CHAPTER 5:RESULTS

Chapter overview

5.1 SAMPLE(S)

All 108 children on the class lists were anthropometrically assessed. Of these, 101 completed the screener and had no missing values in that data set. The re-test sample consisted of 39 children (three groups of each 13 learners). Four children did not participate in the food recording (parental or participant non-consent or absenteeism). Visual inspection of food records resulted in the following additional data cleaning: One food record was discarded because the child reported having gastro-enteritis during the recording period, five had omitted at least one full day of recording, one obviously under-recorded (wrappers were handed in but the foods were not recorded) and for one child one day had clearly been completed by a caregiver and the record appeared like a phantom report. This resulted in seven additional records being excluded from further analyses (some participants were excluded for more than one reason), leaving 93 children for whom the test method, complete anthropometry and usable food records (including three days of recording) were available.

A total of 78 parents returned a dietary screener completed in respect of their grade six child. Six of these contained at least one missing value and were not included in the comparative validation because the final scores would then reflect less than ten category scores. The eventual, triangulation-type comparison was based on this sample of 72 where complete information was available for the test method and both reference methods.

In Table 5.1 the composition of the various samples is summarised in terms of gender, age and anthropometric indices. Overall, the mean age was about twelve years and four months. Apart from height for age for boys, mean percentiles were higher than the median and mean z-scores were positive.

TABLE 5.1: DESCRIPTION OF THE VARIOUS SAMPLES IN TERMS OF MEAN ± STANDARD DEVIATION OF AGE AND ANTHROPOMETRIC INDICES

Sample		Age (Months)	Weight (kg)	Weight for age		Height (m)	Height for age		BMI (kg/m^2)	BMI for age	
				Percentile	Z-score		Percentile	Z-score		Percentile	Z-score
Test method	Male (n=50)	148.9±4.4	47.2±14.2	53.3±32.5	0.20±1.2	1.51±0.07	47.0±26.9	-0.09±0.8	20.4±4.9	58.6±32.0	0.36±1.2
	Female (n=58)	147.5±4.4	49.3±11.0	64.0±29.7	0.46±1.1	1.55±0.06	57.7±24.9	0.23±0.8	20.6±3.9	63.8±30.2	0.45±1.1
	Total (n=108)	148.1±4.4	48.3±12.6	59.0±31.3	0.34±1.1	1.53±0.06	52.6±26.3	0.08±0.8	20.5±4.4	61.4±31.0	0.41±1.1
Retest	Male (n=19)	148.5±4.4	50.3±16.0	60.7±35.0	0.46±1.4	1.51±0.08	50.0±29.9	-0.02±1.0	21.6±5.1	65.9±34.4	0.64±1.3
	Female (n=20)	147.8±3.5	47.4±9.7	59.6±28.7	0.30±0.9	1.54±0.05	55.0±25.2	0.16±0.7	19.8±3.5	58.7±29.8	0.25±1.0
	Total (n=39)	148.1±3.9	48.8±13.1	60.1±31.5	0.38±1.2	1.53±0.07	52.5±27.3	0.07±0.9	20.7±4.4	62.2±31.9	0.38±1.2
Comparative validation 1 (Food record as reference method)	Male (n=43)	149.0±4.6	48.0±16.4	55.3±32.4	0.26±1.3	1.51±0.07	48.6±26.9	-0.04±0.8	20.6±5.1	59.5±32.7	0.40±1.2
	Female (n=50)	147.5±3.9	49.7±11.1	64.8±29.1	0.49±1.1	1.55±0.06	58.4±25.1	0.26±0.8	20.6±3.9	63.5±30.2	0.43±1.1
	Total (n=93)	148.2±4.3	48.9±12.8	60.4±30.9	0.38±1.1	1.53±0.07	53.9±26.3	0.12±0.8	20.6±4.5	61.7±31.1	0.42±1.1
Comparative validation 2 (Parents as reference method)	Male (n=36)	148.7±4.3	49.1±15.3	57.9±33.0	0.36±1.3	1.52±0.08	50.1±29.2	-0.01±0.9	21.1±5.3	62.3±32.7	0.51±1.2
	Female (n=42)	147.7±3.5	48.8±10.2	63.3±28.3	0.43±0.9	1.55±0.06	56.5±25.2	0.19±0.8	20.3±3.4	62.7±28.1	0.42±0.9
	Total (n=78)	148.2±3.9	48.9±12.7	60.8±30.4	0.40±1.1	1.53±0.07	53.5±27.1	0.09±0.9	20.7±4.4	62.5±30.1	0.47±1.1
Triangulation	Male (n=34)	148.0±4.7	46.9±10.7	57.7±31.9	0.24±1.1	1.53±0.06	53.9±26.7	0.11±0.82	19.9±3.8	57.5±32.0	0.26±1.1
	Female (n=38)	149.3±4.1	52.7±14.5	67.1±29.3	0.67±1.2	1.54±0.06	54.6±26.0	0.14±0.80	22.0±5.1	70.6±29.6	0.73±1.2
	Total (n=72)	148.6±4.4	50.0±13.1	62.7±30.7	0.47±1.2	1.54±0.06	54.3±26.2	0.12±0.8	21.0±4.6	64.4±31.2	0.51±1.2

5.2 TEST METHOD

5.2.1 Internal consistency

The item total correlations (Table 5.2) ranged from 0.35 for table fats to 0.66 for cheese. All were highly significant (P<0.0001 in most cases). Cronbach's coefficient alpha for all ten category scores in the whole sample was 0.70 for the raw variables. When performed with deleted variables (that is without table fats), alpha increased to 0.72. The split half method of estimating reliability yielded a correlation coefficient between the two parts of the screener of 0.57 (P<0.0001).

TABLE 5.2: CORRELATION COEFFICIENTS (r) BETWEEN THE CATEGORY SCORES OF ALL FOOD CATEGORIES AND THE FINAL SCORES (n=101)

Food category	r[a]
Meat	0.55[b]
Eggs	0.41[b]
Dairy, milk, high fat	0.54[b]
Dairy, cheese, high fat	0.66[b]
Dairy, dessert, high fat	0.55[b]
Fried foods	0.38[b]
In baked goods	0.64[b]
Convenience foods	0.51[b]
Table fats, high fat	0.35[c]
Snacks, high fat	0.65[b]

[a] Pearson's correlation coefficients
[b] P<0.0001
[c] P<0.0004

5.2.2 Test-retest reproducibility

The check for sampling bias revealed that, within the first administration, there was no significant difference between repeaters and non-repeaters (P>0.05 for all the category scores as well as the final scores; Table 5.3). Cronbach's alpha for the re-test sample was 0.67 for all raw variables and 0.69 with meat deleted.

TABLE 5.3: DIFFERENCE IN CATEGORY AND FINAL SCORES BETWEEN PARTICIPANTS IN RE-TEST AND NON-PARTICIPANTS

Food category	Category scores Mean±SD		P[a]
	Participants (n=39)	Non-participants (n=65)	
Meat	13.2±5.9	13.2±6.3	0.95
Eggs	4.8±3.1	4.8±4.0	0.87
Dairy, milk, high fat	14.4±5.4	14.1±6.7	0.94
Dairy, cheese, high fat	11.7±5.9	9.3±6.2	0.05
Dairy, dessert, high fat	10.6±6.0	10.5±6.5	0.91
Fried foods	11.8±6.6	12.0±6.8	0.93
In baked foods	8.7±4.9	8.58±6.2	0.88
Convenience foods	10.6±6.1	9.5±6.2	0.35
Table fats, high fat	15.8±6.2	14.8±7.1	0.58
Snacks, high fat	12.5±5.7	11.7±6.6	0.52
Final score	114.1±24.9	108.1±35.1	0.42

[a]Wilcoxon Two-sided Rank Sum test

Table 5.4 shows the degree of agreement in the two administrations in terms of the portion size estimates and the categorised frequencies of intake. The percentage of children reporting the identical usual portion size in both administrations varied from less than 50% for milk and snacks to over 70% for dessert, eggs, baked goods, convenience foods, table fats and fried foods. Following adjustment for chance agreement (kappa statistic), table fats, convenience foods and eggs had moderate agreement (kappa 0.41-0.60). Meat, baked goods and dessert showed fair agreement (kappa 0.21-0.40) and for the remaining four food categories agreement was poor (kappa <0.20).[270] The McNemar statistic revealed a departure of symmetry ($P<0.05$) only for meat, suggesting that, in general, changes in reported portion sizes were similar in both directions (from smaller to larger and vice versa) in the second administration.

TABLE 5.4 REPRODUCIBILITY OF PORTION SIZE AND FREQUENCY OF INTAKE ESTIMATES OF ALL FOOD CATEGORIES (n=39)

Food categories	Portion size				Frequency of intake			
	Identical (%)	Kappa		McNemar P	Identical (%)	Kappa		McNemar P
		Value	P			Value	P	
Meat	65.8	0.36	0.01	0.04	82.1	0.53	0.0001	0.06
Eggs	70.6	0.43	0.01	0.37	82.1	0.55	0.0001	0.51
Dairy, milk, high fat	43.2	0.10	0.40	0.44	87.2	0.12	0.30	0.51
Dairy, cheese, high fat	65.7	-0.15	0.26	0.84	48.7	0.14	0.21	0.06
Dairy, dessert, high fat	70.3	0.28	0.16	0.37	56.4	0.19	0.11	0.35
Fried foods	76.3	0.19	0.19	0.10	48.7	0.08	0.53	0.72
In baked goods	71.8	0.34	0.004	0.15	61.5	0.36	0.002	0.04
Convenience foods	72.2	0.48	0.001	0.26	61.6	0.30	0.02	0.51
Table fats, high fat	75.0	0.52	0.002	0.32	84.6	0.17	0.27	0.41
Snacks, high fat	48.7	0.08	0.51	0.62	76.9	0.46	0.002	0.34

In the case of estimated weekly intake, the percentage of agreement ranged from just under 50% for cheese and fried foods to over 80% for meat, eggs, table fats and milk. Correction for chance agreement resulted in moderate agreement for eggs, meat and snacks (kappa 0.41-0.60), fair agreement for baked goods and convenience foods (kappa 0.21-0.40) and poor agreement for the remaining five food categories. Baked goods, cheese and meat were borderline (P about 0.05) in terms of symmetry of the non-identical responses in the two administrations, but, in general, for reported weekly consumption, the increases seemed to be balanced by the decreases (see McNemar information in Table 5.4).

As evident from Table 5.5, the mean category scores in the second administration were lower than in the first administration for six of the ten food categories, but the difference was non-significant (P>0.05). Meat and cheese were clear exceptions, with fats in baked foods being borderline. The mean final scores in the two administrations also did not differ significantly. From the frequency distribution of the difference between the final scores in the two

administrations, it was found that for the whole group about 72% of children were within plus or minus 30 points (Table 5.6). For boys this corresponding cumulative percentage was 58, whilst for girls it was 85. The percentage of girls and boys was similar for an absolute difference in final scores of 20 or less. There was no significant correlation between BMI for age Z-scores and difference in final scores in the two administrations, neither for the group as a whole (r=0.05, P=0.75), nor for the genders separately (males r=-0.08, P=0.74; females r=0.33, P=0.16).

TABLE 5.5 MEAN ±SD CATEGORY AND FINAL SCORES IN THE FIRST AND SECOND ADMINISTRATION (n=39)

Food category		Category scores Mean ± standard deviation			P [c]
		First administration	Second administration	Difference [a]	
Meat		13.2±5.9	16.2±5.9	-2.9±6.0	0.01
Eggs		4.8±3.1	4.4±3.6	0.4±2.9	0.47
Dairy, milk, high fat		14.4±5.4	14.0±6.2	0.4±7.3	0.79
Dairy, cheese, high fat		11.7±5.9	8.6±5.9	3.1±7.1	0.01
Dairy, dessert, high fat		10.6±6.0	10.2±6.5	0.4±7.7	0.76
Fried foods		11.8±6.6	12.8±6.8	-1.0±9.2	0.57
In baked foods		8.7±4.9	10.4±7.2	-1.7±6.2	0.05
Convenience foods		10.6±6.1	9.4±6.1	1.2±8.0	0.48
Table fats, regular (high fat)		15.8±6.2	14.4±6.5	1.3±7.0	0.35
Snacks, high fat		12.5±5.7	12.9±6.6	-0.5±6.7	0.52
Final score	Whole group (CI[b])	114.1±24.9 (106.0, 122.2)	113.4±31.1 (103.3, 123.5)	0.69±32.6 (-9.9, 11.3)	0.86
	Males (CI[b])	115.5±30.6 (100.7, 130.2)	117.2±31.6 (101.9, 132.4)	-1.68±39.4 (-20.7, 17.3)	0.82
	Females (CI[b])	112.8±18.7 (104.0, 121.5)	109.8±31.0 (95.3, 124.3)	3.0±25.4 (-8.9, 14.8)	0.78

[a] First minus second administration
[b] 95% Confidence limits containing the mean
[c] Wilcoxon's Signed Rank test

TABLE 5.6: ABSOLUTE FINAL SCORE DIFFERENCE BETWEEN ADMINISTRATIONS, BY GENDER (n=39)

Absolute final score difference	Respondents								
	Whole group			Males			Females		
	n	%	Cumulative %	n	%	Cumulative %	n	%	Cumulative %
≤10	11	28.2	28.2	5	26.3	26.3	6	30.0	30.0
>10 but ≤20	6	15.4	43.6	4	21.1	47.4	2	10.0	40.0
>20 but ≤30	11	28.2	71.8	2	10.5	57.9	9	45.0	85.0
>30	11	28.2	100.0	8	42.1	100.0	3	15.0	100.0
Total	39	100.0		19	100.0		20	100.0	

An initial indication of a linear relationship between the final scores of the two administrations was suggested by small, but statistically significant correlation coefficient (r=0.36, P=0.02). If separated by gender, the correlation coefficient for boys was non-significant (r=0.26, P=0.29) whilst it was highly significant for girls (r=0.58, P=0.01). Measures of central tendency and variability in the final scores of the dietary fat screener are presented in Table 5.7. For the whole group the means were very similar, but the standard deviations, inter-quartile ranges and 95% confidence intervals point to variability. Girls as a group exhibited overall less variability and the midpoints of the second administration were lower than the first, in contrast to the boys. From Table 5.5 (bottom row) it is, however, evident that for boys and girls the difference in final scores did not significantly differ from zero.

TABLE 5.7: MEASURES OF LOCATION AND VARIABILITY OF FINAL SCORES OF THE DIETARY FAT SCREENER (n=39; 19 male, 20 female)

Measure		First administration	Second administration	Difference[a]
Mean ± standard deviation	Whole group	114.1±24.9	113.4±31.1	0.69±32.6
	Males	115.5±30.6	117.2±31.6	-1.68±39.4
	Females	112.8±18.7	109.8±31.0	2.95±25.4
Median (P_{25}, P_{75}) [b]	Whole group	112.0 (95, 133)	104.0 (93, 142)	1.0 (-20, 26)
	Males	105.0 (87,146)	105.00 (100, 142)	-1.00 (-20, 29)
	Females	112.0 (99.0, 125.5)	100.5 (90.5, 137.0)	5.00 (-22, 24)
95% Confidence interval	Whole group	(106.0, 122.2)	(103.3, 123.5)	(-9.9, 11.3)
	Males	(100.7, 130.2)	(101.9, 132.3)	(-20.7, 17.3)
	Females	(104.0, 121.5)	(95.3, 124.3)	(-8.9, 14.8)

[a] First minus second administration
[b] P_{25} = 25th percentile, P_{75} = 75th percentile

From Table 5.8 it can be deducted that 40% (3 plus 5) of children remained in the same lowest or highest quarter during the two administrations, whilst 15% (2 plus1) changed from one extreme

to the other. When the scores were categorised, then less than 8% (n=3; 2 female, 1 male) of respondents were reclassified from a high fat to a prudent diet.

TABLE 5.8: NUMBER OF RESPONDENTS IN OPPOSITE QUARTERS IN FIRST AND SECOND ADMINISTRATION (n per quartile = 10)

		First administration	
		Lowest quarter	**Highest quarter**
Second administration	**Lowest quarter**	3	1
	Highest quarter	2	5

Figures 5.1a and 5.1b quantify and illustrate the variability of the individual data points in the two administrations. Visual inspection confirms a wide scatter around the diagonal line of equality (Figure 5.1a) and the horizontal line of zero difference (Figure 5.1b) for the group as a whole, with females tending to be closer to these lines, suggesting better reproducibility.

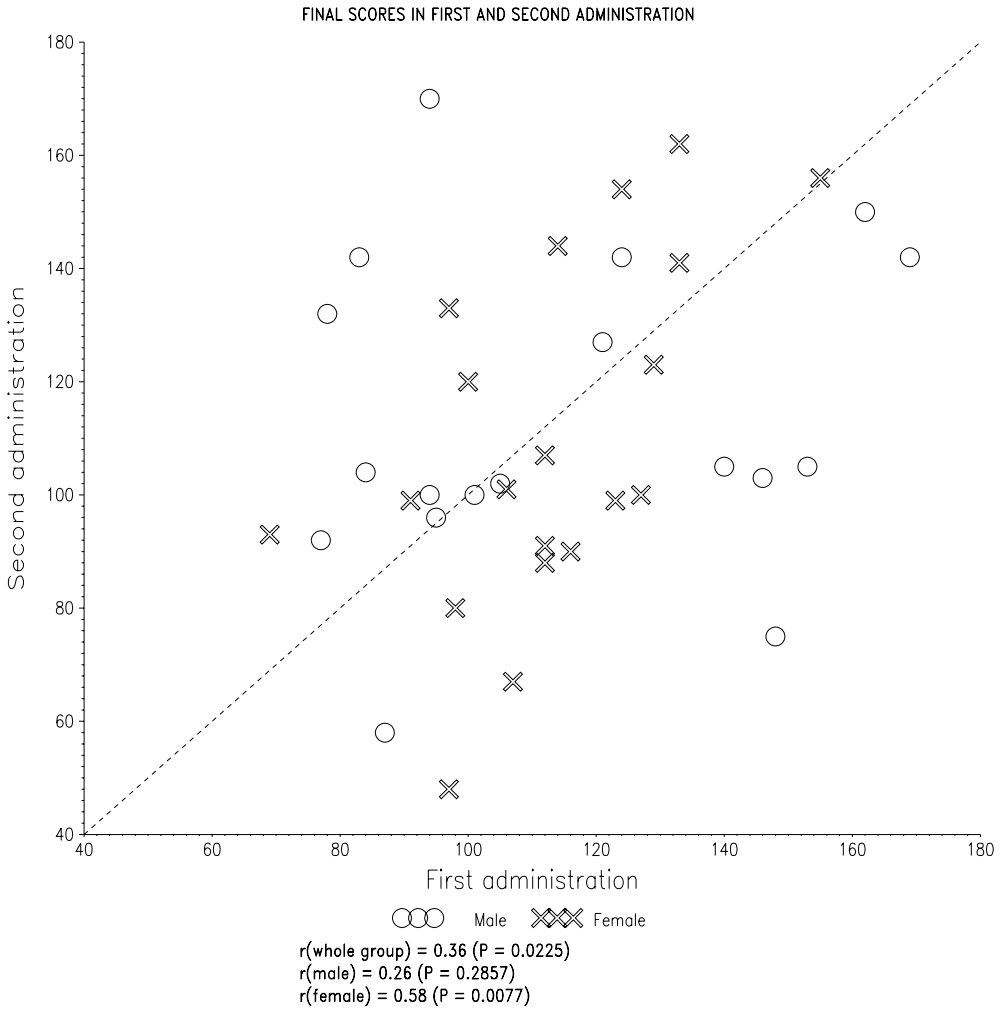

FIGURE 5.1a: FINAL SCORES IN FIRST AND SECOND ADMINISTRATION

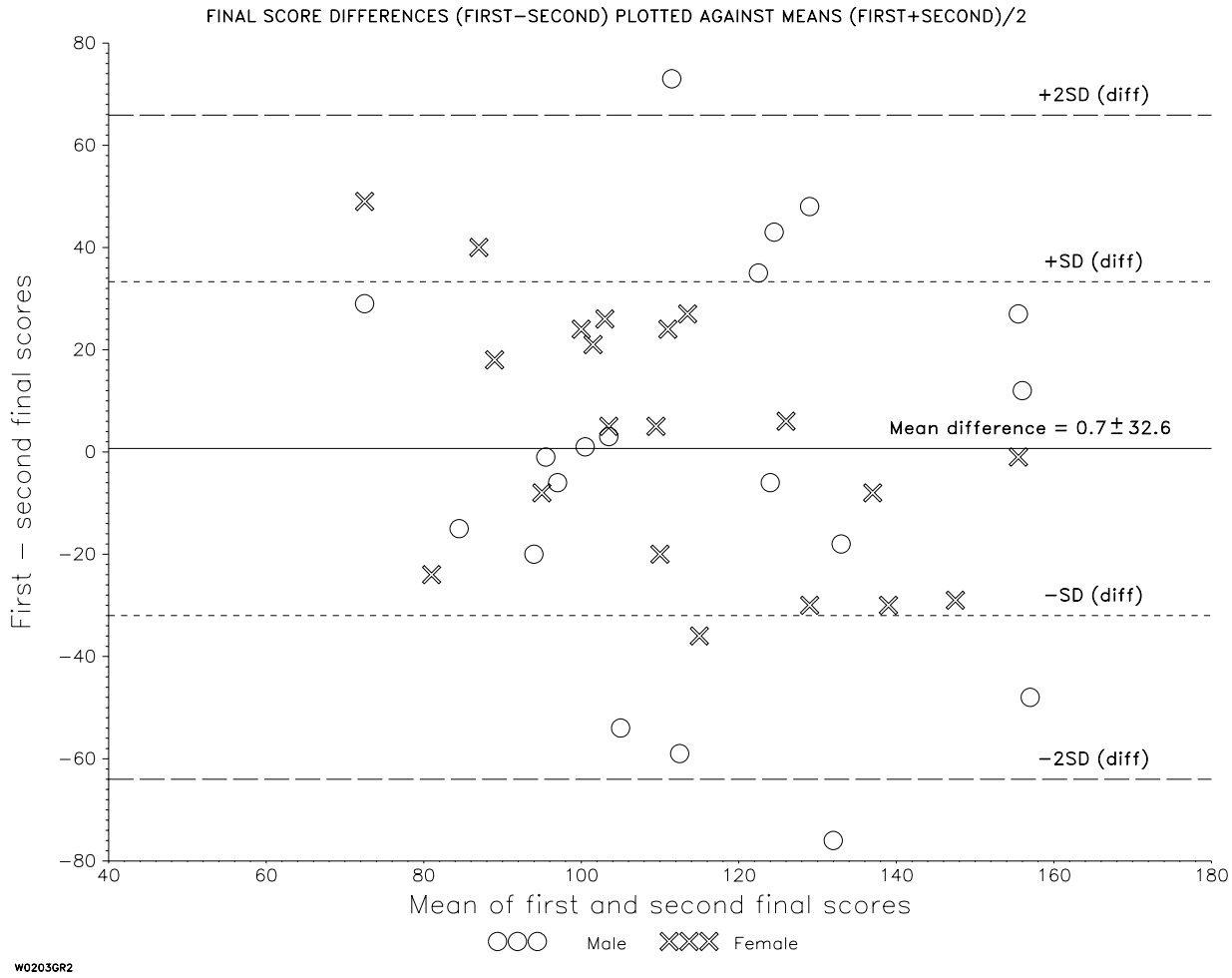

FIGURE 5.1b: FINAL SCORE DIFFERENCES (FIRST – SECOND ADMINISTRATION) PLOTTED AGAINST MEANS ([FIRST + SECOND]/2)

5.3 FOOD RECORD

5.3.1 Quality control

The mean PAL for the final, whole group (n=93) was 1.45±0.4 (range 0.7-2.8). For boys and girls separately the respective values were 1.49±0.4 and 1.41±0.4. Twelve children had a PAL value below 1.06. On average the recorded mean daily energy intakes were 97% and 91% of the 2002 DRI values [10] for boys and girls respectively.

For the group as a whole, a statistically significant positive correlation (r=0.24; P=0.02) was found between mean energy intake over the three days and body weight. For boys this correlation coefficient was 0.46 (P=0.002) and for girls it was shown to be negative (r=-0.12) though not statistically significant (P=0.42).

The energy intakes over the three days, individually and as a group, for each of the three recording periods as well as for the two quantification methods (electronic scale and household measures) are indicated in Table 5.9. Overall there was a statistically significant difference in energy intake between the three recording days (P=0.03) in the sense that the z statistic was larger than the critical value of alpha of 0.05 when day one was compared to day three. Within the Thursday to Saturday and the Sunday to Tuesday recording periods there was no significant difference in energy intake over the three days, but in the Tuesday to Thursday group the difference was statistically significant (P=0.04). Again, specifically between day one and day three the z statistic exceeded the critical value for overall alpha of 0.05.

TABLE 5.9: MEAN (±SD) ENERGY INTAKES OVER THE THREE RECORDING DAYS BY RECORDING PERIOD AND QUANTIFICATION METHOD (n=93)

		Energy intake (kJ)			
		Day 1	**Day 2**	**Day 3**	**Means**
Recording period	Thursday - Saturday (n=22)	8999±2539	8585±2422	9900±7357	9161±7357
	Tuesday - Thursday (n=49)	9562±3735	8460±2818	8204±2897	8742±2505
	Sunday - Tuesday (n=22)	8201±1888	7201±2460	6989±2154	7464±1506
Quantification method	Electronic scales (n=60)	8840±2985	7946±2504	7776±3643	8187±2270
	Household measures (n=33)	9592±3401	8640±2955	9304±5300	9179±2794
	Means	9107±3142	8192±2678	8318±4338	8539±2499

5.3.2 Energy and fat intakes

Reference method one, the three-day food record, contained three measures of high fat intake: Mean percentage total daily fat energy (PFE), mean percentage daily saturated fat energy (PSFE) and mean daily cholesterol intake. In Table 5.10 the mean dietary intakes of these three measures as well as energy intake over the three days of recording are given. In addition the International Institute of Medicine's estimates of within-subject variation for the corresponding nutrients is stated for comparing the observed day-to-day variability in intake to international 'standards'.

TABLE 5.10: MEAN (±SD[a]) INTAKES (THREE-DAY RECORD) AND PUBLISHED INTRA-SUBJECT VARIATION FOR 9-18 YEAR OLDS [272]

Intake	**Boys**			**Girls**			**Whole group** (n=93)
	This study (n=43)	Intra-subject variation		This study (n=50)	Intra-subject variation		
		SD	CV[b] (%)		SD	CV (%)	
Energy (kJ)	9280±3032	3360	33	7902±1717	2638	34	8539±2499
Total fat (g)	86.9±36.0	38.2	42	74.3±21.2	29.8	45	80.1±29.6
PFE[c]	34.9±6.2	NA	NA	35.5±6.5	NA	NA	35.2±6.3
Saturated fatty acids (g)	32.0±15.1	15.3	48	26.7±8.3	11.3	48	29.1±12.2
PSFE[d]	12.9±2.9	NA	NA	12.8±3.1	NA	NA	12.8±3.0
Cholesterol (mg)	275.7±128.0	199	71	211.6±99.2	145	72	241.3±117.3

[a] Standard deviation
[b] Coefficient of variation
[c] Percent fat energy
[c] Percent saturated fat energy
NA: Not applicable

Seventy-two (77.4%) of the children consumed a diet where PFE contributed more than 30% of the energy intake. Seventy-eight (83.9%) and 19 (20.4%) respectively recorded a PSFE higher than ten percent, and mean daily cholesterol consumption greater or equal to 300mg. Figure 5.2 shows that there was considerable overlap between the measures of high fat intake. Sixteen (17.2%) participants were classified as high fat consumers by *all* three measures, whilst 84 (90.3%) of participants would be classified as having a high fat intake if *any* one of the measures was used as criterion. Nine participants' intake was classified as prudent by all three measures.

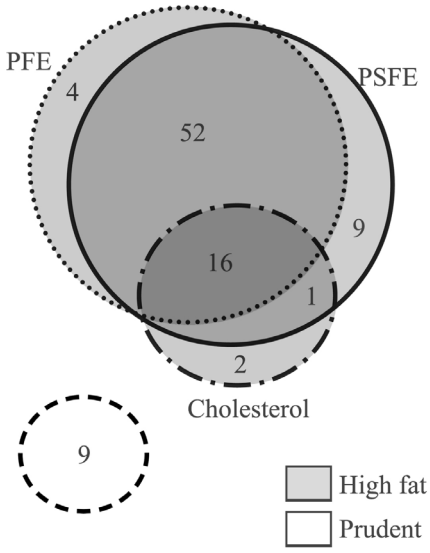

FIGURE 5.2: CLASSIFICATION OF FOOD RECORDS INTO 'HIGH FAT' AND 'PRUDENT' USING PERCENT FAT ENERGY (PFE), PERCENT SATURATED FATTY ACID ENERGY (PSFE) OR CHOLESTEROL INTAKE AS MEASURES (n=93)

5.3.3 Comparative validation: Test method versus food record

The correlations between the final score obtained in the screener and the three measures of fat intake from the three-day food record are presented in Table 5.11. The Table shows that for girls, the final score of the screener was significantly (P<0.05) related to total fat energy, total saturated fat energy and cholesterol intake. For the group as a whole and for boys no one of the measures was significantly correlated. For girls the associations with PFE and PSFE were also non-significant.

TABLE 5.11: CORRELATION COEFFICIENTS (r) BETWEEN TEST METHOD FINAL SCORES AND FOOD RECORD MEASURES OF FAT INTAKE

Measure of fat intake	**Boys** (n=43)		**Girls** (n=50)		**Whole group** (n=93)	
	r	P	r	P	R	P
Total fat energy	0.03	0.87	0.30	0.04	0.16	0.13
PFE [a]	-0.17	0.28	0.14	0.35	-0.02	0.82
Saturated fat energy	0.06	0.72	0.31	0.03	0.20	0.06
PSFE [b]	-0.01	0.93	0.19	0.18	0.08	0.45
Cholesterol	-0.09	0.56	0.31	0.03	0.18	0.10

[a] Percentage fat energy
[b] Percentage saturated fatty acid energy

The mean energy and fat intakes of those classified as consuming a high fat versus a prudent diet according to the test method are presented in Table 5.12.

TABLE 5.12: MEAN (±SD) INTAKES IN TEST METHOD CLASSIFCATION GROUPS (n=93)

Food record measure	**Test method classification**	
	High fat (n=86)	Prudent (n=7)
Energy (kJ)	8589±2521	7928±2303
Total fat (g)	80.5±29.5	75.7±32.3
PFE[a]	35.2±6.4	35.2±5.2
Saturated fat (g)	29.3±12.0	26.8±14.8
PSFE [b]	12.9±3.0	12.2±3.5
Cholesterol (mg)	246.0±113.1	183.1±158.8

[a] Percentage fat energy
[b] Percentage saturated fatty acid energy

Table 5.13 is a multiple cross tabulation of classifications based on each of the measures of fat intake from the food record on the one hand, with the classification according to the screener, on the other hand.

TABLE 5.13: COMPARISON OF TEST METHOD CLASSIFICATION TO CLASSIFICATION OF THREE MEASURES FROM FOOD RECORD (n=93)

		Three-day food record measures									
		PFE[a]		PSFE[b]		CHOL[c]		ANY[d]		ALL[e]	
		+ n(%)	- n(%)	+ n(%)	- n(%)	+ n(%)	- n(%)	+ n(%)	- n(%)	+ n(%)	- n(%)
Test method classification[f]	+ n=86	66 (71.0)	20 (21.5)	74 (79.6)	12 (12.9)	18 (19.4)	68 (73.1)	78 (83.9)	8 (8.6)	15 (16.1)	71 (76.3)
	- n=7	6 (6.6)	1 (1.1)	4 (4.3)	3 (3.2)	1 (1.1)	6 (6.5)	6 (6.5)	1 (1.1)	1 (1.1)	6 (6.6)
Total n (%)	93 (100)	72 (77.4)	21 (22.6)	78 (83.9)	15 (16.1)	19 (20.4)	74 (79.6)	84 (90.3)	9 (9.7)	16 (17.2)	77 (82.8)

[a] Percentage fat energy, where " + " is >30% (high fat); " - " is =<30% (prudent)
[b] Percentage saturated fatty acid energy, where " + " is >10% (high fat); " - " is =<10% (prudent)
[c] Cholesterol intake, where " + " is >=300mg (high fat); " - " is <300mg (prudent)
[d] Any one of the three measures applies
[e] All three measures apply simultaneously
[f] " + " is final score >68 (high fat); " - " is final score =<68 (prudent)

When PFE, PSFE and any measure acted as reference, the percentage true positives (high fat intake) plus true negatives (prudent fat intake) was high. Thus the percentage exact matches (overall predictive value) for PFE, PSFE and "ANY" were 72%, 83% and 85% respectively. This was in contrast to cholesterol intake or meeting all three measures as criterion, where many false positives were found. Nevertheless, the simple kappa coefficient was always below 0.20 denoting poor chance corrected agreement.

With the information from Table 5.13 as starting point, various indicators of the comparative validity of the screener relative to the three measures of fat intake are shown in Table 5.14.

TABLE 5.14: INDICATORS OF VALIDITY OF TEST METHOD AGAINST FOOD RECORD MEASURES OF FAT INTAKE (n=93)

Food record measure	Indicators of validity								
	Sens[g] (CI)[f]	Spec[h] (CI)[f]	OPV[i]	PPV[j] (CI)[f]	NPV[k] (CI)[f]	RR[l]	OR[m]	LR^{+}[n] (CI)[f]	LR^{-}[o] (CI)[f]
PFE[a]	0.92 (0.83, 0.96)	0.05 (0.00, 0.23)	0.72	0.77 (0.69, 0.84)	0.14 (0.01, 0.51)	5.37	0.55	0.96 (0.86, 1.08)	1.75 (0.22, 13.74)
PSFE[b]	0.95 (0.88, 0.98)	0.20 (0.07, 0.45)	0.83	0.86 (0.77, 0.92)	0.43 (0.16, 0.75)	2.01	4.63	1.20 (0.92, 1.54)	0.27 (0.06, 1.03)
CHOL[c]	0.95 (0.75, 1.00)	0.08 (0.04, 0.17)	0.26	0.21 (0.14, 0.31)	0.86 (0.49, 0.99)	0.24	1.59	1.03 (0.91, 1.17)	0.65 (0.83, 5.07)
ANY[d]	0.93 (0.85, 0.98)	0.11 (0.01, 0.44)	0.85	0.91 (0.83, 0.95)	0.14 (0.01, 0.51)	6.35	1.63	1.05 (0.82, 1.33)	0.64 (0.09, 4.76)
ALL[e]	0.94 (0.72, 1.00)	0.08 (0.04, 0.16)	0.23	0.17 (0.11, 0.27)	0.86 (0.49, 0.99)	0.20	1.27	1.02 (0.88, 1.17)	0.80 (0.10, 6.21)

[a] Percentage fat energy
[b] Percentage saturated fatty acid energy
[c] Cholesterol intake
[d] Any one of the measures of fat intake
[e] All measures of fat intake
[f] 95% confidence interval
[g] Sensitivity
[h] Specificity
[i] Overall predictive value
[j] Positive predictive value
[k] Negative predictive value
[l] Relative risk
[m] Odds ratio
[n] Positive likelihood ratio
[o] Negative likelihood ratio

The sensitivity of all three measures, individually or combined, was always very high (>0.9). The specificity was always low, with PSFE having the highest specificity, namely 0.20. The overall and the positive predictive values were higher than 0.7 for PFE, PSFE and when any of the three measures met the cut-off, but for cholesterol and when all three measures had to be met, they were less than 0.3. Negative predictive value was highest (0.86) for both, cholesterol and when all three measures applied. The relative risk was strong (that is above two)[45] for PFE, PSFE and when any one of the measures was applied. The odds ratio for PSFE was much higher than any one of the other two measures or combinations.

5.4 SCREENER BY PARENTS

5.4.1 Internal consistency

When parents completed the screener to assess their grade six children's diets the following was found: Apart from eggs, item total correlations were highly significant (P<0.0001) for all food categories (Table 5.15). For the latter nine food categories the correlation coefficients ranged from 0.48 (meat) to 0.63 (milk). Cronbach's coefficient alpha was 0.69 for all ten category scores and 0.71 when performed without the category scores for eggs. The correlation coefficient (Pearson) obtained between category scores of two random halves of the screener was 0.48 (P<0.0001).

TABLE 5.15 CORRELATION COEFFICIENTS (r) BETWEEN PARENTS' CATEGORY SCORES OF ALL FOOD CATEGORIES AND THEIR FINAL SCORES (n=76)

Food categories	R
Meat	0.48[a]
Eggs	0.09[b]
Dairy, milk, high fat	0.63[a]
Dairy, cheese, high fat	0.50[a]
Dairy, dessert, high fat	0.64[a]
Fried foods	0.52[a]
In baked goods	0.61[a]
Convenience foods	0.54[a]
Table fats, high fat	0.50[a]
Snacks, high fat	0.59[a]

[a] P<0.0001
[b] P=0.4650

5.4.2 Comparative validation: Test method versus screener by parents

5.4.2.1 Portion size

The percentage exact agreements between parents and children in terms of reported usual portion size eaten by the children varied from as low as 18% for fried foods to about 72% for eggs (Table 5.16) with an average percentage agreement over the ten food categories of 45.0%.

Chance corrected agreement based on kappa values was moderate for eggs (kappa=0.44; P=0.0001) and fair for cheese (kappa=0.30; P=0.0006). For all other food categories agreement was poor (kappa < 0.20). Apart from eggs and baked foods, the non-agreeing responses tended to be non-symmetrical (McNemar P<0.05).

5.4.2.2 Frequency of intake

From Table 5.16 it is also evident that the percentage child-parent pairs that reported identical frequency of intake ranged from 42% (convenience foods) to 74% (milk). This represents an average of 60.1% across all ten food categories. For 40% of the food categories (eggs, dessert, cheese and fried foods) the chance corrected agreement was fair (kappa between 0.21 and 0.40 and P<0.05). For the remaining six food categories the chance corrected agreement was poor. For 80% of food categories non-agreement around the diagonal of perfect matches appeared to be not symmetrical (P<0.05) with eggs and snacks being the exception, where P=0.91 and 0.25 respectively.

TABLE 5.16: AGREEMENT BETWEEN PARENTS AND CHILDREN IN TERMS OF REPORTED PORTION SIZE AND FREQUENCY OF INTAKE ESTIMATES OF ALL FOOD CATEGORIES (n=77)

Food categories	Portion size				Frequency of intake			
	Identical (%)	Kappa		McNemar P	Identical (%)	Kappa		McNemar P
		Value	P			Value	P	
Meat	46.7	0.07	0.42	0.01	68.8	0.07	0.36	0.00
Eggs	71.6	0.44	0.00	0.18	68.8	0.22	0.01	0.91
Dairy, milk, high fat	49.3	0.17	0.05	0.07	74.0	0.21	0.01	0.04
Dairy, cheese, high fat	63.2	0.30	0.00	0.05	59.7	0.32	0.00	0.00
Dairy, dessert, high fat	31.7	0.05	0.37	0.00	56.9	0.00	0.98	0.00
Fried foods	18.4	-0.08	0.07	0.00	58.4	0.21	0.03	0.05
In baked goods	53.7	0.14	0.12	0.20	48.1	0.05	0.56	0.10
Convenience foods	39.7	0.03	0.60	0.00	41.6	-0.06	0.38	0.00
Table fats, high fat	29.2	-0.02	0.73	0.00	66.2	0.05	0.34	0.00
Snacks, high fat	46.7	0.14	0.04	0.00	58.4	0.18	0.10	0.25

5.4.2.3 Category and final scores

Table 5.17 summarises the mean category scores of parents and children, as well as the correlations between the scores. Mean category scores of parents were always lower than those of the children, and in the case of dessert and convenience foods the mean was about half of that for the children. A statistically significant (P<0.05) linear relationship between parents' and children's category scores was found for meat, milk and cheese. In the case of table fats and snacks this relationship bordered on statistical significance (P more or less 0.05) whilst for eggs, dessert, fried, baked and convenience foods there was an absence of evidence for a linear relationship.

TABLE 5.17: CHILDREN'S AND PARENTS' CATEGORY AND FINAL SCORES [a]: MEANS AND CORRELATIONS (n=78)

Food category		Mean ±SD	Correlations	
			r	P
Meat	Children	13.4±6.2	0.25	0.03
	Parents	13.2±4.9		
Eggs	Children	5.2±3.9	0.12	0.28
	Parents	4.4±3.1		
Dairy, milk, high fat	Children	13.9±6.2	0.40	0.00
	Parents	11.2±6.4		
Dairy, cheese, high fat	Children	10.4±6.4	0.41	0.00
	Parents	8.2±5.5		
Dairy, dessert, high fat	Children	10.8±5.2	-0.03	0.84
	Parents	5.3±3.8		
Fried foods	Children	12.6±6.9	0.15	0.20
	Parents	8.4±4.6		
In baked goods	Children	8.6±5.2	0.09	0.42
	Parents	7.0±5.2		
Convenience foods	Children	10.8±6.4	0.04	0.70
	Parents	5.0±3.3		
Table fats, high fat	Children	16.1±6.2	0.22	0.05
	Parents	9.9±6.2		
Snacks, high fat	Children	12.3±6.1	0.22	0.06
	Parents	9.1±5.0		
Final score	Children	114.4±30.7	0.23	0.04
	Parents	82.0±25.2		

[a] Frequency score multiplied by portion size score.
Frequency score based on weekly consumption:
Rarely or never = 0
Up to 3 times = 3
More than 3 =7
Portion size score:
Small = 1
Medium = 2
Large = 3

From Table 5.17 it can be seen that the correlation coefficient between the final scores of children and their parents was 0.23 (P=0.04). For boys the correlation coefficient was non-

significant (r=0.13; P=0.46) whilst for girls it higher than the whole group value (r=0.33; P=0.04).

Table 5.18 illustrates the mean difference between children's and parents' final scores. Whilst the mean difference between children and parents was very similar for boys and girls, greater variability (see standard deviations and confidence intervals) was apparent in the case of boys. Nevertheless, the difference in final scores between children and parents differed significantly from zero for the group as a whole and for the gender separately (P<0.0001 in all three instances).

TABLE 5.18: MEAN DIFFERENCE IN FINAL SCORES OF CHILDREN AND PARENTS BY GENDER

	Difference[a] Mean±SD	CI[b]	P[c]
Whole group	32.0±35.1	(23.8; 40.2)	0.0001
Boys	31.6±42.4	(17.0; 46.2)	0.0001
Girls	32.4±27.9	(23.3; 42.4)	0.0001

[a] Child minus parent
[b] 95% Confidence limits containing the mean difference
[c] Wilcoxon's Signed Rank Test

Figures 5.3a and 5.3b compare final scores obtained by children and by their parents. The plot in Figure 5.3a illustrates that in most cases the children had a higher final score than their parents as most of the data points were above the diagonal of perfect agreement. Furthermore this scatter plot gives a visual indication of why the correlation coefficient revealed the weak linear association reported above, in fact the absence of such an association for boys. Figure 5.3b re-emphasises the variability (random error) and the presence of bias (systematic error) by the magnitude of the standard deviation and mean difference respectively.

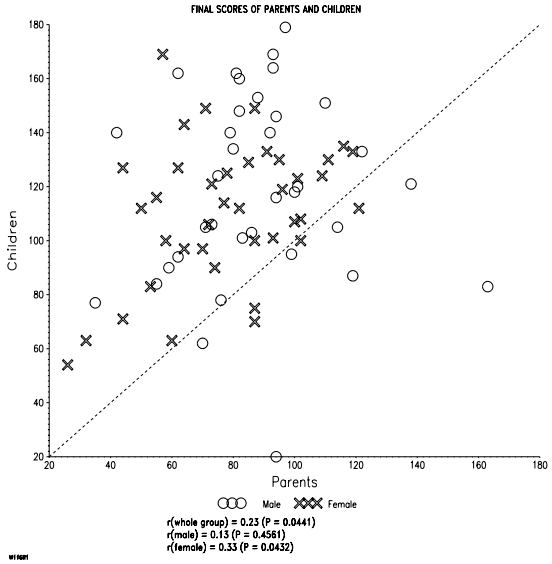

FIGURE 5.3a: FINAL SCORES OF PARENTS AND CHILDREN

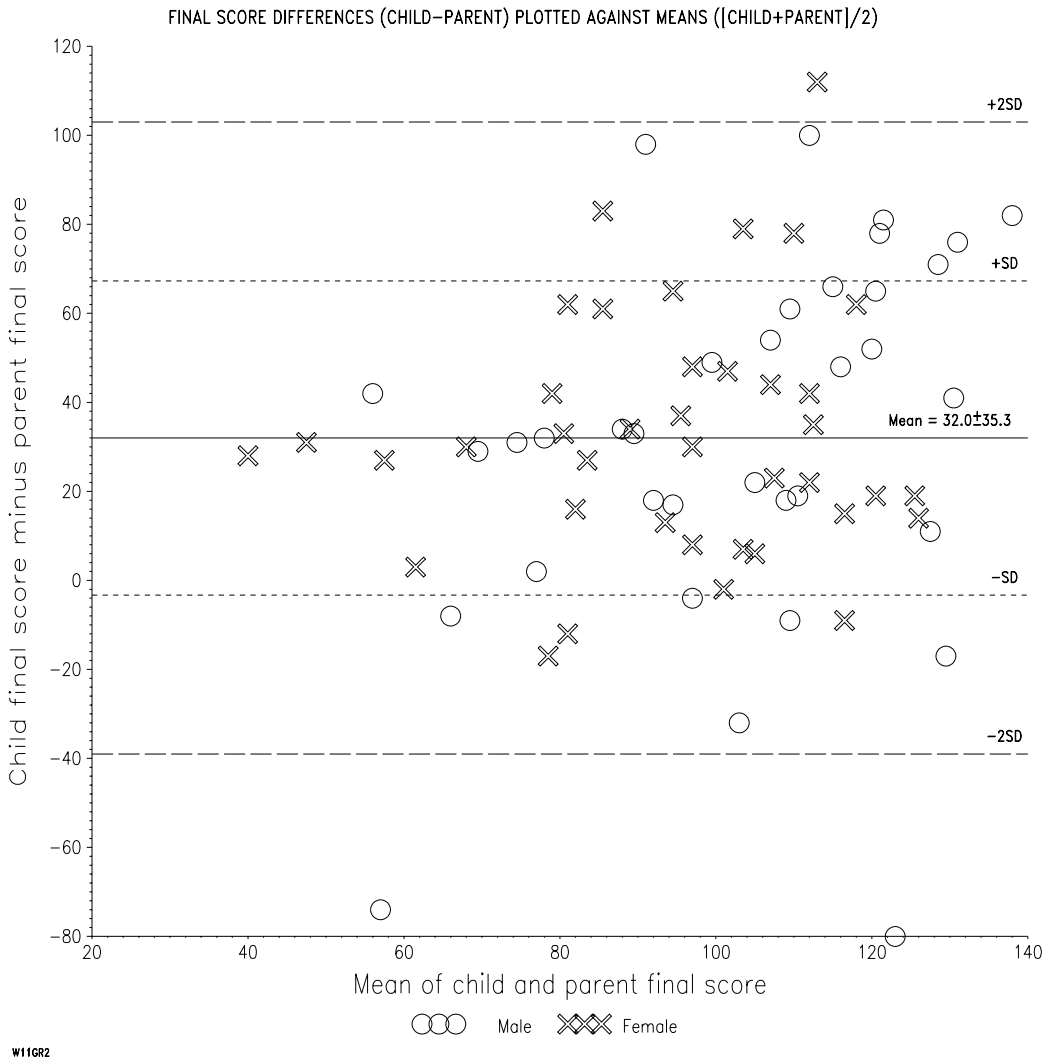

FIGURE 5.3b: FINAL SCORE DIFFERENCES (CHILD-PARENT) PLOTTED AGAINST MEANS ([CHILD + PARENT]/2)

5.4.2.4 Classification agreement

The percentage identical classifications into high fat or prudent was 76%. When corrected for chance the agreement was, however, poor (kappa = 0.16) and the McNemar test indicated a departure from symmetry (P=0.0010).

5.5 TRIANGULATION: TEST METHOD VERSUS FOOD RECORD VERSUS SCREENER BY PARENTS

Figures 5.4a to 5.4e illustrate the classification agreement for the 72 children for whom a comprehensive data set containing a self-assessment by means of the screener (test method), three-day food record (reference method one) and parental completion of screener (reference method two) without any missing values was available.

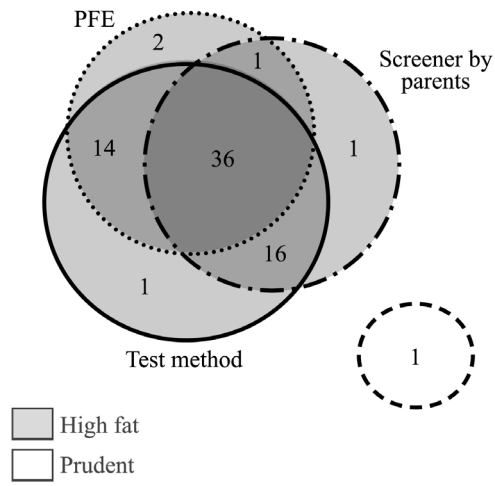

FIGURE 5.4a AGREEMENT: TEST METHOD, PERCENT FAT ENERGY (**PFE**), AND SCREENER BY PARENTS

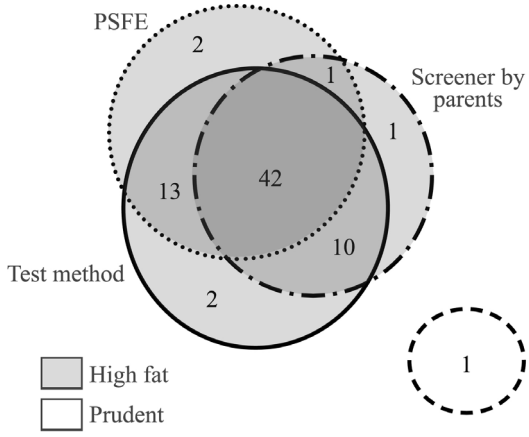

FIGURE 5.4b AGREEMENT: TEST METHOD, PERCENT SATURATED FAT ENERGY (**PSFE**), AND SCREENER BY PARENTS

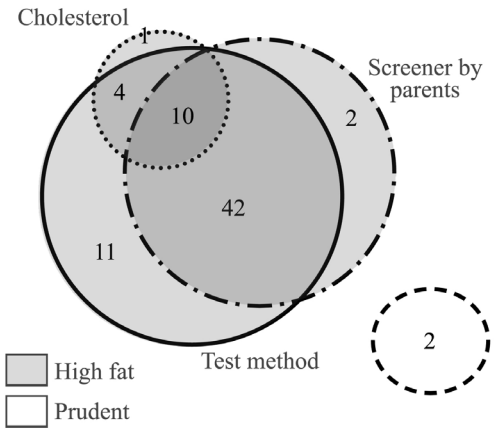

FIGURE 5.4c AGREEMENT: TEST METHOD, **CHOLESTEROL** INTAKE, AND SCREENER BY PARENTS

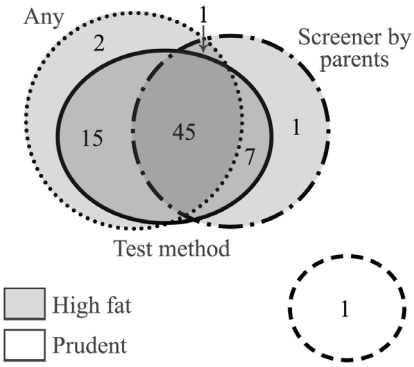

FIGURE 5.4d AGREEMENT: TEST METHOD, ANY FAT MEASURE OF FOOD RECORD (**ANY**), AND SCREENER BY PARENTS

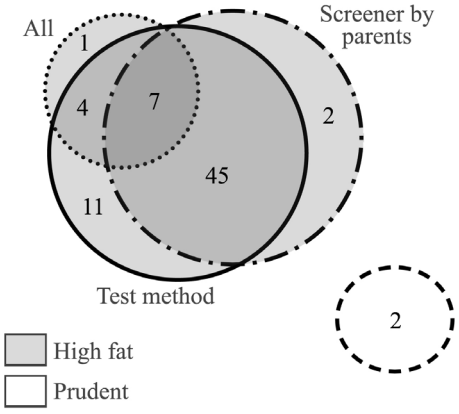

FIGURE 5.4e AGREEMENT: TEST METHOD, ALL FAT MEASURES OF FOOD RECORD (**ALL**), AND SCREENER BY PARENTS

FIGURE 5.4: AGREEMENT AMONG TEST METHOD, FOOD RECORD AND SCREENER BY PARENTS (n=72)

From Figure 5.4 the following is evident:

The percentage perfect agreement between the test method and parental completion of the screener was 73.6% (52 high fat plus 1 prudent out of a total of 72). The number and percentage of participants with identical classifications based on the food record compared to the test method or the parental completion of the screener can be seen in Table 5.19.

TABLE 5.19: IDENTICAL CLASSIFICATIONS BETWEEN FOOD RECORD AND TEST METHOD OR SCREENER BY PARENTS (n=72)

	Food record				
	PFE n (%)	**PSFE** n (%)	**Cholesterol** n (%)	**ANY** n (%)	**ALL** n (%)
Test method	51(70.8)	56(77.8)	16(22.2)	61(84.7)	13(18.1)
Screener by parents	38(52.7)	44(61.1)	12(16.7)	47(65.3)	9(12.5)

There was always a higher percentage exact classification matches between the test method and the food record, than between the parental completion of the screener and the food record. Either way, the highest agreement was found if any of the measures of high fat intake acted as criterion.

The percentage perfect agreement between the screener (either child or parental completion) and the food record was determined by the presence of dietary cholesterol intake as measure. Thus, for Figures 5.4c and 5.4e (which referred to or included cholesterol as outcome measure), the percentage perfect agreement ranged from 12.5% (seven high fat plus two prudent out of 72) to 20.8% (ten high fat plus two prudent), whilst in the absence of cholesterol (Figures 5.4a, 5.4b and 5.4d) the percentage perfect agreement ranged from 52.7% (37 high fat plus one prudent out of 72) to 84.7% (60 high fat plus 1 prudent out of 72).

It follows that perfect agreement within any of the triangulations was also a function of the presence of cholesterol and, as expected, the highest percentage perfect agreement between the test method and both reference methods occurred in 'ANY' (63.8%, that is 45 high fat plus one prudent, Figure 5.4d) even though PFE and PSFE also had considerable perfect agreement among the three methods.

5.6 RECEIVER OPERATING CHARACTERISTICS (ROC)

Figures 5.5a to 5.5e are plots of ROC curves with PFE, PSFE, cholesterol, 'any' and 'all' respectively as standard. The areas under the curve ranged from 0.545 for PFE, 0.548 for cholesterol, 0.555 for 'any', 0.604 for 'all' to 0.654 for PSFE as outcome measure.

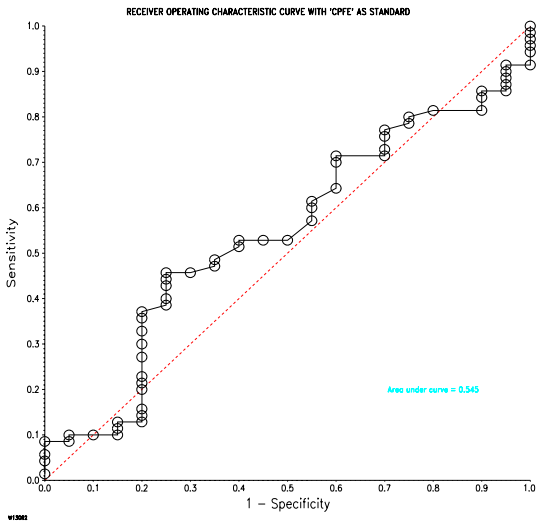

FIG 5.5a PERCENT FAT ENERGY

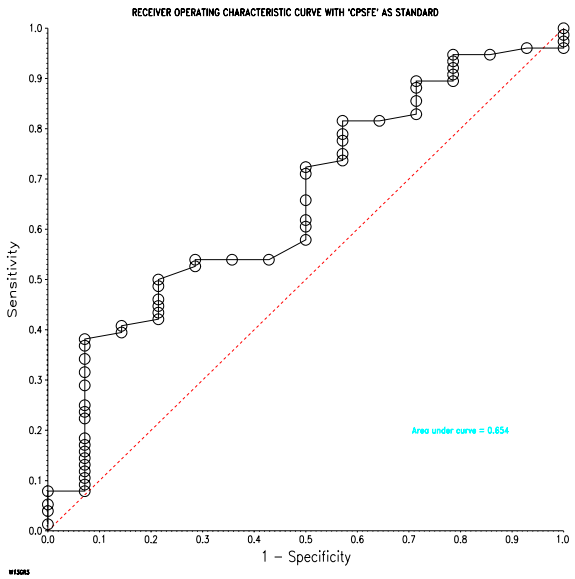

FIG 5.5b PERCENT SATURATED FAT ENERGY

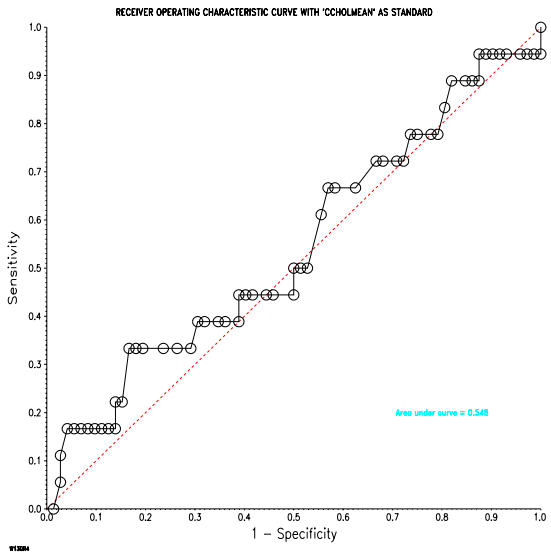

FIG 5.5c CHOLESTEROL INTAKE

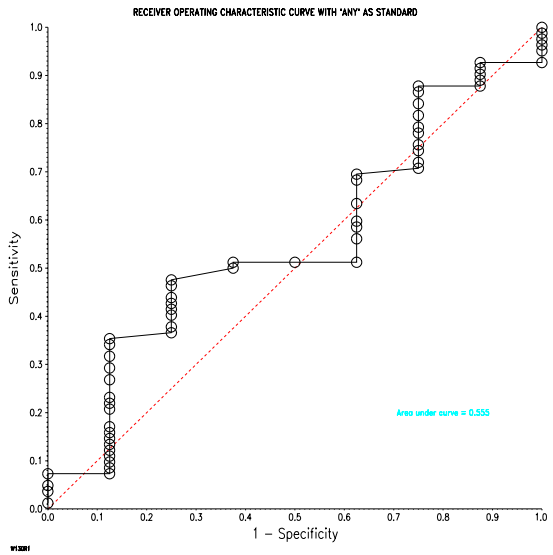

FIG 5.5d 'ANY' MEASURE OF FAT INTAKE

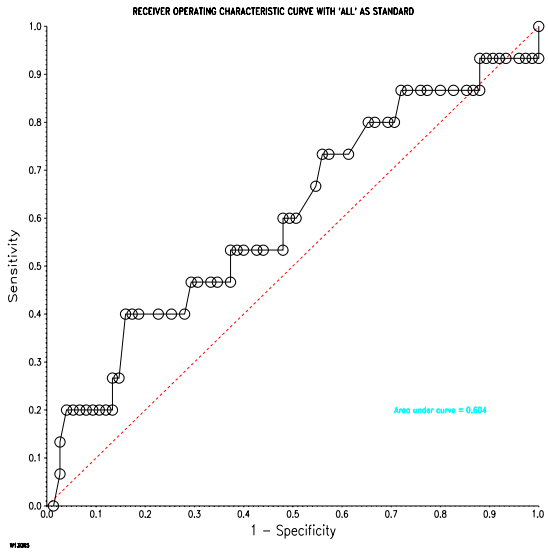

FIG 5.5 e 'ALL' MEASURES OF FAT INTAKE

FIGURE 5.5: RECEIVER OPERATING CHARACTERISTIC CURVES

From the curves it is possible to see how the sensitivity (true positive rate, on Y-axis) and the false positive rate (1 – specificity, on X-axis) co-varied when the cut-off point of the test method was changed. Over the five curves, the sum of sensitivity and specificity was highest at cut-offs of 98 and 118. The effect that changing the cut-off value of the final score of the test method to 98 and 118 would have on the sensitivity and the specificity relative to each of the five outcome measures from the food record is indicated in Table 5.20.

TABLE 5.20: SENSITIVITY (Sens) AND SPECIFICITY (Spec) OF DIFFERENT CUT-OFF VALUES OF THE TEST METHOD RELATIVE TO FOOD RECORD FAT MEASURES OF FAT INTAKE

Test method		**Food record measures of fat intake**									
		PFE [a]		**PSFE** [b]		**Cholesterol**		**ANY**[c]		**ALL**[d]	
		Sens	Spec	Sens	Spec	Sens	Spec	Sens	Spec	Sens	Spec
Cut-off value	68 (original)	0.92	0.05	0.95	0.20	0.95	0.08	0.93	0.11	0.94	0.08
	98	0.71	0.40	0.72	0.50	0.72	0.32	0.70	0.37	0.80	0.33
	118	0.46	0.70	0.45	0.79	0.44	0.58	0.44	0.75	0.53	0.60

[a] Percentage fat energy
[b] Percentage saturated fatty acid energy
[c] Any one of the measures of fat intake
[d] All three measures of fat intake

With a cut-off of 98 the sensitivity dropped from the very high values (also reported in Table 5.14) to 0.70 to 0.80 for ‘any’ and ‘all’ respectively as standard, but the specificity rose to values ranging from 0.32 (cholesterol) to 0.50 (PSFE). Thus, whilst the sum of the sensitivity and specificity was about the same at cut-off 98 and cut-off 118, the former resulted in a higher sensitivity (true positive rate) and in the latter case it was in favour of specificity (true negative rate).