

CHAPTER 5:

DIETARY INTAKE: 24-HOUR

RECALL METHOD

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Introduction

The measurement of dietary intakes of individuals and groups is central to nutrition research^{1,2}. Dietary assessment methodologies may be broadly classified into two categories: those for the measurement of the intakes of groups or households and those for the assessment of individual intakes. Under the former are techniques such as the food procurement and household inventory method, which is presented in Chapter 7 of this report. Individual dietary assessment methodologies include the diet history, 24-hour recall (24-H-RQ), weighed and estimated food records and food frequency questionnaires. For the purposes of this survey, two methods of individual dietary assessment were used, namely the 24-hour recall, the subject of this Chapter of the report, and the quantitative food frequency questionnaire (QFFQ), which is presented in Chapter 6 of this report.

The 24-hour dietary recall (24-H-RQ) method was selected as one of the primary methods to measure dietary intake of 1 to 9 year old children in the current survey. This was based on a review of the literature, particularly on national studies, which have used the 24-H-RQ method, and on consideration of the unique characteristics of the South African population.

One of the principal advantages of the 24-H-RQ is its speed and ease of administration³. This has made its use very attractive in very large scale and national surveys. It has been used extensively in the United States⁴ since 1971 in the:

- National Health and Nutrition Examination Survey (NHANES I, II and III)
- Hispanic Health and Nutrition Examination Survey (HANES)
- Nationwide Food Consumption Survey (1977 and 1987)
- Continuing Survey of Food Intakes of Individuals (CSF II).

Another major advantage of the 24-H-RQ method is the fact that literacy of the respondent is not required. The interviewer administers and fills in the responses, which only require verbal answers from the recipient, which in turn

allows this method to be used across a wide range of populations. There is little burden on the respondent as the interview generally takes about 20 minutes. Additionally, the immediacy of the recall period means that respondents are usually able to recall most of their dietary intake of the previous day. Because the recalls take place after the food has been consumed, it means that the assessment method does not interfere with dietary behaviour⁴.

The principal limitation of the 24-H-RQ is that one cannot use the data from a single 24-H-RQ to characterise the usual diet of an individual. The main use of a single 24-H-RQ is to describe the average dietary intake of groups of individuals⁵. The 24-H-RQ is well suited, therefore, for measuring current diet in groups of subjects, particularly where differences between group means are to be assessed³.

In general terms, group mean nutrient intakes from the 24-H-RQ have been found to be similar to observed intakes^{6,7}. However, it is well known that subjects with lower observed intakes tend to over-report and those with higher observed intakes tend to under-report their past dietary intake⁷. In cases therefore, where data on the variation in dietary intake within and between individuals is required, the 24-H-RQ needs to be repeated, preferably on non-consecutive days⁴. In this regard, Thompson and Byers⁴ have stressed the importance of having a good quality control system for the administration of a 24-H-RQ questionnaire, which includes: a detailed protocol of administration, appropriate training of the administrators of the questionnaire, duplicate collection of some of the recalls in the study period, and the use of a computerised data system for nutrient analyses.

The Nordic Co-operation Group of Dietary investigators have recommended specific procedures when using the 24-H-RQ method in order to ensure the collection of representative results in all surveys⁸. These include:

- The recall should be conducted as an interview in a quiet relaxed atmosphere

- The respondent should not be given advance warning of the interview (in order not to change dietary intake)
- Dietary aids, which assist in identifying portion sizes, should be used
- The interviews should be evenly distributed over the days of the week (for the sample as a whole), and
- The use of open-ended forms with pre-coded foods facilitates the process and decreases errors in transcription.

All the above recommendations^{4,8} were complied with in this survey.

Methodology

A pre-coded 24-H-RQ was used based on a questionnaire developed for use on schoolchildren aged 11 years, from all ethnic groups in the Western Cape Province⁹ (see also Appendix: Questionnaires). This questionnaire was modified to include additional food items commonly eaten in other Provinces, including infant foods. The questionnaire was used when the interviewer recorded a 24-H-RQ of the dietary intake of a child with the child's mother/caregiver. During this interview the respondent was requested to recall all the food and beverages consumed by the child over the previous 24 hours, starting with when the child woke up. At the end of the interview, the interviewer summarised the items that had been eaten by the child and checked with the mother/caregiver of the child that nothing had been omitted. The objective of this recall was to obtain information on the quantity and quality of the current diet eaten by children.

Description of the 24-H-RQ⁹

Food items

All those foods and beverages (food items), which could be consumed by an individual were listed under the following categories (see also Appendix: Questionnaires):

- Tea and coffee
- Milk and milk drinks
- Cold-drinks and juices

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- Breakfast cereals
 - Bread and rolls
 - Spreads on bread
 - Eggs
 - Cheese
 - Meat
 - Fish
 - Starch
 - Soup and legumes
 - Vegetables
 - Salads
 - Dressings
 - Fruit
 - Puddings
 - Sauces
 - Cakes
 - Biscuits tarts, sweets
 - Infant foods
 - Any other food items

Food codes

The computer code for each food item was included on the questionnaire to ensure ease of analysing the data and to prevent errors with coding at a later stage. The interviewer had to circle the appropriate code for each food item in the questionnaire. Training for this purpose was provided. The codes used were those from the latest South African food composition tables¹⁰.

Quantity

The information included under this column of the questionnaire was a direct guide for the interviewer as to the amount for a given food item to be entered in the questionnaire. Commonly eaten portion sizes (in g or ml units) were also included in this column of the questionnaire. The quantity of food eaten

was always filled in under the appropriate interval of the day. Food models (dietary aids) were used to determine portion sizes.

Interval of the day

Food items consumed were always entered under a specific interval of the day. Six daily intervals were defined and included, namely:

- Breakfast (period up to 09h00)
- In-between snack (between 09h00 and 12h00)
- Lunch (12h00 to 14h00)
- In-between snack (14h00 to 18h00)
- Dinner (18h00 to 20h00)
- After dinner (after 20h00)

The importance of determining meal frequency in such a manner was deemed as necessary and appropriate because of the important need for small children to have frequent small meals during the day.

Additional questions

In addition to the 24-hour recall, the questionnaire also included questions specifically related to household food security, namely:

- Participation in a feeding scheme
- Hunger experienced, and
- Intra-household food distribution.

Recipe page

Space was provided at the end of the questionnaire for interviewers to record recipes of food items, which had not been included in the questionnaire.

Reproducibility of the 24-H-RQ

For the purpose of the survey the 24-H-RQ was tested for reproducibility by administering it on three separate occasions. This was done during the pilot phase of the survey in every Province⁵ (see also Appendix: Training Manual). Essentially, the households were randomly selected for the repeatability

exercise and the same fieldworker was required to visit the selected household on a Monday, a Wednesday and a Friday in a random order. The Kruskal-Wallis test was used to test for any significant differences between the three 24-H-RQs. It is important to realise that all the three interviews were completed in the same household regarding the same child selected for inclusion in the survey at the specified time intervals.

Results

Reproducibility

The analysis of this data (Table 5.1) indicated that, of all the nutrients analysed, no statistically significant differences were detected in terms of mean nutrient intakes except for only three nutrients in three different Provinces, namely in niacin intake in Mpumalanga, thiamin intake in the Northern Cape and in riboflavin intake in the Eastern Cape. Furthermore, no statistically significant differences were found between the means in the nutrient intake for the different age groups analysed. These findings indicated very strongly that the data obtained was reliable and reflected fairly well the mean nutrient intakes of the survey population. Further, there was a good distribution of recalls over the weekdays with 16% of the recalls representing weekends and 84% representing weekdays (Table 5.2).

General Results

Nearly 96% of the children were reported to follow their usual eating pattern on the day of the interview. Those that did not ($n = 112$) cited reasons such as outings, parties or not feeling well (Table 5.3). Hard margarine was by far the most commonly (63%) consumed fat (Table 5.4). A significant percentage of respondents (16%) did not use fat at all on their bread. The majority of respondents indicated that they usually cooked with sunflower oil (74%) with the remainder using white fat (11%) or hard margarine (5%), (Table 5.5). Brown bread was consumed most commonly (58%) whereas whole wheat bread was rarely (<1%) consumed (Table 5.6). A small percentage of respondents (<3%) indicated that the child did not usually eat bread. Fresh whole milk was most commonly (52%) consumed, followed by non-dairy

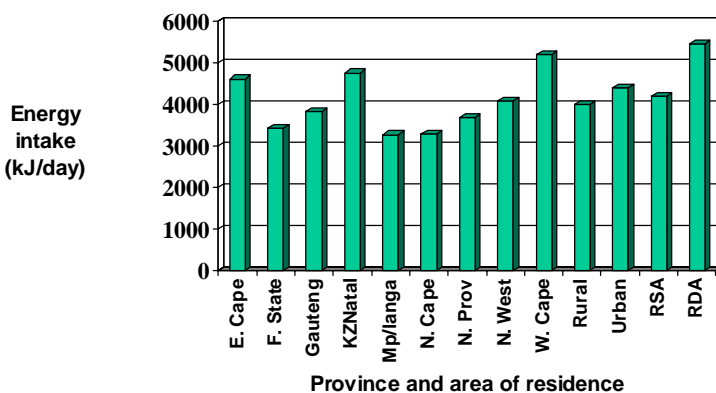
creamer (17%), whereas 13% of respondents did not consume milk at all (Table 5.7). A small percentage (<3%) of children were still being breastfed or were still on breastmilk substitutes (Table 5.7). The majority of children (88%) did not eat at a feeding scheme on the day preceding the interview (Table 5.8). Of the 12% who did so, 63% ate at the Primary School Nutrition Programme (PSNP) and 28% at a crèche (Table 5.9). Although very subjective, a small percentage of respondents (6%) indicated that the child went to bed hungry the previous day (Table 5.10). The majority of children (94%) shared the family meal and 10% of children shared a plate with another sibling (Table 5.10).

Nutrient Intake

Macronutrient intake:

Energy: On the basis of the 24-H-RQ, analysed by Province and age, the mean energy intake of children in all Provinces (Figures 5.1 – 5.3; Table 5.11) was below that recommended for age. Energy intake was the lowest in the Northern Cape for the 1 – 3 year olds (3278 kJ) and in the Free State for the 4 – 6 (4267kJ) and 7 – 9 (4552kJ) year olds. The two Provinces with the highest energy intake for all age groups were the Western Cape and KwaZulu/Natal.

Figure 5.1 The mean energy intake of children aged 1 - 3 years by province and area of residence as determined by the 24-H-RQ: South Africa 1999



At the national level, one out of five and almost one out of two children respectively had an energy intake less than half and less than two-thirds of their daily energy needs (Table 5.11). Indeed, in the Northern Cape, Mpumalanga, Northern Province and the Free State one out of three children of all age groups had less than half of their daily energy needs met. As such, these Provinces can be considered as being the worst affected. Children of all age groups living in rural areas had a consistently and significantly lower energy intake than children living in urban areas (Figures 5.1 – 5.3; Table 5.11). There was an overall tendency, which reached levels of statistical significance in the 1 – 3 year old age group ($p = 0.05$), for boys to have a higher energy intake than girls.

Protein: The reverse was, however, the case for total protein intake (Figures 5.4 – 5.6; Table 5.12). For all age groups and Provinces the mean intakes were greater than the RDA. The highest mean intakes were found in the Western Cape and KwaZulu/Natal and the lowest in the Free State, Eastern Cape, Mpumalanga and Gauteng. Urban children had a significantly greater mean intake than rural ones ($p = 0.0001$). The Northern Cape and the Free State had the greatest percentage children with a protein intake less than half of the RDA. No gender differences were noted.

Carbohydrate: Mean carbohydrate intake (Table 5.13) was highest in the Western Cape, KwaZulu/Natal and the Eastern Cape. Lowest mean intakes were found in the Northern Cape and Gauteng. No significant differences were found with respect to rural-urban areas but only with respect to gender in the 1 – 3 year old group. The highest mean sugar intake (Table 5.14) was found in the Western Cape, Eastern Cape and Gauteng. The lowest mean intake was recorded in the Northern Province, Free State and Mpumalanga. Urban children had a significantly ($p = 0.0001$) greater mean intake than children living in rural areas. No gender differences were found.

Figure 5.2 The mean energy intake of children aged 4 - 6 years by province and area of residence as determined by the 24-H-RQ: South Africa 1999

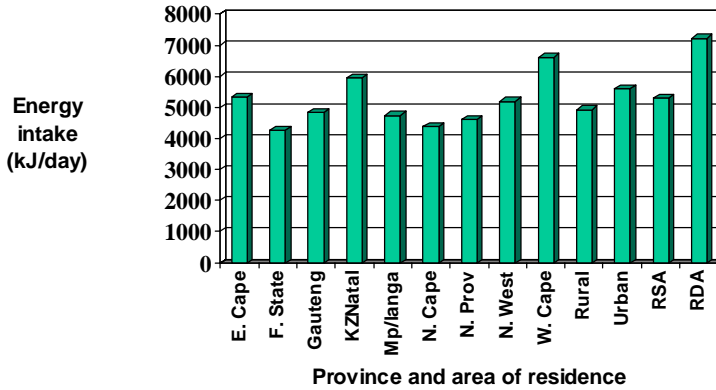


Figure 5.3 The mean energy intake of children aged 7 - 9 years by province and area of residence as determined by the 24-H-RQ: South Africa 1999

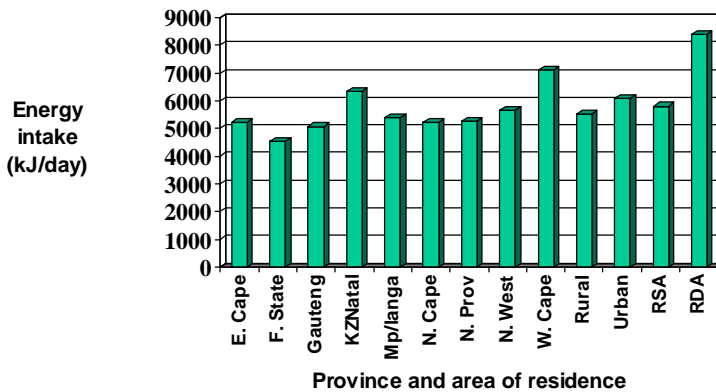


Figure 5.4 The mean protein intake of children aged 1 - 3 years by province and area of residence as determined by the 24-H-RQ: South Africa 1999

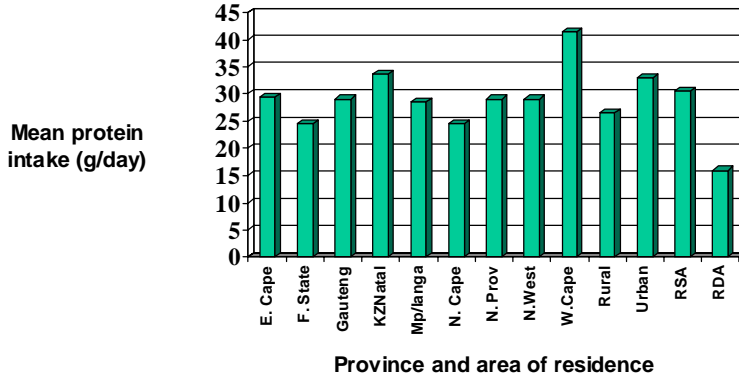


Figure 5.5 The mean protein intake of children aged 4 - 6 years by province and area of residence as determined by the 24-H-RQ: South Africa 1999

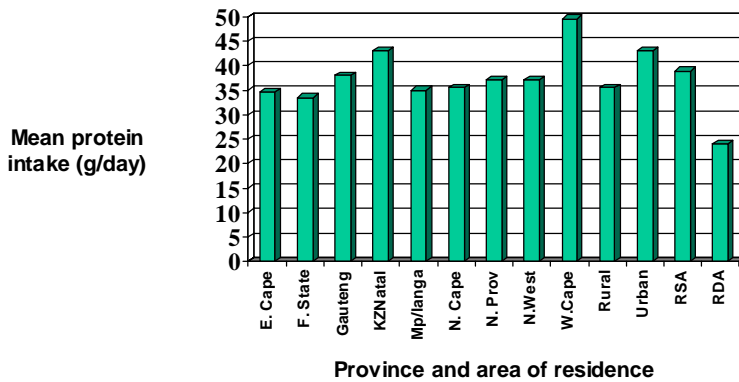
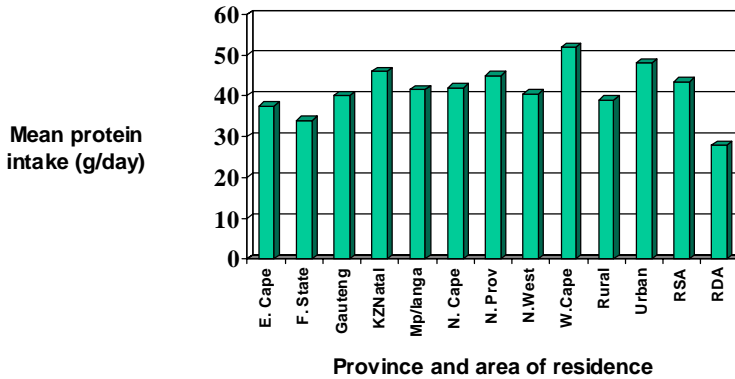


Figure 5.6 The mean protein intake of children aged 7 - 9 years by province and area of residence as determined by the 24-H-RQ: South Africa 1999



Fat: The highest mean fat intake was found in the Western Cape, KwaZulu/Natal and Gauteng (Figures 5.7 – 5.9; Table 5.15). The lowest intake was found in the Free State, Northern Cape, and Eastern Cape. Children living in urban areas had a significantly ($p = 0.001$) higher fat intake than those living in the rural areas, irrespective of gender.

Fibre: The highest mean fibre intake (Table 5.16) was found in KwaZulu/Natal, the Northern Province, the Western Cape and the Eastern Cape. The lowest intake was found in the Free State, Gauteng, Northern Cape and North West. The difference in fibre intake between children living in urban and rural areas reached statistical significance ($p = 0.04$) only for the 7 – 9 year old age group. Similarly, gender differences were significant ($p = 0.0001$ and $p = 0.002$ respectively) in the 1 – 3 and 7 – 9 year olds.

Figure 5.7 The mean fat intake of children aged 1 - 3 years by province and area of residence as determined by the 24-H-RQ: South Africa 1999

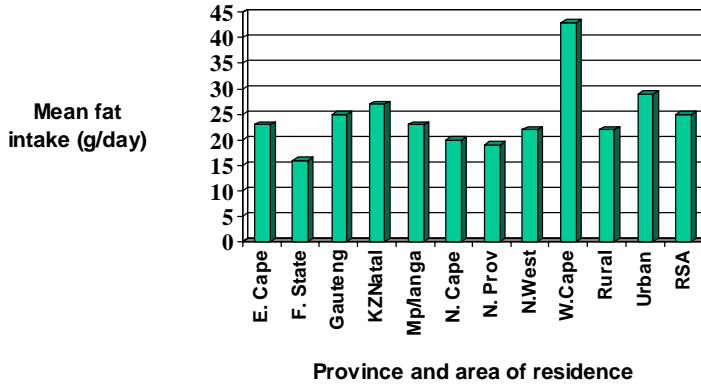


Figure 5.8 The mean fat intake of children aged 4 - 6 years by province and area of residence as determined by the 24-H-RQ: South Africa 1999

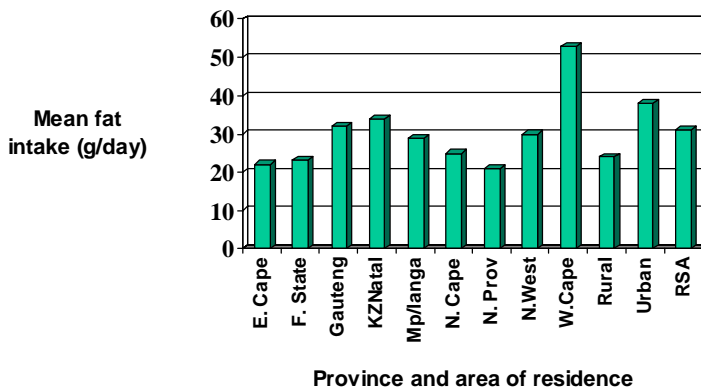
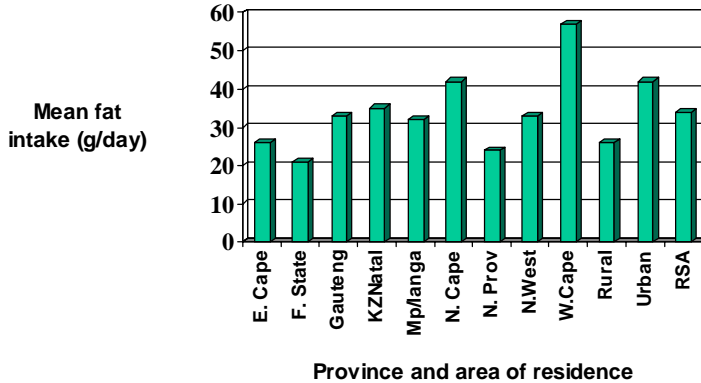


Figure 5.9 The mean fat intake of children aged 7 - 9 years by province and area of residence as determined by the 24-H-RQ: South Africa 1999



Distribution of energy: In terms of the energy distribution of the diet (Table 5.17), total fat, as a percentage of the total energy intake, was less than 30% in all Provinces with the exception of the Western Cape. On a similar basis, the protein contribution to energy intake was less than 15% in all Provinces, whereas that of carbohydrate was greater than 65% in all Provinces, with the exception of the Western Cape (59%). Sugar, as a percentage of energy intake, was highest in the Western Cape (14%) and in the Northern Cape (13%) and lowest in the Free State, Northern Province and Mpumalanga. The P:S ratio ranged from 1.0 in Gauteng to 1.5 in Eastern Cape and the Northern Province. No statistically significant differences were detected for gender. However, children living in rural areas had a significantly greater ($p < 0.001$) percentage of energy contribution from protein of plant origin, a pattern that tended to be also similar at the national level.

Micronutrient intake

Vitamins

Vitamin A: Only children living in urban areas and the Western Cape in the age groups 1- 3 and 4 – 6 had the recommended intake for vitamin A (Figures 5.10 – 5.12; Table 5.18). The remainder of the children had a low intake of vitamin A, which did not reach the recommended intake for age. Indeed, at

the national level less than one out of two (55 – 68%) children had a vitamin A intake that was half the recommended level.

Figure 5.10 The mean vitamin A intake of children aged 1 - 3 years by province and area of residence as determined by the 24-H-RQ: South Africa 1999

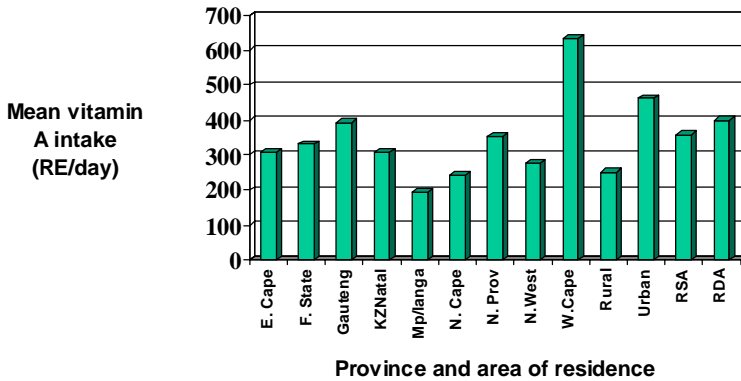


Figure 5.11 The mean vitamin A intake of children aged 4 - 6 years by province and area of residence as determined by the 24-H-RQ: South Africa 1999

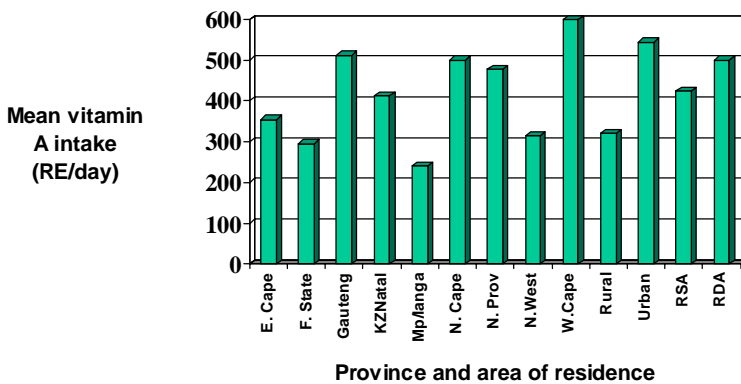
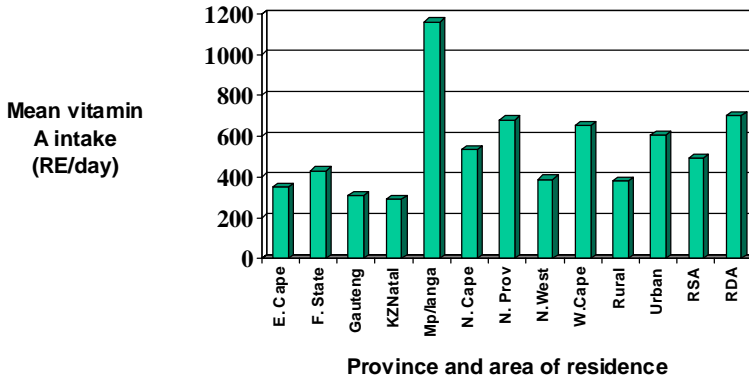


Figure 5.12 The mean vitamin A intake of children aged 7 - 9 years by province and area of residence as determined by the 24-H-RQ: South Africa 1999



A similar pattern (62 –73%) emerged for children living in the rural areas. Nevertheless, the vitamin A intake of children living in urban areas was also very poor with 48 – 62% of them consuming less than half the recommended intake. It should also be noted that the values for the median were generally far lower than the mean intakes, indicating that the data is skewed and the standard deviation is very large in most instances.

Vitamin D: Although the mean daily intake for vitamin D was far below the RDA for all children (Table 5.19), this finding needs to be interpreted cautiously because of the endogenous synthesis of vitamin D in the skin upon exposure to sunlight. Nevertheless, in line with the findings of the survey, statistically significant differences for vitamin D intake between urban and rural areas of residence were found in all age groups.

Vitamin E: The mean intake for this vitamin was highest in the Western Cape, KwaZulu/Natal and the North West, whereas the lowest intakes were recorded in the Northern Province and the Northern Cape (Table 5.20). A large percentage of children (25 – 82%) of all the age groups and in all Provinces had intakes less than 50 % RDA. No urban-rural or gender differences were found except in children in the 1 – 3 year age group living in

rural settings, who had a significantly ($p < 0.03$) lower vitamin E intake than children living in urban areas.

Vitamin C: The recommended intake for vitamin C was attained only by children living in urban areas, in KwaZulu/Natal and the Western Cape (Figures 5.13 –5.15; Table 5.21).

Figure 5.13 The mean vitamin C intake of children aged 1 - 3 years by province and area of residence as determined by the 24-H-RQ: South Africa 1999

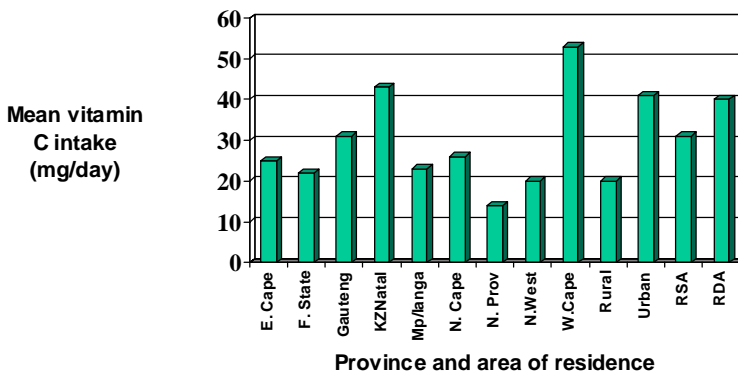


Figure 5.14 The mean vitamin C intake of children aged 4 - 6 years by province and area of residence as determined by the 24-H-RQ: South Africa 1999

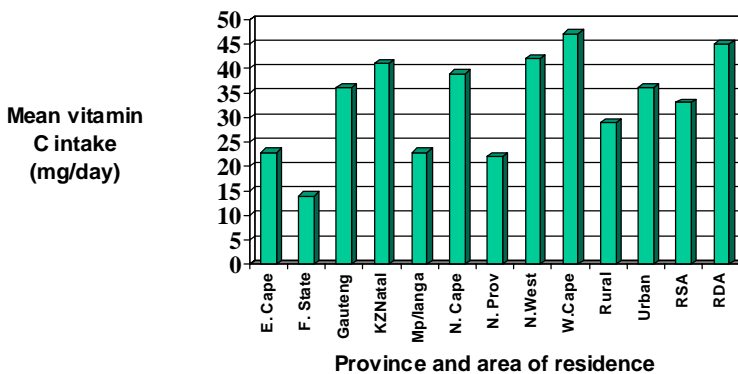
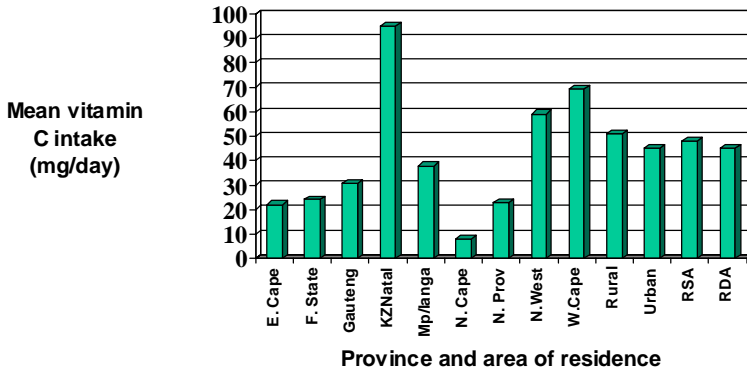


Figure 5.15 The mean vitamin C intake of children aged 7 - 9 years by province and area of residence as determined by the 24-H-RQ: South Africa 1999



Mean intakes were highest in the Western Cape, KwaZulu/Natal and the North West Province. Very low intakes were found in the Northern Province and the Eastern and Northern Cape. At the national level, approximately 60% of children had an intake less than half of that recommended. An urban-rural difference was only found in the 1 – 3 year old group and no gender differences were noted.

Thiamin: In most categories the mean intake exceeded the RDA. However, the median intakes were frequently far less than that recommended (Table 5.22). The Northern Cape had the highest percentage children with intakes less than 50 % RDA. An urban-rural difference was only found in the 1 – 3 year old group, and significant gender differences ($p = 0.009$ and $p = 0.05$ respectively) were noted in the 1 – 3 and 7 – 9 year age groups.

Riboflavin: The mean intake for this vitamin of children in the 1 – 3 year old age group met the RDA. This was not the case, however, in the older age groups (Table 5.23). Generally, median intakes were considerably less than the mean values. With the exception of the Western Cape, more than 40 % children had intakes less than 50 % RDA. Urban-rural differences were

significant ($p = 0.0001$) with children in the rural areas having a lower riboflavin intake.

Niacin: The mean and median intake for this nutrient was highest in the Western Cape and lowest in Eastern Cape, the Free State and the Northern Cape (Table 5.24). At the national level, nearly one third of children had intakes less than 50 % RDA. Significant ($p = 0.0001$) urban-rural differences were found.

Vitamin B₆: Children in all Provinces, except in the Western Cape and KwaZulu/Natal, had a mean and median intake that was less than the RDA (Table 5.25). At the national level, a large percentage children (22 –30%) had an intake less than 50 % RDA, and in an even larger percentage (34 – 44%) of children the intake was less than two-thirds of the RDA. Urban-rural differences were significant ($p = 0.0001$) in all age categories.

Vitamin B₁₂: Although the mean intake for this vitamin was greater than the RDA in almost all Provinces and all age groups, the median intake was considerably lower (Table 5.26). With the exception of the Western Cape, approximately 40% of the children in the other Provinces had intakes of less than 50 % RDA. Urban-rural differences in intake were significant ($p = 0.0009$ and $p = 0.01$ respectively) for the two younger age groups.

Folate: The mean folate intake was consistently and markedly lower than the RDA in all age groups in all Provinces, except the Western Cape and KwaZulu/Natal (Table 5.27). With the exception of the Western Cape, approximately 30 – 60% of children had an intake of less than 50% RDA, and at the national level this was the case for 33% – 53% of the children. Urban-rural differences were significant ($p = 0.0006, 0.0001, 0.03$) in all age groups.

Minerals and trace elements

Calcium: The mean calcium intake was less than half of that recommended in almost 95% of children in most Provinces (Figures 5.16 – 5.18; Table 5.28). At the national level, 81 – 94% of children had an intake much less than half

of the recommended intake. Urban-rural differences in intake were significant ($p = 0.019, 0.0001, 0.002$) in all age groups.

Figure 5.16 The mean calcium intake of children aged 1 - 3 years by province and area of residence as determined by the 24-H-RQ: South Africa 1999

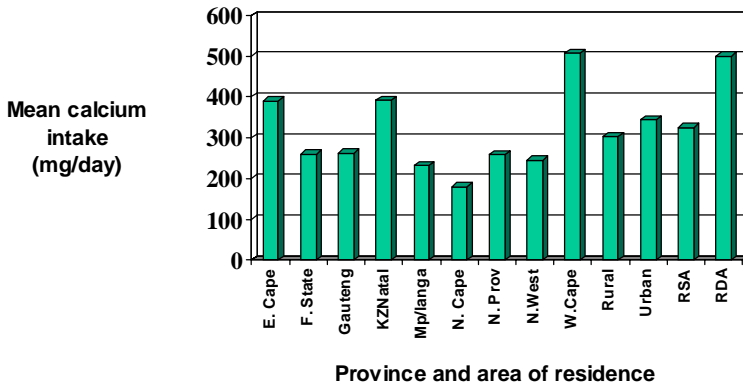


Figure 5.17 The mean calcium intake of children aged 4 - 6 years by province and area of residence as determined by the 24-H-RQ: South Africa 1999

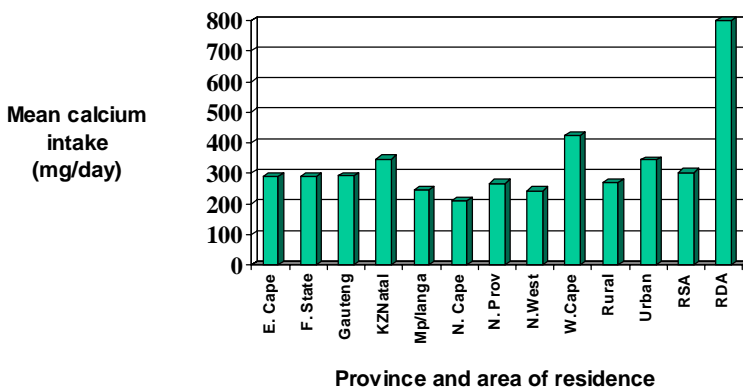
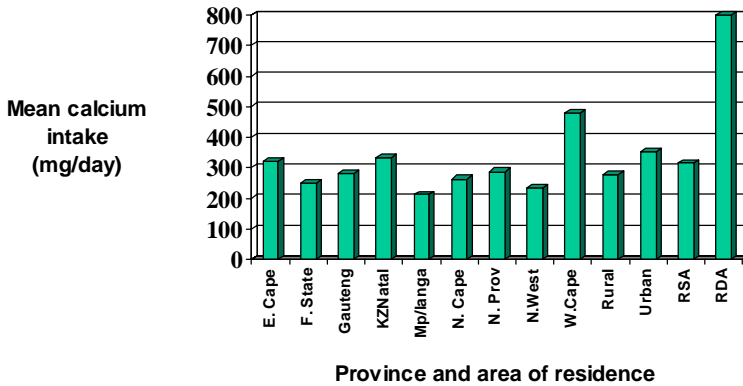


Figure 5.18 The mean calcium intake of children aged 7 - 9 years by province and area of residence as determined by the 24-H-RQ: South Africa 1999



Phosphorus: The intake of this nutrient (Table 5.29) was mostly adequate in all age groups and close to the recommended intake. It is probably a reflection of the adequate protein intake reported on earlier in this section of the report.

Iron: The mean intake of iron was consistently low in all age groups and all Provinces (Figures 5.19 – 5.21; Table 5.30). The lowest iron intake in all age groups was reported in the Free State, Northern Cape, Eastern Cape and the Free State. At the national level, 41 – 63% of children had an intake less than half of the recommended level. The gender and urban-rural differences in intake were not significant.

Figure 5.19 The mean iron intake of children aged 1 - 3 years by province and area of residence as determined by the 24-H-RQ: South Africa 1999

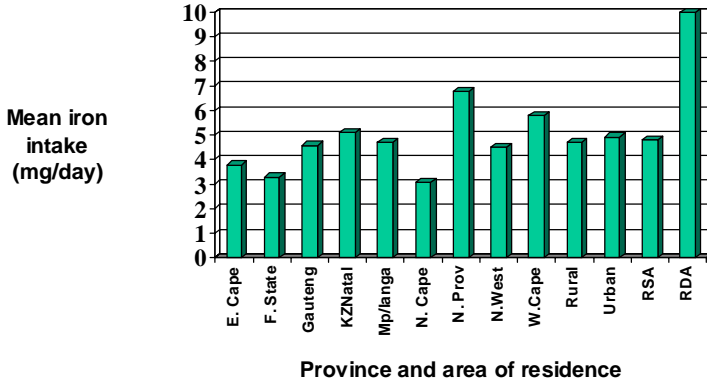


Figure 5.20 The mean iron intake of children aged 4 - 6 years by province and area of residence as determined by the 24-H-RQ: South Africa 1999

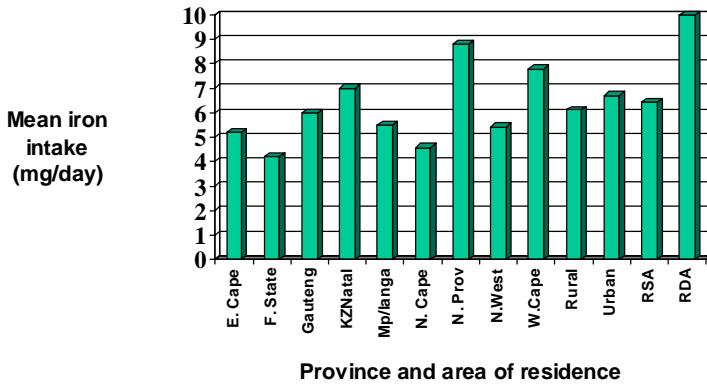
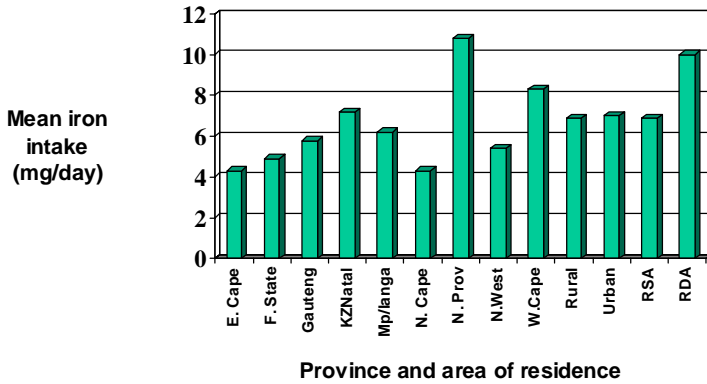


Figure 5.21 The mean iron intake of children aged 7 - 9 years by province and area of residence as determined by the 24-H-RQ: South Africa 1999



Zinc: Similarly to iron, the mean intake of zinc was inadequate in all age groups and in all Provinces (Figures 5.22 – 5.24; Table 5.31). At the national level, 52 – 69% of children had an intake of less than 50% of the RDA. Zinc intake was consistently and significantly ($p = 0.0001$) lower in children living in rural areas.

Figure 5.22 The mean zinc intake of children aged 1 - 3 years by province and area of residence as determined by the 24-H-RQ: South Africa 1999

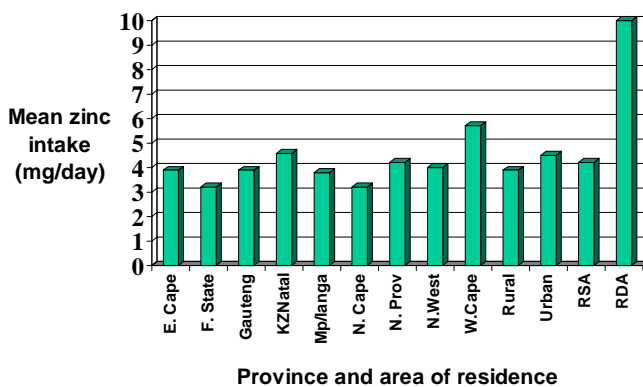


Figure 5.23 The mean zinc intake of children aged 4 - 6 years by province and area of residence as determined by the 24-H-RQ: South Africa 1999

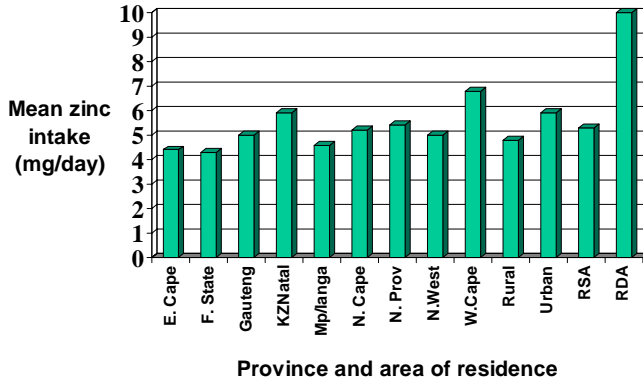
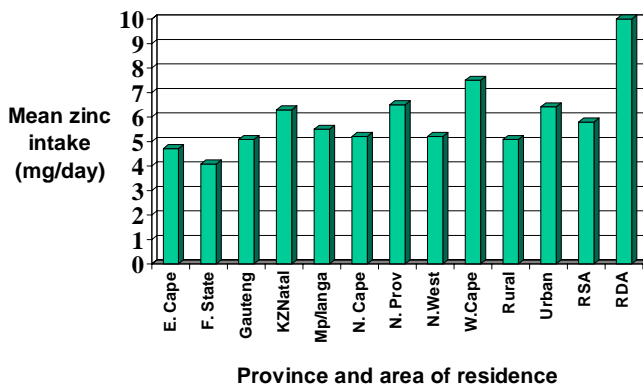


Figure 5.24 The mean zinc intake of children aged 7 - 9 years by province and area of residence as determined by the 24-H-RQ: South Africa 1999



Selenium: Despite the limitations of the Food Composition Tables regarding the data on this nutrient, it is nevertheless to be noted (Table 5.32) that the intake of selenium was consistently low in all age groups and in all Provinces.

Indeed, approximately 60% of all children had an intake of less than 50% of the recommended level.

Magnesium: In line with the findings on protein and phosphorus intake, the intake of magnesium was also adequate in the majority of children of all age groups (Table 5.33).

In summary on the nutrient intake of these children, it would appear that, in general, one out of two children had an intake of approximately less than half of the recommended level for a number of important nutrients. Indeed, the great majority of children consumed a diet deficient in energy and of poor nutrient density to meet their micronutrient requirements (Figures 5.25 - 5.30). Further, it is also to be noted that the analysis of the data by age revealed the expected increase in mean intake of each nutrient from the age groups 1 - 3, to 4 - 6, to 7 – 9 years of age. For the sake of convenience and ease of reference, the lowest and highest intake of individual nutrients are summarised in Table 5.34. For South African children as a whole, the dietary intake of the following nutrients was less than 67% of the RDAs:

- Energy
- Calcium
- Iron
- Zinc
- Selenium
- Vitamin A
- Vitamin D
- Vitamin C
- Vitamin E
- Riboflavin
- Niacin
- Vitamin B₆

Figure 5.25 The percentage of children aged 1 - 3 years with nutrient intakes less than two-thirds of the RDA: South Africa 1999

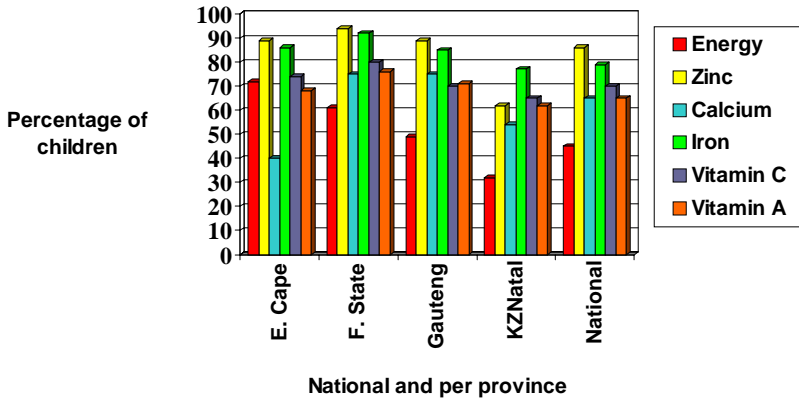


Figure 5.26 The percentage of children aged 1 - 3 years with nutrient intakes less than two-thirds of the RDA: South Africa 1999

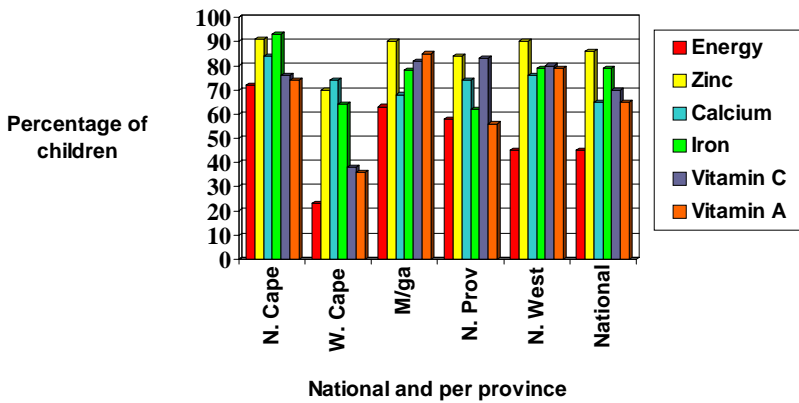


Figure 5.27 The percentage of children aged 4 - 6 years with nutrient intakes less than two-thirds of the RDA: South Africa 1999

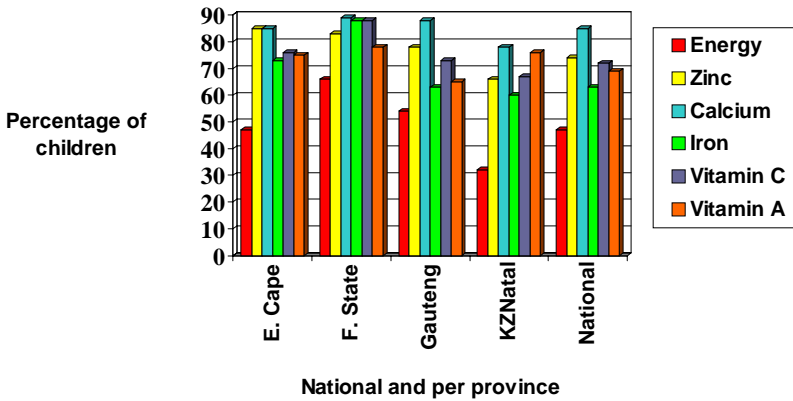


Figure 5.28 The percentage of children aged 4 - 6 years with nutrient intakes less than two-thirds of the RDA: South Africa 1999

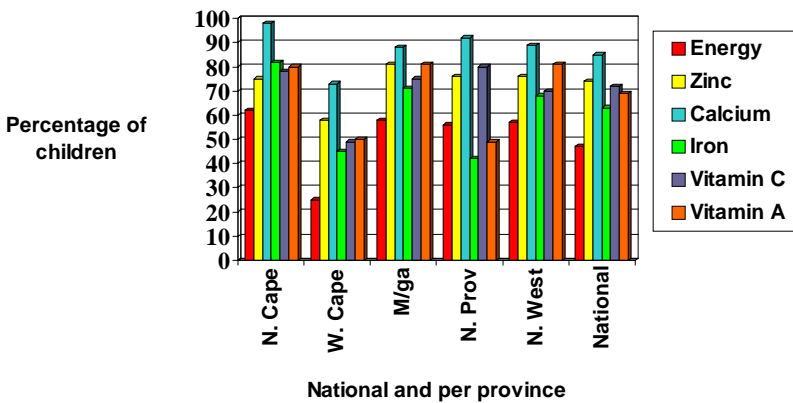


Figure 5.29 The percentage of children aged 7 - 9 years with nutrient intakes less than two-thirds of the RDA: South Africa 1999

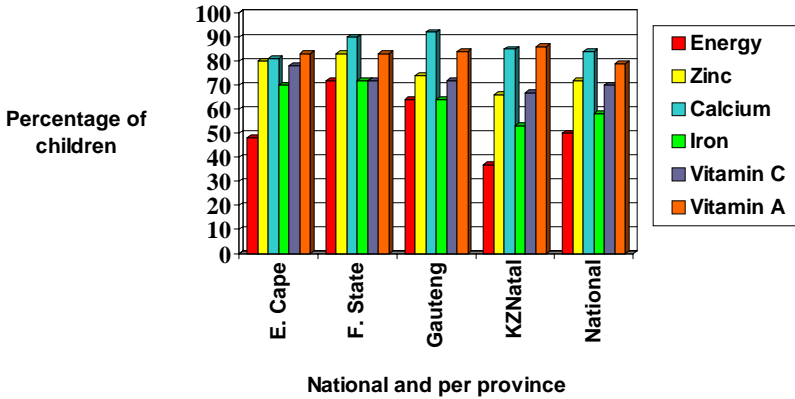
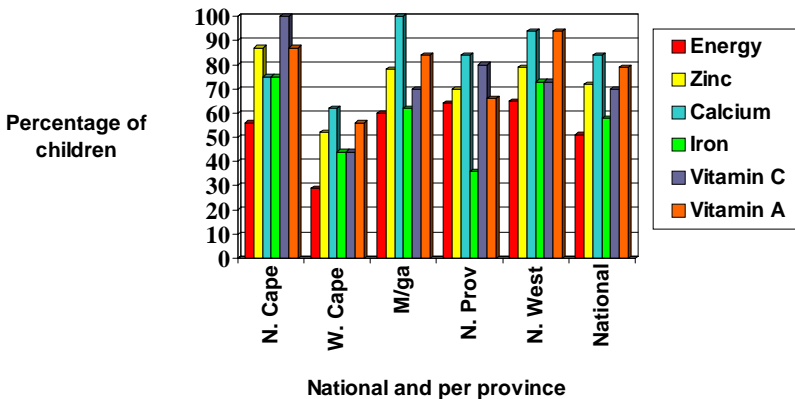


Figure 5.30 The percentage of children aged 7 - 9 years with nutrient intakes less than two-thirds of the RDA: South Africa 1999



Foods Children Eat

At the national level (Table 5.35), the five most commonly eaten foods included maize, white sugar, tea, whole milk and brown bread. With a few exceptions, this pattern, rather than the actual frequency, appears to be fairly consistent in all Provinces. For the sake of convenience and easy reference, the frequency of items consumed in each Province are presented in separate tables (Tables 5.36 – 5.44)

Household Food Security

All variables associated with household food security (Figure 2.2) were assessed for their association with Height for Age Z-scores (H/A) of <-2 SD and Weight for Age Z-scores (W/A) <-1.5 SD using the Chi-square test. Those variables found to have a significant ($p < 0.05$) crude association with stunting or underweight were then entered into a multiple logistic regression analysis. Risk factors for stunting and underweight were the same in terms of significance. The strongest risk factors that were associated with stunting were (Tables 5.45, 5.46):

- No cold storage facilities
- Using paraffin or fire to cook
- No radio or TV in the house
- Mothers with a level of primary school education or less
- Residing in a mud or tin house
- Income of less than R 1 000,00 per month
- Using a communal tap or river water

For example in households where no cold storage facilities were available the child was almost at a 3 times higher risk of being stunted.

The strongest risk factors for being underweight were:

- Lack of cold storage facilities
- Mother with a level of primary school education or less
- Caregiver with a level of primary school education or less
- Cooking with fire or paraffin
- No radio or television in the home
- More than four people sharing a room

Nutrient Intake and Anthropometric Status

In nutritional terms, the consumption of animal products (milk and dairy products, eggs, meat, fish) was significantly ($p < 0.0001$) correlated with H/A (Spearman's; $r = 0.11$) and W/A ($r = 0.12$). This was the case overall for

children in all age groups ($p < 0.05$), in five of the nine Provinces ($p < 0.05$) and for children living in formal urban areas ($r = 0.14$; $p < 0.0001$). Furthermore, a significant correlation was found at the national level between energy intake and stunting (Pearson's; $r = 0.16$; $p = 0.0001$) as well as of being underweight (Pearson's; $r = 0.15$; $p = 0.0001$). This was also true for children living in urban as well as in rural areas.

Discussion

On the basis of the 24-H-RQ, the findings of the present survey indicate that, on a national basis and in broad terms, one out of two children aged 1 – 9 years have an intake of approximately less than half of the recommended level for energy and a number of important micronutrients. The latter included vitamin A, vitamin C, riboflavin, niacin, vitamin B₆, folate, calcium, iron and zinc. This was the case despite the documented and expected increase in mean intake of each nutrient with age. The nutrient intake of children living in rural areas was overall considerably poorer than that of children living in urban areas. Additionally, all variables associated with household food security were associated with a poorer dietary intake and a poorer anthropometric status, particularly stunting and being underweight. At the national level, the five most commonly consumed foods included maize, white sugar, tea, whole milk and brown bread.

In general, the poor energy and micronutrient intake of the children was reflected by their anthropometric status and in their socio-demographic circumstances. A large percentage of children were stunted and the majority were found in homes lacking the most basic of facilities such as water and toilet facilities. Many of these children resided in informal housing and were cared for by a grandmother or mother who was semi-illiterate. Within the households themselves, the majority lacked adequate cooking and storage facilities; all factors indicative of poor household food security. Additionally, it was found that many families were living on the breadline, some being dependent on a grant or pension from a relative. The existence, as documented by the present survey, of the many factors, which contribute to

poor household food security is a cause of grave concern and demands immediate action in terms of interventions that can be implemented sustainably.

The findings of the present national survey support those of previously published, smaller scale, regional studies¹¹⁻¹⁴, which employed the 24-H-RQ methodology as a means of estimating nutrient intake (Table 5.47). The results for energy intake and other nutrients are, indeed, remarkably similar specifically between the 4 - 6 and 7- 9 year olds in the present survey compared with the 2 - 5.9 and 6 -10.9 year olds in the other studies. Additionally, the same urban/rural trends appear to have persisted since these studies were undertaken in the early 90s. In terms of the most frequently consumed foods, the findings of the present survey can be compared with one other such similar study, albeit in adults, at the provincial level¹⁵ (Table 5.48). It is interesting to note that the top seven most commonly consumed food items in the study conducted in the Northern Province are remarkably similar to those of the present national survey. In this regard, the similarities between the findings of the present survey and those in the Northern Province would, indirectly, support the findings of the present survey regarding the majority of children sharing the food prepared for all members of a household.

REFERENCES

1. Nesheim RO. Measurement of food consumption - past, present and future. *Am J Clin Nutr.* 1982; 35: 1292 - 1296.
2. Medlin C, Skinner JD. Individual dietary intake methodology: a 50-year review of progress. *J Am Diet Assoc.* 1988; 88: 1250 - 1257.
3. Nelson M, Bingham SA. Assessment of food consumption and nutrient intake. In: Margetts BM, Nelson M. *Design Concepts in Nutritional Epidemiology*, 2nd ed. Oxford: Oxford University Press, 1997.
4. Thompson FE, Byers T. Dietary Assessment Resource Manual. *J Nutr.* 1994; 124: 2245S - 2246S.
5. Nelson M, Black AE, Morris JA, Cole TJ. Between- and within-subject variation in nutrient intake from infancy to old age: Estimating the

- number of days required to rank dietary intakes with desired precision. *Am J Clin Nutr.* 1989; 50: 155 - 167.
6. Gersovitz M, Madden JP, Smciklas-Wright H. Validity of the 24-hr-dietary recall and seven-day record for group comparisons. *J Am Diet Assoc.* 1978; 73: 48 - 55.
 7. Madden JP, Goodman SJ, Guthrie HA. Validity of the 24-hr recall analysis of data obtained from elderly subjects. *J Am Diet Assoc.* 1976; 68: 143 - 147.
 8. Cameron ME, Van Staveren WA (ed). *Manual on Methodology for Food Consumption Studies.* Oxford: Oxford University Press, 1988.
 9. Steyn NP. *Nutritional Status of Eleven-Year-Old Children in the Western Cape Province of South Africa.* Stellenbosch University: PhD thesis, 1986.
 10. MRC: *Food Composition Tables,* 1998.
 11. Birth-to-ten. 1991 - 1992. Unpublished data.
 12. Bourne LT, Langenhoven ML, Steyn K, et al. Nutritional status of 3 - 6 year old African children in the Cape Peninsula. *East Afr Med J.* 1994; 71: 695 - 702.
 13. Richardson BD, Sinwel R, Cleaton-Jones P, et al. Anthropometric status. In: Cleaton-Jones P, Granath L, Richardson B. Eds. *Dental caries, nutrient intake, dietary habits, anthropometric status, oral hygiene and salivary factors and microbiota in South African black, indian and white 4 - 5 year old children. Descriptive data from a survey in 1984.* Medical Research Council. Tygerberg. 1991.
 14. Badenhorst CJ, Steyn NP, Jooste PL, et al. Nutritional status of Pedi schoolchildren aged 6- 14 years in two rural areas of Lebona. *S Afr J Food Sci Nutr.* 1993; 5: 112 - 119.
 15. Steyn NP, Burger S, Monyeki K, et al. *Dietary intake of the adult population of Dikgale.* UNIN Press: Sovenga, 1998.