

# Variety and total number of food items recorded by a true longitudinal group of urban black South African children at five interceptions between 1995 and 2003: the Birth-to-Twenty (Bt20) Study

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## Abstract

**Objective:** To report on the variety and total number of food items recorded by a true longitudinal group of urban black South African children ( $n = 143$ ) from the Birth-to-Twenty Study at five interceptions at the ages of 5 (1995), 7 (1997), 9 (1999), 10 (2000) and 13 (2003) years, respectively.

**Methods:** Dietary intake was assessed using a semi-quantitative food-frequency questionnaire. Frequencies were calculated per week, for each interception and for all five interceptions combined, using SAS.

**Results:** Five hundred and forty-six different individual food items were recorded 23 480 times for all five interceptions combined. The highest of 124 items was recorded in 1999 contributing 23% of the 546 items recorded. Each of the top 10 items (rice, stiff maize-meal porridge, chicken, sugar, sweets, tea, eggs, full-cream milk, carbonated beverages and oil) contributed between 2.5% and 3% and these items were recorded almost 600 times or more for all interceptions combined ( $n = 23\,840$ ). Rice and stiff maize-meal porridge were the top items recorded 684 and 676 times, both contributing 2.87% and 2.84%, respectively. The variety of food items and the ratio of the food groups to the total number of foods recorded in the present study were not significantly different but the denominators decreased over the five interceptions.

**Conclusion:** The variety of food items recorded did not vary between 1995 and 2003 – the fact that new items were not added to the questionnaire as the children grew older could have contributed to this phenomenon. However, there was a difference in the ranking of these items that may suggest a change in eating patterns.

**Keywords**  
Individual food items  
South African children

According to published literature, urbanisation and nutrition transition has long been recognised as a worldwide phenomenon contributing to emerging crises in both developed and developing countries<sup>1–5</sup>. Even in South Africa, changes in dietary patterns linked to the process of urbanisation and the shift from a traditional lifestyle to a partially Westernised lifestyle and diet have been studied by several authors<sup>6–10</sup>, but none have been longitudinal studies.

A fundamental approach to nutrition research is to identify individual food items consumed. These food items supply the nutrients essential for growth and health.

As children grow older, they experience new food choices and exert independence on these food items<sup>11</sup>. It is these individual food items that will have to change to improve the nutrient intake and the ultimate health of the population.

If dietary habits and nutrition behaviour are dynamic and constantly changing<sup>12–15</sup>, longitudinal studies are essential to determine the change among the same individual over time. Although the nutrient intake of South African populations has been explored<sup>6,7,14–20</sup>, only the energy, macro- and micronutrient intakes of a true longitudinal group of urban black South African children have

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been examined in the Birth-to-Twenty (Bt20) Study at four<sup>19</sup> and at two interceptions<sup>20</sup>. There has not been a longitudinal study on the actual food items consumed by the same children over a period of time.

Scientific evidence on the intake of individual food items at a particular point in time is available<sup>8,21–24,29</sup>. The need for new, recent information is crucial to determine the ongoing change in the dietary patterns of South African children.

The Bt20 Study, a continuation of the Birth-To-Ten (BTT) Study, started in 1990 and is planned to continue to 2010. It is the first and only longitudinal study on food and nutrient intake of South African children and the largest running study on child development in Africa.

## Objective

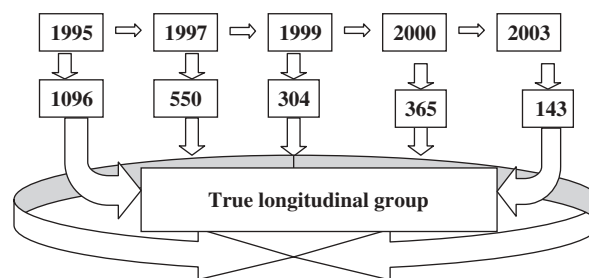
This paper reports on the variety and total number of food items recorded by a true longitudinal group of urban black South African children ( $n = 143$ ) from the Bt20 Study at five interceptions at the ages of 5 (1995), 7 (1997), 9 (1999), 10 (2000) and 13 (2003) years, respectively.

## Methods

Detailed information about the Bt20 Study has been published elsewhere<sup>25–29</sup>. Prior to this study, informed written consent was obtained from the participant's parents/guardians in accordance with the Ethical Committee of the University of Witwatersrand Committee (medical) for Research on Human Subjects.

### Population sample

The Bt20 Study is a longitudinal observation study initiated to determine the biological, environmental, social, economic and psychosocial factors associated with the survival and health of urban South African children<sup>25–29</sup>, living in South Africa's largest metropolitan area, the Johannesburg/Soweto area. The original sample size for the BTT Study was based on a representative proportion of the total South African population according to the 1994 population census<sup>30</sup>. The black community now represents 79% of the total South African population according to the 2001 census<sup>31</sup>. Hence, the true longitudinal core sample for this study comprised 143 urban black children from the Bt20 Study who had nutrition information for all five interceptions<sup>29</sup> and there is no indication whether these 143 subjects were similar to those lost to follow-up. Figure 1 shows the number of children with nutrition information at each separate interception of the Bt20 Study.



**Fig. 1** True longitudinal group of urban black children with nutrition information at all five interceptions (1995, 1997, 1999, 2000 and 2003)

### Dietary assessment

The same semi-quantitative food-frequency questionnaire (FFQ) was used at each nutrition interception of the Bt20 Study because of the large number of subjects living in a culturally diverse population<sup>23,32,33</sup>. The FFQ method was validated by Margetts *et al.*<sup>34</sup>, and has been found to be reproducible, relatively valid and culturally sensitive in assessing the dietary intake of black South African adults and children older than 15 years in the North West Province<sup>32,33</sup>. Parents/guardians or the older children themselves were asked by trained multilingual interviewers to indicate how frequently listed food items were consumed over a weekly period.

### Data management

The same interviewers coded the dietary data on to computer coding sheets using the South African Medical Research Council (MRC) Food Composition Tables and Codes<sup>35</sup>. Either recorded or standard portion sizes were used based on the use of the National Research Institute for Nutritional Diseases (NRIND) Food Quantities Manual<sup>36</sup>. The SAS version 6.1<sup>37</sup> software package was used for statistical analysis.

The raw data were rearranged, merged by child case number and finally the true longitudinal group of 143 children was extracted by the subject's case number. The frequencies were calculated for the number of times each food item was recorded per week, for all five interceptions combined and for each interception separately. The total number of times each food item was recorded for all five interceptions combined was divided by the total number of times all food items at all five interceptions combined were recorded (23840) and expressed as a percentage. The food items were ranked in descending order according to their percentage contribution to the total number of recordings for all five interceptions and then within the six food groups (grain/cereal/breakfast cereal/porridges and other starches; meat and meat substitutes; fruits and vegetables; fats and oils; milk and milk products; and miscellaneous) listed in the semi-quantitative FFQ according to the mean number of recordings over

the five interceptions. In addition, the total number of food items for all the six food groups for each of the five interceptions was calculated ( $Y$ ). The ratio was then calculated for the number of food items recorded in each of the six food groups at each interception ( $X$ ) by dividing  $X/Y$ .

## Results

A total of 546 different individual food items were recorded 23 840 times over the five interceptions. The highest number of food items recorded was 124 (1999) and 123 (2003), being 22.7% and 22.5%, followed by 113 food items (21%) in 2000, 95 (17.4%) in 1995 and 91 (16.6%) in 1997, respectively. Forty-one items contributed 1% or more of the total number of recordings for all five interceptions combined and this was used as a cut-off point as the remaining food items were recorded too infrequently.

Table 1 shows the top 41 food items ranked in descending order according to the total number of times each food item was recorded and their percentage contributions for all five interceptions combined ( $n = 23\ 840$ ). The top 10 food items each contributed between 2.5% and 3% to the overall total number of recordings while the next 23 food items each contributed 1.5–2.3% and lastly eight food items each contributed 1–1.5%. Rice and stiff maize-meal porridge were the top food items, recorded 684 and 676 times, respectively, contributing <3% of the total recordings. The third food item recorded 672 times was chicken, contributing 2.82% of the total number of recordings for all food items for all interceptions. Interestingly, four food items, namely sugar (657 times), sweets (649 times), tea (646 times) and carbonated beverages (600 times), were from the miscellaneous group. The food items that featured down on the ranked list were mixed vegetables (266 times), non-dairy creamer (241 times) and fruit juice (239 times), contributing 1.110%, 1.01% and 1.00%, respectively.

Table 2 shows the top 41 food items ranked in descending order within the food groups according to the mean number of recordings over the five interceptions. The ratio of fruit and vegetables decreased from 0.18 in 1995 to 0.12 in 2003. However, the ratio of other food groups remained fairly stable over the five interceptions.

The number of recordings of the five food items from the grain/cereal/breakfast cereal/porridges and other starches group showed an overall decrease and was not stable. The highest decrease being for soft maize-meal porridge (125 in 1995 to 70 in 2003).

Within interceptions (1997–2000) there were fluctuations in the number of recordings of the eight food items from the meat and meat substitutes group (Table 2). Only peanut butter (a cheap source of protein) and fried fish showed a large decrease in the number of recordings

**Table 1** The top 41 food items ranked in descending order according to the total number of times each food item was recorded and their percentage contribution for all five interceptions combined ( $n = 23\ 840$ )

No.	Food item	Number of times recorded for all five interceptions combined ( $n = 23\ 840$ )	% contribution for all five interceptions combined
1	Rice	684	2.87
2	Stiff maize-meal porridge	676	2.84
3	Chicken	672	2.82
4	Sugar	657	2.76
5	Sweets	649	2.72
6	Tea	646	2.71
7	Eggs	624	2.62
8	Full-cream milk	616	2.58
9	Carbonated beverages	600	2.52
10	Oil	599	2.51
11	Brown bread	559	2.34
12	Beef stew	552	2.32
13	Peanut butter	540	2.27
14	Biscuits	537	2.25
15	Crisps	505	2.12
16	Apple	497	2.08
17	Jam	499	2.08
18	Mashed potato	489	2.05
19	Cabbage	472	1.98
20	Fried fish	468	1.96
21	Salad dressing	462	1.94
22	Popcorn plain	457	1.92
23	Cheese	456	1.91
24	Banana	456	1.91
25	Polony	448	1.88
26	Chocolate	444	1.86
27	Orange	442	1.85
28	Baked beans	425	1.78
29	Soft porridge maize-meal porridge	413	1.73
30	Jelly	386	1.62
31	Coffee	380	1.59
32	Custard	367	1.54
33	Butter	360	1.51
34	Pumpkin	353	1.48
35	Ice-cream	344	1.44
36	Samp and beans	309	1.29
37	Low-fat yoghurt	306	1.28
38	Margarine	285	1.19
39	Mixed vegetables	266	1.11
40	Non-dairy creamers	241	1.01
41	Fruit juice	239	1.00

over the period of investigation (129 to 71 and 111 to 40 from 1995 to 2003, respectively).

However, the number of recordings of fruits and vegetables (apple, banana, orange, cabbage, mashed potatoes, pumpkin and mixed vegetables) decreased steadily over this period. Only fruit juice showed a highly irregular pattern of recordings with an overall increase of 74 from 1995 to 2003.

Oil was recorded between 133 and 139 times in 1995, 1997 and 1999 but gradually decreased to 118 times in 2000 and to 72 times in 2003. Within this food group,

**Table 2** The top 41 food items ranked in descending order within the food-frequency questionnaire food groups according to the mean number of recordings over the five interceptions

Food group	Food item	Number of recordings for each interception					a	b	SD
		1995	1997	1999	2000	2003			
Grain/cereal group, breakfast cereal/porridges and other starches	Rice	140	138	138	139	129	136.8	-11	4.4
	Stiff maize-meal porridge	135	136	135	141	129	135.2	-6	4.3
	Brown bread	113	107	113	118	108	111.8	-5	4.4
	Samp and beans	133	131	70	70	101	101.0	-32	31.0
	Soft maize-meal porridge	125	60	81	77	70	82.6	-55	25.0
	Ratio	0.15	0.13	0.14	0.15	0.16			
Meat and meat substitutes	Chicken	132	130	136	140	134	134.4	+2	3.9
	Eggs	125	131	124	129	115	124.8	-10	6.2
	Beef stew	135	134	59	102	122	110.4	-13	31.7
	Peanut butter	129	111	113	116	71	108.0	-58	21.8
	Fried fish	111	108	97	81	71	93.6	-40	17.3
	Cheese	85	77	101	101	92	91.2	+7	51.1
	Polony	0	125	111	115	97	89.6	+97	51.1
	Baked beans	90	105	87	75	68	86.8	-22	14.3
	Ratio	0.19	0.20	0.21	0.22	0.23			
Fruit and vegetable	Apple	122	117	101	77	80	99.4	-42	20.6
	Mashed potato	116	118	117	101	37	97.8	-79	34.7
	Cabbage	129	107	104	102	30	94.4	-99	37.6
	Banana	100	107	91	86	72	91.2	-28	13.4
	Orange	116	120	80	82	44	88.4	-72	30.1
	Pumpkin	104	92	75	64	18	70.6	-56	33.2
	Mixed vegetable	74	67	51	51	23	53.2	-51	19.7
	Fruit juice	16	26	78	20	99	47.8	+47	38.1
	Ratio	0.18	0.17	0.18	0.16	0.12			
Fats and oils	Oil	139	137	133	118	72	119.4	-67	27.9
	Salad dressing	109	83	94	86	90	92.4	-47	10.2
	Butter	138	132	43	0	47	72.0	-91	60.4
	Ice cream	74	78	45	48	99	68.8	+25	22.5
	Margarine	1	0	80	129	75	57.0	+74	55.7
	Non-dairy creamer	70	74	42	55	0	48.2	-70	29.8
	Ratio	0.12	0.12	0.11	0.12	0.11			
Milk and milk products	Full-cream milk	133	128	129	127	99	123.2	-34	13.7
	Custard	92	92	69	53	61	73.4	-31	17.9
	Low-fat yoghurt	82	67	37	53	67	61.2	-25	16.9
	Ratio	0.07	0.07	0.06	0.06	0.07			
Miscellaneous	Sugar	138	142	108	130	139	131.0	+1	13.8
	Sweets	132	138	132	120	127	129.8	-5	6.6
	Tea	135	129	126	130	126	129.2	-9	3.7
	Carbonated beverages	121	127	117	121	114	120.0	-7	4.9
	Biscuits	114	132	95	110	86	107.4	-28	17.8
	Crisps	133	131	70	70	101	101.0	-32	31.0
	Jam	90	115	102	111	78	99.2	-12	15.3
	Popcorn plain	102	64	115	121	55	91.4	-47	30.1
	Chocolate	95	117	81	67	84	88.8	-11	18.7
	Jelly	121	98	65	44	53	76.2	-68	32.3
	Coffee	70	97	58	73	82	76.0	+12	14.5
	Ratio	0.30	0.30	0.30	0.30	0.30			

SD – standard deviation; a – mean number of recordings over five interceptions; b – decrease (-) or increase (+) in the number of recordings from 1995 to 2003; Ratio – the number of food items recorded in each of the six food groups at each interception (X)/the total number of food items for all the six food groups for each of the five interceptions (Y).

there were fluctuations between interceptions in the number of recordings for salad dressing, butter, margarine and non-dairy creamers. However, recordings for ice-cream and margarine showed an overall increase from 1995 to 2003.

In the group of milk and milk products, full-cream milk was recorded between 127 and 133 times (1995–2000), but then decreased to 99 times in 2003. The number of recordings for custard and low-fat yoghurt showed irregular patterns of consumption over this period.

Eleven food items (sugar, sweets, tea, carbonated beverages, biscuits, crisps, jam, popcorn, chocolate, jelly and coffee) were from the miscellaneous group. Most of these items showed an overall decrease in the number of times recorded from 1995 to 2003, except for coffee, which increased minimally over this time (from 70 to 82 times).

## Discussion

### Main findings

A total of 546 different individual food items were recorded between 1995 and 2003. The highest number of food items was recorded in 1999 (124) and 2003 (123). These 546 items were recorded 23 840 times over the five interceptions combined. Only 41 items contributed 1% or more of the total number of recordings.

Rice and stiff maize-meal porridge were the top items from the grain and cereal group; there was a decrease in the number of recordings of the grain and cereal group, the fruit and vegetable group and the milk and milk products group over the five interceptions. However, among the meat and meat substitutes, chicken, cheese and polony increased over this time as did margarine and ice-cream among the fats and oils. Among the miscellaneous food group, only sugar and coffee showed a minimal increase in the number of recordings. The number of recordings for the remaining items decreased over 8 years.

### Methodology

No method has been able to yield precise and accurate quantitative amounts of foods eaten in obtaining the usual food intake of free-living individuals<sup>38,39</sup>. The FFQ may be the optimal method for epidemiology studies when looking at the eating patterns of large, culturally diverse populations, such as the Bt20, for its ease of application and cost effectiveness<sup>23,29,32,33</sup>. Although this semi-quantitative FFQ was designed to measure the foods and usual intake of these children at baseline, it did not include new foods as they grew older. Hence, omissions of foods from the food list may result in underestimation<sup>29</sup> and this may be a weakness of the study, especially as the study attempts to measure food intake over time. Not only

did the children get older as the study progressed, but the foods available on the market also probably changed. Allowing for new foods to be added to the questionnaire would have given a different result and this has been planned for a future publication. However, using the same questionnaire at all interceptions did allow for consistency.

### Comparisons with other South African studies

Many longitudinal research studies have shown that food habits change over time<sup>12,14,40</sup> but there is paucity of data on the longitudinal assessment of food item intakes in South Africa to show this. Other studies on individual food items consumed by very young rural black children<sup>41</sup>, young rural and urban children<sup>24</sup>, preschoolers<sup>21,42</sup>, schoolchildren<sup>22,43</sup> and adults<sup>8</sup> are available, but true comparison with these other studies cannot be made.

The only longitudinal study<sup>19</sup> conducted on these same Bt20 urban black South African children on their energy, macro- and micronutrient intake at four interceptions was between 1995 and 2000<sup>19</sup>. This study<sup>19</sup> concluded that the nutrient intake of these children deteriorated between 1995 and 2000. These urban black children had the best nutrient intake at 5 years of age in 1995, when the lowest percentage fell below the Recommended Dietary Allowance (RDA) for most nutrients, while the worst nutrient intake was at 10 years when the highest percentage of the children fell below the RDA<sup>19</sup>. However, no individual food items were included in this study.

The results of the present study are similar to those of previous authors<sup>8,14,20,23</sup> in that both stiff and soft maize-meal porridge are important staples among the black community. The National Food Consumption Survey on children aged 1–9 years<sup>14</sup> and Bourne *et al.*'s<sup>8</sup> study among the urban black community also reported rice among the most commonly consumed food items. Rice also ranked the top item in the present study (Table 2).

Among meat and meat substitutes, chicken and eggs ranked high in the present study. Similar findings<sup>14,23,44</sup> also reported frequent consumption of chicken among the study group.

This study observed a decrease in the number of recordings of fruit and vegetables over the five interceptions. Although people eat more than one type of fruit and vegetables<sup>45–47</sup>, consumption of fruits such as apples, banana and oranges decreased in this study but this could have been replaced by other fruits, which were not picked up because of the cut-off point used<sup>46</sup>. Low intakes of fruits and vegetables were also reported in other studies on different South African communities<sup>8,10,45–48</sup>.

Oil ranked high within the fats and oils food group (Table 2). The use of oil was also reported in the National Food Consumption Survey study<sup>14</sup>. The number of

recordings of ice-cream increased from 1995 to 2003 among these children. The consumption of ice-cream was also noted in a study on the frequency of food items consumed by very young rural and urban African children<sup>24</sup>.

Evidence that the consumption of milk decreases as schoolchildren enter adolescence<sup>11</sup> was observed in the number of recordings of milk and milk products over the five interceptions. Other researchers<sup>8,20,29,44,47</sup> have also reported low and inadequate intake of milk products and this confirms the low intake of milk in the present study with the lowest number of recordings (99) in 2003 (Table 2). As Bourne *et al.*<sup>8</sup> stated 'sour milk presents less storage problems than fresh milk and is part of the traditional diet among the black community'<sup>8</sup> and most importantly affordability because dairy products are relatively expensive in South Africa<sup>44</sup>.

Studies have shown frequent intake of sugar, tea and coffee among the miscellaneous food group, with tea and coffee consistently being reported as the usual beverages among both the rural and urban black communities<sup>22,24,48</sup>.

With regard to sugar, a frequent consumption was found among 5-year-old urban black children living in the Johannesburg/Soweto area of the Gauteng Province of South Africa, with the intake remaining relatively constant between 1991 and 1995<sup>46</sup>. In addition, many younger children in Faber *et al.*'s<sup>22</sup> study reported drinking tea with sugar regularly and MacIntyre *et al.*'s study on dietary intakes in different stages of transition in the North West Province of South Africa (THUSA study) also noted sugar consumption by almost all of the participants<sup>5</sup>. Although sugar was not quantified by other authors<sup>5,14,22,24,29,46-48</sup>, it was popular and similar to the present study. The number of recordings of sugar was high and remained relatively stable over the 8 years (Table 2). Authors have also observed frequent intake of food items such as sweets and chocolate<sup>22</sup>, and carbonated beverages<sup>24</sup>, among children in South Africa. Similarly, these items were among the top 41 recorded in this study.

The variety of food items and the ratio of the food groups to the total number of foods recorded in the present study were not significantly different but the denominators decreased over the five interceptions. However, there was a difference in the number of recordings during this period of 8 years. This probably indicates a change in eating patterns among this group of urban black South African children and the fact that new items were not added to the questionnaire as the children grew older could have contributed to this phenomenon.

The low and infrequent recordings of fruits and vegetables are of great concern. These foods were replaced with processed meats; cheese, fats and fruit juice. In addition, the steady and relatively high recordings of

miscellaneous foods reflects a shift towards a Western diet (sugar-based products). The study has provided valuable information that identifies the food types and population age groups that are at risk and that should be targeted. It has also provided guidelines for government policies for nutrition intervention strategies that will lead to healthy dietary habits among children and adolescents in a country undergoing nutritional transition.

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