**Diet quality indices**

The use of diet quality indices is increasing worldwide in various populations. Several diet quality scores reflect a common dietary pattern characterised by high intakes of plant-based foods such as whole grains, and moderate intakes of alcohol, and low intakes of red and processed meat, sweetened beverages andtrans-fatty acids [1]. Various scores and indices are available to assess overall diet quality in population-based or interventional studies. These scores measure either adherence to certain dietary patterns, such as the Mediterranean diet (MedDiet) or the Dietary Approach to Stop Hypertension (DASH), or to country-specific dietary guidelines, such as Healthy Eating Indices (HEI). Dietary patterns and diet quality indices have also been associated with the risk of various diseases, including the metabolic syndrome (MetS), cardiovascular diseases (CVD), stroke or type 2 diabetes [2]. Several investigators in the field of nutrition epidemiology have identified various dietary patterns, including the Mediterranean, the Asian, the Western and the prudent diets, each of which has been shown to have differing effects on human health. For each of the various patterns, suggested portion sizes and the number of servings from each food group to be consumed on a daily, weekly or monthly basis are given [3]. Here, we compiled relevant indices and scores that reflect the diet quality of households, adults, and children living in low- and middle-income countries (Table).

**Table: List of relevant diet quality indicators**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Type of index or score** | **Target group** | **Advantages** | **Disadvantages** | **Construction** | **Assessment instrument** |
| **Diet Quality Index-International (DQI-I)**  Consists of overall variety and variety within protein sources, adequacy of dietary items that need to be supplied sufficiently, moderation for foods and nutrients that should be consumed in limited amounts, and balance for the proportionality in energy sources and fatty acid composition [4]. | Adults | 1. Considers the multidimensional nature of diets.  2. Focuses on concerns related not only to chronic diseases but also to problems of undernutrition.  3. Incorporates both nutrient and food perspectives of the diet in the assessment. | 1. Based on a very strict set of standards, mainly for fat intake  2. Complicated to construct  3. Requires translation of food intake date into nutrient intakes | Variety: 0–20 points  Adequacy: 0–40 points  Moderation: 0–30 points  Overall balance: 0–10 points  DQI-I sum score: 0 – 100 points (0 being the lowest quality) [4]. | 24-hour recall  Food Frequency Questionnaire |
| **Global Diet Quality Score (GDQS)**  1. A simple, standardized metric appropriate for population-based measurement of diet quality globally [5, 6]. | Adults | 1. Captures nutrient adequacy and diet-related risk for NCDs.  2. Uses only food groups.  2. Easy to administer among low-literacy populations in LMICs. | 1. Does not score high consumption of red meat and high fat dairy. | - 25 food groups  - 16 healthy, 7 unhealthy, 2 classified as unhealthy when consumed in excessive amount.  - sum score across all 25 food groups (0 to 49 points). | Diet  Quality Questionnaire  Food Frequency Questionnaire  24-hour dietary recall |
| **Dietary Diversity Score (DDS)**  sum of a number of food groups consumed over a reference period (mostly one week) [7] | Children and adults | 1. Approximates nutrient adequacy.  2. A measure of individual dietary intake. | Only intake frequency of foods considered, not quantitative. | 9 food groups:  0, not consumed per week  1, consumed at least once per week (0-9 points) | Household consumption and expenditure surveys (HCES)  24-hours food recall |
| **Household DDS (HDDS)**  1. Measures household access to food. 2. Proxy measure of the socio-economic level of household [8]. | Households, incl. adults and children | 1. Reflects the economic ability of a household to consume a variety of foods.  2. Considered as a good proxy measures of household energy availability.  3.Measures nutritional adequacy | Only intake frequency of foods considered, not quantitative. | 12 food groups:  0, not consumed per week  1, consumed at least once per week (0-12 points) | Food consumption recall  Household Dietary Diversity Questionnaire |
| **Women’s Dietary Diversity Score (WDDS)**  Reflects the probability of micronutrient adequacy of the diet [9]. | Women | 1. Approximates micronutrient adequacy of diets for women of reproductive age. 2. Validated for adequacy | 1. Put more emphasis on micronutrient intake than on economic access to food. | 10 food groups:  0, not consumed per week  1, consumed at least once per week (0-12 points)  5 out of the ten should be covered to avoid micronutrient deficiency | 24-hours recall |
| **Food Variety Score (FVS)**  Defined as the number of food items consumed over a 24h period, from a possible total of food items, diversity within food groups [10]. | Children and adults | Approximates nutritional adequacy | Only intake frequency of foods considered, not quantitative. | Sum of all consumed food items per 24h [10]. | Food Frequency Questionnaire  24-hours recall |
| **Dietary Inflammatory Index (DII)**  1. Examines the relationship between various dietary constituents and inflammation [11]. | Adults | Useful tool that helps individuals choose more anti-inflammatory foods and meals. |  | Anti-inflammatory foods, standardized to 4184 KJ (1000 kilocalories) (−9 to 9 points) | 24-hours recall  Food Frequency Questionnaire |
| **Sustainable Diet Index (SDI)**  indicators related to healthfulness, environmental impacts, affordability and, socio-cultural aspects. | Adults (and possibly children) | Represents sustainable food dimensions i.e., not limited to health [12] | 1. Difficulties to obtain context-specific data [13]  2. Does not consider all the possibilities of the EAT-Lancet recommendations, such as the minimum and maximum values. | Four equally weighted sub-indices:  1. nutritional sub-index (e.g. DQI-I)  2. environmental sub-index (e.g. CO2-eq, organic)  3.economic sub-index (e.g. income devoted to diet)  4. socio-cultural sub-index (e.g. places of purchase, proportion of ready-made products) | Food Frequency Questionnaire  24-hours recall |
| **Planetary Healthy Diet Index (PHDI)**  Plant-based diet that is healthy and climate-friendly. | Adults | 1. Only based on food groups (simple).  2. Allows the verification of the adherence to the EAT Lancet diet and overall dietary quality [14]. | Has not been validated for the ability to predict death and/or illness. | 23 food groups with quantitative cut-offs, standardized to 2500 kcal/day | Food Frequency Questionnaire |
| **Prime Diet Quality Score (PDQS)**  1. Developed as a response to the need to characterize human diets in a standard way.  2. Based on the principles of simplicity, comprehensiveness, and associations with health outcomes. | Adults | 1. Associated with a lower prevalence cardiovascular risk factor.  2. Provides better pregnancy outcomes in low-income country setting.  3. Promote dietary habits  inversely associated with risk of NCDs | Uses frequency data and does not directly estimate quantities consumed. | Includes 21 food groups:  14 healthy foods and 7 unhealthy foods. Healthy food groups are assigned more points for higher consumption (0 points for 0–1 servings/wk, 1 point for 2–3 servings/wk, and 2 points for 4+ servings/wk). Scoring is reversed for unhealthy groups (more points are given for lower consumption) | 24-hour recall  Food Frequency Questionnaire |
| **Minimum Dietary Diversity (MDD)**  Children (6–23 months) who receive foods from four or more food groups per day [15]. | Children | 1. For the prevention of childhood undernutrition  2. Reflects diet quality and energy intake.  3. Easy to construct. | Coarse indicator of diet quality | 7 food groups: grains, roots and tubers; legumes and nuts; dairy products; flesh foods (meat, fish, poultry and organ meats); eggs; vitamin-A rich fruits and vegetables [16] | Diet Quality Questionnaire (DQ-Q)  24-hour dietary recalls. |
| **Minimum Meal Frequency (MMF)**  Percentage of children 6–23 months of age who consumed solid, semi-solid or soft foods for at least the minimum number of times during the previous day. | Children | 1.Provide a good estimation of energy (quantity) and nutrient intake (quality)  2.Examines the number of times children receives foods other than breast milk |  | **6-8 months**  Breastfed children: Number of solid, semi-solid, or soft foods ≥2 Non-breastfed children: Total of solid, semi-solid, or soft foods AND milk feeds ≥4  **9–23 Months**  Number of solid, semi-solid, or soft foods ≥3 | 24-hour dietary recalls.  WHO standardized questionnaire for infant and young child feeding (IYCF) practices. |
| **Minimum Adequate Diet (MAD)**  Percentage of children 6–23 months of age who consumed a minimum acceptable diet during the previous day | Children | 1.Easy to implement in large surveys  provide a good estimation of energy (quantity) and nutrient intake (quality) |  | **6–8 months**  Breastfed children: Number of food categories ≥4 AND Number of solid, semi-solid, or soft foods ≥2 Non-breastfed children: Number of food categories ≥4, AND Number of milk feeds ≥2, AND Total number of solid, semi-solid, or soft foods AND milk feeds ≥4  **9–23 Months**  Number of food categories ≥4 AND Number of solid, semi-solid, or soft foods ≥3 | 24-hour dietary recalls. |
| **Child Dietary Diversity Score (CDDS)**  Examines seasonal variation in foods and nutrients intakes among children [17]. | Children | 1.Good predictor of quality and nutrient adequacy diet. | Similar to MDD, but on a continuous scale;  policy instrument | Calculated from 24-hour recalls based on seven food groups recommended by WHO. Score ranges from 0 to 7. | Diet Quality Questionnaire (DQ-Q) |
| **Infant and Child Feeding Index (ICFI)**  Index is based on an age-specific scoring system that gives points for positive practices such as breastfeeding, adequate meal frequency, dietary diversity, and avoidance of bottle-feeding [18]. | Children | 1. Measures IYCF (infant and young child feeding) practices in a single composite index.  2. Reflects the nutritional status of the children.  3. Measures the quality of various feeding practices. | Compilation of various data necessary | Scoring based on IYCF practices. Variables used in the indices are as follows: (a) breastfeeding; (b) use of baby bottles in the previous 24 h (yes/no); (c) dietary diversity; and (d) meal frequency. | WHO standardized questionnaire for infant and young child feeding (IYCF) practices |
| **Food Safety Indicators (Irmgard)**  Evaluate the quality of food and water. | Adults | 1. Evaluate restaurant food safety  2.Impact consumer choice of food service establishment. |  | 4 groups of checklists: R1, time and temperature aspects; R2, direct contamination; R3, water conditions and raw material; and R4, indirect contamination. A score adjusted for 100 is calculated for the overall violation score and the violation score for each risk category[19]. | Questionnaire |
| **Nutrient Adequacy Ratio**  The ratio of an individual’s nutrient intake to the current recommended allowance of the nutrient for his or her age and sex. | Children and adults | Evaluate the overall dietary adequacy of individuals and population groups |  | NAR= Daily nutrient intake Recommended amount of nutrient | 24-hour dietary recalls.  Food Frequency Questionnaire |
| **Household Food Insecurity Access Scale (HFIAS)**  Access social and economic access to sufficient, safe and nutritious food that meets dietary needs and food preferences for an active and healthy life [20] | Adults and children | 1.Able to capture three domains: i) anxiety and uncertainty about food access, ii) insufficient quality and iii) insufficient food intake and the physical consequences  2. Provide valid and reliable measure of food security | Failure to capture unequal distribution of food and to guarantee the utilization of food | 9 specific questions for the household during the previous 30d/month.  Standard scoring: 0 if the event described by the question never occurred, 1 point if it occurred 1 or 2 times during the previous 30 d, 2 points if it occurred 3–10 times, and 3 points if it occurred >10 times. Total scores range from 0 to 27. [21] | Household Food Security questionnaire |

**References**

1. Asghari, G., et al., *A systematic review of diet quality indices in relation to obesity.* British Journal of Nutrition, 2017. **117**(8): p. 1055-1065.

2. Harrison, S., P. Couture, and B. Lamarche, *Diet quality, saturated fat and metabolic syndrome.* Nutrients, 2020. **12**(11): p. 3232.

3. Panagiotakos, D., *α‐Priori versus α‐posterior methods in dietary pattern analysis: a review in nutrition epidemiology.* Nutrition bulletin, 2008. **33**(4): p. 311-315.

4. Kim, S., et al., *The Diet Quality Index-International (DQI-I) provides an effective tool for cross-national comparison of diet quality as illustrated by China and the United States.* The Journal of nutrition, 2003. **133**(11): p. 3476-3484.

5. Bromage, S., et al., *Development and validation of a novel food-based Global Diet Quality Score (GDQS).* The Journal of nutrition, 2021. **151**(Supplement\_2): p. 75S-92S.

6. Moursi, M., et al., *There's an app for that: Development of an application to operationalize the Global Diet Quality Score.* The Journal of nutrition, 2021. **151**(Supplement\_2): p. 176S-184S.

7. Savy, M., et al., *Dietary diversity scores and nutritional status of women change during the seasonal food shortage in rural Burkina Faso.* The Journal of nutrition, 2006. **136**(10): p. 2625-2632.

8. Habte, T.Y. and M. Krawinkel, *Dietary diversity score: a measure of nutritional adequacy or an indicator of healthy diet.* J Nutr Health Sci, 2016. **3**(3): p. 303.

9. *Development of a dichotomous indicator for population-level assessment of dietary diversity in women of reproductive age.* Current Developments in Nutrition, 2017. **1**(12): p. cdn. 117.001701.

10. Steyn, N.P., et al., *Food variety and dietary diversity scores in children: are they good indicators of dietary adequacy?* Public health nutrition, 2006. **9**(5): p. 644-650.

11. Wirth, M.D., et al., *Anti-inflammatory Dietary Inflammatory Index scores are associated with healthier scores on other dietary indices.* Nutrition research, 2016. **36**(3): p. 214-219.

12. Seconda, L., et al., *Prospective associations between sustainable dietary pattern assessed with the Sustainable Diet Index (SDI) and risk of cancer and cardiovascular diseases in the French NutriNet-Santé cohort.* European Journal of Epidemiology, 2020. **35**(5): p. 471-481.

13. Seconda, L., et al., *Development and validation of an individual sustainable diet index in the NutriNet-Santé study cohort.* British Journal of Nutrition, 2019. **121**(10): p. 1166-1177.

14. Cacau, L.T. and D.M. Marchioni, *The Planetary Health Diet Index scores proportionally and considers the intermediate values of the EAT-Lancet reference diet.* The American Journal of Clinical Nutrition, 2022. **115**(4): p. 1237-1237.

15. Waswa, L.M., et al., *Community-based educational intervention improved the diversity of complementary diets in western Kenya: results from a randomized controlled trial.* Public health nutrition, 2015. **18**(18): p. 3406-3419.

16. Solomon, D., Z. Aderaw, and T.K. Tegegne, *Minimum dietary diversity and associated factors among children aged 6–23 months in Addis Ababa, Ethiopia.* International journal for equity in health, 2017. **16**(1): p. 1-9.

17. Waswa, L.M., et al., *Seasonal Variations in Dietary Diversity and Nutrient Intakes of Women and Their Children (6–23 Months) in Western Kenya.* Frontiers in Nutrition, 2021. **8**: p. 636872.

18. Chaudhary, S.R., et al., *Infant and young child feeding index and its association with nutritional status: a cross-sectional study of urban slums of Ahmedabad.* Journal of family & community medicine, 2018. **25**(2): p. 88.

19. da CUNHA, D.T., V.V. de ROSSO, and E. Stedefeldt, *Should weights and risk categories be used for inspection scores to evaluate food safety in restaurants?* Journal of food protection, 2016. **79**(3): p. 501-506.

20. Gebreyesus, S.H., et al., *Is the adapted Household Food Insecurity Access Scale (HFIAS) developed internationally to measure food insecurity valid in urban and rural households of Ethiopia?* BMC nutrition, 2015. **1**(1): p. 1-10.

21. Becquey, E., et al., *The household food insecurity access scale and an index-member dietary diversity score contribute valid and complementary information on household food insecurity in an urban West-African setting.* The Journal of nutrition, 2010. **140**(12): p. 2233-2240.