

**DEMAND ANALYSIS OF FRESH FRUITS CONSUMPTION AMONG URBAN
HOUSEHOLDS IN NAKURU CITY**

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for the Award of Master of Science Degree in Agribusiness
Management for Egerton University**


EGERTON UNIVERSITY

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DECLARATION AND RECOMMENDATION

Declaration

I declare that this research thesis as my original work and has not been presented in this or any other institution of higher learning for any award

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ABSTRACT

Fresh fruits are a vital source of essential micro and macro nutrients and play critical role in improved nutrition, disease prevention and dietary balance however, urban Kenyan households consume far below the World Health Organization (WHO) and the United Nations-Food and Agriculture Organization (FAO) recommendations (400g/day. The general objective of this study was to contribute towards improved household nutrition through enhanced fresh fruit consumption among low- and high-income households in Nakuru City, Kenya. Specific objectives were to determine consumption patterns of fresh fruits among low- and high-income households; to estimate the demand of selected fresh fruits among low- and high-income households; and to determine the factors that influence the willingness to pay for selected fresh fruits attributes among the low- and high-income households in Nakuru City. Nakuru City was purposively selected and systemic random sampling proportionate to ward sizes was used to select respondents from each ward and cross-sectional data from 237 households was obtained. Descriptive and inferential statistics, Linearized Approximation Almost Ideal Demand System (LA/AIDS) model and the Hedonic Pricing Model were used for data analysis. The study revealed that low-income households exhibited higher fruit expenditure responsiveness (53.42%) to income changes than high-income households (46.57%). Bananas, oranges and melons displayed elastic demand among low-income households, while avocado and pineapple were inelastic. Own-price elasticities were negative for all fruits implying normal goods. Cross price elasticities indicated substitutability for bananas and avocados and complementarity for bananas and melons. High-income households spent 41% more on fresh fruits monthly than their low-income counterparts. Hedonic results indicated positive income effect and significant preference for quality attributes. Fresh fruit attributes that influenced willingness to pay significantly included absence of defects, texture, size, fruit color, and freshness for both low and high-income households. Perceived nutrition, income, gender of the household head and education level of the household head were the socio-economic characteristics that influenced willingness to pay for fresh fruits. The results underscore income, and not price, as the primary driver of fruit consumption disparities. Fruit vouchers, price control measures and public awareness campaign could be used to assist vulnerable to improve fruit consumption. Attribute-based pricing strategies and income consideration should be applied to enhance fresh fruits consumption.

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LIST OF ABBREVIATIONS AND ACRONYMS

AgGDP	Agricultural Gross Domestic Product
CVD	Cardiovascular Diseases
EPIC	European Prospective Investigation into Cancer and Nutrition
FAO	Food and Agriculture Organization of the United Nations
GAIN	Global Alliance for Improved Nutrition
GoK	Government of Kenya
ITSUR	Iterated Seemingly Unrelated Regression
KES	Kenya Shilling
KIHBS	Kenya Integrated Household Budget Survey
KNBS	Kenya National Bureau of Statistics
KUSP	Kenya Urban Support Programme
LA/AIDS	Linearized Approximation Almost Ideal Demand System
MOALF	Ministry of Agriculture Livestock and Fisheries
MoH	Ministry of Health
NCD	Non-Communicable Diseases
NCIDP	Nakuru County Integrated Development Plan
NCNAP	Nakuru County Nutrition Action Plan
NCNP	Nakuru County Nutrition Policy
SDGs	Sustainable Development Goals
SSA	Sub- Saharan Africa
SURE	Seemingly Unrelated Regression
UN DESA	United Nations Department of Economic and Social Affairs
UNICEF	The United Nations Children’s Fund
WHO	World Health Organization
WTP	Willingness to Pay

CHAPTER ONE

INTRODUCTION

1.1 Background information

Globally, the consumption of fresh fruits is vital in promoting nutritional well-being and reducing the risk of diet-related non-communicable diseases yet their consumption remain low below the World Health Organization's recommended levels of 400 grams per capita per day in many regions with affordability, accessibility and consumer preference being major determinants despite global awareness campaigns for fruit and vegetable consumption (FAO, 2021; Herforth *et al.*, 2022). Rising incomes, globalization and urbanization has led changed consumption patterns globally leading to increased demand for processed and convenience foods while reducing consumption for fresh fruits (Herforth *et al.*, 2022).

Fresh fruits consumption levels in Sub-Saharan Africa are among lowest globally despite its Agro-ecological zone and high horticultural potential (Alemayehu *et al.*, 2022; Ochieng *et al.*, 2021). Households in Sub-Saharan Africa face a number of challenges including low purchasing power, weak market infrastructure and seasonal availability which undermine both availability and accessibility of fresh fruits among households. Urbanization has exacerbated dietary transition with growing demand for convenience foods at the expense of fresh produce (Gbonjubola *et al.*, 2021).

Further in Kenya, horticulture remains one of the fastest growing agricultural sub-sector in Kenya and significantly contributing to employment, household food security, economic development and poverty alleviation. The sub-sector is also among the leading contributors to the Agricultural Gross Domestic Product (AgGDP) at 36.0% , and continues to grow at between 15.0% and 20.0% per year (Ndunda & Mungai 2021; Onyango *et al.*,2022). Major fruits produced and consumed in Kenya in their order of importance include: bananas 35.9%, avocado 23%, mangoes 16%, oranges 5.8%, and watermelon 5%. Other fruits such as pineapples, pawpaw, passion fruits and lime had smaller shares (KNBS, 2024). There is still potential for growth in the Kenya's fruits sector due to increasing demand both in the domestic and export market. In 2023, fruits exports increased by nearly 67%, yielding KES 32.37 billion with avocado leading. Other opportunity exists beside fresh fruits and include fruit products such as juices, salads, dried fruits and concentrates which are alternatives in meeting market demand for fruits (KNBS, 2024).

Despite the availability of these fresh fruits, per capita fruit intake in Kenya remain below the recommended dietary guidelines (Mutuku *et al.*, 2023; Ng'endo *et al.*, 2020). Urban households in Kenya face barriers such as price, income inequality, and dietary preferences which influence the frequency of demand and consumption of fresh fruits (Maina *et al.*, 2020).

Nakuru County located in Rift Valley has a favorable agroecological condition for horticultural production and supplies fresh fruits like avocados to both local, national and international markets according to a report by the County Government of Nakuru (2020). The report further explains that Nakuru City, which is the county's urban region has experienced rapid growth and socio-economic transformation resulting in diversified consumption patterns across income groups. While fresh fruits are available in Nakuru city markets, little is known about how household income, market prices and fruit attributes influence demand for fresh fruits in Nakuru City.

The population of the world is estimated to reach 9.7 billion by 2050, with urban areas experiencing much of this growth (UN DESA, 2024). The number of persons living in urban areas of Eastern and Southern Africa will increase from 200 to 530 million between 2020 and 2050 (UN DESA, 2024). In Kenya, urban population is projected to more than double with Nakuru City projected to surpass one million inhabitants by 2030 (KNBS, 2023; KUSP, 2022; UN-Habitat 2023). One result of this rapid urbanization is that food insecurity, particularly access to safe and nutritious food, has increasingly become an urban problem (FAO, 2022; World Bank 2023). This is because people's food security in urban places is heavily tied to market forces which in turn are influenced by socio-economic conditions. Urban poverty remains high with 47% of urban residents in low-income counties living below national poverty lines (UN-Habitat, 2023; UNICEF 2023).

Consumers in Kenya fall in different income quintiles, ranging from low, medium to high income households. According to the Kenya National Bureau of Statistics (2018), the various income amounts per month for various income groups are as follows, low-income households earn below KES 23, 670, middle-income households earn between KES 23, 671 to KES 119, 999 and high income persons earn above KES 119, 999. These threshold, derived from Kenya Integrated Household Budget Survey (KIHBS) 2015/2016, provide a standardized framework for analyzing and living standards across regions. These income levels influence consumption choices and affordability for food including fresh fruits (FAO, 2023; Waswa *et al.*, 2023).

Previous studies indicate that the consumption of fresh fruits is higher among high-income households than the low-income households who focus on satisfying hunger with calorie-dense staples such as maize-meal, wheat products and rice before considering dietary quality (Githinji & Kamau 2023; Mutisya & Yarime, 2021; Njagi *et al.*, 2021; Onyango & Githinji, 2022).

Nakuru city as an urban area accommodates a diverse population spanning low, middle and high-income households which is consistent with the Kenya National Bureau of Statistics (2018) income quintiles characteristics. Further, fresh fruits consumption pattern in this city varied between low and high income households with low income households relying on inexpensive carbohydrates-rich staples resulting in limited dietary diversity and fresh fruit intake levels below the WHO recommended levels (Onyango *et al.*, 2021). Conversely, high-income households had extensive diversified diets and high intake levels of fresh fruits towards the recommended levels (Steyn & Mchiza, 2020). According to GoK (2021), increased consumption of processed, energy-dense foods that are low in micronutrients and reduced physical activity has contributed to diet-related, non-communicable diseases such as obesity, cardiovascular diseases and diabetes in Nakuru City (Drimie *et al.*, 2018; Rischke *et al.*, 2020).

The recommended minimum daily intake of fresh fruits and vegetables by WHO/ FAO is 400 grams per adult to promote health and reduce non-communicable diseases. However, this recommendation is rarely met in Sub- sharan Africa where average consumption ranges between 27 and 114 kg person per year (Mekonen *et al.*, 2025; WHO/ FAO, 2023). Nakuru City falls within the category of urban areas in Sub-Saharan Africa characterized by low fruit and vegetable consumption (Francis & Njagi 2024). Consumption of fresh fruit and vegetables accounts for slightly over a quarter of average household expenditure on food, second only to staples (Bundi, 2013; Mekonen *et al.*, 2025). The most affected by this problem of low fruit intake are the low income urban households who depend on income from precarious informal sector jobs that rarely meet their consumption needs (Stadlmayr *et al.*, 2023; TechnoServe, 2023). Achieving food and nutrition security in urban areas necessitates improving availability, affordability and diversity of fresh fruits and vegetables especially among the low-income households (GAIN Kenya, 2025; Mekonen *et al.*, 2025).

1.2 Statement of the Problem

The urban household consumption level for fresh fruits and fruit products across low, medium and high-income groups in Kenya is way below the WHO/FAO minimum recommended levels.

despite the nutritional value o. There exists limited information demand for fresh fruit and factors that influence consumption patterns across different income groups in Kenya. In addition, there is little information on the effect of fresh fruit attributes on their observed market prices. Consequently, this study aims bridge this gap using data collected in Nakuru City in Nakuru County.

1.3 Objectives

1.3.1 General objective

To contribute towards improved household nutrition through enhanced consumption of fruits among the low- and high-income households in Nakuru City, Kenya.

1.3.2 Specific objectives

- i. To determine consumption patterns of fresh fruits among low- and high-income households in Nakuru City
- ii. To estimate the demand of selected fresh fruits among the low- and high-income households in Nakuru City.
- iii. To determine the factors that influence the willingness to pay for selected fresh fruits attributes among the low- and high-income households in Nakuru City

1.4 Research questions

- i. What is the difference in patterns of fresh fruit consumption among low- and high-income households in Nakuru City?
- ii. What is the demand of selected fresh fruits among the low- and high-income households in Nakuru City?
- iii. What is the effect of fresh fruit attributes, institutional factors and household characteristics on the willingness to pay for of selected fresh fruits in Nakuru City?

1.5 Justification of the study

Urbanization has triggered significant shifts in food consumption patterns characterized by low intake of fresh fruits. Urban households rely mainly on markets for food access which is closely related to their purchasing power. Understanding the demand and consumption patterns of fresh fruits as well the influence of fresh fruits attributes on their observed market prices is critical for providing evidence on barriers to access and affordability of fresh fruits for urban households

The research findings will be valuable for multiple stakeholders. Farmers can use the findings to understand consumer preferences and price determinants which will inform their production decisions for aligning their supply with market demand to maximize returns. For traders and other market actors, understanding key attributes that influence observed fresh fruits market prices will guide them in improving marketing and pricing strategies to remain competitive. Further, the findings will inform policy makers in designing food and nutrition policies targeting improved accessibility and affordability to nutritious foods like fresh fruits among urban households.

1.6 Scope and limitations of the study

The study focused on common fresh fruits consumed by urban households living in Nakuru city. The common fruits include bananas, mangoes, pineapples, oranges, pawpaw, avocados and watermelon. The major emphasis of the study was to assess how fresh fruit consumption patterns vary between the low income and high-income urban households and determine how these consumption patterns are affected by the socioeconomic and demographic factors. The study further assessed the effect of fresh fruits attributes on their observed market prices. Most of the data depended on consumer's recall of information which may have limit the accuracy of information given however, thorough probing of questions enhanced accuracy of data during data collection.

1.7 Operational definition of terms

Demand analysis referred to the determination customers willing to buy a particular product, how many units they are likely to buy and at what price range.

Fresh fruits referred to fruits that have not been processed to extend their life. This study focused on the various fresh fruits which are commonly found in Nakuru County. The fruits were bananas, mangoes, pineapples, avocados, oranges, and watermelons.

High-income households referred to households who earned above KES 119, 999 per month.

Income group referred to the economic status of the household as determined by the total household income, occupation of the household head, value of observable household items and the residential area.

Low-income households referred to those households who earned less than KES 23, 670 per month

Product attributes are those features of a product meeting consumer needs, in this study fresh fruits attributes include features such as freshness, texture, color, size and absence of defects and blemishes.

Willingness to pay is the maximum price that can be charged without reducing the individuals' welfare and utilization of the product.

CHAPTER TWO

LITERATURE REVIEW

2.1 Nutritional challenges in urban places

Urbanization refers to the mass movement of populations from rural to urban settings and the corresponding physical and social transformation of these environments. Cities play crucial roles in technological advancement and economic growth due to increased incomes and investment opportunities that lead to increased incomes and later dietary diversification. Dietary diversification involves consumption of staples like maize, roots and tubers to processed foods, animal products like sausages, fruits and vegetables as well as cereals like rice and wheat products which are easy to prepare. On the other hand, urbanization may have negative impacts to its dwellers in that they contribute to negative changes in nutrition transition, serve as vineyard for poverty, inequality, environmental hazards and health challenges (Battersby *et al.*, 2021; Vilar- Compte *et al.*, 2022). Major health problems resulting from urbanization include poor nutrition, pollution and infectious diseases all of which affect quality of life and strain public health systems. A balanced diet during childhood and adolescence is crucial not only for the well-being and growth of the child, but also for the establishment of a healthy eating habit that will persist even during adulthood (Choudhury, 2020; Kuddus and Rahman, 2015;).

Urbanization has a major negative impact on nutritional health of the low-income households. This is because they have limited financial resources and the cost of food is higher in cities. As a result, low income households lack diversified nutritious diets (Kuddus and Rahman, 2015; Kikafunda et al., 2020). Urban dwellers also suffer from over nutrition and obesity, a growing global public health problem. Obesity, and other lifestyle conditions, contributes to chronic diseases such as cancers, diabetes and heart diseases. Although obesity is most common among wealthy groups, recent studies show rising obesity rates among the middle- and low-income households in urban areas (Ngala *et al.*, 2021; WHO, 2023).

Among the urban dwellers, women of reproductive age and children are the two population groups most vulnerable to malnutrition and it's devastating consequences for health, nutrition, cognitive development, reproduction and economic productivity throughout the life cycle (Mwangome *et al.*, 2022). Globally, about 38 million children under five suffer from stunted growth, wasting, undernourishment and overweight with higher prevalence being among children from wealthier households (WHO, 2023). There has been no recent data comparing trends in child overweight in urban and rural areas, however, past studies indicated a higher

prevalence in children from urban places (Ngala *et al.*, 2021; Ruel *et al.*, 2017). Children in the adolescent stage are considered to be nutritionally vulnerable especially those in schools and colleges. Factors that reduce macro and micronutrient intake of adolescents could be adverse and harmful dietary practices constituting of majorly junk food. Other factors are dieting and low intake of nutrient dense foods like fruits and vegetables (Amugsi *et al.*, 2021; Deka *et al.*, 2015).

Nakuru city is also among Kenyan urban areas that have been hit by the effect of nutrition transition (Amugsi *et al.*, 2021; Mwangome *et al.*, 2022; Ploubidis *et al.*, 2012). The results from these studies are consistent with other findings on prevalence of hypertension, obesity, diabetes and high cholesterol in urban settings which Nakuru municipality falls prey. These studies have called for urgent intervention that will investigate means of reducing the nutrition transition related illnesses.

These urban challenges call for urgent policy action targeting nutrition-related diseases. Although the government has implemented several schemes and programs to improve the living conditions of people living in urban areas like provision of physical¹ and social² infrastructure, persistent urban poverty, unemployment, low incomes and poor access to nutritious foods remain pressing issues (MoH, 2023). There is need to understand consumer factors influencing demand for fresh fruits, preferences and willingness to pay for fruits attributes to better promote healthier diets.

2.2 Importance of fresh fruits in human diet

The World Health Organisation continue to recommend a minimum daily intake of 400 grams of fruit and vegetables, based on evidence that higher consumption levels reduces the risk of Non-Communicable Diseases (NCD) including Cardio-Vascular Diseases and certain cancers (Oyebode *et al.*, 2014; WHO, 2023). The evidence for a protective effect of fruit and vegetables on CVD has been shown in several meta-analyses. Martinez- Castaneiras *et al.* (2025), Wang, (2023), and Bhandari, (2022) reported that higher fruit and vegetable intake is associated with significant reduction in cardiovascular and all-cause mortality.

Lack of micronutrients or hidden hunger leads to poor health consequences for millions of people. Nutritionists agree that solving malnutrition requires a wide range of interconnected

¹ sewerage system, water supply, sanitation, roads, drainage system, street lighting and electricity

² Schools, health centers, community centers, recreational facilities

approaches which include bio-fortification, spending on supplementation programs and use of a wide range of edible plants for diversified diets. The further promotion of fruit consumption is an attractive option as it allows consumers to take responsibility over their diets (Akinnifesi and Tchoundjeu, 2016; FAO/ WHO, 2024). Encouraging fresh fruits consumption is essential as fruits not only supply essential micro-nutrients and polyphenols but also have a high-water content, low energy density and substantial fiber which contributes to improved overall diet quality (Martinez-Castanerian *et al.*, 2025; Slavin, 2012). Increased fruit consumption increases micronutrient, carbohydrate and fiber intakes, and possibly reduces fat intake, with no overall effect on energy intake (Li *et al.*, 2024; Woodside *et al.*, 2013). Little is found from previous research studies in Kenya on price and income influence on fresh fruit consumption. Further, recent studies highlight a gap regarding the effects of fresh fruit attributes on consumption and expenditure (Li *et al.*, 2024). Understanding these factors is crucial for targeted interventions to increase fresh fruit consumption in urban settings like Nakuru City.

2.3 Fresh fruits expenditure and consumption patterns by urban households

Many low- and middle-income countries are experiencing a nutrition transition, which is the rapid change in diets towards diets high in energy-dense, processed and convenience foods rich in fats, sugars, and salts accompanied by more sedentary lifestyles. The increased availability of ultra-processed foods, such as sugary drinks, sweets, and salted snacks, significantly contributes to poor diet quality and adverse health outcomes (Popkin 2025). The emergence of supermarkets even in remote areas could have led to improved availability of these energy-dense foods among poor households. Nutritional transformation involves shifts in both demand, driven by urbanization and rising incomes (Barrett, 2025; FAO, 2024). Institutional changes have also reorganized supply chains from traditional markets to supermarkets, altering food availability (FAO, 2024).

Demand-side factors influencing dietary practices and consumption patterns include economic variables such as income and prices, individual preferences, social norms and health concerns (Popkin, 2025). Supermarkets offer a broad range of products including healthy, neutral, and unhealthy foods, potentially increasing dietary diversity. However, substitution effects between food categories may both enhance and deteriorate overall diet quality. Despite supermarkets providing stable-year-round food supplies, the net impact on dietary outcomes depends on consumption choices (FAO, 2024).

In most African countries, fresh fruit consumption has remained below the recommended levels with most households consuming less than one serving of fruit per day contributing to food-insecurity and nutrition related mortality (Nambiar *et al.*, 2014; WHO, 2024). Kenya suffers from a dual burden of malnutrition according to the 2024 Demographic and Health Survey data showing 9% of women of ages 15–49 are thin or undernourished; 33% of women are either overweight or obese and 26% of children below 5 years of age being stunted (KNBS, 2024). In Kenya, 70.0% of urban population comprise of low income households who are mostly placed in areas with limited access to supermarkets and spend most of their food budgets on staples (Rischke *et al.*, 2015). While higher-income households are increasing their consumption for fresh fruits and other high value foods, low-income households tend to reduce their share of these foods (GoK, 2015; KNBS, 2024).

Urban food systems provided easier access and food variety, but still, low-income urban households face challenges related to cash-dependency, food price volatility and fragile employment (Ruel *et al.*, 2017; 2022).

Although the research discussed above provided useful insights on the expenditure and consumption patterns of fruits and vegetables and its contribution to nutrition security, there are gaps that still exist. First, there is scarcity of information on expenditure and consumption of fresh fruit alone. Second, most studies tend to focus on promotion of consumption of both fruits and vegetables yet in reality, more of vegetables than fruits are consumed with recent surveys indicating a 32.4% increase in vegetable consumption compared to 21.9% for fruits (KNBS, 2024). This highlights the importance of promoting more fruit intake to meet nutritional recommendations.

2.4 Product attributes, demand analysis and factors influencing fresh fruits consumption

Increasing consumption of fruits plays an important role in preventing chronic diseases including cardiovascular diseases, certain cancers, diabetes, stroke, Alzheimer’s disease, cataracts, and age-related function decline (Smith *et al.*, 2022; WHO, 2023). Globally, enhanced fresh fruit intake is regarded as a practical and cost-effective approach to reduce the burden of non-communicable diseases through improved dietary patterns (WHO, 2023). Fruits provide a complex mixture of essential nutrients and bioactive compounds such as vitamin C and A, minerals like potassium and magnesium, dietary fiber and phytochemicals including phenolics and flavonoids that contribute to health benefits (Smith *et al.*, 2022; WHO, 2023).

Beyond direct nutritional benefits, fresh fruits consumption displaces less healthy foods enganging overall dietary quality (Smith *et al.*, 2022). However, a persistent gap exists between the recommended fruit intake levels and actual consumption, especially in urban Kenyan settings where low fruit intake prevails across income groups (KNBS, 2024).

Beside income and price, fresh fruits consumption is influenced by consumer preferences centered on product attributes. These can be categorized as internal also known as sensory attributes and include tartness, texture, aroma, flavor and crispness while external attributes include color, fruit size, absence of defects, absence of blemishes and freshness. These attributes play an important role in food acceptance, preference, choice and intention to purchase (Mwangi *et al.*, 2024); Thomas *et al.*, 2015. Consumers often prioritize attributes such as freshness and taste above prices or nutritional quality when considering individual factors, which influences purchasing decision and market demand (Mwangi *et al.*, 2024).

Several studies on demand analysis in developing countries have shown socioeconomic and demographic factors such gender of household head, age of the household head, number of household members below five years old, occupation of the household head and household size among others significantly influence food consumption patterns. Variables such household income, education level, age, household size and social influences determine fruit expenditure and consumption behavior (Adams *et al.*, 2017; Kamau *et al.*, 2023; Mwenjeri *et al.*, 2016; Mwikali & Mbogori, 2024). Results from these studies indicated that food commodities are price inelastic for necessity goods such as maize, beans and milk and price elastic for luxuries such as fruits, vegetables and wheat products. Further, the studies found out that that income positively correlates with all food groups including fresh fruit indicating that an increase in income leads to higher consumption while price elasticity indicates fruits as luxury goods with demand sensitive to price changes (Kamau *et al.*, 2023). Education improves nutritional knowledge, leading to healthier diet choices including consumption of fresh fruits. Learned household heads have more information on the health and nutrition and thus include healthy foods like fresh fruits in their diets (Gido *et al.*, 2017; Nambiar *et al.*, 2014; Njiru *et al.*, 2022). Age of the household head influences fresh fruit consumption in a household. As persons become older, they tend to consume more fresh fruits as they become more conscious about their health. Households with members below five years reported high expenditure on fresh fruits while low fresh fruits expenditure was reported for households with children of over five years of age (Kimani-murage *et al.*, 2015; Nambiar *et al.*, 2014). Gender of household head

was also observed to influence fresh fruits consumption levels. Female-headed households generally report higher fresh fruit consumption, possibly due to greater nutritional awareness (Gido *et al.*, 2017; Kamau *et al.*, 2023).

Proximity to retailing outlets also affects fresh fruit expenditure and consumption. Households living far from the retail outlets make higher purchases for fresh fruits than those who live nearby this is because households with nearby retail shops can purchase fresh fruits as when they are needed (Mwikali & Mbogori 2024; Nambiar *et al.*, 2014). Traditional outlets such as roadside kiosks, open air markets and hawkers are preferred over supermarkets when it comes to making purchases for fresh fruits. This is due to the favorable features that traditional outlets possess which include locational convenience, affordable prices, and personalized services for buyers like credit and discount (Mwikali & Mbogori 2024). Social influence prompts household behavior to consume or not consume fresh fruits. Consumers from the same social class refer one another to a certain outlet from where they think they are served well or can find fresh fruits. Social influence is also experienced when consumers pass information they perceive nutritious about fruits to their peers who later make the decision to buy or not buy the fruits (Adams *et al.*, 2017; Kim & Park, 2011)

Previous studies on food expenditure and consumption in Kenya and Sub- Saharan Africa have focused on broad aggregated food groups which provides limited information on expenditure and consumption patterns for disaggregated foods such as fresh fruits and vegetables (Ayieko *et al.*, 2005; Bundi *et al.*, 2013; Nicholson *et al.*, 2023) and found out that consumption of fruits and vegetables was low and below the WHO/ FAO recommended levels. Nicholson *et al.*, (2023) and Ruel *et al.* (2005) did a multi-country analysis of Sub-Saharan Africa (SSA) on fresh fruits and vegetables consumption and the results indicated that consumption is between 27kg and 114kg per person per year which is far below the 400kg recommended levels by WHO/ FAO. The authors found out that fresh fruit and vegetables accounted for slightly over a quarter of average household expenditure on food, second only to staples. Consumption of fresh fruits and vegetables tends to increase with rising incomes although at a slower rate than the increasing income, indicating elastic demand but with varying income sensitivities (Kamau *et al.*, 2023; KNBS, 2024). The Rotterdam, Translog and the Almost Ideal Demand System models have been extensively estimated and used in demand analysis. The Almost Ideal Demand System model has considerable advantages over the two since it is more efficient as it fits to any kind of a utility function (Chongela *et al.*, 2014; Mwikali & Mbogori 2024).

Understanding disaggregated consumption patterns is critical for targeted nutritional interventions and policy development seeking to increase fresh fruits intake in Kenya and similar contexts where intake is still suboptimal despite known health benefits.

Incorporating perceived nutritional attributes into demand models enhances the understanding of fruit consumption behavior. It is also noted that recognition of nutritional attributes in demand analysis is not a straight forward issue since consumers do not possess much and accurate information on nutritional attributes present in foods (Capps & Schmitz, 1991). In light of this fact, this study incorporated perceived nutritional attributes in the analysis. Nutrition awareness and knowledge will be assessed by incorporating a validated Nutrition Knowledge Questionnaire developed by (Parmenter & Wardle, 1999) in the consumer questionnaire for this study. The Nutrition Knowledge Questionnaire has been used (Wardle *et al.*, 2000) to measure the relationship between nutrition knowledge and intake of fat, fruits and vegetables. The questionnaire covered four sections; experts recommendations regarding healthy eating, knowledge about the nutrient content of different foods, consumer everyday food choices and links between diets and diseases. Results from the study showed that nutrition knowledge was significantly related to dietary behaviour through healthy eating. This shows that nutrition awareness and knowledge is an important factor in explaining variations in food choice.

Beside the nutritional fresh fruits attributes, observable quality attributes of fresh fruits such as freshness, colour, juiciness, sweetness, firmness, flavour and tartness are also influential factors in consumer purchasing decision. Several studies have evaluated how these observable quality attributes influence consumer attitude on demand for fresh fruits (Barrett *et al.*, 2010; Opara *et al.*, 2017; Sandrine, 2006; Thomas *et al.*, 2015). Further, willingness to pay studies reveal that consumers are prepared to pay premiums for fruits with desirable attributes (Mwangi *et al.*, 2024; Opara *et al.*, 2017). From the results, it is evident that observable quality attributes count in consumer decision making on purchase of fruits.

Assessment of what consumers value in fresh fruits attributes will contribute to knowledge that is relevant to fruit producers, fruit sellers and marketers to customise programs and products that will accurately match consumers changing tastes and preferences. It can therefore be used for product innovation, packaging and designing additive services to gain competitive advantage (Hossain *et al.*, 2014; Mwangi *et al.*, 2024). However, literature on how these fresh

fruits attributes affect the willingness to pay for fresh fruits is limited, a gap that this study aims to contribute in filling.

2.6 Theoretical and conceptual framework

2.6.1 Theoretical framework

This study was based on the Neoclassical Consumer Demand theory, which hold that a negative relationship exists between the quantity demanded of a product and the products price. The theory assumes that consumer demand is derived from constrained utility maximization. The theory is a cornerstone of modern economics and lays the theoretical foundation for estimating the demand functions derived from utility maximization over quantities of goods consumed which is subject to income constraints and a vector of market prices (Kenton, 2024; Obisean, 2019). From the theory, optimal quantities of fresh fruits consumed by consumers are subject to prices and income as expressed in the function,

$$q_k = q_k(p_k, p_n, x) \dots\dots\dots (1)$$

where q_k - quantity of fresh fruits demanded by a consumer; p_k, \dots, p_n - fruits prices; x - income of the household and $k = 1, \dots, n$ (Bundi, 2013).

The basic axiom of utility maximization process is that a consumer chooses the most preferred bundle of goods from the feasible set of consumption bundles allowed by his budget. A consumer’s indirect utility $u(p, x)$ can be derived from his utility function $u(q)$ defined over vectors of fruits consumed q by. This is done by first computing the most preferred fresh fruits bundle represented by the vector $q(p, x)$ by solving the utility maximization problem. Second, computing the utility $u(q(p, x))$ the consumer derives from the preferred goods bundle. A demand function is inserted into the utility function to derive the indirect utility function as follows (Afzal *et al.*, 2022; Varian, 2020):

$$u = u(q(p, x)) = u(p, x) \dots\dots\dots (2)$$

This study applied this framework to analyze how household socioeconomic, demographic factors and institutional factors influence fresh fruits consumption amongst low- and high-income households in Nakuru City which is consistent with Gichu *et al.*, (2023) and Mutua *et al.*, (2021). The study went further to assess the effect of observable fresh fruits and perceived

nutritional attributes affect consumer willingness to pay and price sensitivity as observed by Njuguna *et al.* (2022) and Waweru & Muriithi (2024).

2.6.2 Conceptual framework

The conceptual framework for this study showed the relationship among the relevant household and fruit attributes and how they influenced household expenditure and consumption levels while contributing to nutritional security. Household socioeconomic and demographic factors such as income, household size, education level of the household head, occupation of the household head and the number of household members below five years influence fresh fruit expenditure decision and consumption levels positively. Institutional factors like type of retailing outlet, market distance, nutrition awareness and access to information on nutrition also influence the levels of household fresh fruit expenditure and consumption. The household based their fresh fruit frequency and quantity of purchase decision on these factors depending on how favorable or adverse they are. Favorable factors led to a higher fresh fruit expenditure and consumption while adverse factors led to reduced fresh fruit expenditure and consumption levels. Quantity of fresh fruits demanded and consumed eventually contributes to nutrition security.

Socioeconomic, demographic factors and institutional factors all combined influences fresh fruits prices since sellers center their fresh fruit pricing mechanism on them. Fresh fruits prices on the other hand influenced quantity demanded and consumed which would later influence contribution to nutrition security. Intervening factors which are regional and local trading policies affect the socioeconomic and demographic factors and institutional factors and determine how these factors influence fresh fruit expenditure and consumption. The framework is operationalized as shown in Figure 1 which show how various factors inter-relate to influence expenditure and consumption of fresh fruits.

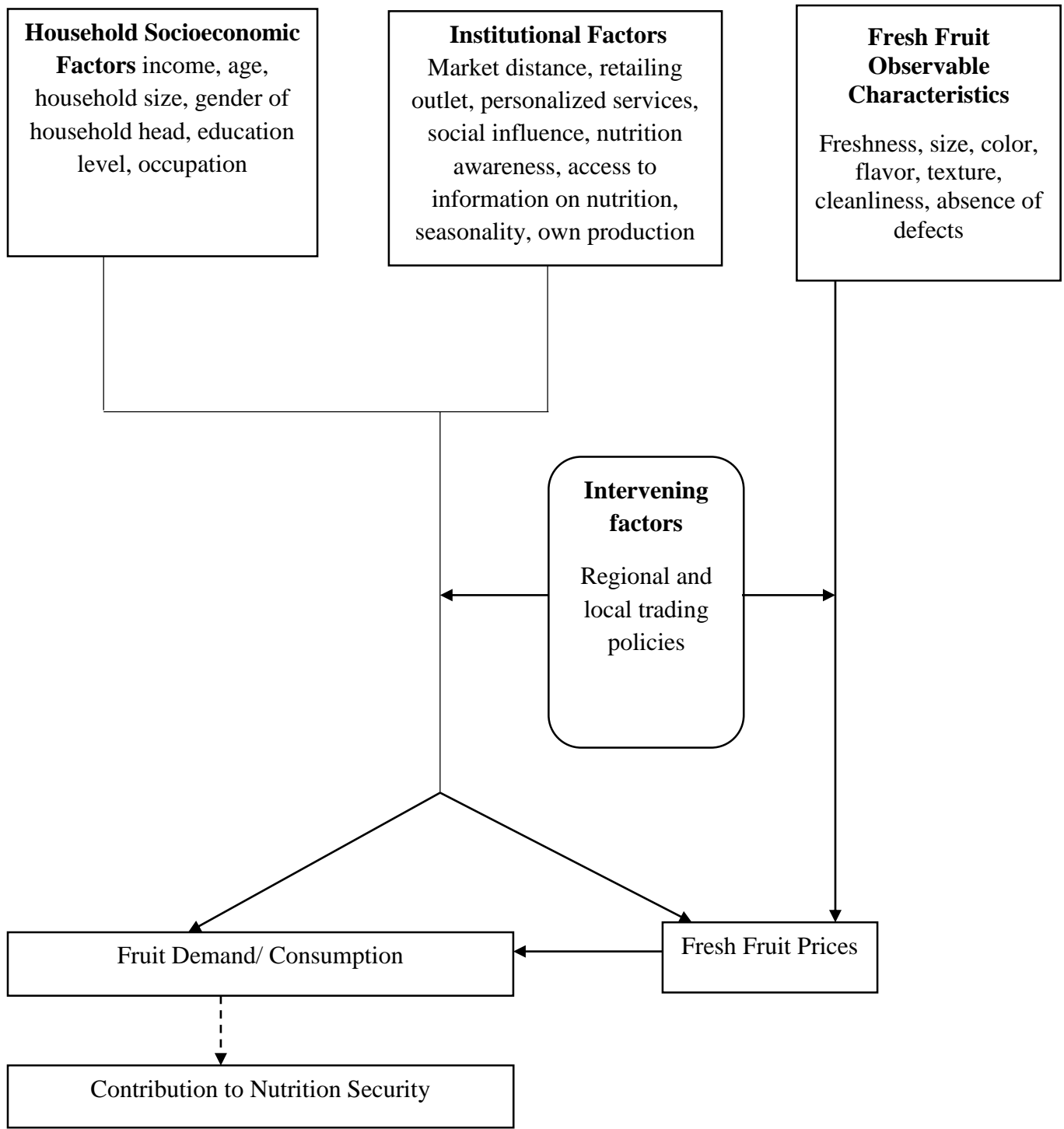


Figure 1: Conceptual framework

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Study area

This study was carried out in Nakuru City, Nakuru County, Kenya. Nakuru city is the Kenya's fourth largest town after Nairobi, Mombasa and Kisumu respectively and is located North West of the capital city, Nairobi, approximately 160 KM. It is one of the nine sub counties of Nakuru County and occupies a land mass of 297.2km square. It is the head quarter of County Government of Nakuru. The city borders the slopes of Menengai Crater to the North, Lake Nakuru to the South, Pre Historic Hyrax Hill to the East and Mau Ridges to the West. It is situated 2000 Meters approximately above sea level, at 0° 16'60.00" N and 36° 03'60.00" E. The city has the highest population size of 384,884 persons and the largest number of households at 125, 879 according to the 2019 census. It is also the most densely populated sub county with 3604 persons per square kilometer (Kenya National Bureau of Statistics [KNBS], 2019).

Nakuru city remain one of the oldest urban area and now among Kenya's youngest officially recognized cities following its elevation from municipality status in December 2021 through a charter meeting the Urban Areas and Cities Act 2011 criterion for cityhood (KNBS, 2022; Nakuru County Integrated Development Plan [NCIDP], 2013). The city's population has grown from 570,674 in 2019 to an estimated 686,630 by 2022, with projections suggesting a rise to 1,054.735 by 2030 at an annual growth rate of 6.36% (KNBS, 2022; UN-Habitat, 2025). Pull factors driving migration to Nakuru city include socio economic activities, superior social amenities facilities, peace and security, agricultural prominence, status as a trade center and transportation hub, improved infrastructure, and hospitality industry with excellent hotels. It has an array of industries which are mostly agro-based that provide employment. It is also centrally placed and connect the grain basket region to the rest of the consumption market (NCIDP, 2013; UN-Habitat, 2025). It has a metropolitan population distributed across its two constituencies, Nakuru Town East and Nakuru Town West. Nakuru town east is divided into five wards which include Biashara, Kivumbini, Langalanga, Menengai and Nakuru East. Nakuru town west has six wards which are Shabaab, London, Rhoda, Kapkures, Kaptembwa East and Barut (Gathogo, 2014; NCIDP, 2013). The target population for this study were the low- and high-income households who were well represented in the two constituencies. Nakuru City was ideal for this study because from previous studies, it is evident that obesity and other lifestyle related conditions like diabetes, hypertension and cancers are prevalent among its

dwellers. According to the Kenya Demographic and Health Survey (KNBS) 2022, the prevalence of overweight or obesity in Kenya remains high, with urban areas like Nakuru showing elevated rates. Nakuru city reported significant burdens of non-communicable diseases including obesity, hypertension, and diabetes (Nakuru County Nutrition Action Plan [NCNAP], 2021; Nakuru County Nutrition Policy [NCNP], 2025; Wanjau, 2022). Further, the prevalence of the non-communicable diseases was linked to dietary patterns characterized by low fruits consumption despite the availability of fresh fruits year-round through both local production and imports which was consistent with findings from recent county nutrition reports highlighting nutrition-related health challenges tied to dietary insufficiencies (NCNAP, 2021; NCNP, 2025). These findings demonstrate the relevance of Nakuru City as a focal area for this study.

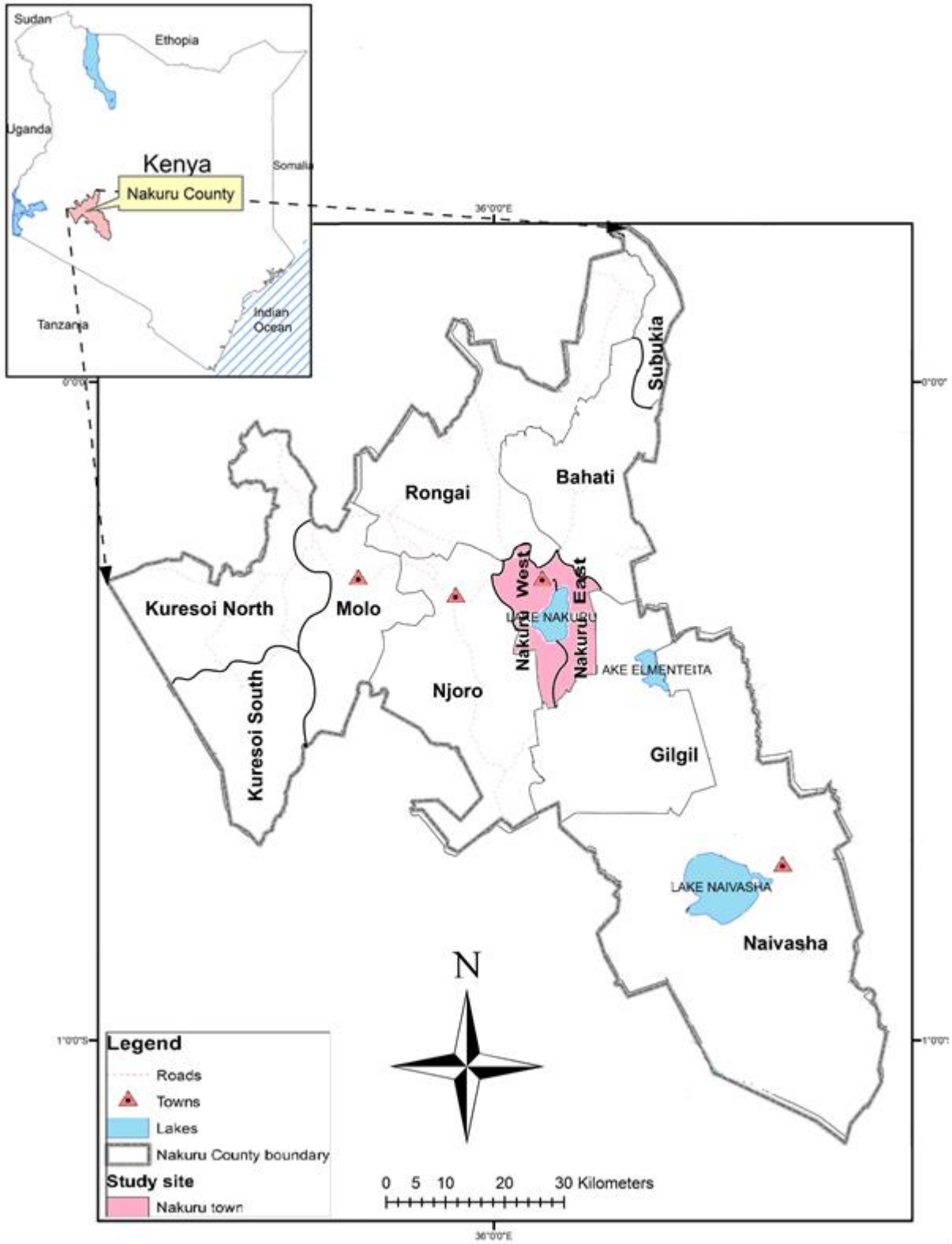


Figure 2. Map of the Study Area

Source: World Resource Center (2017)

3.2 Sampling Technique

The study applied the multistage sampling technique to select study respondents. The area of Nakuru city was purposively selected since it contains a good representation of low- and high-income households in its wards and has the highest population size in Nakuru County. Nakuru city is divided into two constituencies which have several wards each. Two wards were purposively selected, because of their largest population, one picked from each of the two constituencies. Biashara ward was selected from Nakuru town east constituency while Kaptembwa ward was picked from Nakuru town west constituency. The two wards were selected because they have the largest population size. The two wards Biashara and Kaptembwa were characterized with high income and low-income earning groups respectively. To determine the number of households to interview in each ward, proportionate to size sampling was used as show:

$$\frac{P}{N} \times S_{total} \dots\dots\dots (4)$$

Where; *P* - Number of households in the ward; *N* -Total number of households in the two wards; *S_{total}* - Total sample size

Systematic random sampling was used to select the respondent households. The target study respondents were individual consumers responsible for purchasing decision of their households.

3.3 Sample size determination

The required sample size for the study was determined using the following formula Bowley’s (1926) which provides a systemic way of ensuring that each stratum of the population is represented in the sample according to its actual size in the population. This was important for my study since the target population was not homogenous but distributed across different strata, income groups and location. Further, the Bowleys method reduces sampling bias through its proportional allocation which minimizes the risk of underrepresenting or overrepresenting any sub-group and it also increases the precision of estimates because the sample variance is reduced when larger strata receive more respondents (Bowley, 1926).

$$S_{total} = \frac{N}{1 + N(e)^2} \dots\dots\dots (3)$$

Where S_{total} - desired sample size; N -the total projected population of households in Nakuru city; 1 - is a constant and ℓ - the margin of error allowable which is 0.065.

$$S_{total} = \frac{125,879}{1 + 125,879(0.065)^2} = 236.2422$$

$$S_{total} \approx 237$$

The sample size will be 237 households

Table 3.1: Study Household Sample Distribution

Ward	Population size	Sample size
Biashara	35, 916	81
Kaptembwa	70, 352	156
Total	106, 268	237

3.4 Data collection and analysis

This study used primary data which was sourced through interviews with the aid of structured questionnaires (Appendix 1) that were administered by trained enumerators. Secondary data was obtained by reviewing the literature from selected documented book chapters, journals, annual reports, newsletters and other published sources related to my study. Finally, data will be cleaned, organized, and analyzed through STATA computer program. Data collection targeted a one-month recall window to minimize recall bias and provide a relevant measure of household fresh fruit consumption. Consumption quantities were converted into standardized kilogram weight to enable a comparison across fruit type. Recall bias is a common concern in dietary surveys emanating from respondents' difficulty in remembering consumption details over extended periods (Kumar *et al.*, 2024). To mitigate this, the interviews were well structured and utilized aids such as cross-check questions, consumption diaries and prompts about recent shopping activities. Enumerators were trained on how to probe effectively and validate purchases against purchase receipts where possible. Non-consumption of one fruit type indicated by zero reported intake was retained in the data set to accurately reflect household consumption realities and avoid sample selection bias. The LA/AIDs estimation procedure

accommodates zero expenditure shares through addition of a small constant to all quantity values before applying the logarithmic transformation. In this study, a constant of 0.01 was added to all quantity values prior to log transformation as recommended in the current statistical and econometric best practice (FAO 2023; Forgenie *et al.*, 2023; West, 2021)

3.5 Analytical framework

Objective One: To consumption patterns of fresh fruits among low- and high-income households in Nakuru City.

Descriptive and inferential statistics were used where *t*-test formed part of the analytical tool (Croucher *et al.*, 2021). Comparison of means was computed using the *t*-test. Calculation of means, frequencies and percentages was also used to show the comparisons in consumption levels among the low-and high-income households. Tables and graphs were further used to present the results showing fresh fruits consumption levels among the low- and high-income households from which inferences were drawn.

Objective Two: To estimate the demand of selected fruits among the low- and high-income households

The Linearized Approximation Almost Ideal Demand System model (LA/AIDS) developed by Deaton & Muellbauer (1980) was applied for estimation of this objective. The LA/AIDS model is popular for empirical studies and estimation since it is a flexible concept of demand system and has desirable properties. This model gives an arbitrary first order approximation to any demand system; it satisfies the axiom of choice exactly; it aggregates perfectly over consumers; it has a functional form which is consistent with known household budget; it is simple to estimate, largely avoiding the need for non-linear estimation; and can be used to test the restrictions of adding-up, homogeneity and symmetry through linear restrictions on fixed parameters making it more robust for policy analysis (Altayeb & Daoud, 2022; Deaton & Muellbauer, 1980; Verbič *et al.*, 2014). The model is flexible and easy to linearize using the Stone's Price Index. Further, LA/ AIDS allows full derivation of elasticities; expenditure, compensated, uncompensated and cross-price. Although many of these properties are found in one or other of the Rotterdam and Translog models, neither possesses all of them simultaneously like does the LA/AIDS model (Anindita *et al.*, 2022; Deaton & Muellbauer, 1980). Further, compared to other demand models such as the Linear Expenditure System, Rotterdam and Translog, the LA/AIDS offers superior fit and consistency in capturing non-

linear Engel curves typical of food consumption behavior (Anindita *et al.*, 2022). Additionally, its linear approximation specification brings about computational efficiency and makes it suitable for cross-sectional household data analyses (Ayieko *et al.*, 2019).

The model has been used in the recent past demonstrating its robustness for policy-relevance in estimation of price and income responsiveness for nutritionally significant commodities (Barbosa de Lima, 2023)

The AIDS model takes the following budget share:

$$W_i = \alpha_i + \sum_k \gamma_{ik} \ln P_k + \beta_i \ln \left(\frac{x}{p} \right) + \mu_i \dots \dots \dots (5)$$

Where:

α_i, γ_{ik} and β_i - are the parameters ($i, k=1, \dots, n$); n- is the number of fresh fruits analyzed in this case n=6 for oranges, bananas, water melons, pineapple, mangoes, avocado,; W_i - fruit budget share of the household; α - is the intercept, it represents fruit budget share parameter when all prices and real expenditure are equal to one; γ_{ik} - Price coefficient; P_k - Price of fruit k that is within the group being analyzed; β_i -expenditure coefficient; X - total expenditure (real income) on the group of fruits being analyzed; P is the price index of the group; \ln - natural log; μ - random disturbance term assumed with zero mean and constant variance (Bundi *et al.*, 2013; Kimothi *et al.*, 2024). The price index P is defined as;

$$\ln p = \alpha_i + \sum_k \alpha_k \ln P_k + \frac{1}{2} \sum_k \sum_i \gamma_{ik} \ln p_i \ln p_k \dots \dots \dots (6)$$

The influence of socioeconomic and demographic variables on household fruit demand patterns was introduced into the budget share equation through a translating method as applied by Kabugua (2023), Mwenjeri *et al.*, (2016), and Xu (2024) . The intercept α_i of equation (5) will be modified using the translating method as follows;

$$\alpha_i = P_{i0} + \sum_{K=1}^s P_{ik} d_k \dots \dots \dots (7)$$

k=1.....n

Where:

d_k - Household socioeconomic and demographic variables and P_{i0}, P_{ik} - Estimated parameter.

Incorporation of equation (7) to equation (5) yields the following equation:

$$W_i = P_{i0} + \sum_{k=1}^s P_{ik} d_k + \sum_j \gamma_{ik} \ln P_k + \beta_i \ln \left(\frac{x}{p} \right) + \mu_i \dots\dots\dots(8)$$

To avoid empirical difficulties caused by the non-linearity of parameter (price index, equation 6), the Stone index was used to linearize the Almost Ideal Demand System (AIDS) model to LA/AIDS (Deaton & Muellbauer 1980; Forgenie *et al.*, 2023; Mwenjeri *et al.*, 2016; Ximenes *et al.*, 2022). The Stone index, p^* is defined as below:

$$\ln p^* = \sum W_i \ln P_k \dots\dots\dots (9)$$

Where W_i is the budget share of each fruit being used as a weight (Kramer, 2020; Tshikala, 2012).

Substituting equation (9) to (8) results to the LA/AIDS equation as follows:

$$W_i = P_{i0} + \sum_{k=1}^s P_{ik} d_k + \sum_j \gamma_{ik} \ln P_k + \beta_i \ln \left(\frac{x}{p^*} \right) + \mu_i \dots\dots\dots(10)$$

To make the model consistent with the theory of demand, the following restrictions of Adding up, Homogeneity and Symmetry were imposed (Beznoska, 2024; Deaton & Muellbauer, 1980).

$$\sum_i \alpha_i = 1, \sum_i \gamma_{ij} = 0, \sum_i \beta_i = 0 \text{ (Adding up restriction)}$$

$$\sum \gamma_{ij} = 0 \text{ (Homogeneity restriction)}$$

$$\gamma_{ij} = \gamma_{ji} \text{ (Symmetry restriction)}$$

Where α_i, β_i and γ_{ij} - are parameters; α_i - is the estimated budget share of fruit i ; β_i - represents the fruit expenditure coefficient. It determines the variation in fruit expenditure when real income changes; γ_{ik} 's – are the price coefficient. They determine how the budget share of fruit i changes due to a percentage change in the price of fruit k holding real expenditure constant (Tshikala, 2012).

Adding up restriction imply that a household cannot spend more than its total disposable income. Homogeneity restriction ensures unchanged demand for fruits with proportional change in prices and income. Symmetry restriction implies that the effect of a unit increase in price of fruit i on the demand for fruit k is equal to the effect of a unit increase in price of fruit k on the demand for fruit i (Hoang *et al.*, 2021; Verbič *et al.*, 2014). Due to infrequent consumption, some households may not have purchased for consumption some fruits during the survey period implying zero values for the corresponding observations. This creates selectivity bias problem which is solved through either adding a small constant to all quantity values before applying the logarithmic transformation or a censored demand model is employed (Kumar *et al.*, 2024) or applying a two-stage estimation procedure (Heckman, 1979) and first applied within demand frameworks by Heien & Wessells (1990). The first stage involves estimation of a probit regression to represent the household decision to consume a particular commodity or not, in this case the commodity is the fruit. The maximum likelihood estimates from this are then used to create Inverse Mill's Ratio (IMR) for each household. In the second stage, the IMR is used as an instrumental variable in the estimation of the demand equation (Bett *et al.*, 2012; Bundi *et al.*, 2013). In this study, a small constant of 0.01 was added to all quantity values prior to log transformation as recommended by Forgenie *et al.*, (2023) and West (2021).

Price Elasticities

Once the regression coefficients α_i , β_i and γ_{ik} are estimated, the elasticities will be computed using the following formulas (Bundi *et al.*, 2013; Mwenjeri *et al.*, 2016; Tshikala, 2012; Verbič *et al.*, 2014).

Income/ Expenditure elasticity

$$\eta_i = 1 + \left(\frac{1}{W_i}\right) \left(\frac{\partial W_i}{\partial \ln x}\right) = 1 + \frac{\beta_i}{W_i} \dots\dots\dots (11)$$

Marshaillian/ uncompensated own price elasticity

$$\varepsilon_{ii} = -1 + \frac{\gamma_{ii}}{W_i} - \beta_i \dots\dots\dots (12)$$

Marshallian/ uncompensated cross price elasticity among fruit i

$$\varepsilon_{ik} = \frac{\gamma_{ik}}{W_i} - \beta_i \left(\frac{W_k}{W_i}\right) \dots\dots\dots (13)$$

Hicksian/ compensated own price elasticity

$$\varepsilon_{ii} = -1 + \frac{\gamma_{ii}}{W_i} + W_i \dots \dots \dots (14)$$

Hicksian/ compensated cross price elasticity among fruit *i*

$$\varepsilon_{ik} = \frac{\gamma_{ik}}{W_i} + W_k \dots \dots \dots (15)$$

The process of estimation was carried out through the Seemingly Unrelated Regression (SURE). The SURE systems parameter estimates were then obtained by use of STATA econometric software under the constrained Iterated Seemingly Unrelated Regression (ITSUR) procedure (Bett *et al.*, 2012; Nguyen & Nguyen, 2024). The variables that were used to estimate the LA/AIDS model for this study are represented in Table 3.2.

Table 3.2: Description of variables used in the LA/AIDS model

Variables	Description of variables	Expected sign
Dependent Variable		
W_i	Household budget share of the fresh fruit being analyzed (KES).	
Independent Variables		
PcofFF	Price of fresh fruits (KES)	-
IncHh	Total income of the household (KES)	+
OccHH	Occupation of the household head	+/-
AgeHH	Age of the household head (years)	+
EducHH	Education level attained by the household head	+
GndrHH	Gender of the household head, 1=female, 0=male	+/-
AgeHH	Age of the household head	+
EducHH	Education level of the household head	+
SzHh	Number of the household members	+/-
DstncMkt	Proximity to the nearest retailing outlet (walking minutes)	-
TypeMkt	Type of main market outlet	+/-
QtyDisc	Quantity discount offered for buying in bulk	+
NtrAwrnsKnw	Nutritional awareness and knowledge	+/-

Objective Three: To determine the factors that influence the willingness to pay for selected fresh fruit attributes among the low- and high-income households in Nakuru City

The Hedonic Pricing Model was the preferred model in the estimation of this objective because it is more efficient in analyses pertaining goods attributes and capturing the value consumers' places on goods attributes. It reflects actual choices made by consumers and estimates their marginal willingness to pay for the goods attributes considering several possible interactions between the goods attributes, both implicit and explicit. Since the hedonic price model does not require joint consumption of goods within a group, it was preferred over the Contingent Valuation Model. It disaggregates consumption within a bundled group and decomposes observed prices into implicit values of products characteristics thereby estimating willingness to pay for specific attributes allowing for an estimation of attribute preferences (Rosen, 1974). The theoretical basis of the hedonic pricing framework is as developed by Rosen (1974) and Lancaster (1966) and concentrates on measuring factor effect on prices. Hedonic pricing model has been used to determine the willingness to pay for products attributes of several agricultural products including, apples (Carew, 2000; Carew *et al.*, 2012), cowpeas (Ifegwu & Ajetomobi, 2013) wheat (Espinosa *et al.*, 2017) and tomatoes (Huang & Lin, 2017). Recent studies have proven the efficiency of the model in estimating the willingness to pay for quality attributes in fresh fruits such as apples, tomatoes, and other horticultural crops (Kneuertz *et al.*, 2021; Otieno *et al.*, 2023; Wang *et al.*, 2022).

Consumers purchase goods because of the utility derived from their attributes rather than the goods themselves which is in line with Lancaster's (1996) characteristic theory of consumer demand . Hedonic prices explores price-quality relationship in estimating implicit prices for product attributes (Lancaster, 1966). Price paid by the consumer for each product consumed equals sum of the marginal monetary values of the products attributes. It represents a competitive equilibrium price reached simultaneously by both sides of the market in terms of bids consumers are willing to make for different bundles of attributes and the offers of those bundles by suppliers (Rosen, 1974). Consumer bid equations and supplier offer equations must be estimated simultaneously to avoid simultaneous equation bias (Rosen, 1974). However, many economists have contended that the supply of attributes may be considered perfectly inelastic and have therefore used single equation approach to estimate the hedonic price equation (Carew *et al.*, 2012; Hossain *et al.*, 2014; Ifegwu & Ajetomobi, 2013; Nyamwaro &

Muriithi, 2024; Usman *et al.*, 2020; Wilson, 1984). This single equation approach will be applied in this study.

In this study, the hedonic pricing model and regression analysis was used to determine effects of observed fresh fruits attributes and household characteristics on the willingness to pay for fresh fruits. The model disaggregates the observed fresh fruit prices into implicit values corresponding to each attribute within the bundled price. The model estimated the value of specific attributes of fresh fruits from within the bundled price. The regression analysis treats the price of a product a consumer is willing to pay as a function of various attributes capturing heterogeneous consumer preferences and enabling estimation of marginal willingness to pay for fresh fruits attributes (Khan *et al.*, 2019; Osth *et al.*, 2025). The general implicit function is expressed as:

$$P_i(X) = Q^i(X_1, X_2, \dots X_n, Z) + \varepsilon_i \dots\dots\dots (16)$$

Where:

P_i - Price (willingness to pay) of fruit i in the market; $X_1, X_2, \dots X_n$ -Fruit i attributes; Z - Buyer or seller characteristics (Rosen, 1974; Ifegwu & Ajetomobi, 2013 Hossain *et al.*, 2014). Little a priori theoretical guidance is available with respect to the right functional form. Various functional forms are used in studies including linear ($\lambda = 1$), log-linear ($\lambda = 0$) and inverse ($\lambda = -1$). In this study a transformation by Box and Cox (1964) of the dependent variable was used to choose the functional form amongst the linear, log-linear or inverse. The Box-Cox transformation technique provides the advantage of estimating a generalized functional form that best fits the data and improves model performance by stabilizing variance and simplifying interpretation (Blum *et al.*, 2022; Sibono, 2025). Transformation of the price also provides homogeneity of the variance and makes the interpretation of the model to be easier (Szathvary & Trestini, 2014; Rogers, 2025). On the basis of residual sum of squares of each regression, the likelihood is maximized when $\lambda = 0$. The choice is also supported by the Adjusted R^2 estimation. The empirical multiple regression that is transformed from the above function takes the following form (Szathvary & Trestini, 2014; Zhou, 2024).

$$\ln P_i = \alpha_0 + \sum_{b=1}^6 \alpha_b OBS_{bi} + \sum_{r=1}^4 \gamma_r MKT_{ri} + \sum_{s=1}^6 \delta_s SOC_{si} + \varepsilon_i \dots\dots\dots (17)$$

Where:

P_i - Willingness to pay for fresh fruit i which is log transformed; α_0 - The constant effect; OBS_{bi} - Set of observable fruit i attributes which include freshness, color and size, flavor and texture; MKT_{ri} - Set of market factors and characteristics like type of outlet, discount and credit, seasonality, market distance; SOC_{si} - Set of household socioeconomic and demographic characteristics; ε_i - Homoscedastic error term with zero mean. Above equation (17) was run for different fruit types that are included in the group being analyzed. The natural log transformations was used on all of the non-binary continuous variables to allow for implicit price of fruit attributes to vary with the number of attributes. The variables that were used in the Hedonic Pricing Model for this study are represented in table 3.3;

Table 3.3: Description of variables to be used in the Hedonic Pricing Model

Variables	Description of the variables	Expected sign
Dependent Variables		
$\ln P_i$	Natural log for price (WTP) of a fresh fruit (KES).	
Independent Variables		
OBS	Observable fruit attributes that are determined through touch and visual measurements	
Freshness	Succulence or dryness appearance of a fruit	+/-
Color	Represents the ripeness of the fresh fruit	+/-
Absence of defects	Represents the absence or presence of spots, blemishes and bruises	+/-
Size	Represents the maturity of the fresh fruit	+/-
Cleanliness	Refers to the hygiene and neatness of the preferred retailing outlet	+
Texture	Texture is the smoothness, crispness or crunchiness of fresh fruits.	+/-
MKT	Refers to the characteristics of the retailing outlet	
TypeROtl	Type of retailing outlet	+/-
DstncMkt	Proximity to the nearest retailing outlet (walking minutes)	+
Cleanliness	Represents the hygiene measures in the retailing outlet	+
SOC	Household socioeconomic and demographic factors	
AgeHH	Age of the household head in years	+/-
IncHh	Total income of the household	+
EducHH	Education level attained by the household head	+
GenHH	Gender of the household head, 1=female, 0=male	+/-

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1.0 Introduction

In this chapter, the results of data analysis and their interpretation are presented in organized sections according to the study objectives. Descriptive analysis of household socio-economic and institutional characteristics was discussed in section one. Section two discusses results of the Linearized Approximation Almost Ideal Demand System (LA/AIDS) model estimating the demand of selected fruits among the low- and high-income households. Section three discusses results of the hedonic pricing model on factors that influence the willingness to pay for selected fresh fruits among the low- and high-income households in Nakuru city, Kenya.

4.1.1 Income allocation on fresh fruits consumption among low- and high-income households in Nakuru city, Kenya

In this section, we provide a general description of key indicators influencing fresh fruits consumption disaggregated by income categories (Table 4.1). Key issues presented include the socioeconomic characteristics and differences in income and expenditure by low- and high-income households. Mean monthly income spent on fresh fruits, other foods and non-food items was higher among the high-income households than low-income households. High-income households were relatively more educated than the low-income households. These results were consistent with Liguori (2022) who found out that high-income earners had higher educational levels thus better informed on the importance of healthy foods like fruits in their diets. Income allocation on fresh fruits by high-income households was 41% higher than that of low-income households, indicating the positive influence of income on fruit consumption. This coincided with Kaur (2023) who found that income constraints inhibited the ability of low-income households to purchase more fruits and vegetables. The difference in low- and high-income household spending on fruits could be attributed to high-income households having more disposable income allocated to fruit purchases contrary to their low-income counterparts.

Table 4.1: Difference in mean household socio-economic characteristics and expenditures between low income and high income households

Variable	Low-income households = 187				High income households = 50				Ttest
	Mean	Std.Dev.	Min	Max	Mean	Std. Dev.	Min	Max	
Household head age (Yrs)	37.09	12.63	18.00	90.00	37.74	9.78	21.00	70.00	-0.65
Household head education (Yrs)	11.69	4.46	0.00	52.00	13.22	3.48	0.00	18.00	-1.53*
Household head gender (0= female, 1 = male)	0.71	0.45	0.00	1.00	0.84	0.37	0.00	1.00	-0.13
Monthly Income spent on fruits (KES)	300.37	296.57	0.00	1500.00	723.80	860.13	20.00	5000.00	423.40***
Monthly Income spent on other foods (KES)	1182.83	820.84	100.00	5000.00	2458.40	2430.00	300.00	15000.00	1275.60***
Monthly Income spent on nonfood items (KES)	2088.86	2337.61	50.00	16667.00	7926.14	11035.60	300.00	55000.00	5837.30***

*** p<0.01, ** p<0.05, * p<0.1

4.1.2 Differences in mean fruit prices and consumption between the low-and high-income households

This section provides a general description of differences in mean prices and consumption of fresh fruits among the low and high-income households which revealed income related disparities consistent with recent empirical studies in Kenya (Table 4.2). Weekly consumption of bananas, oranges and melons was 50.7%, 55.1% and 40% respectively higher among the high-income households. These findings were consistent with Manyeruke (2025), who reported that income positively influences fruit consumption patterns in Kenya while price remains a critical determinant of fresh fruit demand in urban Kenya. The observed lower prices for bananas and oranges and corresponding higher consumption which was similar finding by Manyeruke (2025) align with the law of demand where lower relative prices induce higher consumption. This price-quantity relationship underpins the significant consumption differences observed, suggesting that affordability is key to improving fruit intake among lower-income households which echo findings by GAIN (2025) which emphasizes income and price barriers to diversified and nutritious barriers in Kenya.

Table 1.2: Differences in mean fruit prices and consumption between the low-and high-income households

Variable	Low-income households = 187					High income households = 50				Ttest
	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max		
Banana price per Kg (KES)	48.84	14.83	20.00	75.00	42.31	10.44	23.56	75.00	6.53**	
Orange price per Kg (KES)	61.22	33.27	12.00	180.00	47.85	20.33	18.00	120.00	13.36**	
Avocado price per Kg (KES)	56.96	19.41	18.00	95.01	59.84	18.88	30.00	95.01	-2.88	
Mango price per Kg (KES)	61.97	56.37	25.00	200.12	80.90	47.08	25.00	200.12	-18.93	
Melon price per Kg (KES)	119.08	35.51	10.00	180.00	88.76	25.30	33.31	178.21	30.32***	
Pineapple price per Kg (KES)	81.39	29.54	25.00	160.00	89.37	34.06	20.00	160.00	-7.97	
Banana consumption per week (Kgs)	2.34	2.34	0.02	22.40	7.17	7.06	0.40	30.00	-4.83***	
Orange consumption per week (Kgs)	1.72	1.28	0.17	7.00	5.95	7.99	0.17	50.00	-4.23***	
Avocado consumption per week (Kgs)	2.13	1.47	0.17	9.33	1.91	1.63	0.17	9.33	0.22	
Mango consumption per week (Kgs)	0.57	0.93	0.20	10.00	0.36	0.61	0.20	4.20	0.21	
Melon consumption per week (Kgs)	1.19	1.00	0.17	8.33	2.77	1.36	0.20	6.67	-1.58***	
Pineapple consumption per week (Kgs)	1.66	1.04	0.13	4.38	1.54	0.79	0.17	4.38	0.12	

*** p<0.01, ** p<0.05, * p<0.1

4.2 Demand analysis of selected fruits in Nakuru City, Kenya

This section presents demand analysis results of selected fresh fruits among the low- and high-income households in Nakuru City Kenya. Expenditure and price elasticities were used to discuss how households reacted to price and income changes. An absolute value between zero and one is considered inelastic while a value above one is considered elastic. The higher the absolute value of price elasticity of a good, the higher the measure of responsiveness of the fruit demanded to a change in price.

4.2.1 Expenditure Elasticities

Expenditure elasticities measure the changes in demand with respect to proportionate changes in expenditure (income). Positive expenditure elasticity indicates a normal good while negative expenditure elasticity indicates an inferior good. All fresh fruits expenditure elasticities for both low- and high-income households were positive (Table 4.3) indicating that the fruits were normal goods. The results coincided with Sadiq *et al.* (2021) who found positive elasticities for fresh fruits.

Among the low-income households, expenditure elasticities for avocado, mangoes and pineapple were significant and less than unity but more than zero which implied although fruits were normal goods and necessities. An increase in household income thus led to increased demand for these fruits but less proportionately (inelastic). A 1% increase in income led to a 0.64%, 0.56% and 0.49% increase in demand for avocados, mangoes and pineapple, respectively, among the low-income households. Even as income among low-income households increased, the inelastic demand could imply that first prioritized purchase of other food items or shifted their taste and preferences to other fruits that were not regularly consumed due to income constraints. This could also be highly attributed to the highly seasonal nature of in the supply of avocados, mangoes and pineapples implying that consumers were willing to pay the prevailing prices when they were available (Olagunju & Omotoye, 2021).

On the other hand, expenditure elasticities for bananas, orange and melon were more than unit indicating that as income increased, quantity demanded increased more than proportionately (elastic and luxury products). A 1% increase in income among low-income households led to a 1.64%, 1.57% and 1.0% increase in demand for bananas, oranges and melon respectively. These results were identical to those of high-income households. The magnitude of changes were however relatively higher among the low-income households indicating higher responsiveness

to income. The results coincided with Komarek *et al* (2021) who found that increased income resulted to a rise in fruit purchases among households. The strong income responsiveness of demand for oranges, melons and bananas could be attributed to the stable nature of their supply all year round (Buccioli *et al.*, 2024; Simon, 2024) making supply shocks a minor worry when making purchase decisions.

Table 4.3: Distribution of elasticities between high-and low-income households

Expenditure elasticity						
Expend Elas	Banana	Orange	Avocado	Mango	Melon	Pineapple
Low	1.643*** (0.102)	1.572*** (0.103)	0.644*** (0.082)	0.557*** (0.092)	1.034*** (0.070)	0.490*** (0.055)
High	1.427*** (0.052)	1.445*** (0.063)	0.512*** (0.141)	0.421** (0.157)	1.033*** (0.067)	0.241* (0.112)

Uncompensated price elasticity, low-income households						
	C1	C2	C3	C4	C5	C6
Banana	-1.015*** (0.105)	-0.268*** (0.081)	0.458*** (0.107)	0.008 (0.070)	-0.529*** (0.095)	-0.297** (0.103)
Orange	-0.261* (0.109)	-0.664*** (0.081)	-0.103 (0.109)	-0.108 (0.071)	-0.294** (0.097)	-0.142 (0.105)
Avocado	0.618*** (0.094)	0.049 (0.069)	-1.338*** (0.093)	0.005 (0.060)	-0.004 (0.079)	0.026 (0.090)
Mango	0.191 (0.103)	-0.003 (0.078)	0.023 (0.104)	-0.925*** (0.070)	0.065 (0.089)	0.093 (0.101)
Melon	-0.308*** (0.077)	-0.136* (0.058)	-0.067 (0.077)	-0.018 (0.050)	-0.729*** (0.066)	0.224** (0.074)
Pineapple	-0.061 (0.060)	0.056 (0.047)	0.047 (0.061)	0.057 (0.041)	0.360*** (0.050)	-0.949*** (0.056)

Uncompensated price elasticity, high income households

	C1	C2	C3	C4	C5	C6
Banana	-1.004*** (0.070)	-0.162** (0.051)	0.301*** (0.069)	-0.002 (0.047)	-0.351*** (0.059)	-0.209** (0.067)
Orange	-0.197* (0.084)	-0.721*** (0.067)	-0.084 (0.087)	-0.092 (0.056)	-0.228** (0.073)	-0.123 (0.081)
Avocado	0.840*** (0.145)	0.048 (0.095)	-1.459*** (0.138)	0.016 (0.084)	-0.006 (0.110)	0.049 (0.127)
Mango	0.241 (0.137)	-0.026 (0.101)	0.035 (0.136)	-0.892*** (0.094)	0.084 (0.119)	0.137 (0.138)
Melon	-0.301*** (0.075)	-0.132* (0.054)	-0.066 (0.076)	-0.018 (0.050)	-0.735*** (0.069)	0.218** (0.076)
Pineapple	-0.102 (0.089)	0.055 (0.071)	0.078 (0.091)	0.098 (0.063)	0.534*** (0.083)	-0.904*** (0.089)

Compensated price elasticity, Low-income households

	C1	C2	C3	C4	C5	C6
Banana	-0.747*** (0.103)	-0.004 (0.077)	0.729*** (0.110)	0.180** (0.069)	-0.180 (0.094)	0.023 (0.098)
Orange	-0.004 (0.107)	-0.411*** (0.078)	0.156 (0.111)	0.056 (0.069)	0.040 (0.097)	0.164 (0.102)
Avocado	0.723*** (0.093)	0.152* (0.067)	-1.232*** (0.094)	0.073 (0.059)	0.133 (0.080)	0.151 (0.087)
Mango	0.282** (0.102)	0.087 (0.076)	0.115 (0.104)	-0.867*** (0.068)	0.183* (0.090)	0.201* (0.098)
Melon	-0.139 (0.076)	0.030 (0.056)	0.103 (0.078)	0.090 (0.049)	-0.509*** (0.067)	0.425*** (0.072)
Pineapple	0.019 (0.059)	0.135** (0.046)	0.128* (0.062)	0.108** (0.040)	0.463*** (0.051)	-0.854*** (0.052)

Compensated price elasticity, high income households

	C1	C2	C3	C4	C5	C6
Banana	-0.653*** (0.071)	0.133* (0.053)	0.472*** (0.069)	0.112* (0.047)	-0.041 (0.062)	-0.022 (0.067)
Orange	0.158 (0.085)	-0.423*** (0.062)	0.090 (0.086)	0.024 (0.056)	0.086 (0.076)	0.066 (0.082)
Avocado	0.966*** (0.133)	0.154 (0.092)	-1.398*** (0.144)	0.057 (0.083)	0.105 (0.111)	0.116 (0.122)
Mango	0.344* (0.134)	0.061 (0.098)	0.086 (0.137)	-0.859*** (0.091)	0.175 (0.118)	0.192 (0.131)
Melon	-0.047 (0.076)	0.082 (0.055)	0.058 (0.076)	0.065 (0.049)	-0.511*** (0.066)	0.353*** (0.074)
Pineapple	-0.042 (0.092)	0.104 (0.068)	0.107 (0.093)	0.117 (0.061)	0.586*** (0.079)	-0.872*** (0.082)

4.2.2 Own Price Elasticities

Own price elasticities were used to measure the percentage of demand changes associated with 1% changes of the respective fruit price. Both compensated and uncompensated own-price elasticities were negative thus consistent with demand theory (Mustafa *et al.*, 2022; Sadiq *et al.*, 2021). The compensated and uncompensated own price elasticities estimate ranged between 0.423 to 1.459 among the high-income households and 0.411 to 1.338 among the low-income households in absolute values. This implied that the impact of own price elasticities was relatively similar for low- and high-income households. For both households, there was a decrease in the quantity demanded for fresh fruits due to increased prices.

A 1% change in orange price led to a 0.42% change in quantity demanded among the high-income households and a 0.41% change among the low-income households (inelastic). A 1% increase in avocado price led to a 1.39% decrease in quantity demanded among the high-income households and a 1.33% decrease in quantity demanded among the low-income households (elastic). These results conformed with Matita *et al.* (2021) who observed that households had more significant responses to changes in food prices in which fruits were included.

4.2.3 Cross Price Elasticities

Cross price elasticities measure the effect on the quantity of a good demanded with respect to change in price of another good. Cross price elasticities can be positive or negative with positive values implying substitute goods and negative elasticities implying compliment goods.

Compensated price elasticities differed from the uncompensated elasticities (Table 4.3). The compensated price elasticities measure substitution effects net of income. Most compensated cross price elasticities were positive among the low and high-income households suggesting that most of the fruits were substitutes. Bananas were substitutes for mangoes and avocados among the low-income households with a substitutability effect being stronger for avocados at 0.723% and weaker for mangoes at 0.18%. A 1% increase in avocado prices led to 0.723% increase in consumption for bananas among the low-income households. Among the high-income households, a 1% increase in avocado prices lead to a 0.472% increase in demand for bananas. The substitutability effect was stronger among low-income households than high-income households implying that low-income households were more sensitive to price changes. This could be attributed to other food expenditure taking up a larger share of their income. When avocado prices increased, they shifted to affordable alternatives like bananas unlike the high-income households whose substitutability effect was weaker. There was also evidence of complementarity in fruit consumption across some fruit pairs. This complementarity was higher among low-income households than high-income households. Banana consumption was complementary to oranges, pineapples and melons for low-income households at -0.268^{***} , -0.297^{**} and -0.529^{***} respectively. Among the high-income households, bananas were complementary to oranges, pineapples and melons at -0.162^{**} , -0.209^{**} and -0.351^{***} respectively. These findings were consistent with Ravi and Ram (2020) who also identified higher complementarity among the low-income households than the high-income households.

4.3 Factors influencing willingness to pay for selected fresh fruits among low- and high-income households in Nakuru City, Kenya.

This objective assessed how various attributes as well as household characteristics influenced the willingness to pay for fruits among low- and high-income households in Nakuru City, Kenya using a hedonic regression model. The model estimated specific prices of various fruit attributes from within the bundled price. The price of a fruit a household was willing to pay was thus treated as a function of its individual attributes.

4.3.1 Factors influencing the willingness to pay for selected fresh fruits among high-income households in Nakuru City, Kenya

The results of the effect of fresh fruit attributes and socioeconomic characteristics on the willingness to pay for fruits among high-income households in Nakuru city, Kenya (Table 4.4) revealed that the effect of both the attributes as well as socioeconomic characteristics on willingness to pay was not uniform across all the fruits but varied depending on the type of fruits.

The marginal willingness to pay for selected fresh fruits among high-income households in Nakuru Municipality is significantly influenced by specific fresh fruits attributes and socio-economic characteristics at high confidence levels. Freshness attribute notably increased willingness to pay for mangoes by 88.9% and melon by 13.4% reflecting the premium these consumers place on fruit quality (Kimani & Wambugu, 2022). The color of fruits positively influenced willingness to pay for oranges, melon, and pineapple with oranges with pineapples being influenced the most which was consistent with findings by Ndiritu *et al.* (2024). Freshness had the largest influence on willingness to pay for fruits by 88.9% implying that high income households were willing to pay higher prices for guaranteed freshness in fruits which concurred with Ikiz *et al.* (2018) concerning the effect of freshness on the willingness to pay for fruits

Consistent with Mugenda *et al.* (2023), perceived nutritional value significantly influenced willingness to pay across several fruits including mangoes, oranges, melon and pineapples suggesting consumers' health consciousness influences demand. Socio economic factors further contribute to price sensitivity; the age of household heads increased marginal willingness to pay for oranges by 1.2%, mangoes by 1.7% and pineapples by 2.6% implying that older consumers value fresh fruits consumption more which was consistent with (Kimani & Wambugu, 2022). A one-year increase in education increased the willingness to pay for banana by 3.6% concurring with Barrett *et al.* (2010) and Ndiritu *et al.* (2024) that education influenced individual awareness on nutritional benefits of fruits hence the willingness to pay a higher price for fruits. Finally, access to discount and credit positively influenced the willingness to pay for oranges by 43.1% emphasizing the significance of financial accessibility in consumer behavior concurring with observations by Mugenda *et al.* (2023). In summary, the results show that fruit attributes as well as socioeconomic characteristics influenced the prices individuals were willing to pay for fruits. Sellers could thus maximize on the attributes as well as target their market based on socioeconomic characteristics to maximize their prices and profitability.

Table 4.4: The effect of fresh fruit attributes and household characteristics on fruit prices among high-income households in Nakuru Municipality, Kenya

HIGH INCOME HOUSEHOLDS						
Fruits	Banana	Orange	Avocado	Mango	Melon	Pineapple
Dependent variable: Price (KES)	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
Absence of defects (0= No, 1= Yes)	0.038 (0.116)	-0.121 (0.141)	0.075 (0.099)	-0.136 (0.169)	-0.065 (0.133)	-0.230 (0.179)
Cleanliness (0= No, 1= Yes)	-0.185 (0.138)	0.294* (0.156)	-0.039 (0.134)	0.189 (0.221)	0.186 (0.158)	0.175 (0.184)
Texture (0 = No, 1 = Yes)	0.057 (0.122)	-0.148 (0.140)	0.117 (0.101)	-0.314 (0.219)	0.008 (0.153)	-0.326* (0.178)
Size (0= No, 1= Yes)	0.089 (0.100)	0.105 (0.116)	0.149* (0.091)	0.262* (0.154)	0.057 (0.097)	0.096 (0.128)
Colour (0= No, 1= Yes)	0.050 (0.174)	0.307** (0.133)	0.221 (0.182)	0.054 (0.194)	0.165* (0.195)	0.399* (0.227)
Freshness (0= No, 1= Yes)	0.665* (0.369)	0.158 (0.114)	0.094 (0.337)	0.889* (0.495)	0.134* (0.123)	0.195 (0.148)
Perceived nutrition (0= No, 1= Yes)	0.088 (0.109)	0.294** (0.109)	0.108 (0.095)	0.448** (0.191)	0.102** (0.115)	0.213** (0.126)
Gender of household head (0 = female, 1 = male)	0.061 (0.120)	0.129 (0.150)	-0.140 (0.117)	-0.077 (0.195)	-0.053 (0.148)	0.096 (0.177)
Age of household head (Yrs)	0.002 (0.005)	0.012* (0.006)	0.007 (0.005)	0.017* (0.009)	0.003 (0.006)	0.026*** (0.008)
Employed (0= No, 1= Yes)	-0.236 (0.198)	0.329 (0.242)	0.139 (0.194)	0.003 (0.302)	-0.170 (0.244)	0.752 (0.282)
Education of the household head (Yrs)	0.036** (0.016)	0.014 (0.019)	0.009 (0.015)	0.013 (0.024)	0.012 (0.019)	0.037 (0.022)
Access to credit/discount	0.022 (0.113)	0.431*** (0.145)	-0.164 (0.119)	0.046 (0.174)	0.156 (0.142)	0.225 (0.163)
Distance to nearest outlet (Km)	-0.006 (0.151)	-0.113 (0.183)	-0.113 (0.149)	-0.082 (0.238)	-0.035 (0.184)	-0.202 (0.219)

Main Outlet	0.218 (0.198)	0.359 (0.265)	-0.386 (0.214)	-0.129 (0.320)	-0.079 (0.245)	-0.834 (0.296)
Cons	2.713*** (0.433)	3.645*** (0.427)	4.096*** (0.456)	6.261*** (0.686)	4.337 (0.425)	5.352 (0.567)

*** p<0.01, ** p<0.05, * p<0.1, standard errors in parenthesis

4.3.2 Factors influencing the willingness to pay for selected fresh fruits among the low-income households

The effect of fresh fruit attributes as well as socio-economic characteristics on the willingness to pay for fruits among the low-income households in Nakuru City, Kenya (Table 4.5) was also done. The effects of the attributes as well as household characteristics on household willingness to pay for fresh fruits varied and was unique per fruit. Fresh fruit attributes that influenced willingness to pay significantly included absence of defects, texture, size, fruit color, and freshness. The household characteristics that influenced willingness to pay positively and significantly included gender of the household head, perceived nutrition, education of the household head, access to credit or discount and distance to the nearest market outlet.

Absence of defects increased the marginal willingness to pay for avocados by 11.5%. This result was akin to those of Hussin *et al.* (2010) who found absence of defects to be among quality attributes considered by consumers when purchasing fresh fruits and vegetables. Freshness increased the willingness to pay for oranges by 30.3%, melon by 32.3% and pineapple by 35.4%. This was consistent with Hussin *et al.* (2010) who found freshness to be among quality attributes that positively influenced consumer decision to purchase fruits. The color of fruits increased the willingness to pay for mango and melon by 25.9% and 30.3% respectively. On the other hand, texture negatively influenced the willingness to pay for orange, avocado and mango by 24.9%, 11.8% and 22.1%, respectively, while size of the fruit positively influenced willingness to pay for oranges by 16% and avocado 11.2%.

Among the socio-economic characteristics assessed, gender of the household head positively influenced willingness to pay for fruits by 14.5% for oranges, 10.9% for avocado and 5.1% for melon although the influence was not significant. This showed that male headed household were willing to pay more for fruits as compared to female headed households. Perceived nutrition

increased the willingness to pay by 18.2% for bananas, 12.5% for avocado, 18.2% for mangoes, 19.2 for melon and 13.4% for pineapples. This concurred with Barrett *et al.* (2010), Hussin *et al.* (2010), Ikiz *et al.* (2018) & Mugenda *et al.* (2023) on the influence of nutritional values on marginal willingness to pay for fresh fruits. Both low- and high-income households appeared to consider size while purchasing fresh fruits. A one year increase in education of the household head increased the willingness to pay for fresh fruits by 1.4% and pineapple by 2.1% concurring with (Barrett et al., 2010) who observed increased demand for nutritious foods as education levels increased. Access to credit/ discount increased the willingness to pay for mangoes by 43.6%. In summary, findings from this study showed that fresh fruit attributes and household socio-economic characteristics influenced low-income household's willingness to pay for fresh fruits. Fruit marketers could adhere to stocking fresh fruits that have desirable attributes to maximize on prices as households were willing to pay a premium for fresh fruits with desirable attributes.

Table 4.5: Fresh fruit attributes and household characteristics on fruit prices among low-income households in Nakuru Municipality, Kenya

LOW INCOME HOUSEHOLDS						
Fruits	Banana	Orange	Avocado	Mango	Melon	Pineapple
Dependent variable: Price (KES)	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
Absence of defects (0= No, 1= Yes)	-0.047 (0.075)	-0.072 (0.091)	0.115** (0.051)	-0.072 (0.118)	0.128 (0.093)	0.031 (0.077)
Cleanliness (0= No, 1= Yes)	-0.053 (0.122)	0.093 (0.152)	-0.075 (0.107)	-0.179 (0.195)	-0.294* (0.154)	0.200 (0.126)
Texture (0 = No, 1 = Yes)	-0.038 (0.068)	-0.249*** (0.082)	-0.118** (0.052)	-0.221* (0.106)	0.053 (0.086)	-0.042 (0.069)
Size (0= No, 1= Yes)	-0.007 (0.063)	0.160** (0.072)	0.112** (0.049)	0.069 (0.090)	0.084 (0.071)	0.117* (0.060)
Colour (0= No, 1= Yes)	-0.140 (0.091)	0.259*** (0.079)	-0.046 (0.079)	0.303*** (0.098)	0.153 (0.113)	0.028 (0.094)
Freshness (0= No, 1= Yes)	0.035 (0.213)	0.303*** (0.084)	0.086 (0.187)	0.070 (0.344)	0.323*** (0.095)	0.354*** (0.073)
Gender of household head (0 = female, 1 = male)	-0.058 (0.059)	0.145** (0.072)	0.109** (0.052)	-0.089 (0.092)	0.051* (0.074)	-0.075 (0.060)
Age of household head (Yrs)	-0.002 (0.002)	0.001 (0.003)	0.000 (0.002)	-0.002 (0.004)	-0.002 (0.003)	0.004 (0.002)
Employed (0= No, 1= Yes)	-0.101 (0.097)	0.119 (0.119)	-0.014 (0.086)	0.149 (0.154)	-0.011 (0.123)	0.137 (0.100)

Perceived nutrition (0= No, 1= Yes)	0.182*** (0.065)	0.125 (0.076)	0.125** (0.054)	0.182* (0.097)	0.192** (0.073)	0.134** (0.058)
Education of the household head (Yrs)	0.000 (0.006)	0.014* (0.008)	0.006 (0.005)	0.010 (0.010)	-0.004 (0.008)	0.021*** (0.006)
Access to credit/discount	0.027 (0.097)	-0.096 (0.122)	0.061 (0.087)	0.436*** (0.159)	0.022 (0.125)	0.015 (0.100)
Distance to nearest outlet (Km)	-0.019 (0.043)	-0.018 (0.053)	-0.049 (0.038)	-0.018 (0.069)	-0.106* (0.054)	-0.051 (0.044)
Main Outlet	0.100 (0.092)	0.257 (0.115)	0.040 (0.082)	-0.063 (0.148)	0.034 (0.116)	0.016 (0.095)
Cons	4.210*** (0.288)	3.447*** (0.278)	3.468*** (0.251)	5.021*** (0.448)	4.744*** (0.296)	3.256*** (0.230)

*** p<0.01, ** p<0.05, * p<0.1, standard errors in parenthesis

4.3.3 The effect of fresh fruit attributes and household characteristics on household willingness to pay for fruits, Pooled data

The pooled data results indicate that fruit texture size, color, freshness, perceived nutrition, education of the household head and access to credit significantly increased marginal willingness to pay for fresh fruits among the low- and high-income households in Nakuru city as shown in the pooled data results (Table 4.6). Influence of the fresh fruit attributes in the pooled data varied depending on the type of fruits which was like the results in the low- and high-income households. Texture attribute influence on marginal willingness to pay for oranges in the pooled data was lower at 21.6% for high-income households compared to the low income category impact at 24.9%.

Household income was positively related to the marginal willingness to pay for the selected fresh fruits and was also significant across all of them. This showed that as household income increased, willingness to pay for fresh fruits increased as well. Similar results of increasing willingness to pay for fresh fruits as income increases were observed by (Barrett *et al.*, 2010; Huang & Lin, 2007; Hussin *et al.*, 2010). Perceived nutritional knowledge was positive and highly significant across all the selected fresh fruits for both low- and high-income households. Even though households might not have been aware of the actual nutritional content present in the fruits, they perceived presence of nutrients like vitamin, minerals and fibre. Total years of schooling was positive for all the fruits and influenced willingness to pay for oranges, mangoes, melons, and pineapples by 1.5%, 1.3%, 0.2% and 1.8% respectively. This implied that highly educated consumers understood the health importance of fruits in their diets and were willing to pay more for fresh fruits. Similar results were observed by (Mwenjeri *et al.*, 2016) in household demand patterns of Laikipia county.

Table 4.6: The effect of fresh fruit attributes and household characteristics on fresh fruit prices, pooled data

POOLED DATA						
Fruits	Banana	Orange	Avocado	Mango	Melon	Pineapple
Dependent variable: Price (KES)	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
Absence of defects (0= No, 1= Yes)	-0.017 (0.063)	-0.079 (0.078)	0.124*** (0.044)	-0.086 (0.099)	-0.094 (0.077)	-0.054 (0.071)
Cleanliness (0= No, 1= Yes)	0.063 (0.093)	0.106 (0.116)	0.057 (0.083)	0.124 (0.147)	0.227** (0.113)	0.147 (0.104)
Texture (0 = No, 1 = Yes)	-0.019 (0.055)	-0.216*** (0.069)	-0.117*** (0.044)	-0.220*** (0.088)	0.031 (0.070)	-0.003 (0.062)
Size (0= No, 1= Yes)	0.023 (0.053)	0.180*** (0.061)	0.135*** (0.042)	0.123 (0.075)	0.095* (0.057)	0.144*** (0.055)
Colour (0= No, 1= Yes)	0.109 (0.077)	0.170** (0.068)	0.002 (0.069)	0.260*** (0.085)	0.167* (0.094)	0.067 (0.088)
Freshness (0= No, 1= Yes)	0.176 (0.180)	0.301*** (0.070)	0.130 (0.160)	0.204 (0.290)	0.244*** (0.074)	0.291*** (0.067)
Household income (KES)	0.000*** (0.000)	0.000** (0.000)	0.000** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000** (0.000)
Gender of household head (0 = female, 1 = male)	-0.028 (0.051)	-0.109* (0.064)	0.056 (0.046)	-0.111 (0.081)	-0.046 (0.063)	-0.075 (0.057)
Age of household head (Yrs)	0.001 (0.002)	0.000 (0.002)	-0.001 (0.002)	-0.004 (0.003)	-0.001 (0.002)	0.001 (0.002)

Employed (0= No, 1= Yes)	-0.085 (0.084)	0.074 (0.105)	0.002 (0.076)	0.065 (0.133)	-0.011 (0.103)	0.118 (0.094)
Perceived nutrition (0= No, 1= Yes)	0.153*** (0.056)	0.169*** (0.064)	0.134*** (0.047)	0.230*** (0.084)	0.158** (0.061)	0.129** (0.054)
Education of the household head (Yrs)	0.004 (0.005)	0.015** (0.007)	0.002 (0.005)	0.013* (0.009)	0.002* (0.007)	0.018*** (0.006)
Access to credit/discount	0.035 (0.075)	0.014 (0.096)	-0.096 (0.068)	0.230* (0.121)	-0.036 (0.095)	0.075 (0.085)
Distance to nearest outlet (Km)	-0.010 (0.040)	-0.012 (0.050)	-0.053 (0.035)	-0.020 (0.064)	-0.094* (0.049)	-0.034 (0.045)
Main Outlet	0.113 (0.082)	0.279*** (0.104)	0.018 (0.074)	-0.074 (0.132)	0.033 (0.101)	-0.058 (0.093)
Cons	3.896*** (0.237)	3.488*** (0.232)	3.476*** (0.211)	5.190*** (0.371)	4.713*** (0.235)	3.597*** (0.208)

*** p<0.01, ** p<0.05, * p<0.1, standard errors in parenthesis

The above results aligned with recent findings showing that consumers in Kenya increasingly prioritised fruit quality attributes such as freshness and nutritional value and socio economic factors such as education and access to finance strongly influence expenditure and consumption patterns (Cheserek, 2025, Mugenda *et al.*, 2023; Ndiritu *et al.*, 2024).

In summary, the results of the pooled data showed that fresh fruit attributes and household socioeconomic characteristics influenced both low and high-income households willingness to pay for fresh fruits. These results coincided with those of low and high income households done separately and further confirmed on the relevance of consideration of fresh fruit attributes and household socioeconomic characteristics in selling fresh fruits. The results confirm that leveraging these attributes offers fruit sellers a competitive advantage across income groups.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the conclusion of this study, the recommendations and areas of further research.

5.2 Conclusions

The study applied the Linear Approximation Almost Ideal Demand System (LA/AIDS) and Hedonic Pricing Models to analyze consumption and expenditure patterns of fresh fruits among the low- and high-income urban households in Nakuru City. Consistent with the study objectives, it was found out that fresh fruits consumption varies significantly by income level and consumer preference. Further, it was revealed that both low- and high-income households spent less on fresh fruits than on other food products. However, high-income households spent more on fresh fruits than their low-income counterparts. Price elasticities varied by fruit, indicating differential sensitivity to market price changes. High-income households exhibited greater fresh fruit expenditure and preference for quality attributes such as freshness and size. The findings further highlighted the heterogeneous nature of urban households and fruit consumption influenced by socio-economic status and product attributes. These results affirm the importance of incorporating both consumer income effects and attribute-based pricing in designing marketing and nutrition interventions. The study contributes to empirical evidence on urban fresh fruits demand vital for formulating policies targeting improved consumption and health outcomes in Kenyan urban areas.

5.3 Recommendations

Improve affordability and accessibility to fresh fruit consumption among urban households in Nakuru City especially the low-income households through targeted price subsidies and promotional programs.

Strengthen food system infrastructure to ensure year-round availability and efficient distribution of fresh fruits.

Provide focused nutrition education to increase awareness of fresh fruits benefits among urban consumers.

Promote quality attributes such as freshness and size in fruit marketing and pricing to align with consumer preferences and willingness to pay.

Collect detailed fresh fruit consumption data disaggregated by income and social groups to guide policy and monitor progress.

Conduct further research on supply-side and retail market factors to complement consumer-focused demand analysis.

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APPENDICES

APPENDIX 1: CONSUMER QUESTIONNAIRE

My name is Lenah Waithira Mwangi and I am a master’s student at Egerton University undertaking a research on “Demand Analysis of Fresh Fruits Consumption among Urban Households’ Consumers in Nakuru Municipality”. The purpose of this study is purely academic and as such I kindly request your participation in answering the questions. Your contribution will be highly appreciated and utmost discretion will be accorded to your responses even as they will be solely used for research purposes.

PART ONE: GENERAL INFORMATION

Questionnaire No..... Date of interview.....
 Constituency.....
 Ward.....
 Enumerators name.....

PART TWO: DEMOGRAPHIC AND SOCIO-ECONOMIC CHARACTERISTICS

- 2.10 Name of the respondent.....
 2.11 Relationship of the respondent to the household head.....
 2.20 Gender of the household head (**GndrHH**).....
 2.21 Age of the household head (**AgeHH**).....
 2.23 Marital status of the household head..... (1a= Monogamous married, 1b=Polygamous married, 2= single, 3= divorced, 4= separated, 5= widowed)
 2.24 How many years have you spent in formal schooling (**EducHH**).....
 2.25 Occupation of the household head (**OccHH**)..... (1=Not employed, 2=Casual employment, 3=Permanent employment, 4=Self-employed, 5=Retired)
 2.30 The following information pertains to the person who is the **key** decision maker on matters pertaining purchasing and consumption of food

Who is the key decision maker on matters pertaining purchasing and consumption of food? 1=Husband, 2=Wife, 3=Elder son, 4=Elder daughter, 5=Servant,6=others (specify)	What is the age of the key decision maker?	What is the education level of the key decision maker?	What is the gender of the key decision maker?	What is the occupation of the key decision maker? 1=Not employed, 2=Casual employment, 3=Permanent employment, 4=Self-employed, 5=Retired

2.40 Household size and composition (**SzCpHh**)

(0-5 years) Nchild5	
6-12 years	
13-25 years	
26-45 years	
over 45 years	

PART THREE: HOUSEHOLD INCOME, EXPENDITURE AND CONSUMPTION
(IncHh and ExpHh)

What is the total household monthly income from the following sources?	
	<u>KES</u>
Salary	
Other Sources	
i. Rental income	
ii. Business income	
iii. Pension	
iv. Remittances	

On average, how much does the household spend on food items in a week?	On average, how much does the household spend on fresh fruits in a week?	On average, how much does the household spend on non-food items in a week?
KES	KES	KES

	How often in the past 1 month did you consume these fruits 1=never,2= once daily,3= \geq 2 times in day 4= \geq 5times in a day, 5=once a week, 6=once a month	What was the main source of the fruits you consumed 1=own production, 2= purchase, 3= Both 4= Other (specify)	How much was the purchase		What is your preference among the following types of fruits provided (rank from most to least preferred) 1=mostl y preferred, 8=least preferred	What is your main reason for the preference 1=affordable prices, 2=taste and flavor, 3=availability, 4= family members do like them 5=others (specify)	Have the following fruits been in the season for the past two weeks? 1=yes (on pick) 0= no (off pick)	What is the highest price for each fruit during Off peak (scarcity season)	What is the lowest price for the fruit during On peak (surplus season)
			Quantity (piece/s/slice/s/kg)	KES(price per piece/slice/kg) (PcoffF)					
Banana									
Avocado									
Orange									
Melon									
Mango									
Pineapple									

Pawpaw									
Passion fruit									

What is your other reason for consuming fruits apart from using them as food 1=nutritional purposes,2=affordable in price, 3=habit developed since childhood, 4=are healthy for consumption,5=recommendation by health personnel and others, 6= special dietary needs 7= others (specify)	Would you buy/consume more fruits if the prices were lowered? 1=yes 2=no	Do you normally negotiate for the fresh fruits prices? 1=Yes 2=No

PART FOUR: NUTRITION KNOWLEDGE AND FRESH FRUIT OBSERVABLE ATTRIBUTES

Do you think experts recommend that people should be eating more, same amount or less of fruits?	How many minimum servings of fruits per person do you think experts are advising people to eat (NB: one serving is approximately a handful) A=1 serving, B=2 servings, C=3 servings, D=4 servings, E=5 servings, F= > 5 servings	How many servings do you personally eat per day (refer to options in previous part)	Do you think you meet the daily recommended minimum servings 1=yes, 2=no
1=More 2=Same amount 3=Less			

Are you aware of major health problems or diseases related to low intake of fruits? 1=yes, 2=no	If yes, what health problems or diseases do you think are related to low intake of fruits	Are you aware of major health problems or diseases related to low intake of nutritional attributes such as fibre, minerals and vitamins 1=yes, 2=no	If yes, what are the related health problems and diseases related to low intake of the following nutritional attributes
			1= Fibre 2= Minerals 3= Vitamins

Do you think eating more of fresh fruits help in reducing some kind of cancers? 1=yes, 2=no, 3=not sure	Do you think eating more of fresh fruits help in reducing the risk of hypertension? 1=yes, 2=no, 3=not sure	Do you think eating more of fresh fruits help prevent heart diseases? 1=yes, 2=no, 3=not sure	Do you think eating more of fresh fruits help reduce malnutrition (underweight, overweight, obesity) 1=yes, 2=no, 3=not sure

Do you feel well informed about the health and nutritional attributes associated with the following fruits 1=yes, 2=no	Does the presence or absence of the nutritional attributes influence the prices of the following fruits; 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree	Which observable attributes do you consider when making purchases for these fruits (OBS) 1=freshness, 2=color, 3=size, 4=texture, 5=cleanliness, 6=flavor, 7=absence of defects	Do sellers charge different prices depending with presence or absence of the observable attributes; 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree	State the charged prices based on observable attributes		
				Low est quality	Average quality	Highest quality
Banana						
Avocado						
Orange						
Melon						
Mango						
Pineapple						
Pawpaw						
Passion						

Do you search for information on nutritional attributes of fresh fruits? 1=Yes 2=No	How long does it take to search for the information? Specify 1=Minutes, 2=Hours, 3=Days, 4=Weeks, 5=Months	From which source do you learn the information on the perceived nutritional attributes; 1=nutritionist/health officer 2= Media(specify for TV, Radio, Internet), 3=other consumers, 4=school	Do you feel that the information is well relayed in terms of content, timeliness, clarity and the means? 1=Yes 2=No	If No, what characteristic (s) do you suggest should be improved from the list below? 1= content, 2= clarity, 3= means, 4=timeliness

PART FIVE: INSTITUTIONAL FACTORS

Which outlet is your main source of purchase for fruits (TypeROtl) (tick the appropriate)	Approximate the distance in walking minutes to the nearest market outlet (DstncMkt)	What are your reasons for the preferred market outlet 1= fresh fruits, 2=varieties, 3=cheap in price, 4=PsoldSvs (credit/ quantity discount), 5= SocInfl (referral by other consumers), 6= negotiable prices, 7=nearest to homestead, 8=hygiene, 9= convenience for other purchases, 10=after sale services, 11= opening and closing time, 12=others (specify)
Kiosks		
Open air market		
Supermarket		
Wholesale market		
Hawkers		
Road side/ street traders		
Farm gate		

Are you satisfied with the quality of the fresh fruits at your preferred retailing outlet? 1=Yes 2=No	If No, what are the main reasons for your dissatisfaction? 1=Fruits not fresh 2= Poor customer service 3= Dirty retailing outlet 4=Dirty fruits	Between the fresh fruits perceived nutritional and observable attributes, which one do you offer higher preference when making the purchase? 1=perceived nutritional attributes 2=observable attributes	State your order of preference for the first three major fresh fruit perceived nutritional and observable attributes (from most important to the least important based on the attributes in (4. A) above)	
			Perceived Nutritional attributes	Observable attributes
			1. 2. 3.	1. 2. 3.

Do you experience post-purchase losses from the fruits 1=Yes 2=No	If yes, what is the percentage of post-purchase losses on the fruits (PostPurLosses) 1=0%,2=25%, 3=50%,4=75%, 5=100%	What do you think are the factors contributing to the perceived losses 1=quality problems present during purchase, 2=lack of proper storage infrastructure, 3=mishandling after purchase, 4=others (specify)	From your purchase of fruits, do you store the surplus 1=Yes 2=No	Do you own a fridge? 1=Yes 2=No	If Yes, to what level do you agree/disagree that having or not having a fridge influence the quantity of fruits you buy 1=strongly agree 2=agree 3=neutral 4=disagree 5=strongly disagree	If No, how do you store your surplus to prevent spoilage 1= transforming,2=sun drying, 4= others (specify)

APPENDIX 2: RESEARCH PERMIT

THIS IS TO CERTIFY THAT:
MISS. LENA WAIHIRA MWANGI
of EGERTON UNIVERSITY, 0-20107
Nakuru, has been permitted to conduct
research in Nakuru County

Permit No : NACOSTI/P/19/79274/30273
Date Of Issue : 29th May,2019
Fee Recieved :Ksh 1000

on the topic: DEMAND ANALYSIS OF
FRESH FRUITS CONSUMPTION AMONG
URBAN HOUSEHOLDS IN NAKURU
MUNICIPALITY

for the period ending:
27th May,2020



Lena Waihira Mwangi
Applicant's
Signature

[Handwritten Signature]
Director General
National Commission for Science,
Technology & Innovation

APPENDIX 3: RESEARCH AUTHORIZATION LETTER



NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone: +254-20-2213471,
2241349, 3310571, 2219420
Fax: +254-20-318245, 318249
Email: dg@nacosti.go.ke
Website: www.nacosti.go.ke
When replying please quote

NACOSTI, Upper Kabete
Off Waiyaki Way
P.O. Box 30623-00100
NAIROBI-KENYA

Ref. No. **NACOSTI/P/19/79274/30273**

Date: **29th May, 2019.**

Lenah Waithira Mwangi
Egerton University
P.O. Box 536-20115
NJORO.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on "*Demand analysis of fresh fruits consumption among urban households in Nakuru Municipality*." I am pleased to inform you that you have been authorized to undertake research in **Nakuru County** for the period ending **27th May, 2020.**

You are advised to report to **the County Commissioner and the County Director of Education, Nakuru County** before embarking on the research project.

Kindly note that, as an applicant who has been licensed under the Science, Technology and Innovation Act, 2013 to conduct research in Kenya, you shall deposit a **copy** of the final research report to the Commission within **one year** of completion. The soft copy of the same should be submitted through the Online Research Information System.

DR. STEPHEN K. KIBIRU, PhD.
FOR: DIRECTOR-GENERAL/CEO

Copy to:
The County Commissioner
Nakuru County.

The County Director of Education
Nakuru County.



**THE PRESIDENCY
MINISTRY OF INTERIOR AND
CO-ORDINATION OF NATIONAL GOVERNMENT**

Telegram: "DISTRICTER" Nakuru
Telephone: Nakuru 051-2212515
When replying please quote

COUNTY COMMISSIONER
NAKURU COUNTY
P.O. BOX 81
NAKURU.

Ref No. CC. SR.EDU 12/1/2/VOL.V/18

6th August, 2019

Deputy County Commissioner
- Nakuru East
- Nakuru West

RE:- RESEARCH AUTHORIZATION - LENA WAIHIRA MWANGI

The above named student from Egerton University has been authorized to carry out a research on "**Demand analysis of fresh fruits consumption among urban households**" in Nakuru East and West Sub Counties in Nakuru County for a period ending 27th May, 2020.

Please accord her all the necessary support to facilitate the success of her research.

**PATRICK OMUSE
FOR COUNTY COMMISSIONER
NAKURU COUNTY**

