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CURRENT OPINION

Dietary assessment is a critical element of health research – Perspective from the Partnership for Advancing Nutritional and Dietary Assessment in Canada

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Abstract: Challenges and complexities associated with assessing dietary intakes are numerous, but not insurmountable. This opinion paper from Canadian researchers draws attention to the importance of building capacity and providing funding opportunities for research in dietary assessment methods in Canada and elsewhere. Such strategies would contribute to a better understanding of the roles played by diet in human health and better translation of this information into the most meaningful and effective dietary guidelines, policies, and interventions.

Key words: dietary analysis, nutrition, dietary intake, diet.

Résumé : Les défis associés à l'évaluation des apports alimentaires sont nombreux, mais non insurmontables. Cette prise de position de chercheurs Canadiens met l'accent sur l'importance d'accroître le renforcement des capacités et les opportunités de financement dans la recherche sur les méthodes d'évaluation alimentaire. De telles stratégies contribueraient à une meilleure compréhension des impacts de l'alimentation sur la santé humaine ainsi qu'à une meilleure traduction de l'information en lignes directrices, politiques et interventions efficaces et significatives.

Mots-clés : analyse alimentaire, nutrition, apports alimentaires, alimentation.

Introduction

According to recent evidence, poor dietary habits may have a greater impact than tobacco, excess body weight, and physical inactivity on the burden of disease in Canada (Institute for Health Metrics and Evaluation 2013; Murray et al. 2012). Identifying strategies to improve health requires a robust evidence base that sheds light on the role of diet in health and disease prevention, as well as on the efficacy of interventions aimed at changing diet. Accumulating such evidence depends on our ability to assess dietary intakes, which is fraught with challenges (see Supplementary Table S1[1] for details). Some critics have gone so far as to completely discredit research in the field of nutrition, arguing that the errors in self-reported intakes are so great that the data are without merit (Archer et al. 2015). In this opinion paper, the Partnership for Advancing Nutritional and Dietary Assessment in Canada (PANDA-C), a recently formed consortium of Canadian researchers, seeks to address concerns about self-report dietary assessment methods and to likewise describe their inherent value. In addition, we are proposing essential strategies that are needed particularly in Canada to support further advances in diet and health.

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Dietary assessment: a complex and challenging undertaking

Common dietary assessment methods and their inherent measurement errors

Dietary assessment is at the core of most applied or population-based nutrition research. It involves collecting information on past or current food consumption, usually through self-report. Food intake can be measured using single or multiple administrations of food records or 24-h recalls (24HRs), food frequency questionnaires (FFQs), or brief focused dietary instruments, often referred to as screeners (Supplementary Table S2[1]). Foods may then be converted into nutrient and/or food group intakes using available software and food composition databases. The choice of the most appropriate instrument depends on the research question and study design, as well as the specific type of dietary data being sought. No self-report instrument is error-free, as all tools generate data with inherent random and systematic measurement errors, which vary depending on the nature of the tool (Supplementary Tables S1 and S2[1]). Although strategies and statistical methods have been developed to address issues associated with random error and to mitigate systematic error (Supplementary Table S3[1]), at the present time it is not possible to completely eliminate bias from self-reporting dietary assessment methods.

Limitations of food and nutrient databases

In addition to errors introduced during data collection, the nutrient values in databases used to estimate the composition of foods may be incomplete or may not adequately reflect the actual nutrient content of foods. An enormous effort is made by national organizations and investigators with limited resources to maintain and improve upon these databases (Health Canada 2015; Thompson et al. 2006). In Canada, the Canadian Nutrient File (CNF) (Health Canada 2015), which draws upon data from the United States Department of Agriculture, serves as the national food composition database. In the CNF, as in similar reference databases, the list of brand-name products as well as composite dishes is incomplete, which limits the specificity with which food composition can be determined. Further, the dynamic nature of the food supply requires frequent updates to food composition databases that may lag behind the actual changes in the food environment.

Differences in food supply, fortification practices, and food habits between countries

Another important consideration is the difference in food supply and fortification practices between countries such that tools and databases may not be directly transferable across research initiatives from different countries. Given the proximity of Canada to the United States, assumptions are often made with respect to the similarity in food supply and food habits. Such assumptions may encourage the use of United States' tools and their associated databases without prior adaptation for, or validity testing in Canada. Moreover, the Canadian and American populations are culturally and ethnically heterogeneous. For example, individuals of Asian origin represent the largest minority group in Canada, compared with Hispanics in the United States (Norris 2012). Despite these differences, the appropriateness of United States' tools for use in Canada has rarely been examined, aside from that related to food database differences (Anderson et al. 2010; Csizmadi et al. 2007). Finally, tools that have been developed for English speaking populations obviously need to be carefully adapted to and tested for French-speaking populations in Canada.

Trade-offs between self-report data and biomarkers

All of these challenges can make dietary assessment daunting, particularly for researchers who do not have expertise in this area and/or resources to allow them to tailor tools and databases to their needs. This has likely led to the use of methods that are less than ideal for given purposes or contexts, contributing to conflicting evidence on diet and health. Errors inherent to self-reporting of food consumption have led critics to suggest that dietary assessment be abandoned in favour of objective measures of intake, such as biomarkers (Archer et al. 2015). However, there is currently a limited number of recovery and predictive biomarkers that reflect true intakes (Supplementary Table S1[1]). Concentrations of blood- and tissue-specific biomarkers of intake are being increasingly used in nutritional research but they do not always have a direct nor constant relationship with nutrient or food intakes (Jenab et al. 2009). The use of biomarkers in research is further limited by cost and participant burden (Thompson et al. 2010).

Self-report dietary data are critical to health research because they provide detailed information that cannot be provided by currently available biomarkers and hence allow for important analyses that are not otherwise possible (Subar et al. 2015). These include the identification of dietary patterns and food group intakes, which is essential to our understanding of the relationship between foods, health, and disease. The best example of this pertains to the risk-reducing impact of a Mediterranean-style dietary pattern on cardiovascular disease, which was first demonstrated by several observational studies based on self-reported dietary intake (Willett et al. 1995), and then further confirmed in a large clinical trial with cardiovascular outcomes (Estruch et al. 2013). Information derived from food pattern or food group analyses is also key to the development of nutrition policy and health promotion programs, which largely rely on dietary surveillance, measurement of population adherence, as well as on identifying important socioeconomic influences (Subar et al. 2015). Thus, even if objective biomarkers were highly available and logistically feasible, self-report data would remain essential to being able to discriminate between different diets in nutrition and health research.

The Canadian landscape

Although the community of Canadian investigators with expertise in dietary assessment is relatively small, there have been numerous recent contributions to the field, including the development of traditional and Web-based FFQs that have been evaluated in specific populations in Canada (Boucher et al. 2006; Csizmadi et al. 2007, 2016; Labonte et al. 2012; Shatenstein et al. 2005). Health Canada (Food Directorate) has also led the adaptation of the Web-based Automated Self-Administered 24-hour Recall (ASA24), originally developed by the United States National Cancer Institute. These and other efforts are promising in terms of providing tools that are tailored for Canadian use in a range of research initiatives to collect comprehensive dietary data at low cost. From the perspective of compositional databases, efforts have also been made to analyze and incorporate foods specifically consumed by Canadians (Schermel et al. 2013; Thompson et al. 2006), and to modify values based on Canadian-specific fortification regulations (Anderson et al. 2010; Csizmadi et al. 2007). However, more studies specific to food and nutrient databases are needed to enhance the value of dietary assessment in nutrition research.

Limited availability of cost-effective and appropriately tested dietary assessment tools has been a barrier to the evaluation of diet-health associations in large health research initiatives underway in Canada. For example, 2 large longitudinal cohort studies — the Canadian Partnership for Tomorrow Project (CPTP) (Borugian et al. 2010) and the Canadian Longitudinal Study on Aging (CLSA) (Raina et al. 2009) — have collected only limited information on dietary intakes because of cost-related concerns and at the time of study design, the near-total absence of online tools specific to the Canadian context and logistically feasible in cohorts of 300 000 and 50 000 participants, respectively. The lack of readily available

and cost-effective tools is also a barrier to providing the necessary evidence for evaluating nutrition policies and programs that have the potential to improve dietary patterns. The process of modifying nutritional information on packaged foods and recommendations regarding sodium intake by Health Canada are examples in which policy change relies in part on the capacity to collect robust dietary data. Though the dietary assessment landscape is beginning to change with the availability of electronic and mobile tools developed or adapted for use in Canada, more research is required to determine how best to apply these tools.

Further, limited capacity in dietary analysis poses a barrier to fully realizing the potential of the data that do exist. The 2004 Canadian Community Health Survey (CCHS) (Health Canada 2006) was the first national survey to collect dietary data since the 1970–1972 Nutrition Canada Survey (National Health and Welfare 1977); this collection was repeated in 2015, again using 24HRs. The 2004 survey yielded invaluable insight into the contemporary dietary habits of Canadians (Garriguet 2007) and our understanding of current diet and health associations (Shi et al. 2011). These data are critical to supporting national and provincial programs and policies, as well as the development of Canadian-specific dietary assessment tools, such as diet screeners and FFQs. However, the true potential of this rich resource likely remains untapped given the small field of researchers with relevant expertise in dietary assessment and the few post graduate students being trained in this field.

Moving forward

To foster the growth of the dietary assessment field, a number of researchers from institutions across Canada have come together to form PANDA-C. Our long-term goal is to ensure that tools and strategies that have been tested for their intended use in terms of validity and reliability are not only available for use by Canadian researchers and policy makers, but become the standard for data collection in nutrition-related health research. In addition to creating bridges and building capacity among researchers in Canada and beyond, a key initiative of PANDA-C is to increase the awareness that advances in dietary assessment are invaluable to health research and thus worthy of investment.

Although self-report measures are currently unable to capture dietary intake with complete accuracy, strategies are available to foster state-of-the-art, high-quality data collection and analyses that are appropriate for study-specific circumstances (Supplementary Table S3[1]). Substantive progress will be possible only if opportunities are made available to develop skills in the appropriate collection, analysis, and dissemination of dietary data, including among trainees and more seasoned investigators. Furthermore, researchers as well as peer reviewers and users of dietary data will need encouragement to become aware of the strengths and limitations of specific tools and food composition databases in estimating and interpreting food and nutrient intake data. This includes knowing whether a given tool was designed to collect the desired data or has been tested in the target population, and if the food composition database is current and complete. There is also a need to be cognizant of differences in food habits and food supplies between and within countries and the implications of these differences for choosing diet assessment tools. Continued efforts toward improving self-report methods, as well as in identifying and making use of biomarkers of intake in combination with self-report data, are also fundamental to the field of nutrition-related research.

Lack of funding for methodological advancements related to dietary assessment remains a significant drawback to advancing the field in Canada. Developing and testing dietary assessment tools are essential activities for scientific innovation, yet few strategic funding opportunities are available for this type of foundational research in Canada. Further research and better implementation and dissemination for dietary assessment methodologies will improve the quality of dietary data, which in turn will provide reliable results used to inform our understanding of the association between diet and health, and subsequent translation into evidence-based nutrition policies and food regulations in Canada. The importance of dietary assessment research must be acknowledged and translated into funding opportunities that permit development and evaluation of instruments for the collection of high-quality data.

Finally, opportunities to foster collaborations with international researchers working to improve dietary assessment methodologies are essential so that lessons learned in different jurisdictions can be leveraged to benefit the entire field of nutrition-related research. Increased international collaboration also has the potential to pave the way for generating comparable dietary data that are amenable to pooling, resulting in a stronger evidence base for informing strategies to improve nutritional health and reduce the burden of chronic disease.

Conclusion

Assessing population-based dietary intakes is essential to untangling the nutrition and health puzzle. Self-report dietary assessment tools provide invaluable data toward this end. There are recognized challenges and complexities associated with dietary assessment but these are not insurmountable. Increasing support for capacity building and methodological advances is of the utmost importance to maximize the value of self-report dietary data in the future.

Conflict of interest statement

B.L. and M.E.L. have developed a Web-based FFQ that is licensed for utilization by researchers and clinicians through formal agreements with Laval University's Research Office. User fees serve solely for the maintenance and upgrade of the dietary assessment tool. S.I.K. receives financial support from the Canadian Cancer Society Research Institute (grant no. 702855). R.C.B., B.A.B., I.C., A.K., M.R.L., I.M., P.J.R., I.R., B.S., A.F.S. report no conflicts of interest.

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