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Deploying high-frequency market data to estimate the cost of recommended diets: Recent trends in Rwanda

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This study estimates the cost and affordability of recommended diets in Rwanda from April 2019 to December 2024 using high-frequency market price data. By deploying standardised methods for healthy diet costs to eSoko data (www.esoko.gov.rw), and local food based dietary guidelines, we calculate the monthly cost of recommended diets at the district level. Key findings reveal significant dietary cost fluctuations, with nominal costs increasing 67% between June 2022 and October 2023, coinciding directly with Russia's invasion of Ukraine. The research also identifies affordability challenges; by mid-2023, and again in late 2024, where up to 70% of wage earners could not afford a recommended diet. Spatial variations were also evident, with diet costs differing between rural and urban areas, and across districts bordering different countries, with the highest dietary costs observed along the Democratic Republic of Congo border and the least expensive along the border of Tanzania. Utilizing Rwanda's eSoko data platform, the study demonstrates the value of high-frequency, spatially explicit data for understanding food system dynamics. The findings call for policy actions to consider dietary affordability, particularly for low-income groups, and suggest that Rwanda's data collection approach could serve as a benchmark for other countries.

Main Findings:

- Nominal daily diet costs remained stable between April 2019 and May 2022, at around 600 RWF.
- While acknowledging that Rwandan weather patterns disrupted agricultural production over the study period, COVID-19 appears to have had minimal impact on recommended diet costs, but Russia's invasion of Ukraine coincided directly to dietary cost increases, with the food and beverage monthly inflation rate peaking at 5.6 percent, or an annualized inflation rate of over 65 percent, in November 2022.
- From June 2022 to October 2023, costs of recommended diets rose 67%, reaching 920 RWF, and then peaking again in November 2024.
- Both in late 2023 and late 2024, an estimated 70% of wage earners (formal and informal) could not afford recommended diets.

- According to NISR's 2023 labour force survey wage data, only the three highest wage quintiles could feasibly afford a recommended diet.
- Rural areas had significantly cheaper recommended diets, while urban areas faced higher food prices with only marginally higher wages.
- Border districts show price variations, with the most expensive diets near the Democratic Republic of Congo, least expensive near Tanzania and Uganda, and no discernible difference near Burundi.

Improving access to nutritious foods and healthy diets are key strategies in addressing malnutrition. Systematic methods have been developed for costing healthy diets and have shown them to be unaffordable for 42% of the global population. Local adaptation of these methods, using national food-based dietary guidelines and sub-national food item price datasets, reiterates the unaffordable nature of healthy diets and their spatial and temporal dynamism in countries around the world. Monitoring this dynamism through improved spatial and temporal disaggregation of data can improve our understanding of the responsiveness of dietary cost to expected (e.g., seasonal) and stochastic (e.g., conflict-induced) price shocks.[1] These types of data can provide timely insights to guide policymakers in protecting year-round access to a healthy and affordable diet for all consumers.

In Rwanda, high-frequency, spatially disaggregated market price data collection is part of the government's efforts to improve nutrition and transform the country's food system. Rwanda's adoption of a holistic food systems approach in its latest agricultural sector strategic policy document, the Fifth Strategic Plan for Agriculture Transformation (PSTA 5), necessitates innovative new quantitative indicators collected in ways that reflect the dynamic nature of transforming economies. As part of long-standing data collection strategies, food prices have been collected since 2017 across more than 60 markets daily and are publicly available on the eSoko platform (www.esoko.gov.rw). The spatial and temporal richness of this dataset is an invaluable, yet heretofore underutilised, resource and represents a unique opportunity for spatially explicit, high-frequency estimation of diet costs, a rarity even in high-income countries.

By deploying standardised methods for healthy diet costs to the eSoko data and local food based dietary guidelines, we calculate the monthly cost of recommended diets at the district level. The aim is to generate outputs which provide policymakers with timely information to formulate and target policies for improved nutrition and health outcomes.

To calculate the monthly costs of a recommended diet across the districts of Rwanda, we adopted a method that computes the least-cost diet that fulfils minimum food group serving and diversity requirements for a healthy diet basket. The forthcoming Rwandan national food-based dietary guidelines (FBDGs) were used to define the dietary parameters (Table 1). The Rwandan FBDGs were sourced from relevant materials provided at a validation workshop convened by the Rwandan Ministry of Agriculture and Animal Resources (MINAGRI) and the FAO in late 2021. The FBDGs recommend a healthy diet made up of 11 food items, split across five food groups (number of food items, Table 1).

[1] This policy note is a summary of forthcoming research by R. Manners, J. Warner, K. Schneider, E. Matsiko, H. Vasanthakaalam, G. Benimana, and D.J. Spielman, titled "Cost and affordability of recommended diets in Rwanda using [near] real-time market data."

Table 1. Rwandan food based dietary guidelines adapted for healthy diet construction

Food Groups	Number of Food Items	Recommended Amount per Group (grams/day)	Recommended Amount per Item (grams/day)
Animal sourced foods	2	111.19	55.60
Starchy staples (cereals, roots & tubers)	2	441.75	220.88
Fruits and vegetables	5	429.53	85.91
Oils and fats	1	51.25	51.25
Legumes, pulses, and nuts	1	203.06	203.06

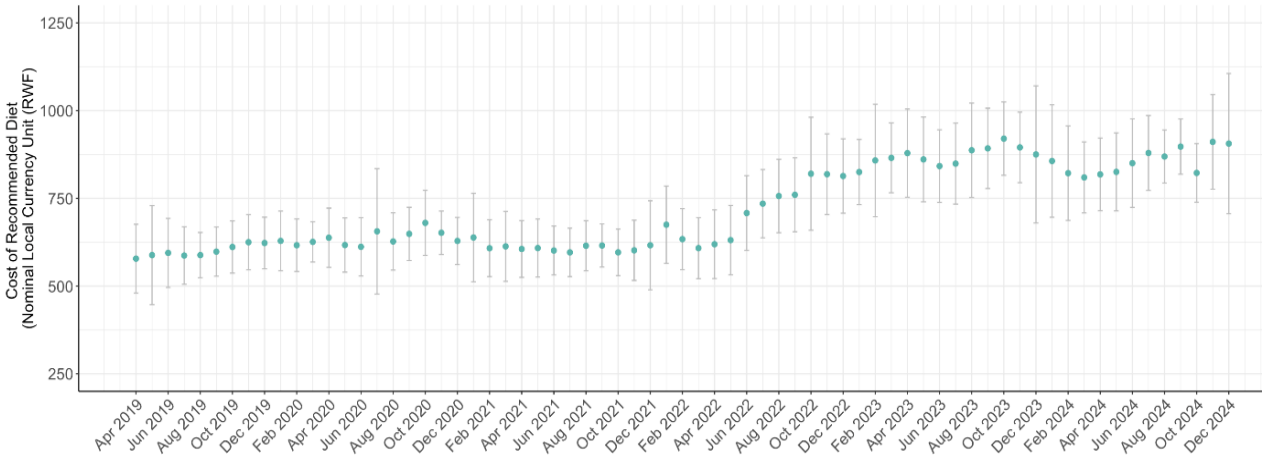
Each of the 56 food items available in the eSoko price data were grouped into the 5 food groups listed in Table 1. Using price data, we calculated the cost per gram of each available food item (edible amount), in each district, for each month. We then calculated the cost of the required amounts for each food item, using the per gram costs, multiplied by the recommended amount values, depicted in Table 1. The costs of the recommended amount per item were then ordered from cheapest to most expensive, with the cheapest items per food group selected, based upon the required number of food items. This process was repeated for each food group. The costs per group were then calculated, with the total of these values used to generate the cost of a recommended diet in each district by month. This was repeated in all 30 districts, for each of the 69 months analysed (April 2019 – December 2024).

Using daily wage data, disaggregated across sex and wage quintile, we estimated the affordability of diets at two levels: (i) where 100% of an individual's daily earnings are freely and uniquely available for purchasing food items for themselves, not accounting for dependents, rents, or other expenditures; and (ii) using the more realistic proportion of wages that may be directed to food purchasing, at 52% of daily wages.

Spatial patterns were analysed across districts, the rural-urban continuum, and districts that border Rwanda's neighbours (ie. Burundi, Democratic Republic of Congo, Tanzania, and Uganda).

Figure 1 presents the costs of recommended diets as a national average in nominal Rwandan Francs (RWF). Nominal prices (i.e., prices without adjustments for inflation) were selected as they are the prices observed and experienced by consumers on a regular basis and thus affect consumer decision-making in the short run. In nominal terms, the cost of a recommended diet was stable at around 600 RWF from 2019 to mid-2022. From June 2022, we observed 17 months of near-constant price rises, increasing costs by 67% to a peak of 920 RWF in October 2023. The peak was followed by five months of decline to 807 RWF in March 2024 (an 11% decline), with a secondary peak of 907 RWF observed in November 2024. Year-on-year changes in diets were most extreme for the years 2022 and 2023, with 22% and 21% nominal increases, respectively.

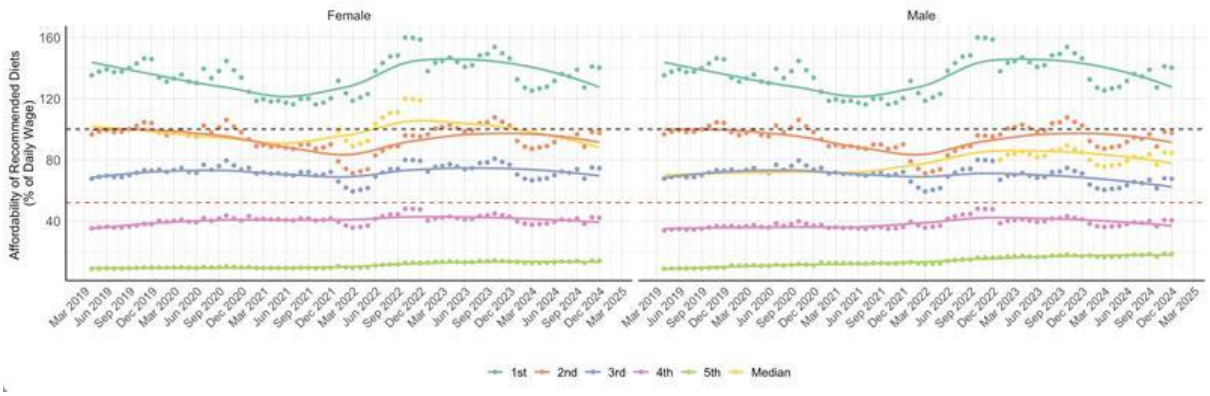
Figure 1. Cost of recommended diet in Rwanda in nominal local currency units



Exploring the spatial features further using regression analysis shows that average diet costs in districts with international borders deviate significantly from average costs in non-border districts, and that these deviations closely mirror Rwanda's trade relations. Diets were significantly cheaper in districts bordering Tanzania (6.5%, p=0.009) and Uganda (3.4%, p=0.042), likely reflecting access to lower-cost food imports from both countries. Diet costs were 6.8% more expensive in districts bordering the DRC compared to non-border districts (p=<0.001 in all cases), reflecting Rwanda's lucrative exports in food items to DRC through both informal and formal markets.

Smoothed affordability trends for the recommended diet are presented as a proportion of daily wages (Figure 2). Trends are disaggregated for female and male wage earners across wage quintiles. Overlayed on Figure 2 are two proportions of wages used for food spending (100%, black dashed line; 52%, red dashed line). Recommended diets were unaffordable throughout the study period for low to mid wage earners (quintiles 1-3), based upon 52% of wages directed towards food purchases, a pattern maintained by gender. By late 2023/early 2024, wage earners in quintiles 1 and 2 would need to spend over 100% of their wages on the recommended diet, respectively. Earners in quintile 4 would spend almost 43% of their wages on the recommended diet. For Rwanda's highest earners (quintile 5), a recommended diet would consume almost 15% of their daily wages for both genders. Notably, female median affordability rates are considerably lower, reflecting overall lower relative wages for women.

Figure 2. Affordability of recommended diets



Affordability of recommended diets relative to median daily wage across wage quintiles, female and male wage earners. Black dashed line represents 100% of daily income and red dashed line 52% of income, a threshold used in international studies of the affordability of a healthy diet.

By late 2023, approximately 70 percent of all wage-earning Rwandans were unable to afford a recommended diet.

We present a comprehensive study on dietary costs and affordability in Rwanda from April 2019 to December 2024. Over the time analysed, an affordability challenge emerged, where recommended diet costs rose dramatically by 67%, reaching 920 RWF in October 2023 and 907 RWF in November 2024. By late 2022, the lowest income earners faced a serious challenge, with an estimated 150 percent of their daily wages needed to afford recommended diets. By mid-2023 approximately 1.9 million wage earners (70%) were unable to afford recommended diets, with only the two highest wage quintiles being able to afford the recommended diets.

Spatial variations revealed complex and nuanced economic dynamics across Rwanda. Rural areas consistently demonstrated significantly cheaper recommended diets, while urban areas confronted higher food prices coupled with only marginally higher wages. Border districts exhibited particularly interesting pricing patterns, with cheaper diets near Uganda and Tanzania, and more expensive diets near the Democratic Republic of Congo. These spatial differences underscore the intricate relationships between geographical location, cross-border trade, and food pricing.

We believe that the policy implications emerging from this research are important. The study illuminates the critical importance of high-frequency price data (eSoko) for comprehensive policymaking and could form the foundation of an early warning system for food item price and diet affordability. Further, considering the scale of the affordability challenge, deployment of innovative policy approaches are needed to increase dietary affordability, particularly in urban settings.

Ultimately, this research underscores a significant systemic challenge: making recommended diets affordable. By advocating for comprehensive, data-driven approaches, our study provides critical insights into the affordability of recommended diets. However, Rwanda offers a potential framework for addressing food system challenges by demonstrating how granular, high-frequency data can transform understanding of food system dynamics and vulnerability.

Recommendations

- As part of PSTA 5’s emphasis on food systems, indicators tracking the cost of healthy diet could monitor progress for access to affordable and nutritious foods in Rwanda.
- Deconstructing elements of the cost of a recommended diet indicator could be tracked to better determine potential bottlenecks for achieving the targets. This could include relative costs of specific food groups, items in food groups, as well as wage rates.
- Recent policy actions in Nigeria adjusted the minimum wage to better reflect the cost of recommended diets. This example could be leveraged to better address affordability challenges in Rwanda.
- Collection of high-frequency consumption data would improve understanding of the impacts of price and diet cost changes on dietary outcomes and indexes of a healthy diet.
- Consumption data could lead to tracking ‘consumed diets’, their costs, and monitoring progress towards a nutritious diet.

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