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Food and Nutrition Security in Kenya: Embedding Nutrition Element within the Four Pillars of Food Security in the Counties

Foreign, Commonwealth & Development Office

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Agriculture Sector

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Abbreviations and Acronyms

KIHBS	Kenya Integrated Household and Budget Survey
KDHS	Kenya Health Demographic Survey
KCHS	Kenya Continuous Household Survey
NDMA	National Drought Management Authority
FNSP	Food and Nutrition Security Policy
IPC	Integrated Food Security Phase Classification
KNAP	Kenya National Nutrition Action Plan
UNDP	United Nation Development Programme
OPHI	Oxford Poverty and Human Development Initiative
MDD	Minimum Dietary Diversity
FIES	Food Insecurity Experience Scale
FAO	Food and Agriculture Organization
WHO	World Health Organization
ANIS	Agri-Nutrition Implementation Strategy
BETA	Bottom-up Economic Transformation Agenda
SDG	Sustainable Development Goal
WB	World Bank
WFC	World Food Conference
NSA	Nutrition Sensitive Agriculture

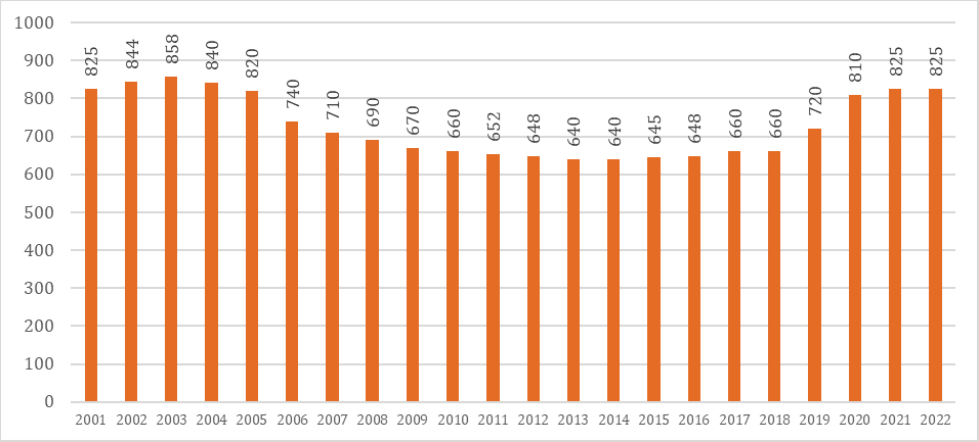
Abstract

Food and nutrition security is a major global concern. Kenya's increasing population exacerbates food insecurity, which is at moderate to severe levels. Despite the various policies that the government has put in place to address food and nutrition security, prevalence of food insecurity and malnutrition persists across the country. The study examines the four pillars of food security and their influence on nutrition in the 47 counties. The food security index was calculated across various counties in the country, considering four distinct pillars each with its set of indicators. These pillars encompassed food availability, accessibility, utilization, and stability. The purpose was to construct the food security index based on the pillars in the county governments and assess its role in nutrition indicator (stunting) of different counties. The average food security index score for the 47 counties was 0.48 and ranged between 0.30 and 0.60. Food security reveals significant disparities in food availability, accessibility, utilization, and stability among the counties. The highest food availability index score was 0.57, while the lowest was 0.32, indicating a considerable range in food availability across the counties. Only 15 counties had a food availability index of 0.50 or above, highlighting that many counties still face challenges in ensuring availability of sufficient food. More importantly, food accessibility and food utilization scored 0.86 and 0.94, respectively, indicating they are critical to overall food security. Noteworthy, while food might be available, its accessibility and proper utilization are crucial in achieving food security. The average food stability index score was 0.41, and it ranged between 0.19 and 0.62, indicating instability in continuous supply of food resources across the counties. Additionally, stunting prevalence among children varies widely from 9 per cent to 37 per cent. This reflects the uneven impact of food security on child nutrition across the different counties. The key policy recommendations focus on strengthening the four pillars to enhance food security comprehensively. There is a need to implement policies that encourage sustainable agricultural practices, support smallholder farmers with access to quality seeds, and improve irrigation infrastructure for improved food availability. Putting in place measures that ensure efficient supply chains, reduce food prices through subsidies and market interventions, and improve rural-urban connectivity helps to improve food accessibility. There is a need to strengthen food utilization through nutrition education, ensuring food safety, and increasing access to healthcare services to address malnutrition. It is also paramount to promote strategic policies to establish robust food storage and distribution systems, create social safety nets to protect vulnerable populations during crises, and invest in climate-resilient agricultural technologies to mitigate the impacts of climate change. Through collaborative and focused efforts, both national and county governments, together with non-State actors, can fully address malnutrition through a clear and well-coordinated policy framework. This will ensure food security is improved significantly to achieve a stable and nutritious food supply for all.

1 Introduction

Food and nutrition security is a global concern, particularly in Sub-Saharan Africa (SSA) where 123 million people are acutely food insecure (FAO et al., 2022). More than 830 million people globally experienced physical food insecurity and particularly those living in low-income countries in Sub-Saharan Africa and South Asia, while more than a billion people were micronutrient deficient in 2018-2019. Although there was a decline in the number of undernourished people from 2003 to 2015 (Figure 1.1) owing to the global efforts focused on alleviating global hunger, the number of undernourished increased by 21.82 per cent between 2015 and 2022. Moreover, the number of undernourished is projected to reach 840 million by 2030 (Roser and Ritchie, 2019) compared to 825 million in 2022 (Figure 1.1).

Figure 1.1: Global undernutrition (2001-2022)



Data source: World Bank (2022) Database

One third of the world's undernourished people reside in Africa, a continent whose per capita agricultural productivity has been on the decline for more than three decades (de Carvalho et al., 2021), yet its population has been increasing gradually and it is expected to reach 1.8 billion people by 2050. In 2021, about 7.2 million people in East Africa were at risk of hunger, 26.5 million suffered from severe food insecurity and more than 12.8 million children suffered from acute malnutrition.

Kenya, like any other developing economy, is food and nutrition insecure (Lokuruka, 2021), and about 10 million of the population suffer from chronic food insecurity and poor nutrition. Malnutrition is a public concern and is a significant contributor to child mortality, mainly due to household food insecurity, inadequate food intake, poor child-care practices, and inadequate sanitation and health care services. The country's food insecurity persists at moderate to severe levels as the national population rises as shown in Figure 2.1. The Kenya

Health Demographic Survey (KDHS) 2022 reports that 18 per cent of children under five years are stunted, 5 per cent are wasted, and 10 per cent are underweight. The high prevalence of malnutrition in children is a clear indicator of inadequate access to sufficient, safe, and nutritious food.

In February 2024, the number of people with insufficient food insecurity remained unchanged. However, in the same year, the number of people with insufficient food consumption increased by 52.81 per cent while the commodity prices declined by 39.03 per cent compared to the previous year (FSM, 2024). About 12 per cent of the population faced high acute food insecurity between February and March 2024 (Integrated food security phase classification, IPC 2024). The report further projected about 7 per cent of the population to experience high food insecurity between April and June 2024. This calls for urgent actions to reduce food insecurity at the national and county levels.

The concept of food and nutrition security encompasses the four pillars of food and nutrition security, which are availability, accessibility, utilization, and stability. Physical availability of food focuses on factors such as production, stock levels, trade, and ensuring a stable food supply. Consequently, access to food is influenced by income, expenditure, markets, and prices. recognizing that a global surplus does not guarantee household-level food security (Vila-Real et al., 2022). Food utilization emphasizes nutrient optimization and proper feeding practices within households for individual well-being. Stability ensures ongoing food security, acknowledging that access can falter due to factors such as weather, politics, or economic issues (Charlton, 2016). Integrating these pillars increases the chances of individuals meeting their need for a nutritious diet.

A nutritious diet is one that provides macronutrients and micronutrients in appropriate proportions to meet the physiological needs of the body (FAO et al., 2020). Macronutrients, comprising carbohydrates, proteins, and fats, play integral roles in supporting the body's cellular processes for daily functioning (FAO et al., 2020). Micronutrients such as vitamins and minerals are required in small amounts for normal growth, development, metabolism, and physiologic functioning. Nutritious diets must be affordable and culturally acceptable, and their production must be sustainable and align with the four pillars of food and nutrition security (Canfield et al., 2021).

Food security and nutrition is dependent on agriculture, which is a devolved function in Kenya. The county governments play an important role in implementing food and nutrition security policies. The counties, therefore, lead in addressing the specific food and nutrition challenges faced, guided by the food and nutrition security frameworks. Promoting collaboration between national and county governments enhances the effectiveness and impact of food security and nutrition initiatives (Hammond and Dubé, 2012).

This research provides a comprehensive analysis of food security pillars in the 47 counties while taking into consideration a nutritive diet. Specifically, the study seeks to assess the food security pillar indices and examine its influence on nutrition outcome indicator. The findings will inform policy actions aimed at improving the nutrition status and food security in the counties and, overall, improve the national food security and nutrition.

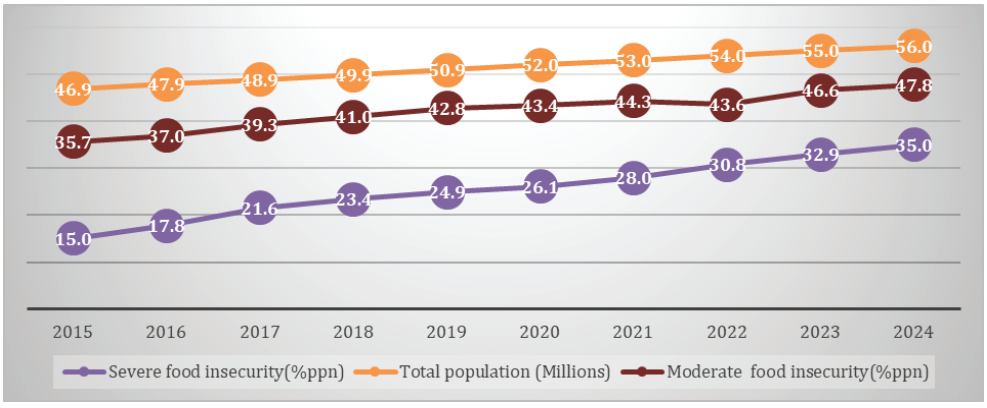
2 Status of Food Security

This section provides the status of food security in the country. It also discusses food security dynamics at the national and county levels while at the same time elucidating the need to undertake the study.

2.1 Trend Analysis of Food Security Status and Population

Food insecurity and malnutrition have been increasing with increase in population. Food insecurity increased with an increase in population between 2015 and 2024 (Figure 2.1). Furthermore, moderate food insecurity increased from 35.7 per cent in 2015 to 46.6 percent in 2023 and was projected to increase to 47.8 per cent in 2024. However, there was a slight drop in moderate food insecurity in 2022 by 0.07 per cent compared to 2021. Severe food insecurity rose from 15.0 per cent in 2015 to 30.8 per cent in 2022 and was projected to increase by 4.2 per cent in 2024. This indicates a rise in the proportion of the population who do not have reliable access to sufficient and nutritious food to meet their dietary needs. The trends depict the gaps in the efforts put in place by the government and other stakeholders in reducing food insecurity.

Figure 2.1: Trend analysis of status of food security in Kenya (2015-2024)



Data source: World Bank (2015-2022)

The prevalence of stunting among children aged below five (5) years declined from 26 per cent in 2014 to 18 percent in 2022 (KNBS and ICF, 2022). The prevalence of underweight was 11 per cent in 2014 and 10 per cent in 2022. Wasting among the under-five slightly increased from 4 per cent in 2014 to 5 per cent in 2022. Overall, while there is notable progress in improving nutrition among the under five children, the achievement remains below the country's target of reducing stunting and underweight to 14.7 per cent and 8.4 per cent, respectively, by 2030 (Kenya Vision 2030). Micronutrient deficiencies are prevalent among women and children

under the age of five, caused by inadequate consumption of nutritious diets (FAO et al., 2022). Therefore, it is imperative for the government to strengthen the implementation of policies aimed at reducing malnutrition among women and children, especially across the counties in Kenya. This will ensure the objective of reducing stunting and wasting among children as envisioned in the Kenya Vision 2030 is achieved.

Acute malnutrition is prevalent, for instance, in arid counties, due to the cumulative net effect of the failed previous growing seasons and poor infant feeding practices. About 0.1 million pregnant and lactation women are acutely malnourished while 0.85 million children aged 6-59 months are acutely malnourished. Some of the major contributing factors for acute malnutrition include high morbidity, poor childcare and inadequate feeding practices, poor WASH practices, sub-optimal coverage of multisectoral interventions and multiple recurrent environmental shocks (IPC, 2024).

The major drivers of acute food insecurity include flooding, cost of staple food and insecurity conflicts. The cumulative impacts of seasonal rains between October and December 2023 and April to May 2024 resulted in flooding, causing loss of livestock, destruction of infrastructure, property, and farmland. A number of households were displaced and some lost lives due to the flash floods. Food prices are high, driven by high demand and high marketing costs due to high fuel prices and the high cost of cross-border imports (Government of Kenya, 2023). Both human-wildlife and resource-based conflicts resulted in the loss of livestock and hindered farmers' access to their fields, consequently affecting agricultural production and overall productivity (IPC, 2024). This leads to increased food insecurity across the counties and, therefore, the need to have in place strategic interventions to build resilience against such shocks.

2.2 Food and Nutrition Security Governance

Kenya has established comprehensive policies and frameworks to address food and nutrition security, recognizing it as a critical government mandate. The Constitution of Kenya explicitly guarantees the right to adequate food as Article 43(1) of the Constitution declares that every person has the right to be free from hunger and to have adequate food of acceptable quality, while Article 53(1) affirms that every child has the right to basic nutrition, shelter, and healthcare (Government of Kenya, 2010). Furthermore, the Constitution establishes the fundamental duty of the State and all State organs to observe, respect, protect, promote, and fulfill the rights and fundamental freedoms in the Bill of Rights, including the right to adequate food.

The aspirations to enhance food security in Kenya have also been highlighted in the Kenya Vision 2030 under the Social Pillar. The Vision recognizes the agricultural sector as a key driver of economic growth and poverty reduction. It sets the goal of sustaining a 10 per cent average economic growth rate and reducing poverty levels to 25 per cent by 2030. Achieving these objectives necessitates a strong focus on food and nutrition security. By including nutrition in the four pillars framework, the government can ensure that economic growth is not only measurable but also inclusive, as improved nutrition is vital to the overall well-being of the population (Ministry of Health Kenya, 2018). In the same capacity, the Medium-Term Plan - MTP IV focuses on enhancing food security and nutrition by increasing agricultural productivity, improving market access, and promoting nutritional outcomes. This strategic framework aims to ensure that all individuals have consistent access to sufficient, safe, and nutritious food. The key interventions include supporting smallholder farmers, developing infrastructure, strengthening food systems, and integrating nutrition education with health services. By addressing the challenges such as climate change, economic disparities, and conflicts, MTP IV seeks to build resilient and sustainable food systems, aligned with global

initiatives such as the Sustainable Development Goals, particularly Goal 2: Zero Hunger (Government of Kenya, 2024). In tandem with this developmental framework, the Bottom-Up Economic Transformation Agenda (BETA) aims to empower communities and promote inclusive economic growth by investing in agriculture and improving agriculture value chains that ensure improved food production, market accessibility, safety, and reduction of post-harvest losses.

Additionally, the National Food and Nutrition Security Policy of 2011 provides a structured approach to realizing the right to food in Kenya. This policy underscores the vital role of access to adequate and nutritious food in preserving human life and upholding human dignity. It represents the government's commitment to ensuring that all Kenyans, at every stage of their life, enjoy the right to adequate food. Additionally, the policy acknowledges the importance of enhancing food production, preservation, and distribution by harnessing technical and scientific knowledge, disseminating nutrition principles, and reforming agrarian systems for optimal natural resource utilization. In the same manner, policies and frameworks such as the Kenya National Nutrition Action Plan (KNNAP) 2018-2022, the Agri-Nutrition Implementation Strategy (ANIS) 2020-2025 and the Agriculture Policy of 2021 are designed to address the root causes of malnutrition and food insecurity in the country.

The Kenya National Nutrition Action Plan (KNNAP) 2018-2022 aims to tackle malnutrition throughout the stages of life by providing a multi-faceted approach to managing the root causes of malnutrition, from community health services to food production, education, social protection, trade and safe water supply. ANIS guides the coordinated implementation of high-impact agriculture and nutrition interventions by the government and nutrition-sensitive stakeholders for maximum impacts at all levels of operation. The Agriculture Policy of 2021 seeks to enhance agriculture-led economic growth, improve nutrition outcomes, strengthen county government capacity, increase resilience, and promote sustainable use of natural resources. The government is committed to increasing productivity in key food value chains and reducing reliance on basic food imports, aligning with the integration of nutrition.

Literature Review

3.1 Evolution of Food Security Concepts

The Evolution of Food Security Concepts theory underscores how our understanding of food security has undergone a significant transformation over the years, shaped by global shifts and evolving policy priorities. It traces its roots back to the seminal World Food Conference of 1974, a landmark event that set the stage for international collaboration in addressing hunger and malnutrition (Gustafson, 2016). At this conference, the primary focus was on ensuring stability in food supply and stabilizing prices to mitigate hunger-related challenges. However, as the discourse on food security evolved, subsequent analyses conducted by organizations such as the Food and Agriculture Organization (FAO) brought to light the need for a more complex approach. In 1983, the FAO emphasized the critical importance of food access, signaling a shift from merely ensuring food availability to also addressing the socio-economic factors that impede individual's ability to obtain the food they require. This transition marked a pivotal moment in the conceptualization of food security, broadening its scope beyond mere production concerns (Bahn and Labban, 2021).

Further refinement occurred with the publication of the World Bank Report on Poverty and Hunger in 1986. This influential report introduced the notion of temporal dynamics in food security, distinguishing between chronic and transitory food insecurity. It highlighted the multifaceted nature of food insecurity, recognizing that it is not solely a product of insufficient food production but also a consequence of broader structural issues such as poverty and inequality. The report laid the groundwork for a more holistic approach to addressing food insecurity. These key documents provide a rich historical context for understanding the evolution of food security. They reflect a progressive shift from a narrow focus on food supply to a broader framework encompassing access, utilization, and stability (Schlomo, 1986).

Food security and nutrition then became integrated into the four pillars of availability, accessibility, utilization, and stability (Boliko, 2019). These pillars play a crucial role in ensuring that individuals and communities have access to sufficient, safe, and nutritious food. The availability pillar of food security ensures that enough food is produced, stored, and made accessible to meet the population's needs. Two crucial indicators for assessing food availability are the Food Production Index (FPI) and food prices. The FPI measures changes in the volume of food commodities produced over time, adjusted for the relative importance of different commodities, reflecting a region's agricultural productivity and capacity (World Bank, 2023). Stable or low food prices generally signify sufficient supply relative to demand, making food more accessible to a larger portion of the population. Together, these indicators provide a comprehensive understanding of food availability, highlighting the dynamics of food supply and guiding policies to maintain consistent food availability to meet the demand and enhance overall food security (FAO, 2023).

The accessibility pillar of food security ensures that individuals and households have the means to obtain sufficient, nutritious food. Key among the considered indicators include the consumption of a variety of foods from ten diverse food groups, which reflects access to a balanced diet and nutritional adequacy (FAO, 2016). Adequate intake of fruits and vegetables,

with a recommended daily minimum of 400 grams, highlights access to essential nutrients and reveals potential barriers such as economic constraints (WHO, 2003). Food poverty, defined as the inability to afford a nutritionally adequate diet, underscores economic access challenges (FAO, 2020). Monitoring the share of household income spent on food helps assess food affordability, with higher expenditure indicating less disposable income for other needs (World Bank, 2022). Additionally, the consumption of vitamin-A rich foods among children is critical for preventing deficiencies, with low intake suggesting issues in accessing nutrient-rich foods (UNICEF, 2019). These indicators collectively offer a comprehensive view of food accessibility, guiding efforts to reduce barriers and improve food security.

The utilization pillar of food security emphasizes the nutritional quality and safety of food, and the ability of individuals to effectively metabolize their intake. The key indicators of this pillar include the Minimum Dietary Diversity for Women (MDD-W), which measures the variety in women's diets to ensure nutritional adequacy, with diverse diets being essential for providing necessary nutrients (FAO and FHI 360, 2016). The time taken and distance to a water source are crucial for ensuring access to safe drinking water, impacting food preparation and hygiene, which are vital for safe food utilization (WHO and UNICEF, 2021). The Food Consumption Score (FCS) evaluates household dietary quality by assessing the frequency and diversity of food consumption, thus reflecting nutritional sufficiency and overall dietary health (WFP, 2008). Additionally, households' utilization of iodized salt is a significant indicator of nutrient quality and public health, as iodine is essential for preventing cognitive impairments and thyroid issues (UNICEF, 2008).

The stability pillar specifically focuses on the reliability of food supply and access over time. Several indicators effectively measure this pillar. For instance, social protection mechanisms, that is cash transfers, provide a financial safety net, allowing households to purchase food during crises, thereby stabilizing access (FAO, 2015). Rainfall patterns are critical for regions dependent on rain-fed agriculture, directly affecting food availability and prices by influencing crop yields (FAO, 2021). Household consumption trends offer insights into economic stability and food distribution effectiveness, signaling potential issues in access and utilization if they decline (World Bank, 2022). Households' direct experiences and perceptions of food insecurity provide a better view of how stable their food access is over time (Ballard, Kepple and Cafiero, 2013). The frequency and severity of coping strategies, such as reducing meal sizes or selling assets, indicate the extent of instability in food security, with frequent or severe strategies pointing to significant vulnerabilities (Maxwell and Caldwell, 2008). Together, these indicators provide a comprehensive understanding of the stability of food security and help identify areas needing intervention.

3.2 Theoretical Framework

3.2.1 Interconnectedness of food security and nutrition theory

The theory of Interconnectedness of Food Security and Nutrition highlights the intrinsic relationship between these two domains, emphasizing that food security extends beyond mere availability to encompass nutritional adequacy and utilization. This theory elucidates how achieving food security necessitates addressing nutrition concerns at various levels, from individual dietary choices to broader community and societal factors. At its core, this theory recognizes that access to sufficient food is only one aspect of ensuring overall well-being. The quality of that food, in terms of its nutritional content, is equally crucial. Thus, achieving food security entails not only guaranteeing access to food but also ensuring that the food available is nutritious and conducive to promoting health and well-being (Reddy, 2020).

A key aspect of this theory lies in the integration of nutrition considerations into the four pillars of food security: availability, accessibility, utilization, and stability. By incorporating nutrition

concerns into each of these pillars, policy makers and stakeholders can adopt a more holistic approach to addressing food and nutrition insecurity. For instance, strategies aimed at enhancing food availability may also focus on promoting the production and distribution of nutrient-rich foods. Moreover, the theory recognizes the broader mandate of combating food and nutrition insecurity, extending beyond the agricultural sector to encompass health, education, and other relevant sectors. This holistic approach acknowledges that food security and nutrition are complex issues with multifaceted solutions (Chen and Hollander, 2016).

3.2.2 The theory of a multi-sectoral approach to food and nutrition security

The theory of a Multi-Sectoral Approach to Food and Nutrition Security emphasizes the imperative of adopting a collaborative, cross-cutting strategy to tackle the multifaceted challenges associated with food and nutrition security. This theory contends that addressing these complexities effectively demands concerted efforts and cooperation across diverse sectors, including but not limited to agriculture, trade, health, education, and water sanitation. At its core, this theory recognizes that the root causes of food and nutrition insecurity are deeply intertwined with various social, economic, and environmental factors. Therefore, interventions aimed at alleviating these issues must extend beyond the confines of any single sector and instead embrace a holistic, multi-sectoral perspective (Badewa and Dinbabo, 2023).

A key argument put forth by this theory is the necessity of overcoming challenges related to leadership, coordination, and investment. Many governments encounter difficulties in effectively implementing multi-sectoral interventions due to fragmented leadership, insufficient coordination mechanisms, and inadequate investment in relevant sectors. The theory advocates for the establishment of new political incentives and institutional arrangements that facilitate the integration of agriculture and health systems (Badewa et al., 2023).

3.3 Empirical Literature Review

Access to electricity enables the use of refrigerators and freezers, which are crucial for preserving perishable foods, reducing spoilage, and ensuring a diverse diet rich in nutrients (FAO, 2021). Electricity facilitates safer and more efficient cooking methods, such as using electric stoves instead of open fires or traditional biomass stoves, which are linked to indoor air pollution and health risks (World Bank, 2020). Thus, increased electricity connectivity supports stable food supplies and better nutritional standards, reducing issues such as stunting and malnutrition. Gross County Product (GCP) is an indicator of the economic vitality and income levels within a county, profoundly influencing household food accessibility and nutrition. Higher GCP typically reflects robust economic activity, translating into higher household incomes and greater purchasing power, which are critical for accessing a diverse and nutritionally adequate diet (UNDP, 2022).

Road connectivity, particularly the percentage of tarmacked roads, is crucial for the efficient movement and supply of food, significantly influencing food stability and nutritional outcomes. Well-developed road networks facilitate the transportation of agricultural products from rural production areas to urban markets, ensuring that fresh produce reaches consumers promptly and reducing post-harvest losses (IFPRI, 2020). Agroecological conditions, specifically the distinctions between arid and semi-arid lands (ASALs) and more fertile non-ASALs, significantly impact food production capacities and, therefore, food security and nutrition outcomes. ASALs typically endure harsher climatic conditions, such as lower rainfall and higher temperatures, which limit agricultural productivity and food availability. Households experiencing poverty often struggle to afford sufficient, safe, and nutritious food, leading to

higher instances of food insecurity and malnutrition (World Bank, 2022). Economic hardship restricts dietary diversity and results in inadequate caloric intake, critical factors contributing to undernutrition, including stunting and wasting among children (UNICEF, 2021).

Stunting, a critical indicator of chronic malnutrition, is influenced by the complex interplay of the above factors that go beyond the food security pillars. These factors are essential for preventing infections and nutrient deficiencies in children through proper hygiene and healthcare, preservation of food quality through refrigeration, and safe cooking methods because of proper electrification. The ability to purchase nutritious foods is influenced by a good Gross County Product (GCP) while road connectivity facilitates efficient food distribution and market access, hence reducing stunting. Arid and semi-arid lands (ASALs) impact local food production capabilities and often limit the diversity and quantity of food. High poverty levels increase food insecurity, as financially constrained households struggle to afford adequate or diverse diets, leading to higher stunting rates (FAO, 2019; World Bank, 2020; UNICEF, 2021).

4 Methodology

4.1 Data Sources

This study used various data sources to derive the food security and nutrition indicators. The data sources include the Kenya Demographic Health Survey (KDHS, 2014; 2022), Kenya Integrated Household and Budget Survey (KIHBS 2015/2016), Kenya Continuous Household Survey (KCHS, 2021), KilimoStat, 2021; World Bank 2022; Kenya National Bureau of Statistics (KNBS, 2023); National Drought Management Authority (NDMA, 2019-2023).

4.2 Food Security Index

This section presents the methods and data that were used in deriving the food security indexes and their influence on nutrition outcome (stunting). A food security index was computed for the four pillars across the 47 counties. An index for each pillar of food security was derived from various indicators that were obtained through sector expert review and analysis of nutrition sensitive indicators, activities, strategies and programmes. A total of 19; food availability (2 with 2 sub-indicators each), food accessibility (5), food utilization (5) and food stability (5). For food availability, crop and livestock production were used to derive food production indicator while food price indicator was derived from marketed crops and livestock products. The weights of each indicator were assigned based on their importance (Appendix II). The indicators were extracted based on the global humanitarian indicators used to measure food security status.

4.3 Derivation of Indices for Food Security and its Pillars

The indices for food security and its pillars were computed to assess their performance across the 47 counties. The positive and negative nature of the indicator with respect to its contribution to food and nutrition security was computed as follows:

$S_i=(X_i\text{-Minimum value})*100)/(\text{Maximum value-Minimum value})$

where S_i = Scaled value for positive indicator and X_i = Data value of the indicator

$S_i=(\text{Minimum value- Xi })*100)/(\text{Maximum value-Minimum value})$

where S_i= Scaled value for negative indicator and X_i = Data value of the indicator

The minimum and maximum value for each of the positive and negative indicator was determined based on the values for that indicator across counties. Because all the indicators included in the study did not have an equal importance, each indicator was assigned weight (W_i) based on its impact on food security status.

Finally, based on the above-scaled value and weight given to the particular indicator, a composite-weighted index was thus calculated as follows:

$$\text{Composite–weighted index}=(\sum W_i*S_i)/(\sum Ww_i)$$

4.4 Index Robustness Analysis

After computing the food security index under varying weights, we tested the robustness of the indices for use for reporting. The use of varying weights presents an element of uncertainty. Therefore, the most robust index is the one that is least sensitive to changes in the sources of uncertainty. To have a reliable and consistent index, robustness analyses are conducted followed by statistical inference.

Robustness analyses involved checking the fragility of the ranking of two or more counties under alternative choices of weights. Further, statistical inference tests involved estimating the unknown population parameters such as testing for equality of means and variances under alternative choices of weights. The weights' scheme used in this study was compared to assuming equal weights for all indicators and pillars.

To test if the ranking of two or more counties remains the same when the weights are altered, the robustness of the indices was evaluated by conducting the correlation rank correlation coefficient between the weights applied and assuming equal weights for all indicators and pillars. Three alternative rank correlation coefficients were considered: Pearson's correlation coefficient, Spearman's Correlation coefficient, and Kendall's rank correlation coefficient (Tau-b). Spearman's rank correlation and Kendall's rank correlation are the most common methods used in assessing ranking robustness in development research (Alkire et al., 2015; UNDP and OPHI, 2019). An underlying assumption in both coefficients is that there is no single tie in the ranking of any single pair of counties. Spearman's rank correlation coefficient is given by the formula below:

$$R^{p} = 1 - \frac{6\sum_{i=1}^{m}(r_i - r_i')}{m(m^2-1)}$$

Kendall's tau correlation coefficient is preferred in cases where the sample size is small with a possibility of many tied ranks. The approach also considers elements of discordant and concordant pairs in reflecting the consistency of the index. The formula for computing Kendall's tau is given by:

$$R^{\tau} = \frac{\#Concordant\ Pairs - \#Discordant\ Pairs}{m(m-1)/2}$$

The results show a strong correlation between the rankings of the counties under the two weighting schemes for all indices. For the food security index, Kendall's tau of 0.870 indicated that 87 per cent of the pairwise county comparisons were concordant and robust, while 13 per cent were discordant.

Table 4.1: Correlation coefficients

		Correlation Coefficient (Score)	Correlation Coefficient (Rank)
Accessibility	Pearson	0.930	0.945
	Spearman	0.945	0.945
	Kendall's tau	0.804	0.804
Utilization	Pearson	0.982	0.975
	Spearman	0.975	0.975
	Kendall's tau	0.889	0.889

Stability	Pearson	1.000	1.000
	Spearman	1.000	1.000
	Kendall's tau	1.000	1.000
Availability	Pearson	0.950	0.930
	Spearman	0.930	0.930
	Kendall's tau	0.795	0.795
Food Security Index	Pearson	0.981	0.972
	Spearman	0.972	0.972
	Kendall's tau	0.870	0.870

Source: Authors' computation 2024

The results of the independent samples t-test were used to study the equality of means and variances between the two weighting schemes. Lavene's tests of equality of variances revealed that the variances of the means under the two schemes were not significantly different from each other ($p > 0.05$) for all indices. The means of the food security index under the two alternative weighting schemes was not significantly different, $t(92) = 1.113$, $p = 0.269$. This confirmed that the index was robust.

Table 4.2: Equality of means and variance

Independent Samples Test				
	Levene's Test for Equality of Variances		t-test for Equality of Means	
	F	Sig.	t	Sig, (2-tailed)
Accessibility	1.884	0.173	1.113	0.269
Utilization	0.233	0.631	-1.391	0.168
Stability	0.000	1.000	0.000	1.000
Availability	0.004	0.951	1.408	0.162
Food Security Index	0.983	0.324	0.681	0.497

Source: Authors' computation 2024

4.5 Stunting (a Measure of Nutritional Outcome in Children)

Stunting is a condition marked by impaired growth and development in children due to factors such as poor nutrition, recurrent infections, and insufficient psychosocial stimulation and stands as a critical indicator within the domain of food and nutrition security. This measure is typically assessed by comparing a child's height-for-age against established reference standards, such as those provided by the World Health Organization (WHO) Child Growth Standards (children under 5 years of age; Height/length (cm) for age (months) < -2 SD of the WHO Child Growth Standards median). Stunting is measured by taking the percentage of children aged 0–59 months who are below -2 SD from the median height-for-age as guided by WHO Child Growth Standards. Low height-for-age is an indicator that reflects the cumulative effects of undernutrition and infections since and even before birth. For this study, data from KDHS (2022) was used to analyze the stunting prevalence among children under five (5) years

of age across the 47 counties. The stunting prevalence for children with moderate and severe stunting was measured as a percentage of the children population in the respective counties.

4.6 The Influence of Food Security Indices on Child Nutritional Status (Stunting)

Nutrition status and food security are supported by several pillars that interrelate and work together to ensure access to a balanced, diverse, adequate, and nutritious diets for all individuals including children. The second objective of this study was to assess the influence of the food security indices (four index) on nutrition indicator (stunting) in the 47 county governments in Kenya. The following analytical framework was employed to understand how food security indicators and sub-indicators influenced stunting in children in counties.

Stunting = f (food availability, food accessibility, food utilization, food stability)

Stunting = f (food availability indicators, accessibility indicators, utilization indicators, stability indicators and control variables (poverty rates, county being an ASAL, gross county product, households with electricity connectivity and road density))

$$y_1 = \beta_\theta + \beta_{1i} x_{1i} + \beta_{2i} x_{2i} + \ldots\ldots\ldots \beta_{ki} x_{ki} + \varepsilon$$

y_i represents stunting, which is the dependent variable; $x_{i's}$ represent availability, accessibility, utilization, stability indicators and control variables, which are the independent variables, influencing the levels of stunting among children; β_{1}, β_{2}, β_{3}, *to* β_{9}, are the coefficients representing the influence of the independent indicators for each food security pillar and control variables on stunting; β_0 is the intercept term; ε is the error term, representing the unobserved factors that influence stunting but are not captured by the independent variables.

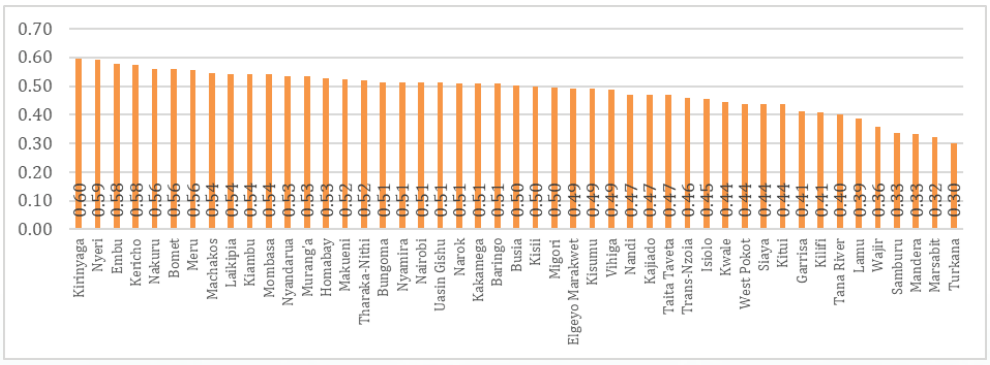
5 Food Security Index and Its Components

This section entails a discussion of findings on the overall food security index and its indicators. It also discusses the sub-indicators that were used to derive the food security index. The index for each of the 47 counties is derived from the weighted food security pillars (availability, accessibility, utilization and stability), which have also been derived from a number of selected weighted indicators.

5.1 Overall Food Security Index and its Pillars

The overall food security index ranges between 0.60 and the lowest 0.30. Counties with high index include Kirinyaga (0.59), Nyeri (0.58), Embu (0.58), and Kericho (0.56) and exhibit high levels of food security. These counties have relatively stable food supply and better access to nutritious food. They are likely to benefit from favourable agricultural conditions and good infrastructure, which collectively contribute to their higher levels of food security. On the other hand, the counties with lowest food security index are Turkana (0.30), Marsabit (0.32), Mandera (0.33), Samburu (0.33) Wajir (0.36), and Lamu (0.39), which face significant challenges, such as harsh climatic conditions, poor infrastructure, limited market access, and recurring conflicts, which increase food insecurity. The low indices in these counties reflect high levels of vulnerability to food shortages, malnutrition, and related health issues such as stunting (FAO et al., 2022). Over 25 counties recorded a food security index of 0.50 and above, suggesting that while many counties are relatively food secure, there are still regions with critical needs.

Figure 5.1: Overall food security index across counties

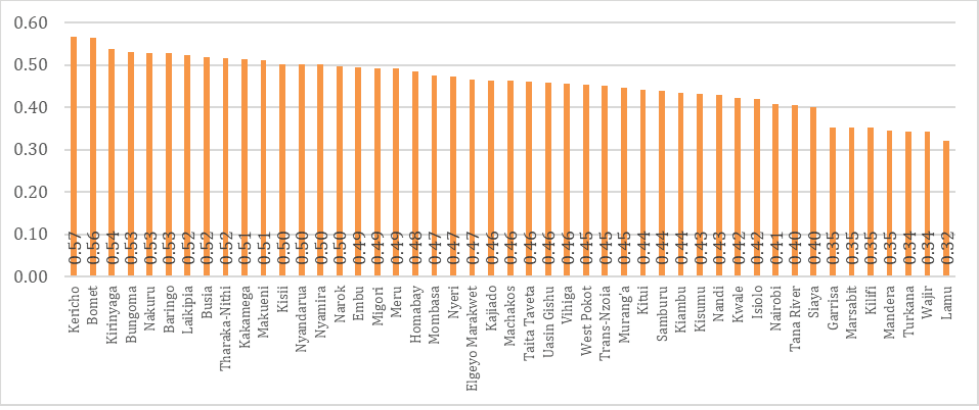


Data source: KDHS (2022), KNBS (2023), KCHS (2021), KILIMOStat (2021), NDMA (2023)

5.1.1 Food availability index across counties

The food availability index results (Figure 5.2) show a range between 0.32-0.57. Counties contributing to this high score are Kericho (0.57), Bomet (0.56), Kirinyaga (0.54), Bungoma (0.53), Nakuru (0.53), and Baringo (0.53). This can be attributed to the high level of agricultural productivity in these counties compared to their counterparts. Despite being an ASAL, Baringo County has a food availability index of 0.53. This could be attributed to the availability of food production from irrigated farming and could also imply that most of the food commodities are mainly produced for home consumption compared to commercial purposes. The long rains food and nutrition security assessment of Baringo County (Baringo County, 2019) established the county to be enjoying stable supply of food products from both rain-fed and irrigated farming despite high food prices. Lamu (0.32), Wajir (0.34), Turkana (0.34), Mandera (0.35), Kilifi (0.35), Marsabit (0.35), and Garissa (0.35) are some of the counties that had a low food availability index. Most of these counties are found in arid and semi-arid parts of the country. They are prone to frequent droughts and other climatic variability, and limited arable land that limits agricultural production and access to food sources. Insecurity and conflicts in parts of these counties may disrupt food supply chains and agricultural activities, which further exacerbates food shortages and thus the need for multifaceted interventions that seek to improve food availability and hence enhancing food security in the region. Although most of these counties practice pastoralism, it does not fully support their daily livelihood as they are among counties with high poverty levels.

Figure 5.2: Food availability index across counties



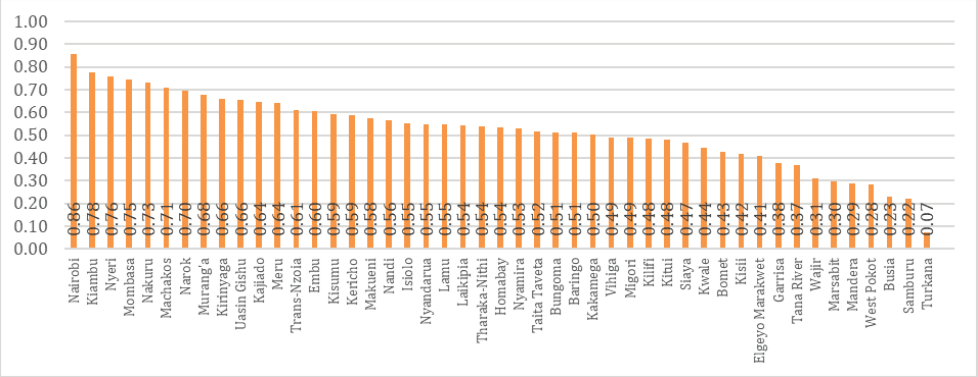
Data source: (KCHS, 2021; KILIMOStat 2021)

5.1.2 Food accessibility index across counties

The food accessibility performance index ranged from a high of 0.85 to a low of 0.1. Counties that showed a strong accessibility performance index such as Kiambu and Nyeri have high Gross County Product (GCP), and these counties are known for cultivation of food and cash crops, livestock rearing, and they experience a favourable economic environment (KNBS, 2023). Nairobi county also performed well on the food accessibility index. This can be attributed to its high commercial activities and leads on GCP. Thus, the high accessibility index in the three counties reveals that households in these counties are likely to have access to a diverse range of fresh, healthy foods, which is essential for maintaining a balanced diet and promoting overall health. This, in turn, can contribute to lower rates of malnutrition, improved cognitive development, and better overall well-being among residents.

Conversely, the counties that have poor accessibility index such as Turkana and Samburu have low GCP and exhibit significantly lower accessibility index, with values below 0.1 and 0.21, respectively. These low scores underscore the challenges faced by households in these regions in accessing nutritious foods due to their low economic status. Factors such as geographical isolation, limited infrastructure, and socio-economic disparities may contribute to these difficulties, resulting in food insecurity and heightened vulnerability to malnutrition and related health issues (WHO, 2018).

Figure 5.3: Food accessibility index across counties



Data source: KIHBS (2015)

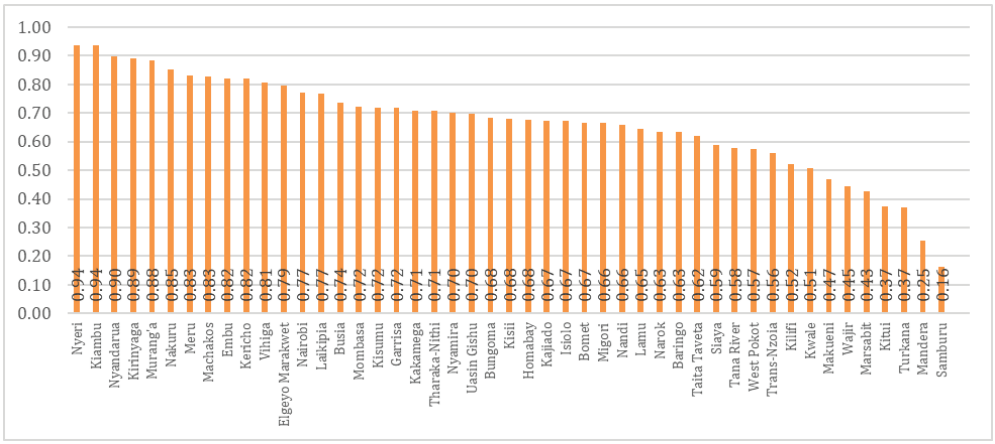
5.1.3 Food utilization index across counties

The food utilization index is a crucial measure of food security. It indicates how effectively food resources are used to meet the population's nutritional needs. Across the counties, the utilization index ranges from a high of 0.94 to a low of 0.16. Counties that performed well in terms of the food utilization index include Kiambu, Nyandarua, Kirinyaga, and Murang'a. These counties are likely to have better access to clean water, food preparation methods and sufficient dietary diversity, which contribute to the high food utilization index.

Furthermore, in counties with high food utilization index, households are likely to consume a diverse and balanced diet, ensuring adequate intake of essential nutrients (Leroy et al., 2015). This leads to enhanced health outcomes, reduced malnutrition rates, and increased productivity among the population. Moreover, a favourable index indicates that communities are effectively managing food resources, minimizing food waste, and optimizing food distribution systems (FAO, 2022). Ultimately, a high food utilization index is crucial for sustainable food security, economic development, and social stability, fostering resilience against food insecurity challenges and promoting a healthier and more prosperous society (Barret, 2021).

Conversely, counties that had low food utilization performance index, such as Mandera, Turkana, Kitui, Marsabit, and Wajir face challenges of lack of portable water for drinking and cooking, strong food cultural beliefs and poor economic status (KNBS, 2023).

Figure 5.4: Food utilization index across counties

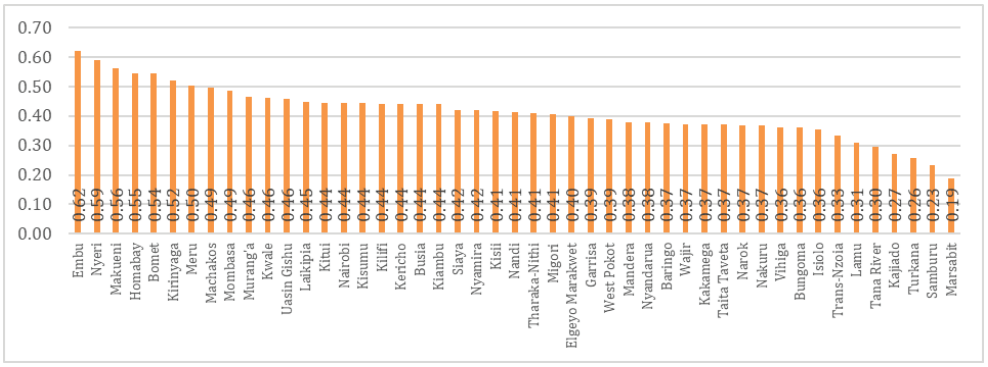


Data source: KDHS (2022) and KIHBS (2015)

5.1.4 Food stability index across counties

In Kenya, the performance of food stability index reveals disparities across the counties. Embu, Nyeri, and Makueni have higher index at 0.62, 0.59, and 0.56, respectively, indicating better access to and continuous supply of food resources.

Figure 5.5: Food stability index across counties



Data source: KDHS (2022), KCHS (2020, 2022), NDMA (2019-2023) KIHBS (2015)

These counties benefit from favourable agricultural conditions, good infrastructure, which collectively contribute to their comparatively higher levels of food security. On other hand, Marsabit, Samburu, and Turkana struggle with significantly lower index of 0.19, 0.23, and 0.26, respectively, underscoring pronounced challenges in ensuring food access and availability. Arid climates, limited market access, and socio-economic disparities aggravate food insecurity in these areas.

5.2 Pillars of Food Security and their Components

This section entails a discussion on the indicators that were used to compute each index pillar of food security across the 47 counties.

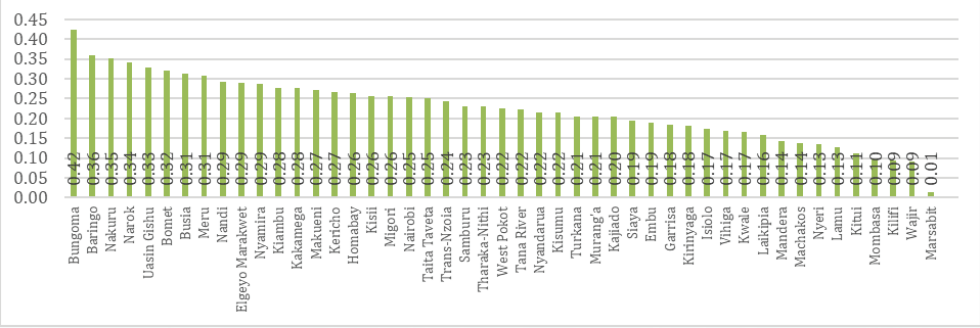
5.2.1 Food availability pillar

The availability pillar of food and nutrition security assesses the physical availability of food within a given region or country. Nationally, the food availability pillar focuses on agricultural production (crops, livestock, and fish production), import, export, and stock levels of food commodities. At the county level the availability pillar focuses on food production and prices of food commodities. To assess food availability, various data sources and indicators were used, including the various food groups and food prices across the counties. The food groups enumerated in Appendix I contain the food crops and livestock products that were selected in deriving the food production index. Similarly, food prices for the selected food commodities were also considered in developing the food availability index. The foods in different food groups contain nutrients that capture both the food security and nutrition components that this paper seeks to address.

5.2.1.1 Food production index (selected food crops)

The results in Figure 5.6 show that the highest food production index achieved is 0.42 by Bungoma County, while Marsabit County had the lowest at 0.01. Bungoma County is well suited for agricultural production compared to Marsabit County, and this could explain the reason why Bungoma County has a higher food production index. Notably, Baringo (0.36), Nakuru (0.35), Narok (0.34), and Uasin Gishu (0.33) seem to be doing well in terms of food production compared to Kitui (0.11), Kilifi (0.09), Mombasa (0.10), and Wajir (0.09), which seem to be worse off on food production. Most of the ASALs have low food production, except Baringo which seems to be doing well perhaps using irrigated systems, which ensure production activities are uninterrupted. ASALs experience harsh weather conditions such as droughts and flooding, which adversely affect their food production and which in turn affect nutrition levels of the population.

Figure 5.6: Food production index (selected from ten food groups)



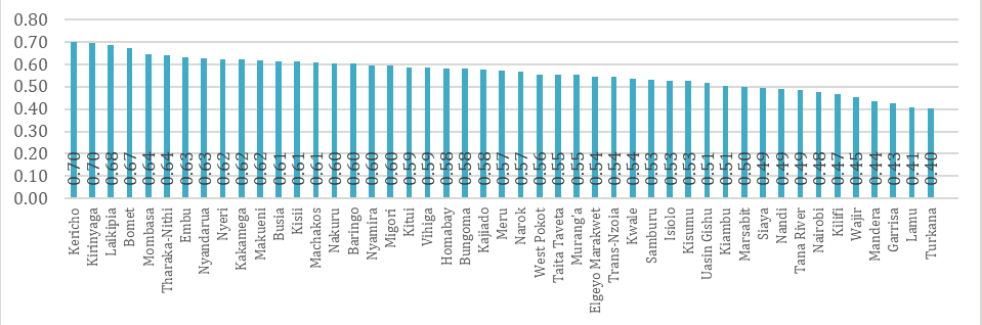
Data source: KilimoStat (2021); KCHS (2021)

5.2.1.2 Food prices index (selected food items)

The results in Figure 5.7 show that Kericho (0.70), Kirinyaga (0.70), Laikipia (0.68), and Bomet (0.67) counties have food price index above 0.65, with Kericho and Kirinyaga counties recording the highest food price index. These counties mainly produce cash crops compared to food crops. This pushes up the prices of food and hence the revealed high food price indices in the counties.

On the other hand, Turkana (0.40), Lamu (0.41), Garissa (0.43), and Mandera (0.44) counties recorded a price index of 0.45 and below, with Turkana County recording the lowest price index. This could be attributed to low economic status (KNBS, 2023) and their dependence on food aid (NDMA, 2023). For instance, Trans Nzoia and Uasin Gishu counties are food baskets of the economy, but they mainly produce maize for commercial purposes, which overall impacts on the nutrition status of the residents.

Figure 5.7: Food prices index (prices for food items selected from ten food groups)



Data source: KCHS (2021), KilimoStat (2021)

5.2.2 Food accessibility pillar

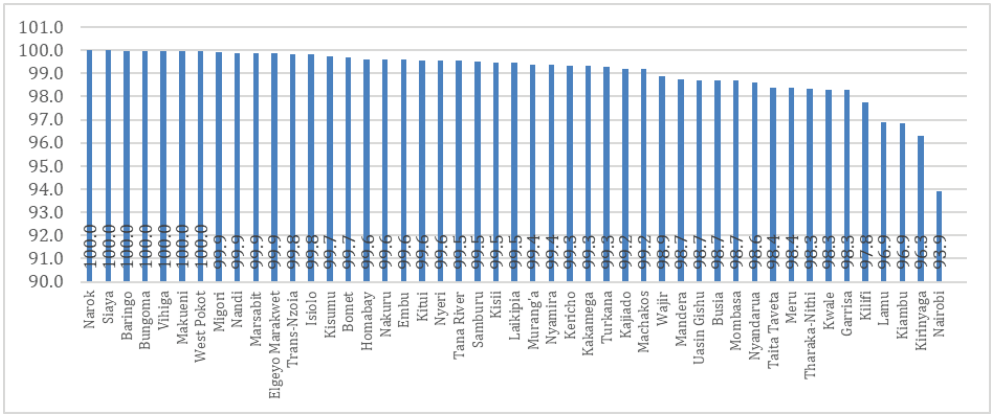
Food accessibility refers to the ease with which individuals or communities can obtain and acquire sufficient, safe, and nutritious food to meet their dietary needs and preferences. It is a critical aspect of food security, which encompasses not only the availability of food but also its affordability and physical accessibility.

5.2.2.1 Proportion of population who have consumed target foods (ten food groups/quality diet - FAO)

The proportion of the population consuming target foods serves as a critical indicator of food accessibility, reflecting nutritional adequacy, dietary diversity, food access, affordability, and long-term health outcomes within a population in a region. Consuming target foods is essential for achieving dietary diversity and maintaining adequate nutrition for individuals in different regions. Individuals consuming diverse and balanced diet can meet their nutritional needs, support healthy growth and development, and reduce the risk of malnutrition and diet-related diseases. Target foods, that include a variety of nutrient-rich foods such as fruits, vegetables, grains, proteins, and dairy products, provide essential nutrients needed for optimal health and well-being. In the current study, individuals from most of the households across various counties managed to consume the target foods (100%). These target foods are from the ten food groups as enumerated by FAO (Appendix I). However, a fewer proportion of individuals

from Nairobi (6.1%), Kirinyaga (3.7%), Kiambu (3.1%), Lamu (3.1%), Kilifi (2.2%), and Garissa (1.7%) did not consume targeted foods. This could be attributed to low disposable income, seasonality in food production and poor food distribution channels.

Figure 5.8: Proportion of population who have consumed target foods (ten food groups/ quality diet, FAO)

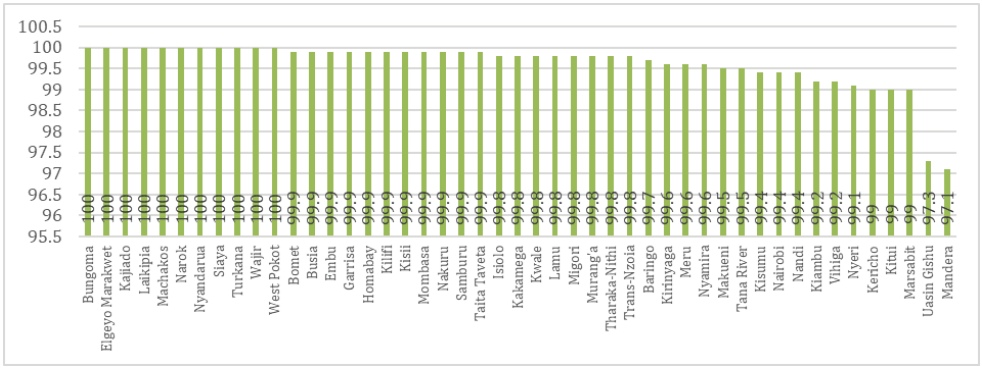


Data source: KIHBS (2015)

5.2.2.2 Consumption of fruits and vegetables below 400g

The proportion of the population consuming fruits and vegetables below 400g has significant implications for the health and well-being of individuals in various counties in Kenya.

Figure 5.9: Consumption of fruits and vegetables below 400gms



Data source: KIHBS (2015)

All households in Bungoma, Elgeyo Marakwet, Kajiado, Machakos, Narok, Nyandarua, Siaya, Turkana, Wajir, and West Pokot consume below 400gms of fruits and vegetables daily. The implications are that the households miss out on key nutrients, both macronutrients and micronutrients that are required for the protection and proper functioning of the body. On the other hand, households in Mandera (2.9), Uasin Gishu (2.7), Kitui (1), and Nyeri (0.01) counties consume 400gms of fruits and vegetables as recommended by WHO (2005). Consumption of fruits and vegetables below 400gms limits access to nutritious food sources and dietary

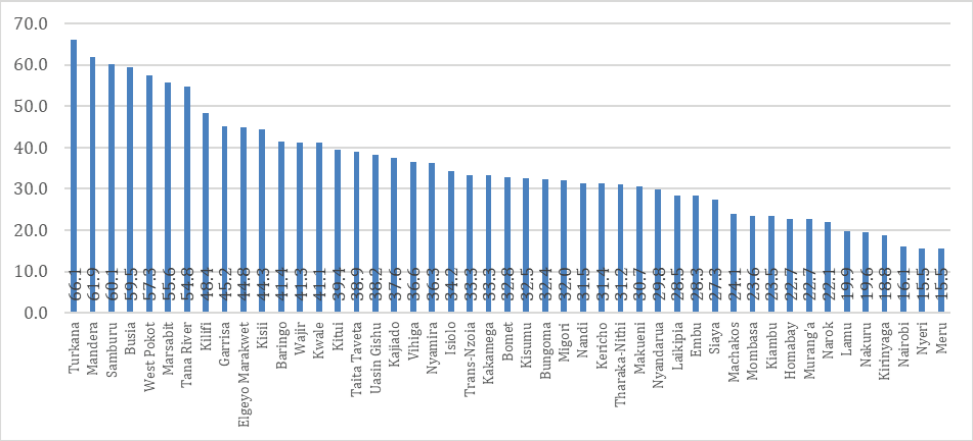
diversity. These foods are essential for maintaining good health and preventing diseases. Insufficient intake increases the risk of nutrient deficiencies, compromised immune function, and chronic health conditions. This issue reflects food preferences, food insecurity, socio-economic disparities, and limited access to fresh produce.

5.2.2.3 Food poverty

The findings of food poverty rates reveal profound implications for the status of food security across counties in Kenya. Turkana County had the highest food poverty rate at 66.1 per cent, indicative of severe challenges in ensuring access to nutritious food for its residents, likely worsened by factors such as drought and limited infrastructure. Mandera and Samburu counties follow closely behind with rates of 61.9 per cent and 59.5 per cent, respectively, reflecting critical situations regarding food security in these arid and semi-arid regions.

In contrast, Nyeri and Meru counties exhibit lower food poverty rates of 15.5 per cent, suggesting relatively better food security outcomes, although with potential disparities within these regions. The lower food poverty rates could be attributed to better access to nutritious diets, access to the market, and better food distribution networks that promote access to cheap and affordable food items. This in turn has a positive impact on their nutritional status owing to the access to a sufficient and adequate nutritious diet.

Figure 5.10: Food poverty



Data source: KIHBS (2015)

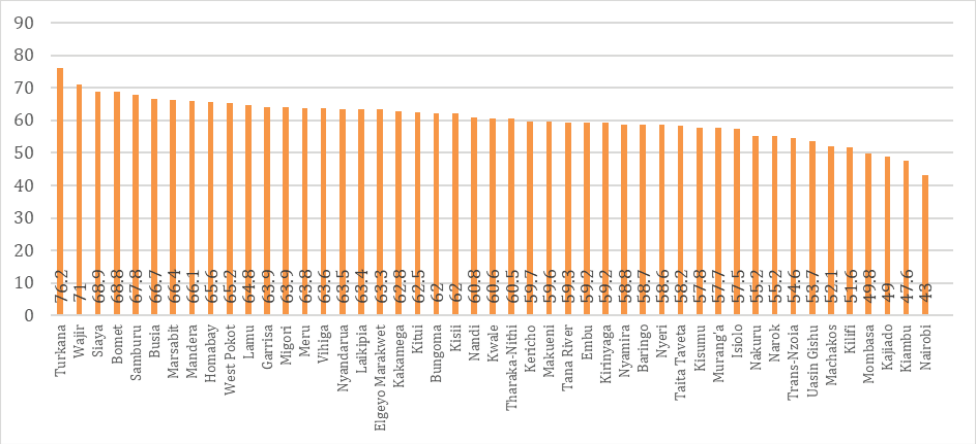
5.2.2.4 Food expenditures (% of income spent on food)

The results reveal considerable disparities in food expenditure as a percentage of income across various counties in Kenya. Turkana and Wajir counties exhibit the highest percentages, with 76.2 per cent and 71 per cent of income spent on food, respectively, highlighting a significant financial burden on households in these regions. This also indicates the possibility of the residents in the respective counties having low disposable income, which leads to a higher proportion of the available income being spent on food. These findings suggest that households in Turkana and Wajir counties may face challenges in accessing affordable and adequate food, potentially indicating higher levels of food insecurity in these areas. Despite Bomet and Siaya counties being better placed geographically compared to Wajir and Turkana counties in terms of favourable weather conditions, access to the market and generally on

production of food items, they also demonstrate high food expenditure proportions at 68.9 per cent each. These, therefore, could mean that residents in these counties face challenges in accesing adequate and sufficient food, which also impacts on their nutrition status.

In contrast, Nairobi, Kiambu, and Kajiado counties exhibit notably lower percentages of income spent by households on food, with 43 per cent, 47.6 per cent, and 49 per cent, respectively. The lower percentages observed may imply relatively better food accessibility and affordability, indicative of improved food security conditions in these regions. These statistics underscore the importance of targeted interventions to address food insecurity, particularly in regions with higher food expenditure proportions, to ensure equitable access to nutritious food for all.

Figure 5.11: Food expenditures (% of income spent on food)

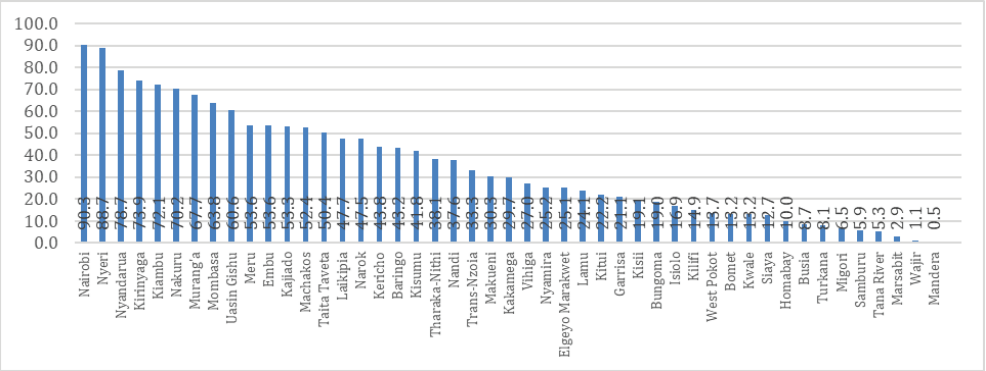


Data source: KIHBS (2015)

5.2.2.5 Consumption of Vitamin A-rich foods among children

The findings reveal a significant disparity in the consumption of Vitamin A-rich foods among children across different counties. Nairobi, Nyeri, and Kirinyaga counties demonstrate notably higher rates of consumption, with 90.3 per cent, 88.7 per cent, and 73.9 per cent of children, respectively, reported to consume these foods. This is attributed to easy access of Vitamin A-rich foods in the indicated counties.

Figure 5.12: Consumption of Vitamin A-rich foods among children



Data source: KIHBS (2015)

Well established distribution channels positively improve the nutrition status of children in the mentioned counties. On the contrary, Mandera, Wajir, and Marsabit counties exhibit alarmingly low rates of consumption of Vitamin A-rich foods among children, with only 0.5 per cent, 1.1 per cent, and 2.9 per cent of children, respectively, consuming an adequate amount of Vitamin A-rich foods. This may mean that these counties have very limited access to Vitamin A-rich foods. This discrepancy underscores a pressing issue of nutritional imbalance and potential health risks among children in less privileged areas, where insufficient intake of Vitamin A-rich foods may lead to increased vulnerability to various health complications associated with Vitamin A deficiency, thus necessitating targeted interventions to address these disparities and improve overall child health outcomes.

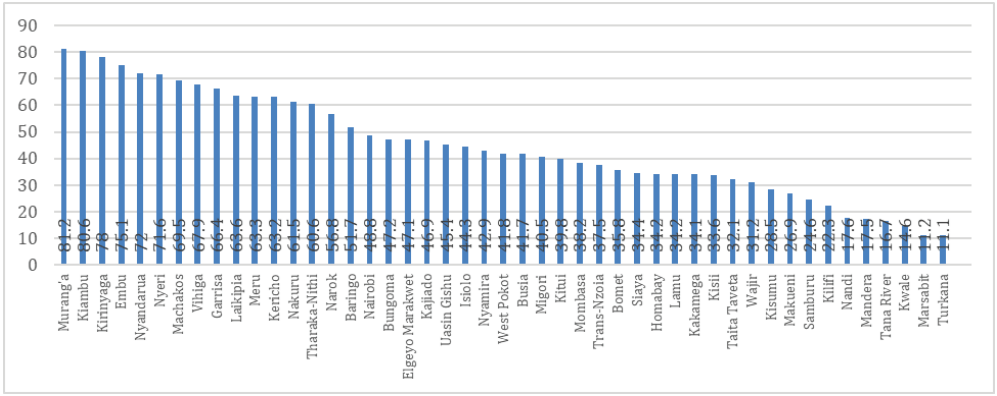
5.2.3 Food utilization pillar

Food utilization is commonly understood as the way the body makes the most of the various nutrients in the food. It refers to households' ability to use food that they have access to, safely prepare, and store healthful meals. Sufficient energy and nutrient intake by individuals are the result of good care and feeding practices, food preparation, diversity of the diet and intra-household distribution of food. However, based on the availability of data, the utilization pillar focuses on diet quality among women as measured by MDD-W, the time taken to the water source, the distance to the source of drinking water, food consumption score, and adequate use of iodized salt among households.

5.2.3.1 Diet quality (MDD-W)

Diet quality for women is crucial for their overall health and well-being. It involves the nutritional adequacy and diversity of food consumed, and the efficiency of nutrient absorption and utilization. Inadequate diet quality can lead to deficiencies and health issues.

Figure 5.13: Diet quality (MDD-W)



Data source: KDHS (2022)

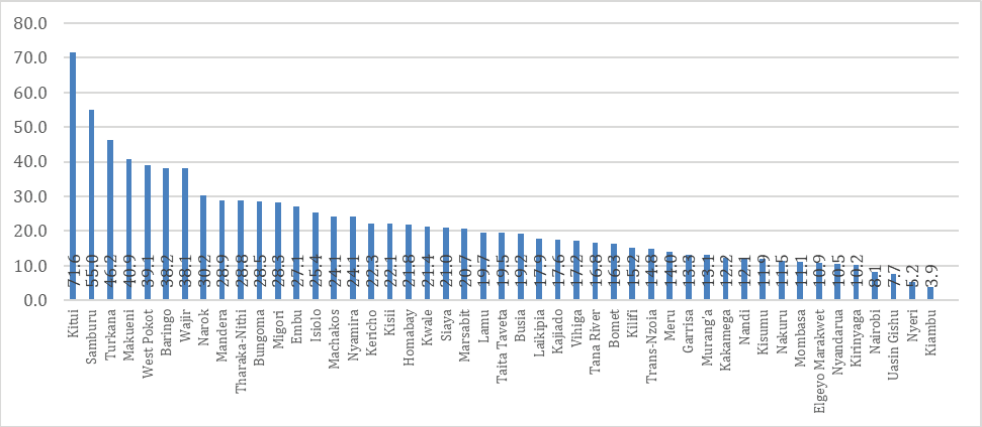
A diet rich in diverse, nutrient-dense foods promotes optimal food utilization, providing women with necessary vitamins, minerals, and macronutrients. Murang'a (81.2%), Kiambu (80.6%), Kirinyaga (78%), Embu (75.1%), and Nyandarua (72%) counties are among the counties that have the proportion of women with high diet quality. This implies that women in these regions properly use the food they have access to, to achieve the required sufficient energy and nutrition amount.

This could also indicate that these regions have better access to adequate and sufficient food items for their nutritional demands. However, Turkana (11.1%), Marsabit (11.2%), Kwale (14.6%), Tana River (16.7%), and Mandera (17.5%) counties had the proportion of women with low diet quality, implying that they have limited access to enough food for their nutritional requirements. They could also be experiencing droughts and famine that normally hit such areas. Promoting diet quality through access to diverse foods, nutrition education, and healthcare services is essential for improving food utilization and addressing nutritional deficiencies.

5.2.3.2 Time taken to the source of water (minutes)

Across counties, Kitui (71.6), Samburu (55.0), Turkana, (46.2), and Makueni (40.9) are leading in terms of time taken to the source of water in minutes. This implies that a lot of time is used in fetching water, which lowers the utilization levels of water in food preparation and cooking for household consumption, and hence impacting on the nutritional status of the residents. Kirinyaga (10.2), Nairobi (8.1), Uasin Gishu (7.7), Nyeri (5.2), and Kiambu (3.9) counties take the least minutes to reach water sources, thus indicating high utilization of water in food preparation, food handling and cooking for household consumption. Thus, the residents are likely to have adequate and sufficient utilization of food. In addition, the type of water used to cook food is important when assessing the food utilization pillar.

Figure 5.14: Time taken to the source of water (minutes)



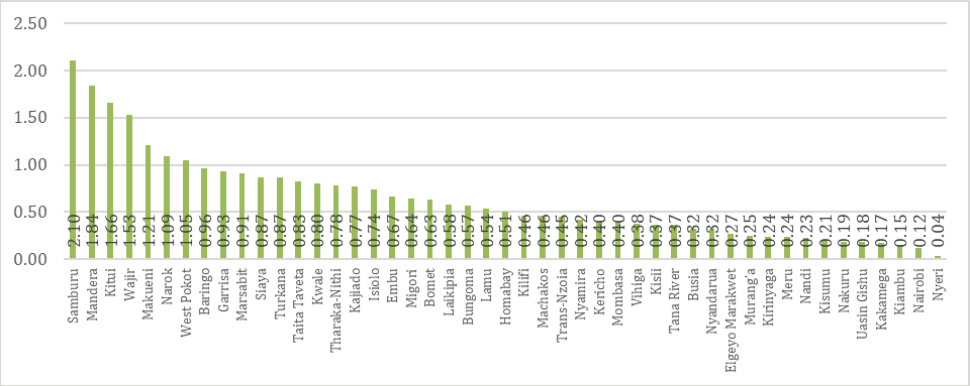
Data source: KIHBS (2015)

Access to safe and reliable water sources, within a short period of time, is essential for food preparation and the overall household well-being. Access to drinking water is crucial for food utilization and nutritional outcomes, especially in rural and underserved communities. Long journeys to fetch water consume time and energy, leading to decreased food security and dietary diversity. Inadequate access to clean water compromises food safety and hygiene, increasing the risk of foodborne illnesses and malnutrition. Reducing water accessibility barriers through improved infrastructure, water resource management, and community empowerment is essential for enhancing food utilization, promoting healthy dietary practices, and achieving sustainable development goals related to nutrition and well-being.

5.2.3.3 Distance to the source of drinking water

Samburu (2.10), Mandera (1.84), Kitui (1.66), and Wajir (1.53) are leading in terms of distance to the source of drinking water while Uasin Gishu (0.18), Kakamega (0.17), Kiambu (0.15), Nairobi (0.12), and Nyeri (0.04) registered the least distance to the source of drinking water, respectively. Longer distances mean more time will be taken to reach water sources. This can negatively impact the efficiency of using water and, therefore, affect food security and the nutritional status of the household. Nyeri County performed better at (0.04), which means that the distance to the source of water is shorter and thus contributing positively to the food utilization index and overall impact on nutrition outcome.

Figure 5.15: Distance to the source of drinking water



Data source: KIHBS (2015)

Additionally, Turkana (0.37), Mandera (0.25), and Samburu (0.16) counties are performing poorly in the utilization index. Long distances to fetch water for drinking, cooking, and food preparation consume time and energy, affecting productive activities such as agriculture, education, and income-generating work. Inadequate access to clean water can compromise hygiene and sanitation practices, increasing the risk of waterborne diseases and food contamination. The distance to drinking water sources can significantly affect food utilization, especially in rural or underserved areas.

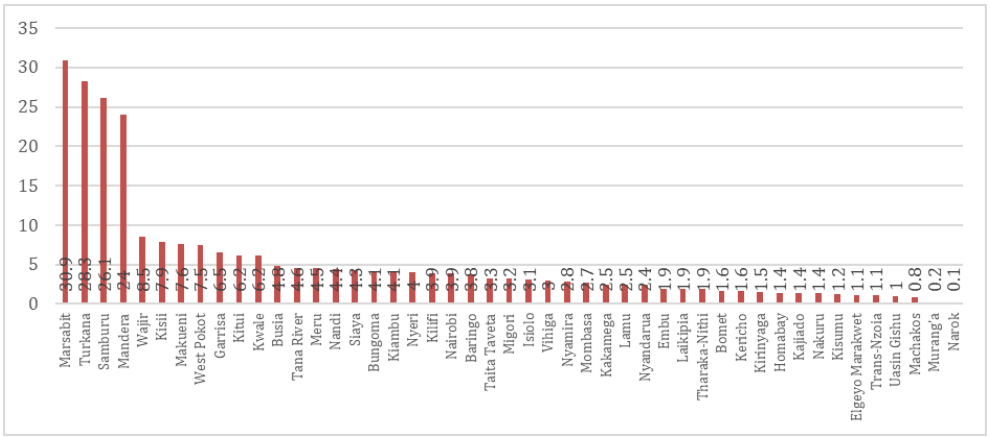
5.2.3.4 Food consumption score (percentage of household with poor consumption)

Ten food groups were considered in computing the food consumption score as shown in Appendix I. The food groups include grains, white roots, tubers, and plantains; pulses (dry beans, dry peas, and lentils); dairy and dairy products; meats, poultry, and fish; eggs; dark green leafy vegetables; Vitamin A-rich fruits and vegetables; other vegetables; other fruits; nuts and seeds.

Across the counties, Marsabit (30.9), Turkana (28.3), Samburu (26.1), and Mandera (24) counties had the highest percentage of households with poor food consumption score (FCS). A low FCS indicates insufficient consumption of diverse and nutritious foods, leading to poor health outcomes and increased vulnerability to malnutrition. Poor food utilization, characterized by limited dietary diversity, insufficient caloric intake, and inadequate nutrient absorption, perpetuate food insecurity and hinders efforts to improve nutrition.

This is indicative of poor access to adequate and sufficient nutritious diets in the areas. It could also imply that the food distribution networks are undefined, thus limiting the supply of food and, therefore, affecting the households in achieving their dietary requirements for better nutrition. On the other hand, Narok (0.1), Murang'a (0.2), Machakos (0.8) and Uasin Gishu counties had the lowest percentage of households with poor FCS, respectively. This reveals that they experience stable access to diverse food items and meet the required nutrient demand for their bodies. The counties could also have better access to the available markets, and the infrastructure is well developed for better distribution of food items.

Figure 5.16: Food consumption score (percentage of household with poor consumption)

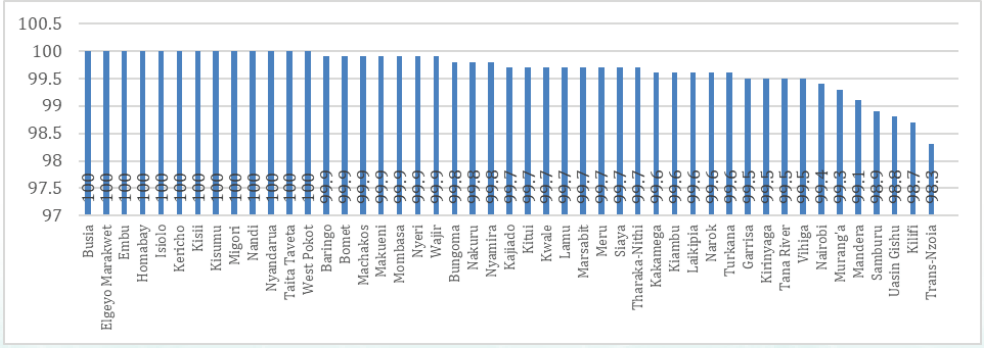


Data source: KDHS (2022)

5.2.3.5 Percentage of households using adequately iodized salt

Most of the counties, including Busia, Elgeyo Marakwet, Embu, Homa Bay, Isiolo, Kericho, Kisii, Kisumu, Migori, Nandi, Nyandarua, Taita Taveta, West Pokot, Baringo, Bomet, Machakos, Makueni, Mombasa, Nyeri, Wajir, Bungoma, Nakuru, Nyamira, Kajiado, Kitui, Kwale, Lamu, Marsabit, Meru, Siaya, Tharaka Nithi, Kakamega, Kiambu, Laikipia, Narok, Turkana, Garissa, Kirinyaga, Tana River, and Vihiga recorded 100 per cent of households using adequately iodized salt. This is an indication that iodized salt is a very important commodity whose supply network is efficient. Iodized salt is cheaply accessible for household use. However, counties including Nairobi (99%), Murang'a (99%), Mandera (99%), Uasin Gishu (99%), Kilifi (99%), and Trans Nzoia (98%) recorded less than 100 per cent households using adequately iodized salt. All these counties are deemed to be advantaged counties, except for Mandera and Kilifi, and thus the proportion of households not adequately using iodized salt is very small. Therefore, on average, households have access to iodized salt and thus can sufficiently use it for household consumption.

Figure 5.17: Percentage of households using adequately iodized salt



Data source: KDHS (2022)

Iodized salt is crucial for maintaining optimal health and preventing iodine deficiency disorders (IDDs). Iodine is essential for thyroid hormone synthesis, metabolism, growth, and development, and can lead to health problems such as goitre, hypothyroidism, intellectual disabilities, and impaired growth. Adding iodine to salt ensures adequate iodine intake, preventing IDD-related health conditions. Iodized salt also supports maternal and child health, supporting proper fetal brain development and cognitive impairments in newborns. It also contributes to public health initiatives by reducing the burden of IDDs on healthcare systems and economies. Iodized salt is especially important for children, as it supports cognitive development and prevents long-term health risks.

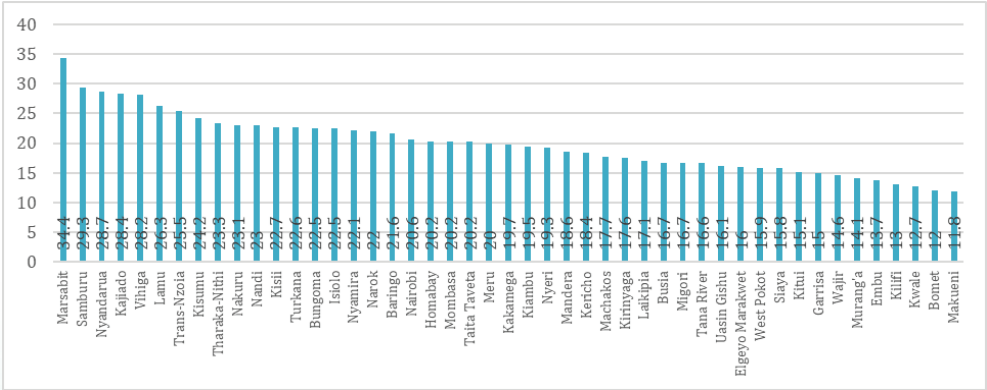
5.2.4 Food stability pillar

Food stability refers to a situation whereby a population, household, or individual must always have access to adequate food and be resilient to shocks, which could be a result of weather variability, food price fluctuations, political factors, and economic factors. The specific indicators used to compute the food stability index were coping strategy, food insecurity experience scale, per capita consumption, average annual rainfall (MM) and proportion of population receiving cash transfers.

5.2.4.1 Coping strategy indicator

The disparity in coping strategy percentages across different regions in Kenya sheds light on the varied approaches used by communities to mitigate food insecurity challenges. Marsabit, Samburu, and Nyandarua counties exhibit the highest coping strategy percentages at 34.4 per cent, 29.3 per cent, and 28.7 per cent, respectively. These regions likely face pronounced food insecurity issues, leading residents to resort to coping mechanisms to meet their basic needs. Coping strategies may include reducing meal portions, relying on less expensive food items, borrowing food or money from relatives, or engaging in informal income-generating activities. The prevalence of these coping strategies underscores the urgency of addressing underlying factors contributing to food insecurity in these areas, such as environmental degradation, climate change, limited access to markets, and socio-economic inequalities.

Figure 5.18: Coping strategy indicator



Data source: KDHS (2022)

In contrast, Makueni, Bomet, and Kwale counties demonstrate relatively lower coping strategy percentages at 11.8 per cent, 12 per cent, and 12.7 per cent, respectively. While these

regions still experience food insecurity to some extent, the prevalence of coping strategies is comparatively lower. This may indicate better access to resources, more stable livelihoods, or more effective support systems in place.

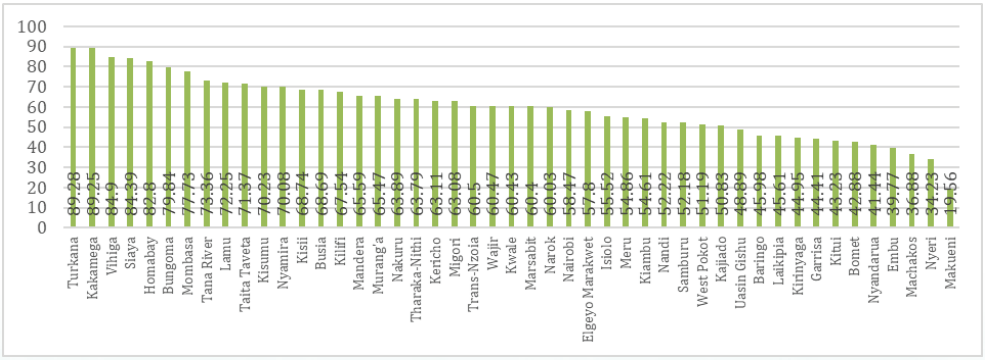
However, it is essential to recognize that even lower coping strategy percentages do not necessarily equate to optimal food security. Addressing the root causes of food insecurity and building resilience remains crucial in ensuring sustainable food access and nutrition outcomes across all regions of Kenya. By implementing targeted interventions that address the unique challenges faced by each region, Kenya could work towards building a more food-secure future for all its citizens across the counties.

5.2.4.2 Food insecurity experience scale

The food insecurity experience scale (FIES) offers insights into the prevalence of food insecurity across different regions of Kenya, revealing significant disparities in experiences among communities. Turkana, Kakamega, and Vihiga counties have high percentages of food insecurity experience, with rates of 89.28 per cent, 89.25 per cent, and 84.9 per cent, respectively. These figures underscore the acute challenges faced by populations in these regions in accessing sufficient, safe, and nutritious food on a consistent basis. Factors such as environmental degradation, climate variability, limited access to markets, and socio-economic vulnerabilities likely contribute to the high prevalence of food insecurity experiences. Urgent interventions are needed to address these underlying issues and provide sustainable solutions to improve food access and nutrition outcomes for affected communities.

Conversely, Makueni, Nyeri, and Machakos counties demonstrate relatively lower percentages of food insecurity experience, with rates ranging from 19.56 per cent to 43.23 per cent. This may be attributed to efforts such as agricultural diversification, livelihood support programme, infrastructure development, and social safety nets that have helped mitigate food insecurity risks. However, sustaining and enhancing these interventions is crucial to ensure continued progress towards food security and improved well-being for all Kenyan citizens. By addressing the root causes of food insecurity and implementing evidence-based strategies tailored to the specific needs of each region, counties in Kenya could strive towards a future where food insecurity is significantly reduced, if not eradicated, across the nation.

Figure 5.19: Food insecurity experience scale



Data source: KCHS (2020)

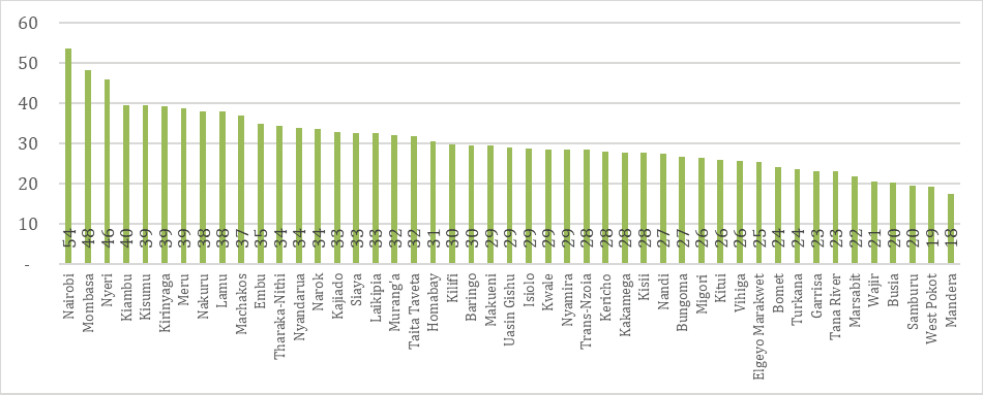
The significant improvement in food insecurity experienced in Kitui County is a positive development, indicating successful interventions and efforts to address food security challenges within the region. Kitui's improved food insecurity experience, with a rate of 43.23

per cent, suggests that targeted interventions and programmes have effectively reduced the prevalence of food insecurity among its population. These interventions may include initiatives aimed at promoting sustainable farming practices, improving access to markets, and providing nutrition education and support services.

5.2.4.3 Per capita consumption

The per capita consumption rates provide valuable insights into the variations in food consumption patterns across different regions of Kenya, reflecting both dietary habits and food accessibility levels. A less volatile trend in consumption patterns is an indicator for food stability in terms of continuous supply. Nairobi, Mombasa, and Nyeri counties emerge with the highest per capita consumption rates at 54 per cent, 48 per cent, and 46 per cent, respectively. These urban centres likely benefit from a diverse range of food options available in markets and supermarkets, and higher purchasing power among residents. Additionally, the cosmopolitan nature of Nairobi and Mombasa may contribute to a more varied diet, incorporating both traditional and modern food choices.

Figure 5.20: Per capita consumption ('000)



Data source: KNBS (2023)

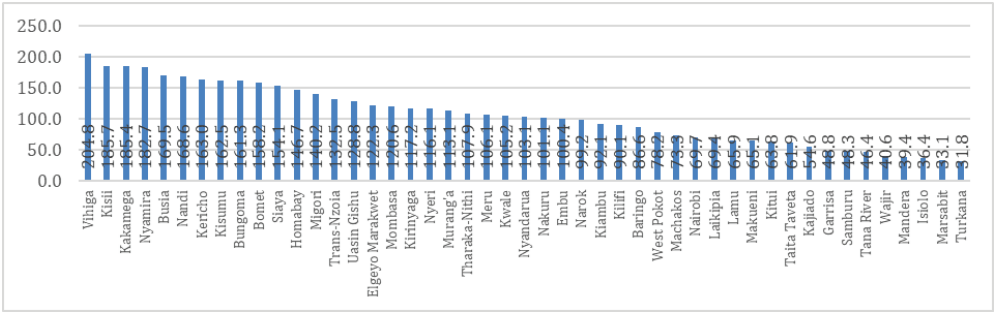
Conversely, Mandera, West Pokot, and Samburu counties exhibit the lowest per capita consumption rates, ranging from 18 per cent to 20 per cent. These regions, characterized by arid or semi-arid climates and pastoralist livelihoods, may face challenges in accessing a sufficient variety of foods year-round. Limited agricultural productivity, sparse distribution networks, and socio-economic vulnerabilities could further contribute to lower food consumption levels in these areas. Turkana County's improvement in per capita consumption, reaching 24 per cent, signifies progress in addressing food access challenges within the region. This improvement could result from interventions aimed at enhancing food availability, such as agricultural development programme, food aid initiatives, or infrastructure investments. By increasing access to nutritious foods, Turkana County's population may experience improved dietary diversity and enhanced nutritional outcomes, contributing to better health and well-being.

5.2.4.4 Average annual rainfall (MM)

The variations in average rainfall across different regions of Kenya reflect diverse climatic conditions and have significant implications for agricultural productivity, water availability,

and livelihoods. Vihiga, Kisii, Kakamega and Nyamira counties emerge with the highest average annual rainfall levels, ranging from 182.7 mm to 204.8 mm. These regions, located in the western part of Kenya, typically experience higher precipitation due to their proximity to the Lake Victoria basin and the influence of the Inter-Tropical Convergence Zone (ITCZ). The abundant rainfall supports lush vegetation, fertile soils, and agricultural activities such as tea and coffee cultivation, which are vital sources of income for local communities.

Figure 5.21: Average annual rainfall (MM)



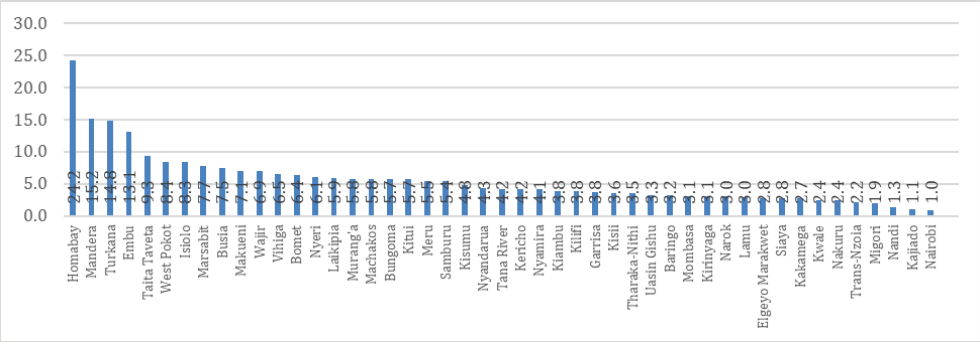
Data source: NDMA (2019-2023)

Conversely, Turkana, Marsabit, and Isiolo counties exhibit the lowest average rainfall levels, ranging from 31.8 mm to 36.4 mm. These arid and semi-arid regions, located in the northern and eastern parts of Kenya, experience limited rainfall throughout the year. The low precipitation levels pose significant challenges for agriculture and water availability, leading to food insecurity, pasture shortages, and water scarcity for pastoral communities. In these regions, communities often rely on alternative livelihood strategies such as livestock keeping, drought-resistant crops, and water harvesting techniques to cope with the arid conditions.

5.2.4.5 Proportion of population receiving cash transfers

The distribution of cash transfers across various regions in Kenya underscores the diverse socio-economic landscapes within the country. Homa Bay County emerges as a focal point with the highest proportion of its population, at 24.4 per cent, receiving cash transfers. This statistic reflects the region's susceptibility to poverty and economic hardships, possibly exacerbated by factors such as limited employment opportunities and challenges in agricultural productivity. Mandera and Turkana counties follow closely, both areas grappling with arid and semi-arid conditions, which often translate into higher vulnerability among residents. The relatively elevated percentages in these regions underscore the imperative for sustained support mechanisms to uplift livelihoods and mitigate the impacts of pervasive poverty.

Figure 5.22: Proportion of population receiving cash transfers



Data source: KCHS (2022)

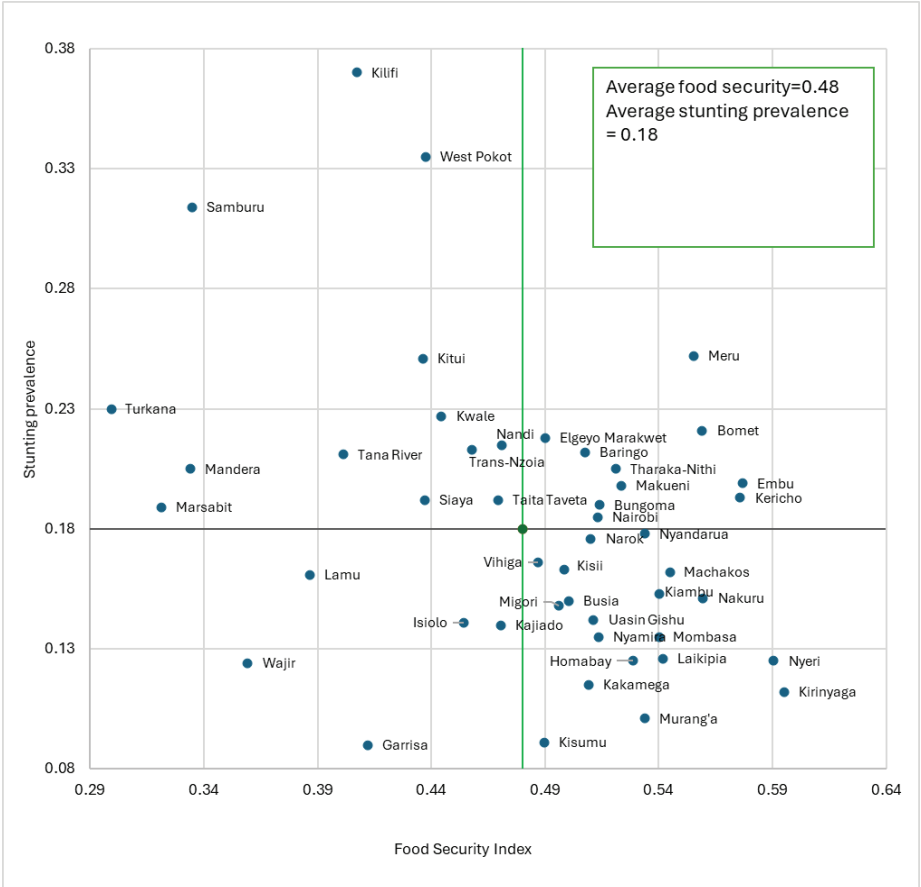
Conversely, Nairobi, Kajiado, and Nandi counties exhibit markedly lower percentages of their populations reliant on cash transfers, ranging from 1.0 per cent to 1.3 per cent. These regions typically boast more diversified economies, with Nairobi County being the economic hub and Kajiado and Nandi potentially benefiting from agricultural activities and other local resources. The lower dependence on cash transfers in these areas suggests a relatively higher degree of economic resilience and access to alternative sources of income. Nonetheless, disparities persist within and between regions, emphasizing the ongoing need for targeted social welfare policies and interventions tailored to address the specific challenges faced by different communities across Kenya.

5.3 Performance of Food Security Index and Stunting in Children

5.3.1 Overall performance of food security index and stunting in children

Figure 5.23 shows that the overall food security index is decreasing as stunting prevalence of children increases across the counties. For instance, Kirinyaga and Nyeri counties have an overall food security index of 0.60 and 0.59, respectively, while the stunting prevalence in the same counties are 0.11 and 0.13, respectively. On the other hand, Turkana and Marsabit counties have low overall food security index of 0.30 and 0.32, with high stunting prevalence among children of 0.23 and 0.19, respectively. This implies that households in counties with high food security experience good nutrition due to accessible and available diverse diets, which are adequate and stable in supply for household consumption. This means that as food security improves across the counties, the stunting prevalence among children decreases.

Figure 5.23: Overall performance of food security index and stunting in children across the 47 counties



Data source: KDHS (2022), KCHS (2020, 2021, 2022), NDMA (2019-2023) KIHBS (2015) KNBS (2023)

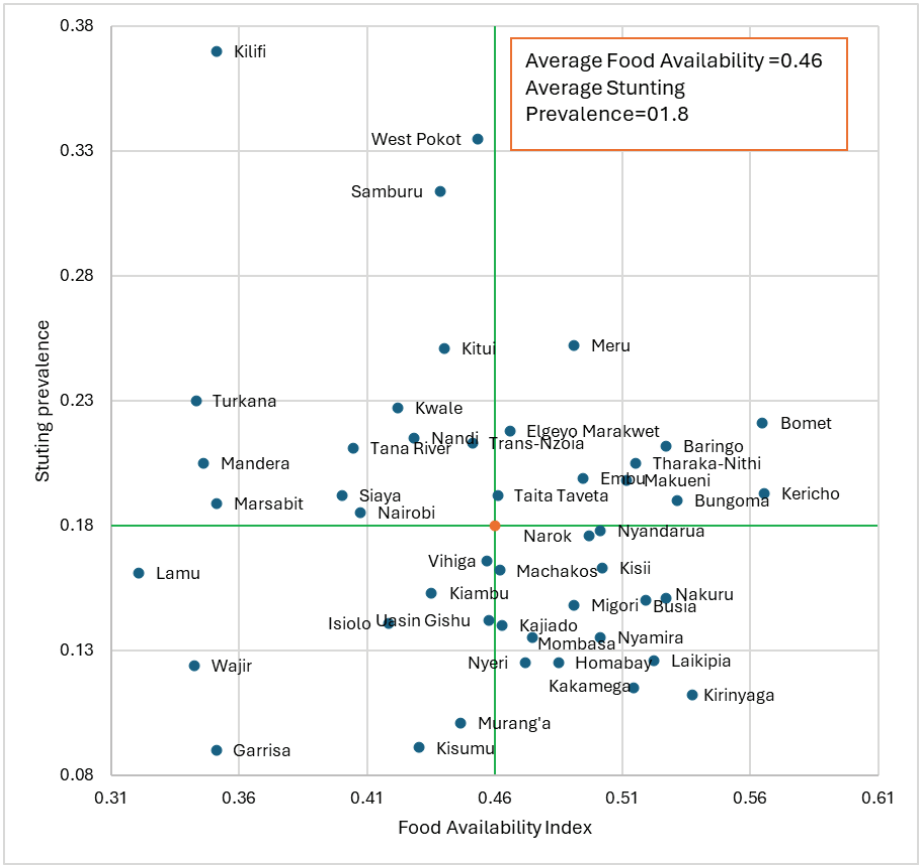
Food security and stunting prevalence in children are closely linked. For instance, inadequate access to sufficient, safe, and nutritious food significantly affects child growth and development. Children in food-insecure households are more likely to experience chronic malnutrition, leading to stunting, which has long-term consequences on cognitive and physical development. Thus, policy interventions need to focus on improving food security through increased agricultural productivity, enhanced food distribution systems, and social safety nets. Additionally, implementing nutrition-specific interventions such as micronutrient supplementation and diversified diets can directly help reduce malnutrition. Overall, establishing a good framework to strengthen these policies can help ensure that all children receive the nutrition they need for healthy growth and development.

5.3.2 Food availability index and stunting in children

Results in Figure 5.24 reveal that West Pokot (0.47), Samburu (0.44), and Kilifi (0.35) counties with food availability index below 0.5 had high levels of stunting–West Pokot (0.34), Samburu (0.31), Kilifi (0.37)) counties compared to counties that had high food availability index–Kericho (0.57), Kirinyaga (0.54), Kakamega (0.51), and Busia (0.52) counties, and low levels of

stunting–Kericho (0.19), Kirinyaga (0.11), Kakamega (0.12), and Busia (0.15) counties. Non-ASAL counties, for instance, have high potential areas for food production, which translates to high food availability and, therefore, reduced stunting compared to ASAL counties that are affected by drought and mainly depend on rainfed farming, thereby affecting their food availability and ultimately contributing to stunting among children in the regions. Counties that have a high food availability index could be having efficient food distribution networks, well established markets and economic activities that generate better livelihoods and increased welfare, with better nutrition.

Figure 5.24: Food availability index and stunting in children



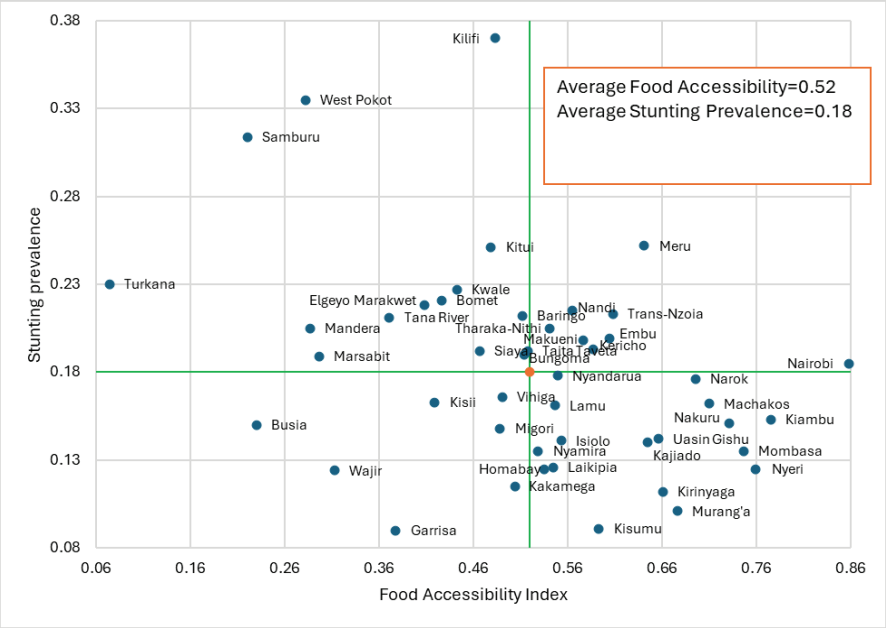
Data source: KilimoStat (2021), KCHS (2021) and KDHS (2022)

Therefore, ensuring food availability through sustainable agricultural practices, efficient food distribution systems, and equitable access to food resources is paramount for achieving food security and better nutrition outcomes. In addition, investment in agricultural infrastructure and technology is crucial for enhancing productivity and diversifying food production in ASALs. This includes promoting climate-resilient crops and implementing water management systems. Supporting sustainable land management practices and rehabilitating ecosystems can improve food security. Improving market access and strengthening local food systems can stimulate agricultural growth, and therefore improved food availability for better nutrition outcome.

5.3.3 Food accessibility index and stunting in children

Generally, most of the non-ASAL counties (Nairobi, Kiambu, Nyeri) with high food accessibility performance index had low levels of stunting among children compared to the ASAL counties (Turkana, Lamu, West Pokot, Mandera) that had low food accessibility index and high levels of stunting among children. Food accessibility is crucial in addressing stunting among children across counties. Factors such as poverty, food insecurity, and inadequate infrastructure contribute to limited access to diverse and nutritious foods, leading to micronutrient deficiencies and impaired growth. The stunting that emanates from chronic undernutrition during the early years of life is closely linked to inadequate access to nutritious food and dietary diversity.

Figure 5.25: Food accessibility index and stunting in children



Data source: KIHBS (2015) KDHS (2022)

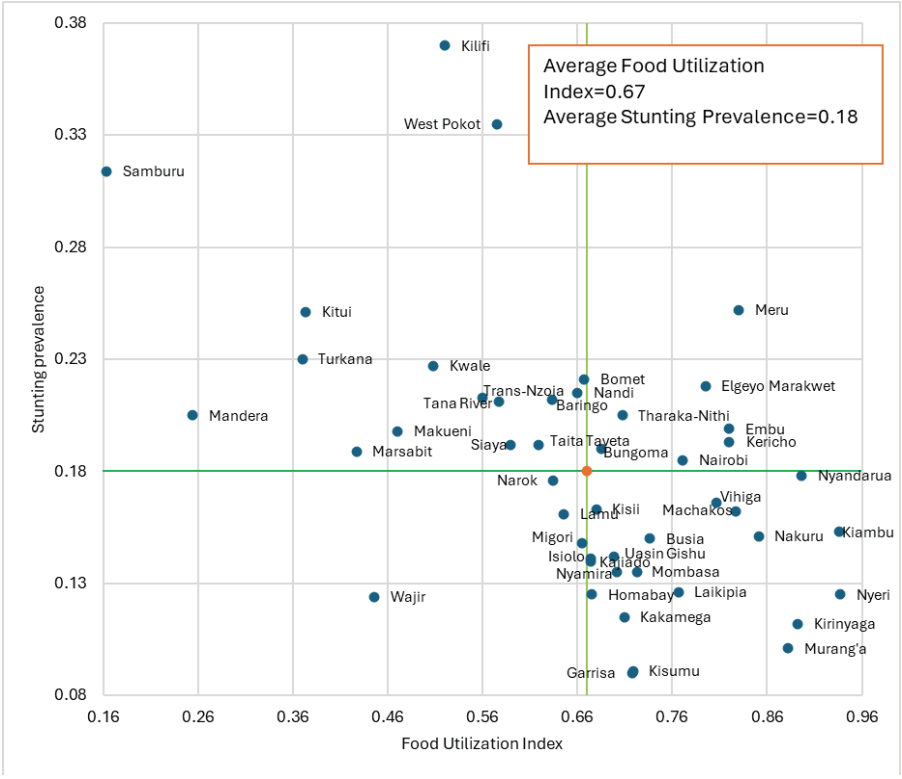
In counties where food accessibility is limited, children are more likely to experience nutritional deficiencies, which can hinder their physical and cognitive development, leading to stunted growth. Policy makers may consider interventions that promote food accessibility. These can be agricultural development, market infrastructure improvement, social safety nets, and nutrition-sensitive programmes that are essential for ensuring children have access to necessary nutrients for healthy growth, reducing stunting rates, and improving the overall child well-being.

5.3.4 Food utilization index and stunting in children

The food utilization index contributed significantly to the food and nutrition security index. It had the highest index value of 0.94 compared to the availability index, accessibility index and stability index. More than 40 counties had food utilization index above 0.50 while only seven (7) counties had food utilization index less than 0.50. Kirinyaga County recorded the highest food utilization index while Samburu County recorded the lowest food utilization index.

These results imply that considering and improving the availability and accessibility of the selected indicators will further improve food utilization index and consequently enhance food utilization for reduced stunting prevalence among children. To reduce stunting and improve food utilization, it is essential to improve women's diet quality, use iodized salt, and enhance food consumption. Iodized salt can prevent iodine deficiency, which is crucial for cognitive development and stunting reduction. Monitoring food consumption scores can provide insights into diet quality and target interventions effectively.

Figure 5.26: Food utilization index and stunting in children



Data source: KDHS (2022) and KIHBS (2015)

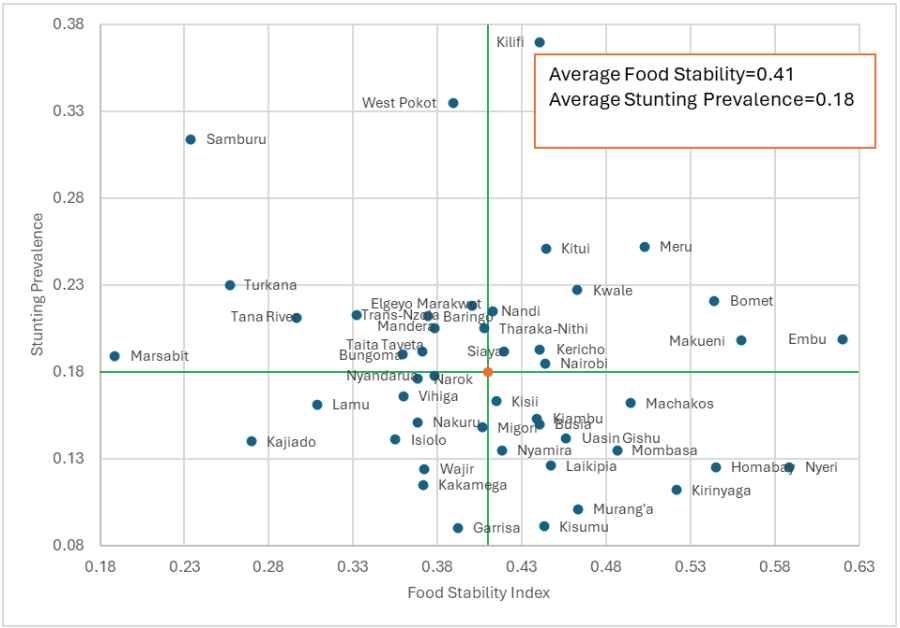
5.3.5 Food stability index and stunting in children

The food stability index offers crucial insights into the resilience of regions in Kenya against food insecurity and disruptions in food supply chains. Embu and Nyeri counties emerge as leaders with the highest food stability index scores, indicating a relatively robust food security situation in these areas, with scores of 0.62 and 0.59, respectively. These regions likely benefit from favourable agricultural conditions, diversified economies, and effective food distribution systems, contributing to their higher levels of stability in food availability. Makueni County stands out for its significant improvement, with a food stability index of 0.56. This suggests proactive measures or investments in agricultural development, infrastructure, or social programmes aimed at enhancing food security and stability within the region. Such improvements are pivotal in bolstering resilience against external shocks and ensuring consistent access to food for local populations.

On the other hand, Marsabit, Samburu, and Turkana exhibit the lowest food stability index scores, ranging from 0.19 to 0.26. These regions face considerable challenges related to arid and semi-arid conditions, limited agricultural productivity, and vulnerabilities to climate change, leading to higher levels of food insecurity. Efforts to address these challenges, such as investment in drought-resistant crops, water management initiatives, and targeted food aid programmes, are crucial for improving food stability and uplifting livelihoods in these underserved areas. Overall, these disparities underscore the importance of targeted interventions and comprehensive policies to ensure equitable access to food security across all regions of Kenya.

When examining the stunting index across various regions in Kenya, there persists significant disparities in nutrition outcomes. Kilifi, West Pokot, and Samburu counties report the highest stunting indices, with values of 0.37, 0.34, and 0.31, respectively. These regions grapple with elevated levels of chronic malnutrition, indicating a pressing need for interventions to address nutritional deficiencies and improve child health outcomes.

Figure 5.27: Food stability index and stunting in children



Data source: KDHS (2022), KCHS (2020), NDMA (2023) KIHBS (2015)

Conversely, Murang'a and Kirinyaga counties exhibit the lowest stunting indices, with values of 0.10 and 0.11, respectively. Despite relatively better nutrition outcomes in these regions, sustained efforts are required to maintain and further improve child health indicators. Notably, Kitui County demonstrates a significant improvement in the stunting index, with a value of 0.25, indicating progress in addressing malnutrition within the region. This improvement underscores the effectiveness of targeted interventions and investments in improving nutritional outcomes.

5.4 Effect of Food Security Indices on Nutrition Outcome Across Counties

This section provides regression results on the influence of food security indices on stunting among children in the 47 counties in Kenya. The results in Table 5.1 reveal that food accessibility

index and food utilization index had a negative and significant influence on stunting prevalence among children. Food stability had a negative influence on stunting prevalence in children. However, the relationship was not significant. Among the control variables, high poverty rates across the counties significantly increased stunting prevalence among children (UNDP, 2022). In addition, Gross County Product and road density had negative but insignificant influence on stunting prevalence.

Increase in food utilization index reduces stunting prevalence by 15.6 per cent. For example, establishing water sources near the household's residence ensures adequate and sufficient water supply for household consumption particularly in food preparation, cooking and generally on food utilization. It also reduces the time taken in fetching water for timely home utilization (FAO, 2022). Improving dietary diversity is also key with a keen interest on the ten food groups to ensure adequate utilization of both macronutrients and micronutrients for children body development, protection, and performance of body tissues for optimum growth and development.

Table 5.1: Effect of food security indices on nutrition outcome across the 47 counties in Kenya

Stunting prevalence	Coef.	Std. Error	t-value	p-value
Food availability index	0.195	0.173	1.12	0.268
Food accessibility index	-0.026*	0.014	-1.83	0.076
Food utilization index	-0.156**	0.074	-2.09	0.043
Food stability index	0.079	0.107	0.74	0.466
Poverty rates	0.006***	0.002	3.12	0.003
ASAL(Dummy)	0.01	0.02	0.47	0.642
Gross County Product (% GDP)	-0.001	0.001	-0.85	0.402
Households with electricity connectivity	0.0002	0.001	-0.00	0.998
Road density	-0.118	0.098	-1.20	0.238
Constant	0.265**	0.102	2.59	0.014
Mean dependent var 0.182		SD dependent var 0.059		
R-squared 0.369		Number of obs 47		
F-test 3.690		Prob > F 0.002		
Akaike crit. (AIC) -135.659		Bayesian crit. (BIC) -117.158		
*** p<.01, ** p<.05, * p<.1				

Source: Authors' computation 2024

An increase in food accessibility significantly reduces the stunting prevalence among children by 2.6 per cent. This implies that indicators that contributed to food accessibility should be addressed, such that they are accessible and affordable to the household; for instance, by encouraging the consumption of the target foods to increase the proportion of population consuming the target foods (FAO, 2022), and improving the consumption of fruits and vegetables to reduce the proportion of population of consuming fruits and vegetables below 400g. Prices of food in the market should be affordable to the households, which in turn reduces the proportion of income spent on food. Finally, enhancing the consumption of Vitamin A-rich foods among children helps reduce stunting prevalence among children.

6 Conclusion and Policy Recommendations

6.1 Conclusion

The assessment of food availability, accessibility, utilization, and stability across the 47 counties in Kenya underscores the complexity and severity of food security challenges in the country. Counties such as Kericho, Bomet, and Nakuru showcase relatively higher levels of food availability, attributed largely to conducive agroecological environments and efficient food distribution systems. In contrast, Lamu County faces pronounced obstacles, including recurring droughts, limited cultivable land, and insecurity, all of which disrupt food supply chains and heighten vulnerability to food shortages.

Regarding food accessibility, Nairobi, Kiambu, and Nyeri coutnies emerge as regions with notably high scores, indicative of better access to a wide variety of nutritious food options. Conversely, Turkana and Samburu counties confront significant hurdles in accessing adequate nutrition due to their remote locations, infrastructural deficits, and socio-economic disparities, highlighting the pressing need for targeted interventions to address these systemic challenges. While the data on food utilization remains limited, it emphasizes the necessity for more comprehensive assessments to gauge the quality of diets, food safety practices, and access to clean water sources. These factors play crucial roles in determining the nutritional adequacy and overall health outcomes of communities. The disparities in food security index scores across regions paint a stark picture of inequality within Kenya. Regions such as Embu and Nyeri benefit from favourable agricultural conditions and robust infrastructure, resulting in comparatively higher levels of food security. Conversely, arid regions such as Marsabit and Turkana grapple with lower scores, exacerbated by climatic adversities and socio-economic marginalization, amplifying the risk of food insecurity and malnutrition among vulnerable populations.

These findings underscore the urgent need for holistic and targeted interventions aimed at addressing the multifaceted dimensions of food security. Investments in agricultural productivity, infrastructure development, and social safety nets are essential to mitigate disparities, enhance resilience, and ensure equitable access to sufficient, nutritious food for all Kenyan citizens. Additionally, addressing underlying socio-economic inequalities is paramount to fostering sustainable food security and promoting inclusive development across the nation. Collaboration between government agencies, civil society organizations, and the private sector is essential to implement these strategies effectively and create a future where food security is a reality for every Kenyan, regardless of their geographic location or socio-economic status.

6.2 Policy Recommendations

To effectively address food insecurity in Kenya, a multifaceted approach targeting the root causes of disparities between regions is imperative. Investments should be directed towards agricultural development, particularly in areas with lower food availability and stability indices. These investments should support smallholder farmers, promote sustainable farming practices, and provide access to modern agricultural technologies to enhance productivity and

resilience against climate-related challenges. Additionally, improving infrastructure, including roads, bridges, storage facilities, and market infrastructure, is essential for enhancing food accessibility and stability, especially in remote and marginalized areas. These efforts will facilitate the efficient transportation and storage of food products, reducing wastage and improving market access for farmers.

Implementing robust social safety nets, such as cash transfer programmes, food assistance schemes, and school feeding programmes is necessary to provide immediate relief to vulnerable populations facing food insecurity. These programmes should be designed to target the most marginalized communities and should be accompanied by measures to promote long-term resilience against future food crises. Addressing underlying socio-economic inequalities through targeted poverty alleviation programmes, improving access to education and healthcare, and promoting inclusive economic growth is fundamental to achieving sustainable food security.

Collaborative governance involving government agencies, civil society organizations, and the private sector is essential for the effective implementation of food security strategies. By adopting these recommendations in a coordinated and collaborative manner, Kenya could work towards a future where all its citizens have access to sufficient, nutritious food, irrespective of their location or socio-economic status. This holistic approach will not only address immediate food security challenges but also contribute to long-term sustainable development and poverty reduction across the country.

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Appendix

Appendix I: Food groups, sources and weights

Food group	Nutrient	Description	Foods sources	Weights (based on food plates)
Grains, white roots, tubers and plantains	Carbohydrates, fibre, minerals	Energy-giving foods. Eating more complex carbohydrates than polished/simple carbohydrates is encouraged	Sorghum, maize, wheat, yam, cassava, sweet potatoes, arrowroots, green bananas, millet, Irish potatoes and rice	25
Pulses (dry beans, dry peas and lentils)	Plant source of proteins, fibre, minerals	Body building foods for growth and repair of worn-out tissues	Green grams, pigeon peas, beans, garden peas Note: Seeds harvested at maturity and dried. It does not include the same plants harvested green/ immature and eaten fresh in the pod	25
Dairy and dairy products	Calcium; protein; milk fat and sugar	Bone development; growth and development; source of energy	Milk and dairy products. Common types of milk; cow milk, goat milk, camel milk	25
Meats, poultry and fish	Protein; Iron; vitamins B12; Omega 3	Body building foods for growth and repair of worn-out tissues; red meats prevent anemia, good oils for brain functioning	All flesh foods; chicken and beef	25
Eggs	Inexpensive source of high-quality protein, essential vitamins, and minerals (Vitamin A (yolk)	Consumption of one egg per day will have no effect on blood cholesterol	Chicken	25

Dark green leafy vegetables	Iron, vitamin A, Vitamin C (raw)	Protective foods; boost blood; vision; supports immune system;	Cowpeas leaves, kales, pumpkin leaves, amaranth leaves, black nightshade, spider plant, spinach	50
Vitamin A-rich fruits and vegetables	Vitamin A rich	Protects eyes from night blindness; supports the immune system; reduces acne; brain development	Carrots, pumpkin, mangoes, and papaya	50
Other vegetables		Benefits vary widely. Mainly protective foods	Tomatoes, legumes when the fresh/green pod, e.g. fresh peas, snow peas, green peas, cowpeas and cabbage	50
Other fruits		Benefits vary widely. Mainly protective foods	Avocado, banana, oranges, watermelon, pineapple	50
Nuts and seeds	Oils, minerals, fibre		Groundnuts	25

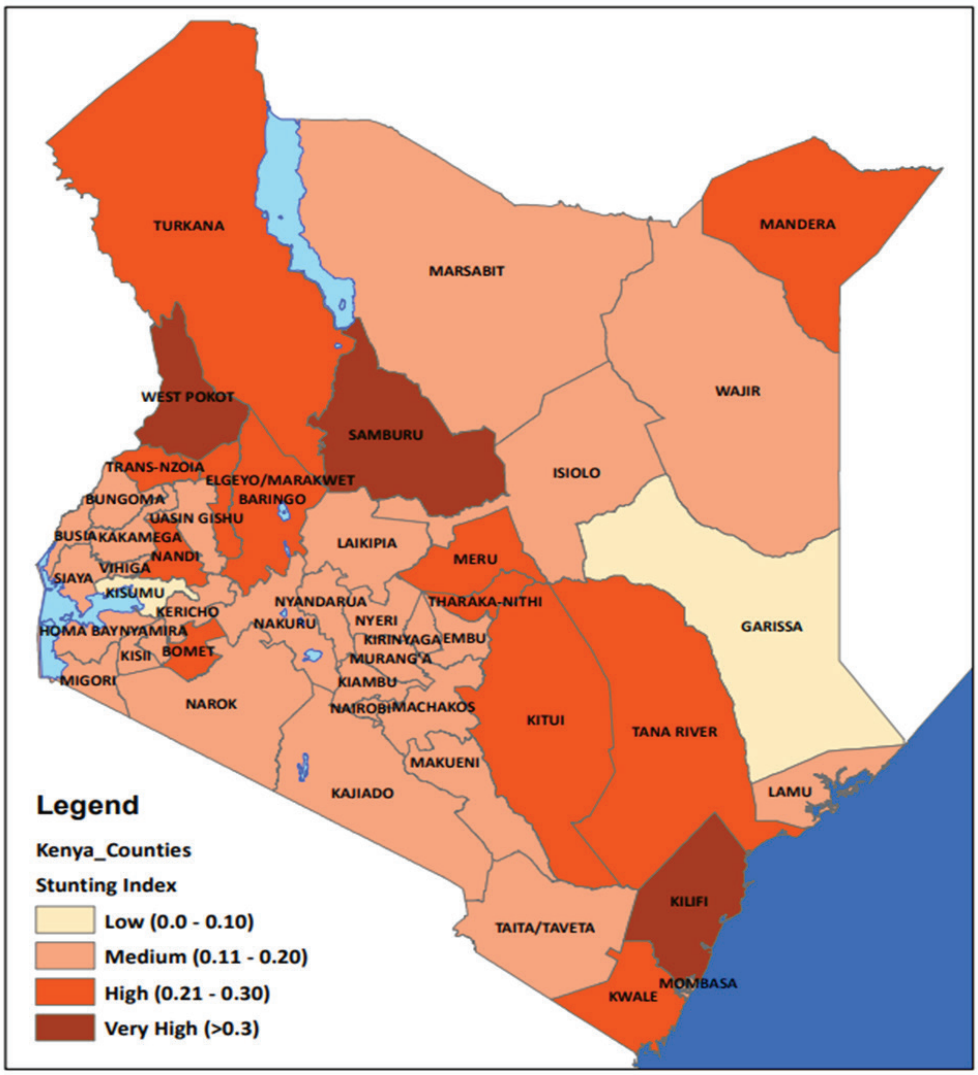
Appendix II: Food security pillars and weights

Food security pillars	Description of indicators		Data sources	Measurement	weight	Indicator type
Availability	Food production					
	Crop production	All food crops as indicated in Appendix I	KilimoStat (2021)	All measured in Ksh/Kg	Weights according to food plates as shown in Appendix 1	+
	Livestock production	All animal and poultry products as indicated in Appendix I	KCHS (2021)	All measured in Kgs except eggs in trays and milk in litres	Weights according to food plates as shown in Appendix 1	+
	Food prices					
	Crop products	All food crops as indicated in Appendix I			Weights according to food plates as shown in Appendix 1	-

	Animal products	All animal and poultry products as indicated in Appendix I		All measured in Ksh/Kg except eggs in Ksh/tray and milk in Ksh/ litre	Weights according to food plates as shown in Appendix 1	-
Accessibility	Consumption of target foods (ten food groups/ quality diet according to FAO (see Appendix I)	Proportion of population who have consumed target foods (ten food groups/ quality diet according to FAO)	KIHBS 2015		20	+
	Consumption of fruits and vegetables below 400gms	Proportion of population that consumed fruits and vegetables below 400gms	KIHBS 2015		20	+
	Food expenditures (% of income spent)		KIHBS 2015		100	-
	Food poverty		KIHBS 2015		100	-
	Consumption of Vitamin A-rich foods among children (Appendix I)	Proportion of children consuming Vitamin A-rich foods	KIHBS 2015		20	+
Utilization	Distance to the source of drinking water	Measured in kilometres (km)	KIHBS 2015		50	-
	Time taken to the source of water	Measured in minutes (minutes)	KIHBS 2015		50	-
	Diet quality (MDD-W)		KDHS 2022		100	+

	Food Consumption Score - FCS is a composite indicator that measures dietary diversity, food frequency and the relative nutritional importance of food groups based on a seven-day recall of food consumed at household level	Percentage of households with poor consumption.				
	KDHS 2022		20	-		
	Consumption of iodized salt	Percentage of households using adequately iodized salt	KDHS 2022		50	
+						
Stability/ sustainability/ adaptation	Food insecurity coping strategy	Coping index	KDHS 2022		100	-
	Prevalence of moderate or severe food insecurity in the population, based on (FIES)	Food insecurity Experience Scale (FIES)				
	KDHS 2022		100	-		
	Precipitation rainfall	Measured in milliliters (mm)	NDMA 2019-2023		100	+
	Per capita consumption	Annual	KNBS 2023		100	+
	Social protection	Proportion of population covered by social protection programmes	KCHS 2022		100	+

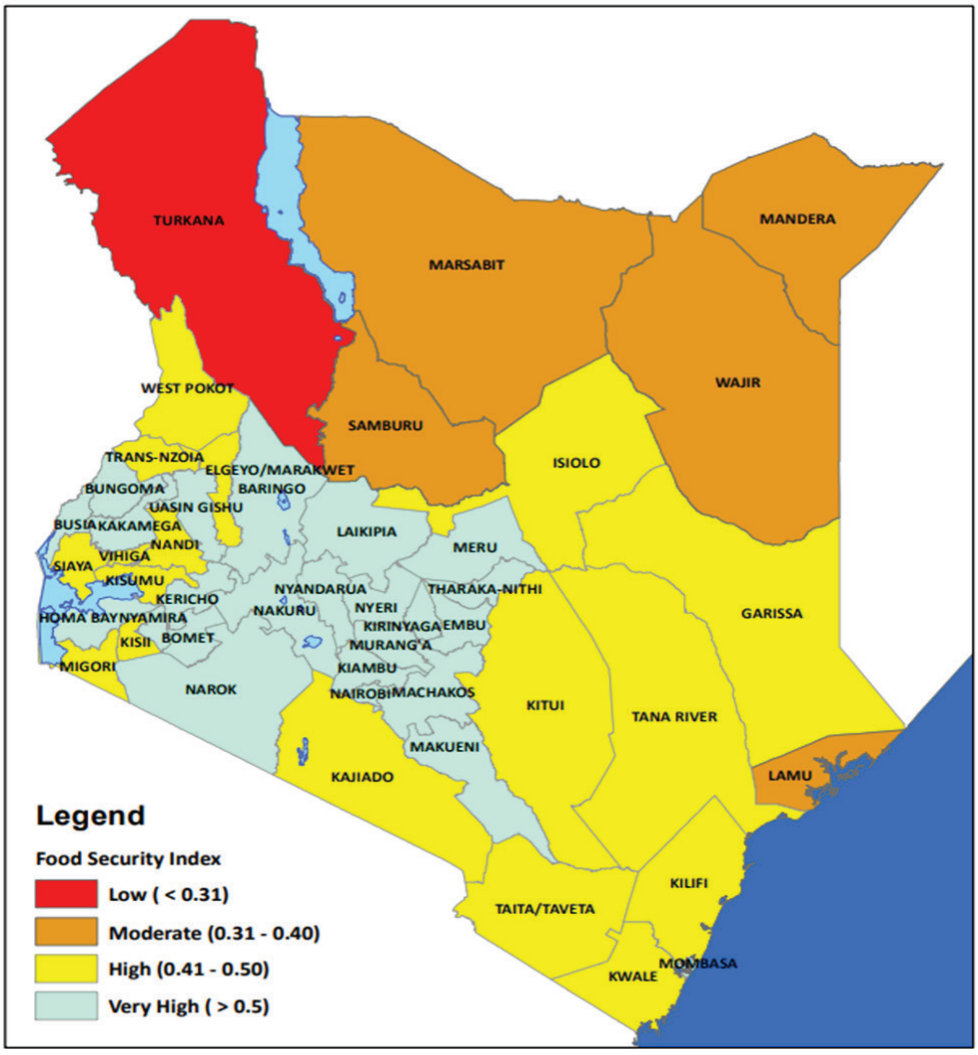
Stunting prevalence among children under five (5) years



Data source: KDHS 2022

NB: The boundaries used in this map are not an authority on administrative units

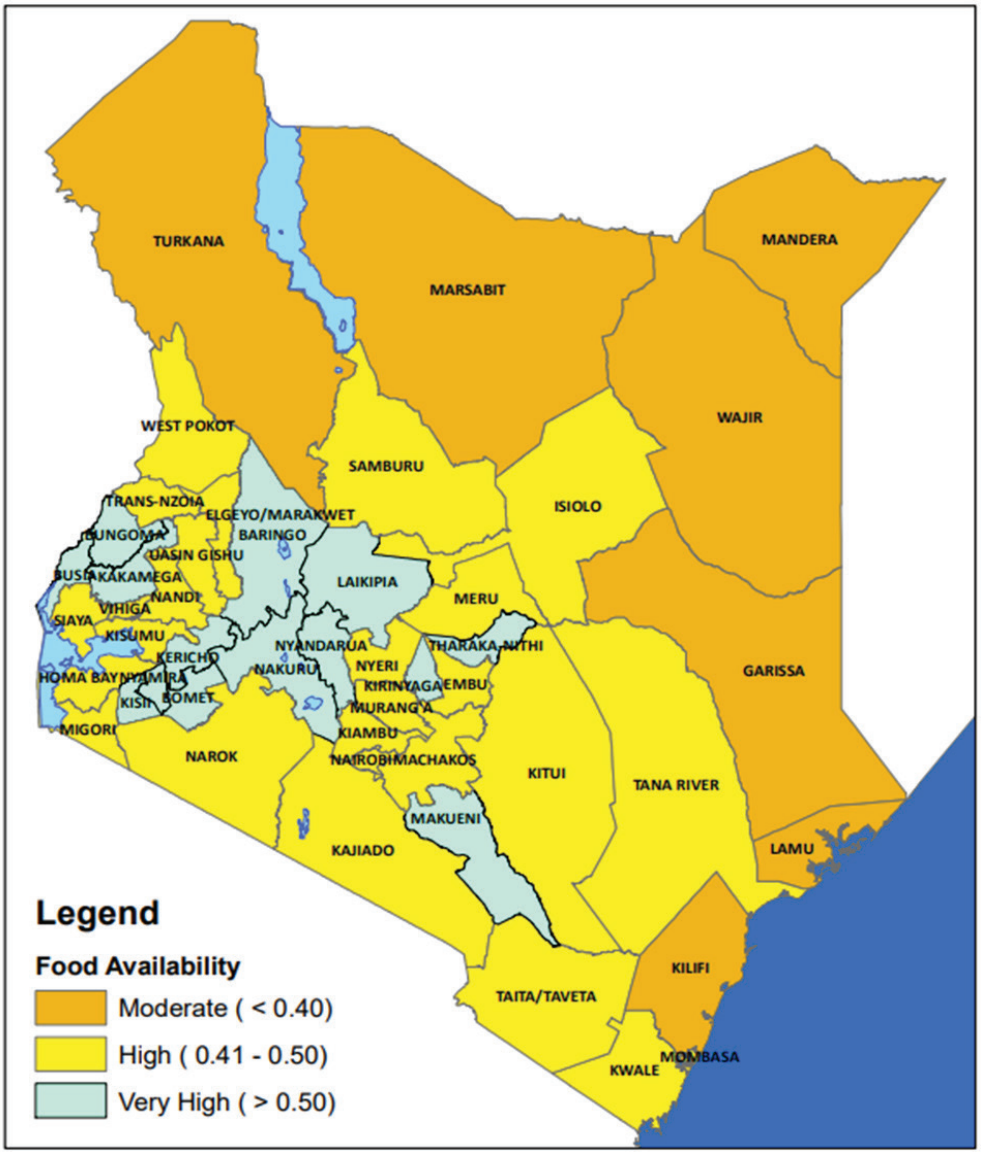
Food security index across the 47 counties



Data source: KDHS (2022), KCHS (2020, 2021, 2022), NDMA (2019-2023) KIHBS (2015) KNBS (2023)

NB: The boundaries used in this map are not an authority on administrative units

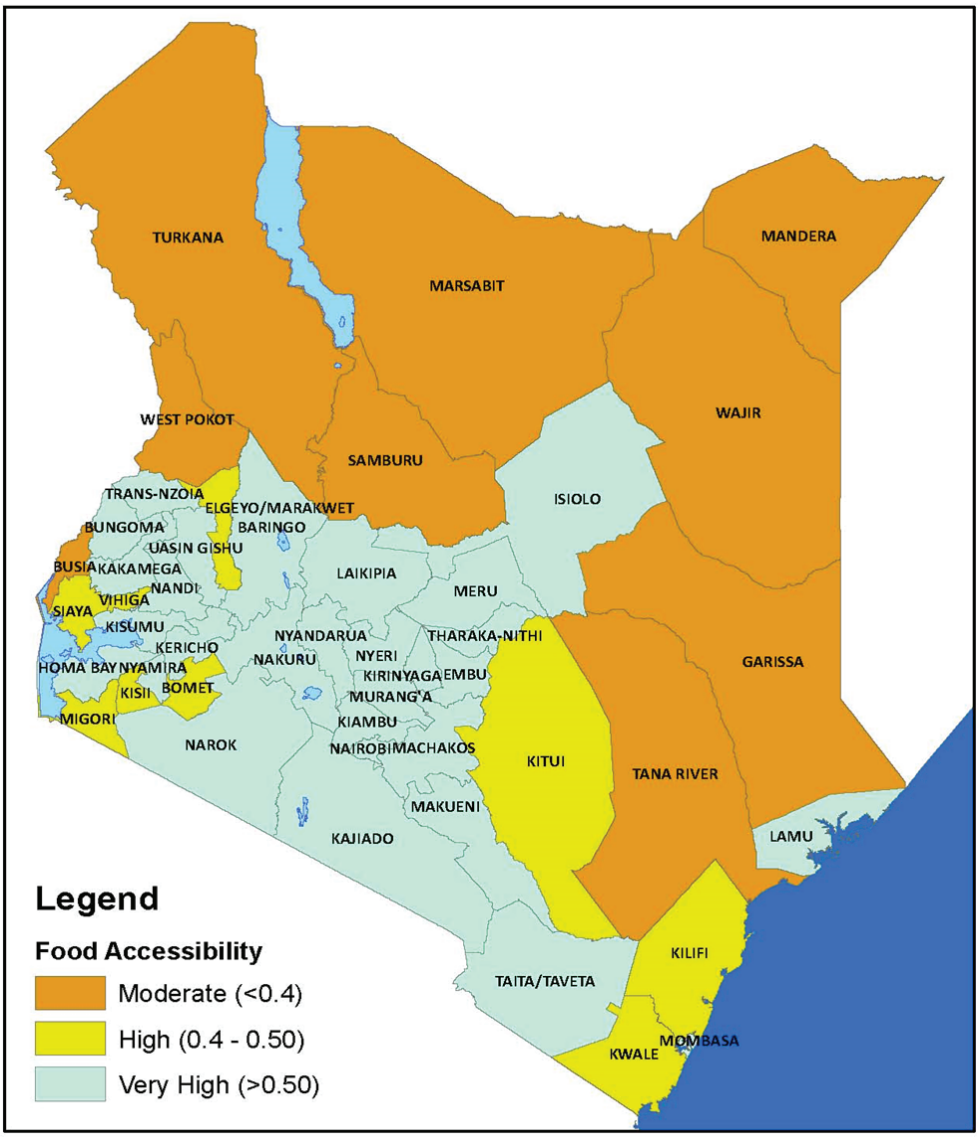
Food availability index across the 47 counties



Data source: KilimoStat (2021), KCHS (2021)

NB: The boundaries used in this map are not an authority on administrative units

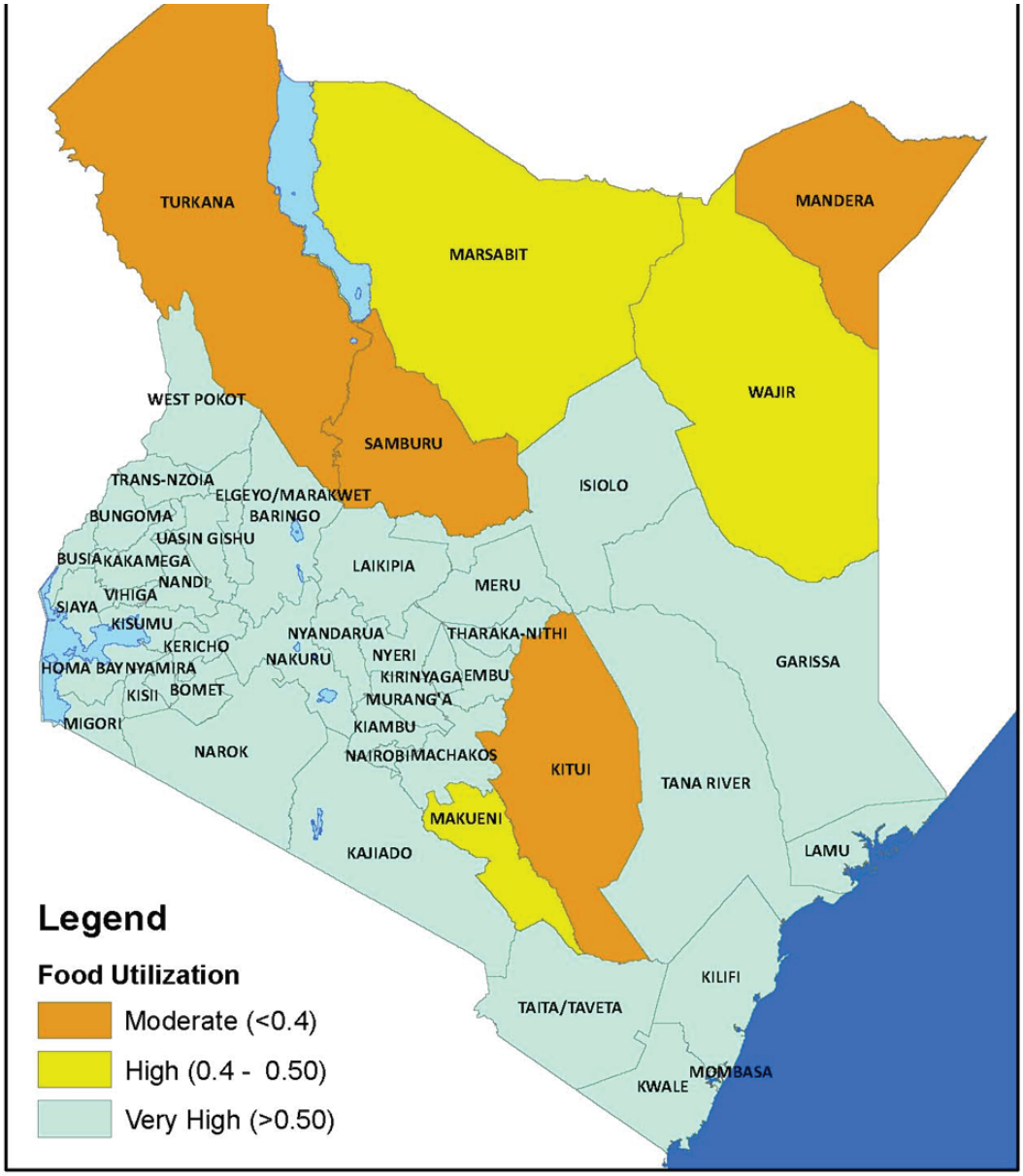
Annex IV: Food accessibility index across the 47 counties



Data source: KIHBS (2015)

NB: The boundaries used in this map are not an authority on administrative units

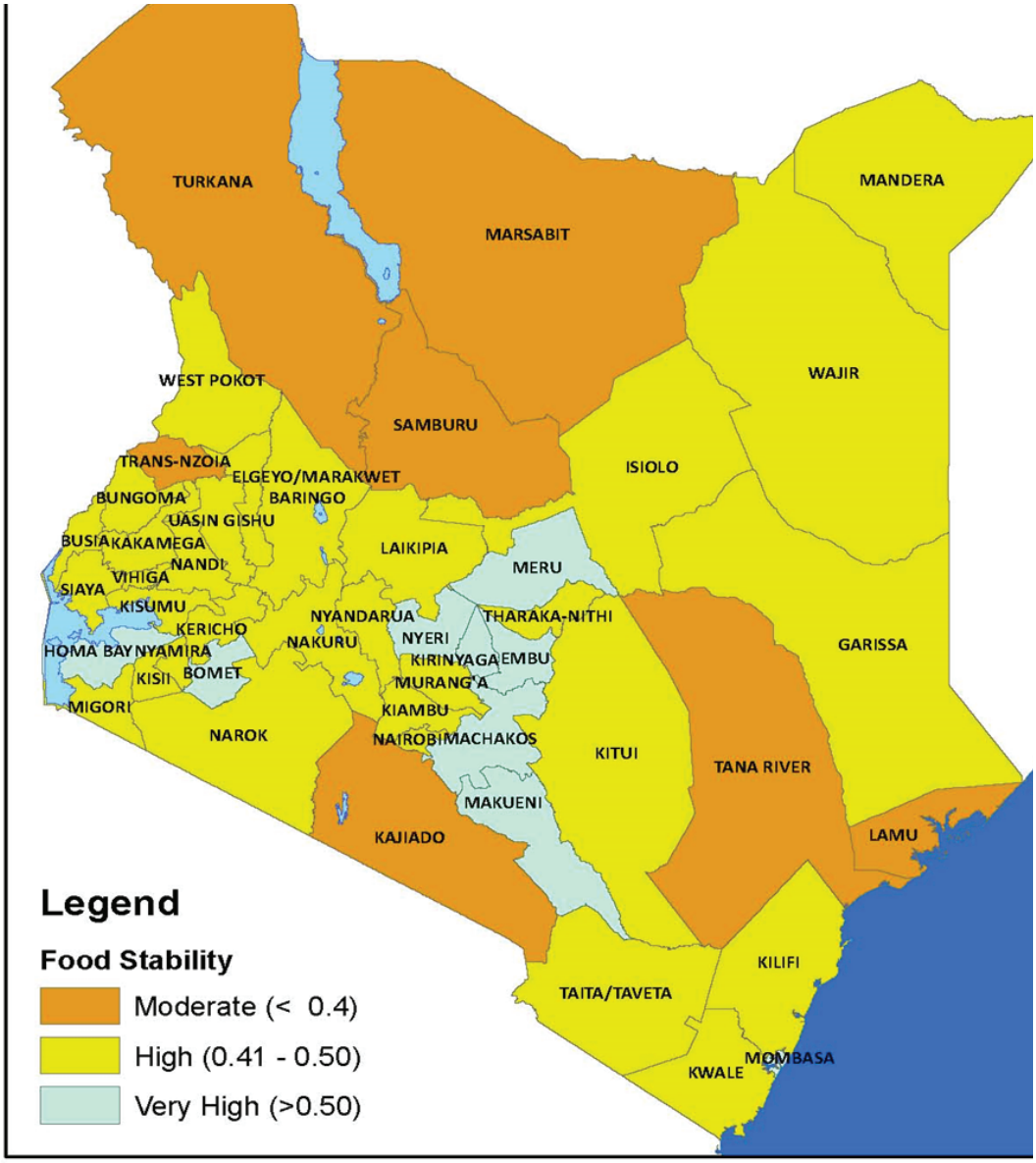
Food utilization index across the 47 counties



Data source: KDHS (2022), KIHBS (2015)

NB: The boundaries used in this map are not an authority on administrative units

Food stability index across the 47 counties



Data source: KDHS (2022), KCHS (2020), NDMA (2019-2023), KNBS (2023)

NB: The boundaries used in this map are not an authority on administrative units