INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE
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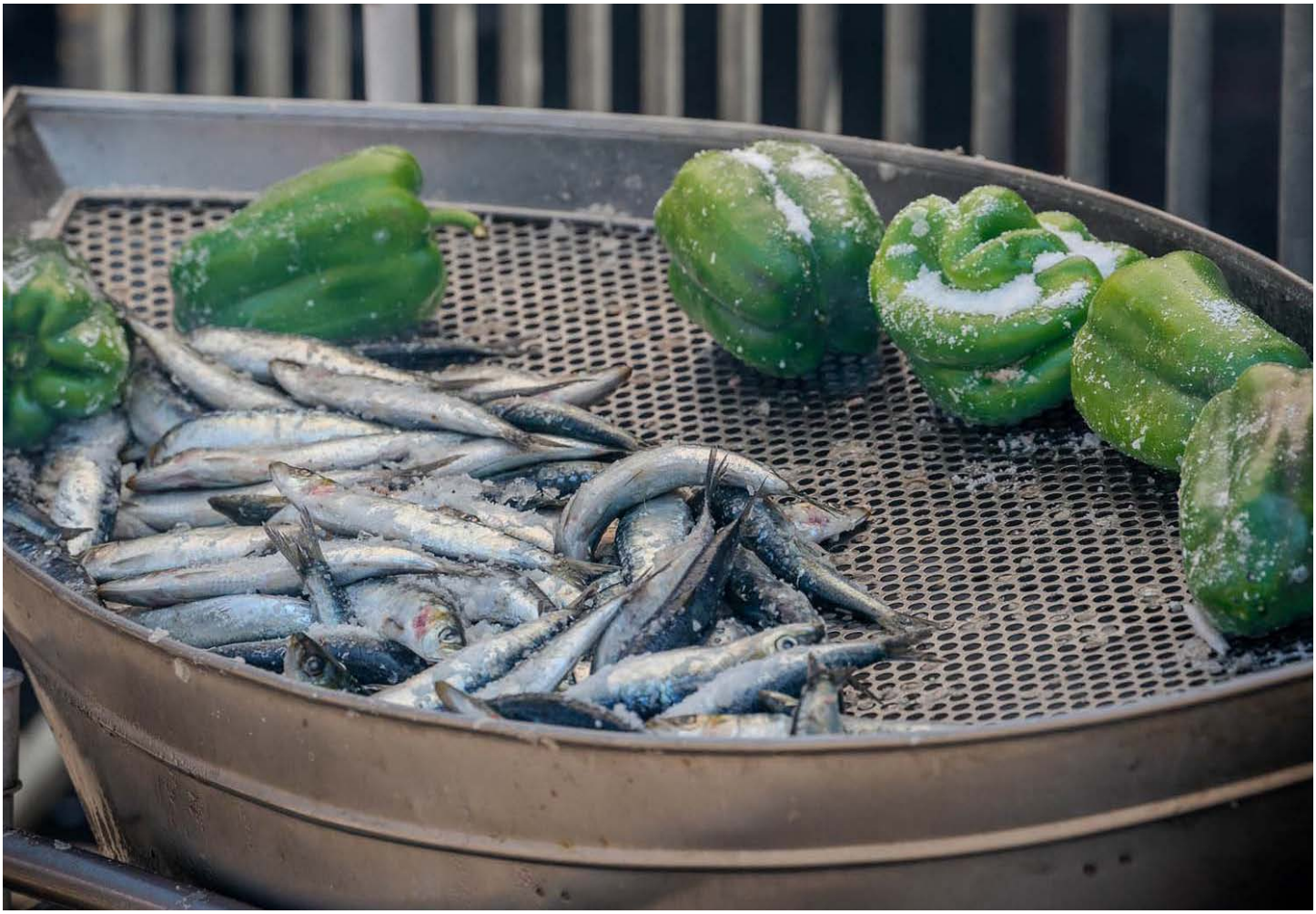
UFED
Urban Food Environments and Diets Tool

DIET ASSESSMENT

24-Hour Recall

Overview

The 24-hour recall (24HR) recall is a widely used retrospective recall of dietary items consumed in the day preceding the interview (usually from 6:00 am the previous day to 6:00 am on the survey day. Typically, a trained enumerator asks the interviewee to recall all the foods and beverages consumed over the previous day, including quantities, brand names for packaged foods, preparation, and cooking (food or dish). The 24HR has been studied extensively and validated for its accuracy and reliability against the observed weighed food record (OWFR), often used as a standard for dietary assessment.



Rationale

24HR recalls are widely used to assess nutrient intakes in low- and middle-income countries (LMICs). Data on foods consumed are matched to a food composition database, with single recalls estimating mean intake and repeated recalls on non-consecutive days assessing usual intake (Saravia 2022, Freedman 2018). The enumerator does not observe the meals, so household units (e.g., cups, measuring spoons) and visual aids (pictures, models) are used to help estimate portion sizes and food weights.

Type of data

The 24HR quantitative recall measures quantity of consumption at the food level (detailed food intake and portion sizes) with food data matched with a food composition database to derive nutrient content.

Indicators

All indicators derived from an observed weighed food record (OWFR) can also be derived from a 24-hour recall (24HR), provided the same conditions are met (e.g., repeat recalls to estimate usual intake). However, the 24HR is typically recommended over the OWFR, as it is less burdensome, more cost-effective, and less likely to influence participants' eating behavior, whereas the act of weighing foods in real time may alter usual consumption patterns.

If using a quantitative 24HR and a food composition table (FCT)

A quantitative 24-hour dietary recall (24HR) is a powerful tool for measuring both macronutrient and micronutrient intake, as well as assessing the adequacy of those intakes relative to established nutritional standards.

Quantitative intake measures (macro- and micronutrients, total energy intake, food group intake)	Quantified daily intake of macro- and micronutrients can be estimated using 24-hour dietary recall data combined with a locally adapted food composition table (FCT). The FCT provides nutrient values for each food reported, allowing calculation of energy, protein, fat, carbohydrates, and essential vitamins and minerals such as iron, vitamin A, and zinc. These intake amounts are then compared to recommended daily requirements based on a person's age, sex, and physical activity level to assess whether their diet meets nutritional needs.
Nutritional adequacy indicators (adequacy of energy intake, micronutrient adequacy, mean probability of adequacy (MPA), and macronutrient distribution	These indicators estimate how well a person's diet meets their nutritional needs using food intake data from a 24HR converted into nutrient intake using an FCT. For individual-level assessment, nutrient intakes are compared to recommended daily requirements based on age, sex, and physical activity. For population-level assessments, multiple 24HRs are used to estimate usual intake and account for day-to-day variation (National Cancer Institute). Nutrient adequacy is then evaluated using methods such as the Estimated Average Requirement (EAR) cut-point method or the probability approach, which estimate the proportion of the population at risk of inadequate intake—though the EAR cut-point method is not suitable for nutrients like iron in women and children due to skewed requirement distributions. To assess overall micronutrient quality, the Mean Probability of Adequacy (MPA) is often used. It combines the probability that a person's intake of each selected micronutrient—such as iron, zinc, and vitamin A—meets their daily requirement and averages these values to give a single score (Arimond 2010). The MPA is based on dietary intake data to estimate usual intakes and their variability[1]. A higher MPA means better overall micronutrient adequacy. MPA does not capture excessive intake, so separate indicators are for overconsumption, such as the proportion of individuals exceeding upper intake levels.
Indicators of diet quality	Suggested indicators for tracking healthy and unhealthy food consumption—especially in urbanized settings—include dietary energy density (kilocalories per gram of food), percentage of energy from free sugars and saturated fat, and total energy intake. These data can also be used to assess overall diet quality using tools like the Global Diet Quality Score (GDQS), which organizes all foods consumed into standardized food groupings. GDQS generates a positive score for healthy foods and a negative score for unhealthy foods. This approach supports monitoring of nutrition transitions, identification of dietary risks, and design of targeted interventions to improve diet quality. Other composite diet quality indicators include Diet Diversity Scores and Minimum Dietary Diversity for Women (MDD-W).

[1] To estimate MPA, collect at least two non-consecutive 24HRs per person on a random subsample, ensuring at least 50 individuals with repeat recalls per nutrient or food group of interest (NCI Diet Primer). If resources are limited, collect one recall from all and a second from at least 30–40%, then use statistical methods to model usual intake and calculate adequacy. For nutrients or foods with high daily variation or infrequent consumption, increase the individual recalls or expand the proportion of the sample with repeat recalls.

Indicators of diet quality: If not using a quantitative 24HR and a food composition table

A simplified 24-hour recall can still be useful when the goal is to assess food group consumption rather than nutrient intake. In this case, quantities may or may not be collected. If quantities are included, researchers can estimate the amount of specific food groups consumed (e.g., grams of fruits and vegetables), even without calculating nutrient content. If quantities are not collected, the recall can still provide information on the frequency of consumption of specific food groups, which may be sufficient for certain indicators or for monitoring. This approach is useful when nutrient analysis is not needed but understanding dietary patterns or food group intake is still important.

Minimum Dietary Diversity for Infants and Young Children (MDD-IYC)	The Minimum Dietary Diversity for Infants and Young Children (MDD-IYC) was developed to assess dietary diversity in children aged 6–23 months (WHO/UNICEF 2021). While the original MDD-IYC indicator is validated for this age group, recent research has explored adaptations and proxy indicators for older children and adolescents in LMICs (Diop et al 2025).
Minimum Dietary Diversity for Women (MDD-W)	Similarly, the Minimum Dietary Diversity for Women (MDD-W), based on consumption from at least 5 out of 10 defined food groups (FGS-10), is a validated indicator of better micronutrient intake for adult women (15-49 years) in LMICs (FAO/FHI 2016). MDD-W has also been used in some settings with adult men (Gomez et al 2024) and shown to be a useful proxy for micronutrient adequacy. These indicators are commonly used to evaluate the impact of interventions aimed at improving diet diversity and quality.
Proportion of [population group] that consumed [food group/s]	Researchers may also gain insight from estimating intake of individual food groups. A binary indicator can be generated to measure consumption of a particular food group (yes/no) in an individual's diet. At the population-level, this can estimate the proportion of the population that consumes the food group.

Pros

- The 24HR has higher accuracy than the Food Frequency questionnaires (FFQs) and a lower respondent burden than the observed weighed food record (OWFR) (Bailey 2022, Hemsworth 2018). Like the OWFR, the 24HR can account for foods consumed together that may inhibit or enhance micronutrient absorption. Also, like the OWFR, it can capture local foods, place of purchase, and inform on consumption of both fresh and processed/ultra-processed and convenient foods. The data can provide granular data on unhealthy food consumption patterns, which is important in urban areas given the rapid rises in availability, access, and consumption of such foods. The 24HR has been used widely in large surveys in LMICs, does not require literacy from respondents (if administered by an enumerator, which is typically the case in LMICs). The 24HR is good at identifying nutrient inadequacies at population level but is not designed to assess dietary patterns or habits over time, unless multiple 24HR on the same sample can be collected.

Cons

- Quantitative 24HRs are not well suited for diet quality monitoring at scale in low- and middle-income countries. The reasons are that they are costly requiring significant enumerator training and supervision, and time for data collection, analysis, and synthesis. Moreover, a single recall does not provide a comprehensive picture (e.g., usual intake) of an individual's diet, but it can characterize population-level dietary intake. Population-level distribution of usual intake can also be generated by conducting the 24HR on an additional day for a sub-sample of the population. Two or more 24HRs are needed to model usual intake distributions. A second recall in 20–30% of the sample is typically recommended to balance accuracy and feasibility (Saravia 2022).

- In populations where mobility is high, like in urban areas, it may be challenging to schedule return visits for a repeat 24HR. Mobile-based recalls may be a useful option for these types of populations and could be administered by an enumerator or self-administered (if level of literacy is sufficiently high in the targeted population). Self-administered mobile apps for 24HRs often have limited tools for estimating portion sizes, relying on simplified images or preset options, which can reduce the accuracy of dietary data compared to enumerator-led recalls.

- Another challenge in urban settings is the common practice of consumption of unhealthy, ultra-processed foods (UPFs), and of eating out at restaurants or fast-food outlets or purchasing from street food vendors. These consumption patterns complicate the collection of data on ingredients and portion sizes. Moreover, staple foods in urban areas are more likely to be industrially processed and fortified, adding another layer of complexity to nutrient profiling. Databases must include these types of urban foods such as convenience foods, snacks, and fortified foods. However, in low-income countries, updating food composition databases to reflect urban diets is particularly challenging due to the dominance of informal food vendors, limited laboratory and technical capacity, weak nutrition labeling regulations, and scarce resources. Rapid urbanization and the influx of UPFs and fortified foods, often without standardized or transparent ingredient information, further complicate efforts to collect accurate, updated nutrient data.

Tool and indicator validation

To ensure these indicators are reliable and meaningful, validation studies have been conducted across diverse settings and populations.

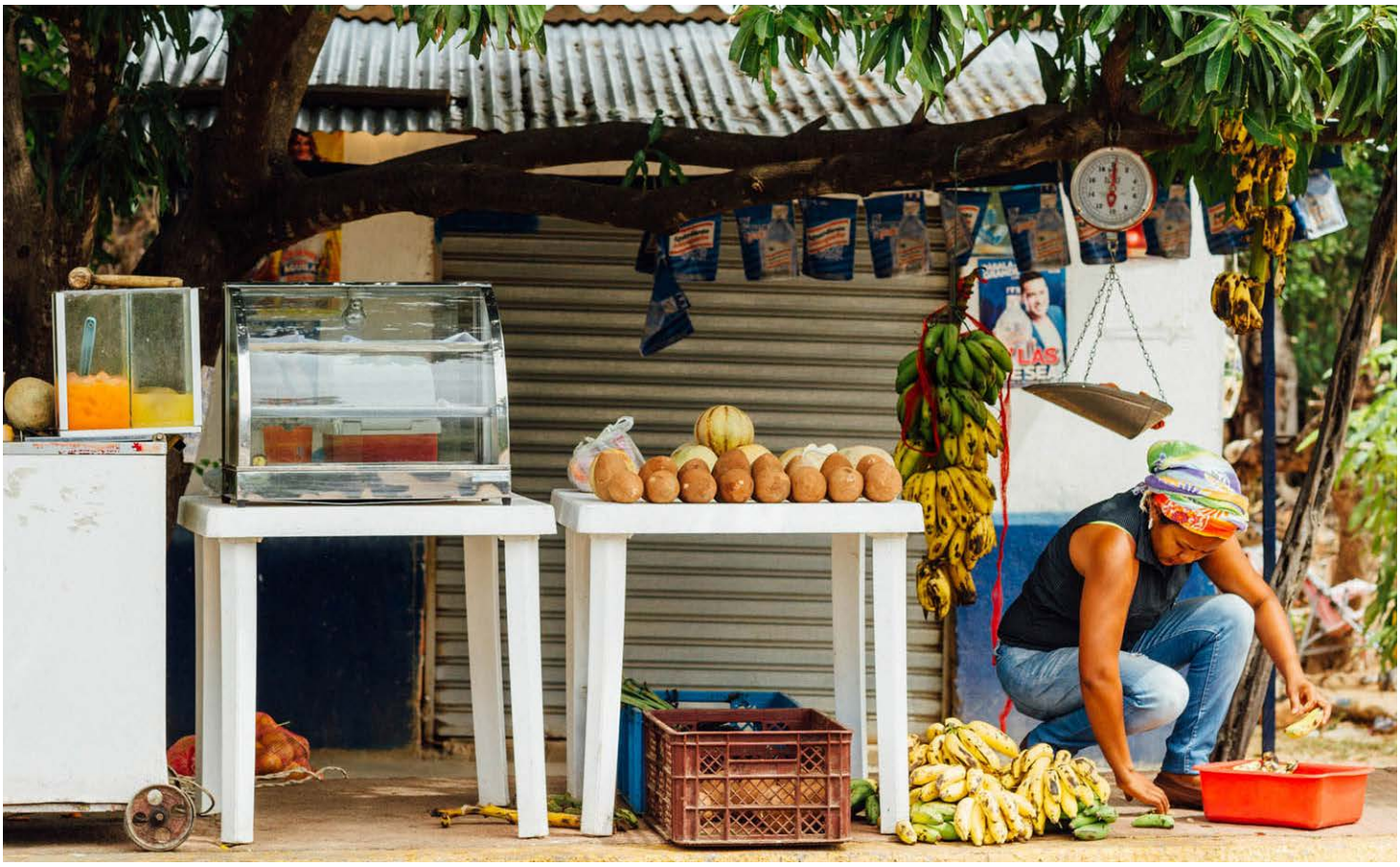
Validation is essential in determining the suitability of a dietary assessment instrument, focusing on its validity, misreporting and measurement errors. Validity assesses how accurately the instrument reflects actual intake, usually in comparison with other methods. Misreporting, influenced by factors like social desirability or memory limitations, can impact accuracy. Measurement errors, either systematic (bias) or random, affect the reliability of findings. Every dietary assessment method has its own set of potential biases and errors – no method is perfect.

24HRs can underestimate energy intake, especially among overweight individuals in urban areas, but repeat recalls improve accuracy (Nightingale 2016). Validation should cover diverse populations, age groups, and data collection modes, including paper questionnaires, CAPI, phone interviews, and online tools. Phone-based 24HRs offer valid alternatives to in-person interviews (Galasso 1994), as do web-based tools for macro- and micronutrient assessments (Timon 2016). Despite some underreporting, 24HRs reliably assess group-level dietary intake.

LMIC children and adolescents, single 24HRs tend to underestimate intake, especially in younger ages, but accuracy improves with age and adaptation. In Burkina Faso, results were acceptable for ages 12–14 (Arsenault 2020). The INDDEX24 mobile tool showed feasibility and reasonable accuracy in Malawi's low-literacy settings. Studies in Kenya and Bangladesh stress the importance of age-appropriate tools, trained interviewers, and repeat recalls to enhance accuracy.

Among LMIC adults, two 24HRs outperform 7-day diaries and moderately correlate with weighed records, underestimating intake by 6–12%. Examples include Ghanaian adolescents (8–12% underestimation) (Gibson 2020), Ethiopian women (~10%) (Alemayehu et al. 2011), and rural Kenyan women (6%) (Gewa et al. 2008). These findings affirm 24HR's practicality and validity in LMIC settings when combined with proper protocols and repeated measures.

Find more info on how to conduct a 24HR in LMIC settings



Lower-resource adaptations

In settings with limited resources, adaptations to the GDQS tool and data collection methods can help maintain data quality while reducing costs and logistical burdens.

- Different methods of 24HR application entail different amounts of time and participant and/or enumerator burden. These methods include paper and pen interviews (PAPI), which can be administered face-to-face (FTF), via app (e.g., INDDEX24), or by phone. Respondents do not have to be literate if responding to an interview (i.e., they do not have to list or write their own responses) when an enumerator administers a 24HR to a respondent, which is a reason they are popular in LMIC settings (whether FTF, app, or phone (Gibson 2017).

- The 24HR can also be self-administered via web platforms or mobile apps, offering a cost-effective way to collect dietary data in urban LMICs and via mobile applications (e.g., Intake24). These tools have potential to simplify data collection in urban LMICs and can lower staffing costs. These tools are especially useful for reaching mobile populations, such as informal workers or residents of informal settlements, by enabling on-demand reporting, push notifications, geotagging, and offline data entry. However, they require users to be literate, and in some cases, computer literate with access to digital devices. While self-administered apps can improve recall by allowing real-time logging, they often offer limited options for portion size estimation, which may reduce data accuracy compared to enumerator-led methods

Higher-resource adaptations

Conversely, in high-resource contexts, expanded data collection and broader geographic coverage can enhance the depth and utility of GDQS findings.

- Expanding geographic scope - such as adding rural or peri-urban population groups for comparison. Expanding geographic scope would require increasing the sample of households to ensure representativity of each additional geographic group to allow assessing differences between location (see sampling considerations).

- Increasing number of recalls per respondent to reflect usual intake - to collect per respondent. Repeat recalls are needed (ideally on nonconsecutive days) to reflect usual; these can be done either by FTF or by phone.

- Complement the 24HR dietary with a food frequency questionnaire (FFQ) on a subsample, to improve the assessment of usual intake for foods and food groups that are less frequently consumed (or consumed when in season). However, the FFQ must be validated, which is a significant amount of additional work.

- Adapt portion size tools and food composition tables (FCTs) to be culturally appropriate and specific to urban foods commonly consumed in the setting of interest. Use standardized dietary scales to assess quantity accuracy and ensure and make sure measurement error is acceptable. Acceptable measurement error in dietary assessment depends on minimizing bias, keeping deviations from true intake to under ten percent, and achieving strong agreement with reference methods.

- Visiting households prior to day of interview (24HR) to ensure the interviewee is present and available on the scheduled day. Enumerators can visit households at least 3 days prior to the first 24HR recall to sensitize and prepare respondent for the visit. In contexts where people eat from a shared plate, this visit entails distributing cups, bowls, and plates so that people can use them to better estimate their food consumption on the recall day. Asking someone to change how they usually eat might affect their diet, but this trade-off can be worth it if it helps us to more accurately estimate how much food they would normally eat from a shared plate.

Sampling and data collection considerations

- **The sampling approach depends on the user's question of interest and target population**, but it is crucial to ensure that the study sample is representative of the target population. The two primary sampling approaches are probability and non-probability sampling. There are several methods of probability sampling, including:

  - simple random sampling, where any member of the target population has an equal chance of being selected into the study.

  - interval sampling, in which people of the targeted group are continually available and selected into a sample (i.e., consumers in a market).

  - stratified sampling, which divides the target population into groups for sampling, and/or

  - cluster sampling which uses groupings from which the sample population is selected.

- **In urban settings, administrative boundaries and enumeration areas can help organize sampling.** In many countries, lists of enumeration areas can be acquired, after which a sample frame or list of households or targeted individuals from each of those areas is developed to draw the sample of households or individuals. Correcting for over- or under sampling through sample weighting is essential to improve data accuracy. If the question of interest is to assess changes at population-level in dietary quality due to a program or policy, it is critical that the sampling frame include populations that have been exposed to those interventions. Non-probability sampling methods, such as convenience and snowball sampling, can be used when ease of access is prioritized.

- **Careful conceptualization of the relationship between food environments and diets helps guide geographic focus and sampling strategy**, ensuring more meaningful and representative results. For example, if your research question involves comparing diets across diverse levels of urbanization, you might sample households from urban, peri-urban, and rural areas. Alternatively, if you are interested in how distinct types of food environments influence diets, you could stratify your sample based on dominant food environment characteristics (e.g., areas with high density of informal vendors vs. areas with supermarkets or fast-food outlets). The choice between geographic or food environment-based sampling depends on the specific objectives of your study.

- **A sufficient sample size is essential when using the 24-hour dietary recall (24HR) method to account for usual intake and day-to-day dietary variability**. A general rule of thumb is to include at least 200 participants, but this should be increased to 500 or more to account for design effects, non-response, and attrition—especially in urban areas, where busy schedules and high population mobility can lead to greater dropout rates. Oversampling may be necessary to ensure adequate data quality and representation. To estimate usual intake, a second recall on a non-consecutive day is typically conducted for a subsample of participants. This subsample should include at least 50–100 individuals, depending on the study design and statistical power required. In household-based sampling, the second recall is often conducted with a random subset of those who completed the first recall. Repeated recalls improve the precision and reliability of intake estimates, but there is no single "optimal" sample size. There are several ways to increase the number of repeated measures: increase the number of individuals who receive a second recall, increase the number of recalls per person (e.g., 2–3 recalls per participant), or combine both strategies to strengthen the estimation of usual intake. The optimal number of repeated recalls depends on the nutrients of interest, population variability, and available resources. For example, nutrients with high day-to-day variation (like vitamin A or iron) may require more repeated measures to accurately estimate usual intake.

Other data sources

When primary data collection is not feasible, alternative data sources can complement or substitute GDQS-based assessments, though each comes with its own trade-offs.

While it is ideal to collect primary data, real world limitations to data collection in urban settings may prevent this, including on the implementing side (e.g., budget/resource constraints) and in the field (e.g., difficulty in accessing populations, conflict-affected settings). It may be helpful to examine secondary data sources, either as background to inform primary data collection or in place of it, if data collection is not feasible.

Data Sources	Pros	Cons	Indicators
Household consumption and expenditure surveys (HCES) [Household-level consumption]	Low cost, nationally -representative -Conducted regularly (every 3-5 years) with a large sample -Contains other variables such as data on socioeconomic status, education, and other determinants relevant to nutrition -often also includes acquisition data (food acquired from purchases, production, in-kind)	-Need nutrition and data analysis expertise -Modules are heterogenous across countries, making comparisons challenging -Does not differentiate between subgroups to estimate differences in probability of deficiencies in high-risk groups -Household level (no individual dietary data), does not address intra-household allocation issues that may affect household members -May have issues with accurately recording food consumed away from home (FAFH) which are very important in urban settings (e.g., street foods, meals consumed at school)	-Diet diversity (Household diet diversity score) -Food consumption (Food consumption score) -Nutrient availability: macronutrient and micronutrient availability per capita per day (micronutrient availability requires use of FCT), per capita energy intake. -Consumption patterns (frequency or shares of animal-sourced foods, staple foods, ultra-processed foods)
Global Dietary Database [Individual-level diets]	-Harmonized data (variables, units, food definitions) for individual-level dietary data from nutrition surveys for 188 countries	-Need nutrition and data analysis expertise -Surveys use different designs and tools -Certain food categories excluded (e.g., poultry, dairy-based desserts, highly processed or packaged foods, mixed dishes and recipes, condiments and spice, supplements)	-Includes 51 dietary factors including 14 foods, 7 beverages, 12 macronutrients, and 18 micronutrients
GIFT Database (FAO) [Individual-level dietary diversity]	-Data are disaggregated by sex and age. -Individual quantitative food consumption data coded with the FoodEx2 classification system, data are screened and formatted using R -dashboards presenting indicators and summary statistics on foods and diets -Can link food groupings to own dietary data (dataset available upon request)	-Need nutrition and data analysis expertise, particularly as outliers and missing data not removed from original datasets and energy and nutrient values are provided directly from surveys (does not link food consumption datasets to food composition data) -Data not available for some countries -Many datasets are old and often not nationally representative -No data on statistical weights	-Statistics on food consumption can be calculated for individual food items or using the nutrition-sensitive food groups (e.g., sources of micro- and macronutrients in the diet, macronutrient contribution to total intake) -Estimated usual intakes of selected nutrients (with SPADE tool) -MDD-W (and Food group diversity score, individual food group consumption) -Food consumption (daily diet g/per person per day, proportion of food groups consumed (%), calories per person per day) -other indicators for food safety (dietary exposure to chemicals) and environmental impacts of food consumption (emission, water, and land use)

Data Sources	Pros	Cons	Indicators
Demographic and Health Surveys	-Nationally representative data on dietary diversity	-Need nutrition and data analysis expertise -Alternatively, the DHS StatCompiler and mobile app allows for automatic indicator calculation and disaggregation	MDD-W -IYCF practices (MAD, MDD, MMF) -Percentage consuming food group (PLW, WRA)
Gallup World Poll (GWP) (Global Diet Quality Project)	-Global coverage and standardization (140 countries, including those that lack nutrition surveillance data) -Integration with economic, social and health indicators -Frequent updates (every 5 years) -Samples adults aged 15+ (not just women)	-Other national surveys tend to align more closely with DHS than GWP. -GWP often collects data in lean seasons, potentially underestimating MDD-W compared to DHS. -Validating MDD-W for males aged 15–49 could expand GWP's utility. -Greater variability in GWP estimates than DHS.	MDD-W, DDS -All-5, protective, and unhealthy food consumption -Healthy diet pattern for NCD prevention -Zero fruit or vegetable consumption -Consumption (yes/no) of food groups included in the DQQ

Illustrative research using these tools and indicators in urban settings

- Changes in children's and adolescents' dietary intake after the implementation of Chile's law of food labeling, advertising, and sales in schools: A longitudinal study. (Fretes, 2023)
- Perception of affordable diet is associated with pre-school children's diet diversity in Addis Ababa, Ethiopia: the EAT Addis survey. (Abdelmenan, 2024)
- Market food environments and child nutrition (Huelsen, 2024).

24HR and Dietary Assessment-related resources

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