Obesity Research & Clinical Practice (2017) xxx, xxx—xxx

ORIGINAL ARTICLE

Comparison of an electronic versus traditional food diary for assessing dietary intake—A validation study

Nicholas R. Fuller*, Mackenzie Fong, James Gerofi, Fatima Ferkh, Chloris Leung, Lisa Leung, Shaoyu Zhang, Michael Skilton, Ian D. Caterson

The Boden Institute of Obesity, Nutrition, Exercise & Eating Disorders, Charles Perkins Centre, The University of Sydney, NSW 2006, Australia

Received 3 August 2016; received in revised form 14 March 2017; accepted 1 April 2017

KEYWORDS
Nutrition;
Obesity;
Dietary assessment;
Clinical trial;
Self-monitoring

Summary
Background: Paper-based estimated food diaries are often used in research to collect dietary data, despite this method being burdensome for both participants and researchers. Such food diaries are often time consuming, labour intensive, and rely on participant literacy and therefore may lead to greater rates of under-reporting.
Methods: This study assessed the validity of the '*Boden Food Plate*', a novel web-based electronic application, compared to a paper-based three-day estimated food diary. Participants were also asked to rate their satisfaction with the new electronic diary. Sixty-seven participants with overweight or obesity completed both the electronic and paper-based diaries at two different time-points.
Results: Baseline BMI of participants (mean ± standard deviation (SD)) was 30.4 ± 2.9 kg/m^2, body weight was 87.6 ± 13.4 kg, and age was 42.3 ± 7.7 years. Fifty four percent (n = 41) of the cohort were female. Bland Altman plots for total energy, and percentage of total energy intake from fat, carbohydrate, and protein, indicated wide limits of agreement between the two methods of dietary data collection, and in some analyses there were a few cases that did not lie within the 95% confidence intervals. Approximately 70% of participants rated the electronic food diary as easier to use and more fun when compared to the traditional paper-based estimated food diary.
Conclusion: Innovative and visual dietary collection applications such as the 'Boden Food Plate' provide an enjoyable and interactive means of measuring nutritional

* Corresponding author at: The Boden Institute, Charles Perkins Centre D17, The University of Sydney, NSW 2006, Australia. Fax: +61 2 8627 0141.
E-mail address: nick.fuller@sydney.edu.au (N.R. Fuller).

http://dx.doi.org/10.1016/j.orcp.2017.04.001

Please cite this article in press as: Fuller NR, et al. Comparison of an electronic versus traditional food diary for assessing dietary intake—A validation study. Obes Res Clin Pract (2017), http://dx.doi.org/10.1016/j.orcp.2017.04.001

intake in a time efficient manner. Further validation studies incorporating micronutrient analysis and to improve the applications validity are warranted.

Introduction

Worldwide obesity rates for adults have more than doubled since 1980; approximately 1.9 billion are overweight and 600 million are obese [1]. Consequently, there is a need to identify both efficacious and cost-effective programs to treat this problem. An integral part of identifying such programs is the dietary behavioural changes associated with them.

Many methods have been utilised to assess dietary intake and these have differing research goals. A food frequency questionnaire can be used to describe usual intake over a long period of time in groups of people. This is used in cohort studies to place groups of people into categories [2]. Twenty four hour recalls provide a quantitative assessment of the food intake of the previous day and are used to estimate average intake of a group [2—4]. These rely on short-term memory and communication with the patient, and do not depend on patient literacy as the food frequency questionnaire or food records do [5]. Food records are written records of actual food consumption recorded at the time of consumption over multiple days [2,6]. Estimated food records use household measures to quantify the amount of food consumed, whilst weighed food records require the individual to actually weigh each item consumed and thus places a greater responder burden on the participant than any other method. Such paper food records require literacy, as participants are required to read instructions for the diary and then document their intake meticulously [7]. Initially seven-day weighed food records were considered the 'gold standard' of dietary intake measurement. With the advent of food biomarkers, however, weighed food records have been shown to have an increased rate of under-reporting due to the responder burden over seven full days [2]. Hence, due to the greater practicality for participants, a three-day estimated food diary may be more viable than a seven-day weighed food record. As there are many disadvantages of current dietary collection methods, new platforms or techniques are needed to decrease inaccuracies and responder burden which occurs with all observational dietary assessments across a wide range of the population, with the degree of under-reporting shown to be positively correlated with an increase in body mass index (BMI) [8—10].

Electronic diaries, used in multiple health-related fields, have been shown to be valid and efficient methods of data collection, however, more research is warranted with respect to the validity of innovative dietary assessment tools [11,12]. Further, there may be added benefit in collecting data from participants in the form of pictures or visual representations rather than verbal or written data [13]. Although online technology may be expensive and require both computer literacy skills and more time for the participant to complete the entry [14], there are savings in researcher time and cost of subsequent data analysis [12,15]. Furthermore electronic diaries and food intake monitoring systems have the benefit of providing immediate feedback to the participant, which can be a useful tool in self-monitoring of energy and nutrient intake and instigating change for individuals for those in weight management programs [16]. Electronic diaries have also been shown to increase patient compliance to dietary goals and produce greater acceptance of regular blood glucose self-monitoring for those with diabetes mellitus [17].

This study was conducted to test the agreement between an electronic food diary with a traditional three-day written food diary method. Most importantly this study addresses whether any advantages exist when utilising visual versus written data, and the former may be considered a valid, fun and interactive means of collecting research data. The electronic food diary was designed to allow users to enter information interactively by selecting visual depictions of popular food and beverage items in fixed serving sizes. This design is novel and innovative compared to currently available platforms, while remaining practical and easy to use. It was hypothesised that the newly created platform

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