Table 3.2. Validation of dietary assessment methods in toddler (13 to 24 months) populations

Reference	Study Population	Test Method (TM)	Reference Measurement (RM)	Design Features	Correlation Between TM and RM	Mean Intake Difference Between TM and RM
DOUBLY LABELED WATER (DLW) METHOD FOR TOTAL ENERGY EXPENDITURE (TEE) – FORMULA FEEDING						
Fjeld et al., 1988 (101)	Mean age 16.4 mo. = 11 Recovering from protein energy malnutrition; free of infection, fever or diarrhea. Lima, Peru	DLW method (16 studies on 11 infants)	10d test weighing of formula by investigators	Children were hospitalized in a metabolic ward. Dose 1 administered d1 and Dose 2 administered d5-10. Urine collected pre and 6h and 24h after dose 1 and 5-10 days post. Milk intake measured days 1 through 10.	0.98	**DLW vs. Test Weighing** 76 g/d or 6% overestimation of intake With corrections for environmental water influx and insensible water loss, -29 g/d or underestimation of 2% $\pm$ 3%
FOOD RECORDS (FR) or DIET HISTORY (DH)						
Lanigan, et al., 2001 (90)	6-12 mo. = 38 (45% M) 12-24 mo. = 34 (53% M) UK	5d Estimated FR	5d Weighed FR DLW method (subset of 21 infants 6-12 mo.)	Crossover design of 5d weighed FR and 5d estimated FR; collection periods separated by approximately 2wks. DLW spot urine collected for 7d. Random assignment to one method in week 1 crossing over to alternative method in week 2. Parents attended 3 training sessions. Child Care Input: Not specified	Not specified	**Estimated vs. Weighed FR** 3.6% mean difference (937 $\pm$ 205 vs. 904 $\pm$ 206kcal/d) [non-significant] **Estimated/Weighed FR vs. DLW (Infants only)** Both overestimated DLW measurement of energy expenditure by 7%. **Estimated intake vs. DLW** = 238 $\pm$ 1623kJ/d. **Weighed intake vs. DLW** = 243 $\pm$ 1690kJ/d.

Table 3.2. Validation of dietary assessment methods in toddler (13 to 24 months) populations, continued

Reference	Study Population	Test Method (TM)	Reference Measurement (RM)	Design Features	Correlation Between TM and RM	Mean Intake Difference Between TM and RM
FOOD RECORDS (FR) or DIET HISTORY (DH), CONTINUED						
Davies et al., 1994 (129) National Diet and Nutrition Survey	1.5-4.5 yrs. = 81 52%M; 29% 1.5-2.49 yrs.; 38% 2.5-3.49 yrs.; 27% 3.5-4.49 yrs. UK	4d Weighed FR	DLW method to estimated TEE	In fall of 1989, DLW dose followed by 10 daily spot urine collections. During 10d period, mothers kept 4d Weighed FR including 1 weekend day. 64% response rate for all parts of study.	**4d Weighed FR vs. DLW** 0.41 kJ/d $P < 0.01$ 0.36 kJ/kg $P < 0.01$	**4d weighed FR vs. DLW** -7% (778 vs. 838 kcal/d) Mean energy difference was greatest for ages 1.5-2.5 yrs. (6% underestimation), and smallest for ages 3.5-4.5 yrs. (1% overestimation)
Harbottle and Duggan, 1993 and 1994 (91;92)	4-40mo = 117 Indo-Asian children from low literacy HHs. Sheffield, UK	4d Weighed FR (infants) or 5d weighed FR (children) with a Portable Electronic Tape Recording Automated (PETRA) scale	Diet History (DH) and collection of food samples	The weighed FR completed by mother in home or occasionally by older female sibling or other relative. Field worker provided participant training in home and did monitoring visit after first 24h of weighed FR. DH collected in home to validate FR. BM Intake: Not Specified Child Care Input: Not Specified	Not specified	**Weighed FR vs. DH** FR lower than DH for mean intakes as follows: -7% energy, -9% protein, -3%, fat; -9% iron and -6% vitamin C. Analyzed by age group, differences were significant for energy at 12 to < 18 mo.; for iron at 6 to < 12 mo. and 12 to < 18mo.; and for vitamin C at < 6 mo.
Wharf et al., 1997 (93)	8 mo. = 20 18 mo. = 20 From healthy full-term pregnancies Norwich, UK.	DH (Standardized question sheet reprinted in article)	3d Weighed FR (at least one weekend day and 2 weekdays)	DH obtained by interview using a standardized question sheet. One wk. later mothers kept a 3d weighed FR. BM Intake: Not Specified Child Care Input: Not Specified	8 mo. Iron intake = 0.93 18 mo. Iron intake = 0.66	**DH vs. Weighed FR** 8mo overestimated kcal by 5% and iron intake by 8%. 18mo overestimated kcal by 5% and iron intake by 2%. Differences not significant at 8 or 18 mo.

Table 3.2. Validation of dietary assessment methods in toddler (13 to 24 months) populations, continued

Reference	Study Population	Test Method (TM)	Reference Measurement (RM)	Design Features	Correlation Between TM and RM	Mean Intake Difference Between TM and RM
24-HOUR RECALL (24HR)						
Bogle et al., 2001 (97)	0-2yrs. = 32 17 from telephone HHs and 43 from non-telephone HHs. Lower Mississippi Delta Region, US	Telephone 24R	In-person 24HR	Dual sampling frame from telephone and non-telephone HHs. In telephone HHs caretaker completed 24HR either in-person or by telephone. In non-telephone HHs 24HR completed in-person or by cell phone provided by the interviewer. Multiple pass methodology from 1994-96 CSFII used for 24 HR. BM Intake: Time of feeds collected. Low BF rates; BF infants excluded from analysis. Child Care Input: Caretaker provided information or interviewer contacted child care center.	Not specified	**Telephone 24HR vs In-person 24HR** Results reported for total sample and not by age group. Mean non significant difference between telephone and in-person interviews for telephone HHs was –171kcal, and for non-telephone HHs –143kcal (P=0.1).
FOOD FREQUENCY QUESTIONNAIRES (FFQ)						
Parrish et al., 2003(102) Diabetes Autoimmunity Study in the Young (DAISY)	1-3 yrs. = 68 49%M; 79% white; 57% of mothers 4 yrs. college; 79% HH income > $30,000; high risk for development of diabetes	111-item Harvard FFQ Self-administered Past year intake	4 24HR NCC method, 3 mo. apart with primary caregiver Blood sample on random sub sample of 38: Plasma lipids; alpha tocopherol; and ascorbic acid	In 1997-98, primary caregiver of participants completed 24HR interview quarterly. At end of year primary caregiver completed self administered Harvard FFQ. Child Care Input. Alternative caregivers (child care, fathers non living in home, grandparents, etc.) contacted for information in 24HR. Responses of parent and alternative caregiver combined into one 24HR.	**Pearson Correlation FFQ vs. 24HR** 0.08 kcal (-0.16 to 0.31) Energy-Adjusted nutrient correlations ranged from 0.33 for protein to 0.41. FFQ and plasma correlations: vitamin C (0.51); alpha tocopherol (0.48), beta cryptoxanthin (0.41) and alpha carotene (0.39)	**FFQ vs. 24HR** All ages: +70% kcal 2070 ± 709 kcal vs. 1220 ± 347 kcal 1 yr. (n=24) +72% kcal 1960 ± 597 kcal vs. 1140 ± 332 kcal 2 yr. (n=20) +77% kcal 2080 ± 787 kcal vs. 1170 ± 327 kcal

Table 3.2. Validation of dietary assessment methods in toddler (13 to 24 months) populations, continued

Reference	Study Population	Test Method (TM)	Reference Measurement (RM)	Design Features	Correlation Between TM and RM	Mean Intake Difference Between TM and RM
FOOD FREQUENCY QUESTIONNAIRES (FFQ)						
Blum et al., 1999 (103)	1-5 yrs. = 233 55% 1-2 yrs. 45% 3-4 yrs. M and F; 56% Native American; 44% white; WIC Program participants North Dakota, US	Modified 84-item Harvard FFQ 2x with 1 mo. interval Modified for 1 mo. period; self-administered	24HR 3x in 1mo. (@ 10d intervals) NDS computer assisted	1st HFFQ administered at routine WIC visit. 3 24HRs administered by telephone or in-person 10 days apart. HFFQ administered again after final 24HR. Mean of 3 24HR and 2 HFFQs compared	Pearson Correlation Protein = 0.43 CHO = 0.52 Fat = 0.59 14 other nutrients ranged from 0.26 – 0.63 Correlations not different for younger vs. older children or for Native Americans vs. Caucasians.	**HFFQ vs. 24HR** 0.2% kcal overestimation 1688 ± 482 kcal vs. 1684 ± 467 kcal HHHQ overestimated 10 of 20 nutrients, HFFQ intakes for each nutrient within 10% of 24HR.
Kuehneman et al., 1994 (104)	18-36mo. =22 Mean age 25.6 mo.; 12 from minority backgrounds; 8 in WIC program; most caretakers had HS education Omaha, Nebraska	64-item FFQ Interviewer administered with different portion size measurement aides: 1) graduated food models; 2) food pictures; 3) plastic food models; 4) standard serving sizes for age group.	24h duplicate diets Monthly for 12 mo.	FFQ administered in 1-hour interview with child caretaker. For each food, all three types of portion size measurement aides shown and caretaker asked to indicate if portion was same, less, or more. For 12 mo. following interview participant collected 24h duplicate diet monthly. The mean difference between actual amount ingested and the estimated amount in FFQ for each of the four comparisons for 38 foods was determined. Child Care Input: Not specified	Not specified	For 31 of the 38 foods, there was no significant difference between the standard serving size and the amount consumed. For the 38 foods studied, the standard serving size showed the smallest error for 17 foods compared with 4 for the graduated models, 6 for food pictures, and 5 for plastic models.