Public Health Nutrition: 6(7), 631–644 DOI: 10.1079/PHN2003482

Secondary data analyses of dietary surveys undertaken in South Africa to determine usual food consumption of the population

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Submitted 29 January 2003: Accepted 30 April 2003

Abstract

Objective: The primary objective of this study was to generate a reference table of food items and average amounts of these items consumed by South Africans, for the Department of Health. The reference table was required to be representative of foods and beverages eaten frequently by children and adults from all age and ethnic groups in order for the Department of Health to test for contaminants in these foods.

Design: The National Food Consumption Survey (NFCS) served as a framework for compiling data on children since this was a national representative survey of 1–9-year-old children undertaken in South Africa in 1999. However, there has never been a national dietary survey on adults in South Africa. Consequently the data had to be extrapolated from existing isolated surveys on adults. Secondary data analysis was conducted on existing dietary databases (raw data) obtained from surveys undertaken on adults in South Africa between 1983 and 2000. Available datasets were regional and independent, and were not individually representative of the South African diet. It was therefore necessary to use different statistical methods, including factor analyses, weighting and correlations, to generate ethnic and geographic representative data for adults. Two methods were used: Method 1, which corresponded with results of the NFCS (over-sampled for low socio-economic status), and Method 2, which was based on ethnic proportions of the population.

Results: The secondary data analyses generated food items most commonly consumed by the South African adult population (Method 1) in descending frequency of usage and average (mean) amount per day: maize porridge (78%/848 g), white sugar (77%/27 g), tea (68%/456 g), brown bread (55%/165 g), white bread (28%/163 g), non-dairy creamer (25%/6 g), brick margarine (21%/19 g), chicken meat (19%/111 g), full-cream milk (19%/204 g) and green leaves (17%/182 g). In 6–9-year-olds, maize porridge (72%/426 g), sugar (76%/23 g), tea (51%/258 g), full-cream milk (35%/171 g) and white bread (33%/119 g) were eaten most frequently. Similarly, in 1–5-year-olds, the foods consumed most frequently were maize porridge (80%/426 g), sugar (76%/21 g), tea (44%/224 g), full-cream milk (39%/186 g) and white bread (24%/83 g). In order to evaluate the validity of the adult data generated, kilojoule values of the individual food items (per capita) were compared with food balance sheets (FBSs). The comparison was favourable except that the FBSs had a higher overall energy intake per capita of between 22 and 28%.

Conclusion: Reference tables of commonly consumed foods and beverages were generated at minimal cost based on secondary data analyses of past dietary surveys in different South African populations.

Keywords
Nutrition survey
Validation
Food balance sheets
Food intake
Dietary intake
South Africa

The Food and Agriculture Organization (FAO), the World Health Organization (WHO) and the United Nations Environment Programme have jointly developed guidelines for the determination of chemical contaminants in foods and beverages[1–3]. These guidelines provide detailed procedures and methods by which such studies should be conducted in order to ascertain whether consumers are at risk from chemical contaminants found in the foods they consume. Since South Africa is one of the Codex Alimentarius Member Countries, it is required to undertake an analysis of contaminants in the national food supply on a regular basis. To do this, the Department of

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Health (DOH) needs to know which items, and the average portion size, are eaten by the majority of the population.

Three practical approaches to determine amounts of contaminants from dietary intake studies have been recommended, namely: (1) the total diet study method; (2) selective studies of individual foodstuffs; and (3) duplicate portion studies. Since the WHO/FAO has recommended use of the 'total diet study' approach, which focuses on food and beverage consumption of the general population, this method was selected for the current study[2,4,5].

To measure contaminants in food it is necessary to know what the main dietary sources are. This ideally entails the undertaking of a dietary survey on a nationally representative sample in order to determine which foods items are consumed by at least 97.5% of the population. Since this is a very costly undertaking, the DOH decided to utilise data on adults from dietary surveys undertaken from 1983 to 2000. The National Food Consumption Survey (NFCS)[6], which was undertaken in 1999, served as a source of nationally representative data on children.

The primary objective of this study was to generate a reference table of food items and average (mean) portion sizes consumed by South Africans for the DOH. The reference table was required to be representative of items eaten by children and adults from the major ethnic groups (black and white) found in nine provinces. Since the majority (77%) of the population is black, it is important to note that the final food items generated mostly reflect the 'typical' diet consumed by black South Africans. The DOH will subsequently undertake analyses of items in the reference table and contaminant exposure doses will be calculated for the population by multiplying the average (mean) food intake by substance concentrations to determine average daily dose per contaminant. Evaluation of risk will be determined by comparison of exposure doses with exposure limits according to the Acceptable Daily Intakes (ADIs), Theoretical Maximum Daily Intakes (TMDIs) and Codex Maximum Residue Limits (MRLs)[2,4,5].

Methods and materials

Dietary survey databases utilised in development of the food tables

The first phase of this study involved an evaluation of available databases. These were obtained by the DOH from the original sources (organisations/authors). The NFCS provided a database on dietary intakes of children aged 1–9 years. Data on adults were integrated from eight different studies (one unpublished) undertaken in different provinces and ethnic groups[6–32]. The national food balance sheets (FBSs)[33] and data from an isolated study on water consumption[34] were also included. Most databases were available on Excel spreadsheets and were subsequently analysed using the SAS System for Windows, Release 8.02 (SAS Institute Inc., Cary, NC, USA, 2001). Table 1 presents a description of the studies utilised and their dietary methodologies. Since two different methods were used (24-hour recall* and frequency method†), the data were kept in the two separate categories and analysed separately. Since all of the databases (24-hour and frequency) were used to compare the mean consumption of adolescents and adults, the 'frequency' databases are also shown in Table 1. However, only results using 24-hour recalls are reported here. Results of the frequency databases are published elsewhere[36].

Structuring of existing dietary databases

Step 1: Standardisation of food codes in all dietary databases

The dietary databases used in this study made use of the *Medical Research Council Food Composition Tables* and software[37,38]. These tables were updated in 1999 and many of the food codes were changed[38]. Hence it was necessary to first ensure that all databases conformed to the updated food codes.

Step 2: Aggregation of information on food

The WHO[5] provides three lists of analyses and commodities that should be monitored by member countries of the Codex Alimentarius: a core list (for developing countries), an intermediate list (for countries with some industrial development) and a comprehensive list (for developed countries). Because of the availability of the NFCS data, which comprises a nationally representative sample[6], and other appropriate surveys, this study focused on providing tables according to the comprehensive list. In order to compile comprehensive tables, aggregation of food items was done at three levels.

- *Level 1*. Foods and beverages contained in the South African food composition tables[37] were first classified into food categories according to the GEMS/Food (Global Environmental Monitoring System/Food Contamination Monitoring and Assessment Programme) commodities of the WHO[3]. The GEMS/Food categories include the following main groups: cereals; sugars and honey; nuts and oilseeds; vegetable oils and fats; stimulants; spices; pulses; roots and tubers; vegetables; fish and seafood; eggs; fruit; milk and milk products; meat and offal; animal oils and fats. Since there were no GEMS/Food codes for some food commodities, new groups were created for alcoholic beverages, infant

*The 24-hour recall method requires participants to recall all food and beverages consumed during the previous 24 h. It is a reflection of current dietary consumption. A limitation of this method is that it is inclined to underreport dietary intake.

†The quantified food frequency method requires participants to recall average amounts of food consumed on a daily, weekly or monthly basis. It is a reflection of a longer period of consumption. A limitation of this method is that it is known to overreport dietary intakes[35].

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Table 1 Summary of the databases and dietary methods used in the present study

Database* (dietary method†)	Ethnic group	Area	Groups	Age in years: (*n*)	Publications
NFCS (24HR and FFREQ)	All	South Africa	Pre-school & primary	1–9: $n = 2868$‡ 1–5: $n = 2051$ 6–9: $n = 817$	Labadarios *et al.*, 2000[6]
Lebowa Study (24HR)	Black	Northern Province, rural	Pre-school, primary school & secondary school	1–25: $n = 483$‡ 1–5: $n = 118$ 6–9: $n = 73$ 10+: $n = 292$ 10–13: $n = 187$ 14–18: $n = 75$ 19–25: $n = 30$	Steyn *et al.*, 1992[7]; Steyn *et al.*, 1993[8,9]; Badenhorst *et al.*, 1993[10]
Dikgale Study (24HR)	Black	Northern Province, rural	Adults (19 years and above)	$n = 111$ with age available, 209 in total‡ 19–24: $n = 2$ 25–39: $n = 33$ 40–59: $n = 38$ 60+: $n = 38$	Steyn *et al.*, 1998[11]; Steyn *et al.*, 2001[12,13]
BRISK (24HR)	Black	Western Cape, urban	Children & adults	3–99: $n = 1507$‡ 1–5: $n = 127$ 6–9: $n = 137$ 10+: $n = 1243$ 10–13: $n = 133$ 14–18: $n = 146$ 19–24: $n = 199$ 25–39: $n = 372$ 40–59: $n = 245$ 60+: $n = 148$	Bourne *et al.*, 1993[14]; Bourne *et al.*, 1994[15,16]
THUSA (FFREQ)	Black	North West Province, urban & rural	Adults	18+: $n = 890$‡ 14–18: $n = 81$ 19–24: $n = 137$ 25–39: $n = 318$ 40–59: $n = 302$ 60+: $n = 52$	Venter *et al.*, 2000[17]; Vorster *et al.*, 2000[18]; MacIntyre *et al.*, 2000[19–21]; MacIntyre *et al.*, 2002[22]
THUSA Bana (24HR)	All	North West Province, urban & rural	Children	All: $n = 1257$‡ 6–9: $n = 6$ 10–13: $n = 868$ 14–18: $n = 383$	Underhay *et al.*, 2001[23]; Kruger *et al.*, 2002[24]
FYFS Project (FFREQ)	Black	Northern Province, Gauteng, urban & rural	Adult females	18–34: $n = 136$‡ ≤18: $n = 52$ 19–24: $n = 63$ ≥25: $n = 21$	Steyn *et al.*, 2000[25,26]; Senekal *et al.*, 2001[27]
WRFS (FFREQ)	All	South Africa	Adults	18+: $n = 449$‡ <25: $n = 43$ 25–34: $n = 124$ 35–44: $n = 117$ 45–54: $n = 93$ 55–64: $n = 61$ 65+: $n = 9$	Senekal and Steyn, 1997[28]; Senekal *et al.*, 2003[29]
CORIS (24HR)	White	Western Cape, urban & rural	Adults (15 years and above)	15–99: $n = 1784$‡ 14–18: $n = 281$ 19–24: $n = 127$ 25–39: $n = 463$ 40–59: $n = 686$ 60+: $n = 227$	Wolmarans *et al.*, 1989[30]; Steyn *et al.*, 1989[31]; Steyn *et al.*, 1997[32]; Wolmarans (unpublished dietary data)
SA Food Balance Sheets	All	South Africa	All	All	Steyn *et al.*, 2001[33]; Department of Agricultural Statistics
Water estimates	White & coloured	Greater Cape Town	All	As for BRISK	Bourne, 1986[34]

*Database: NFCS – National Food Consumption Survey; BRISK – Black Risk Factor Study; THUSA – Transition, Health and Urbanisation Study; THUSA Bana – Transition, Health and Urbanisation Study in Children; FYFS – First Year Female Students; WRFS – Weight and Risk Factor Study; CORIS – Coronary Risk Factor Study; SA – South Africa.
†Dietary method: 24HR – 24-hour recall; FFREQ – food frequency.
‡Data are given for the total group first, followed by corresponding values for subgroups.

https://doi.org/10.1079/PHN2003482 Published online by Cambridge University Press

foods, breast milk and breast milk substitutes, dietary supplements and soup mixes. This was done because these groups represent important commodities in the total South African diet.

- *Level 2*. Certain main groups were further sub-divided into smaller groups. For example, cereals were sub-divided into maize, wheat, oats, barley, sorghum, rye and rice products. Fruit, vegetables, meat and offal were also sub-divided further.
- *Level 3*. This step involved grouping items of consumption within the GEMS/Food subgroups. This involved aggregating (grouping) foods that were similar in kind but were consumed in smaller amounts. Re-coding all food items into the Eurocodes made this possible since the Eurocodes provided more detail within food subgroups[39].
- *Level 4*. Lastly, food items were also classified according to method of processing. Due to the relative importance of processing methods in determining levels of contaminants, foods and beverages were further categorised according to processing methods[2]: fresh, canned, smoked, raw, dried, juice, pickled and frozen.

The preceding steps were taken to develop a new database comprising 1535 food items, originally created in the food composition tables[37]. Each food item now comprised a national (SA) food composition code and description; a GEMS/Food main group code[3]; a GEMS/Food subgroup code[3]; a detailed item code (Eurocode)[39]; and a description of processing when appropriate (i.e. dried/canned/fresh). Examples of the food groups are presented in Table 2.

The final tables generated comprised the following data with regard to food items consumed: main food group (e.g. cereals); the subgroup where appropriate (e.g. maize); a description of the item where appropriate (e.g. maize porridge); the percentage of the sample consuming that item; the portion consumed per day by those individuals who actually consumed the item (average/mean portion); and the per capita amount consumed per day by all individuals in the relevant sample. The latter portion is smaller because it represents the total quantity consumed divided by the size of the relevant sample.

Selection of age groups

The WHO[5] has recommended that where specific national or regional consumption data are available for different population subgroups (e.g. toddlers and infants), exposure assessments should be carried out for these groups. Using these recommendations as guidelines, all tables generated in the present study included the following age groups: pre-school – age 1–5 years (1.00–5.99 years); schoolchildren – age 6–9 years (6.00–9.99 years); adolescents and adults – age 10+ years (sometimes referred to as 'adults').

The reason for selecting these age groups was based on the fact that the largest dietary database (NFCS) in South Africa[6] included children aged 1–9 years. The NFCS data were available in two age groups (1–5 years and 6–9 years), for each of nine provinces of South Africa, and in urban or rural format. Vulnerable groups such as pregnant women and the elderly could not be determined since no (or very little) data were available on these groups.

The rationale for treating age 10+ as a unit (and calling it an adult group) was the finding that the average consumption of adolescents (10–15 years) did not differ significantly from that of adults. Table 3 presents comparisons of mean energy intakes of the different age groups to substantiate this.

After careful consideration of the available databases, and after a comparison of data obtained by the food frequency and 24-hour recall methods of the NFCS, it was decided to keep data generated by the two methods apart and to analyse them separately. This was due to the following findings: (1) the average quantities consumed per food item were greater when the food frequency method was used; (2) a greater variety of items was consumed when using the food frequency method versus the 24-hour recall method (72 items vs. 16 items); and (3) the percentage of the group consuming a specific item was generally greater when the food frequency questionnaire was used.

It is important to evaluate the results of this paper in the context of the databases used. The estimates generated represent crude portions of food items consumed and should not be compared with the methods generally used in dietary surveys to evaluate macro- and micronutrient intakes of specific age groups. Although an attempt was made to include as many databases as possible to represent the average South African population, it was not realistic or feasible to include every study that had been undertaken in the specified period.

Generation of adult data

First, data from the NFCS were correlated with data from individual surveys on adults. Pearson correlation coefficients were calculated using both per capita portion size and percentage of the sample consuming the food item, using all items and subgroups consumed. An example of this is shown in Table 4. These analyses showed significant relationships (and correspondence) between children aged 1–5 and 6–9 years in the NFCS and the 1–5- and 6–9-year-olds of studies using the 24-hour recall method. Then NFCS 6–9-year-olds were correlated with 10+-year-olds in the 24-hour recall studies, namely the Black Risk Factor Study (BRISK), the Lebowa Study, the Coronary Risk Factor Study (CORIS) and the Dikgale Study (note: Lebowa and Dikgale are place names). Correlation coefficients varied between 0.7 and 0.9, and all were significant at the 99% level of confidence.

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Table 2 Example of the final food item database with its various aggregates

GEMS/Food main group	GEMS/Food subgroup	Combination of codes	Description of food item
Cereals	Combined GEMS/Food code with Eurocode. The purpose was to distinguish between milled and grain products, breakfast cereals, snacks, breads and confectionery		
	MAIZE	CF 1255 06.18	MAIZE PORRIDGE & DISHES
		CF 1255 06.19	CUSTARD POWDER, CORN STARCH
		CF 1255 06.70	BREAKFAST CEREALS, MAIZE-BASED, CORN FLAKES, PUFFED CORN, ETC.
		CF 1255 12.65	MAIZE-BASED SNACKS – NIKNAKS, CHIPNIKS
		GC 645 06.18	MAIZE SAMP/RICE & DISHES
		GC 656 12.65	POPCORN
	WHEAT	CF 1210 06.10	TASTEE WHEAT, WHEAT GERM, SEMOLINA
		CF 1211 06.10	WHEAT FLOURS
		CF 1211 06.40	ROTI
		CF 1211 06.44	MATZOS, CRACKERS, PROVITA
		CF 1211 06.48	RUSKS
		CF 1211 06.50	COOKIES, LOAVES, PANCAKES, TARTS, CAKES, PUDDING
		CF 1211 06.60	SAMOOSA, VETKOEK, CHILLI BITES, SAVOURY TARTS
		CF 1211 06.70	WHEAT-BASED CEREALS – ALL BRAN, WEETBIX, PUFFED WHEAT
		CF 1212 06.30	PASTA & NOODLE DISHES
		CP 1211P	WHITE BREAD/ROLLS
		CP 1212P	BROWN BREAD/ROLLS
		GC 654P 06.10	CRUSHED & PEARL WHEAT
Fish	Combined GEMS/Food code with processing method. Overall consumption of fish was too little to distinguish food items in more detail		
	CRUST	WC 143 CF	CRUSTACEANS (CRAB, LOBSTER, MUSSELS, OYSTERS), COOKED
	FISH	WF 115 CF	FISH, FRESHWATER, COOKED
		WS 125 CF	FISH – SEA, COOKED, FRESH
		WS 125 CZ	FISH – SEA, FROZEN, COOKED
		WS 125P CA	FISH – SEA, CANNED
		WS 125P CF	FISH PASTE
		WS 125P SM	FISH – SEA, SMOKED

GEMS/Food – Global Environment Monitoring System/Food Contamination Monitoring and Assessment Programme.

Second, relationships between databases were explored by means of factor analyses. This was done to determine whether the adult databases would follow a similar trend to the NFCS as for the 'step' on correlations, and also to determine whether it was possible to combine data from provinces when trying to estimate adult consumption. Factor analyses were done to establish the relationship between NFCS 6–9-year-olds in the nine provinces of South Africa, urban and rural separately, with those databases having adult participants, namely BRISK, the Lebowa Study, CORIS urban and rural (adults), the Dikgale Study (adults) and the Transition, Health and Urbanisation Study (THUSA) in children (THUSA Bana; urban and rural). Observations used in this process consisted of the different GEMS/Food subgroups consumed.

The results showed that factor 1 reflected portion size and factor 2 reflected variety of items consumed. Dikgale and Lebowa data clustered together with most NFCS rural groups to form a group (group 1). CORIS, BRISK and the Western Cape NFCS data clustered together (group 2). Data of the main urban areas clustered together in a corresponding third group (group 3), which lay between Lebowa/Dikgale on the one hand and BRISK on the other. Group 1 was regarded as the cluster of studies that consumed large portions of food (specifically maize) and included: Northern Province (urban and rural), Free State (urban and rural), North West (urban and rural) and rural areas of Mpumalanga, Eastern Cape, Gauteng and KwaZulu-Natal. Group 2, on the other hand, included studies where participants consumed smaller portion sizes yet consumed a large variety of food items. This group included the Western Cape urban and rural areas. Group 3 formed a cluster that lay between groups 1 and 2. Group 3 included all of the remaining urban areas: Gauteng, Eastern Cape, KwaZulu-Natal, Mpumalanga and Northern Cape.

Equations were developed to determine combined estimates for different population groups by two different methods.

Method 1

- *Estimation of group 1*. Adult consumption was estimated by taking the average values of Dikgale and Lebowa adult data. These data formed a pivotal point of group 1. Dikgale and Lebowa data complemented each other, since the latter included adolescents and the former adults.
- *Estimation of group 2*. CORIS data represented the white population of the Western Cape, and BRISK data

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Table 3 Comparison of age groups in terms of quantity of food (in grams) and kilojoules consumed based on dietary surveys*

Study	Age group (years)	*n*	Total grams consumed per day (SD)†	Total kilojoules consumed per day (SD)†	Notes on test (where appropriate) for significant differences
NFCS	1–5	2072	1083[a] (453)	4531[a] (2121)	Significant difference between the two age groups for both quantity and kilojoules consumed (independent *t*-test)
	6–9	832	1224[b] (480)	5722[b] (2419)	
BRISK	1–5	127	1305[e] (440)	5271[c] (1721)	For both kilojoules and grams, the 10–13-year-olds consumed smaller quantities than older groups, but these differences were not significant (Bonferroni)
	6–9	137	1422[ed] (454)	6426[b] (2180)	
	10–13	133	1662[dc] (542)	7082[ab] (2365)	
	14–18	146	1825[cb] (604)	7993[a] (3378)	
	19–24	199	1889[cb] (694)	7748[a] (3122)	
	25–39	372	1987[ba] (832)	7541[a] (3398)	
	40–59	245	2220[a] (1075)	7250[ab] (3444)	
	60+	148	1915[cb] (823)	6289[bc] (2933)	
CORIS	14–18	281	2804[a] (1699)	14 225[a] (9613)	No significant difference in quantities consumed, 14–24-year-olds consumed significantly more kilojoules than older groups (Bonferroni)
	19–24	127	2860[a] (1521)	12 993[a] (8397)	
	25–39	463	2703[a] (1458)	11 091[b] (6506)	
	40–59	686	2523[a] (1185)	9946[b] (5592)	
	60+	227	2601[a] (1532)	9749[b] (4934)	
Lebowa Study	1–5	118	1151[b] (336)	5211[b] (1734)	Only the 1–5-year-olds differed significantly from other groups when comparing average kilojoule intake and total grams consumed. The other age groups had similar means (Bonferroni)
	6–9	73	1632[a] (527)	7755[a] (2881)	
	10–13	187	1585[a] (498)	7671[a] (2813)	
	14–18	75	1617[a] (547)	7707[a] (2756)	
	19–24	29	1771[a] (489)	7815[a] (2256)	
Dikgale Study	19–24	2	1245 (65)	4561 (19)	No significant differences between the four groups for quantity and kilojoules consumed (Kruskal—Wallis test)
	25–39	33	1848 (762)	6702 (3732)	
	40–59	37	2079 (1408)	7270 (3823)	
	60+	37	1896 (511)	7268 (2456)	
THUSA Bana	10–13	498	1311[a] (551)	11 784[a] (7369)	10–13-year-olds consumed more in terms of quantity and kilojoules but only kilojoules significant (independent *t*-test)
	14–18	189	1262[a] (516)	9982[b] (5849)	
THUSA	14–18	81	1861[b] (599)	13 588[a] (5059)	Both variables in no group was d
	19–24	137	2007[ba] (807)	14 251[a] (5542)	
	25–39	318	2123[ba] (787)	14 025[a] (5995)	
	40–59	302	2207[a] (923)	13 569[a] (6358)	
	60+	52	2092[ba] (909)	13 270[a] (6317)	
FYFS Project	≤18	52	2521[a] (1272)	11 929[a] (3772)	No difference found in quantities, but an increase and then a decrease found in kilojoules. The ≤ 18-year-olds differed significantly from the ≥ 25-year-olds (Bonferroni)
	19–24	63	2043[a] (724)	9995[ab] (3381)	
	≥25	21	2153[a] (709)	9904[b] (3056)	
WRFS	<25	43	2270[a] (876)	8508[a] (2972)	No significant differences found in quantities consumed, but the younger group consumed more in terms of kilojoules than the middle-aged groups (Bonferroni)
	25–34	124	2231[a] (761)	7624[ab] (2611)	
	35–44	117	2296[a] (844)	7388[ab] (2576)	
	45–54	93	2100[a] (647)	6624[b] (2354)	
	55–64	61	2108[a] (711)	6398[b] (2253)	
	65+	9	1997[a] (749)	6963[ab] (2520)	

SD – standard deviation.
* For abbreviations and sources of the studies, see Table 1.
† Differing superscript letters indicate that the means are significantly different.

represented the black population of the Western Cape. Because of the similarities between CORIS urban and rural data, the combined databases were used in further analyses. Adult dietary intakes for the Western Cape were calculated as the weighted average of CORIS and BRISK data, using the ratio of black to non-black residents in the Western Cape as described in the 1996 Census data[40].

- *Estimation of group 3*. The average of BRISK and the combined average of Lebowa and Dikgale data were used to estimate adult consumption for this group.

Urban and rural intakes were combined to produce a single adult estimate per province, using the ratio between urban and rural per province, as calculated from the 1996 Census data. Adult intakes (average per capita portion size and percentage of adults consuming the item) in South Africa (RSA) were estimated by applying weights according to the proportions of

https://doi.org/10.1079/PHN2003482 Published online by Cambridge University Press

Table 4 Pearson correlation coefficients between Lebowa* data (age 10+ years) and NFCS† data of 6–9-year-old children, by province

Portion size (POR) or % of sample (PER) consuming item/subgroup	Item or subgroup	Best eight correlations‡							
POR Lebowa	Item ($n = 319$)	mpr	nwu	npr	fsr	fsu	nwr	kzr	gpr
		0.9899	0.9773	0.9758	0.9719	0.9614	0.9562	0.9473	0.9434
PER Lebowa	Item ($n = 319$)	mpr	kzr	gpu	nwr	npu	npr	nwu	gpr
		0.9394	0.8866	0.8773	0.8428	0.8412	0.8356	0.8338	0.8331
POR Lebowa	Subgroup ($n = 57$)	mpr	npr	nwu	fsr	ecr	fsu	gpr	nwr
		0.9930	0.9865	0.9816	0.9812	0.9737	0.9720	0.9610	0.9608
PER Lebowa	Subgroup ($n = 57$)	mpr	gpr	npu	gpu	kzr	ecr	npr	fsu
		0.9786	0.9610	0.9414	0.9264	0.9251	0.9209	0.9153	0.9038

*Lebowa Study (Steyn *et al.*, 1992[7]).
†National Food Consumption Survey (Labadarios *et al.*, 2000[6]).
‡First two symbols indicate the NFCS province: ec = Eastern Cape, fs = Free State, gp = Gauteng, kz = KwaZulu-Natal, mp = Mpumalanga, np = Northern Province, nw = North West Province and wc = Western Cape Province; third symbol: r = rural and u = urban.

populations in each province[40] as follows:

$$\text{RSA} = 0.155 \times \text{EC} + 0.065 \times \text{FS} + 0.181 \times \text{GP} + 0.207 \times \text{KZ} + 0.069 \times \text{MP} + 0.021 \times \text{NC} + 0.122 \times \text{NP} + 0.083 \times \text{NW} + 0.097 \times \text{WC},$$

$$\text{RSA (rural)} = 0.21 \times \text{EC} + 0.05 \times \text{FS} + 0.01 \times \text{GP} + 0.26 \times \text{KZ} + 0.09 \times \text{MP} + 0.01 \times \text{NC} + 0.23 \times \text{NP} + 0.12 \times \text{NW} + 0.02 \times \text{WC}$$

and

$$\text{RSA (urban)} = 0.11 \times \text{EC} + 0.08 \times \text{FS} + 0.33 \times \text{GP} + 0.17 \times \text{KZ} + 0.05 \times \text{MP} + 0.03 \times \text{NC} + 0.02 \times \text{NP} + 0.05 \times \text{NW} + 0.16 \times \text{WC},$$

where EC = Eastern Cape, FS = Free State, GP = Gauteng, KZ = KwaZulu-Natal, MP = Mpumalanga, NP = Northern Province, NW = North West Province and WC = Western Cape Province.

These equations were further simplified and adjusted for sample size, in terms of the original databases, to:

$$\text{RSA} = 4.365 \times \text{Lebowa} + 5.901 \times \text{Dikgale} + 0.575 \times \text{BRISK} + 0.152 \times \text{CORIS},$$

$$\text{RSA (rural)} = 5.932 \times \text{Lebowa} + 8.019 \times \text{Dikgale} + 0.011 \times \text{BRISK} + 0.032 \times \text{CORIS}$$

and

$$\text{RSA (urban)} = 3.002 \times \text{Lebowa} + 4.059 \times \text{Dikgale} + 1.078 \times \text{BRISK} + 0.250 \times \text{CORIS}.$$

Method 2

Adult data were calculated by using proportions of urban and rural data for black and non-black ethnic groups according to the 1996 Census results[40]. BRISK represented urban blacks, the average of Lebowa and Dikgale represented rural blacks, CORIS–urban represented non-black urban and CORIS–rural represented non-black rural. In terms of the original databases, after adjusting for sample size, the following equations were obtained:

$$\text{RSA} = 0.642 \times \text{CORIS–urban} + 0.152 \times \text{CORIS–rural} + 0.948 \times \text{BRISK} + 2.628 \times \text{Lebowa} + 3.553 \times \text{Dikgale},$$

$$\text{RSA (rural)} = 0.110 \times \text{CORIS–rural} + 1.874 \times \text{Lebowa} + 2.534 \times \text{Dikgale}$$

and

$$\text{RSA (urban)} = 0.800 \times \text{CORIS–urban} + 1.181 \times \text{BRISK}.$$

Method 1 results corresponded with results from the NFCS, which was over-sampled for lower socio-economic areas[6], whereas the results from Method 2 ignored relationships with NFCS data and was based on the ethnic proportions of the population in South Africa. Summaries of the methods used in the 'weighting' process are shown in Table 5.

Results and discussion

Table 6 provides a comprehensive table of the GEMS/Food main food groups for all South Africans. The percentages of the age groups consuming the GEMS/Food groups were similar throughout. The main three GEMS/Food groups were the same for all age groups, being cereals, sugars and honey, and stimulants. Cereals were consumed by 99% of all age groups and sugar and honey by more than 80%. The average consumption of cooked cereals was 493 g in 1–5-year-olds, 559 g in 6–9-year-olds and 690–879 g in 10+-year-olds when taking the group of consumers into consideration. Infant foods, animal oils, spices, alcoholic beverages, supplements and condiments were consumed by less than 3% of 1–9-year-olds. In the 10+-year-old group, less than 3% consumed soups, condiments, supplements, human and formula milk, and spices. The meat and offal group was consumed by 48% of

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Table 5 Calculation of adjusted relative weightings used to calculate intakes of South African adults

		Dataset†				
					CORIS	
Group	Step	Dikgale	Lebowa	BRISK	Urban	Rural
Method 1*						
RSA ($n = 3535$)	A = weighting of dataset*	0.3606	0.3606	0.2022	0.0766	–
	B = sample size	216	292	1243	1784	–
	Adjusted relative weighting = $(A \times 3535)/B$	5.901	4.365	0.575	0.152	–
RSA urban ($n = 3535$)	A = weighting of dataset*	0.248	0.248	0.379	0.126	–
	B = sample size	216	292	1243	1784	–
	Adjusted relative weighting = $(A \times 3535)/B$	4.059	3.002	1.078	0.250	–
RSA rural ($n = 3535$)	A = weighting of dataset*	0.490	0.490	0.004	0.016	–
	B = sample size	216	292	1243	1784	–
	Adjusted relative weighting = $(A \times 3535)/B$	8.019	5.932	0.011	0.032	–
Method 2*						
RSA ($n = 3535$)	A = weighting of dataset*	0.2171	0.2171	0.3332	0.204	0.028
	B = sample size	216	292	1243	1125	659
	Adjusted relative weighting = $(A \times 3535)/B$	3.553	2.628	0.948	0.642	0.152
RSA urban ($n = 2368$)	A = weighting of dataset*	–	–	0.620	0.380	–
	B = sample size	–	–	1243	1125	–
	Adjusted relative weighting = $(A \times 2368)/B$	–	–	1.181	0.800	–
RSA rural ($n = 1167$)	A = weighting of dataset*	0.469	0.469	–	–	0.062
	B = sample size	216	292	–	–	659
	Adjusted relative weighting = $(A \times 1167)/B$	2.534	1.874	–	–	0.110

RSA – Republic of South Africa.
* See text for description.
† For abbreviations and sources of the studies, see Table 1.

Table 6 Comprehensive table of GEMS/Food main food groups consumed by children* and adults† in South Africa

Age group	GEMS/Food main group	% of sample consuming the item	Average consumption (g day^{-1})	SD of average consumption	Average per capita consumption (g day^{-1})
Children aged 1–5 years ($n = 2048$)	CEREALS	99.22	493.00	301.11	489.15
	SUGARS	82.64	79.23	141.77	65.48
	STIMULANTS	63.82	230.21	123.48	146.93
	MILK	56.27	220.21	223.65	123.9
	MEAT + OFFAL	47.93	94.08	69.64	45.09
	VEGETABLES	43.64	118.07	96.86	51.52
	VEG_OILS	36.76	12.70	11.21	4.67
	ROOTS	26.38	110.64	81.82	29.18
	FRUIT	21.60	222.58	167.61	48.07
	EGGS	13.21	71.92	32.04	9.50
	PULSES	10.73	154.07	109.35	16.53
	NUTS + OILSEEDS	7.70	14.66	17.39	1.13
	FISH	7.56	89.66	90.41	6.78
	HUMAN MILK	6.92	366.96	324.86	25.41
	SOUPS	3.95	147.12	95.94	5.81
	ALCOHOL	2.58	420.75	240.51	10.87
	INFANT FOODS	1.85	105.29	115.44	1.95
	CONDIMENTS	1.41	11.62	20.66	0.16
	ANIMAL FAT	0.73	15.67	9.52	0.11
	SPICES	0.20	1.25	0.5	0.00
	SUPPLEMENTS	0.20	75.25	54.30	0.14
Children aged 6–9 years ($n = 817$)	CEREALS	99.88	559.28	324.53	558.59
	SUGARS	85.07	120.19	188.17	102.24
	STIMULANTS	69.89	254.94	125.91	178.18
	MEAT + OFFAL	52.02	122.29	92.14	63.61
	MILK	48.84	207.39	197.39	101.28
	VEG_OILS	45.29	17.78	20.87	8.05
	VEGETABLES	44.55	130.93	98.12	58.34
	ROOTS	25.46	137.86	120.07	35.10
	FRUIT	20.93	286.81	229.20	60.03
	PULSES	12.73	186.07	124.01	23.69
	EGGS	12.48	79.99	37.88	9.99

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Table 6. *Continued*

Age group	GEMS/Food main group	% of sample consuming the item	Average consumption (g day^{-1})	SD of average consumption	Average per capita consumption (g day^{-1})
	NUTS + OILSEEDS	11.51	17.04	14.24	1.96
	FISH	8.69	84.23	54.16	7.32
	SOUPS	5.02	152.37	94.38	7.65
	ALCOHOL	1.84	343.67	178.07	6.31
	CONDIMENTS	1.35	34.27	58.92	0.46
	ANIMAL FAT	1.10	23.33	26.16	0.26
	SPICES	0.98	2.19	1.81	0.02
	SUPPLEMENTS	0.61	30.40	5.37	0.19
	INFANT FOODS	0.37	23.33	23.86	0.09
Adults aged 10+ years, Method 1	CEREALS	98.95	878.74	579.11	869.48
	SUGARS	80.47	94.98	187.43	76.44
	STIMULANTS	78.35	487.71	446.59	382.10
	MEAT + OFFAL	57.39	149.38	119.52	85.72
	VEGETABLES	55.75	165.99	153.09	92.53
	VEG_OILS	47.91	16.46	14.48	7.88
	MILK	30.64	239.13	179.96	73.27
	FRUIT	21.39	286.72	186.73	61.32
	ROOTS	21.03	191.31	93.25	40.24
	EGGS	15.04	100.86	41.64	15.17
	PULSES	14.00	248.77	363.74	34.82
	FISH	10.51	113.46	61.52	11.93
	NUTS + OILSEEDS	6.66	27.91	27.50	1.86
	ANIMAL FAT	6.60	15.57	21.70	1.03
	ALCOHOL	5.99	898.11	756.35	53.80
	SOUPS	1.72	148.50	130.21	2.56
	CONDIMENTS	1.53	31.38	18.73	0.48
	SUPPLEMENTS	0.18	28.48	38.65	0.05
	HUMAN MILK	0.12	6.00	0.00	0.01
	INFANT FOODS	0.01	69.00	7.72	0.01
	SPICES	0.01	3.50	0.83	0.00
Adults aged 10+ years, Method 2	CEREALS	98.62	689.93	545.02	680.44
	SUGARS	83.62	156.56	257.99	130.91
	STIMULANTS	80.42	547.93	509.36	440.63
	MEAT + OFFAL	67.32	169.61	146.44	114.17
	VEG_OILS	58.22	21.35	20.79	12.43
	VEGETABLES	56.96	159.77	150.29	91.01
	MILK	48.18	267.84	232.70	129.05
	ROOTS	36.43	191.08	118.19	69.62
	FRUIT	31.64	325.22	267.80	102.91
	EGGS	17.79	93.66	45.45	16.66
	PULSES	15.23	234.05	305.27	35.66
	FISH	12.23	125.44	84.84	15.35
	ANIMAL FAT	10.84	12.87	19.13	1.39
	ALCOHOL	9.71	709.04	812.38	68.83
	NUTS + OILSEEDS	6.22	31.01	35.13	1.93
	CONDIMENTS	3.91	19.77	23.52	0.77
	SOUPS	2.28	204.13	154.95	4.66
	SUPPLEMENTS	0.25	53.23	69.52	0.13
	HUMAN MILK	0.07	6.00	0.00	0.00
	INFANT FOODS	0.04	69.00	15.86	0.03
	SPICES	0.02	2.57	1.05	0.00

GEMS/Food – Global Environment Monitoring System/Food Contamination Monitoring and Assessment Programme; SD – standard deviation.
* Adapted from the National Food Consumption Survey, 24-hour recall (Labadarios *et al.*, 2000[6]).
† Methods 1 and 2, as described in the text.

1–9-year-olds and by 57–67% of the older group. An egg product was consumed by 13–18% of participants and 11–15% consumed pulses.

A comparison of the data extrapolated in this study with FBSs for South Africa is presented in Table 7. This step was undertaken in order to assess the relative validity of the data generated. However, it should be kept in mind that comparisons can only be made in terms of energy intake since the FBSs give raw food values whereas the data generated were for cooked foods. Generally FBS values compared favourably with the data generated for adults. FBS values were higher with respect to the consumption of milk, pork, fats and oils, maize, rice and sugar. Beef and offal, eggs, oats, potatoes and fruit consumption values were similar to FBS data. FBS items that showed lower consumption in comparison with data generated were

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Table 7 Comparison of mean consumption data for children* and adults† with data from food balance sheets (FBSs) for South Africa

	Quantity (g day^{-1})					Energy intake (kJ day^{-1})				
			10 + years					10 + years		
	1–5 years	6–9 years	Method 1	Method 2	FBS (g day^{-1})	1–5 years	6–9 years	Method 1	Method 2	FBS (kJ day^{-1})
Milk & butter	123.9	101.2	73.5	129.2	134.4	358.7	300.9	235.9	412.1	413.8
Meat										
Beef & offal	20.4	27.6	37.9	50.00	37.3	180.6	243.9	394.7	536.6	430.1
Venison	0	0	0.3	0.6	–	0	0	1.6	3.7	–
Mutton/goat & offal	4.8	6.6	10.5	24.6	10.7	44.4	63.8	121.9	236	108.2
Pork & offal	1.6	2.4	2.6	5.2	8.3	22.3	28.1	39.6	69.2	129.9
Chicken & offal	17.9	26.3	34.6	33.93	69.4	137.8	199.5	300.4	259.4	375
Eggs	9.5	10	15.2	16.7	19.9	70.1	75.1	113.5	128.6	131.6
Fish & seafood	6.8	7.3	12	15.4	–	43.2	47.4	88.6	109.7	
Insects	0.4	0.8	–	–	–	6.2	13.5	–	–	–
Legumes	16.5	23.7	34.9	35.7	8‡	87.6	126.8	203	185.4	114.6
Nuts (mainly peanuts)	1.1	2	1.9	1.9	3.2	27.6	48.4	48.5	60.9	76.9
Vegetable oils	4.7	8.1	7.9	12.4	–	130.1	215.9	222.7	431.1	–
Animal fat	0.1	0.3	1	1.4	–	4.2	9.5	38.1	48	–
Total fat/oils	4.8	8.4	8.0	13.8	26.3	134.3	225.4	260.8	479.1	926.6
Cereals										
Maize	364.3	392.9	690.1	475.1	235‡	1490	1733	2859	1931	3267
Wheat	64.5	109.2	153	160.6	140‡	708.9	1233	1721	2058	2001
Sorghum	16.2	7.2	1.7	1.4	4.2	64.1	29.3	3	2	62.4
Barley	0	0	0	0	14.3	0	0	0	0	209.5
Oats	7.7	5	2.8	5.8	0.5‡	21.7	17.4	9.3	22	10.8
Rice	36.6	44.2	22.2	37	34.2‡	195.4	240.3	118.5	204.4	515.8
Rye	0	0	0	0.1	–	0	0	0.3	0.8	–
Roots/tubers (e.g. potatoes)	29.2	35.1	40.4	69.7	87	158.5	223.8	189.8	363.6	254.6
Vegetables										
Stem	0	0	0	0.1	–	0	0	0.1	0.3	–
Brassica	11.5	13.2	16.4	15	–	52.3	64.7	83.7	61.9	–
Leaf	17.9	17.3	34.7	22.6	–	23.1	23.5	52.4	32.6	–
Fruiting	10.5	15	25.4	28	–	28.8	44.4	44.5	59	–
Cucrubits	8.8	9.9	10.9	14	–	20.4	25.1	29.6	37	–
Bulb	0.4	0.4	0.6	1.3	–	2.6	2.5	1.9	3.9	–
Green legumes	1.6	1.8	3	8	–	4.4	6	9.1	24	–
Mixed vegetables	0.9	0.6	1.6	2	–	2.9	2	6.8	6.6	–
Total vegetables	51.6	58.2	92.6	91	110.7	134.5	168.2	228.1	225.3	107.6
Fruit										
Pome	19.3	21.7	20.9	43	–	54.8	61	60.4	142.3	–
Tropical	8.9	8.8	15.3	14.6	–	31.5	30.4	66.4	67.8	–
Citrus	12.1	18.8	11.7	15.2	–	27	41.6	26	36.5	–
Stone	4.8	5.7	6.7	13.1	–	11.4	13.2	16.9	39	–
Berry	2.9	4.9	6.7	16.4	–	8.7	14.8	20.6	50.4	–
Other	0.1	0.2	0.3	0.6	–	0.5	0.7	0.9	1.5	–
Total fruit	48.1	60.1	61.6	102.9	110.4	133.9	161.7	191.2	337.5	257.1
Other items										
Sugar	16.2	18.2	20.5	24.3	79.3	275.4	308.4	347.7	383.6	1286
Sugar – other	49.2	84	56	106.3	–	97.3	177.5	129.1	260.8	–
Honey	0	0	0.1	0.4	–	0.2	0.3	2	5.4	–
Tea	129.9	154.5	311.1	275	–	5.9	7.3	15.6	13.1	–
Coffee	16.5	22.9	71.4	164.7	–	1.5	2.1	6.4	12.8	–
Cocoa	0.4	0.7	0.4	1.2	0.6	9.5	15.7	7.9	26.1	8.7
Soups	5.8	7.6	2.6	4.7	–	9.8	12.6	4.4	6.3	–
Alcoholic beverages	10.9	6.3	53.9	68.8	–	17.1	10	33.2	18.8	–
Infant food	2	0.1	0	0	–	12.2	1.3	0.1	0.4	–
Condiments	0.2	0.5	0.5	0.8	–	1.3	4.6	2.7	3.6	–
Spices	0	0	0	0	–	0	0.4	0	0	–
Supplements	0.1	0.2	0.1	0.1	–	1.9	3.4	0.8	1.8	–
Breast milk & substitutes	25.4	0	0	0	–	77.5	0	0.2	0.1	–
Total	1082	1223	1813	1917	1134	4530	5723	7680	8358	10 687
RDA§						5460	7560	7980	7980	

* Adapted from the National Food Consumption Survey, 24-hour recall (Labadarios *et al.*, 2000[6]).
† Methods 1 and 2, as described in the text.
‡ Weights are for dry products.
§ Recommended Dietary Allowances (lowest of the range) (Food and Nutrition Board[41]).

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Table 8 Summary of food items consumed frequently by children* and adults† in South Africa

	1–5 years			6–9 years			10+ years, Method 1			10+ years, Method 2		
Items consumed by at least 3% of the age group (– indicates that item consumed by <3% of the group)	Mean portion (97.5th percentile) (g)	Per capita portion (g)	% of sample consuming the item	Mean portion (97.5th percentile) (g)	Per capita portion (g)	% of sample consuming the item	Mean portion (97.5th percentile) (g)	Per capita portion (g)	% of sample consuming the item	Mean portion (97.5th percentile) (g)	Per capita portion (g)	% of sample consuming the item
Beer, commercial	–	–	–	–	–	–	–	–	–	1048 (4125)	32	3
Spirit drinks – brandy, whiskey, gin, etc.	–	–	–	–	–	–	–	–	–	109 (360)	4	4
Cooked maize porridge (part of CF 1255)	426 (1140)	340	80	486 (1250)	35	72	848 (2100)	661	78	762 (2000)	429	56
Custard powder (part of CF 1255)	–	–	–	–	–	–	–	–	–	97 (250)	3	3
Breakfast cereal, maize-based, corn flakes, etc.	–	–	–	39 (80)	1	4	–	–	–	–	–	–
Maize-based snacks (part of CF 1255)	27 (55)	2	7	30 (50)	2	7	–	–	–	–	–	–
Cooked samp/mealie rice (GC 645)	257 (525)	20	8	400 (1125)	37	9	407 (1040)	27	7	423 (1212)	42	10
Cooked oats (part of GC 647)	227 (500)	8	3	–	–	–	–	–	–	–	–	–
Boiled white rice (GC 649)	133 (460)	36	27	156 (500)	43	28	163 (440)	22	14	145 (404)	37	25
Rusks (part of CF 1211)	–	–	–	–	–	–	–	–	–	61 (200)	3	5
Cooked maltabella porridge (GC 651)	276 (875)	16	6	–	–	–	–	–	–	–	–	–
Cookies or cakes (part of CF 1211)	56 (240)	3	5	60 (270)	4	7	106 (380)	4	4	122 (440)	10	8
Fat cakes (part of CF 1211)	–	–	–	155 (420)	7	4	155 (360)	9	6	147 (360)	8	6
Wheat cereal (part of CF 1211)	38 (75)	2	4	42 (75)	2	4	–	–	–	46 (185)	2	3
White bread (CP 1211)	83 (270)	20	24	119 (360)	39	33	161 (480)	45	28	157 (480)	55	35
Brown bread (CP 1212)	90 (240)	32	35	126 (360)	53	42	165 (400)	91	55	152 (480)	78	52
Fish – fresh, fried (part of WS 125)	–	–	–	–	–	–	120 (340)	7	6	140 (400)	11	8
Canned fish, pilchards (part of WS 125)	99 (225)	5	5	87 (225)	4	4	99 (210)	4	4	103 (240)	3	3
Grapes, fresh (part of FB 269)	–	–	–	–	–	–	–	–	–	351 (1250)	15	4.3
Orange juice – liqui fruit/ceres type (FC4)	254 (1000)	9	4	287 (500)	15	5	–	–	–	–	–	–
Apple, fresh (part of FP 226)	132 (1000)	11	8	160 (300)	12	7	209 (600)	11	6	227 (630)	24	10
Peach, fresh (part of FS 247)	–	–	–	–	–	–	–	–	–	258 (750)	8	3
Banana, peeled (part of FI 327)	85 (200)	7	8	126 (755)	6	5	167 (600)	11	7	142 (540)	10	7
Human milk (part of Breast milk)	631 (8001)	23	4	–	–	–	–	–	–	–	–	–
Beef steak – fillet, sirloin/rump (part of MM 812)	80 (250)	4	5	89 (200)	4	5	140 (452)	17	12	154 (520)	18	12
Beef stew (part of MM 812)	146 (420)	6	4	169 (420)	9	5	–	–	–	–	–	–
Meat dish – cottage pie or bobotie (MM 812)	61 (213)	3	5	48 (230)	4	8	104 (345)	4	4	101 (345)	8	8
Beef sausage – worst (part of MM 812)	–	–	–	–	–	–	76 (180)	2	3	75 (180)	5	6
Beef gravy (part of MM 812)	–	–	–	–	–	–	33 (120)	2	6	33 (180)	3	10
Chicken meat – drumstick, thigh, breast (PM 840)	61 (160)	10	17	80 (250)	15	19	111 (260)	21	19	112 (270)	24	22
Chicken stew (part of PM 840)	111 (250)	7	6	128 (360)	9	7	139 (750)	6	5	143 (495)	5	3
Chicken giblets (part of PO 111)	–	–	–	–	–	–	67 (160)	2	3	–	–	–
Chicken heads & feet (part of PO 111)	–	–	–	–	–	–	80 (300)	5	6	79 (300)	3	4
Mutton (part of MM 822)	–	–	–	113 (420)	3	3	165 (490)	10	6	159 (480)	23	14
Beef offal – other than liver & kidney (MO 812)	–	–	–	–	–	–	–	–	–	167 (570)	6	4
Full-cream liquid milk (part of ML 812)	186 (700)	72	39	171 (500)	59	35	204 (750)	38	19	213 (805)	74	35
Skimmed milk, reconstituted (ML 812)	–	–	–	–	–	–	–	–	–	219 (870)	7	3
Full-cream milk (ML 812)	23 (125)	1	5	–	–	–	–	–	–	–	–	–
Full-cream processed milk – maas/buttermilk	306 (1000)	38	12	322 (1000)	28	9	449 (1000)	16	4	457 (1000)	26	6
High-fat cheese – cheddar, gouda	–	–	–	25 (80)	1	4	37 (130)	2	4	40 (144)	4	11

Table 8. *Continued*

Items consumed by at least 3% of the age group (– indicates that item consumed by <3% of the group)	1–5 years			6–9 years			10+ years, Method 1			10+ years, Method 2		
	Mean portion (97.5th percentile) (g)	Per capita portion (g)	% of sample consuming the item	Mean portion (97.5th percentile) (g)	Per capita portion (g)	% of sample consuming the item	Mean portion (97.5th percentile) (g)	Per capita portion (g)	% of sample consuming the item	Mean portion (97.5th percentile) (g)	Per capita portion (g)	% of sample consuming the item
Low-fat milk, buttermilk (ML 812)	–	–	–	–	–	–	284 (1000)	10	3	–	–	–
White cooking fat (FA 818)	–	–	–	–	–	–	13 (45)	0.5	3	13 (45)	0.7	6
Chicken eggs (part of PE 840)	70 (156)	8	11	80 (200)	9	11	99 (208)	15	15	91 (208)	15	17
Peanut butter, smooth type (SO 703)	13 (50)	1	8	16 (60)	2	11	25 (110)	2	6	27 (120)	1	5
Dry beans, cooked (part of VD 71)	167 (480)	10	6	213 (510)	16	8	255 (800)	30	12	228 (700)	27	12
Boiled sweet potato (part of VR 508)	–	–	–	–	–	–	–	–	–	208 (675)	9	4
Boiled carrots (part of VR 577)	76 (300)	3	4	77 (210)	2	3	56 (160)	2	3	59 (160)	4	6
Cooked potatoes (part of VR 589)	108 (300)	24	22	143 (480)	29	20	165 (480)	28	17	167 (480)	52	31
Soup mix, average (part of Soups)	136 (340)	4	3	138 (250)	6	4	–	–	–	–	–	–
Coffee (SM 716)	231 (540)	17	7	243 (540)	23	9	438 (1360)	71	16	484 (1440)	164	34
Tea (part of DT 171)	224 (500)	100	44	258 (520)	131	51	456 (1300)	311	68	444 (1260)	275	62
Rooibos tea (part of DT 171)	243 (675)	30	12	235 (500)	23	10	456‡ (1300)	311	‡	444‡ (1260)	275	‡
White sugar (part of GS 659)	21 (59)	16	76	23 (60)	18	76	27 (90)	20	77	31 (108)	24	77
Jam (part of GS 659)	21 (59)	1	6	22 (60)	2	8	34 (160)	2	6	37 (160)	3	9
Hard boiled sweets (part of GS 659)	19 (85)	1	5	36 (100)	2	6	–	–	–	33 (200)	1	4
Carbonated cold drink (GS 659)	256 (700)	11	4	339 (750)	20	6	427 (1200)	44	10	444 (1360)	82	19
Cold drink, squash type (GS 569)	282 (750)	35	12	326 (750)	59	18	–	–	–	367 (1180)	17	5
Boiled cabbage (part of VB 41)	79 (220)	11	14	91 (240)	13	14	114 (360)	16	14	105 (320)	13	13
Fried onions (part of VA 385)	–	–	–	–	–	–	–	–	–	22 (100)	1	4
Boiled pumpkin (part of VC 429)	90 (225)	7	8	103 (250)	7	7	203 (1000)	8	4	138 (750)	9	6
Tomato, raw (part of VO 448)	–	–	–	–	–	–	103 (400)	4	4	102 (360)	10	10
Tomato and onion stew (VO 448)	85 (210)	5	6	124 (300)	7	6	119 (300)	20	17	118 (300)	15	13
Green beans, cooked (part of VP 526)	–	–	–	–	–	–	–	–	–	117 (300)	5	4
Peas, boiled (part of VP 529)	–	–	–	–	–	–	–	–	–	64 (160)	2	4
Wild green leaves/spinach (VL 53)	151 (420)	15	10	150 (420)	14	9	182 (500)	31	17	175 (500)	20	11
Vegetable atchar (part of Mixed Vegetables)	–	–	–	–	–	–	19 (80)	1	5	–	–	–
Non-dairy creamer (part of OR 172)	7 (24)	1	10	7 (24)	1	13	6 (20)	2	25	8 (24)	1	20
Brick margarine (part of OR 172)	12 (35)	3	24	16 (48)	5	30	19 (60)	4	21	21 (70)	7	33
Medium-fat spread (part of OR 172)	10 (28)	1	5	14 (28)	1	8	15 (45)	1	8	18 (56)	2	11
Sunflower oil (OR 702)	–	–	–	–	–	–	8 (31)	0.5	6	8 (28)	1	9
Water (tap) – additional to cooking§	277 (995)	175	100	284 (700)	209	100	493 (1800)	304	100	493 (1800)	304	100

* Adapted from the National Food Consumption Survey (Labadarios *et al.*, 2000[6]).
† Methods 1 and 2, as described in the text.
‡ Rooibos tea has not been distinguished from ordinary tea in adult surveys, so the figure given is based on that for tea.
§ Water consumption from the Black Risk Factor (BRISK) Study[14–16].

mutton and goat, legumes and vegetables. The higher consumption of these specific food items in comparison with the FBSs is probably due to the fact that sheep, goats, vegetables and legumes are frequently kept for home consumption, particularly in rural areas. Consequently these home-produced food items would not be accounted for in the FBSs.

Another measure of validity of the adult data generated was shown by a comparison of the average energy intakes of groups with the Recommended Dietary Allowances (RDAs). Such comparisons showed that adult estimates were similar to the lower range of the RDA for energy[35]. By comparison, the FBSs overestimated energy for adults by 28% (Method 1) and 22% (Method 2). This is a general finding that has been reported elsewhere[1–4].

Table 8 gives commonly consumed food items for each of the age groups studied. This table comprises food items eaten by at least 3% of the target population. Food items consumed most commonly by the South African adult population (Method 1) in descending frequency of usage and average (mean) amount per day were: maize porridge (78%/848 g), white sugar (77%/27 g), tea (68%/456 g), brown bread (55%/165 g), white bread (28%/163 g), non-dairy creamer (25%/6 g), brick margarine (21%/19 g), chicken meat (19%/111 g), full-cream milk (19%/204 g) and green leaves (17%/182 g).

It is recommended that average/mean portion size, and not per capita portion size, be used for analyses of contaminants since per capita portion size would greatly underestimate contaminants determined. Additionally it is recommended that, for adults, average portions from Method 1 be used for analyses since these give a larger estimate and a better representation of those who have a poorer socio-economic status. Items that appear in tables by means of Method 2, and not by Method 1, should be included to ensure that items eaten by the white (minority) population have not been excluded.

Conclusion

Secondary data analyses of past dietary surveys can be used to generate 'relatively' valid food consumption data for populations where nationally representative surveys are not feasible or possible. These data can be used as an alternative to food balance sheets when undertaking analyses of contaminants in foods and beverages.

Acknowledgements

This study was funded by the World Health Organization and supported by the Department of Health (Directorate: Food Control) and the Chronic Diseases of Lifestyle Unit of the Medical Research Council. We extend our gratitude to the original authors of the research databases used, particularly: Professor D Labadarios and directors of the NFCS; Dr Lesley Bourne; Dr Petro Wolmarans; Dr U MacIntyre and Dr M Senekal. We thank Nicolene Davids and Jean Fourie for technical support.

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