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

# DIET ASSESSMENT

# Observed Weighed Food Record (OWFR)

## Overview

An observed weighed food record (OWFR) is an individual prospective quantitative dietary assessment method with high accuracy in assessing food and nutrient intake. An OWFR is typically conducted over a 3-day or a 7-day period, although the longer observation period is rarely used because it is too resource-intensive. Repeating the OWFR can improve accuracy and reliability and help capture daily variation in diets (e.g., twice over several weeks). All foods and beverages are weighed by an enumerator while they are being consumed. The prepared meals are described, including ingredients, ingredient weights, preparation or cooking methods, food names or brands. Any waste or leftover food after the meal is eaten is also recorded. OWFR are highly precise and can be used to correlate intake with biomarkers, but still tend to underestimate intake, particularly energy and sodium relative to Doubly labeled water (DLW), which is the best reference for validating energy intake. A variation on the OWFR is the WFR, where individuals are asked to note and weigh their food and write a diary to allow for longer-term accurate estimates. We focus here on OWFR as they are most appropriate for settings in low and middle-income countries, however, participant-led WFR are also an option when circumstances allow. OWFR and WFR are often used to compare with or to validate other methods of dietary assessment but have their own set of biases.

## Rationale

The OWFR is a high-accuracy method, as it does not rely on recall (enumerator observes and weighs actual intake). The WFR is particularly well-suited for clinical settings, for examining diet-disease relationships, and for populations where portion sizes are difficult to estimate (i.e., young infants). WFR is often used in laboratory settings which allows for greater control of assessment parameters and is typically used for smaller samples (less than 1,000 participants) due to the burdensome nature of administration on respondents and enumerators.

# Type of data

The WFR collects weighed portion size of individual food intake of individual food consumption and nutrient intake.

# Indicators

Recommended indicators depend on the objectives of your study, and which aspects of dietary assessment are of interest (i.e., nutrient adequacy, dietary diversity, moderation). The intake and/or adequacy of specific nutrients or micronutrients, which requires the use of a food composition table (FCT), allows the computation of mean adequacy ratio (MAR) or the calculation of distributions of nutrients of interest or a suite of multiple other indicators that may provide useful information. All the indicators that can be generated from the use of 24HR can be generated from the OWFR with the same conditions (e.g., repeat recall for usual intake).

Indicators that don't require a food composition table—such as MDD-W or GDQS—can be calculated using OWFR and may be more accurate than list-based or open 24HR methods (Hanley-Cook et al 2020, 2024). While we don't recommend MDD-W in this context, as our guidance prioritizes indicators most fit for the research question (per the decision tree), it can still be easily generated if you already have OWFR data.

## Pros

- High accuracy for individual food and nutrient intake compared to recall-based dietary methods, including food preparation and how preparation could impact nutrient content, and can be used for diverse groups.
- OWFR are often used as a reference method for actual dietary intake, such as examining the percentage difference between what the OWFR measures and comparing reproducibility across other methods of dietary assessment (i.e., differences in energy, micro- or macro-nutrient intakes).

## Cons

- The method is time-consuming, costly, and complex, and requires researchers to carry out data entry and standardization. It also is the method that entails the largest respondent burden of all dietary assessment methods and requires a caregiver to report for younger age groups (infancy, toddlers, young children).
- The OWFR requires careful and detailed training for enumerators to ensure reduced measurement errors. Infrequently consumed foods may be missing due to the short observation period, and it is difficult to weigh foods consumed away from home which is a common phenomenon in urban settings.
- Participants may change their eating habits because they are being watched, for example, and are more inclined to avoid foods that they recognize as being unhealthy. In settings with low literacy an enumerator must accompany the respondent continually, which is challenging for individuals who work outside the home.
- The WFR is precise for period of data collection but may not reflect habitual intake or longer-term dietary patterns.

**Note:** if you plan for a repeat observation in a subsample (minimum is 15% of the sample, providing it is at least 50 people), you can then calculate usual intakes of nutrients at population level or correlate intakes with a disease or biomarker dependent variable. Repeat OWFR observations can be done in three ways: by having a subsample complete a second full 3– 7-day sequence to capture seasonal or long-term variation, by adding one extra day to the standard sequence to estimate within-person variability, or by repeating a single-day observation on non-consecutive days for validation purposes. Each approach varies in burden and statistical power, depending on the study's goals.

# 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.

OWFR are often used as a reference method for actual dietary intake against other methods like the 24HR and the FFQ, such as examining the percentage difference between what the OWFR measures and to compare reproducibility across other methods of dietary assessment (i.e., differences in energy, micro- or macro-nutrient intakes). However, validity of OWFR may be lower among adolescents because they often forget to report foods, change their eating when being observed, or eat in ways that are harder to track, like snacking or eating away from home (Bokhof et al 2010; Livingstone et al 1992).

## 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.*

- Use a small sample or a sub-sample: OWFR are typically used for small samples due to high participant and researcher time burdens. However, caution must be taken to ensure that the sample is representative of the population studied and to make sure there is enough power to get the precision needed for the objective.
- Conduct OWFR in a study subset and then collect dietary data from the full population using a less resource-intensive method (e.g., 24HR or FFQ). This approach balances accuracy with feasibility, especially in LMIC settings where large-scale OWFR is typically not practical; the OWFR data can then be used to adjust or model intake estimates from the full sample to improve the overall accuracy of dietary intake estimates across the population.
- Self-administered OWFR can be used in literate populations, but can lead to underreporting, especially for unhealthy foods, due to factors such as reactivity, social desirability, or fatigue.
- Some non-FTF dietary record tools can utilize images or portion size estimation visual tools or AI-assisted approaches to increase accuracy and improve recall [4, 5] especially among populations who otherwise might have higher inaccuracies such as adolescents, who often struggle with attention, motivation, and accurate reporting [6]. Specific language learning models (LLM) such as ChatGPT require development to ensure accuracy in dietary assessment [7].
- Alternatively, one could use the 24HR recall which is less costly and easier to administer (see UFED Kit on 24HR for more information). However, the 24HR requires more resources for portion-size calculation.

## Higher-resource adaptations

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

- Increase the duration of data collection (e.g., to capture habitual or seasonal dietary patterns over a longer period).
- Expand geographic scope beyond a small urban sample - such as adding a rural or peri urban population group for comparison, or a different type of urban population.

# Sampling and data collection considerations

Regardless of resource level, thoughtful sampling and data collection strategies are essential to ensure representativeness and relevance of OWFR data.

The sampling approach depends on the user's question of interest and target population, but it is crucial to ensure a study's 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), and 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 are developed, from which households or individuals are sampled. 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 question of interest is to compare between areas of differing levels of urbanization, the geographic frame could include urban, peri-urban, and rural areas, and a sampling strategy would need to select a representative sample of households and individuals.

OWFR are often used in clinical settings, and due to their high resource requirements, tend to use small samples that may have limited external validity (e.g., are not applicable beyond the specific setting or to a broader, more representative population). Other issues with OWFR samples are that they rarely cover other household members who may normally share meals, and participants may change their behavior because they know they are being observed (e.g., Hawthorne effects). In addition, like a 24HR recall, the limited period of observation typically does not represent the actual variability of day-to-day diets. One option is to conduct a repeated OWFR over 24 hours on a non-consecutive day, which requires a subsample of at least 50 observations (FAO 2021). Selecting a sample for OWFR involves similar steps as any sampling approach, such as defining the target population of interest, setting inclusion and exclusion criteria, and determining sample size, to ensure sufficient size to detect meaningful differences in dietary 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.

While the OWFR is a gold standard for collecting dietary data, real world financial, resource, capacity, and time constraints may restrict the use of the method in urban settings 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 |
|---|---|---|---|
| Global Dietary Database<br>[Individual-level] | -Most are nationally representative<br>-Urban/rural residence included in half of surveys<br>-Harmonized data (variables, units, food definitions) for individual-level dietary data from nutrition surveys for 188 countries | -Requires nutrition and data analysis expertise<br>-Surveys use different designs and tools<br>-Certain food categories are excluded (e.g., poultry, dairy-based desserts, highly processed or packaged foods, mixed dishes and recipes, condiments and spice, supplements) | -Includes 51 dietary factors based on public health and chronic disease risk (e.g., foods, beverages, nutrients, dietary patterns, or qualities) |
| GIFT Database (FAO)<br>[Individual-level] | -Data are disaggregated by sex and age but inconsistent urban/rural disaggregation<br>-Individual quantitative food consumption data coded with the FoodEx2 European standardized food classification system to code foods for dietary and exposure assessments, data are screened and formatted using R<br>-Dashboards presenting indicators and summary statistics on foods and diets<br>-Can link food groupings to own dietary data (dataset available upon request) | -Need nutrition and data analysis expertise, particularly as outliers and missing data have not been removed from original datasets and energy and nutrient values are provided directly from surveys (does not link food consumption datasets to food composition data)\<br>-Many datasets are old, most not nationally representative and there are no data on statistical weights<br>-Data covers only 36 countries (Africa: Benin, Burkina Faso, Cameroon, Ghana, Kenya, Malawi, Mali, Mozambique, Nigeria, Senegal, South Africa, Tanzania, Uganda; Asia: Bangladesh, Cambodia, China, India, Indonesia, Lao PDR, Nepal, Philippines, Thailand, Vietnam; Latin America: Brazil, Guatemala, Haiti, Mexico, Saint Kitts and Nevis; Europe: Albania, Armenia, Georgia, Moldova, Ukraine; Middle East/North Africa: Egypt, Lebanon, Morocco, Tunisia; Oceania: Fiji) | -Estimated usual intakes of selected nutrients (with SPADE tool)<br>-MDD-W (and Food group diversity score, individual food group consumption)<br>-Food consumption (daily diet g/per person per day, proportion of food groups consumed (%), calories per person per day)<br>-Other indicators for food safety (dietary exposure to chemicals) and environmental impacts of food consumption (emission, water, and land use)<br>-Statistics on food consumption can be calculated for individual food items or using food groups (e.g., sources of micro- and macronutrients in the diet, macronutrient contribution to total intake) |
| Demographic and Health Surveys<br>[Individual-level] | -Nationally representative data on dietary diversity<br>-Urban/rural disaggregation | -Need nutrition and data analysis expertise<br>-Alternatively, the DHS StatCompiler and mobile app allows for automatic indicator calculation and disaggregation | -MDD-W<br>-IYCF practices (MAD, MDD, MMF)<br>-Percentage consuming ten food groups[1] (PLW, WRA) |
| Gallup World Poll (GWP)<br>(Global Diet Quality Project) | -Global coverage and standardization (140 countries, including those that lack nutrition surveillance data)<br>-Integration with economic, social and health indicators<br>-Frequent updates (every 5 years)<br>-Samples adults aged 15+ (not just women) | -Other national surveys tend to align more closely with DHS than GWP.<br>-GWP often collects data in lean seasons, potentially underestimating MDD-W compared to DHS.<br>-Validating MDD-W for males aged 15–49 could expand GWP's utility.<br>-Greater variability in GWP estimates than DHS. | -MDD-W, DDS<br>-All-5, protective, and unhealthy food consumption<br>-Healthy diet pattern for NCD prevention<br>-Zero fruit or vegetable consumption<br>-Food groups |

[1] The food groups used in the DHS include grains, white roots and tubers, and plantains; pulses such as beans, peas, and lentils; nuts and seeds; dairy products; meat, poultry, and fish; eggs; dark green leafy vegetables; other vitamin A-rich fruits and vegetables; other vegetables; and other fruits.

| Data Sources | Pros | Cons | Indicators |
|---|---|---|---|
| Household consumption and expenditure surveys (HCES)<br>[Household-level food consumption] | -Implemented at scale often with national representativeness, but made financially viable through public and donor subsidies<br>-Conducted some countries (every 3-5 years) with a large sample<br>-Urban/rural disaggregation<br>-Contains other variables such as data on socioeconomic status, education, and other determinants relevant to nutrition<br>-Often also includes acquisition data (food acquired from purchases, production, in-kind) | -Household level food consumption, does not address intra-household allocation issues that may affect household members – not ideal source of dietary data.<br>-Modules are heterogenous across countries, making comparisons challenging<br>-Does not differentiate between subgroups to estimate differences in probability of deficiencies in high-risk groups<br>-Often lacks information on types of foods consumed away from home (FAFH); the information on cost of meal consumed outside the home may be available, but not the type of foods/meals. This is a problem especially in urban settings where working HH members or school-age children often eat one or more meals outside the home. | -Food variety (Household diet diversity score)<br>-Food consumption (Food consumption score)<br>-Nutrient availability: macronutrient and micronutrient availability per capita per day (micronutrient availability requires use of FCT), per capita energy intake.<br>-Consumption patterns (frequency or shares of animal-sourced foods, staple foods, ultra-processed foods), however, recall periods are variable (some foods reported over a week, others a month) |

# Illustrative research using these tools and indicators in urban settings

- Beyond price and income: Preferences and food values in peri-urban Viet Nam (Bell 2021)
- Urban-rural difference in the determinants of dietary and energy intake patterns: A case study in West Java, Indonesia (Kosaka 2018)
- Policy Implications of Using a Household Consumption and Expenditures Survey versus an Observed-Weighed Food Record Survey to Design a Food Fortification Program (Lividini 2013)

## WFR and Dietary Assessment-Related Resources

Data4Diets: Building Blocks for Diet-related Food Security Analysis, Version 2.0. (2023). Tufts University, Boston, MA. https://index.nutrition.tufts.edu/data4diets.

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Smith, L., Dupriez, O and Nathalie Troubat. "Assessment of the reliability and relevance of the food data collected in national household consumption and expenditure surveys." *International Household Survey Network* 82 (2014).