Appetite 58 (2012) 1164–1168

Contents lists available at SciVerse ScienceDirect

Appetite

journal homepage: www.elsevier.com/locate/appet

Research report

Validation of food diaries as measures of dietary behaviour change ☆

Sally L. Pears [a], Margaret C. Jackson [a], Emma J. Bertenshaw [b], Pauline J. Horne [a,*], C. Fergus Lowe [a], Mihela Erjavec [a]

[a] School of Psychology, Bangor University, Brigantia Building, Penrallt Rd., Bangor, Gwynedd LL57 2AS, United Kingdom
[b] Unilever, St. Albans, United Kingdom

ARTICLE INFO

Article history:
Received 28 August 2011
Received in revised form 30 January 2012
Accepted 14 February 2012
Available online 28 February 2012

Keywords:
Children
Fruit and vegetables
Consumption
Weighed measures
Food diaries
Behaviour change
Healthy eating interventions

ABSTRACT

This study aimed to validate the ability of a 24-h food diary (the DIET-24) to accurately detect change in children's fruit and vegetable consumption at school snack time following implementation of the Food Dudes healthy eating intervention. Participants were 4- to 9-year-old children from two primary schools in England. There were 148 participants in the intervention school and 43 participants in the no intervention control school. For each child, snack-time fruit and vegetable consumption was measured separately by weight (grammes), and compared with teachers' estimates (to the nearest half portion) using the DIET-24. Both consumption measures were taken at T1 (pre-intervention) and T2 (post-intervention). At each time-point, Spearman rank correlations between the two measures were low to moderate, but significant. However, when compared with weighed measures, the DIET-24 did not always accurately detect significant changes in children's fruit and vegetable consumption following the intervention. To provide sensitive measures of behaviour change, it is important that dietary measures assess as accurately as possible the amount of food consumed, rather than, as is often the case, rely on all-or-none portion estimates. This issue is important for the establishment of a reliable evidence-base for healthy eating interventions.

Introduction

There is now good evidence that there are health benefits associated with increasing fruit and vegetable intake (Antova et al., 2003; Gaziano et al., 1995; Gillman, 1996; Joshipura et al., 2001; Key, Thorogood, Appleby, & Burr, 1996; Maynard, Gunnell, Emmett, Frankel, & Davey-Smith, 2003; Steinmetz & Potter, 1996). However, the UK has one of the lowest fruit and vegetable intakes in Europe, with only approximately 18% of young adults and 22% of children (aged 5–15 years) consuming the recommended five or more portions per day (Health Survey for England, 2009). Children in particular are reluctant to eat fruit and vegetables, and it is the aim of the present UK Government to increase children's consumption of these foods by identifying effective behaviour change interventions that target fruit and vegetable consumption (A Healthier Nation: Policy Green Paper No. 12). Given that recent surveys of children's food preferences show that vegetables are the least liked food category (Cashdan, 1998; Perez-Rodrigo, Ribas, Serra-Majem, & Aranceta, 2003; Skinner, Caruth, Bounds, & Ziegler, 2002), it is important to identify interventions that can increase children's consumption of vegetables as well as fruit. In order to establish whether or not a particular intervention is effective, it is extremely important that a valid measurement tool capable of detecting even relatively small changes (≈0.5 portion) in fruit and vegetable consumption, is used to quantify children's fruit and vegetable consumption both before and after the intervention.

Arguably the most objective measure of a child's fruit and vegetable consumption would be for every fruit and vegetable the child ate to be weighed or visually estimated before and after consumption by an unbiased and trained researcher. Although these measures have been used very successfully in a number of small- to medium scale studies to assess fruit and vegetable consumption at specific times of the day (Auld, Romaniello, Heimendinger, Hambidge, & Hambidge, 1998; Horne, Lowe, Fleming, & Dowey, 1995; Horne, Tapper, Lowe, Hardman, Jackson & Woolner, 2004; Horne et al., 2009; Lowe, Horne, Tapper, Bowdery, & Egerton, 2004; Perry et al., 1998; Reynolds et al., 2000), the use of such measures to assess a full day's consumption, or evaluate the effect of an intervention on a large number of participants, is impractical. Both weighed and non-weighed observation measures by trained raters are labour-intensive and would be highly intrusive if used to assess consumption over a 24-h period.

To assess a large number of children's consumption of fruit and vegetables over a 24-h or longer period (i.e., both in school and out of school), it is necessary to use some form of food diary. For example, weighed and non-weighed food diaries, food frequency questionnaires (FFQs), and twenty-four hour (24-h) recalls are often

☆ *Acknowledgements:* This study was funded by Unilever. However, Unilever cannot accept any responsibility for any information provided or views expressed.
* Corresponding author.
E-mail address: p.j.horne@bangor.ac.uk (P.J. Horne).

0195-6663/$ - see front matter © 2012 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.appet.2012.02.017

used to provide estimates of children's 1-day, 3-day, or 7-day consumption (Bere, Veierød, Bjelland, & Klepp, 2006; Blenkinsop et al., 2007; Cade, Freer, & Greenwood, 2005; Epstein, Gordy, Raynor, Beddome, Kilanowski & Paluch, 2001; Schagen et al., 2005; te Velde et al., 2008; Wind et al., 2008). Although food diaries are a less objective measure of food consumption than weighed and non-weighed observation measures conducted by trained raters, they may provide approximate estimates of a child's current and/or past fruit and vegetable intake. However, food diaries, food recalls and FFQs all have their limitations because they rely heavily on memory and can suffer from intentional or unintentional over- or under-estimation of consumption. It is therefore very important to assess the reliability and validity of these measurement techniques. The consensus has been that if a food diary produces an estimate of consumption that does not differ statistically when administered to the same person over several time points (reliability) and provides an approximate measure of what it attempts to measure (validity), then the diary can be used to evaluate the efficacy of an intervention (Anderson et al., 2004; Bere et al., 2006; Blenkinsop et al., 2007; Cade, Thompson, Burley, & Warm, 2002; Epstein et al., 2001; Kremer, Bell, & Swinburn, 2006; Masson et al., 2002; Moore, Tapper, Dennehy, & Cooper, 2005; Moore, Tapper, Murphy, Clark, Lynch, & Moore, 2007; Reinaerts, de Nooijer, & de Vries, 2007; Rockett et al., 1997; Thompson et al., 2000; Wilson, Magarey, & Mastersson, 2008; Wind et al., 2008).

The traditional methods of determining the validity and reliability of a new dietary measure may be suitable when the measure is used in epidemiological studies or in studies that assess dietary intake at a single time point. In such cases the dietary tool needs only to provide a measure of consumption that gives a reasonably accurate "snapshot" of an individual's diet. However, when a dietary measure is used to evaluate the efficacy of a behaviour change intervention, it must be capable of detecting changes in consumption following that intervention. Therefore, in order to measure behaviour change accurately, the dietary measure used to evaluate the impact of an intervention on consumption of fruit and vegetables (or consumption of any other food or nutrient) should first be validated in terms of its ability to accurately measure intake at each time point.

Despite the fact that an instrument's sensitivity to change is crucial if it is to detect any dietary change (Edmunds & Ziebland, 2002) as far as we are aware no attempts have been made to validate the ability of a food diary to detect changes in fruit and vegetable consumption over time by comparing its measurement of change with that of a more precise and accurate reference measure. Reported here are the findings of an attempt to validate a semi-quantitative, food diary (the 24-h Dietary Intake Evaluation Tool, DIET-24) as a measure of behaviour change in response to the Food Dudes intervention (a whole school programme that aims to increase children's consumption of fruit and vegetables; Horne et al., 2004, 2009; Lowe et al., 2004). Although DIET-24 is designed to record consumption of all foods over a whole day, only the school snack time component of the DIET-24 was validated in this study as this was the only eating occasion at which the fruit and vegetables consumed by children could be assessed using the "gold standard" measure of weighing foods before and after consumption. The goal of the validation was to determine if any changes in children's consumption of fruit and vegetables from time point 1 (T1, baseline) to time point 2 (T2, follow up) detected by weighed measures would also be detected by the DIET-24.

Method

Ethical approval

Permission to conduct the study was granted by the School of Psychology Ethics Committee, Bangor University.

Participants

All 4- to 9-year-old children enrolled at two primary schools in Bedfordshire took part in an evaluation of the Food Dudes Healthy Eating intervention (Horne et al., 2004, 2009; Lowe et al., 2004). Parents could opt their children out of the study if they so wished. Children at the intervention school ($n = 318$) took part in the Food Dudes programme in March 2009. Children at the control school ($n = 174$) were given free fruit and vegetables at snack time for 20 days, but did not receive the Food Dudes intervention.

Diet-24 development and design

The DIET-24 was developed to assess fruit and vegetable consumption over a 24-h period at five different eating occasions (breakfast, mid-morning, lunchtime, afternoon, evening) and in any location (both in school and outside school), and was loosely based on the CADET (Cade et al., 2005), the food diary used to evaluate the efficacy of the UK School Fruit and Vegetable Scheme (SFVS, Blenkinsop et al., 2007; Schagen et al., 2005). Each eating occasion had a list of 75 foods, which included 15 vegetables and 13 fruits, and 13 "blanks" that could be filled in with any food consumed that was not on the list. For fruits and vegetables, the DIET-24 instructed guardians/school staff to record the number of portions (to the nearest half portion) consumed of each food.

Measurement procedures

Measurements were taken on one day at T1 (baseline) and on one day at T2 (follow up). On each of these two measurement days, children in both the intervention school and the control school were provided with a portion of fruit (satsumas, average weight = 84.4 g) and a portion of raw vegetable (peppers, average weight = 50.0 g) at morning snack time.

Weighed measure

The weighed measure of fruit and vegetable consumption for each child was taken at snack time by two trained researchers, on each of the two measurement days. Prior to distribution, the portions of fruit and vegetables to be given to each child at snack time were individually weighed using digital scales and then placed in a clear plastic food bag, labelled with the child's name and number. Children were instructed to place all waste and uneaten fruit and vegetables back into their own plastic bag and, after snack time, researchers again weighed the leftover fruit and vegetables in each bag. The amount consumed in grammes was calculated from the before and after weights for each child.

DIET-24 measure

The DIET-24 was distributed to teachers in each classroom at the beginning of the school day. Teachers were first given oral instructions by researchers on how to complete the diary and were told that written versions of the same instructions could be found at the front of each diary. At snack time, children ate the fruit and vegetables provided in the classroom and teachers completed the "mid-morning" section of the DIET-24, recording the quantity of food and drink consumed by each child. A researcher monitored completion of the DIET-24 in each classroom.

The lunchtime section of the diary was next completed either by teachers or other members of school staff in the school dining hall. At the end of the school day, the diary was sent home with the child, together with a letter and instructions to parents on how it should be completed for the rest of that day and at breakfast time the next day. Parents were asked to return the diary to the

school and were informed that these would be entered into £50 prize draw. The present study reports only the data for the "mid morning" section of the DIET-24 to calculate the child's snack time consumption of fruit and vegetables. There were 148 diaries (of 318; 47%) returned and coded from the intervention school and 43 diaries (out of 174; 25%) from the control school). These DIET-24 measures were then compared with the weighed snack time measures collected by researchers, in order to assess the validity of the diary methodology.

Statistical analyses

Given that the DIET-24 data are categorical (consumption was estimated to the nearest half portion) and do not fit the normal distribution, non-parametric analyses were employed throughout. Although non-parametric tests provide a conservative estimate of behaviour change objectively recorded in the weighed measures at T1 and T2, their use ensures the same level of test sensitivity for both the categorical and weighed measures.

Spearman rank correlations were first conducted at T1 and T2 to determine whether weighed measures were significantly correlated with the DIET-24 measures at each time point. Next, non-parametric Wilcoxon analyses, one for fruit and one for vegetables, were conducted to determine whether there were significant changes in consumption from T1 to T2 as measured by weight. The same analyses were then conducted using the DIET-24 measures. Note that Spearman correlation coefficients were calculated using data combined from the intervention school and the control school. However, for the Wilcoxon tests, data were analysed separately for each school as it was predicted that there would be significant pre- to post intervention increases in fruit and vegetable consumption in the intervention school, but not in the control school.

Results and discussion

Table 1 shows the mean snack time fruit and vegetable consumption recorded at T1 by the DIET-24 and the weighed measure (in grammes) at T1, and again at T2, along with the Spearman correlation coefficients and associated *p*-values. The analyses show that the weighed and DIET-24 measures are significantly correlated for both the fruit and vegetable measures at snack time at T1 and T2, suggesting that DIET-24 is capable of accurately ranking children according to their consumption of these foods. However, the Spearman correlation coefficients fall in the weak to borderline-moderate range (.236 to .419), which suggests that as compared with the weighed measure, the DIET-24 is considerably less sensitive to the amount of food the children actually consumed.

Table 2 shows children's mean consumption of fruit and vegetables at snack time as recorded by the DIET-24, and weighed measures, at T1 and T2. The mean changes in consumption from T1 to T2 are also shown for each measure, along with associated *z*-values and *p*-values of the Wilcoxon tests for significant differences.

G*Power 3 software was used to compute the effect sizes (*d*) and post hoc power (1-β) of each test. In the intervention school, the weighed measure detected a significant increase in both fruit consumption ($p < .001$; Cohen's $d = 0.44$; *power* = 1.00) and vegetable consumption ($p = .001$; $d = 0.31$; *power* = 0.97) from T1 to T2. In the control school, the weighed measure found no significant change in fruit consumption ($p = .152$; $d = 0.23$; *power* = 0.31), but vegetable consumption showed a significant decrease ($p = .003$, $d = 0.46$; *power* = 0.83). These results show that the present sample sizes were sufficient to provide enough statistical power to detect medium-size changes in children's consumption of fruit and vegetables. In the intervention school, the DIET-24 (incorrectly) reported no significant increase in fruit consumption ($p = .904$), but (correctly) found a significant increase in vegetable consumption ($p = .001$). In the control school, the DIET-24 (correctly) found no change in fruit consumption ($p = .904$) but (incorrectly) reported that there was no significant decrease in vegetable consumption ($p = .182$).

This validation study shows that the DIET-24 failed to detect both a significant 15.6 g mean *increase* in fruit consumption in the intervention school and a significant 12.9 g mean *decrease* in vegetable consumption in the control school, and that these failures to detect behaviour change occurred despite significant (albeit weak) correlations between the DIET-24 and the "gold standard" weighed measure at each time point. This discrepancy between the objective weighed measures and the DIET-24 occurred despite the study being suitably powered (power ranged from 0.83 to 1.00). Given the pressing need to identify interventions that produce significant improvements in children's diets, it is important to first develop dietary tools that are able to measure accurately (i) the amount of a particular food consumed at each test time point and (ii) behaviour change between time points. Our findings suggest that any method used to assess change in dietary consumption should be validated against an objective weighed measure of consumption. Therefore, diaries that require raters to estimate consumption of each food to the nearest whole portion (and score even a taste as a portion consumed) are unlikely to provide valid dietary measures of behaviour change. A key point here is that an instrument can be judged "reliable" if it gives similar scores at T1 and T2 and this reliability criterion can be met readily by the all-or-none dietary measures described above. However, in order to detect behaviour change, consumption must be estimated more accurately. In the present study, the DIET-24 estimates to the nearest half portion did not always provide valid measures of behaviour change. This suggests that the sensitivity of this instrument to behaviour change should be improved by incorporating a more fine-grained categorisation scale for each food consumed and there is good evidence that greater sensitivity can be achieved in applied settings. For example, Lowe et al. (2004, p. 513) conducted a validation of raters' visual estimates of consumption using a 5-point scale, by comparing these with objective weighed measures. Cohen's *K* coefficients ranged from 0.96 to 0.99. Support for teachers and other caregivers in making such discriminations of amount consumed could include sample photographs illustrating what 0, 25%, 50%, 75%, and 100% consumption of a given target food looks

Table 1
Means and Standard Deviations (SD) for fruit and vegetable consumption at baseline (T1) and follow-up (T2), recorded by the DIET-24 (in portions) and weighed measures (in grammes), for intervention and control schools combined ($n = 191$). Spearman rank correlation coefficients (Spearman's Rho) and associated *p* values comparing the DIET-24 measure and the weighed measure are also shown.

Foods consumed	DIET-24 mean (SD)	Weighed mean (SD)	Spearman's Rho	*p* value
T1 fruit	0.69 (0.62)	55.06 (30.42)	.236	$p = .001$
T1 vegetable	0.35 (0.48)	24.55 (23.58)	.419	$p < .001$
T2 fruit	0.70 (0.81)	64.68 (39.90)	.388	$p < .001$
T2 vegetable	0.51 (0.50)	26.61 (23.51)	.332	$p < .001$

Table 2
Means (M) and Standard Deviations (SD) for fruit and vegetable consumption at baseline (T1), follow-up (T2), and pre-post consumption change (T2–T1) recorded by the DIET-24 (in portions) and weighed measures (in grams), for intervention ($n = 148$) and control ($n = 43$) schools. Wilcoxon test z scores and associated p values comparing mean consumption at T1 and T2 are also shown for each method of measurement.

Foods consumed	DIET-24 (portions)				Weighed measure (grammes)			
	T1 mean (SD)	T2 mean (SD)	T2–T1 Change M (SD)	z Score (p)	T1 mean (SD)	T2 mean (SD)	T2–T1 Change M (SD)	z Score (p)
Intervention	0.72	0.74	+0.03	$z = -0.121$	51.89	67.47	+15.57	$z = -4.992$
Fruit	(0.66)	(0.88)	(0.72)	($p = .904$)	(25.51)	(38.27)	(35.28)	($p < .001$)
Control	0.59	0.56	−0.03	$z = 0.357$	65.98	55.07	−10.91	$z = -1.432$
Fruit	(0.48)	(0.48)	(0.49)	($p = .721$)	(41.84)	(44.20)	(47.67)	($p = .152$)
Intervention	0.39	0.56	+0.18	$z = -3.373$	24.53	30.93	+6.40	$z = -3.464$
Vegetable	(0.49)	(0.50)	(0.57)	($p = .001$)	(22.92)	(22.37)	(20.38)	($p = .001$)
Control	0.21	0.30	+0.09	$z = -1.333$	24.63	11.77	−12.86	$z = -2.972$
Vegetable	(0.41)	(0.44)	(0.43)	($p = .182$)	(26.04)	(21.39)	(28.18)	($p = .003$)

like (e.g., Overby, Lillegaard, Johansson, & Anderson, 2004; Lillegard & Andersen, 2005). Given the attrition in snack time data by T2, the second data collection point, future studies should collect these data from the diaries before sending them home with the children for the parents to complete and return the following day.

The weighed outcomes in the control school in the present study replicate previous findings (Horne et al., 2004) of a decrease in vegetable consumption from baseline to follow up despite the children having received the same number of presentations (20 days) of vegetables as in the intervention school. As such, this adds to the increasing evidence (Cooke et al., 2011; Horne, Greenhalgh, Erjavec, Lowe, & Viktor, 2011) that mere presentation of vegetables to children at snack time in a school classroom setting does not reliably encourage consumption of these foods and that incentives for consumption are initially required to produce lasting increases in vegetable consumption.

We conclude that diary measures that do not require 5-point scalar estimates of portions consumed are unlikely to be sufficiently sensitive to differentiate interventions that do produce behaviour change from those that do not. In our view, the use of sensitive measures (validated against objective measures) not only increases confidence that behaviour change is being accurately assessed, but by reducing the required sample size it can help to minimise the costs incurred in evaluating behaviour change interventions.

References

Anderson, A. S., Porteous, L. E. G., Foster, E., Higgins, C., Stead, M., Hetherington, M., et al. (2004). The impact of a school-based nutrition education intervention on dietary intake and cognitive and attitudinal variables relating to fruits and vegetables. *Public Health Nutrition, 8*, 650–656.

Antova, T., Pattenden, S., Nikiforov, B., Leonardi, G. S., Boeva, B., Fletcher, T., et al. (2003). Nutrition and respiratory health in children in six Central and Eastern European countries. *Thorax, 58*, 231–236.

Auld, G., Romaniello, C., Heimendinger, J., Hambidge, C., & Hambidge, M. (1998). Outcomes from a school-based nutrition education program using resource teachers and cross-disciplinary models. *Journal of Nutrition Education, 30*, 268–280.

Bere, E., Veierød, M. B., Bjelland, M., & Klepp, K.-I. (2006). Outcome and process evaluation of a Norwegian school-randomized fruit and vegetable intervention. Fruits and Vegetables Make the Marks (FVMM). *Health Education Research, 21*, 258–267.

Blenkinsop, S., Teeman, D., Schagen, S., Scott, E., Bradshaw, S., Chan, D., et al. (2007). *The further evaluation of the School Fruit and Vegetable Scheme*. London: Department of Health.

Cade, J., Thompson, R., Burley, V., & Warm, D. (2002). Development, validation and utilization of food-frequency questionnaires. A review. *Public Health Nutrition, 5*, 567–587.

Cade, J. E., Frear, L., & Greenwood, D. C. (2005). Assessment of diet in young children with an emphasis on fruit and vegetable intake: using CADET. Child and Diet Evaluation Tool. *Public Health Nutrition, 9*, 501–508.

Cashdan, E. (1998). Adaptiveness of food learning and food aversions in children. *Social Science Information, 37*, 613–632.

Cooke, L. J., Chambers, L. C., Añez, E. V., Croker, H. A., Boniface, D., Yeomans, M. R., & Wardle, J. (2011). Eating for pleasure or profit. The effect of incentives on children's enjoyment of vegetables. *Psychological Science, 22*, 190–196.

Edmunds, L. D., & Ziebland, S. (2002). Validation of a fruit and vegetable questionnaire for 7–9 year olds. *Health Education Research, 17*, 211–220.

Epstein, L. H., Gordy, C. C., Raynor, H. A., Beddome, M., Kilanowski, C. K., & Paluch, R. (2001). Increasing fruit and vegetable intake and decreasing fat and sugar intake in families at risk for childhood obesity. *Obesity Research, 9*, 171–178.

Gaziano, J. M., Manson, J. E., Branch, I. G., Colditz, G. A., Willet, W. C., & Burring, J. B. (1995). A prospective study of consumption of carotenoids in fruit and vegetables and decreased cardiovascular mortality in the elderly. *Annals of Epidemiology, 5*, 255–260.

Gillman, M. W. (1996). Enjoy your fruit and vegetables. *British Medical Journal, 313*, 765–766.

Health Survey for England (2009). The NHS Information Centre, 2010. Available at: www.ic.nhs.uk/pubs/hse09report.

Horne, P. J., Greenhalgh, J., Erjavec, M., Lowe, C. F., & Viktor, S. (2011). Increasing pre-school children's consumption of fruit and vegetables. A modelling and rewards intervention. *Appetite, 56*, 375–385.

Horne, P. J., Lowe, C. F., Fleming, P. F. J., & Dowey, A. J. (1995). An effective procedure for changing food preferences in 5–7-year-old children. *Proceedings of the Nutrition Society, 54*, 441–452.

Horne, P. J., Tapper, K., Lowe, C. F., Hardman, C. A., Jackson, M. J., & Woolner, J. (2004). Increasing children's fruit and vegetable consumption. A peer-modelling and rewards-based intervention. *European Journal of Clinical Nutrition, 58*, 1649–1660.

Horne, P. J., Hardman, C. A., Lowe, C. F., Tapper, K., Le Noury, J., Madden, P., et al. (2009). Increasing parental provision and children's consumption of lunchbox fruit and vegetables in Ireland. The Food Dudes intervention. *European Journal of Clinical Nutrition, 63*, 613–618.

Joshipura, K. J., Hu, F. B., Manson, J. E., Stampfer, M. J., Rimm, E. B., Speizer, F. E., et al. (2001). The effect of fruit and vegetable intake on risk of coronary heart disease. *Annals of Internal Medicine, 134*, 1106–1114.

Key, T. J. A., Thorogood, M., Appleby, P. N., & Burr, M. L. (1996). Dietary habits and mortality in 11000 vegetarians and health conscious people. Results of a 17-year follow up. *British Medical Journal, 313*, 775–779.

Kremer, P. J., Bell, C. A., & Swinburn, B. A. (2006). Calibration and reliability of a school food checklist. A new tool for assessing school food and beverage consumption. *Asia Pacific Journal of Clinical Nutrition, 15*, 465–473.

Lowe, C. F., Horne, P. J., Tapper, K., Bowdery, M., & Egerton, C. (2004). Effects of a peer modelling and rewards-based intervention to increase fruit and vegetable consumption in children. *European Journal of Clinical Nutrition, 58*, 510–522.

Lillegard, I. T. L., & Andersen, L. F. (2005). Validation of a pre-coded food diary with energy expenditure, comparison of under-reporters v. acceptable reporters. *British Journal of Nutrition, 94*, 998–1003.

Masson, L. F., McNeill, G., Tomany, J. O., Simpson, J. A., Peace, H. S., Wei, L., et al. (2002). Statistical approaches for assessing the relative validity of a food-frequency questionnaire. Use of correlation and the kappa statistic. *Public Health Nutrition, 6*, 313–321.

Maynard, M., Gunnell, D., Emmett, P., Frankel, S., & Davey-Smith, G. (2003). Fruit, vegetables, and antioxidants in childhood and risk of adult cancer; the Boyd-Orr cohort. *Journal of Epidemiology and Community Health, 57*, 218–225.

Moore, L., Tapper, K., Dennehy, A., & Cooper, A. (2005). Development and testing of a computerised 24-h recall questionnaire measuring fruit and snack consumption among 9–11 year olds. *European Journal of Clinical Nutrition, 59*, 809–816.

Moore, G. F., Tapper, K., Murphy, S., Clark, R., Lynch, R., & Moore, L. (2007). Validation of a self-completion measure of breakfast foods, snacks and fruit and vegetables consumed by 9–11 year old school children. *European Journal of Clinical Nutrition, 61*, 420–430.

Overby, N. C., Lillegard, I. T. L., Johansson, L., & Andersen, L. F. (2004). High intake of added sugar among Norwegian children and adolescents. *Public Health Nutrition, 7*, 285–293.

Perez-Rodrigo, C., Ribas, L., Serra-Majem, L., & Aranceta, J. (2003). Food preferences of Spanish children and young people. The enKid study. *European Journal of Clinical Nutrition, 57*, S45–S48.

Perry, C. L., Bishop, D. B., Taylor, G., Murray, D. M., Warren Mays, R., Dudovitz, B. S., et al. (1998). Changing fruit and vegetable consumption among children. The 5-a-day Power Plus Program in St. Paul, Minnesota. *American*

Journal of Public Health, 88, 603–609.
Reinaerts, E., de Nooijer, J., & de Vries, N. K. (2007). Parental versus child reporting of fruit and vegetable consumption. *International Journal of Behavioral Nutrition and Physical Activity, 4*, 33–41.
Reynolds, K. D., Franklin, F. A., Binkley, D., Raczynski, J. M., Harrington, K. F., Kirk, K. A., et al. (2000). Increasing the fruit and vegetable consumption of fourth-graders. Results from the High 5 Project. *Preventive Medicine, 30*, 309–319.
Rockett, H. R., Breitenbach, M., Frazier, A. L., Witschi, J., Wolf, A. M., Field, A. E., et al. (1997). Validation of a youth/adolescent food frequency questionnaire. *Preventive Medicine, 26*, 808–816.
Schagen, S., Blenkinsop, S., Schagen, I., Scott, E., Teeman, D., White, G., et al. (2005). Evaluation of the School Fruit and Vegetable Pilot Scheme. Final Report. Published by Evaluation and Research Team, Big Lottery Fund: 1 Plough Place London EC4A 1DE.
Skinner, J. D., Caruth, B. R., Bounds, W., & Ziegler, P. J. (2002). Children's food preferences. A longitudinal analysis. *Journal of American Dietetic Association, 102*, 1638–1647.
Steinmetz, K. A., & Potter, J. D. (1996). Vegetables, fruit, and cancer prevention. A review. *Journal of the American Dietetic Association, 96*, 1027–1039.
Thompson, F. E., Kipnis, V., Subar, A. F., Krebs-Smith, S. M., Kahle, L. L., Midthune, D., et al. (2000). Evaluation of two brief instruments and a food-frequency questionnaire to estimate daily number of servings of fruit and vegetables. *American Journal of Clinical Nutrition, 71*, 1503–1510.
Wilson, A. M., Magarey, A. M., & Mastersson, N. (2008). Reliability and relative validity of a child nutrition questionnaire to simultaneously assess dietary patterns associated with positive energy balance and food behaviours, attitudes, knowledge and environments associated with healthy eating. *International Journal of Behavioral Nutrition and Physical Activity, 5*, 5–17.
Wind, M., Bjelland, M., Pérez-Rodrigo, C., te Velde, S. J., Hildonen, C., Bere, E., et al. (2008). Appreciation and implementation of a school-based intervention are associated with changes in fruit and vegetable intake in 10- to 13-year old school children. The Pro Children study. *Health Education Research, 23*, 997–1007.
te Velde, S. J., Brug, J., Wind, M., Hildonen, C., Bjelland, M., Pérez-Rodrigo, C., et al. (2008). Effects of a comprehensive fruit- and vegetable-promoting school-based intervention in three European countries. The Pro Children Study. *British Journal of Nutrition, 99*, 893–903.