its contribution to be estimated. We followed the method de-

1. https://databank.worldbank.org/reports.aspx?source=world-development-indicators#

scribed by (Wagstaff et al., 2001) to disaggregate the *CI* into contributions of individual factors to socioeconomic inequalities in food consumption.

We assumed that food consumption (FC_i) could be described as a linear relationship with a vector of covariates (X_{ki}) such as age, education, aggregate consumption, gender, place of residence, household size etc., affecting food consumption. The equation was written as follows:

$$\mathrm{FC_i} = a_i + b_k X_{ki} + \varepsilon_i , \quad (2)$$

then the *CI* was written as:

$$CI = \sum_k \left(\frac{b_k \bar{x}_k}{\mu} \right) C_k + \frac{GC_\varepsilon}{\mu} , \quad (3)$$

with C_k the concentration index for each covariate which suggests the degree to which the covariate itself varies with respect to socioeconomic status; b_k is the coefficient or partial effect for each covariate; is the generalized *CI* for the residual (ε_i). The term is the elasticity of food consumption with respect to the covariate, and the following term $\left(\frac{b_k \bar{x}_k}{\mu}\right) C_k$ is the contribution of each covariate to the socioeconomic inequality in food consumption. The percentage contribution is obtained by dividing the contribution by the overall income-related inequality. The results are presented as a bar graph with contributions of the set of selected covariates.

v. Assessing the price and expenditure elasticities of food consumption

The estimations of price and expenditure elasticities utilized data from the Kenyan Integrated Health Budget Survey (KIHBS) that was undertaken in 2015-2016. This nationally representative survey compiled the most recent and available dataset on food and non-food consumption expenditures, including data from both rural and urban areas. The research measured the responsiveness of demand for food, focusing on nine food items, including bread and cereals; meat, fish and seafood; milk, cheese and eggs; oils and fats; fruits; vegetables; sugar and other confectioneries; salt and non-essential condiments (NECs); coffee, tea and cocoa. The quadratic almost ideal demand system model based on standardized approaches (Deaton and Muellbauer, 1980) was followed to derive relationships (i.e. elasticities) between the share of expenditure on a product and its price, the prices of other products and the total value of expenditure being incurred by households. An uncompensated demand function that maximizes utility given prices and wealth was prioritized in estimating own- and cross-price elasticities.

vi. Exploring perceptions and drivers of healthy versus unhealthy food choices in Kenya

Interview guides and audio recorders were used to gather the information from the participants. The recorded interviews were then retrieved and labelled anonymously before transcription. The audio recordings were transcribed by a seasoned transcriber from Swahili to English and a few others from local languages to English. The data analysis utilized a thematic approach, that is, themes were developed and the data coded. The thematic areas included: perceptions on eating healthy, facilitators of healthy eating, barriers to healthy eating, perceptions on the cost of healthy eating and, recommendations for healthy eating.

3. Key Findings

Quantitative findings

Sociodemographic characteristics of the study sample

The analytical dataset used in this study excluded 2,488 households whose food energy and nutrient composition equivalents could not be obtained from the Kenya Foods Composition Tables (KFCT). This meant that healthy or unhealthy consumption status could not be determined. Thus, a final dataset containing 21,512 households in Kenya was used. The average household size was 4.0 (SD 2.4) members and the average age of the household heads was 43 years (SD 15.7). Male household heads were on average 42 years (SD 14.9) while female household heads were 46 years (SD 17.0), with about two thirds falling between 30 and 59 years of age. The average monthly per adult equivalent consumption expenditure was USD 76.5 (SD 75.6). Majority of households were in the rural areas (60%), headed by males (66%), had up to primary level education (65%), were living in marital union (71%) and practiced Christianity (83%) as seen in Table 3. Appendix 1 shows a summary of continuous sociodemographic characteristics of the study sample.

Table 3: Sociodemographic characteristics of the study sample

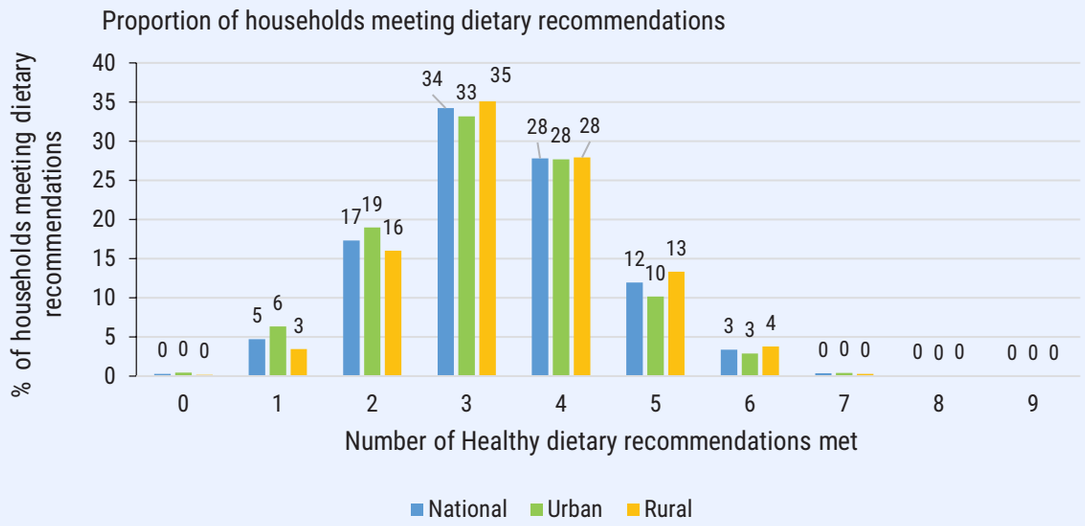
	n	%
Age group		
Below 30 years	3,890	18.1
30 – 44 years	8,234	38.3
45 – 59 years	5,308	24.7
60 years and above	4,080	19.0
Residence		
Urban	8,556	39.8
Rural	12,956	60.2
Gender of household head		
Female	7,266	33.8
Male	14,246	66.2
Education of household head		
No education	4,446	20.7
Primary	9,540	44.4
Secondary and above	7,387	34.3
Other	139	0.7
Marital status of household head		
Not in union	6,229	29.0
In union	15,283	71.0
Religion		
Christian	17,778	82.6
Muslim	2,826	13.1
Other religion	278	1.3
No religion	630	2.9
Socioeconomic Status		
Poorest	7,149	33.2
Poor	5,003	23.3
Middle	3,997	18.6
Rich	3,162	14.7
Richest	2,201	10.2
Total	**21,512**	**100.0**

Patterns of healthy diet consumption in Kenya

Number of dietary recommendations met by Kenyan households

Figure 3 shows the number of healthy diet recommendations met by Kenyan households overall and by residence. The findings indicate that the majority of Kenyan households (84%) met four or less of the healthy diet recommendations with no households meeting more than seven of the recommendations. The picture was similar by residence with 82% and 86% of rural and urban households meeting four or less of the healthy diet recommendations.

Figure 3: Proportion of Kenyan households meeting WHO/FAO healthy diet recommendations overall, and by residence



Proportion of households meeting WHO recommendations for HDI components

Table 4 shows the proportion of households in Kenya who met the WHO healthy diet recommendations for each HDI component. Forty-five percent of households met the recommended fruit and vegetable intake. More female-headed households (50%) and urban households (52%) met the recommended fruit and vegetable intake compared to their male-headed (43%) and rural (40%) counterparts, and this was statistically significant. With regard to the recommended total fat intake, majority of households (87%) met the recommendations with more female-headed (88%) and rural households (88%) meeting these recommendations than male-headed (86%) and urban households (86%). Overall, only 25% of households met the recommended total carbohydrate intake, with more female-headed (30%) and rural households (13%) meeting the recommendations compared to their counterparts. A similar pattern was observed for total protein and dietary fibre recommendations. Overall, about a third of the households met the recommended saturated fat intake with more urban households meeting the recommendation compared to their rural counterparts. Only 5% of households met the recommended polyunsaturated fats intake level with more urban households meeting this requirement compared to their rural counterparts. Overall, only 3% of households met the recommended total trans-fats energy requirements with more males meeting this requirement. Appendix 2a and Appendix 2b show the proportions of households above and below recommended healthy diet ranges respectively for selected nutritional components of HDI.

Table 4: Proportion of households meeting WHO recommendations for various components of HDI

		Gender		Residence		Socioeconomic Status				
HDI Components	**Overall (%)**	**Female**	**Male**	**Urban**	**Rural**	**Poorest**	**Poor**	**Middle**	**Rich**	**Richest**
Fruits and vegetables, >400g per day	45.3 (44.6 – 45.9)	49.9*** (48.7 – 51.0)	43.1 (42.2 – 43.9)	52.0*** (51.0 – 53.1)	40.0 (39.2 – 40.9)	15.0 (14.2 – 15.8)	37.3 (36.0 – 38.6)	51.9 (50.4 – 53.5)	63.3 (61.6 – 65.0)	79.7 (78.0 – 81.4)
Total fat, 15-30% of total energy	86.7 (86.3 – 87.2)	88.2*** (87.5 – 89.0)	86.0 (85.5 – 86.6)	85.6 (84.9 – 86.4)	87.6** (87.0 – 88.2)	85.0 (84.2 – 85.9)	89.2 (88.3 – 90.0)	87.9 (86.9 – 88.9)	86.9 (85.7 – 88.1)	84.6 (83.1 – 86.1)
Total carbohydrates, 55%-75% of total energy	25.3 (24.7 – 25.9)	30.1*** (29.0 – 31.1)	23.0 (22.3 – 23.7)	20.8 (20.0 – 21.7)	28.8*** (28.0 – 29.5)	30.9 (29.8 – 31.9)	32.0 30.7 – 33.3)	28.0 (26.6 – 29.3)	18.7 (17.4 – 20.1)	10.7 (9.4 – 12.0)
Total Protein, 10%-15% of total energy	21.0 (20.4 – 21.5)	24.7*** (23.67 – 25.6)	19.2 (18.5 – 19.8)	14.3 (13.5 – 15.0)	26.1*** (25.3 – 26.8)	36.7 (35.6 – 37.8)	22.5 (21.4 – 23.7)	17.0 (15.9 – 18.2)	9.8 (8.8 – 10.9)	9.2 (8.0 – 10.4)
Saturated Fats, <10% of total energy	32.9 (32.3 – 33.6)	33.7 (32.6 – 34.7)	32.6 (31.8 – 33.4)	39.8*** (38.7 - 40.8)	27.7 (26.9 – 28.4)	35.0 (33.9 – 36.1)	28.7 (27.5 – 30.0)	30.8 (29.3 – 32.2)	33.2 (31.5 – 34.8)	37.6 (35.6 – 39.6)
Polyunsaturated Fats, 6%-10% of total energy	5.0 (4.7 – 5.3)	4.4 (4.0 – 4.9)	5.3 (4.9 – 5.7)	6.5*** (6.0 – 7.0)	3.9 (3.5 – 4.2)	1.7 (1.4 – 2.0)	4.1 (3.6 – 4.7)	4.3 (3.6 – 4.9)	6.4 (5.5 – 7.3)	11.5 (10.1 – 12.8)
Trans-Fats, <1% of total energy	3.0 (2.7 – 3.2)	2.3 (2.0 – 2.6)	3.3*** (3.0 – 3.5)	2.6 (2.3 – 3.0)	3.2 (2.9 – 3.5)	2.4 (2.0 – 2.7)	3.5 (3.0 – 4.0)	3.1 (2.5 – 3.6)	2.4 (1.9 – 3.0)	3.6 (2.8 – 4.4)
Dietary fibre, <25g/day	71.0 (70.4 – 71.6)	76.8*** (75.8 – 77.8)	68.2 (67.5 – 69.0)	56.5 (55.5 – 57.6)	82.1*** (81.5 – 82.8)	7.1 (7.0 – 7.2)	7.7 (7.6 – 7.8)	7.0 (6.9 – 7.2)	6.8 (6.6 – 7.0)	6.7 (6.5 – 6.9)
Salt intake, <5g/ day	45.6 (45.0 – 46.3)	38.8 (37.6 – 39.9)	48.9*** (48.1 – 49.7)	47.2 (46.1 – 48.2)	44.5 (43.6 – 45.3)	56.7 (55.6 – 57.9)	44.6 (43.2 – 45.9)	42.4 (40.9 – 43.9)	39.8 (38.1 – 41.5)	38.6 (36.6 – 40.6)

Notes: We are reporting the proportion of households who met the criteria for healthy eating based on WHO recommendations. Survey weights are used to account for the survey design and clustering. The 95% CI were computed using the Delta method. ** $p < 0.05$, *** $p < 0.01$

Distribution of HDI score by gender, residence, socioeconomic status, and county

Table 5 shows a summary of HDI score countrywide, by gender, residence and socioeconomic status. The HDI score ranges from -1.13 to 1.70, with a higher score indicating healthier eating as per WHO/FAO dietary recommendations. The overall mean HDI score in Kenya was 0.24, with female-headed households scoring 0.25 and male-headed households scoring 0.24. Similarly, the mean for urban residents was 0.25 while that for rural residents was 0.23. In terms of socioeconomic status, the findings indicate an increasing trend in HDI with rising socioeconomic status, meaning that households with higher socioeconomic status were eating healthier. For instance, while the mean HDI is -0.02 for the poorest households, it is 0.46 for the wealthiest households.

Table 5: Summary of HDI score overall, by gender, residence and wealth quintile

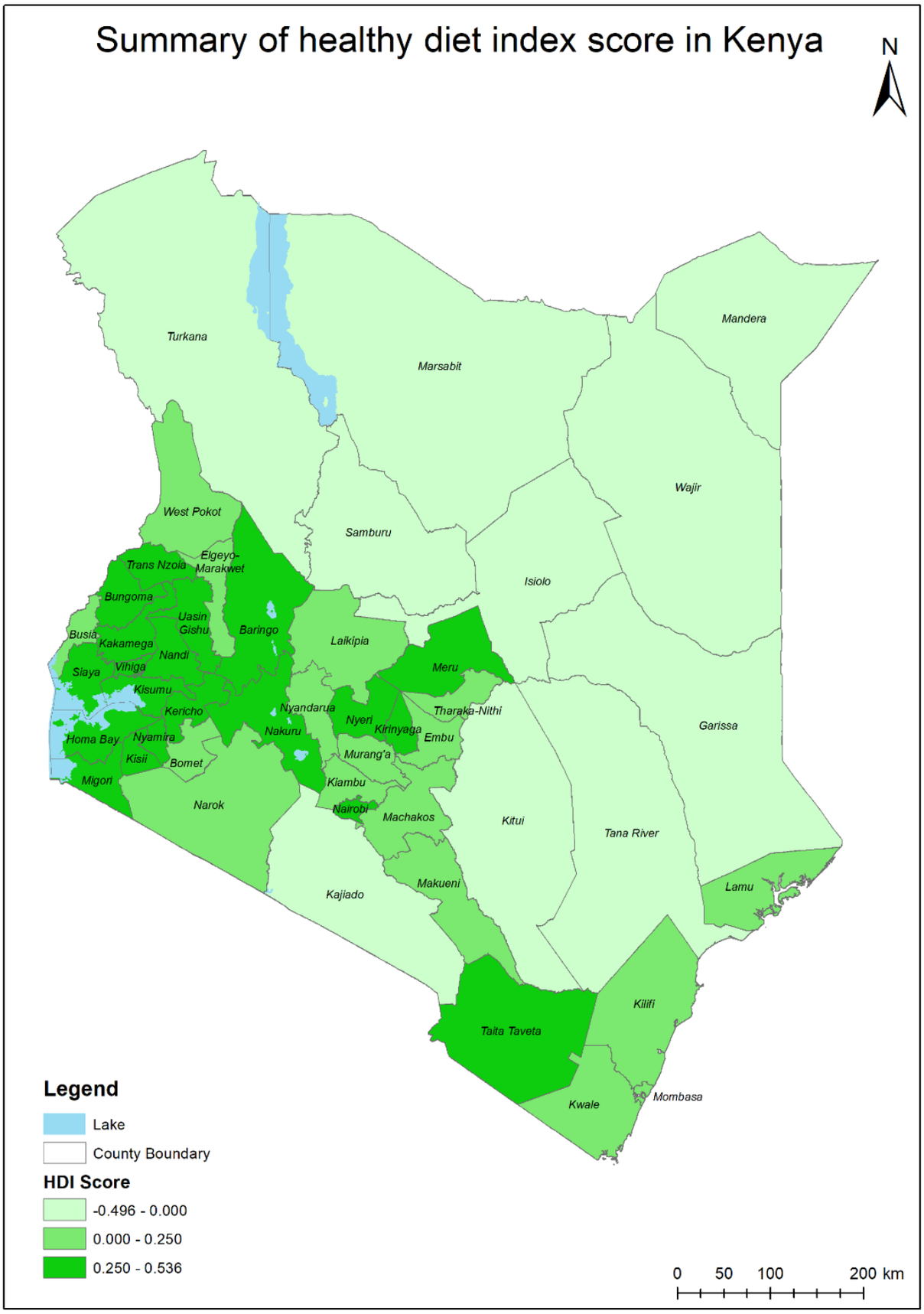
	Mean	95% CI		Minimum	Maximum
Overall	0.24	0.24	0.25	-1.13	1.70
Gender					
Female	0.25	0.24	0.26	-1.13	1.70
Male	0.24	0.23	0.25	-1.13	1.70
Residence					
Urban	0.25	0.24	0.26	-1.13	1.70
Rural	0.23	0.22	0.24	-1.13	1.70
Socioeconomic status					
Poorest	-0.02	-0.03	-0.01	-1.13	1.70
Poor	0.17	0.16	0.18	-1.13	1.70
Middle	0.25	0.24	0.27	-1.13	1.70
Rich	0.34	0.33	0.35	-0.98	1.70
Richest	0.46	0.45	0.48	-0.98	1.70

Notes: N=total, n=frequency, Survey weights are used to account for the survey design and clustering

Distribution of HDI score by county

Distribution of the HDI scores by county showed that Western counties had higher HDI values in comparison to counties in ASAL (arid and semi-arid lands) areas which had the lowest HDI scores (Figure 4). It was also evident that counties that were neighbouring high HDI counties had moderate HDI scores.

Figure 4: The distribution of HDI scores in Kenya by county



Costs of health eating in Kenya

Table 6 shows adjusted household annualized expenditure and adjusted annualized expenditure per adult equivalent on total food consumption overall, by gender, residence and socioeconomic status. The overall annualized household expenditure on total food consumption in Kenya was USD 1,482.14 (150,109 KES) and the annualized expenditure per adult equivalent was USD 598.34 (60,605 KES). Male-headed households had a significantly higher annualized expenditure compared to female-headed households. The adult equivalents were higher for male-headed (3.22; 95% CI 3.19-3.25) than female-headed (2.67; 95% CI 2.63-2.71) households. However, the annualized expenditure per adult equivalent was significantly higher for female-headed (USD 640.94 (64,920 KES)) households than male-headed (USD 578.04 (58,549 KES)) ones. Urban households had significantly higher annualized expenditure and expenditure per adult equivalent than rural households. Annualized expenditure and expenditure per adult equivalent on food consumption increased with higher socioeconomic status, but these increments were not statistically significant.

Table 6: Adjusted household annualized total expenditure and expenditure per adult equivalent on food consumption (USD)

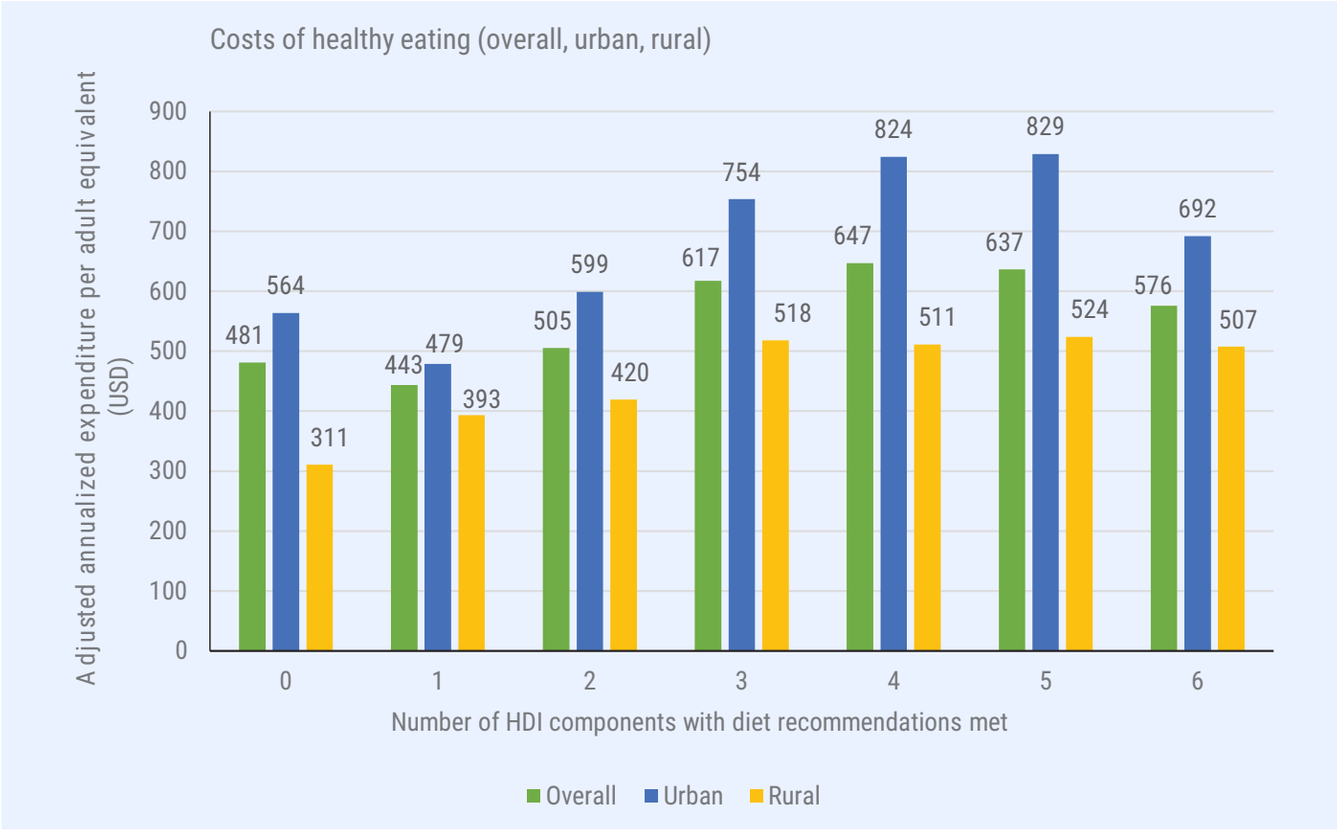
	Household cost			Cost per adult equivalent		
	Cost (USD)	Confidence Interval		Cost (USD)	Confidence Interval	
Overall	1482.14	1468.07	1496.21	598.34	591.97	604.71
Gender						
Female	1291.74	1271.86	1311.62	640.94***	628.71	653.18
Male	1572.90***	1554.49	1591.30	578.04	570.71	585.37
Residence						
Urban	1584.65***	1558.89	1610.41	730.90***	718.93	742.87
Rural	1403.16	1387.66	1418.66	496.21	489.94	502.48
Socioeconomic status[a]						
Poorest	1023.25	1010.33	1036.17	263.95	261.44	266.46
Poor	1367.30	1347.04	1387.56	426.76	422.41	431.10
Middle	1500.78	1473.86	1527.69	565.88	559.00	572.76
Rich	1661.77	1623.41	1700.12	751.70	740.59	762.81
Richest	2211.38	2142.96	2279.81	1283.67	1253.45	1313.90

Notes: ** p<0.05, ***p<0.01; 2018 Exchange rate (1 USD=101.288 KES); a=to account for multiple comparison correction, we report the p-value using Bonferroni correction which shows significant differences at 1% level. Survey weights are used to account for the survey design and clustering.

Annualized expenditure per adult equivalent on total food consumption by HDI components

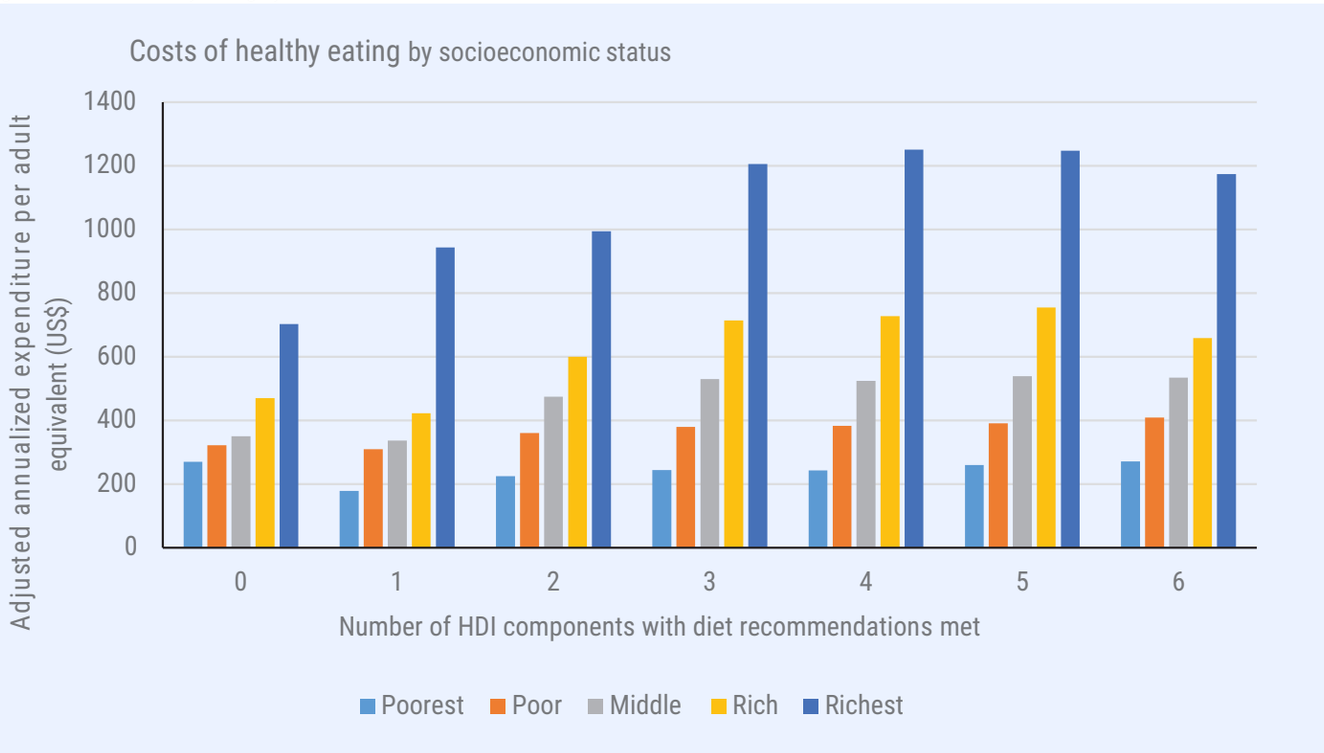
Figure 5 shows a bar graph summarizing the mean annualized expenditure per adult equivalent by the number of HDI components with diet recommendations met. Overall, households that met six of the nine dietary recommendations spent on average USD 576 (58,346 KES) per person per year, while those that did not meet any of the dietary recommendations spent on average USD 481 (48,720 KES) per person per year. Urban households that met six of the nine dietary recommendations spent significantly more per adult equivalent (USD 692 (70,091 KES)) annually in comparison to rural households (USD 507 (51,353 KES)).

Figure 5: Costs of healthy eating overall, and by residence



The results showed that there were differences in healthy eating by socioeconomic status. Poorer households spent less to meet the healthy dietary recommendations in comparison to the wealthiest households. For instance, for households that met six out of the nine dietary recommendations, the richest households spent USD 1,174 (KES 118,912) compared to USD 271 (KES 27, 449) in the poorest households (Figure 6).

Figure 6: Costs of healthy eating by socioeconomic status



Significant differences in the costs of healthy eating were noted by gender. For households that met one, three and four of the healthy dietary recommendations, female-headed households spent more in meeting the recommendations in comparison to their male counterparts (Figure 7).

Figure 7: Costs of healthy eating by gender of household head

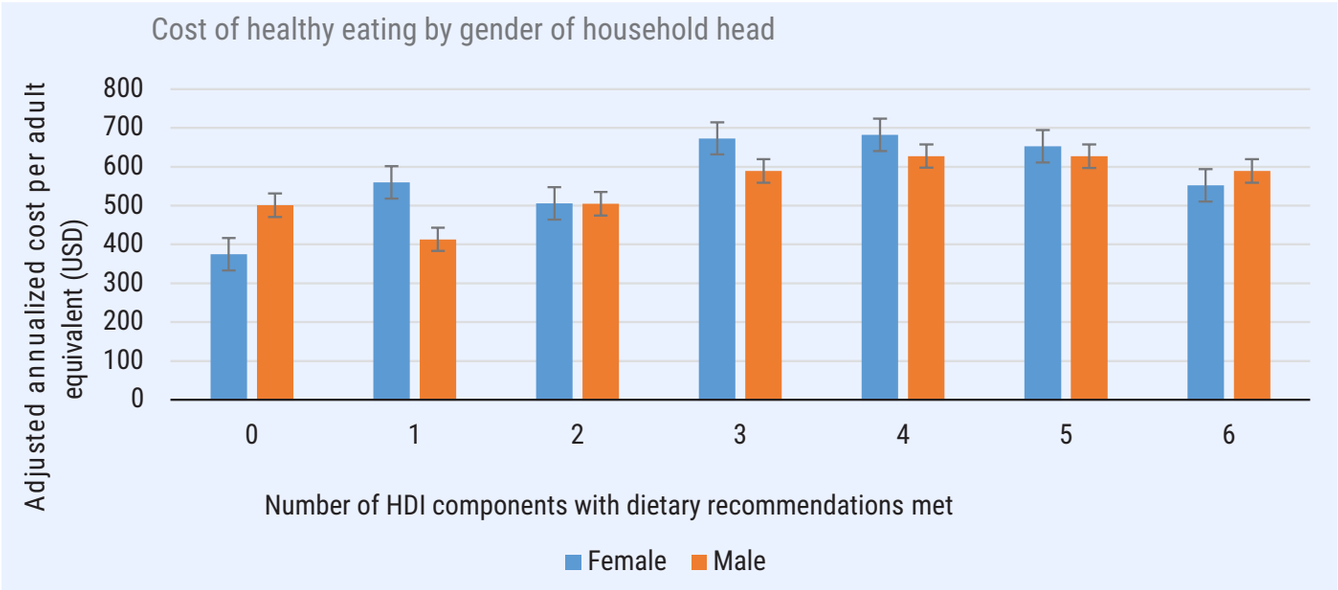


Figure 8 presents adjusted annualized expenditure per adult equivalent on total food consumption by HDI component. Households meeting fruit and vegetable recommendations spent significantly more (USD 822.66 (84,635 KES)) than those that did not meet the recommendations (USD 412.97 (42,486 KES)). The same pattern was observed for total fats, polyunsaturated fats, dietary fibre, and trans-fats as households which met the healthy requirements had significantly higher annualized expenditure per adult equivalent on food consumption. There were no significant differences in expenditure for saturated fats. On the contrary, households eating unhealthily with regard to carbohydrates, proteins and salt intake had significantly higher annualized expenditure per adult equivalent on total food consumption in comparison to those with healthy eating. Turning to gender, female-headed households that met the fruit and vegetables dietary recommendations spent significantly more than male-headed households that met the same recommendations (Figure 9). No significant differences by gender were observed for the other dietary recommendations. For fruits and vegetables, total fats, polyunsaturated fats and dietary fibre, urban households who met dietary recommendations spent significantly more annually per adult equivalent in comparison to rural households (Figure 10).

Figure 8: Adjusted household annualized expenditure per adult equivalent on total food consumption by healthy diet index (HDI) components

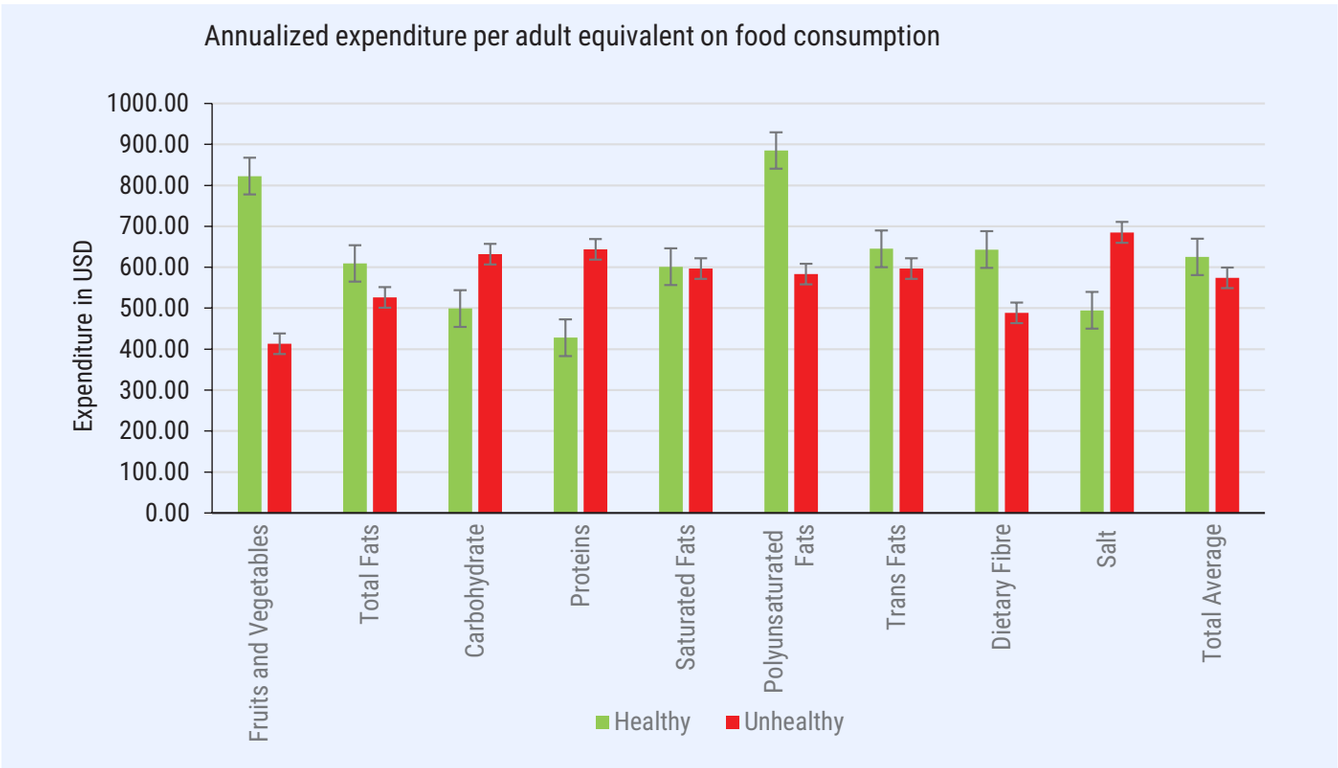


Figure 9: Adjusted household annualized expenditure per adult equivalent on total food consumption by healthy diet index (HDI) components, disaggregated by gender

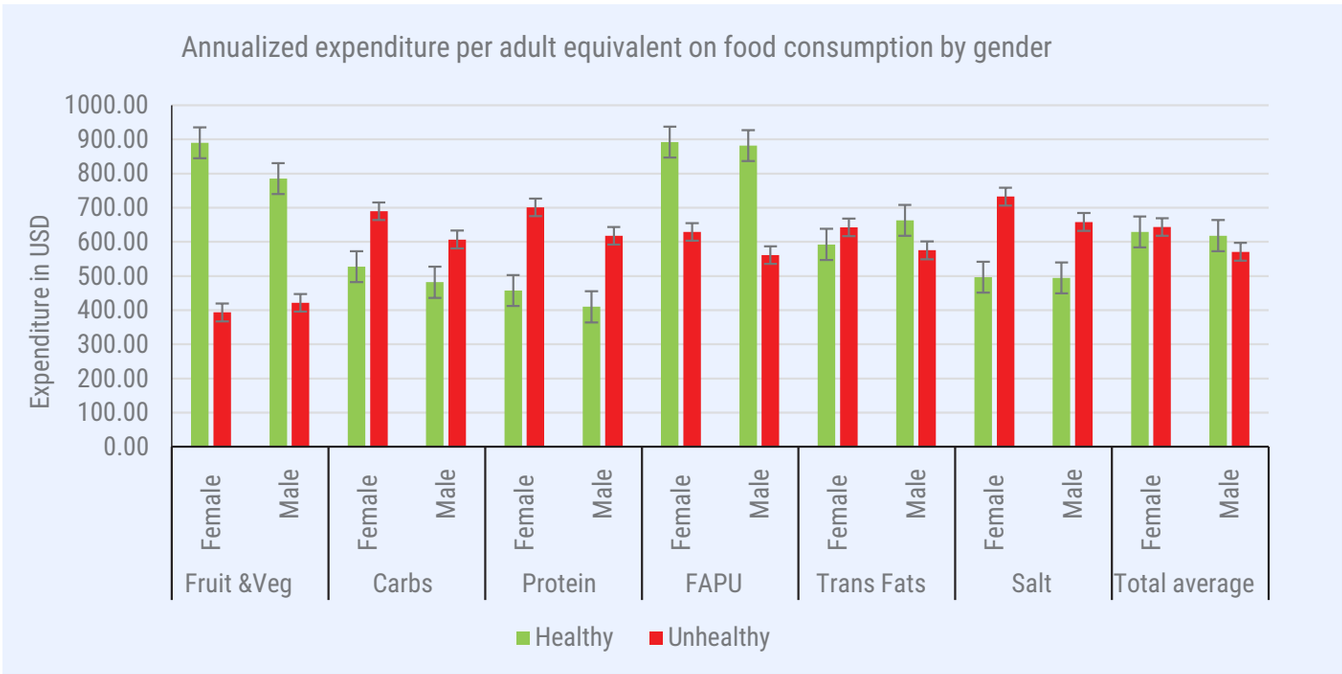
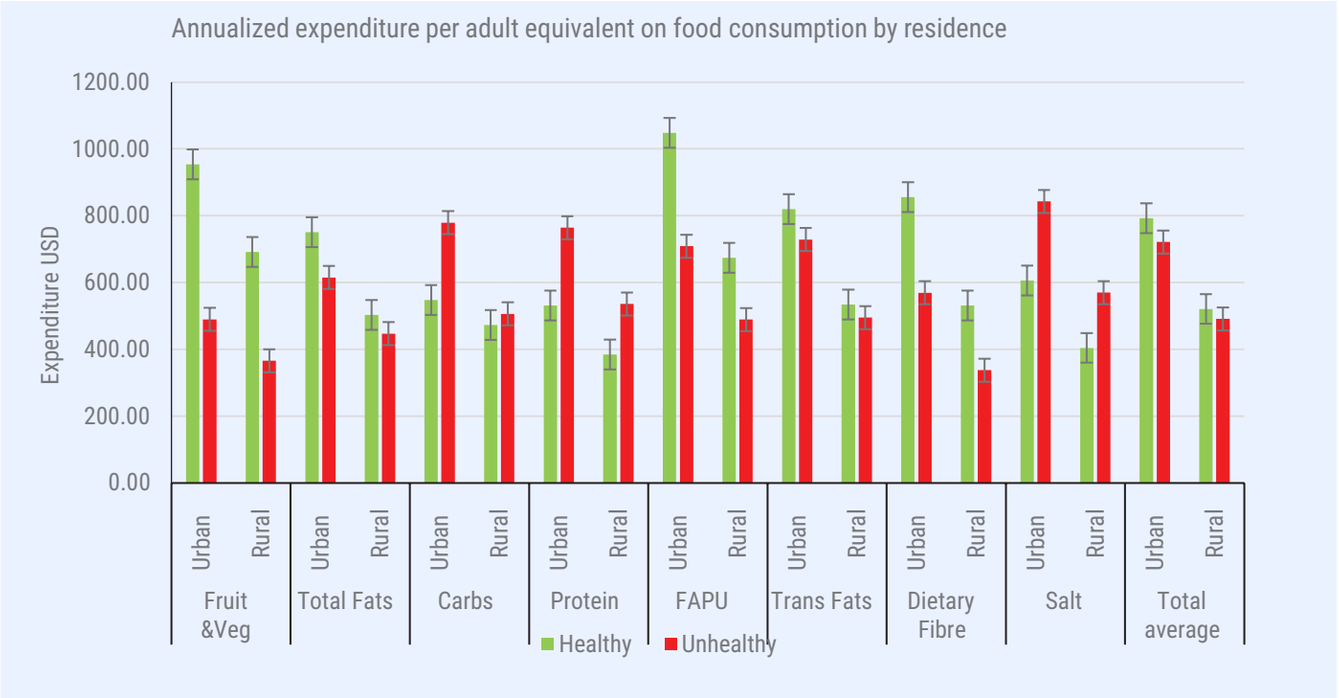


Figure 10: Adjusted household annualized expenditure per adult equivalent on total food consumption by healthy diet index (HDI) components, disaggregated by residence (urban/ rural)



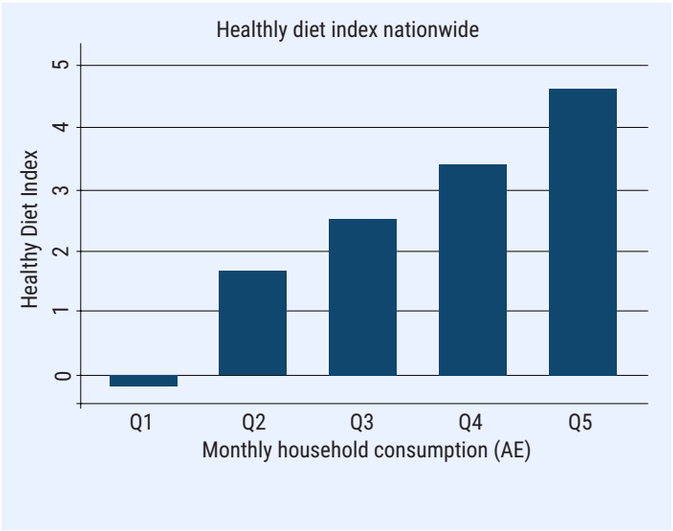
Socioeconomic inequalities in healthy eating in Kenya, by gender and residence

In this study, we used the relative ratio (RR) and concentration index (CI) approaches to explore socioeconomic inequalities in healthy eating.

Socioeconomic inequalities in HDI score overall, by gender and residence

Figure 11 presents the distribution of HDI scores by wealth quintile using the relative ratio approach. Overall, healthy food consumption by the richest households is more than double that of the poor households (RR=2.74 (95% CI 2.52-2.96). Similarly, the same pattern is observed with regard to gender (Figure 12) and residence (Figure 13) of households. Irrespective of the gender (for male, RR=2.60, 95% CI 2.34-2.86; female RR=3.09, 95% CI 2.68-3.50) and residence (for rural, RR=2.45, 95% CI 2.23-2.66; urban RR=18.73, 95% CI 1.69-35.77), the richest households consumed healthier foods in comparison to poor households.

Figure 11: Summary of HDI by wealth quintile countrywide



Notes: Q1=Poorest, Q2=Poor, Q3=Middle, Q4=Rich, Q5=Richest

Figure 12: Summary of HDI by wealth quintile disaggregated by gender

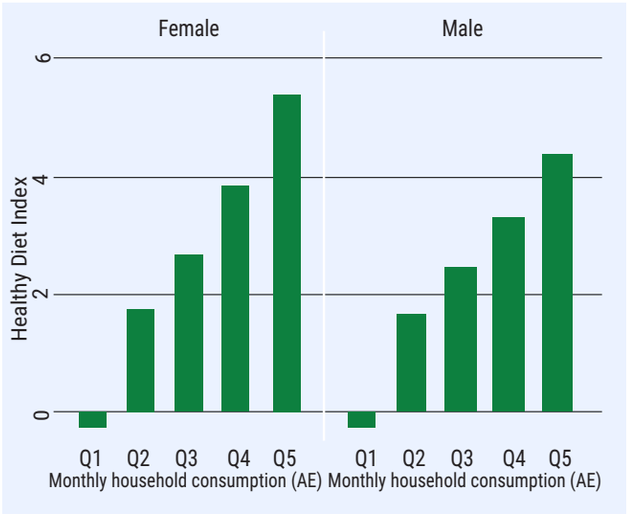
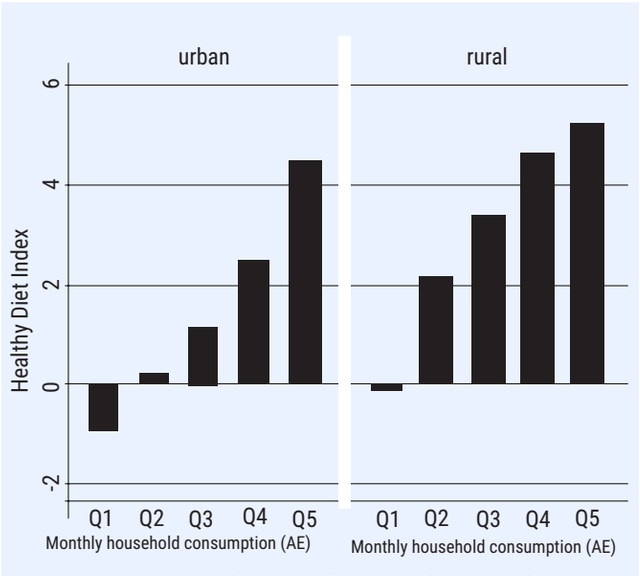


Figure 13: Summary of HDI by wealth quintile disaggregated by residence



Notes: Q1=Poorest, Q2=Poor, Q3=Middle, Q4=Rich, Q5=Richest

Table 7: Concentration index *(CI)* values of HDI countrywide, by gender and residence

	CI value	S.E.	p-value
Overall	0.403	0.014	0.000
Gender			
Female	0.464	0.020	0.000
Male	0.374	0.016	0.000
Residence			
Urban	0.414	0.021	0.000
Rural	0.489	0.013	0.000

Notes: The *CI* is estimated using the Wagstaff's method. Survey weights are used to account for the survey design and clustering.

Table 7 shows the results of socioeconomic inequality analysis of HDI overall, by gender and residence, based on the Concentration Index *(CI)*. The results indicated that eating healthy foods in Kenya was concentrated among the richest households (*CI* = 0.40, p<0.01). This result is confirmed by the finding in Figure 14, which shows that the concentration curve was below the line of perfect equality. Similar results (Table 7, Figure 15 and Figure 16) were observed with respect to gender (Female *CI*=0.46, p<0.01; Male *CI*=0.37, p<0.01) and residence (Rural *CI*=0.50, p<0.01; Urban *CI*=0.41, p<0.01). The results suggest that inequality in eating healthy food was greater among female-headed households (diff=0.09, p<0.01) and rural households (diff=0.07, p<0.01).

Figure 14: Concentration curve of HDI nationwide

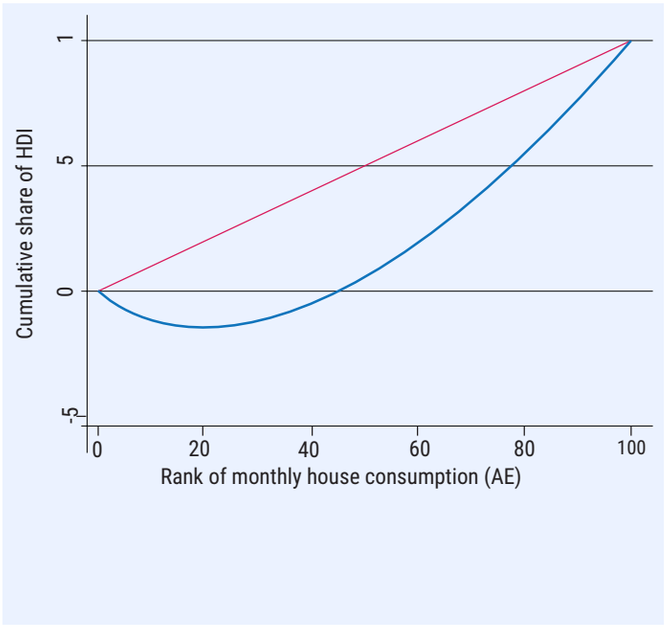


Figure 15: Concentration curve of HDI by gender

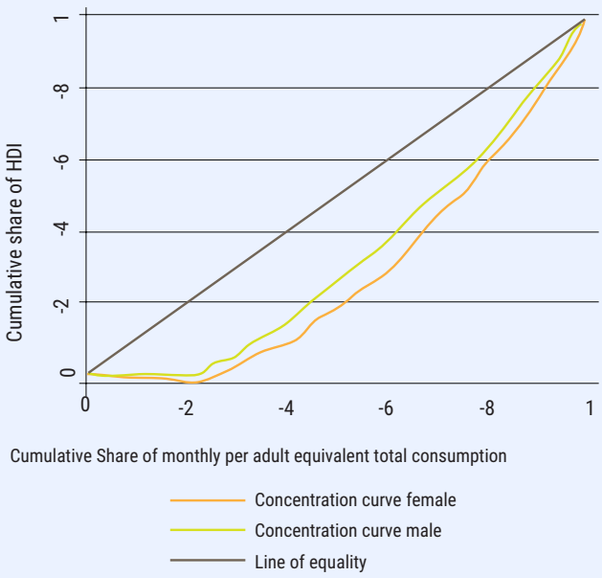
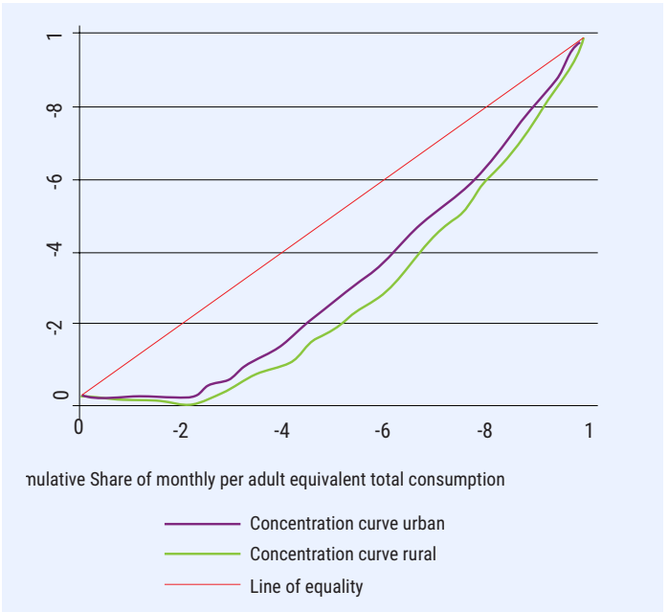


Figure 16: Concentration curve of HDI by residence



Determinants of healthy food consumption in Kenya

Table 8 shows the determinants of eating healthy in Kenya. In model 1, we explore the unadjusted relationship between eating healthy foods and aggregate consumption expenditure per adult equivalent while in model 2 we control for other factors. Irrespective of the model used, the findings indicated that healthy eating was positively and significantly associated with increased aggregate consumption expenditure per adult equivalent, suggesting that the wealthier the households, the more likely they were to consume healthy foods. In other words, if the aggregate consumption expenditure per adult equivalent increases by 10%, their probability of eating healthy foods would eventually increase by 0.028 or 2.8 percentage points.

The findings show that as the number of household members aged under five increases, the probability for healthy eating increased by 0.02 whereas as the number of household members aged 13-19 years and 40-64 years increases, the probability for healthy eating decreased by 0.01 and 0.03 respectively. Furthermore, being from a male-headed household decreased the probability of eating healthy foods by 0.05. As the age of the household head increases, the probability of eating healthy foods increased by 0.003. The results also indicated that not having formal education decreased the probability of eating healthy foods by 0.11 while being employed or self-employed increased the probability for healthy eating by 0.04 and 0.03 respectively. Being in a rural household increased the probability for healthy eating by 0.2. With regard to marital status and religion, being in union increased the probability of eating healthy foods by 0.04 while being a Christian was associated with the increased probability of eating healthy foods by 0.11.

Table 8: Determinants of healthy food consumption in Kenya

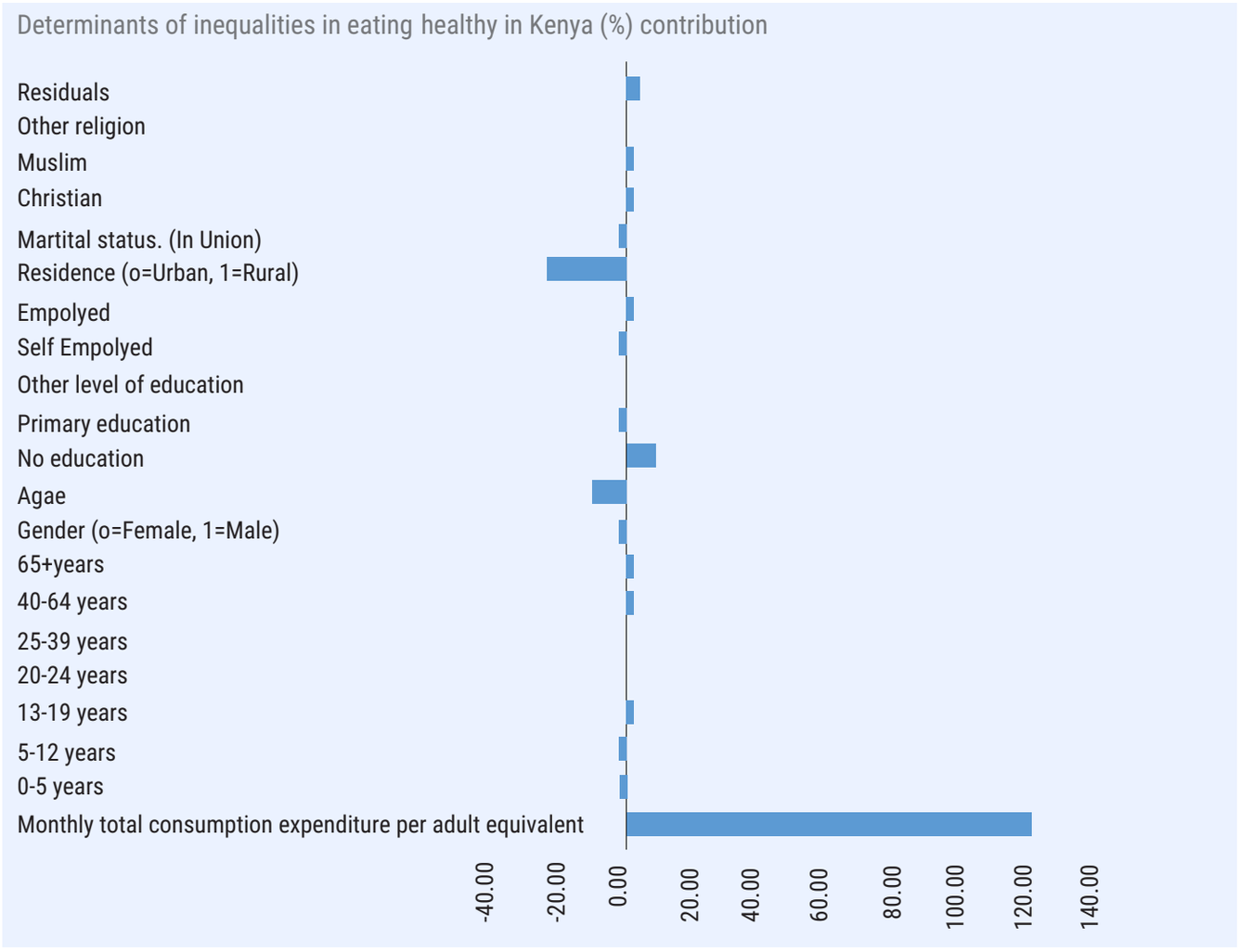
	Model 1 Unadjusted Marginal Effects	Model 2 Adjusted Marginal Effects
Log of monthly per adult equivalent total consumption expenditure	0.23*** (0.01)	0.28*** (0.01)
Number of members 0-4 years		0.02*** (0.01)
Number of members 5-12 years		0.01* (0.00)
Number of members 13-19 years		-0.01** (0.00)
Number of members 20-24 years		0.01 (0.01)
Number of members 25-39 years		-0.01 (0.01)
Number of members 40-64 years		-0.03*** (0.01)
Number of members 65+ years		-0.02 (0.01)
Female (Ref)		0.00 (.)
Male		-0.05*** (0.01)
Household head age in years		0.003*** (0.00)
Secondary and above (Ref)		0.00 (.)
No education		-0.11*** (0.02)
Primary		0.01 (0.01)
Other		-0.12** (0.05)
Unemployed (Ref)		0.00 (.)
Self-employed		0.03** (0.02)
Employed		0.04** (0.02)
Urban (Ref)		0.00 (.)
Rural		0.16*** (0.01)
Not in union (Ref)		0.00 (.)
In union		0.04*** (0.01)
No Religion (Ref)		0.00 (.)
Christian		0.11*** (0.02)
Muslim		-0.12*** (0.03)
Other religion		0.03 (0.04)
Constant		-2.54*** (0.08)
Observations		21512

Notes: Standard errors in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01. Ref: Reference category. Survey weights are used to account for the survey design and clustering.

Factors that generate inequalities in healthy eating

Figure 17 shows results of the percentage contribution of different factors to inequalities in healthy eating from the decomposition analysis of the *CI*. A detailed table showing elasticity, concentration index values, absolute contribution, and percentage contribution of each factor is shown in Appendix 3. The factors included in the decomposition analysis explained 97.1% of overall inequality in healthy eating in Kenya. The unexplained determinants (residuals) contributed only 2.9% to the inequalities in healthy eating observed. The results show that inequalities in healthy eating were mainly explained by monthly total consumption per adult equivalent (119.7%), residence (-23.4%), age (-8.2%) and education (7.2%) of the household head.

Figure 17: Percentage contribution of socioeconomic factors to inequalities in eating healthy in Kenya



Expenditure and price elasticities of commonly consumed foods in Kenya

Table 9 shows total expenditure elasticities. These quantify the change in demand of a given product for a specified increase in the total budget that households allocate to expenditure. The total expenditure elasticities were positive and significant for all food groups. Although positive, total expenditure elasticities for coffee, tea and cocoa, sugar and other confectionery, vegetables, oils and fats, roots and tubers, bread and cereals as well as salt and non-essential condiments were less than 1. This shows that these food groups were considered basic foods and their demand was relatively less sensitive to changes in total food expenditures.

The findings also showed that total expenditure elasticities for milk, cheese and eggs, fruits, and meat, fish and seafood were greater than 1, denoting that these food groups were considered as more aspirational or luxury foods. This suggests that the demand for milk, cheese and eggs, fruits, and meat, fish and seafood would increase more than the proportionate increase in total food expenditures.

Table 9: Total expenditure elasticities of food groups consumed in Kenya

Food Group	Elasticities (Standard error)
Bread and Cereals	0.92 (0.009)
Meat, Fish and Seafood	1.41 (0.019)
Milk, Cheese and Eggs	1.00 (0.017)
Oils and fats	0.85 (0.022)
Fruits	1.18 (0.026)
Vegetables	0.82 (0.016)
Roots and tubers	0.88 (0.027)
Sugar and other confectionery	0.72 (0.020)
Salt and NEC	0.92 (0.052)
Coffee, Tea and Cocoa	0.55 (0.029)

Notes: NEC - non-essential condiments; all estimates were significant at the 95% confidence level

Table 10 reports the estimated own- and cross-price elasticities by food groups for the whole study sample. Own-price elasticities are shown on the diagonal while cross-price elasticities are displayed on the off-diagonal. As expected, all own-price elasticities were negative and significant. Own-price elasticities for meat, fish and seafood as well as milk, cheese and eggs were less than -1, denoting that these foods were price-elastic. A 10.0% increase in the price of foods in these food groups will lead to a 13.80% and 10.70% reduction in the demand respectively. The remaining own-price elasticities were greater than -1, suggesting that the corresponding food groups (including cocoa, tea and coffee, salt and non-essential condiments, oils and fats, roots and tubers, vegetables, fruits and bread and cereals) were price-inelastic. This meant that an increase in their prices will only lead to marginal changes in their demand.

Cross-price elasticities measure the percentage change in the demand for a food product when there is a percentage increase in the price of an alternate product. Positive cross-price elasticities suggest that the corresponding food products were substitutes, meaning that the demand for a food product increases when the price for the substitute food product increases. Negative cross-price elasticities suggest that food products are complements. This means that if the price of a food product increases, the demand for a closely associated food product necessary for the consumption of the initial food product decreases since the demand for the main food product has also dropped. The current analyses revealed significant complementary effects between bread and cereals with roots and tubers, oils and fats, and sugar and other confectionery. Similarly, significant complementary effects were observed between meat, fish and seafood with oils and fats, and salt and non-essential condiments.

Table 10: Own and cross price expenditure elasticities of food groups consumed in Kenya

Uncompensated	BC	MFS	MCE	OF	F	V	R	SC	SN	CTC
Bread and Cereals	-0.97 (0.016)	0.10 (0.013)	0.01 (0.008)	-0.02 (0.004)	0.01 (0.006)	0.00 (0.007)	-0.01 (0.005)	-0.04 (0.005)	0.00 (0.001)	0.00 (0.002)
Meat, Fish and Seafood	0.03 (0.026)	-1.38 (0.034)	0.07 (0.016)	-0.09 (0.009)	-0.10 (0.013)	0.02 (0.014)	0.04 (0.010)	0.05 (0.010)	-0.03 (0.003)	-0.03 (0.005)
Milk, Cheese and Eggs	-0.01 (0.019)	0.16 (0.019)	-1.07 (0.018)	0.05 (0.006)	0.02 (0.010)	-0.08 (0.011)	-0.05 (0.008)	0.01 (0.008)	0.01 (0.002)	-0.03 (0.003)
Oils and fats	-0.10 (0.035)	-0.28 (0.038)	0.20 (0.021)	-0.77 (0.029)	0.02 (0.020)	0.05 (0.021)	0.05 (0.019)	-0.03 (0.019)	0.00 (0.007)	0.01 (0.012)
Fruits	-0.04 (0.031)	-0.21 (0.032)	0.01 (0.020)	0.00 (0.012)	-0.90 (0.024)	-0.08 (0.018)	0.03 (0.014)	0.01 (0.014)	0.01 (0.004)	0.00 (0.006)
Vegetables	0.03 (0.020)	0.13 (0.021)	-0.07 (0.013)	0.02 (0.008)	-0.02 (0.011)	-0.89 (0.016)	-0.04 (0.009)	0.02 (0.009)	0.00 (0.003)	0.01 (0.004)
Roots and tubers	-0.08 (0.038)	0.26 (0.040)	-0.14 (0.025)	0.05 (0.018)	0.07 (0.022)	-0.10 (0.023)	-0.82 (0.027)	-0.08 (0.019)	-0.01 (0.006)	-0.03 (0.010)
Sugar and other confectionery	-0.13 (0.029)	0.27 (0.030)	0.05 (0.018)	-0.02 (0.014)	0.05 (0.016)	0.04 (0.017)	-0.06 (0.015)	-0.95 (0.020)	0.02 (0.005)	-0.01 (0.008)
Salt and nec	-0.06 (0.079)	-0.62 (0.082)	0.14 (0.049)	-0.03 (0.044)	0.10 (0.045)	0.06 (0.048)	-0.06 (0.043)	0.20 (0.043)	-0.60 (0.020)	-0.05 (0.025)
Coffee, Tea and Cocoa	0.10 (0.047)	-0.14 (0.051)	-0.17 (0.029)	0.04 (0.032)	0.05 (0.027)	0.12 (0.029)	-0.06 (0.027)	-0.01 (0.028)	-0.02 (0.010)	-0.48 (0.028)

Qualitative findings

All the data were analyzed and integrated. Four significant themes were identified as influencing healthy eating: perceptions, policy, socioeconomic, and environmental factors. The results are integrated from the interviews and FGDs.

Perceptions on a healthy diet

Participants noted that consumption of a balanced diet is key to healthy eating. This means that people need to eat various foods including meat, vegetables, and fruits instead of eating a single type of food. In addition, consuming fruits and vegetables as part of the diet was generally considered healthy. Foods were also perceived as healthy, based on their nutritional composition and impact on the body. Despite this knowledge, participants reported consuming unbalanced diets consisting of the same foods.

> "It [healthy diet] should have proteins, carbohydrates, vitamins so that even if you have 'ugali' with vegetables you have some avocado. But in this community a household can go for two days without eating any vegetable or fruit. They just have 'ugali' and 'omena' for three days because 'omena' is easily available. If they get some vegetables they can eat it for two days and that's it especially during the dry seasons." (FGD - Kisumu Resident)

> "What makes food healthy is that the food should be energy-giving, bodybuilding and can also improve immunity from diseases. So energy-giving foods may be ugali and rice; then the foods with proteins may include beans, milk and meat and vitamins are found in vegetables and fruits. So that's what would make the food healthy and can improve one's immunity." (FGD – Isiolo Resident)

Respondents also perceived healthy foods to be those that are natural and not processed. They indicated that these natural foods provide health benefits and prevent diseases in the population. For instance, residents in ASAL areas perceived meat and milk from their livestock to be healthy and linked them to strengthening immunity and prevention of diseases.

> "According to us, meat and milk are the most healthy foods. These other ones like, rice, ugali, you have to eat with something like vegetables, ..., but meat and milk are healthy...they are products of our animals, they are good for our children as well, they make them grow healthy. They also boost immune system, you don't get sick with cold/flu." (IDI - Isiolo Resident)

Participants mentioned that chemicals in food production and processing made foods unhealthy as they increased the risk of diseases. In rural areas, participants mentioned that eggs from chickens fed on fortified feeds were not healthy as these feeds contained chemicals. In addition, respondents linked health issues to the consumption of vegetables sprayed with pesticides or other chemicals.

> "The reason why I don't think they are healthy foods is that sometimes when I cook the kales and eat it, I do have a lot of stomach upsets. So I sometimes think that maybe I got them from the farm immediately after they were sprayed with chemicals and that is why I am having a stomach upset." (FGD – Kisumu Resident)

> "I was saying that the foods that people eat nowadays are not like the foods people used to eat before. For example, kales are sprayed with pesticides and that also affects people. Tomatoes are also sprayed with pesticides and that's why you find that nowadays even young children get ulcers when they eat the foods… Also the animals are nowadays injected with some chemicals which also affect the milk we get from them." (FGD – Isiolo Resident)

A few respondents considered the foods they consumed to be healthy as long as they did not fall ill or experience any side-effects. Some respondents avoided certain foods due to health conditions and therefore did not regard them as healthy.

> "You know if you eat food in your house without any side effects, you cannot say that it is unhealthy. So I have never had any side effects with the foods I eat and I feel I am healthy and even my children are healthy." (IDI – Isiolo Resident)

> "So I don't eat kales because I have ulcers and even my husband has the same problem so we have to eat foods that do not affect me though it doesn't affect the children." (IDI – Kisumu Resident)

There were different understandings about what was considered healthy and unhealthy with regards to cooking methods. Respondents perceived foods to be healthy based on how they were cooked. The addition of condiments in place of natural additives was considered unhealthy and likely to cause disease. Participants also considered the source of food when determining what was healthy or not.

> "The problem with the foods we eat is that those who cook for us may not cook the food well. But previously you would find that 'omena' is boiled from two in the afternoon in the traditional pot and then they would add milk and ghee before it is eaten. So you find that these kinds of foods creates immunity in the system and also you become strong." (FGD – Kisumu Resident)

> "… personally I think that spices can make the foods unhealthy because you may not have money and you decide to buy Royco (condiment). If you use it, as it does what tomatoes can do, you should cook the food properly so that the foam is all gone. But since you don't have the time to boil the food, you will get some diseases and hence make the food unhealthy. So these shortcuts really hurt us. That is my opinion." (FGD – Kisumu Resident)

> "… you also don't know if it is indeed healthy food. You don't know where it comes from." (FGD – Kisumu Resident)

There were some thoughts around the types of foods that people should eat based on their sex and age. Respondents indicated that men should eat more bodybuilding and energy-giving foods while children were expected to eat foods with vitamins to keep them healthy. Participants also mentioned that having children in a household was likely to influence consumption of a healthy and balanced diet. Women were perceived to be more inclined to make health-conscious decisions on the foods that they or their families ate.

"If you chill with women, they are likely to be healthier and I don't know, I feel like women are better than us in so many ways because guys don't care about our health that much if you think about it." (IDI – Nairobi Resident)

Culture and social interactions were noted to influence food preferences. For instance, community members from the arid areas preferred to only eat meat even though other foods were available while others indicated that they were more likely to expand their dietary diversity based on the people they interacted with.

"Culture and norms influence the mindset of the community. They say that they do not eat a particular food, like here in [area] they do not eat fish. If you look at a place like [place name], there is the [river] with mudfish but they do not want to eat mudfish yet they are found to have issues of malnutrition. Other people take that fish and sell it elsewhere." (KII – Agriculture Sector)

"We have interacted with different people. We didn't even know what spinach looked like but due to the interaction and peace, we have been able to get different types of foods and know their benefits to the body. So the improved security has also brought about changes in the foods we eat." (IDI – Isiolo Resident)

Health conditions and the presence of young children in the household influenced the types of foods consumed. It was noted that some households ate healthily, particularly when there were children and people with health conditions.

"…Mothers with young children, the sick – some diseases require you to eat spinach; some people don't eat kales due to ulcers, others eat cowpeas because they have certain diseases." (KII – Food vendor - Kisumu)

"I do have hypertension, so things like salt or acidic foods can sometimes also increase hypertension so that also influences the foods we eat." (IDI – Nairobi Resident)

"Because for example, if one has ulcers, they are told not to eat kales so if they only eat one type of food daily like milk and ugali, then they won't be eating healthy food. People with hypertension are also told to avoid certain foods." (FGD – Isiolo Resident)

Knowing what is healthy was perceived to promote access to healthy foods. However, others thought that there were knowledge gaps around what constitutes a healthy diet.

"Also if you have the information on the healthy and unhealthy foods then you can access them easily. So if you have information about balanced diet then you will be able to have a balanced diet." (IDI – Isiolo Resident)

"It's even not familiar to most people that there is something which somebody can say that you are eating healthy. People take food to fill their stomach and most food to fill your stomach are those which don't have the nutritional value and they are the most available, so (little) has been taught about eating healthy." (KII – Nutrition Sector)

"And also something that makes it difficult for us to eat healthy foods is that there is lack of awareness from people on types of foods one should eat for them to eat healthy. So they just end up eating ugali and milk all the time because they don't have the awareness on which other foods are healthy." (FGD – Isiolo Resident).

Policy level factors

Key stakeholders mentioned that comprehensive policies, strategies, action plans, and guidelines exist across different government ministries and departments that promote consumption, distribution, availability, accessibility, safety, and quality of foods. These exist within the Ministry of Health, Ministry of Agriculture, Ministry of Labour and Social Protection and Ministry of Education. For instance, there are policies and guidelines at an agricultural level to ensure that the food produced is fortified with the appropriate micronutrients to prevent nutritional deficiencies.

"Like now the orange flesh sweet potatoes, you see the attributes are more – they are not different from the original white sweet potatoes – but you see how it has been fortified with beta carotene, so it's a rich source of vitamin A. We have legislation that made it mandatory for fortification of salt with iodine, fortification of cooking fat and oils with vitamins and minerals, and mandatory fortification of packaged maize and health flour. So that is food fortification to address micronutrients..." (KII – Nutrition Sector)

Respondents also mentioned that the government promotes the production and consumption of healthy foods by promoting high-value indigenous crops. Farmers were further trained on nutritional value addition approaches.

"They have been promoting what we call the high-value crops, the traditional – our indigenous foods, the sweet potato, the sorghum, the millet, the cassava – indigenous vegetables and all those, the main focus is about a healthy diet." (KII – Nutrition Sector)

"We have agriculture technology development centres to train farmers on value addition and how to (add value to) their products so that they retain the nutrient content and at the same time they can earn money ... All these technologies are promoted at the county level. " (KII – Agriculture Sector)

Participants mentioned that nutritional messages are usually given to social protection recipients in cash transfer programs to encourage healthy eating. Similarly, it was reported that the Kenyan school curriculum has a component on food and nutrition, which is taught during science classes. Multi-sectoral collaborations were cited to be beneficial in promoting healthy eating.

"These policies have also enabled multi-sectoral collaboration. Sectors have been brought together. For us, like the meteorological department when they get their reports they share them with us and we can advise the farmers." (KII – Agriculture Sector)

Participants reported that food security was enhanced by grants and loans to farmers to engage in agri-business and cushion them against post-harvest losses. Participants also

mentioned that government subsidies facilitated access to healthy eating by reducing the cost of production which made healthy foods available at affordable prices.

> "When the government provides fertilizer subsidies to the farmers and they get a good harvest the farmers will also sell at a lower price. Therefore, when the farmers get a good harvest in their farms we get the foods cheaply here as well. So even if they charge the transportation cost we would still get a good quantity of food." (FGD – Isiolo Resident)

Despite all the policies in place to promote healthy eating, study participants reported that implementation of these policies was inadequate. The main reasons cited were lack of financial resources, limited human capacity and little translation of evidence to policies and practice.

> "I think number one is cascading the policies to the lower levels is lacking and even those policies, some government agencies don't know whether they exist. Another one is the implementation of the policies, we lack that implementation because without funding of the policy, it's like a useless document in itself because a policy is supposed to be followed by resources." (KII – Planning Sector)

> "I think there is a challenge in the human capital; no people to go and monitor - or the people that are there are not facilitated or even if they are facilitated you know you need some structure and in case somebody is found violating, action can be taken against them. So getting an equitable number of extension officers and health officers to reach the village professionally becomes a problem. So you find these things at times are done with non-professional officers like the sub-chief and village elders who cannot detail the nitty-gritty of healthy living." (KII – Nutrition Sector)

It was noted that taxation greatly influenced the production and purchase of healthy foods. Participants mentioned that current taxes levied affected the consumption of healthy foods. Others also noted that the cost of local food production in Kenya is very expensive and as a result, the food industry capitalized on importation of unhealthy foods.

> "When the taxes are increased then everything else is increased. First, the cost of fuel is increased and that makes the cost of everything else shoot up. [For instance]… tomatoes from Uganda, if it was being sold at ten shillings for three, it will be sold at ten shillings each." (FGD – Kisumu Resident)

> "Also, the cost of production in Kenya is high. It is higher than the neighbouring areas like Tanzania. For example, if you compare the cost of production of onions in Kenya it is higher than in Tanzania, so when the Tanzanian onions come, the market is flooded and the Kenyan farmers have difficulty selling theirs." (KII – Agriculture Sector)

> "To some extent, they (food industry) have the power, instead of buying from local farmers they import. We know fresh fruit is more nutritious than these juices that have a lot of additives that are not healthy for the population." (KII – Agriculture Sector)

Socioeconomic level factors

A few facilitators for healthy eating were mentioned at the socioeconomic level. The availability of credit to consumers facilitated access to healthy eating. Participants indicated that food vendors gave them food on credit. Food vendors also reported providing credit to the elderly and other vulnerable populations who receive monthly cash transfers.

> "The socioeconomic status of my customers is low, some are poor and even ask me to give them on credit and they get to pay later. Some are also old people and when they get the 'old peoples' money, that's when they get to pay. Some also receive disability money [money given to persons living with disability] and that is when they get to pay their debts." (KII – Food vendor, Isiolo).

Barriers mentioned at this level included low socioeconomic status coupled with the high cost of healthy foods. Participants also reported that because of their low socioeconomic status, they consumed low quality foods.

> "It is true that our socioeconomic status influences the decisions we make and the types of foods we eat because you cannot buy what you cannot afford. If I earn two hundred shillings per day then I cannot buy anything beyond that because I have to budget within my budget." (FGD – Kisumu Resident)

> "…People are ready to eat unsafe food if they don't have any other food." (KII – Nutrition Sector)

Participants noted that they often needed to balance the purchase of food versus non-food items. It was also difficult for many participants to make a trade-off between other responsibilities and the purchase and consumption of healthy food.

> "The barrier that stops me from eating healthy foods is (my) low income. Yes, you may want to eat – you know children like these need still need to have fruits. So we don't have that ability because fruits are also expensive. An orange goes for thirty (shillings) and you know very well you don't have several things in the house. So we can't buy such things." (IDI – Kisumu Resident)

> "Some of us are widows, so maybe you have children and you may struggle to feed the children because you have a lot of responsibilities such as school fees and what they should eat. So those barriers will prevent you from accessing the healthy foods for your children." (FGD – Kisumu Resident)

Participants noted that the increased demand for indigenous foods which are considered healthy among those of higher socioeconomic status, led to higher prices for these foods making it difficult for poorer households to access. Participants mentioned that the supply of foods limited the varieties that food vendors could offer to their customers. This limited the healthy food choices for consumers.

> "You know a lot of times if you were elite those (traditional foods) were poor man's food, yeah but now it has turned, and one of the biggest disadvantages is that with hyping of class, the traditional vegetables are increasingly becoming expensive... meaning they are now out of reach of the majority of the population who would require them for the nutrients they possess." (KII – Nutrition

Sector)

"Sometimes you can go to buy vegetables as it is seasonal, you may think you are going to get them from the lorry but you find that the lorry didn't arrive. Therefore, you will have to buy whatever you get even if they are not good. So you will just buy something to maintain your customers even though they won't like them and that gives you a hard time selling them." (KII – Food vendor - Kisumu)

Environmental level factors

Generally, participants alluded to the influence of seasonality on the availability, consumption and purchase of healthy foods. During the rainy seasons, healthy foods were cheaper and easily accessible. Participants noted that farmers were also more likely to get a higher yield of healthy foods during the rainy season.

"During the rainy season like this one, we have very many farms so we just grow the vegetables; there are some that also grow naturally like 'dek' and 'apoth'. The moment the farm is prepared they just grow. You can also grow some kales. For the fish, we just go to the market on Fridays where the fishmongers sell them at the stalls." (FGD – Kisumu Resident)

"During the dry season they rarely buy healthy foods but during rainy seasons like now most people can buy them because they can always get 'terere' (amaranth) and even potatoes worth twenty shillings." (KII – Food vendor, Isiolo)

"Right now we have food in plenty and it will only reduce towards January. We grow various vegetables including the traditional ones, we grow tomatoes, we grow fruits. We have a seasonal water source from the hills, it goes to the lake and helps us grow rice. So after harvesting the rice, we grow vegetables on the same farms." (IDI – Kisumu Resident)

Participants also mentioned that foods appeared fresher in the rainy season and so consumers purchased more of them. Additionally, it was noted that participants varied the crops they planted based on the weather conditions.

"When they find fresh vegetables they do buy them, but if they are wilted they don't buy them. So whenever the sun is up we do cover them with an umbrella but at times like these we let them free and they can be rained on. So when you pass by they just attract you and you end up buying them." (KII – Food vendor, Nairobi)

"During the harvesting season, maize doesn't do well in this area so most people plant sorghum, so you find that most people eat 'ugali' from sorghum because that's what is available…. So you may find that you just have sorghum and 'apoth' as the most common meals then." (FGD – Kisumu Resident)

Harsh climatic conditions such as floods and droughts hindered access and availability of healthy foods. Participants noted that some foods were not readily available during the dry season and required additional transport costs to access. Additionally, poor road networks were reported to affect the transportation of foods.

"During the dry season when we don't have the traditional vegetables available, it is not easy to get vegetables around. You would have to travel a long distance looking for vegetables. So you will always have to eat food without vegetables." (IDI – Isiolo Resident)

"Also the bad roads contribute because sometimes the road is impassable so they are stuck which means they cannot go to Maua [location] or come back to Garba

4. Discussion

This study aimed to assess the patterns, costs, determinants and socioeconomic inequalities affecting healthy eating in Kenya. Additionally, it explored the perceptions and drivers of healthy eating. Our findings indicate that, no household met all of the nine dietary recommendations. However, those who met six out of the nine spent on average KES 160 (approx. US$1.60) per person a day to eat healthy. The HDI score for Kenya was moderate with urban households having higher scores compared to rural households. Socioeconomic inequalities exist with healthy eating being more concentrated among households of higher socioeconomic status. We also found that household expenditures were sensitive to changes in disposable income. The evidence from this study on the costs of healthy eating and income-related inequalities is useful in informing the decision-making processes in policies for food pricing, food provision, food retailing, food trade and investment, in order to support families to make healthy food choices.

To our knowledge, this is the first study in Kenya to use a healthy diet index to assess patterns of healthy eating. Previous studies that used a healthy diet index have been conducted in high income countries (HIC) (Kanauchi and Kanauchi, 2018, Stefler et al., 2014, Berentzen et al., 2013, Cade et al., 1999). Our findings show that the majority of households were not meeting the healthy diet recommendations. Previous studies conducted in LMICs corroborate our results and show that poor dietary behaviour in developing countries is present and increasing (Afshin et al., 2019, Popkin et al., 2012, Hall et al., 2009, Mazzocchi et al., 2008). While Kenya's vegetable and fruit intake was low (45%), it was much higher than what was found in South Africa (32%) (Peltzer and Phaswana-Mafuya, 2012), as well as the findings from an analysis involving 52 LMICs (22%) (Hall et al., 2009). A study in South Africa also reported that fruits were considered luxuries that were only bought if money was left over after the purchase of staple foods (Sedibe et al., 2014). The low fruit and vegetable consumption observed in these countries may be linked to the low supply of fruits and vegetables that has been reported in sub-Saharan Africa (Gebremedhin and Bekele, 2021).

Our findings show substantial variation exists in terms of healthy eating in Kenya. Climatic conditions in Kenya vary by location. Counties in Western and Central Kenya had the highest HDI values indicating healthy eating compared to counties in those areas designated arid and semi-arid lands (ASAL). These variations are somewhat expected because of differences in climatic conditions, social and economic factors, among other factors (CGIAR and CCAFS, 2018).

Adhering to a healthier diet has been linked to improved health outcomes and lower risk of cardiovascular disease (Mozaffarian et al., 2011) (Estruch et al., 2018). However, cost has been cited as a barrier to healthy eating. Findings from the current study showed that households which met six of the healthy diet recommendations had higher expenditures than households which met fewer recommendations. A systematic review and meta-analysis looking at the cost of healthier diets and diet patterns found similar results to the current study, that is, healthier food-based diet patterns were more expensive than less healthy patterns (Rao et al., 2013a). With 36% of the Kenyan population living on less than two dollars a day (World Bank, 2020) and the rising cost of living, eating healthy is becoming more difficult for Kenyans. The qualitative findings from this study corroborated the quantitative findings and showed that high prices limited options for healthy eating in Kenya. Our findings further indicated that expenditure on food consumption rises alongside increases in meeting the number of recommended healthy diet components. Our results are similar to findings from South Africa which showed that a healthier diet on average costs 69% more than an unhealthy diet (Temple and Steyn, 2011). A UK study also reported that the healthier the diet the higher the direct costs incurred (Cade et al., 1999). Other studies have also suggested the importance of spending more in order to achieve a healthy diet (Jones et al., 2014, Drewnowski and Darmon, 2005, Cade et al., 1999) (Andrieu et al., 2006).

Dietary recommendations emphasize the consumption of fruits and vegetables, whole grains, low fat dairy foods and lean sources of protein. However, our study revealed that only 45% of Kenyan households were meeting the fruit and vegetable recommendations and these households were spending significantly more compared to households that were not meeting this recommendation. Cade and colleagues (1999) also found that among those meeting the highest dietary recommendations, their largest cost contribution was from fruit and vegetables.

A number of factors were identified as influencing people's decisions and ability to eat healthy, as well as meet the health diet recommendations in this study. These include availability, accessibility, convenience, source, socio-environmental and cultural influences, food prices, income, education level, preparation and storage of food. This is consistent with what was found in a study looking at the urban food environment in Africa (Osei-Kwasi et al., 2021).

In the current study, socioeconomic status was a determinant of healthy eating. This was reflected in both the quantitative and qualitative results. Our findings showed that ability to meet the healthy diet recommendations was positively and significantly associated with a higher socioeconomic status. Similar results were found in a study conducted in Kenya among people who lived in low-income urban areas which revealed that the quantity of food the urban poor could afford was not sufficient for them to meet the FAO dietary recommendations (Olielo, 2013). Other studies have also shown that people living in low-income populations have economic limitations that prevent them from eating healthily (Temple et al., 2011, McDermott and Stephens, 2010). These findings were further supported by the qualitative study, as participants repeatedly reported that their choice and consumption of healthy foods was heavily dependent on their income.

Gender differences exist in choices made regarding the types of foods consumed in a household (Shiferaw et al., 2012). Our study found that households headed by a female were more likely to eat healthy. This is consistent with other studies which show that women generally make healthier food choices by eating more fruits and fibre, avoiding foods high in fats, and limiting their salt intake (Shiferaw et al., 2012, Wardle et al., 2004). A study by (Sedibe et al., 2014) reported that female caregivers were the main promoters of healthy eating practices.

Our study found that households headed by an educated individual were more likely to eat healthily. This corroborates findings from studies conducted in rural and urban South Africa that found an association between poor education and unhealthy food purchasing behaviour and dietary diversity (Taruvinga et al., 2013, Muzigaba, 2013). Another study in the same setting demonstrated that low education was associated with inadequate fruit and vegetable intake (Peltzer and Phaswana-Mafuya, 2012).

Urban-rural differences have been reported in healthy diet consumption (Hall et al., 2009). Our study found that rural households were more

likely to eat healthily in comparison to their urban counterparts. A systematic review and meta-analysis of salt intake in sub-Saharan Africa found a higher consumption of salt in urban areas compared to rural areas (Oyebode et al., 2016). A study conducted in Soweto, South Africa also demonstrated that urbanization has led to increased consumption of diets higher in energy and containing more salt, saturated fats and more sugar (Pretorius and Sliwa, 2011).

Our study found that socioeconomic inequalities in healthy eating exist in Kenya. Healthy eating was more concentrated among households of higher socioeconomic status. Our findings are consistent with numerous studies, which have found that food prices influence purchasing decisions made by lower-income groups (Dachner et al., 2010, Wiig and Smith, 2009, Dowler, 1997). Our findings showed that households of higher socioeconomic status had healthier diets. This could mean that low-income households consumed less nutritious energy-dense foods that are often cheaper sources of calories (Jones et al., 2014, Hall et al., 2009, Drewnowski and Darmon, 2005).

Consistent with economic theory, all estimated own-price elasticities were negative, ranging from -1.38 to -0.48. These estimates were generally in line with the estimated uncompensated own-price elasticities from a previous study that was conducted in Kenya using the 2005-2006 KIHBS (Korir, Rizov, & Ruto, 2018). In addition, the estimated expenditure elasticities for all food groups were positive and significant. Furthermore, the expenditure elasticities for milk, cheese and eggs, fruits, and meat, fish and seafood were all elastic, indicating that they were considered luxury foods. Our results supplement findings from a previous study in Kenya on expenditure elasticities which also showed that meat, fish and essential condiments were luxury foods (Korir et al., 2018). In the current study, sugar, tea and coffee were found to be normal foods, however a previous study conducted in South Africa found these same food items to be luxury foods (Stacey, Tugendhaft, & Hofman, 2017). Our findings were consistent with a previous study in Kenya that found cereals, vegetables and other condiments to be expenditure inelastic and therefore considered as normal food groups (Korir et al., 2018). However, contrary to our findings, Korir et al. (2018) found that fruits were considered normal foods. (Stacey et al., 2017) A likely reason for the difference in findings could be that fruits are considered for commercial purposes rather than for household consumption in most households in Kenya. Another likely reason could be the economic advances that have taken place in Kenya since 2004 when Korir et al. (2018) conducted the study. Overall, salt and non-essential condiments; bread and cereals; sugar and other confectionery; oils and fats; coffee, tea and cocoa; roots and tubers as well as vegetables were price-inelastic which means that household consumption of these foods was relatively less sensitive to changes in prices. This finding provides important information that could be used for the promotion of healthy food consumption.

Study strengths and limitations

This study has strengths and limitations. A major strength is the use of a nationally representative dataset which makes our results generalizable to the Kenyan population. Second, this is the only study to examine patterns, costs, determinants and socioeconomic inequalities related to healthy eating in Kenya. Previous studies in Kenya have only looked at the demand system elasticities for a limited number of food groups. Third, the use of the HDI as a continuous score reduced the potential bias of information loss in the outcome variable. Lastly, the qualitative data in the study provides rich descriptions that supplement the quantitative data. However, there are some limitations to note. Some data was excluded because their nutritional values were not found in the KFCT. The quantitative study was cross-sectional thus limiting findings on causality. Further, data from the study were from 2015-2016 and a lot in regard to healthy eating may have changed. Despite these limitations, this study provides important information on the costs of healthy eating and its associated factors in Kenya. Results from this study can be used as a benchmark against which progress can be measured. The findings can be used to inform decision-making processes to ensure that policies around food pricing, food provision, food retailing, food trade, and investment, are aligned with health outcomes.

Conclusions

Based on the findings from this study, we conclude that the majority of Kenyan households do not meet all of the healthy dietary recommendations and with a significant proportion of people living below the poverty line, it is costly to eat healthy. Furthermore, socioeconomic inequalities are prevalent and healthy eating is concentrated among households of higher socioeconomic status. Healthy eating is also associated with higher socioeconomic status, living in a rural area, having children under five years in the household, and the household head having education or being in a marital union. Furthermore, food groups such as milk, cheese and eggs, fruits, and meat, fish and seafood were considered luxury foods.

5. Recommendations

1. All stakeholders need to work together to create greater awareness on the healthy foods that are available locally and increase people's knowledge while giving them options on the various types of affordable, healthy foods that they can consume.
2. The government should consider approaches that could improve access to healthy foods such as reducing or removing taxes imposed directly or indirectly on foods like milk, cheese and eggs, fruits, fish and seafood
3. The government needs to implement agricultural programs in ASAL areas to mitigate against food scarcity and related high costs of food in a bid to ensure that residents can access diverse and nutritious food-items.

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7. Appendices

Appendix 1: Summary of continuous sociodemographic characteristics of the study sample

	Variable	Mean (SD)
1.	Age	43.2 (15.7)
2.	Household size	4.0 (2.4)
3.	Number of members aged 0-4 years	0.5 (0.8)
4.	Number of members aged 5-12 years	0.9 (1.1)
5.	Number of members aged 13-19 years	0.6 (0.9)
6.	Number of members aged 20-24 years	0.4 (0.6)
7.	Number of members aged 25-39 years	0.8 (0.8)
8.	Number of members aged 40-64 years	0.6 (0.7)
9.	Number of members aged 65 and over	0.2 (0.4)
10.	Monthly per adult equivalent total consumption expenditure (KES)	7,756.9 (7656.6)

Appendix 2a: Proportion of households above upper limit of recommended healthy range

	Overall		Gender				Residence			
			Female		Male		Urban		Rural	
	N	n (%)	N	n (%)	N	n (%)	N	n (%)	N	n (%)
Total fat	3,010	1496 (49.7)	954	411 (43.1)	2,056	1077 (52.4)***	1,314	776 (59.1)***	1696	701 (41.3)
Total carbohydrates	15,534	15211 (97.9)	4972	4943 (99.4)***	10,562	10274 (97.3)	6392	6187 (96.8)	9,142	9039 (98.9)***
Total Protein	16,252	15650 (96.3)	5,229	5008 (95.8)	11,023	10640 (96.5)*	7,084	6850 (96.7)*	9,168	8796 (95.9)
Polyunsaturated Fats	20,601	12782 (62.0)	6,994	4515 (64.6)***	13,607	8278 (60.8)	8,088	5974 (73.9)***	12,513	6656 (53.2)

Notes: N=total, n=frequency, Survey weights are used to account for the survey design and clustering

Appendix 2b: Proportion of households below lower limit of recommended healthy range

	Overall		Gender				Residence			
			Female		Male		Urban		Rural	
	N	n (%)	N	n (%)	N	n (%)	N	n (%)	N	n (%)
Total fat	3,010	1514 (50.3)	954	543	2,056	979 (47.6)	1,314	538 (40.9)	1696	995 (58.7)***
Total carbohydrates	15,534	323 (2.1)	4972	29 (0.6)	10,562	288 (2.7)***	6392	205 (3.2)***	9,142	103 (1.1)
Total Protein	16,252	602 (3.7)	5,229	221 (4.2)*	11,023	383 (3.5)	7,084	234 (3.3)	9,168	372 (4.1)*
Polyunsaturated Fats	20,601	7819 (38.0)	6,994	2479 (35.5)	13,607	5329 (39.2)***	8,088	2114 (26.1)	12,513	5857 (46.8)***

Notes: N=total, n=frequency, Survey weights are used to account for the survey design and clustering

Appendix 3: Decomposition of socioeconomic inequalities in healthy eating in Kenya

Variables	Elasticity	CI	Absolute	Percentage contribution
Monthly total consumption expenditure per adult equivalent	10.20	0.05	0.48	119.77
0-4 years	0.05	-0.16	-0.01	-2.09
5-12 years	0.02	-0.30	-0.01	-1.83
13-19 years	0.03	-0.29	0.01	2.17
20-24 years	0.01	0.00	0.00	0.00
25-39 years	0.03	0.01	0.00	-0.05
40-64 years	0.07	-0.13	0.01	2.14
65+ years	0.01	-0.27	0.00	0.88
Gender (0=Female, 1=Male)	0.15	0.03	0.00	-1.11
Age	0.57	-0.06	-0.03	-8.18
No education	0.07	-0.44	0.03	7.15
Primary education	0.03	-0.14	0.00	-0.94
Other level of education	0.00	-0.19	0.00	0.08
Self employed	0.06	-0.09	0.00	-1.21
Employed	0.08	0.10	0.01	2.17
Residence (0=Urban, 1=Rural)	0.38	-0.25	-0.09	-23.35
Marital status (In Union)	0.11	-0.04	0.00	-1.16
Christian	0.41	0.02	0.01	1.68
Muslim	0.03	-0.13	0.00	1.08
Other religion	0.00	-0.12	0.00	-0.04
Residual			0.01	2.92
Total			0.40	100.06

ISBN 978-9966-135-84-1

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