Use of electronic visual recording to aid assessment of dietary intake of Australian Aboriginal children living in remote communities

Selma C. Liberato,[1] Therese Kearns,[1] Felicity Ward,[1] Julie Brimblecombe[1]

Abstract

Objective: To assess the feasibility of using electronic visual recording in combination with food records to evaluate dietary intake in Aboriginal infants and children.

Methods: All foods and drinks consumed by the child over four consecutive days were recorded in daily food records and pictures or videos. Feasibility was assessed by determining i) proportion of meals reported to be consumed; ii) cost of data collection; iii) day-to-day variation in energy intake and; iv) acceptability of the method.

Results: Dietary intake data was collected from three girls and five boys aged 11 months to eight years, five over four days and three during one day, at a cost of $3,300 per child. One-third of the 89 meals reported to be consumed through the food records were electronically recorded. Most photographs were taken in the first two days with the number of meals electronically recorded decreasing each day over the four-day period. There was a large day-to-day variation in energy intake.

Conclusions: Use of electronic recording to aid individual usual dietary intake data collection was feasible. Collection periods spread over 1–2 weeks may be more appropriate due to the large variance in day-to-day dietary intake.

Key words: food records, pictures, dietary intake

To evaluate interventions, assess potential improvements and determine long-term progress in dietary change, it is essential to have an accurate method to measure food consumption. Electronic visual recording such as digital photography has been shown to aid estimation of cafeteria consumption among college students with high accuracy when compared with food intake weight (r=0.92)[1] and among pre-schoolers when compared with weighed intake (r=0.96 $p<0.001$).[2] Recording intake over three days has been found to provide an accurate average of daily dietary intake among children.[3] It has been suggested that dietary intake be collected in remote communities for at least 3–4 days because variation in dietary intake is likely to be high among populations where food expenditure varies with the pay cycle.[4]

This pilot study aimed to assess the feasibility of using electronic visual recording in combination with food records to evaluate individual level dietary intake over a four-day period in Aboriginal infants and children.

Methodology

The study was conducted in a remote Aboriginal community with a population of about 2,300 people,[5] where household food preparation facilities and food storage were limited.[6] All people with an interest in nutrition were eligible. Participants were recruited to attend classroom-based in-community training for two weeks. The first component of the training was delivered over one week and aimed to build the research skills of participants. A practical exercise involved each participant collecting dietary intake from a child related to them and younger than 10 years of age over four consecutive days, including two week days, Saturday and Sunday. The foods and drinks were estimated using household measuring utensils and electronically recorded by mothers before and after consumption using a digital camera or an Apple iPod Touch angled at 45 degrees and held one arm-length away from the object. The research team comprised three people (one project officer, one dietitian and one community-based worker). One or two research team members who had a close relationship with the community visited participating households daily to: i) support the mothers to complete food records; ii) provide batteries or to recharge the iPod if necessary; iii) download the photos and movies onto a laptop and; iv) clarify any doubts. The second component of the classroom-based training aimed to provide information on nutritional needs. This was delivered over two days after the practical activity of collecting dietary intake data. The participants were given a statement of attainment for the nutrition unit at certificate IV level.

At least two of the research team members, including a dietitian, analysed all electronic photographs and videos regarding brand, flavour, serving sizes, and time and date of

1. Menzies School of Health Research, Charles Darwin University, Northern Territory
Correspondence to: Dr Selma Liberato, Menzies School of Health Research, John Mathews Building, Charles Darwin University, Casuarina, NT 0810; e-mail: selma.liberato@gmail.com
Submitted: September 2014; Revision requested: October 2014; Accepted: January 2015

The authors have stated they have no conflict of interest.

Aust NZ J Public Health. 2016; 40 (Suppl. 1) S27-S29; doi: 10.1111/1753-6405.12373

consumption. Photographs of the commonly consumed foods taken from the community stores helped determine food serving sizes. The four-day food records were entered by a dietitian into Foodworks Professional software, version 4 (Xyris Sofware, Brisbane, QLD, 2005) including Food Standards Australia and New Zealand AUSNUT (Australian Food and Nutrient) and NUTTAB (nutrient data table) 2010 (developed by FSANZ) databases to calculate daily energy intake. Feasibility of using electronic visual recording to aid the evaluation of individual-level dietary intake was assessed by determining i) proportion of meals reported to be consumed; ii) cost of data collection; iii) day-to-day variation in energy intake and; iv) acceptability of the method as perceived by mothers participating in the study through providing oral feedback on their experience.

Mothers participating in the study were given a digital camera, a basket of fruits and vegetables and a report of the nutritional analysis of the foods consumed by the child at the end of the dietary data collection period. Unemployed participants attending the training were given up to $500 to reimburse their time. Ethical approval (ref: HREC-2012-1898 and HREC-2012-1904) was granted by the Human Research Ethics Committee of the Northern Territory Department of Health and Menzies School of Health Research.

Results

Eight of the 11 participants completed the training on dietary intake assessment. Dietary intake data was collected from three girls and five boys aged 11 months to eight years, five over four days and three during one day. Participation in funeral and ceremonies prevented dietary data collection during the whole four-day period. The youngest four children were being partially breastfed.

A total of 113 photos and 48 movies were taken ranging from four to 62 and from one to 16 respectively, according to the child (Table 1). Around one-third of the 89 meals reported to be consumed through the food records were electronically recorded. Most photos were taken in the first two days. All children had food records taken on day one with photo or video covering 45% of the meals ranging from 20% to 100%. By day two, three and four, 38%, 31% and 21% of the meals were electronically recorded, respectively (Table 1).

The data collection cost was more than $26,000 or more than $3,300 per child. More than half the cost was spent with project officer wages (19.7%), travel and accommodation for the research team (22.2%) and wages for the dietitian (9.1%). There was a large variation in reported energy consumption in those children having dietary intake data collected over the four-day period. This was higher in the oldest children reported to no longer be breastfed (SD=2,200.2 kcal) than in the youngest children, who were partially breastfed (SD=1043.1 kcal).

All mothers participating in the study provided positive oral feedback on their experience. All mothers were able to use the equipment and said they would participate in the study again if they had the opportunity.

Discussion

The use of electronic visual recording to aid dietary data collection was found to be feasible among this small sample of Aboriginal people living in a remote community. It appeared to be well accepted and useful in providing additional information to aid dietary intake evaluation. However, a great amount of support was required as the initial plan, where participants of the training program would assist the mothers in completing food records over the four days and download the pictures onto a laptop was modified and these tasks were conducted by the research team. It was also expensive ($825/child/day) compared to a similar study conducted in seven countries (US$494.70 or around AU$500).[7] However, having a researcher visiting the houses daily was likely to have contributed to a better quality of the data collected. The training participants were awarded with a nationally accredited certificate of attainment, which is quite different from recruiting participants and providing training on how to collect and record data. The data collection cost would have been reduced by 50% if the methodology had been modified to: i) train one or two community workers to help with recruitment and dietary data collection and; ii) provide an information session to the mothers with practical activities about recording meals and serving size estimation. Cost savings could also be achieved through using innovative data upload techniques where a mobile device captures before and after images of food and drinks consumed and is automatically uploaded to a server for analysis.[8] However, findings from the current study show that visuals were mostly recorded in the first two days, even with a research team member visiting the house at least once a day. Other activities also prevented three of the eight children from having complete food records for more than one day.

It may be more feasible for care-givers to record children's meals spread over one to two weeks rather than on consecutive

Table 1: Number of daily meals written in food records (WFR) and electronically recorded by taking at least one photograph (P) or one video (V).

Participant	Day 1			Day 2			Day 3			Day 4			Total		
	WFR	P or V	%[a]	WFR	P or V	%	WFR	P or V	%	WFR	P or V	%	Meals	P or V	%
A	3	2 (8P, 1V)	67	2	1 (6P)	50	3	1 (4P)	33	4		0	12	4	25
B	4	1 (2P)	25	6	1 (3P)	17	3			4		0	17	2	11.8
C	3	1 (6P)	33		1 (2P)	100[b]							3	2	67
D	5	2 (4P, 16V)	40	3[c]		0	3			4		0	15	2	13
E	5	5 (35P, 4V)	100	6	3 (12P, 4V)	50	5	2 (4P)	40	5	3 (11P)	60	21	13	62
F	5	1 (7P, 1V)	20										5	1	20
G	3	3 (5P, 9V)	100		1 (3V)	100[b]							3	4	100
H	5			3	1(4V)	33	2	2 (2V)	100	2	1(2V)	50	12	4	33
Total	33	15	45	21	8	38	16	5	31	19	4	21	89	32	36

a: Percentage of the meals electronically recorded

b: Foods consumed in one meal was electronically recorded but not written in food records and not considered in the dietary intake analysis.

c: A relative of the family passed away in the second day and no pictures were taken but all foods were recalled during the remaining three days.

days but this may also increase the cost. A minimum of seven days has been recommended to provide a valid estimative of energy and macronutrients consumed,[9] however, this has implications of cost and participant burden and in this study context would appear to not be feasible.

Limitations

The small sample impedes the generalisability of results. Incentives provided to participants do not seem to have influenced the outcomes of this study, as not all participants completed the training requirements or dietary data collection. In addition, the dietary intake data was collected before the nutrition training was delivered to the participants and the basket of fruit and vegetables given to the mothers. These incentives were therefore not likely to influence usual intake or participation. The oral feedback about mothers' participation in the study was likely to have been influenced as it was collected at the same time that a basket of fruit and vegetables was given to the mother.

Conclusion

Use of electronic recording to aid individual usual dietary intake data collection appeared to be well accepted by participants, but was resource intensive. The use of photos or video was important to complement the food record data, however, the percentage of meals electronically recorded decreased over the four days. Even though the first day had a higher number of meals electronically recorded, electronic visual recording alone would not be enough as a dietary intake assessment tool. Collection of dietary intake data spread over one to two weeks for at least seven days may be more appropriate, however, this would also increase the cost and possibly participant burden. The findings from this study provide insights into further development of an appropriate approach for measuring individual dietary intake in remote communities.

Acknowledgements

The authors thank the participants, mothers and children of this study.

References

1. Williamson DA, Allen HR, Martin PD, Alfonso AJ, Gerald B, Hunt A. Comparison of digital photography to weighed and visual estimation of portion sizes. *J Am Diet Assoc.* 2003;103:1139-45.
2. Nicklas TA, O'Neil CE, Stuff J, Goodell LS, Liu Y, Martin CK. Validity and feasibility of a digital diet estimation method for use with preschool children: A pilot study. *J Nutr Educ Behav.* 2012;44:618-23.
3. Erkkola M, Kyttala P, Takkinen HM, et al. Nutrient intake variability and number of days needed to assess intake in preschool children. *Br J Nutr.* 2011;106:130-40.
4. Lee AJ, Smith A, Briyce S, O'Dea K, Rutishauser IHE, Mathews JD. Measuring dietary intake in remote Australian Aboriginal communities. *Ecol Food Nutr.* 1995;34:19-31.
5. Australian Bureau of Statistics. *3101.0 - Australian Demographic Statistics, Sep 2014* [Internet]. Canberra (AUST): ABS; 2014 [cited 2014 Jun 11]. Available from: http://www.abs.gov.au/ausstats/abs@.nsf/mf/3101.0/
6. Torzillo PJ, Pholeros P, Rainow S, et al. The state of health hardware in Aboriginal communities in rural and remote Australia. *Aust N Z Journal Public Health.* 2008;32:7-11.
7. Fiedler JL, Martin-Prevel Y, Moursi M. Relative costs of 24-hour recall and Household Consumption and Expenditures Surveys for nutrition analysis. *Food Nutr Bull.* 2013;34:318-30.
8. Kerr DA, Pollard CM, Howat P, et al. Connecting Health and Technology (CHAT): Protocol of a randomized controlled trial to improve nutrition behaviours using mobile devices and tailored text messaging in young adults. *BMC Public Health.* 2012;12:477.
9. Nelson M, Black AE, Morris JA, Cole TJ. Between- and within-subject variation in nutrient intake from infancy to old age: Estimating the number of days required to rank dietary intakes with desired precision. *Am J Clin Nutr.* 1989;50:155-67.