Progress in Nutrition 2022; Vol. 24, N. 1: e2022017 DOI 10.23751/pn.v24i1.11107

Review

Traditional Dietary Assessment Tools Verses Technology-Based Methods in Children and Adolescence. An Updated Review

Khlood Baghlaf[1, 2]

[1]King Abdulaziz University, Faculty of Dentistry, Preventive Dentistry Department, Jeddah, Kingdom of Saudi Arabia; [2] Centre of Dental Public Health and Primary Care, Institute of Dentistry, Queen Mary University of London Whitechapel, London E1 2AT, UK.

Abstract. Dietary assessment in children is challenging for several reasons. In research, there are several challenges in the accurate assessment of diet and nutrition. This is an updated review that focuses on studies that evaluated the diet assessment methods in children. The aim of this review is to evaluate the most common traditional and technology-based tools that are used in children for dietary assessment implementation. Traditional diet assessment methods are available to assess children dietary intake in research, each one with different strengths and weaknesses. The most common dietary measures to assess children's diet are food frequency questionnaires, weighed food records, 24-hour recall and diet history interviews because they are valid accurate measures Recently, several technology-based tools have been introduced to provide a more accurate record of portion size using visualisations and to improve the participation response of traditional dietary surveys. These new measurement tools optimized to use on mobile phones and tablets, which makes it more accessible for participants. The development of technology-based dietary measures now allows for a detailed analysis of the whole diet on different days and at different times of the day with low-cost, precision and convenience to patients.

Key words: diet assessment, children, online diet assessment, diet records, food questionnaires

Introduction

Dietary assessment is challenging for several reasons. These reasons include the inherent errors created by measuring past and current food intake and the limited information available for nutrients available in reference databases (1). There is also the continued debate about whether dietary assessments should use self-reported data or objective biomarkers (2); there is not a consensus about this. However, the limitation of self-reported data is bias from participants, which can be eliminated by using dietary biomarkers (3). The ideal dietary assessment should be valid, reliable, appropriate for the target population and outcome of interest; practical to use, and have a low burden on participants during completion (4). Validity is defined as the degree of probability to which the tool measures what it claims to measure (5). Validity can be established by direct comparison of the assessment tool against an alternative gold standard method used to calculate the energy expenditure (4). The doubly labelled water (DLW) is the gold standard method to calculate the total energy expenditure in humans (6). Validity also includes providing an accurate assessment of food portion and amount.

Reliability is defined as the extent to which the tool yields the same results once repeated (5). The reliability of a dietary assessment can be established using

test-retest reliability, comparing scores from two measurements, administered one week or more apart (7). The most common dietary measures to assess children's diet are food frequency questionnaires (FFQ), weighed food records, 24 hour recall and diet history interviews because they are valid accurate measures (8). Therefore, the present review focuses on studies that have evaluated traditional and technology-based dietary assessment tools that have been used in children.

Traditional dietary assessment tools in children

Food frequency questionnaires (FFQ)

FFQ are a self-reported method that explores the food intake frequency of commonly consumed foods and/or beverages; how often each type of food is consumed, the quantity of the food and the timing of each food and drink (9). FFQ consist of a specific list of different types of foods and beverages with specific categories to indicate each frequency of consumption over a period greater than 24 hours.

The validity and reproducibility of using FFQ to assess diet-disease relationships is well established against the gold standard DLW (10-13). Several studies have used FFQ to assess FS consumption in children aged six- to eight-year-old (14-16). However, a systematic review, which evaluated all studies that reported the reliability or validity of questionnaires in children, reported limitations related to FFQ because of their tendency to overestimate food intakes, the limited food lists, portion sizes, and recall bias (17). Fifteen cross-sectional studies were included in this systematic review and two studies only used FFQs with a reporting period of the previous 12 months. FFQ take less time to complete in children than 24-hour recall and food records (18). FFQ take between 30 to 60 minutes to complete (19).

Weighed food records (WFR)

In this method, the participant is required to weigh each item of food and drink prior to consumption and the leftovers food (20). Participants receive detailed instructions on how to accurately weigh the food and beverages. Weighed records are collected for three days or more; seven days is usually considered the gold standard. One of the drawbacks of this method is the presence of a trained researcher in the household is required if working in a low- or middle-income country with low literacy levels (8, 21).

A systematic review that assessed the validity of different dietary assessment methods in children and adolescents (17) found that one of the included studies that used the WFRS as a dietary assessment method significantly under-reported energy intake by between 11% to 27% (20). A validation study compared concurrent estimates of total energy expenditure measured using a seven-day WFRs against the DLW gold standard in a study of children aged one and a half to four and half years (22). Similarly, in contrast, a second cross-sectional study that used WFRs to assess seven- to 18-year-old children for seven days showed that WFRs underestimated the food intake of adolescents (22).

Although WFRs have been used in children to assess sugar consumption in preschool children, it is an expensive method because of the weighing, and it is liable to misreporting (23, 24). For younger children aged one to four years WFRs provide the best estimate (25). The practical limitations related to the time taken to record, the need for the researcher to be present in some circumstances and the questions about validity and underreporting make WFRs less suitable dietary assessment method for some studies.

The 24- hour multiple pass recall (MPRs)

The MPRs method is a structured interview that captures all food and drinks consumed by participants in the past 24 hours. The steps involved in the interview to allow revisiting and checking dietary information usually refers to "Multiple pass". In the first pass, a quick list of foods consumed is obtained. Then, information about the time of the meals and the snacks consumed is collected in the second pass (8). The new multiple pass method developed in the late 1990 uses computerized data collection to produce an improved 24-hour dietary recall method (26).

The validity of the MRPs has been established for children based on their total energy expenditure

against the DLW gold standard (27). A systematic review that compared the validity of different dietary assessment methods for estimating energy intakes by children aged four- to eleven-year-old found that the MPRs was the most valid method for reporting energy in children in this age group with accurate results (17). This systematic review suggested that MPRs includes weekdays and weekend days and should be conducted over at least a three-day period that using parents as reporters. The limitations of this review were its small sample size (24 children) and the recall bias that could result from prejudice of parents (17).

The findings of the study conducted by Jonson *et al* (1996) on the accuracy of the twenty-hour recall method for estimating the energy intake by 4-7 years old children showed that this method was easily applied, valuable, practical measure of energy intake (28). The MRPs method has been used in children to assess the sugar consumption (29, 30).

The disadvantages of MPRs include questions about the ability to estimate portion size. It is a researcher reported recorded method which makes it difficult to use at home over an extended period (8). There are some difficulties when using this method on large populations (31).

Estimated food records (EFR)

The EFR method is similar to the weighed food record method except for the estimation of the quantification of the foods and drink rather than being weighed (8). To calculate food and nutrient intake, the assessor converts the estimates of foods and drink into weights that can then be used. A series of questions at the end of each day records foods that are commonly eaten between mealtimes. The EFR booklet describes portion sizes (32).

A study was carried out by Chinnock (2006) to examine the validity of EFR using WFRs as the reference method for the determination of food consumption and nutrient intakes (32). The results showed that EFR was a valid method and comparable to WFRs. A cross-sectional study conducted in Western Sydney compared measurements of energy intake from a 3-day estimated food record and of total energy expenditure by the doubly labelled water (33). At the individual level, this study found that EFR lack precision but may be used for population surveys of energy intake in schoolchildren aged 6-9 years. However, Champagne *et al.* (1996) raised questions about EFR underreporting energy intake. The EFR has been used in children to assess sugar consumption (34). The limitations of EFR include the estimation of portion sizes, misreporting and the relatively high cost (8).

Diet History Interview (DHI)

The DHI method measures dietary intake using an open-ended detailed questionnaire and an interview. This classic diet history method was introduced by Burke between 1938 and 1947 in multiple clinical evaluations (35). The questionnaire is divided into sections to measure both food and drink consumed throughout the day. It includes detailed questions about the usual patterns of eating organized by meal; a list of foods and beverages for which information about usual frequency and amount are collected in a self-administered 3-day food record. The researcher who carries out the DHI should be trained and have detailed nutritional knowledge (36).

A school-based validation study was conducted to compare DHI with the gold standard DLW and found that the DHI was a valid method to assess the habitual food intake of adolescents (36). However, a study of eight to ten year old children found that the DHI had difficulty estimating the intake of certain foods such as sweets, chips, and popcorn (17, 37). Additionally, DHI is relatively costly and often not practical to administer in large scale population studies (38).

Technology-based dietary assessment methods

Nowadays, the use of technology-based methods has the potential to reach large populations and this is due to the accessibility of mobile devices and the high rates of use in both developed and developing countries. Technological based-dietary assessment methods reduce language barriers through use of images rather than verbal descriptions (39).

Interactive Portion Size Assessment System (IPSAS)

A meeting held at Newcastle University in December 2009 involving a number of investigators announced the development of new technologies for children's dietary assessment (40). These new novel methods were introduced to provide a more accurate record of portion size using visualisations and to improve the participation response of traditional dietary surveys. One of these technologies was the Interactive Portion Size Assessment System (IPSAS) developed for children and adolescents (41).

The IPSAS system displays food images that allow users to estimate the portion size and the amount of each food consumed by children. A validation of estimates of food made by children 4-16 years of IPSAS against 4-day weighed intakes showed IPSAS is a valid alternative to the weighed food diary in this age group (41). However, the weight of food consumed was over-estimated by 2% on average by the children compared to 1% by their parents (40). Consequently, it is advised that the IPSAS tool be used with the parent for children aged 10 years or younger.

Self-Completed Recall and Analysis of Nutrition (SRAN24).

The IPSAS has been developed further into a 24-hour recall system called the Self Completed Recall and Analysis of Nutrition (SRAN24). The foods and drinks are selected from listed categories in the system and then assigned to the time of each meal with the portion size. SRAN24 is accepted by children because it is easy and quick to be completed while the accuracy and precision of this system is comparable to other computer-based systems used in dietary assessments (42). Subsequent studies have extended SRAN24 into INTAKE24 on participants aged 11-24 years (40).

INTAKE24

INTAKE24 is an online dietary assessment method, developed by the Newcastle study team to recall food intake over a 24-hour period in a Scottish food and nutrition survey (43). It was specifically designed to include the portion size of foods linked to the nutrient data bank (43). The INTAKE24 estimated portion size is shown using a series of over 3000 photographs of food (Figure 1) (44). Based on the portion sizes of foods reported in the UK National Diet and Nutrition Surveys (NDNS) these photographs have been developed (45). INTAKE24 has been validated in a validation study against 4-day weighed intakes (43, 44). Foods entered into the software programme are linked to the NDNS Nutrient Databank and all data are automatically coded. INTAKE24 was further developed to record missing food items, recipes and composite dishes using including a video tutorial (46).

The INTAKE24 has been also validated against interviewer-led multiple pass 24-hour recall. This validation study found that INTAKE24 was comparable to the interviewer-led multiple pass 24-hour recalls for people aged 11 -24 years old (43, 44). The daily energy, nutrient intakes and mean intakes reported using INTAKE24 were compared to those reported in the interviewer-led recall.

In 2016, a study aimed to examine the performance of INTAKE24 in young people and adults living in Scotland and the suitability of INTAKE24 as a system for collecting dietary information for Scottish Health Survey (SHeS) participants (46). This study found that INTAKE24 was a practical option to measure dietary intake in this younger population. INTAKE24 was further developed to recording of missing food items, recording of recipes for composite dishes and including a video tutorial. INTAKE24 is currently being used to explore the baseline dietary habits of 5–6-year-old children in Scotland as part of the Bedtime: Brush and Read Together, Sleep (BBaRTS) clinical trial (47). In this study, parents/guardians of children were asked to complete the INTAKE24over 3 consecutive days.

The advantages of INTAKE24 are that it is a web-based and multiple pass recall methods; participants can complete the survey at any time and place and there is no need for the researcher to be present. It is currently optimized to use on mobile phones and tablets, which makes it more accessible for participants. INTAKE24 also reports the nutrient intakes and food groups with accuracy and precision. This method involves viewing photographs to estimate the portion size of the food and drinks. Furthermore, the survey is also quick to complete (43).

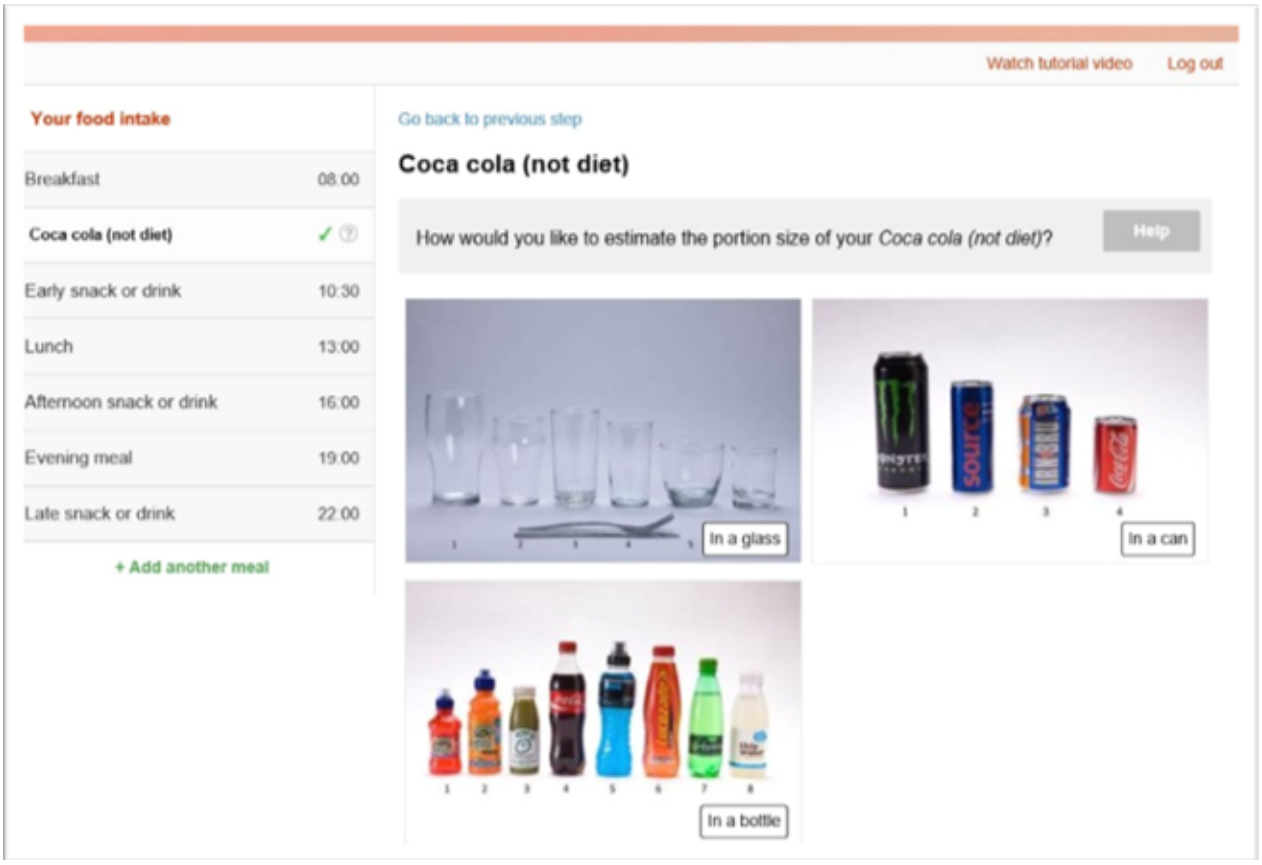

Figure 1. Example of screenshot of portion-sized photographs for estimation of the amount served in INTAKE24.

Recently, a study aimed to explore the accuracy and acceptability of Web-based dietary assessment surveys based on a progressive recall, where a participant is asked to record multiple recalls throughout a 24-hour period using the multiple-pass protocol and portion size estimation methods of the 24-hour recall (48). They found similar number of foods and similar amount of energy reported for other meals across the two methods. However, more than fifty percent of the respondents in this study preferred the 24-hour recall (INTAKE 24) method because it was easier to integrate into their daily routine. INTAKE 24 is more convenient in terms of fitting in with participants lifestyles (48). However, the INTAKE24 only available in English and the system is being translated into other languages for international use such as Arabic, Portuguese, and Danish (49). This process involves studying the food culture in these countries with external collaborators.

A systematic review aimed to provide an overview of technology-based dietary assessment methods that have been used in validation studies in comparison with plasma carotenoids as a biomarker of usual intake (39). They found that some of the technology-based dietary assessments can provide good estimates of carotenoid intake when compared to objective biomarkers of carotenoids. However, the correlations were moderate (39). Table 1 shows a summary of the most common traditional dietary assessment tools and compare it to the INTAKE24.

Conclusion

Assessment of diet in children is challenging and relied on their parents. Different factors depend on the selection of the diet assessment method. Several traditional diet assessment methods such as FFQ,

Table 1. A compartive assessment of most common tradiotional dietary assessment methods to be used with children versus INTAKE24.

The traditional dietray assessment method	**Technique**	**Advantages**	**Dissadvantages**
Food frequency questionnaires (FFQ)	A specific list of different types of foods and beverages with specific categories to indicate each frequency of consumption over a period greater than 24 hours.	Valid and reproducible. Considered one of the most common methods used in children. Completed in short time.	Tendency to overestimate food intakes, the limited food lists, portion sizes, and recall bias.
Weighed food records (WFR)	The participant is required to weigh each item of food and drink prior to consumption and the leftovers food, (3-days, 7-days).	Valid and accurate .	This method needs time and a trained researcher. Considered expensive.
The 24- hour multiple pass recall (MPRs)	A structured interview that captures all food and drinks consumed by participants in the past 24 hours.	Valid, easily applied, valuable and a practical measure of energy intake.	Difficult to assess children in large population because its need a resercher to be present and record.
Estimated food records (EFR)	The participant is required to estimate the weight of each item of food and drink prior to consumption and the leftovers food.	Validated method.	Estimation of portion sizes, misreporting and the relatively high cost.
Diet History Interview (DHI)	An open-ended detailed questionnaire and an interview.	Validated method.	Difficulty estimating the intake of certain foods , it is relatively costly and often not practical to administer in large population.
The technology-based dietray assessemnt method			
INTAKE24	An online dietary assessment method to recall food intake over a 24-hour period using pictures to estimate the portion size of foods and drinks.	Valid and reports the nutrient intakes with accuracy and precision. Easy to be used and accessible for participants. It is currently optimized to use on mobile phones and tablets.	Expensive for large population. Only availble in Enghlish ,Arabic, Portuguese, and Danish.

weighed food records, 24-hour recall and diet history interviews.

Recently, the introduction of technological-based dietary assessment methods have been more practical and convenient for participants. Participants can be complete online-dietary methods at times and places that are suitable for them. They also substantially reduce the cost of nutritional analysis and increase participants engagement. Technological-based dietary assessment methods may offer low-cost, low-burden alternatives for collecting dietary information.

Acknowledgements: The author would like to thank Professor. Cynthia Pine and Dr. Vanessa Muirhead for reviewing a draft of this manuscript.

Financial support: This research received no specific grant from any funding agency, commercial or not-for -profit sectors.

Conflict of interest: None.

Authorship: K.B was responsible for the entirety of this manuscript.

Ethical Standards Disclosure*:* Not applicable.

References

1. Labonté M-È, Kirkpatrick SI, Bell RC, et al. Dietary assessment is a critical element of health research–Perspective from the Partnership for Advancing Nutritional and Dietary Assessment in Canada. Applied Physiology, Nutrition, and Metabolism 2016;41(10):1096-9.
2. Archer E, Pavela G, Lavie CJ, editors. The inadmissibility of what we eat in America and NHANES dietary data in nutrition and obesity research and the scientific formulation of national dietary guidelines. Mayo Clinic Proceedings 2015; Elsevier.
3. Hedrick VE, Dietrich AM, Estabrooks PA, Savla J, Serrano E, Davy BM. Dietary biomarkers: advances, limitations and future directions. Nutrition journal 2012;11(1):109.
4. Walker JL, Ardouin S, Burrows T. The validity of dietary assessment methods to accurately measure energy intake in children and adolescents who are overweight or obese: A systematic review. European journal of clinical nutrition 2017;1.
5. Kimberlin CL, Winterstein AG. Validity and reliability of measurement instruments used in research. American Journal of Health-System Pharmacy 2008;65(23):2276-84.
6. Speakman JR. The history and theory of the doubly labeled water technique. The American journal of clinical nutrition 1998;68(4):932S-8S.
7. Singh AS, Vik FN, Chinapaw MJ, et al. Test-retest reliability and construct validity of the ENERGY-child questionnaire on energy balance-related behaviours and their potential determinants: the ENERGY-project. International Journal of Behavioral Nutrition and Physical Activity 2011;8(1):136.
8. Wrieden W, Peace H, Armstrong J, Barton K, editors. A short review of dietary assessment methods used in National and Scottish Research Studies. Briefing Paper Prepared for: Working Group on Monitoring Scottish Dietary Targets Workshop Edinburgh 2003;
9. Kolodziejczyk JK, Merchant G, Norman GJ. Reliability and validity of child/adolescent food frequency questionnaires that assess foods and/or food groups. Journal of pediatric gastroenterology and nutrition 2012;55(1):4-13.
10. Hu FB, Rimm E, Smith-Warner SA, et al. Reproducibility and validity of dietary patterns assessed with a food-frequency questionnaire. The American journal of clinical nutrition 1999;69(2):243-9.
11. Watson JF, Collins CE, Sibbritt DW, Dibley MJ, Garg ML. Reproducibility and comparative validity of a food frequency questionnaire for Australian children and adolescents. International Journal of Behavioral Nutrition and Physical Activity 2009;6(1):62.
12. Rockett HR, Breitenbach M, Frazier AL, et al. Validation of a youth/adolescent food frequency questionnaire. Preventive medicine 1997;26(6):808-16.
13. Kroke A, Klipstein-Grobusch K, Voss S, et al. Validation of a self-administered food-frequency questionnaire administered in the European Prospective Investigation into Cancer and Nutrition (EPIC) Study: comparison of energy, protein, and macronutrient intakes estimated with the doubly labeled water, urinary nitrogen, and repeated 24-h dietary recall methods–. The American journal of clinical nutrition 1999;70(4):439-47.
14. Masson LF, Blackburn A, Sheehy C, et al. Sugar intake and dental decay: results from a national survey of children in Scotland. The British journal of nutrition 2010;104(10):1555-64.
15. Yabao R, Duante C, Velandria F, et al. Prevalence of dental caries and sugar consumption among 6–12-y-old schoolchildren in La Trinidad, Benguet, Philippines. European journal of clinical nutrition 2005;59(12):1429-38.
16. García-Closas R, GarcIa-Closas M, Serra-Majem L. A cross-sectional study of dental caries, intake of confectionery and foods rich in starch and sugars, and salivary counts of Streptococcus mutans in children in Spain. The American journal of clinical nutrition 1997;66(5):1257-63.
17. Burrows TL, Martin RJ, Collins CE. A systematic review of the validity of dietary assessment methods in children when compared with the method of doubly labeled water. Journal of the American Dietetic Association 2010;110(10):1501-10.
18. Buzzard M. 24-hour dietary recall and food record methods. Monographs in Epidemiology and Biostatistics 1998;1(30):50-73.
19. Subar AF, Ziegler RG, Thompson FE, et al. Is shorter always better? Relative importance of questionnaire length and cognitive ease on response rates and data quality for two dietary questionnaires. American journal of epidemiology 2001;153(4):404-9.
20. Davies PS, Coward W, Gregory J, White A, Mills A. Total energy expenditure and energy intake in the preschool child: a comparison. British Journal of Nutrition 1994;72(01):13-20.
21. Ortega RM, Pérez-Rodrigo C, López-Sobaler AM. Dietary assessment methods: dietary records. Nutricion hospitalaria 2015;31(3).
22. Livingstone MB, Prentice AM, Coward WA, et al. Validation of estimates of energy intake by weighed dietary record and diet history in children and adolescents. The American journal of clinical nutrition 1992;56(1):29-35.
23. Gibson S, Williams S. Dental caries in pre–school children: associations with social class, toothbrushing habit and consumption of sugars and sugar–containing foods. Caries research 1999;33(2):101-13.
24. Gibson SA. Breakfast cereal consumption in young children: associations with non-milk extrinsic sugars and caries experience: further analysis of data from the UK National Diet and Nutrition Survey of children aged 1.5–4.5 years. Public health nutrition 2000;3(2):227-32.
25. Burrows T, Truby H, Morgan P, Callister R, Davies P, Collins CE. A comparison and validation of child versus parent

reporting of children's energy intake using food frequency questionnaires versus food records: who's an accurate reporter? Clinical nutrition 2013;32(4):613-8.
26. Raper N, Perloff B, Ingwersen L, Steinfeldt L, Anand J. An overview of USDA's dietary intake data system. Journal of food composition and analysis 2004;17(3):545-55.
27. Montgomery C, Reilly JJ, Jackson DM, et al. Validation of energy intake by 24-hour multiple pass recall: comparison with total energy expenditure in children aged 5–7 years. British journal of nutrition 2005;93(5):671-6.
28. Johnson RK, Driscoll P, Goran MI. Comparison of multiple-pass 24-hour recall estimates of energy intake with total energy expenditure determined by the doubly labeled water method in young children. Journal of the American Dietetic Association 1996;96(11):1140-4.
29. Evans EW, Hayes C, Palmer CA, Bermudez OI, Cohen SA, Must A. Dietary Intake and Severe Early Childhood Caries in Low-Income, Young Children. Journal of the Academy of Nutrition and Dietetics 2013;113(8):1057-61.
30. Fiorito LM, Marini M, Mitchell DC, Smiciklas-Wright H, Birch LL. Girls' early sweetened carbonated beverage intake predicts different patterns of beverage and nutrient intake across childhood and adolescence. Journal of the American Dietetic Association.110(4):543-50.
31. Krantzler NJ, Mullen BJ, Schutz HG, Grivetti LE, Holden CA, Meiselman HL. Validity of telephoned diet recalls and records for assessment of individual food intake. The American journal of clinical nutrition 1982;36(6):1234-42.
32. Chinnock A. Validation of an estimated food record. Public health nutrition 2006;9(07):934-41.
33. O'Connor J, Ball EJ, Steinbeck KS, et al. Comparison of total energy expenditure and energy intake in children aged 6–9 y. The American journal of clinical nutrition 2001;74(5):643-9.
34. Marshall TA, Levy SM, Broffitt B, et al. Dental caries and beverage consumption in young children. Pediatrics 2003;112(3):E184-E91.
35. Burke BS. The dietary history as a tool in research. Journal of the American Dietetic Association. 1947;23:1041-6.
36. Sjöberg A, Slinde F, Arvidsson D, et al. Energy intake in Swedish adolescents: validation of diet history with doubly labelled water. European journal of clinical nutrition 2003;57(12):1643-52.
37. Waling MU, Larsson CL. Energy intake of Swedish overweight and obese children is underestimated using a diet history interview. The Journal of nutrition 2009;139(3):522-7.
38. Moran Fagundez LJ, Rivera Torres A, Gonzalez Sanchez ME, de Torres Aured ML, Perez Rodrigo C, Irles Rocamora JA. Diet history: Method and applications. Nutr Hosp 2015;31 Suppl 3:57-61.
39. Burrows TL, Rollo ME, Williams R, et al. A systematic review of technology-based dietary intake assessment validation studies that include carotenoid biomarkers. Nutrients 2017;9(2):140.
40. Adamson A, Baranowski T. Developing technological solutions for dietary assessment in children and young people. Journal of Human Nutrition and Dietetics 2014;27(s1):1-4.
41. Foster E, Hawkins A, Simpson E, Adamson A. Developing an interactive portion size assessment system (IPSAS) for use with children. Journal of Human Nutrition and Dietetics 2014;27(s1):18-25.
42. Foster E, Hawkins A, Delve J, Adamson A. Reducing the cost of dietary assessment: Self-Completed Recall and Analysis of Nutrition for use with children (SCRAN24). Journal of Human Nutrition and Dietetics 2014;27(s1):26-35.
43. Foster E, Delve J, Simpson E, Breininger S-P. Comparison study: INTAKE24 vs Interviewer led recall. United Kingdom: Newcastle University and Food Standards Agency 2014; October 2014.
44. Bradley J, Simpson E, Poliakov I, et al. Comparison of INTAKE24 (an online 24-h dietary recall tool) with interviewer-led 24-h recall in 11–24-year-old. Nutrients 2016;8(6):358.
45. Bates B, Lennox A, Prentice A, et al. National Diet and Nutrition Survey: Results from Years 1-4 (combined) of the Rolling Programme (2008/2009-2011/12). Executive Summary: Public Health England 2014;
46. Rowland M, Poliakov I, Christie S, Simpson E, Foster E. Field testing of the use of INTAKE24 in a sample of young people and adults living in Scotland 2016.
47. Pine C, Adair P, Robinson L, et al. The BBaRTS Healthy Teeth Behaviour Change Programme for preventing dental caries in primary school children: study protocol for a cluster randomised controlled trial. Trials 2016;17(1):1.
48. Osadchiy T, Poliakov I, Olivier P, Rowland M, Foster E. Progressive 24-Hour Recall: Usability Study of Short Retention Intervals in Web-Based Dietary Assessment Surveys. Journal of Medical Internet Research 2020;22(2):e13266.
49. Simpson E, Bradley J, Poliakov I, et al. Iterative development of an online dietary recall tool: INTAKE24. Nutrients 2017;9(2):118.

Correspondence
Dr Khlood Baghlaf
King Abdulaziz University,
Faculty of Dentistry, Preventive Dentistry Department,
Jeddah, Kingdom of Saudi Arabia Institute of Dentistry,
Barts and The London School of Medicine and Dentistry,
Queen Mary University of London,
4 Newark Street, London, UK, E1 2AT
Tel no: 011 44 207 882 7526
Fax no: 011 44 207 377 7064
E-mail: kbaghlaf@kau.edu.sa -k.k.h.baghlaf@qmul.ac.uk