**Draft: A Comparative Food Consumption Analysis of 24-Hour Dietary Recall Data and Household Consumption and Expenditure Survey Data Using FRESH Baseline Survey**

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1. **Abstract**
2. **Introduction**

In Tanzania, around 26% of the population, equivalent to approximately 14 million individuals, lives below the basic need poverty threshold, while 37% of adults manage with only one or two meals daily and 31% of adults have expressed challenges having enough foods(1,2). A recent study using 2014-15 national survey data in Tanzania reported that the estimated prevalence at risk of inadequate apparent intakes was 93% of households for vitamin A and 77% for iron, 43% for zinc, 50% for vitamin B12, and 16% for folate(3). The ongoing issue of food insecurity alongside diets lacking in nutrient-rich options like animal-source foods, legumes as well as fruits and vegetables (F&V) may underlie the prevalent occurrence of micronutrient deficiencies, leading to increased mortality and morbidity rates.

To assess the diet inadequacy in the national level, household food consumption data can be used to infer individual nutritional intake, due to the widespread lack of data on personal consumption. It is often calculated by distributing the household's aggregate consumption according to the energy requirements among household members. However, there has been limited exploration into the direct comparison of food consumption between household food consumption data and quantitative open individual 24 hour recall (24hR), which can test the assumption of the equitable intra-household allocation of foods. Some studies have examined the utility of Household Consumption and Expenditure Survey (HCES) data compared to 24hR for estimating dietary intake of specific fortification vehicles rather than conducting broader nutritional assessments(4–6).

Some studies have reported discrepancies between food consumption data from HCES and 24hR. A study compared food consumption across nine food groups using the Bangladesh Household Integrated Survey in 2011-12, revealing that individualized household estimation (e.g. adult male or female equivalent) tended to overestimate F&V intakes, with 239% overestimation for fruits and 54% for non-starchy vegetables(7). Similarly, a study in Mongolia found that individualized household estimation led to about three times overestimation of fruit and non-tuber vegetable intakes (90.0g/adult male equivalent, in the 2013 Food Consumption Survey (FCS)) compared to 24hR (31.6g, in a subset of FCS)(8). The proportion of individuals or households observed to consume fruits and non-tuber vegetables was also overreported, with 63% in 24hR compared to 96% in FCS(8). Harris-Fry et al. (2022) conducted the comparison of food consumption between HCES and 24hR in Bangladesh and explained two main sources of measurement error: the mismeasurement of household consumption and intra-household allocation assumptions used to individualized household consumption. They reported that HCES, relative to 24hR, overestimates household-level quantities and underestimates women’s share of household foods(9). Although these studies provide valuable insights within the Asian context, the lack of comparable research in African settings remains a limitation.

The FRESH project implemented in Northern Tanzania uses a holistic approach to address supply, demand, and food environment barriers to F&V production and intake to improve F&V availability, access, affordability, and appeal, which should lead to healthier eating habits, higher F&V intake, and better diet quality. The project also hypothesized additional benefits, such as positive impacts on women’s time use, household spending, and nutritional status. The project has two main focuses: (1) to track changes over time in vegetable production and F&V intake among both farming and non-farming households, and (2) to assess the impact of the FRESH approach on vegetable production and F&V intake among intervention groups. A baseline household survey was conducted from October 2023 to January 2024, measuring household food consumption over the past 7 days and individual food consumption for women of reproductive age (WRA) using the quantitative multi-pass 24-hour recall method.

Tanzania National Panel Survey (TNPS) is a nationally representative household survey that collects information on the living standards of the Tanzanian population, including their socio-economic characteristics, consumption, agricultural production, and non-farm income generating activities. The most recent, fifth wave took place between December 2020 and January 2022 (TNPSW5), following Wave 1 (2008-2009), Wave 2 (2010-2011), Wave 3 (2012-2013) and Wave 4 (2014-2015). As part of TNPS, the Household Consumption and Expenditure Survey (HCES) gathers detailed data on household food consumption patterns and quantities over the preceding seven days. This enables the assessment of national and sub-national food consumption trends and their implications for nutrition.

This study aims to review how comparable the estimated individual food intakes describe the two different set up of surveys; The FRESH baseline survey which collected HCES data and 24hR in WRA in same households, and a nationally representative HCES data using Tanzania National Panel Survey (TNPS). The analysis aims to;

1. Calculate the household food consumption per day of each food item and group including F&V and fortifiable foods (e.g. wheat flour, maize flour and edible oils) of the FRESH household food consumption data (FRESH HH), and compare this to the individual food consumption in WRA (FRESH 24hR).
2. Compare these values in FRESH study with regional and national levels from a nationally representative data using Tanzania National Panel Survey Wave 5 conducted in 2020-21 (TNPSW5)
3. **Methods**

**3.1 Surveys and Datasets**

FRESH baseline survey

The FRESH baseline study was conducted in two districts in Arusha Region (Arusha and Meru) and three in Kilimanjaro Region (Hai, Siha, and Moshi Rural) where FRESH supply activities are implemented or are planned to be implemented (Figure 1). The study took place in a total of 33 villages across 14 wards in five districts. All households with at least one WRA (15-49 years) and one adolescent (10-14 years) were invited to participate (if a household included multiple WRAs and only one adolescent, the WRA with her biological child was enrolled). In total of 2,611 households with 2,611 WRA were participated in the baseline study.

A map of a country

Description automatically generated

Figure 1. Study areas in Arusha and Kilimanjaro regions

Tanzania National Panel Survey

Since the Wave 1 survey in 2008-09, Tanzania National Panel Survey (TNPS) has followed a structured approach in its design and sampling. TNPS Wave 1 sample consisted 409 clusters and 3,265 households, and the Waves 2 and 3 conducted used the same sample design as the first wave and re-interviewed the households from the initial households in Wave 1. In Wave 4, the following panel from the first round reduced 860 households (68 clusters, so called “Extended panel”) and added new samples of 3,352 households (419 clusters, so called “Refresh panel”). The Wave 5 survey followed and re-interviewed the “Refresh panel” of 3,042 households. Also a new sample “Booster sample” was added from large cities (Arusha, Dodoma, Mbeya, Mwanza, Tonga and Dar es Salaam). In total of 4709 households were included in The Wave 5 survey(2).

The details of the datasets of FRESH 24hR, FRESH HH, and TNPSW5 were summarised in Table 1.

Table 1. The summary of the datasets of FRESH 24hR, FRESH HH, regional (Arusha and Kilimanjaro regions) and national TNPSW5

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | FRESH 24hR | FRESH HH | TNPSW5 - Arusha and Kilimanjaro regions | TNPSW5 - national |
| Time | Oct 2023 – Jan 2024 | | Oct 2020 – Sep 2021 | |
| Number of households or individuals | 2,611 WRA individuals | 2,611 HHs | 370 HHs (Arusha 221, Kilimanjaro 149) | 4,709 HHs |
| Food consumption | 1-day 24-hour recall | 7 days of food consumption in the HH | 7 days of food consumption in the HH | 7 days of food consumption in the HH |
| Food items | 158 items | 134 items | 75 food items (91%) and 60 food items (9%) | 75 food items (91%) and 60 food items (9%) |

* 1. **Food consumption data**

FRESH HH

In FRESH baseline survey, the enumerators asked a head of household to recall foods consumed over the past 7 days by all members of the household, using a predefined list of 134 food items, with quantities recorded in standard units (kilograms, grams, litres and millilitres) and seven non-standarised units (e.g. bunch, spoon, bowl etc.).

FRESH HH food consumption data did not adjust with edible portions etc. Please discuss.

FRESH 24hR

Dietary intakes in WRA were measured using a detailed four-step 24-hour recall method(10). In the first step, participants listed all foods, drinks, and snacks consumed over the past 24 hours. In the second step, they provided detailed descriptions of each item, including recipes for mixed dishes. If the woman didn’t prepare the meals herself, the person who did was asked to help list ingredients. In the third step, participants estimated portion sizes using predefined methods. Food quantities were recorded using a digital kitchen scale with 2g precision. If exact portions weren’t available, amounts were estimated using volume, weight comparisons with other foods, or household measures like spoons or ladles. When foods were purchased and eaten, their cost was noted instead of volume, especially if consumed solely by the participant. The team agreed on standard portion sizes (small, medium, large) for items like fruits (e.g., mangoes, papayas) and vegetables (e.g., onions, tomatoes). For shared dishes, the woman estimated her typical portion, and the number of people sharing the bowl was noted to assist with data analysis. In the fourth and final step, the enumerator reviewed the list with the participant to ensure completeness, prompting for commonly forgotten items such as fruits, sweets, and snacks, but without naming specific foods, minimizing overreporting. Any potential social desirability bias, especially around fruit consumption, was adjusted using a specific social desirability module. To account for differences in intake between days and interviewers, a random 20% of women from the first 24-hour recall were selected for a repeat recall in each survey round. This helps us adjust for random daily variations in dietary intake. In 24hR, total of 158 food items were collected from 24rR.

Please add some information from Readme\_FRESH\_TZ\_24hR\_20240611.pdf

TNPSW5

In the dataset of TNPSW5, 4,290 households (91%) were asked 75 food items and 419 households (9%) were asked 60 distinct food items to recall foods consumed over the past 7 days with quantities in the household, but not included foods consumed outside the home. The quantities reported using the unit ‘pieces’ (e.g., ‘Eggs’, ‘Sweets’, ‘Ripe bananas’ etc.) were estimated using Food Portion Size Databases in the Tanzania Food Composition Table(11) and unit conversion factor used in Malawi study(12) to convert into metric units (i.e., grams). The weights of food items were adjusted for liquid food items using water weight equivalent such as cooking oils(13), and the non-edible portions of foods (e.g., banana skins) were subtracted(11,14,15).

To calculate the consumption of wheat flour, the quantity of wheat flour (i.e., wheat flour equivalents) in products such as ‘Breads’, ‘Buns’, ‘Cakes, and biscuits’, and ‘Sweets’, each were derived from a recipe using a methodology in Goto et al. (2024)(3) (see Supplementary Table 1).

**3.3. Food group**

A total of 134 food items in FRESH HH, 158 food items in FRESH 24hR, and 75 food items along with 60 food items in TNPSW5 were categorized into 13 food groups: cereals and cereal products; starches; pulses, dry; vegetables; fruits; beverages; sugar and sweets; nuts and seeds; meat, meat products, and fish; eggs; oil and fats; milk and milk products; spices and other foods (see Supplementary Table 2). The weights of powdered milk were adjusted to the fresh milk equivalents (i.e. whole milk contains 87% water while powder milk contains 6% water(16)) for inclusion in the food groups (dried fish conversion, however, was not considered due to the absence of household consumption).

The food groups need to be discussed. Please modify ‘food-id\_groups\_ja1\_rg.csv’ and ‘food-id\_groups\_j1\_rg.csv’ (in “data-TNPS”) and ‘Foodlist\_24hR\_Rie\_food groups.csv’ in “data-FRESH” according to the discussion. Please see the script ‘01consumption\_quantities\_RG.R’

**3.4. The adult female equivalent approach**

Household-level nutrient supplies were standardised for comparability across households using the AFE approach. Similar to the adult male equivalent (AME) approach(17), the AFE approach divides household-level food supplies by the sum of AFEs based on energy requirements. The AFE approach first involved calculating the total number of AFE for each household based on a reference value of estimated energy requirement of each member of the family, and divided by the energy requirement In this study, we estimated 1 AFE = 2,291kcal/day based on the equations for a 55kg female of a non-pregnant and non-lactating female aged 18–29.9 years(18). The energy requirements of household members were calculated according to their age and gender, estimating the activity level as ‘active or moderately active lifestyle’ (i.e., physical activity level [PAL] 1.76)(18). The average weights used to calculate estimated energy requirements were estimated as 65kg for adult men and 55kg adult females. We estimated the average energy cost of lactation is 505kcal for first 6-months of lactation and 460kcal after 6-months of lactation(18). As there was no data in the TNPSW5 to determine pregnancy trimester, therefore we assumed the average daily energy cost during pregnancy is 275kcal/day (i.e. the average total energy cost of a pregnancy is 77,100kcal(18) was divided by the average length of a pregnancy 280 days).

Energy requirements were estimated from non-breastmilk foods for children below 24 months by subtracting the energy from breast milk, using the energy needed from complementary foods in LMICs context (i.e., infants aged 0–2 months: 0 kilocalories [kcal]/day, 3–5 months: 76 kcal/day, 6–8 months: 269 kcal/day, 9–11 months: 451 kcal/day, 12–23 months: 746 kcal/day, estimating ‘average’ energy intakes from breastmilk)(19). Additional energy requirements of 500 kcal/day for lactating women were calculated as follows: women identified in the survey as being the biological mother of a child below 24 months of age were assumed as lactating women(20). This assumption was necessary because there is no information on lactation or pregnancy status of participants in TNPSW5.

* 1. **Data cleaning**

Data cleaning in FRESH – please get information from Lily and Fusta

For data cleaning purposes in TNPSW5, the total food consumption of each food item in the households was divided by the total household AFEs, to obtain the apparent consumption per AFE per day. On visual inspection, the distribution of the individual consumption quantities of all food items was right-skewed. Thus, consumption quantities were log-transformed prior to identifying outlying values, which were defined as quantities >3 standard deviations from the mean. Outliers and missing data were converted to the median consumption quantity of consuming households prior to further analysis.

The TNPSW5 survey was conducted among 4,709 households. However, 200 households did not report their food consumption over the past 7 days, and 40 households provided insufficient data to calculate food consumption. Consequently, the analysis included data from 4,469 households including 349 households in Arusha and Kilimanjaro regions (Arusha 208 and Kilimanjaro 1411 households.

**3.6. Data analysis**

Data analysis was conducted in the RStudio (RStudio 2024.09.1 Build 394, Posit Software, PBC)(21) and used several R packages: tidyverse(22) for data manipulation and creating graphics, and survey(23) and srvyr(24) for analysing complex survey samples and calculating summary statistics of the survey data.

**3.7. Ethical clearance**

FRESH Initiative in Tanzania obtained permission from the National Institute of Medical Research (Reference number NIMR/HQ/R.8a/Vol1X/4537), and also from the following institutions; IFPRI Institutional Review Board (Reference number 00007490), University of California, Davis Institutional Review Board (Reference number 2066798-1), Wageningen University Research Ethics Committee (Reference number 2066798-1), and LSHTM (ethical clearance number: 21903).

1. **Results**
2. **Discussion**
3. **Conclusion**

Table 2. Characteristics of the participants and households in FRESH 24hR, FRESH HH, TNPSW5 in national and Arusha and Kilimanjaro regions

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | FRESH 24hR | FRESH HH | TNPSW5 - Arusha and Kilimanjaro regions | TNPSW5 - National |
| Sample size | 2,601 WRA | 2,611 HHs | 349 HHs (Arusha 208 HHs, Kilimanjaro 141 HHs) | 4,469 HHs |
| HH size (mean and SD) | 6.3 (1.9) | | 4.3 (2.3) | 4.7 (2.8) |
| Characteristic of household head (%) |  |  |  |  |
| Female | 15.1 | | 34.3 | 26.5 |
| Education | WRA | HH head |  |  |
| * None or Primary uncompleted | 18.6 | 17.3 | 9.9 | 16.3 |
| * Primary completed | 66.3 | 68.1 | 52.9 | 44.2 |
| * Secondary or higher | 15.0 | 14.3 | 37.2 | 39.5 |
| Main occupation in the last 12 months | WRA (%) | HH head (%) |  |  |
| * Agriculture/livestock | 58.5a | 54.4b | 50.7 | 55.2 |

aIncluding self-employment farming 47.5% and self-employment animal husbandry 11.0%, bIncluding self-employment farming 46.3% and self-employment animal husbandry 8.1%

Education – TNPSW% asked ‘What is the highest grade completed by [NAME]?’ (hh\_c07). The above group includes; 1) None or Primary uncompleted: PP, ADULT, Primary (D1-D7), 2) Primary completed: D8, and 3) Secondary: OSC, MS+COURSE, F1-F4, 'O'+course, F5-F6, 'A'+course, Diploma), University & equivalent (U1-U5 above). I asked Hoyce about this grouping and she is searching for more info. If necessary, please modify the code in 04hh\_info\_RG.R

Main occupation in the last 12 months – TNPSW5 asked What was [NAME]’s main occupation for the past 12 months? (hh\_b11). The list of the occupations were: Agriculture/livestock, Fishing, Mining, Tourism, EMPLOYED government, parastatal, private sector and NGO/religions, EMPLOYED (NOT AGRICULTURAL) with employees, without employees, unpaid family, work, paid family work, job seekers, student, disabled and no job. There were not many common items of occupation with FRESH baseline. Here I explained the population involved in agriculture/livestock. The code is in 04hh\_info\_RG.R

Table 3. Estimated energy intake, food consumption by food groups between FRESH 24hR, FRESH HH, and Arusha and Kilimanjaro regions and national in TNPSW5

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | FRESH 24hR | | FRESH HH | | TNPSW5 Arusha and Kilimanjaro regions | | TNPSW5 National | |
|  | Median (IQR) | % | Median (IQR) | % | Median (IQR) | % | Median (IQR) | % |
| Energy intake | 2,586.2 (1,794.8-3,641.4) |  |  |  | 2,079.6 (1,565.5-2,800.5) |  | 2,144.7 (1,514.3-2,882.8) |  |
| Food groups |  |  |  |  |  |  |  |  |
| - Cereals and cereal products | 441.7 (276.5-631.9) | 66.4 |  |  | 323.8 (240.2-442.5) | 100.0 | 387.1 (260.4-540.5) | 98.1 |
| - Starches | 82.2 (28.9-208.5) | 26.6 |  |  | 125.4 (59.7-211.7) | 74.8 | 141.0 (69.0-273.4) | 75.9 |
| - Pulses, dry | 79.6 (49.5-170.5) | 16.2 |  |  | 48.3 (28.4-78.9) | 79.3 | 43.7 (25.4-75.4) | 74.9 |
| - Vegetables | 233.1 (120.9-391.8) | 69.7 |  |  | 106.5 (57.7-180.1) | 98.4 | 93.6 (53.0-157.3) | 97.7 |
| - Fruits | 57.6 (0.0-247.7) | 10.5 |  |  | 75.8 (39.0-169.9) | 77.0 | 69. (28.1-158.0) | 67.9 |
| - Beverages | 5.9 (3.0-8.2) | 8.7 |  |  | 3.0 (1.1-50.5) | 70.4 | 7.8 (0.8-55.0) | 55.8 |
| - Sugar and sweets | 30.8 (21.0-46.6) | 23.4 |  |  | 34.8 (23.3-51.6) | 90.5 | 27.9 (17.0-43.2) | 71.8 |
| - Nuts and seeds | 10.8 (9.5-18.9) | 12.5 |  |  | 22.2 (12.3-36.0) | 24.1 | 28.8 (14.1-55.3) | 44.9 |
| - Meat, meat products and fish | 67.6 (32.5-141.2) | 22.7 |  |  | 42.2 (22.2-89.7) | 80.6 | 39.1 (17.5-75.6) | 85.6 |
| - Eggs | 39.2 (16.0-85.6) | 1.7 |  |  | 10.5 (5.0-19.4) | 24.7 | 9.8 (5.2-17.1) | 16.7 |
| - Oil and fats | 33.5 (17.6-59.8) | 79.2 |  |  | 24.2 (16.2-37.7) | 96.3 | 15.1 (8.7-25.3) | 90.2 |
| - Milk and milk products | 144.1 (113.0-273.7) | 14.0 |  |  | 140.9 (59.5-352.8) | 73.5 | 90.6 (43.4-200.0) | 33.6 |
| - Spices and other foods | 6.6 (3.1-12.7) | 83.2 |  |  | 7.7 (5.4-12.5) | 98.9 | 7.8 (5.3-11.8) | 98.8 |
| <400g fruits and vegetables |  | 70.6 |  |  |  | 85.0 |  | 88.2 |

The table may change according to the discussion of the food group

Table 4. Fortifiable food consumption between FRESH 24hR, FRESH HH, and national estimation of food consumption in TNPSW5

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | FRESH 24hR | | FRESH HH | | TNPSW5 Arusha and Kilimanjaro regions | | TNPSW5 National | |
| Fortifiable foods | Median (IQR) | % | Median (IQR) | % | Median (IQR) | % | Median (IQR) | % |
| Maize flour |  |  |  |  | 145.7 (87.8-278.2) | 95.2 | 222.6 (134.3-351.6) | 90.7 |
| Wheat flour\* |  |  |  |  | 51.9 (25.8-95.6) | 62.4 | 58.7 (26.0-108.1) | 56.8 |
| Cooking oils\* |  |  |  |  | 27.3 (17.3-39.9) | 96.0 | 18.4 (10.1-30.2) | 93.0 |

\*Included wheat flour and oil consumption from wheat flour products

In FRESH 24hR, there were some cooked items (Rice, fried and boiled; Banana, fried; Meat, barbecued; Pork, medium fat, cooked; Beef, medium fat, cooked; Beef, liver, cooked) may contain cooking oils? The item Mixed porridge flour (with maize) – we need to know how much maize flour contains in the product (and can we consider it is the fortifiable maize flour in Tanzania?).

Table 5. Estimated consumption of cereals and cereal products between the levels of education of head of household and wealth quintile in FRESH 24h, FRESH HH, and Arusha and Kilimanjaro regions and national level in TNPSW5

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cereals and cereal products | FRESH 24hR | | FRESH HH | | TNPSW5 Arusha and Kilimanjaro regions | | TNPSW5 National | |
|  | Median (IQR) | % | Median (IQR) | % | Median (IQR) | % | Median (IQR) | % |
| Education of HH head |  |  |  |  |  |  |  |  |
| * None or Primary uncompleted |  |  |  |  | 354.9 (258.0-418.7) | 100.0 | 385.3 (244.4-524.0) | 96.0 |
| * Primary completed |  |  |  |  | 315.9 (218.7-442.9) | 100.0 | 378.1 (255.8-535.5) | 98.5 |
| * Secondary or higher |  |  |  |  | 336.1 (241.2-424.4) | 100.0 | 393.1 (269.3-556.5) | 98.5 |
| Wealth quintile |  |  |  |  |  |  |  |  |
| * Q1 (lowest) |  |  |  |  | 302.0 (213.4-358.8) | 100.0 | 299.4 (207.2-418.7) | 96.7 |
| * Q2 |  |  |  |  | 258.0 (186.7-349.6) | 100.0 | 364.9 (261.2-494.0) | 98.1 |
| * Q3 |  |  |  |  | 347.8 (267.1-464.9) | 100.0 | 404.8 (278.6-537.0) | 98.4 |
| * Q4 |  |  |  |  | 354.6 (240.2-452.2) | 100.0 | 428.3 (287.2-590.1) | 98.7 |
| * Q5 (highest) |  |  |  |  | 365.1 (253.3-503.6) | 100.0 | 459.0 (297.6-696.7) | 98.8 |

Table 6. Estimated consumption of meat, meat products and fish between the levels of education of head of household and wealth quintile in FRESH 24h, FRESH HH, and Arusha and Kilimanjaro regions and national level in TNPSW5

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Meat, meat products and fish | FRESH 24hR | | FRESH HH | | TNPSW5 Arusha and Kilimanjaro regions | | TNPSW5 National | |
|  | Median (IQR) | % | Median (IQR) | % | Median (IQR) | % | Median (IQR) | % |
| Education of HH head |  |  |  |  |  |  |  |  |
| * None or Primary uncompleted |  |  |  |  | 33.0 (15.9-92.0) | 87.1 | 29.6 (13.4-60.1) | 86.2 |
| * Primary completed |  |  |  |  | 43.6 (22.2-88.4) | 80.2 | 37.0 (15.7-72.4) | 85.7 |
| * Secondary or higher |  |  |  |  | 41.8 (25.7-88.4) | 79.6 | 45.0 (20.5-84.6) | 85.2 |
| Wealth quintile |  |  |  |  |  |  |  |  |
| * Q1 (lowest) |  |  |  |  | 10.1 (4.9-26.5) | 59.8 | 12.8 (6.2-26.3) | 71.2 |
| * Q2 |  |  |  |  | 25.4 (18.7-35.1) | 79.1 | 26.3 (13.7-43.9) | 83.7 |
| * Q3 |  |  |  |  | 36.0 (16.1-56.1) | 73.7 | 40.8 (20.6-63.1) | 87.9 |
| * Q4 |  |  |  |  | 46.3 (26.0-88.4) | 75.7 | 53.4 (27.7-87.5) | 90.5 |
| * Q5 (highest) |  |  |  |  | 76.5 (41.3-134.6) | 96.7 | 90.5 (49.2-141.9) | 95.5 |

Table 7. Estimated consumption of eggs between the levels of education of head of household and wealth quintile in FRESH 24h, FRESH HH, and Arusha and Kilimanjaro regions and national level in TNPSW5

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Eggs | FRESH 24hR | | FRESH HH | | TNPSW5 Arusha and Kilimanjaro regions | | TNPSW5 National | |
|  | Median (IQR) | % | Median (IQR) | % | Median (IQR) | % | Median (IQR) | % |
| Education of HH head |  |  |  |  |  |  |  |  |
| * None or Primary uncompleted |  |  |  |  | 8.5 (5.0-12.7) | 98.2 | 6.0 (3.8-9.3) | 86.3 |
| * Primary completed |  |  |  |  | 10.5 (3.5-21.0) | 96.7 | 9.5 (5.0-15.4) | 91.8 |
| * Secondary or higher |  |  |  |  | 11.6 (6.5-19.4) | 95.3 | 11.3 (6.3-21.3) | 90.0 |
| Wealth quintile |  |  |  |  |  |  |  |  |
| * Q1 (lowest) |  |  |  |  | 2.3 (1.2-2.6) | 7.4 | 6.4 (3.1-9.2) | 3.9 |
| * Q2 |  |  |  |  | 8.4 (5.0-8.4) | 14.2 | 6.0 (3.6-12.7) | 10.2 |
| * Q3 |  |  |  |  | 3.5 (3.4-17.8) | 19.9 | 7.8 (3.6-11.2) | 16.1 |
| * Q4 |  |  |  |  | 11.1 (9.0-21.5) | 20.9 | 9.3 (8.4-14.4) | 22.7 |
| * Q5 (highest) |  |  |  |  | 13.9 (7.3-24.0) | 41.8 | 14.7 (8.4-25.3) | 34.2 |

Table 8. Estimated consumption of fruits and vegetables between the levels of education of head of household and wealth quintile in FRESH 24h, FRESH HH, and Arusha and Kilimanjaro regions and national level in TNPSW5

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Fruits and vegetables | FRESH 24hR | | FRESH HH | | TNPSW5 Arusha and Kilimanjaro regions | | TNPSW5 National | |
|  | Median (IQR) | % | Median (IQR) | % | Median (IQR) | % | Median (IQR) | % |
| Education of HH head |  |  |  |  |  |  |  |  |
| * None or Primary uncompleted |  |  |  |  | 132.3 (56.5-309.1) | 100.0 | 119.4 (61.6-222.4) | 96.9 |
| * Primary completed |  |  |  |  | 171.4 (106.1-294.2) | 98.5 | 139.9 (70.5-260.1) | 99.1 |
| * Secondary or higher |  |  |  |  | 179.6 (83.4-292.3) | 97.9 | 154.1 (82.3-281.1) | 98.5 |
| Wealth quintile |  |  |  |  |  |  |  |  |
| * Q1 (lowest) |  |  |  |  | 76.8 (22.3-114.2) | 92.7 | 64.5 (31.5-115.9) | 97.2 |
| * Q2 |  |  |  |  | 106.1 (65.6-174.8) | 100.0 | 110.7 (64.4-191.6) | 98.6 |
| * Q3 |  |  |  |  | 163.3 (101.3-226.8) | 96.6 | 147.8 (84.3-252.3) | 98.7 |
| * Q4 |  |  |  |  | 227.9 (120.0-300.1) | 100.0 | 184.8 (103.8-316.6) | 98.7 |
| * Q5 (highest) |  |  |  |  | 278.9 (168.1-443.6) | 100.0 | 281.1 (164.3-472.1) | 99.3 |

Or we may produce figures of;

Figure 2 Male and female headed household – what WRA eat (F&V, eggs, meat, fortifiable foods, energy)

Figure 3 Fortifiable foods in FRESH 24h between the levels of education of head of household and wealth quintile + Estimated energy intakes, food consumption by food groups and fortifiable foods in FRESH HH between the levels of education of head of household and wealth quintile

Figure 4 Estimated energy intakes, food consumption by food groups and fortifiable foods in TNPSW5 Arusha and Kilimanjaro regions between the levels of education of head of household and wealth quintile

Figure 5 Estimated energy intakes, food consumption by food groups and fortifiable foods in national TNPSW5 between the levels of education of head of household and wealth quintile

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Supplementary Table 1. The percentage of wheat flour and oil in selected food items

|  |  |  |  |
| --- | --- | --- | --- |
|  | Food items | Wheat flour (%) | Oils (%) |
| FRESH 24hR | Bread, white |  |  |
|  | Bread roll |  |  |
|  | Biscuit |  |  |
|  | Cookie |  |  |
| TNPSW5 | Buns, cakes, and biscuits | 84.5 | 9.35 |
|  | Buns | 89.7 | 9.4 |
|  | Cakes and biscuits | 81.7 | 4.9 |
|  | Sweets | 82.0 | 12.2 |
|  | Bread | 86.0 | 4.9 |

Supplement Table 1 The list of food items and food groups in FRESH HH and TNPSW5

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **FRESH 24hR** | **FRESH HH** | **TNPSW5 (using 60 food items)** | **TNPSW5 (using 75 food items)** |
| **Cereals and Cereal products** | 1. Biscuit 2. Bread roll 3. Bread, white 4. Cookie 5. Maize, dried, raw 6. Maize, flour, dry 7. Maize, green, cooked 8. Maize, on the cob, immature 9. Maize, yellow, flour 10. Millet 11. Mixed porridge flour (with maize) 12. Rice, fried and boiled 13. Rice, flour, local 14. Rice, white, grain, raw 15. Sorghum, flour 16. Vermicelli - uncooked 17. Wheat flour 18. Wheat, flour, maida 19. Refined corn flour 20. Corn, roasted | 1. Rice 2. Rice flour 3. Maize 4. Pearl millet 5. Red millet 6. White millet 7. Millet 8. Wheat flour 9. Barley 10. Bread 11. Macaroni, spaghetti 12. Other cereal products 13. Maize on the cob 14. Samosa 15. Other fried foods | 1. Rice (paddy) 2. Rice (husked) 3. Maize (green, cob) 4. Maize (grain) 5. Maize (flour) 6. Millet and sorghum (grain) 7. Millet and sorghum (flour) 8. Wheat flour 9. Wheat, barley grain and other cereals 10. Bread 11. Buns, cakes and biscuits 12. Macaroni, spaghetti 13. Other cereal products | 1. Rice (paddy) 2. Rice (husked) 3. Maize (green, cob) 4. Maize (grain) 5. Maize (flour) 6. Millet and sorghum (grain) 7. Millet and sorghum (flour) 8. Wheat flour 9. Barley grain and other cereals 10. Bread 11. Macaroni, spaghetti 12. Other cereal products 13. Buns 14. Cakes and biscuits |
| **Tubers / Starches** | 1. Potato, English, cooked 2. Taro, raw 3. Muhogo mbichi / Cassava, raw 4. Cassava, dried, flour 5. Sweet potato, fresh-AP 6. Sweet potato, fresh--EP 7. Cassava, dried 8. Yam, raw 9. Potato, boiled 10. Banana, fried 11. Cassava, boiled 12. Sweet potato, fried 13. Sweet potato, boiled 14. Banana, boiled 15. Taro, cooked, without salt 16. Banana, roast | 1. Cassava 2. White or yellow fleshed sweet potatoes 3. Yams/cocoyams 4. Taro 5. Irish potatoes 6. Cooking bananas, plantains 7. Other tubers 8. Cassava chips 9. Cassava-based fried snacks | 1. Cassava fresh 2. Cassava dry/flour 3. Sweet potatoes 4. Yams/cocoyams 5. Irish potatoes 6. Cooking bananas, plantains 7. Other starches | 1. Cassava fresh 2. Cassava dry/flour 3. Sweet potatoes 4. Yams/cocoyams 5. Irish potatoes 6. Cooking bananas, plantains 7. Other starches |
| **Pulses, dry** | 1. Beans, kidney, mature, boiled without salt 2. Bean, kidney, green, cooked 3. Chickpea 4. Chickpea flour (besan) 5. Pigeon peas, cooked 6. Soybean, yellow 7. Beans, kidney, mature seeds, raw 8. Lentil, whole 9. Mung bean (dry, boiled) | 1. Kidney beans 2. Green mung beans 3. Pigeon peas 4. Cow peas 5. Peas 6. Other beans, lentils and pulses | 1. Peas, beans, lentils and other pulses | 1. Peas 2. Green beans 3. Other beans, lentils, and pulses |
| **Vegetables** | 1. Amaranth, leaves, raw 2. Cabbage, raw, green, white 3. Karoti mbichi / Carrots, raw 4. Matango na maganda / Cucumber, wit 5. Biringanya mbichi / Egg plant, raw 6. Cassava leaf 7. Cowpea leaf 8. Green medium, leaf 9. Pumpkin leaf, raw 10. Lettuce 11. Okra, raw 12. Onion, raw 13. Pea, green, fresh 14. Spinach 15. Nyanya chungu / Tomato, bitter (Af 16. Nyanya zilizoiva / Tomato, ripe 17. pilipili za kijani/ chilli, gree 18. Chinisi mbichi / Cabbage, chinese, 19. Green pepper (capsicum) 20. Cabbage, chinese, raw 21. Salad, green 22. Pepper dried or fresh, hot 23. Saro (Kales, raw) 24. Sukuma Wiki, boiled 25. Coriander Leaves 26. Tomato paste | 1. Spinach 2. Lettuce 3. Amaranth greens 4. Pumpkin leaves 5. Cowpea leaves 6. Sweet potato leaves 7. Nightshade 8. Eggplant 9. Cassava leaves 10. Cabbage 11. Chinese cabbage 12. Pumpkin 13. Tomato 14. Carrot 15. Green pepper 16. Okra 17. Onion 18. Spider flower 19. Snap beans or green beans 20. Ethiopian mustard 21. African eggplant 22. Bean leaves 23. Spring onions 24. Cauliflower 25. Bok Choy 26. Jute mallow 27. Broccoli 28. Mushroom 29. Water cress | 1. Onions, tomatoes, carrots and green pepper, other viungo 2. Spinach, cabbage and other green vegetables 3. Canned, dried and wild vegetables | 1. Onions 2. Tomatoes 3. Carrots and green pepper, other viungo 4. Cabbage 5. Chiness/spinach 6. Other green vegetable 7. Canned, dried, and wild vegetables |
| **Fruits** | 1. Avocado, raw, all common variety 2. Banana, ripe 3. Grapes 4. Jackfruit, raw 5. Lemon, raw, without peel 6. Limes, raw 7. Mango juice 8. Mango, ripe, fresh-EP 9. Mango, unripe 10. Oranges 11. Papaya, ripe 12. Papaya, unripe 13. Passion, fruit 14. Pineapple 15. Plums, raw 16. Watermelon, raw 17. Peach 18. Raspberry 19. Apple 20. Sugarcane | 1. Ripe banana 2. Mango 3. Tamarind 4. Plum 5. Papaya 6. Tangerine 7. Lemon/lime 8. Jackfruit 9. Cucumber 10. Baobab 11. Watermelon 12. Guava 13. Peaches 14. Avocado 15. Pineapple 16. Orange 17. Passion fruit 18. Breadfruit 19. Sour sop 20. Pomelo 21. Grapefruit 22. Grapes 23. Sugar apples 24. Cashew fruits 25. Strawberries 26. African Star Apple 27. Dates 28. Pomegranate 29. Marula 30. Tree tomato 31. Pears 32. Strychnos cocculoides fruit 33. Black plums 34. Loquat fruit Indian almond fruit (Kungu) | 1. Ripe bananas 2. Citrus fruits (oranges, lemon, tangerines, etc.) 3. Mangoes, avocadoes and other fruits 4. Sugarcane | 1. Ripe bananas 2. Lemon/lime 3. Orange/tangerine 4. Other citrus fruits 5. Mangoes 6. Avocado 7. Other fruits 8. Sugarcane |
| **Beverages** | 1. Beer, commercial 2. Beer, local, grain 3. Beer, local, non-specific 4. Carbonated, beverage, coca cola 5. Orange drink, concentrated 6. Majani ya chai / Tea leaves 7. Coffee, instant 8. Fruit flavored drink, concentrated 9. Energy drink 10. Tea, infusion | 1. Juice 2. Soft drinks/ sodas/ carbonated drinks 3. Tea 4. Coffee 5. Beer 6. Wine 7. Liquor 8. Local brew 9. Coconut water | 1. Tea dry 2. Coffee and cocoa 3. Other raw materials for drinks 4. Bottled/canned soft drinks (soda, juice, water) 5. Prepared tea, coffee 6. Bottled beer 7. Local brews 8. Wine and spirits | 1. Tea dry 2. Coffee and cocoa 3. Other raw materials for drinks 4. Bottled/canned soft drinks (soda, juice, water) 5. Prepared tea, coffee 6. Bottled beer 7. Local brews 8. Wine and spirits |
| **Sugar and Sweets** | 1. Sugar 2. Candy, chocolate | 1. Sugar 2. Doughnut 3. Cakes 4. Candies 5. Biscuits 6. Chocolate 7. Honey Jams/Marmalade 8. Other sweets | 1. Sugar 2. Sweets 3. Honey, syrups, jams, marmalade, jellies, canned fruits | 1. Sugar 2. Sweets 3. Honey, syrups, jams, marmalade, jellies, canned fruits |
| **Nuts and Seeds** | 1. Bambara groundnut, fresh 2. Groundnuts 3. Cashewnut 4. Coconut milk and water 5. Coconut cream 6. Coconut meat, raw 7. Coconut juice | 1. Groundnuts 2. Sesame 3. Other nuts and seeds | 1. Groundnuts in shell/shelled 2. Coconuts (mature/immature) 3. Cashew, almonds and other nuts 4. Seeds and products from nuts/seeds (excl. Cooking oil) | 1. Groundnuts in shell/shelled 2. Coconuts (mature/immature) 3. Cashew, almonds and other nuts 4. Seeds and products from nuts/seeds (excl. Cooking oil) |
| **Meat, meat products and fish** | 1. Beef, liver, cooked 2. Beef, medium fat, cooked 3. Beef, tripe 4. Beef, boneless 5. Chicken, raw 6. Fish, fresh 7. Fish, high fat 8. Fish, raw 9. Fish, sardines 10. Fish, small, dried, fresh water 11. Goat meat 12. Mutton, meat 13. Pork, medium fat, cooked 14. Fish, smoked, dried-AP 15. Fish, fried 16. Meat, barbecued 17. Chicken, boiled or roasted 18. Perch Nile | 1. Beef meat 2. Goat meat 3. Lamb and mutton meat 4. Pork meat 5. Liver, kidney, gizzard 6. Chicken 7. Fresh fish 8. Small dried fish 9. Canned fish 10. Insects 11. Bush meat 12. Other meat products | 1. Goat meat 2. Beef including minced sausage 3. Pork including sausages and bacon 4. Chicken and other poultry 5. Wild birds and insects 6. Other domestic/wild meat products 7. Fresh fish and seafood (including dagaa) 8. Dried/salted/canned fish and seafood (incl. Dagaa) 9. Package fish | 1. Goat meat 2. Beef (including minced sausage) 3. Pork (including sausages and bacon) 4. Chicken 5. Other poultry 6. Wild birds and insects 7. Dagaa (fresh) 8. Kolekole (fresh) 9. Tilapia (fresh) 10. Other fresh fish and seafood 11. Other domestic/wild meat products 12. Dried/salted/canned fish and seafood (incl. Dagaa) 13. Packaged/canned fish |
| **Eggs** | 1. Yai la kuku / Egg, chicken 2. Egg boiled | Eggs | Eggs | Eggs |
| **Oil and fats** | 1. Butter refined-ghee 2. Margarine 3. Palm oil 4. Vegetable fat 5. Vegetable fat, Cowboy 6. Vegetable oil 7. Animal fat/Lard | 1. Vegetable oil 2. Margarine 3. Butter 4. Red palm oil 5. Other oils and fats | 1. Cooking oil 2. Butter, margarine, ghee and other fat products | 1. Cooking oil 2. Butter, margarine, ghee and other fat products |
| **Milk and milk products** | 1. Fresh milk, cow 2. Ice cream 3. Milk powder, full-cream 4. Milk 5. Yogurt, plain, whole milk | 1. Fresh cow’s milk 2. Yogurt 3. Cheese 4. Other dairy products 5. Ice cream | 1. Fresh milk 2. Milk products (like cream, cheese, yoghurt etc) 3. Canned milk/milk powder | 1. Fresh milk 2. Milk products (like cream, cheese, yoghurt etc) 3. Canned milk/milk powder |
| **Spices and other foods** | 1. Salt, iodized 2. Vinegar, wine 3. Chili sauce 4. Ginger 5. Cardamon 6. Chilli, fresh, raw 7. Cinnamon 8. Garam masala 9. Black pepper 10. Yeast 11. Cloves 12. Chili powder, red 13. Garlic, fresh-AP 14. Baking powder 15. Baking soda 16. Potash, solid | 1. Chilli peppers 2. Tomato paste 3. Garlic 4. Bouillon cube 5. Salt | 1. Salt 2. Other spices | 1. Salt 2. Other spices |

Supplementary Table 3. Food consumed in FRESH 24hR

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Food items | Median | QT 25 | QT 75 | Frequencies |
| Sweet potato, fried | 656.0 | 656.0 | 656.0 | 1 |
| Beer, local, grain | 638.8 | 427.3 | 1000.0 | 14 |
| Beer, commercial | 500.0 | 375.0 | 1500.0 | 11 |
| Fish, high fat | 495.9 | 289.0 | 495.9 | 2 |
| Sweet potato, fresh-AP | 489.6 | 489.6 | 734.4 | 6 |
| Yam, raw | 486.0 | 486.0 | 486.0 | 1 |
| Maize, green, cooked | 412.7 | 316.2 | 486.9 | 13 |
| Beer, local, non-specific | 402.3 | 354.5 | 450.2 | 2 |
| Sweet potato, boiled | 393.6 | 253.6 | 629.6 | 8 |
| Sweet potato, fresh--EP | 393.6 | 262.4 | 734.4 | 11 |
| Coconut juice | 381.0 | 381.0 | 381.0 | 1 |
| Fruit flavored drink, concentrated | 374.0 | 374.0 | 374.0 | 1 |
| Cassava, boiled | 364.5 | 324.0 | 486.0 | 8 |
| Bean, kidney, green, cooked | 361.0 | 334.0 | 493.9 | 8 |
| Carbonated, beverage, coca cola | 350.0 | 350.0 | 350.0 | 12 |
| Energy drink | 350.0 | 350.0 | 350.0 | 1 |
| Orange drink, concentrated | 336.0 | 180.4 | 518.0 | 3 |
| Banana, fried | 335.6 | 251.7 | 419.5 | 12 |
| Fresh milk, cow | 323.4 | 323.4 | 323.4 | 1 |
| Watermelon, raw | 309.5 | 172.4 | 344.8 | 8 |
| Mango, ripe, fresh-EP | 289.2 | 204.8 | 409.6 | 22 |
| Mango, unripe | 289.2 | 195.8 | 349.4 | 3 |
| Mango juice | 288.5 | 269.2 | 307.7 | 2 |
| Maize, yellow, flour | 272.7 | 120.0 | 276.1 | 6 |
| Beans, kidney, mature, boiled without salt | 259.4 | 159.3 | 334.0 | 28 |
| Banana, roast | 251.6 | 208.7 | 278.2 | 11 |
| Maize, flour, dry | 248.9 | 124.4 | 357.2 | 150 |
| Taro, cooked, without salt | 243.0 | 215.3 | 324.0 | 5 |
| Lettuce | 217.2 | 217.2 | 217.2 | 1 |
| Cassava, dried | 215.4 | 215.4 | 215.4 | 1 |
| Vegetable fat | 212.0 | 212.0 | 212.0 | 1 |
| Papaya, unripe | 205.6 | 205.6 | 205.6 | 1 |
| Yogurt, plain, whole milk | 202.7 | 96.0 | 323.4 | 48 |
| Bambara groundnut, fresh | 189.5 | 151.8 | 227.3 | 2 |
| Cowpea leaf | 182.2 | 152.1 | 212.3 | 2 |
| Pigeon peas, cooked | 179.8 | 179.8 | 179.8 | 1 |
| Corn, roasted | 166.4 | 131.2 | 201.6 | 2 |
| Rice, white, grain, raw | 164.1 | 84.7 | 176.6 | 107 |
| Taro, raw | 162.0 | 162.0 | 162.0 | 1 |
| Bread roll | 160.0 | 118.0 | 236.0 | 8 |
| Muhogo mbichi / Cassava, raw | 157.9 | 108.0 | 330.2 | 16 |
| Papaya, ripe | 154.2 | 39.3 | 347.0 | 24 |
| Maize, dried, raw | 151.5 | 97.9 | 151.5 | 90 |
| Banana, boiled | 134.8 | 103.9 | 148.7 | 132 |
| Potato, boiled | 131.8 | 131.8 | 333.3 | 4 |
| Oranges | 128.0 | 75.5 | 128.0 | 21 |
| Maize, on the cob, immature | 127.3 | 111.3 | 197.0 | 7 |
| Passion, fruit | 126.5 | 126.5 | 126.5 | 1 |
| Bread, white | 120.0 | 120.0 | 160.0 | 13 |
| Milk | 113.0 | 67.7 | 194.5 | 156 |
| Mung bean (dry, boiled) | 109.2 | 46.2 | 119.3 | 11 |
| Milk powder, full-cream | 103.6 | 49.1 | 207.1 | 10 |
| Chickpea | 95.1 | 95.1 | 95.1 | 1 |
| Matango na maganda / Cucumber, wit | 91.0 | 13.8 | 291.8 | 27 |
| Pineapple | 90.1 | 61.0 | 98.2 | 15 |
| Wheat, flour, maida | 88.7 | 59.1 | 125.4 | 91 |
| Fish, small, dried, fresh water | 86.9 | 13.8 | 86.9 | 12 |
| Rice, fried and boiled | 86.6 | 77.2 | 86.6 | 46 |
| Banana, ripe | 86.6 | 86.6 | 123.4 | 21 |
| Ice cream | 85.0 | 85.0 | 85.0 | 1 |
| Avocado, raw, all common variety | 84.2 | 70.2 | 84.2 | 12 |
| Mutton, meat | 83.8 | 47.8 | 150.7 | 7 |
| Vermicelli - uncooked | 80.2 | 80.2 | 117.8 | 14 |
| Meat, barbecued | 79.0 | 49.5 | 273.0 | 6 |
| Palm oil | 77.5 | 63.3 | 77.5 | 11 |
| Chickpea flour (besan) | 77.5 | 77.5 | 77.5 | 1 |
| Soybean, yellow | 77.5 | 49.9 | 104.4 | 52 |
| Beef, liver, cooked | 72.9 | 72.9 | 72.9 | 3 |
| Fish, raw | 69.0 | 44.8 | 131.0 | 45 |
| Beans, kidney, mature seeds, raw | 69.0 | 38.3 | 76.5 | 162 |
| Egg boiled | 66.2 | 45.1 | 93.1 | 6 |
| Pork, medium fat, cooked | 65.8 | 39.7 | 116.7 | 17 |
| Sukuma Wiki, boiled | 62.6 | 59.9 | 97.9 | 22 |
| Jackfruit, raw | 60.0 | 60.0 | 60.0 | 1 |
| Cassava, dried, flour | 57.5 | 34.3 | 57.5 | 14 |
| Wheat flour | 57.4 | 28.7 | 74.2 | 17 |
| Saro (Kales, raw) | 56.0 | 56.0 | 56.0 | 1 |
| Mixed porridge flour (with maize) | 54.7 | 54.7 | 82.1 | 33 |
| Beef, medium fat, cooked | 52.3 | 42.8 | 70.6 | 146 |
| Cabbage, raw, green, white | 50.5 | 32.5 | 67.4 | 48 |
| Grapes | 50.3 | 17.1 | 56.4 | 10 |
| Raspberry | 50.3 | 17.1 | 56.4 | 10 |
| Cookie | 44.0 | 44.0 | 44.0 | 1 |
| Tomato paste | 44.0 | 44.0 | 44.0 | 1 |
| Beef, boneless | 41.9 | 36.9 | 58.9 | 72 |
| Amaranth, leaves, raw | 41.3 | 20.7 | 43.0 | 28 |
| Refined corn flour | 41.1 | 41.1 | 82.2 | 15 |
| Pumpkin leaf, raw | 40.8 | 33.2 | 79.2 | 65 |
| Sugarcane | 40.0 | 20.0 | 50.0 | 5 |
| Chinisi mbichi / Cabbage, chinese, | 39.5 | 24.9 | 70.3 | 29 |
| Chicken, raw | 38.0 | 24.0 | 52.0 | 2 |
| Plums, raw | 37.2 | 30.8 | 43.6 | 2 |
| Yai la kuku / Egg, chicken | 36.9 | 12.3 | 75.0 | 35 |
| Sorghum, flour | 36.9 | 33.3 | 63.6 | 10 |
| Spinach | 36.8 | 15.0 | 110.4 | 36 |
| Lentil, whole | 33.3 | 8.0 | 35.6 | 5 |
| Biringanya mbichi / Egg plant, raw | 32.4 | 19.2 | 40.7 | 254 |
| Goat meat | 32.2 | 19.2 | 65.3 | 17 |
| Coffee, instant | 31.9 | 16.0 | 31.9 | 7 |
| Millet | 31.1 | 31.1 | 37.6 | 19 |
| Butter refined-ghee | 29.8 | 25.0 | 59.0 | 15 |
| Beef, tripe | 27.9 | 13.2 | 27.9 | 2 |
| Chicken, boiled or roasted | 27.6 | 18.4 | 34.4 | 11 |
| Fish, sardines | 26.3 | 15.0 | 43.4 | 82 |
| Cassava leaf | 25.8 | 25.8 | 25.8 | 2 |
| Rice, flour, local | 25.5 | 15.5 | 191.8 | 19 |
| Cashewnut | 23.4 | 23.4 | 23.4 | 1 |
| Green medium, leaf | 23.4 | 19.0 | 45.4 | 121 |
| Fish, fresh | 21.9 | 8.2 | 79.5 | 30 |
| Fish, fried | 20.9 | 11.5 | 30.3 | 2 |
| Karoti mbichi / Carrots, raw | 20.0 | 12.0 | 31.0 | 775 |
| Cabbage, chinese, raw | 19.2 | 15.6 | 37.2 | 73 |
| Fish, smoked, dried-AP | 19.1 | 13.8 | 38.6 | 6 |
| Potato, English, cooked | 18.8 | 15.0 | 54.1 | 240 |
| Sugar | 17.8 | 8.9 | 29.7 | 240 |
| Animal fat/Lard | 17.2 | 11.3 | 23.9 | 13 |
| Nyanya zilizoiva / Tomato, ripe | 16.7 | 10.8 | 25.8 | 780 |
| Limes, raw | 16.5 | 7.6 | 20.8 | 14 |
| Peach | 15.9 | 15.9 | 15.9 | 1 |
| Candy, choclate | 15.0 | 12.3 | 15.0 | 2 |
| Perch Nile | 12.9 | 8.7 | 31.4 | 23 |
| Nyanya chungu / Tomato, bitter (Af | 12.8 | 6.5 | 27.7 | 187 |
| Chili sauce | 12.7 | 12.7 | 12.7 | 1 |
| Coconut cream | 11.6 | 9.5 | 14.3 | 48 |
| Groundnuts | 11.0 | 6.7 | 21.2 | 51 |
| Biscuit | 11.0 | 11.0 | 55.0 | 4 |
| Salad, green | 10.7 | 8.3 | 10.7 | 35 |
| Coconut milk and water | 10.6 | 6.8 | 11.0 | 106 |
| Pea, green, fresh | 10.5 | 5.3 | 15.8 | 51 |
| Vegetable oil | 9.6 | 4.9 | 15.8 | 1046 |
| Green pepper (capsicum) | 8.1 | 3.9 | 12.5 | 654 |
| Okra, raw | 7.9 | 4.6 | 19.5 | 180 |
| Vegetable fat, Cowboy | 7.7 | 4.0 | 8.1 | 192 |
| Apple | 6.7 | 2.3 | 7.5 | 10 |
| Onion, raw | 4.9 | 2.7 | 7.9 | 857 |
| Coconut meat, raw | 3.4 | 3.4 | 6.2 | 2 |
| Ginger | 3.0 | 2.7 | 3.9 | 189 |
| pilipili za kijani/ chilli, gree | 2.6 | 0.9 | 6.4 | 6 |
| Garlic, fresh-AP | 2.6 | 1.8 | 3.2 | 200 |
| Majani ya chai / Tea leaves | 1.8 | 0.7 | 5.9 | 62 |
| Tea, infusion | 1.6 | 1.6 | 3.1 | 28 |
| Margarine | 1.5 | 1.1 | 1.8 | 45 |
| Salt, iodized | 1.1 | 0.6 | 2.0 | 1027 |
| Baking soda | 0.7 | 0.4 | 1.3 | 49 |
| Vinegar, wine | 0.6 | 0.6 | 0.6 | 2 |
| Chili powder, red | 0.5 | 0.5 | 0.5 | 2 |
| Cloves | 0.5 | 0.5 | 0.5 | 2 |
| Baking powder | 0.5 | 0.3 | 0.7 | 55 |
| Yeast | 0.4 | 0.3 | 0.6 | 73 |
| Garam masala | 0.4 | 0.3 | 0.5 | 25 |
| Coriander Leaves | 0.4 | 0.4 | 0.5 | 11 |
| Chilli, fresh, raw | 0.4 | 0.2 | 0.5 | 17 |
| Pepper dried or fresh, hot | 0.3 | 0.1 | 0.5 | 25 |
| Cardamon | 0.2 | 0.2 | 0.3 | 19 |
| Potash, solid | 0.2 | 0.1 | 0.2 | 47 |
| Black pepper | 0.1 | 0.1 | 0.1 | 26 |
| Cinnamon | 0.0 | 0.0 | 0.1 | 11 |
| Lemon, raw, without peel | 0.0 | 0.0 | 1.0 | 70 |

Supplement Table 3. National food consumption in grams per day per AFE in TNPSW5 (weighted)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Food items | Median | QT 25 | QT 75 | % |
| Maize (flour) | 222.6 | 134.3 | 351.6 | 90.7 |
| Rice (paddy) | 220.8 | 73.6 | 385.1 | 1.0 |
| Other starches | 136.6 | 85.7 | 246.8 | 1.0 |
| Barley grain and other cereals | 133.5 | 105.6 | 189.4 | 0.2 |
| Rice (husked) | 119.6 | 69.4 | 202.9 | 70.0 |
| Local brews | 111.8 | 42.9 | 221.3 | 4.8 |
| Cassava dry/flour | 111.8 | 58.7 | 202.9 | 14.8 |
| Sweet potatoes | 98.8 | 50.8 | 187.7 | 27.8 |
| Fresh milk | 95.6 | 46.2 | 202.7 | 26.0 |
| Cooking ba00s, plantains | 70.2 | 37.5 | 137.1 | 32.5 |
| Bottled beer | 67.4 | 37.4 | 120.0 | 1.7 |
| Sugarcane | 65.1 | 28.2 | 129.4 | 16.7 |
| Yams/cocoyams | 63.8 | 38.0 | 114.8 | 7.2 |
| Other poultry | 60.9 | 29.2 | 131.6 | 0.4 |
| Cassava fresh | 57.5 | 35.1 | 98.5 | 28.0 |
| Irish potatoes | 55.3 | 30.1 | 106.8 | 26.9 |
| Maize (green, cob) | 54.1 | 27.1 | 112.6 | 11.8 |
| Other cereal products | 53.7 | 28.6 | 118.9 | 1.1 |
| Millet and sorghum (grain) | 50.8 | 30.0 | 83.1 | 0.8 |
| Bottled/canned soft drinks (soda, juice, water) | 49.1 | 31.0 | 80.1 | 22.2 |
| Millet and sorghum (flour) | 48.5 | 24.7 | 103.1 | 8.1 |
| Milk products (like cream, cheese, yoghurt etc) | 48.2 | 27.0 | 95.8 | 14.4 |
| Maize (grain) | 47.7 | 29.8 | 83.6 | 15.7 |
| Other fruits | 46.6 | 27.3 | 103.3 | 5.9 |
| Wheat flour | 46.2 | 29.7 | 78.6 | 17.6 |
| Mangoes | 46.1 | 20.8 | 107.3 | 23.2 |
| Other domestic/wild meat products | 45.2 | 45.2 | 157.6 | 0.1 |
| Chicken and other poultry | 43.5 | 21.7 | 61.2 | 0.0 |
| Onions, tomatoes, carrots and green pepper, other viungo | 43.4 | 22.0 | 76.5 | 0.0 |
| Mangoes, avocadoes and other fruits | 43.3 | 24.0 | 84.7 | 0.0 |
| Peas, beans, lentils and other pulses | 42.4 | 28.4 | 82.4 | 0.0 |
| Other beans, lentils, and pulses | 40.1 | 23.6 | 69.1 | 52.0 |
| Green beans | 39.8 | 22.5 | 73.9 | 21.4 |
| Tomatoes | 39.3 | 21.3 | 70.5 | 90.7 |
| Ripe ba00s | 39.2 | 20.0 | 69.9 | 29.8 |
| Pork including sausages and bacon | 38.8 | 19.0 | 45.0 | 6.0 |
| Coconuts (mature/immature) | 35.7 | 18.6 | 64.7 | 19.7 |
| Bread | 35.4 | 20.6 | 61.8 | 19.7 |
| Other citrus fruits | 35.3 | 16.4 | 74.8 | 1.2 |
| Cabbage | 33.3 | 19.4 | 54.6 | 19.5 |
| Prepared tea, coffee | 33.3 | 4.0 | 44.1 | 0.3 |
| Spi0ch, cabbage and other green vegetables | 31.6 | 16.6 | 62.5 | 0.0 |
| Beef (including minced sausage) | 31.1 | 20.9 | 53.4 | 34.4 |
| Orange/tangerine | 31.1 | 16.0 | 59.1 | 19.7 |
| Beef including minced sausage | 30.3 | 18.8 | 44.7 | 34.4 |
| Pork (including sausages and bacon) | 29.6 | 20.8 | 54.2 | 6.0 |
| Avocado | 28.6 | 15.1 | 50.6 | 20.8 |
| Wine and spirits | 28.6 | 9.8 | 110.8 | 0.4 |
| Chicken | 28.2 | 18.6 | 46.7 | 17.7 |
| Citrus fruits (oranges, lemon, tangerines, etc.) | 27.3 | 10.7 | 46.8 | 0.0 |
| Sugar | 26.6 | 16.6 | 40.0 | 70.8 |
| Buns, cakes and biscuits | 25.9 | 13.2 | 48.9 | 0.0 |
| Seeds and products from nuts/seeds (excl. Cooking oil) | 25.4 | 4.2 | 38.3 | 0.2 |
| Other green vegetable | 24.4 | 12.7 | 47.6 | 68.6 |
| Macaroni, spaghetti | 24.4 | 17.7 | 39.9 | 8.9 |
| Chiness/spi0ch | 23.7 | 12.4 | 44.5 | 27.9 |
| Buns | 23.6 | 13.1 | 44.9 | 31.0 |
| Canned, dried and wild vegetables | 23.1 | 10.9 | 46.0 | 9.9 |
| Goat meat | 22.7 | 15.6 | 41.6 | 9.4 |
| Tilapia (fresh) | 21.8 | 10.7 | 41.6 | 3.8 |
| Peas | 21.7 | 12.1 | 35.5 | 14.0 |
| Kolekole (fresh) | 20.8 | 13.9 | 46.1 | 1.7 |
| Other fresh fish and seafood | 20.3 | 9.8 | 39.8 | 14.6 |
| Cashew, almonds and other nuts | 20.2 | 11.3 | 41.6 | 1.9 |
| Groundnuts in shell/shelled | 19.9 | 10.8 | 40.1 | 27.9 |
| Canned, dried, and wild vegetables | 17.1 | 9.1 | 51.5 | 9.9 |
| Honey, syrups, jams, marmalade, jellies, canned fruits | 16.9 | 9.9 | 47.5 | 8.8 |
| Cooking oil | 15.1 | 8.7 | 25.2 | 89.1 |
| Fresh fish and seafood (including dagaa) | 14.6 | 5.8 | 36.0 | 0.0 |
| Dried/salted/canned fish and seafood (incl. Dagaa) | 14.2 | 7.9 | 27.4 | 34.7 |
| Carrots and green pepper, other viungo | 13.7 | 7.1 | 26.1 | 34.8 |
| Canned milk/milk powder | 12.9 | 4.2 | 25.5 | 0.6 |
| Wild birds and insects | 12.6 | 4.0 | 30.9 | 0.2 |
| Onions | 12.2 | 7.2 | 19.9 | 90.7 |
| Dagaa (fresh) | 11.1 | 5.3 | 23.2 | 41.8 |
| Butter, margarine, ghee and other fat products | 10.1 | 6.8 | 16.7 | 2.5 |
| Eggs | 9.8 | 5.2 | 17.1 | 16.7 |
| Other raw materials for drinks | 8.9 | 8.9 | 8.9 | 1.8 |
| Lemon/lime | 8.2 | 4.3 | 15.6 | 27.4 |
| Salt | 7.3 | 5.1 | 10.8 | 98.7 |
| Packaged/canned fish | 6.3 | 6.3 | 6.4 | 0.1 |
| Other spices | 6.1 | 2.3 | 13.5 | 11.1 |
| Coffee and cocoa | 5.6 | 1.4 | 13.6 | 1.7 |
| Cakes and biscuits | 3.6 | 2.1 | 8.6 | 5.8 |
| Sweets | 1.2 | 0.4 | 2.7 | 6.2 |
| Tea dry | 0.8 | 0.5 | 1.4 | 43.7 |

Supplement Table 4. Arusha and Kilimanjaro regions food consumption in grams per day per AFE in TNPSW5 (weighted)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Food items | Median | QT 25 | QT 75 | % |
| Maize (flour) | 145.7 | 87.8 | 278.2 | 95.2 |
| Fresh milk | 143.2 | 61.6 | 361.4 | 62.0 |
| Bottled beer | 120.0 | 42.0 | 333.8 | 0.6 |
| Chicken and other poultry | 85.7 | 37.9 | 132.7 | 0.0 |
| Rice (husked) | 83.5 | 50.8 | 126.4 | 68.6 |
| Local brews | 75.1 | 43.2 | 152.1 | 7.1 |
| Irish potatoes | 66.8 | 33.3 | 116.7 | 41.0 |
| Cassava dry/flour | 63.9 | 40.0 | 78.5 | 5.2 |
| Cooking bananas, plantains | 58.5 | 35.8 | 107.5 | 56.2 |
| Millet and sorghum (flour) | 56.3 | 26.6 | 126.4 | 9.2 |
| Onions, tomatoes, carrots and green pepper, other viungo | 55.9 | 16.5 | 95.0 | 0.0 |
| Bottled/canned soft drinks (soda, juice, water) | 52.4 | 28.3 | 67.6 | 24.2 |
| Yams/cocoyams | 50.8 | 27.4 | 73.1 | 9.9 |
| Maize (green, cob) | 50.4 | 25.1 | 88.8 | 14.2 |
| Peas, beans, lentils and other pulses | 50.3 | 32.3 | 73.6 | 0.0 |
| Sweet potatoes | 50.1 | 36.5 | 107.3 | 15.6 |
| Spinach, cabbage and other green vegetables | 49.6 | 15.9 | 65.2 | 0.0 |
| Milk products (like cream, cheese, yoghurt etc) | 49.4 | 32.7 | 81.5 | 34.2 |
| Maize (grain) | 49.2 | 30.0 | 106.7 | 45.5 |
| Wheat flour | 48.9 | 28.7 | 74.0 | 21.5 |
| Sugarcane | 46.7 | 15.1 | 90.7 | 13.6 |
| Other poultry | 46.1 | 21.7 | 46.1 | 0.9 |
| Other beans, lentils, and pulses | 45.1 | 26.6 | 79.7 | 64.2 |
| Bread | 44.5 | 20.9 | 76.3 | 33.6 |
| Wine and spirits | 41.6 | 41.6 | 41.6 | 0.1 |
| Green beans | 40.6 | 18.6 | 68.1 | 17.3 |
| Citrus fruits (oranges, lemon, tangerines, etc.) | 40.2 | 31.2 | 43.0 | 0.0 |
| Mangoes | 40.1 | 23.4 | 74.6 | 21.2 |
| Ripe bananas | 40.0 | 21.7 | 65.4 | 49.8 |
| Cassava fresh | 39.6 | 27.8 | 65.8 | 14.4 |
| Tomatoes | 38.7 | 20.7 | 67.1 | 92.0 |
| Chicken | 36.2 | 21.5 | 51.3 | 11.4 |
| Avocado | 35.0 | 16.8 | 51.1 | 44.4 |
| Beef (including minced sausage) | 34.7 | 21.9 | 63.2 | 49.4 |
| Sugar | 34.5 | 22.6 | 51.3 | 90.5 |
| Orange/tangerine | 34.4 | 20.2 | 62.6 | 34.5 |
| Mangoes, avocadoes and other fruits | 33.8 | 18.7 | 61.4 | 0.0 |
| Millet and sorghum (grain) | 32.8 | 20.8 | 32.8 | 0.7 |
| Other fruits | 32.3 | 26.5 | 77.9 | 1.3 |
| Cabbage | 31.1 | 17.4 | 48.7 | 23.5 |
| Beef including minced sausage | 30.3 | 30.3 | 52.3 | 49.4 |
| Other green vegetable | 29.5 | 12.6 | 60.8 | 75.6 |
| Pork (including sausages and bacon) | 28.8 | 18.8 | 57.4 | 7.9 |
| Other cereal products | 28.6 | 28.6 | 73.8 | 0.4 |
| Buns | 25.9 | 14.8 | 39.4 | 35.3 |
| Chiness/spinach | 24.4 | 10.2 | 38.0 | 24.0 |
| Cooking oil | 24.2 | 16.1 | 37.7 | 95.5 |
| Goat meat | 24.1 | 13.9 | 40.3 | 12.6 |
| Other citrus fruits | 23.8 | 23.8 | 23.8 | 0.6 |
| Macaroni, spaghetti | 23.3 | 14.9 | 34.4 | 12.7 |
| Coconuts (mature/immature) | 22.4 | 8.8 | 33.3 | 13.4 |
| Groundnuts in shell/shelled | 20.1 | 12.8 | 27.5 | 13.1 |
| Carrots and green pepper, other viungo | 19.3 | 9.7 | 35.6 | 72.3 |
| Peas | 19.1 | 13.0 | 26.5 | 6.3 |
| Butter, margarine, ghee and other fat products | 18.6 | 3.5 | 22.4 | 2.7 |
| Other starches | 17.8 | 17.8 | 17.8 | 0.2 |
| Buns, cakes and biscuits | 17.1 | 17.1 | 57.4 | 0.0 |
| Onions | 15.5 | 8.5 | 26.0 | 96.0 |
| Honey, syrups, jams, marmalade, jellies, canned fruits | 15.4 | 9.6 | 21.1 | 6.3 |
| Other fresh fish and seafood | 14.8 | 10.5 | 23.3 | 7.8 |
| Dried/salted/canned fish and seafood (incl. Dagaa) | 13.1 | 8.4 | 28.7 | 44.1 |
| Tilapia (fresh) | 13.1 | 13.1 | 13.1 | 0.1 |
| Other spices | 12.2 | 4.8 | 27.1 | 12.9 |
| Pork including sausages and bacon | 11.1 | 11.1 | 11.1 | 7.9 |
| Eggs | 10.5 | 5.0 | 19.4 | 24.7 |
| Canned, dried and wild vegetables | 10.4 | 10.4 | 17.5 | 2.2 |
| Canned milk/milk powder | 9.8 | 9.8 | 9.8 | 0.1 |
| Packaged/canned fish | 9.5 | 9.5 | 9.5 | 0.1 |
| Dagaa (fresh) | 9.2 | 3.8 | 20.1 | 22.0 |
| Lemon/lime | 8.9 | 6.0 | 16.6 | 28.4 |
| Salt | 7.2 | 5.3 | 10.4 | 98.9 |
| Fresh fish and seafood (including dagaa) | 7.2 | 6.4 | 10.4 | 0.0 |
| Coffee and cocoa | 5.6 | 5.4 | 19.1 | 2.0 |
| Cakes and biscuits | 2.6 | 2.5 | 10.3 | 4.7 |
| Tea dry | 1.1 | 0.8 | 1.9 | 62.5 |
| Canned, dried, and wild vegetables | 1.0 | 1.0 | 34.8 | 2.2 |
| Sweets | 0.3 | 0.3 | 2.3 | 4.1 |