South African Journal of Clinical Nutrition 2024; 37(3):i–ii
https://doi.org/10.1080/16070658.2024.2402646

SAJCN
ISSN 1607-0658 EISSN 2221-1268

EDITORIAL

Estimating portion size in dietary assessment

Mieke Faber*

Non-Communicable Diseases Research Unit, South African Medical Research Council, Tygerberg, South Africa
Department of Dietetics and Nutrition, University of the Western Cape, Bellville, South Africa
Centre of Excellence for Nutrition, North-West University, Potchefstroom, South Africa
**Correspondence: mieke.faber@mrc.ac.za*

Poor diets have a profound impact on global health. In 2019, 7.9 million deaths and 187.7 million disability-adjusted life years (DALYs) were attributable to dietary risk factors.[1] Accurate data on dietary intake are therefore needed to enhance the understanding of the relation between diet and disease, and to develop dietary interventions and policies to improve dietary intake and health. According to Boeing,[2] accurately estimating dietary exposure and modelling the relationship between diet and disease are central to nutritional epidemiology.

Diet is, however, a complex exposure, due to its multidimensional and dynamic nature. Dietary exposure can range from specific nutrients or other food components (e.g. phytochemicals, contaminants, preservatives), to individual foods, food groups, dietary patterns, and overall dietary quality.[3,4] Also, self-reported dietary intake data are subjective and prone to measurement error. Estimating the amount of food consumed is particularly challenging, and misreporting is a significant source of measurement error.[5]

In self-reported dietary assessment, portion size estimation aids are used to improve portion size estimation, but the accuracy thereof depends on the ability of individuals to recall and relate the amount eaten to a portion size estimation aid. Testing portion size estimation aids in the target population before research data collection is of utmost importance, as perceptions of amounts and interpretation of dietary assessment aids differ across populations.[5]

Dietary assessment aids must be culturally appropriate, context specific, and aligned with local dietary practices. For example, population-specific dish-based dietary assessment tools may be useful in populations where mixed dishes are well defined and an integral part of the diet, notable in Asian populations. Dish-based methods focus on entire dishes rather than individual ingredients, thereby reducing participant burden.[6] Another example of culturally appropriate dietary assessment aids is a series of photographs that were developed, based on local eating habits, to determine maize intake in the rural Eastern Cape, South Africa. This included a series of photographs to determine portion size for maize-based dishes, as well as a series of ratio photographs to estimate the amount of maize in mixed maize-based dishes.[7] In Ethiopia, a five-photograph indicator was used to describe the consistency of complementary food.[8]

Commonly used portion-size estimation aids in low-income countries include for example local household utensils, bowls, cups, graduated measuring jugs, tape measures, drawings, modelling clay or playdough, and graduated photographs.[5] In this issue of the journal, Wenhold and MacIntyre[9] describe six sub-studies in which bean bags were used to estimate the volume of amorphous food. Accuracy was assessed for different types of amorphous food, different portion sizes, and different contexts. Each sub-study was preceded by a pilot study to establish feasibility, which is an important but often overlooked step in research. Bean bags are low-cost and easy to make and may potentially contribute towards more accurate and standardised reporting of amorphous foods. Bean bags provide a volumetric measure for amount, which needs to be converted to weight (grams) to enable the data to be linked with the food composition database. For manual conversion, the Food Quantities Manual[10] can be used, as weight (g) per 125 mL edible portion is given for most amorphous foods. When using software such as FoodFinder, volumetric measures can be entered. Guidelines for making bean bags are provided in the Supplementary material.[9] Ideally, other researchers will follow suit and test the accuracy of the bean bags in different contexts and publish their results. Wenhold and MacIntyre[9] did not test whether participants were able to relate an amount of food to bean bags 24 hours after exposure, which would be more representative of the 24-hour dietary recall method.

Diets are evolving and food systems are changing rapidly. To move forwards and generate credible dietary intake data, continued improvements in dietary assessment methodology are needed.[11] In South Africa, collection of dietary intake data is still mostly paper-based, which requires manual data coding and entry. This process is generally error-prone, with a long delay before the results are available.[12] Digital adaptations of these paper-based methods reduce human errors, are more cost-effective in terms of time and human resources, and results can be available much more quickly.[12] Online dietary assessment tools that are linked to a food composition database have the additional benefit that results for an individual can be available in real time. It is important to note that the inherent limitations of self-reported dietary intake data will still be present when using digital tools.[13] Studies therefore need to be carefully designed to allow adjustments for measurement error during data analysis.[11,14]

Accuracy of dietary intake data can be improved by using a combination of short-term and long-term dietary assessment methods,[13,14] and dietary biomarkers.[14] Methods using new technologies should be explored.[14] For example, image-assisted methods have the potential to improve accuracy of portion size estimation,[15] and image-based dietary assessment was found to be useful in specific groups.[16] However, challenges with participants having to take photographs as part of data collection include participants finding it burdensome, low adherence, not remembering to take the photographs, and low-quality images.[16] The feasibility of using image-assisted and image-based methods in large population studies in the near future is low. Practical aspects of these methods need to be researched. To develop and adapt new innovations for dietary

intake assessment will require long-term collaboration between nutrition researchers and the developers of digital and mobile dietary assessment tools.[13]

Nutrition researchers also need to collaborate with statisticians as advanced statistical analyses are needed to capture the multifaceted nature of dietary exposure,[3,4] and for adjustment of measurement error.[14] When interpreting the results, the limitations of self-reported dietary data should be acknowledged.[14] A thorough understanding of nutritional epidemiology and measurement error in dietary assessment is therefore needed.[11] Boeing argues that there is a need for specific training programmes in nutritional epidemiology for young scientists, either as a PhD student or post-doc, because of the increasing complexity of nutritional epidemiological studies.[2]

Despite the limitations of self-reported dietary intake data, measuring dietary exposure is a key aspect of nutritional epidemiology.[2] A concerted effort is therefore needed to ensure accurate dietary intake data. This will require collaboration and affective communication between, among others, nutrition researchers, food composition database compilers, technology developers, and statisticians. Information sharing will further enhance the field of dietary assessment. The use of bean bags for portion size estimation, as reported in the paper by Wenhold and MacIntyre,[9] can, as a whole, contribute to accuracy of dietary intake estimation.

ORCID

Mieke Faber http://orcid.org/0000-0002-8878-254X

References

1. Qiao J, Lin X, Wu Y, et al. Global burden of non-communicable diseases attributable to dietary risks in 1990–2019. *J Hum Nutr Diet*. 2022;35(1):202–213. https://doi.org/10.1111/jhn.12904.
2. Boeing H. Nutritional epidemiology: new perspectives for understanding the diet-disease relationship? *Eur J Clin Nutr*. 2013;67:424–429. https://doi.org/10.1038/ejcn.2013.47.
3. Kirkpatrick SI, Baranowski T, Subar AF, et al. Best practices for conducting and interpreting studies to validate self-report dietary assessment methods. *J Acad Nutr Diet*. 2019;119(11):1801–1816. https://doi.org/10.1016/j.jand.2019.06.010.
4. Sullivan VK, Rebholz CM. Nutritional epidemiology and dietary assessment for patients with kidney disease: a primer. *Am J Kidney Dis*. 2023;81(6):717–727. https://doi.org/10.1053/j.ajkd.2022.11.014
5. Gibson RS, Charrondiere UR, Bell W. Measurement errors in dietary assessment using self-reported 24-hour recalls in low-income countries and strategies for their prevention. *Adv Nutr*. 2017;8(6):980–991. https://doi.org/10.3945/an.117.016980.
6. Shinozaki N, Yuan X, Murakami K, et al. Development, validation and utilisation of dish-based dietary assessment tools: a scoping review. *Public Health Nutr*. 2021;24(2):223–242. https://doi.org/10.1017/S136898002000172X.
7. Lombard M, Steyn N, Burger HM, et al. A food photograph series for identifying portion sizes of culturally specific dishes in rural areas with high incidence of oesophageal cancer. *Nutrients*. 2013;5(8):3118–3130. https://doi.org/10.3390/nu5083118.
8. Faerber EC, Stein AD, Webb Girard A. Portion size and consistency as indicators of complementary food energy intake. *Matern Child Nutr*. 2021;17(2):e13121. https://doi.org/10.1111/mcn.13121
9. Wenhold FAM, MacIntyre UE. Estimation accuracy of bean bags as portion size estimation aids for amorphous foods. *S Afr J Clin Nutr*. 2024;37(3):106–115. https://doi.org/10.1080/16070658.2024.2336290.
10. SAFOODS. *SAMRC food quantities manual for South Africa*. 3rd ed. (ebook). Cape Town: South African Medical Research Council; 2018. http://safoods.mrc.ac.za
11. Satija A, Yu E, Willett WC, et al. Understanding nutritional epidemiology and its role in policy. *Adv Nutr*. 2015;6(1):5–18. https://doi.org/10.3945/an.114.007492.
12. Rogers B, Somé JW, Bakun P, et al. Validation of the INDDEX24 mobile app a pen-and-paper 24-hour dietary recall using the weighed food record as a benchmark in Burkina Faso. *Br J Nutr*. 2022;128(9):1817–1831. https://doi.org/10.1017/S0007114521004700.
13. Das SK, Miki AJ, Blanchard CM, et al. Perspective: opportunities and challenges of technology tools in dietary and activity assessment: bridging stakeholder viewpoints. *Adv Nutr*. 2022;13(1):1–15. https://doi.org/10.1093/advances/nmab103.
14. Subar AF, Freedman LS, Tooze JA, et al. Addressing current criticism regarding the value of self-report dietary data. *J Nutr*. 2015;145(12):2639–2645. https://doi.org/10.3945/jn.115.219634
15. Boushey CJ, Spoden M, Zhu FM, et al. New mobile methods for dietary assessment: review of image-assisted and image-based dietary assessment methods. *Proc Nutr Soc*. 2017;76(3):283–294. https://doi.org/10.1017/S0029665116002913.
16. Tanweer A, Khan S, Mustafa FN, et al. Improving dietary data collection tools for better nutritional assessment – a systematic review. *Comput Methods Programs Biomed Update*. 2022;2:100067. https://doi.org/10.1016/j.cmpbup.2022.100067.