A LIQUID CONSUMPTION SURVEY OF INDIVIDUALS IN GREATER CAPE TOWN

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ABSTRACT

There is no published data for the per capita consumption of water of individuals in South Africa. A daily rounded volume of 2 litres per person is usually taken as a working estimate from world-wide data. As part of ongoing epidemiological studies into potential health effects of changes in the water supply to greater Cape Town, water consumption patterns were ascertained.

As health effects are often spatially ascribed to the place of residence of a person, it was necessary to ascertain how much water was drunk at home as well as away from home. Water consumed was divided into three classes : (i) water consumed from the tap, (ii) commercial beverages and (iii) water bound in food.

A review of methods of conducting dietary surveys indicated that a 24-hour recall would be the most appropriate method.

Two surveys on total dietary intake utilizing a 24-hour recall were carried out (n=2 000 persons for each survey), one in winter and the other in summer. The design of the survey involved a cluster sample of households that were representative of the socio-economic and demographic structure of greater Cape Town.

Three pretested types of questionnaires were administered by trained interviewers : (i) a placement questionnaire to describe the household composition, (ii) a recall questionnaire for individual adults and children and (iii) a recall questionnaire for babies. Particular attention was paid to the accurate ascertainment of the volumes of food and drink consumed as well as their preparation, to facilitate accurate analysis. The water content of each food item was calculated by a computer program that utilized computerized food composition tables.

The water consumption data was analyzed by sex, age, population group, income and the season of the year. Detailed graphs and tables are provided. Results were also standardized to the population of greater Cape Town.

It was found that the difference in consumption between the White and 'Coloured' population groups was greater than the difference between those people of high and low income groups.

The mean total water intake for Whites was 2.19 litres per day, while for 'Coloureds' it was 1.26 litres per day. There is no obvious bias to account for this difference. The figures for protein consumed by the two groups, which was used as a control, are consistent with values reported in the literature.

Summer consumption was higher than that during winter.

The ratio of tap water consumed at home to total liquid consumed was approximately 0.5.

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CHAPTER 1

THE ROLE OF WATER IN THE HUMAN BODY

The most urgent of all nutritional needs is the need for water. If nothing is taken in, man dies of thirst far more quickly than he dies of hunger. This is so self-evident, that in the "Manual on the Nutritional Needs of Man" issued in 1974 (Lafontaine, 1975), the FAO and WHO forgot to mention water ...

There is very little specific evidence on the human daily physiological requirement for water. There tend to be ranges of figures used by researchers from unquoted sources. However, this is summed up largely by Lafontaine in his introductory report to the European Scientific Colloquium on "Hardness of Drinking Water and Public Health", held in Luxembourg during 1985:

"The adult's daily water requirement is in the region of 35 to 50g of water per kilogram of body mass, this being the case for large children, adolescents and adults in the normal conditions of a moderate climate. However, this need can be increased during pregnancy and lactation as well as in a tropical climate or during work in high temperatures. Relative humidity can also play an important role."

"All other things remaining equal, infants' needs are proportionately much higher, ranging from 100 to 150g per

kilogram body mass per day, or three times those of an adult.

"However, water is lost:

a) through urine (in general 1 000 to 1 500 ml/24h)

b) through bowel movements (in general 140 ml/24h)

c) through the lungs (300 to 400 ml/24h)

d) through the skin as perspiration (passive process) (600 to 800 ml/24h) and as sweat (active process) (from 0 to 1 500 ml (sic) depending on circumstances).

(Lafontaine, 1975).

In "The Practice of Dietetics" Newburgh and MacKinnon (1934) state that generally a total of 2 000 to 3 000 ml is lost daily and possibly much more under certain conditions. The 24 hour requirement is that amount that replaces the losses. Ordinarily thirst is an accurate guide to supplying the necessary amounts of water.

However experiments have shown (Rolls and Rolls, 1982) that giving liquids a pleasant taste significantly increases fluid consumption. Another factor unrelated to physiological need which may affect intake, is the variety of fluids available. Most animals do not 'overdrink' but when an abundance of palatable liquid refreshment is available, 'overdrinking' more than is required for homeostatic control, and the consequent production of a dilute urine occurs commonly in man and may occur in animals.

Fluid intake must depend as much on social habits as on physiologic needs (Ellwood, 1974). Some people always have a cup of tea on rising, others never; some habitually drink with meals, others do not; some like a bedtime drink, others take nothing during the evening. Tap water intake must also depend on beverage preferences. Tea, coffee and fruit juices contribute as can some alcoholic beverages (eg. whisky and water): pure fruit juices and milk (ie. excluding reconstituted milk powder) do not.

Water is taken via the alimentary tract, either in the form of drinks (water, tea, coffee, fruit juices, beer, etc.) or as water constituting part of so-called "solid" foodstuffs. Opinions as to how much is consumed through the different sources vary from 1 100 to 1 500 ml in the form of drinks, 900 to 1 00 ml in the form of water as a solid food component, to which must be added 200 to 400 ml water formed during food combustion.

(Newburgh and MacKinnon, 1934)

With regard to differing individual requirements and possible variation in exposure to elements in the water, Lederer (1971) emphasizes the following points:

1. Water requirements vary considerably according to age and type of climate, work or food. Therefore water constituents which have no appreciable effects with normal quantities of drink can play a not inconsiderable role when the quantities consumed are

greater, for example, by reason of the climatic or working conditions. Because of this, the population will contain critical groups which are exposed to a greater extent;

2. water requirements can also be influenced by pathological states (diabetes mellitus or diabetes insipidus, for example, or diseases accompanied by profuse sweating or renal elimination disorder); in a specific group, therefore, pathologically critical individuals who are particularly vulnerable can be found;

3. water requirements can also change during pregnancy or breastfeeding. As has been mentioned, the water requirements of the newborn baby are relatively considerable. There therefore exists, possibly superimposed on the abovementioned critical groups or individuals, a population subject to a greater degree of exposure, constituted by pregnant or nursing women and by very young children. The risk must be all the more precisely evaluated since the bodies of these individuals are generally more sensitive to alterogeneous substances and since certain nutritional habits, such as diluting milk powder or concentrated milk, require considerable quantities of water;

4. the form in which water is taken can play an important role; tap water can differ considerably from water from

a catchment or supply reservoir, and its composition can vary during the day. Cases of lead poisoning, due to drinking coffee prepared in the morning with soft water distributed by lead piping where the water has remained all night long, are common knowledge. The actual preparation of drinks can also introduce a series of previously non-existing factors, such as fluorine in tea, or it can eliminate others, such as when calcium is rendered insoluble by boiling. The balance of certain elements can sometimes be considerably upset by certain factors such as the large quantities of phosphoric acid present in some lemonades. Non-mineral nutrients can affect the metabolism of certain mineral elements, for example the role of vitamin D in the metabolism of calcium and phosphorus. Such instances of interference are certainly numerous, but many remain inadequately defined;

5. it has been indicated above that the composition of prepared drinks can be very different from that of the ordinary water supply; in Europe the latter fairly often constitutes only a relatively minimal part of what is consumed as a drink. Furthermore, the composition of water can significantly affect the preparation of foodstuffs. A known fact is the loss of calcium incurred by steeping and cooking foodstuffs in water which is too soft. Another less known fact is the immobilization of part of the fluorine added to water

when calcium is precipitated during boiling. Water with a high calcium content could affect the supply of iron to the intestine.

6. it seems likely that this interference between calcium and iron is a more frequent feature of the nutritional process than is believed. A more precise knowledge of the repercussions in man of such phenomena is required to fully appreciate the role played by water and drinks taken in, and the interactions between the latter and other foods, medicines, etc., and to evaluate the possible effects of the various changes undergone by water before and during its distribution.

CHAPTER 2

LITERATURE REVIEW

Relatively few studies have been carried out to determine actual amounts and patterns of water intake (Gardner, 1976; Abu Zeid, 1979; Comstock, Cauthen and Hesling, 1980).

Nationwide drinking habits have previously been investigated by two large surveys in Canada (Ministry of Health and Welfare, 1979) and the Netherlands (Haring, 1978), covering sample sizes of 342 and 1 472 households respectively. A limited study has been carried out in the U.K. (Hamilton, 1974) amongst 100 adults living in two areas of Britain.

In addition, the National Academy of Sciences, U.S.A. (National Academy of Sciences, 1977) carried out a literature survey and combined nine sources of information to obtain a mean daily consumption of water per head. The results of the average daily intake of tap water and total liquid obtained from these surveys are broadly summarized in Table 1.

In the nationwide survey covering the drinking habits of 1 320 households in England, Scotland and Wales, Hopkin and Ellis (1980) found that the mean liquid intake for the whole sample (excluding babies) was 1.8 litres per head per day (l/hd.d), and that the mean tap water intake was 1.1 litres per head per day.

TABLE 1 A SUMMARY OF THE RESULTS FROM PREVIOUS STUDIES OF LIQUID CONSUMPTION OF TAP WATER AND TOTAL LIQUID IN LITRES PER HEAD PER DAY

	Volume Consumed Total Liquid (ℓ/hd.d)	Tap Water (ℓ/hd.d)
United Kingdom	1.79	1.52
Netherlands	----	1.26
United States of America	1.95	1.63
Canada	----	1.30

(National Academy of Sciences, 1979).

An investigation on arsenic exposure in drinking water (Southwick, et al., 1981) in which the water intake of participants from three communities in Utah were determined, the mean intakes were found to be 2.4; 2.7; 2.9 l/hd.d.

A New Zealand study aimed at obtaining accurate information on the actual amounts and the mineral content of the water individuals drink in a day (Gillies and Paulin, 1983) revealed that there may be more than a ten-fold variation in daily water intake among individuals. The total intake for men and women was found to range from 0.26 to 2.81 l/hd.d.

In most countries, an arbitrary figure for average liquid intake per head per day, is normally used as a basis in calculating exposure to elements in drinking water. Mean values ranging from one to two litres per day are used as indicated in the following paragraphs.

In the 3rd edition of the report on "International Standards for Drinking Water" (WHO, 1971) the WHO assumed an average daily intake of 2.5 litres by a man weighing 70 kg. Subsequently in revising these standards, the WHO Regional Officer for Europe in Denmark decided to use a daily per capita consumption of 2 litres of water as a basis for calculation (Lewis and Waddington, 1980).

In German studies an individual daily water consumption of 2 litres was assumed (Sonnebron and Mandelkow, 1980).

In the formulation of a national policy on drinking water constituents in the Netherlands, calculations were based on an assumed average daily consumption of 2 litres (Verkerk and Bos, 1980). Another Dutch study (Kool et al., 1980) assessing the toxicity of organic compounds in drinking water estimates the total maximum daily water intake of an adult to be in the region of 1.4 litres).

The U.K. took a figure of 2 litres/hd.d as the average adult liquid intake for calculations until Water Research Centre research provided more accurate information (Hopkin and Ellis, 1980). In estimating the daily exposure to lead from tap water in Britain an average of 1.25 litres/hd.d was used for adults with a maximum of 2.9 litres/hd.d (Mathew, 1980). However, the Society for Water Treatment and Examination in the U.K. estimated the daily intake of water by an adult to be about 1.5 litres (Holden, 1970).

The Environmental Protection Agency of the United States (E.P.A., 1976) based its drinking water standards on an assumption that the average water intake is 2 litres per day.

In most countries only very rough assessments are available concerning the daily drinking habits of the consumer (i.e. quantities used for drinking water and food preparation, frequencies, use of bottled water and alcoholic beverages, etc.)A table was compiled (Zoeteman and Brinkman, 1976) of variations in the liquid consumption pattern of nine

countries in Europe, basing their estimations on import and local production data. Table 2 illustrates some striking differences between the nations.

For example, 60 times as much wine is consumed per head in Italy as in the U.K., while 100 times the volume of mineral water is consumed in France compared with the U.K. These differences can largely be attributed to culture.

Figures for some of the items are available for South African consumption as is indicated in Table 3.

In South Africa the only published report on water consumption for potable use has been by Alcock (1986) giving an approximate figure of 2.3 litres/hd.d for a rural population in KwaZulu.

It is also important to acknowledge that consumption patterns are subject to change, as is illustrated in Table 4 below. The consumption of spirits has risen consistently and gradually over 20 years, whereas beer consumption has increased far more rapidly and wine intake has been variable with an overall increase.

In all of these studies there has been considerable rounding off of figures and certainly none of them have taken into account the tap water component of many so-called "solid" foodstuffs (such as porridges, rice, spaghetti, etc.), which for the first time are included in this study, and some of

TABLE 2 DIFFERENCES IN WATER CONSUMPTION IN BEVERAGES IN THE EUROPEAN COMMUNITIES (1970 - 1971)

Water Intake Routes
Quantities in litres/head.year

	Coffee	Tea	Beer	Milk	Wines	Mineral Water	Soft Drinks
Belgium	165	10	126	78	14	31	55
Denmark	300	20*	100	112	7	0.5*	44
France	127	67	40	71	124	50	19
Germany	137	16	140	77	18	13	53
Irish Rep.	50*	400	48	213	2	0.5*	20
Italy	85	5	12	67	113	20	23
Luxemborg	165	10	125	70	41	29	50
Netherlands	250	250	60	107	6	0.5	55
U.K.	50	410	74	140	2	0.5	22
Ave. E.E.C.	110	125	65	90	65	21	29

*Estimate

(Zoeteman and Brinkman, 1975)

TABLE 3 CONSUMPTION OF BEVERAGES IN SOUTH AFRICA

Quantities in litres/head.year

	(a)	(b)
Spirits	1.26	3.4
Beer	37.0	49.2
Wine	9.55	11.7

(a) Produkschäp voor Gedistilleerde Drinken (1983)

(b) BMI (1985)

TABLE 4 ANNUAL CONSUMPTION OF ALCOHOL-CONTAINING DRINKS PER HEAD OF THE POPULATION IN SOUTH AFRICA (1962 - 1982)

Year	Spirits (100% proof) litres/year	Beer litres /year	Wine litres /year
1962	0.90	5.8	6.53
1963	0.90	6.5	7.77
1964	1.00	7.8	9.09
1965	1.11	9.3	8.68
1966	1.14	9.2	8.41
1967	1.11	8.2	9.23
1968	1.15	8.9	9.09
1969	1.11	10.9	9.40
1970	1.33	12.1	9.17
1971	1.12	12.0	11.28
1972	1.01	13.0	9.97
1973	1.15	15.3	10.72
1974	1.31	17.9	11.34
1975	1.38	19.5	10.41
1976	1.15	19.2	9.89
1977	1.03	18.5	9.00
1978	1.02	19.1	8.80
1979	1.19	21.9	8.43
1980	1.27	28.6	8.84
1981	1.40	33.3	9.63
1982	1.26	37.0	9.55

(Produktschäp voor Gedistilleerde Drinken (1983))

which are dietary staples. It is estimated that 1 litre is taken daily as a solid food component, a proportion of which is tap water (Lafontaine, 1975).

Water is the principal constituent by weight of almost all foods except for pure sugars and fats (Table 5).

In some foods, such as home prepared stews and cooked cereals, the high water content would be made up almost entirely of domestic tap water.

A study of liquid consumption should therefore ideally provide information on the intake of such foods.

TABLE 5 WATER CONTENT OF CERTAIN FOODS

Foods	Percent Water
Milk	87
Eggs	75
Meat (well done)	40
Meat (rare)	75
Stew (with vegetables)	82
Fruit, vegetables	70 - 95
Cereals (ready to eat)	1 - 5
Cereals (cooked)	80 - 88
Bread	35

(Newburgh and MacKinnon, 1934).

CHAPTER 3

BACKGROUND TO THE SURVEY

In recent years, much scientific effort has been expended on the possible relationships between drinking water quality and human health (Hopkin and Ellis, 1980). The findings from this field of enquiry are likely to make an increasing impact on the formulation of standards governing the concentration of various drinking water constituents. For such standards to rest on a logical basis, population exposure to water constituents must be estimated; and a prerequisite of this, is a knowledge of the quantities of tap water that people actually drink.

1. PROBLEM IDENTIFICATION

A detailed study of liquid consumption in Cape Town has not previously been attempted. Epidemiological studies are in progress to relate potential changes in health patterns to a possible augmentation of the water supply with water reclaimed to potable standards which have been derived from sewerage effluent (Bourne and Watermeyer, 1985). The health related data for the epidemiological study would be based on information relating to the person's residence. It would therefore be necessary to distinguish between water derived from the municipal (i.e. tap) supply at home, and that consumed away from home, as well as that derived from other sources, such as that contained in beverages and water bound in food.

There is undoubtedly great variation in amounts and types of foods and drinks consumed by different sectors of the population, and therefore differing degrees of exposure to elements in tap water. Factors such as age, sex, socio-economic group, culture, geographic area and climate, are all likely to influence intake (Hopkin and Ellis, 1980) and it would be desirable for estimates of these effects to be available. Furthermore, data on the entire consumption over a specified period would be necessary, in order to incorporate a complete cycle of drinking habits.

A large-scale survey of liquid consumption would thus have to be conducted to provide information to meet this end.

2. OBJECTIVES

The objectives of such a survey pointed to a large-scale study of individuals or households, with questions to elicit information on the following :

(i) type and quantity of drinks and foods consumed,

(ii) volume of water consumed, in fluids and foods, in the following three categories:

(a) local tap water – e.g. in drinking, coffee, tea, soup, stew, porridge, etc.

(b) non-local tap water (commercial beverages) - e.g. commercial beer, soft drinks, mineral water, etc.

(c) *water bound in food - e.g. milk, wine, citrus juice, meat, vegetables, eggs.

NB. Foods can be 'solid' and 'liquid.'

*This excludes absorbed tap water.

(iii) factors affecting the volume and type of drinks and foods consumed (i.e. age, sex, geographical area, socio-economic group)

(iv) place of consumption (at home or elsewhere)

(v) differences between consumption during the week, and at weekends

(vi) differences between consumption during the summer and winter.

In order to measure these variables, it was necessary to construct questionnaires for recording dietary consumption, and to test various aspects of these to evaluate the following:

(i) the response rate

(ii) quality of data obtained

(iii) the degree of detail which could reasonably be expected

(iv) the means by which "volume of utensil" data could be collected

(v) the way in which the questionnaires should be administered

(vi) the way in which information on alcohol consumption could be elicited.

3. RATIONALE FOR THEORETICAL DESIGN OF FIELD WORK

There is no generally accepted method of measuring the dietary intake of free-living individuals (Marr, 1971). Yet there is a constant demand by clinicians, epidemiologists,

nutritionists and others for such measurements to be made. The literature on diet survey methodology is vast. Workers tend to hold strong views about the different methods despite much uncertainty regarding the inability to measure intakes of individuals. Mann et al. (1962) complain that "a superficial examination of the technical problems experienced in measuring dietary intake meets such a morass of conflicting opinions that the first inclination is apt to be a decision for abandonment".

Another major problem experienced in reviewing the literature on dietary surveys was that very few studies actually deal with a semi-literate population with the same combination of socio-economic problems as exists in Cape Town. It was thus important to investigate the suitability of the various methods in this particular context. The ultimate choice of methods depends above all on the aim of the survey, the size of the sample needed and the funds and personnel available (Pekkarinen, 1970). With these factors in mind, a small scale pilot study was conducted in order to determine which method was most applicable.

In this study, it was found that respondents in this semi-literate section of the population were unable to complete self-administered records of their intake. It thus became obvious that if a standardized approach was to be adopted for all groups, all questionnaires would have to be administered by trained interviewers, i.e. all self-administered methods were automatically eliminated.

It also became clear that certain methods commonly used in dietary surveys would not be suitable, as is outlined below.

(i) The Food Frequency Interview enquires about usual intake in terms of consumption of various items, per day, per week or per month (Morgan et al., 1978). Since this is only an assessment of qualitative intake, and in this study quantities were required as well, it was clearly inappropriate.

(ii) The Diet History is directed towards a subject's usual pattern of consumption with items recorded in common household measures (Morgan et al., 1978). However, there is a temptation for subjects to be idealistic about what they usually eat and especially about the quantities of food. Records of actual intake may thus present a more realistic picture. Furthermore, the pilot study revealed that in many cases respondents were unable to quantify their usual intake or even understand what "usual" meant. Possibly this is because the availability of foods is inconsistent as it is dependent on the variable cashflow situation in the household.

(iii) The Diet Record is usually used for collection of individual dietary data and is directed to current intake. Since the actual recording is performed by the respondent (over a minimum period of three days)

the method can only be used for literate persons (Darby, 1952). If an interviewer were to record the information there would undoubtedly be lapses of memory after three days.

(iv) The Weighed Dietary Record is an accurate but time-consuming procedure in which every item consumed is weighed (Pekkarinen, 1970). Since respondents could not be relied upon to do this, it would necessitate intensive involvement by interviewers. This would have been extremely costly and impractical with the large sample in this study. Furthermore the involvement of an outside investigator could in fact bias the study (Den Hartog et al., 1965).

(v) Chemical Analysis of food actually eaten would be the most accurate method of collecting the samples to be analyzed, the most commonly used and most precise method is the duplicate portions technique : at each meal a duplicate portion of the food eaten or aliquots of it are collected, and the composite equaling one day's consumption is analyzed. The composites can be combined and collected daily but must be stored in a refrigerator. Furthermore, each item must be weighed and recorded (Pekkarinen, 1970).However, not only would this have been logistically impossible to carry out with such a large sample, but it would also not serve the aims of the study, i.e. chemical analysis would not

differentiate the sources of the water components and the respondent would still have to be interviewed as to what was consumed and where. All this intervention would be extremely costly and could lead to biased results; and even if families were paid for foods prepared, they may not have the time or facilities to prepare double quantities of all foods.

Thus by elimination, the remaining most suitable method was the Recall Interview, in which consumption for a specified period of time is recalled in as much detail as possible. The recall period may vary from one day to weeks, though long periods are presumably subject to substantial defects of memory. The 24-hour period is most commonly used (Morgan et al., 1978).

Although the 24-hour recall may not give data on the usual intake of an individual, since the consumption on the day recalled may be atypical, the method is believed to give fairly reliable data on the correct consumption of a group over a period of time (Larsen et al., 1974; Games and Daniel, 1974).

The 24-hour Recall-Discussion

The pilot study revealed that the recall method of food intake assessment would be most appropriate in this survey, particularly in view of the relatively large sample size, as well as the low educational standard of many respondents. The 24-hour recall in particular has the advantage of no

significant memory loss in comparison with 3 day and 7 day recalls when the ability to recall over a longer period may be substantially impaired (Pekkarinen, 1970).

Various aspects of this method are discussed below.

(a) Validity of the 24-hour recall

The validity of the 24-hour recall has been tested in several studies by comparing recall data to actual or observed intake. Unfortunately samples were drawn from select groups and sample sizes in these studies are small; no definitive studies have apparently been done.

Madden et al. (1976) compared unobtrusive observation of actual food intake (in inspecting plate waste and weighing standard food portions) with a 24-hour recall of 16 elderly subjects from congregate meal sites. For each person, intakes of energy and 7 nutrients were computed by dividing intake by the R.D.A. (Recommended Daily Allowances) for each age and sex category. No significant differences were found for the 7 nutrients.

The validity of the 24-hour recall method was also assessed by Stunkard and Waxman (1981) when they compared observed food intake and one-time recall for 3 obese and 3 non-obese boys. Results were reported solely for kilocalories and showed a strong correlation between observed and recalled kilocalories. Emmons and Hayes (1973) tested the ability of 431 elementary school children to recall school lunches and

meals at home. - the comparison between lunch and the actual lunch eaten being a test of the validity of the recall. Results showed that the majority of mothers and their children listed each food group the same number of times.

The predictive validity of the 24-hour recall was investigated by Greger and Etnyre (1978), in a study including 32 adolescent girls participating in a metabolic study. Each girl completed an open-ended interview to recall her 24-hour food intake. The food had been weighed previously, so validity was determined by comparing reported intake with actual intake. To facilitate comparison, food items were converted to nutrients and major food groups. Results indicated that dietary recall provided valid estimates of energy, protein, calcium and zinc.

(b) Reliability of the 24-hour recall

No definitive studies have been done to test the reliability of the 24-hour recall.

In fact, only one study was found which tested the repeatability of 24-hour dietary recalls. However, only 10 children aged ten to sixteen years were included in the sample. The dietary recalls of these children were compared after two trained nutritionists had independently interviewed each child, followed by a third who checked the duplicate recalls. No mention was however made of the time lapse between interviews, but obviously they occurred on the same day, making it easier for respondents to repeat an

intake which had been reported earlier. Nevertheless the authors (Frand , et al., 1977) report that a paired t-test showed no significant difference ($p < 0.05$) between interviewers for the mean intakes computed for selected variables, and that the coefficients of variation were relatively low (less than 20 per cent) for all except two of the variables. Because of the small sample size and small time lapse between interviews, the results cannot be considered meaningful.

However, some investigators (Chalmers, et al., 1952) are of the opinion that short, one-day surveys give as reliable results as one-week surveys, if the sample is large and the aim of the survey is to study the mean food consumption of large population groups. It is often more advisable to take a large sample than to lengthen the recording period to increase the reliability. The length of the recording period also depends on whether groups or individuals are being surveyed. A shorter period is evidently sufficient in the former case.

(c) Comparison with other methods

Although comparative studies of different dietary interview methods have been published during four decades, the results are still inconclusive (Karvetti and Knuts, 1981). Pekkarinen (1970) points out however (in a review article) that comparisons do not indicate for certain which of the methods is best, as the reliability of all the methods in such comparisons may be questionable.

Furthermore, there are no definitive studies in the literature with proper experimental design comparing the various methods of collecting dietary intake, including sufficiently large representative samples of the general population. This applies in general and certainly no definitive work has been done locally.

Such studies as have appeared, deal with small numbers from selected groups. Furthermore, because of variations in sampling methods and statistical techniques, these studies are not strictly comparable (and in fact appear to contradict each other). Nevertheless, according to most investigators, recall and weighed or estimated food records give comparable results on the mean intakes and can thus replace each other in group surveys (Young, 1952; Payton et al., 1960; Combs and Wolfe 1960; Adelson, 1960; Pekkarinen et al, 1967). Concerning individuals recall may, however, give results which deviate so much from those obtained by more accurate methods that its reliability as a quantitative method is questionable (Pekkarinen, 1970).

Young et al. (1952) made a comparison of the use of the dietary history versus 24-hour recall and 7-day record as methods of estimating the nutrients intake of an individual and of a group. Data for these comparisons were obtained from 3 different population groups : grade school children (New York), high school and college students (Rhode Island) and pregnant women (Massachusetts). This sample included 34

men and 142 women, aged 11 to 34 years. For an individual in any of the three population groups studied, the 24-hour recall did not give the same estimate of intake as the dietary history, or the 7-day record. Thus to describe the intake of individuals, the authors concluded that the two methods could not be used interchangeably. For the mean of a group, however, the 7-day record and the 24-hour recall tended to give approximately the same estimates for the dietary intake for most nutrients. This was true for all three population groups to which the two methods were applied. For the mean of a group, the dietary history has distinctively higher values for grade school children and for pregnant women than did the estimates obtained by 24-hour recall. The history and 24-hour recall gave results which were in better agreement with the college group studies. The authors concluded that under certain circumstances the 24-hour recall can be substituted for the 7-day record in estimating food intakes.

Stevens et al. (1963) have also studied to what extent the results of the 24-hour recall and diet history differ from each other. The authors found more similarities between the two methods than Young et al. (1952), and of the five groups of individuals studied, in that the "values of the two methods were more nearly alike than for other groups, though differences were small for all groups for some nutrients". According to Stevens et al., the good agreement between the two methods was due to the high levels of education and intelligence of the respondents. The conclusion was "that

consistent estimates can be obtained by interview for the 24-hour recall diets and the usual pattern of intake using informed subjects".

Dietary intakes of 40 lactating women were measured by a 7-day record, and compared with results using a 24-hour recall, 3-day record, and a food frequency form (Stuff et al., 1983). The estimated intakes of energy, protein, calcium, phosphorus and iron were used in the comparison. Intraclass correlation coefficients used to compare methods indicated good, moderate and poor agreement for 3-day record/7-day record, 24-hour recall/7-day record and food frequency/7-day record comparisons respectively. Intakes were also classified as high (> 1.33 Recommended Daily Allowance (RDA)), medium (.67 to 1.33 RDA) or low (< .67 RDA), and Cohen's "R" was used to measure agreement between methods. None of the intakes was found to agree with the 7-day record classification.

However, the authors mention that in some comparisons of dietary survey methods, investigators suggest agreement between methods when no statistically significant differences in mean estimates of intake are obtained. In this investigation, mean estimates of mean nutrient intakes determined by 24-hour recall, 3-day record and 7-day record did not differ significantly. However, further analysis by intraclass correlation coefficients and regression indicated substantial disagreement between individuals.

The point was made previously that many comparative studies include samples from selected groups. This is no exception as lactating women are generally very aware of their eating habits (as this may influence the health of their babies). Moreover the different conclusions obtained by the two differing statistical techniques, illustrates the fact that most comparative studies are not comparable.

In yet another study involving a highly selected group of respondents, comparison of the mean nutrient intake calculated from the dietary history and 24-hour and 7-day recall methods showed considerable and statistically significant differences between methods when a sample of 86 men interviewed one and two years after acute myocardial infarction was used (Karvetti and Knuts, 1981).

The largest differences were found between the dietary history and the 24-hour recall, the latter methods showing mean intakes from 69 and 93 percent of the intakes reported in the dietary history. The intraclass correlation coefficients ranged between 0.24 and 0.69 revealing moderate to good agreement between the three methods. However agreement among the three methods in relation to changes in nutrient intakes for this study group was poor.

The authors conclude that the results of different dietary interview methods are not directly comparable with one another and that more research and standardization is

required to gain more reliable and comparable results than are presently obtainable.

Other studies indicate that the 24-hour recall method compares favourably with other methods. Balogh et al. (1971) compared repeated 24-hour recalls with dietary history information using data from 100 adult male volunteers. Using coefficients of variation, the authors estimated the number of 24-hour recalls required for 95% probability of obtaining a sample mean within 20% of the mean of 11 nutrients obtained from the dietary history. The average intake obtained from the diet history did not exceed the average from 24-hour recalls for any nutrient.

The internal validity of both the 24-hour recall and 7-day record methods was tested by Gersovitz et al. (1978) on a sample of 65 elderly people participating in a congregate meals programme. The 24-hour group reported at intervals of either 3.5 hours or 24 hours after lunch. T-tests and regression analysis performed on the aggregate data showed that both methods provided equally accurate data on mean nutritional intake.

However, the definitive comparative study has yet to be done. In such circumstances, it is advisable to qualify results with an explicit reference of the methodology used.

(d) Flat slope syndrome

One of the apparent limitations of the 24-hour recall, is the tendency of groups to under-report high intake and to over-report low intake. Several researchers have reported on this phenomenon which some of them refer to as the flat slope syndrome. In the study by Gersovitz et al. (1978), the workers found that the 24-hour recall group demonstrated this "flat slope syndrome". In another study (Linusson et al., 1974) where 24-hour recall was compared with actual observed intake in a sample of 84 hospitalized lactating women, regression analyses revealed a tendency for the participants to over-estimate small quantities and under-estimate large quantities of food consumed.

Madden et al. (1976) found that participants tended to over-report small quantities and under-report large quantities of food eaten for kilocalories, protein and vitamin A. Stunkard and Waxman's study (1981) on 3 obese and non-obese boys tended to over-report low intake and to under-report high intake in their 24-hour recalls.

However, certain studies have indicated that the 24-hour recall is thus more suitable for populations, rather than for individuals because of this phenomenon. Garn et al. (1976) in their review of 1-day methods recommended that the analysis of 1-day dietary intakes be limited to group trends. In an editorial reviewing the limitations of the 24-hour recall, (Nutrition Reviews, 1976) it was concluded, according to the studies cited, that the 24-hour recall can

be used for groups larger than 50 when an error of 10% can be tolerated. For individuals, the 24-hour recall does not compare with weighed intake because of under- and over-reporting errors.

It was found that the "flat slope syndrome" observed by Madden et al. (1976) in an elderly population was also observed in the paediatric population studied by Carter et al. (1981) even though food models were used for identification of food portions sizes. That is, children with low intakes tended to under-report their food consumption.

Hegsted (1982) sums up the situation in his review article when he says, "In general (these studies) confirm the 24-hour recall as a measure of the intake of the group but indicate that individuals tend to over-estimate low intakes and under-estimate high intakes."

"The regression of reported intake on actual intake is flatter than it should be. Thus, it appears that even though enormous differences in intake are reported, the range is actually under-estimated."

Because of this phenomenon, the median should be determined as it is a better indication of central tendency than the mean.

(e) Problems

Another danger of using the 24-hour recall method is the more obvious fact that it may not represent typical diet, since one day's diet may be an invalid or unreliable estimate of long-term patterns. However, this problem is minimized with large samples and by repeating the recalls. Chalmers et al. (1952) found in a study of the 3 groups who contributed 7-, 14- or 28-day dietary records, that a one-day record was sufficient to characterize nutrient intake for each group. Except in a distinct sample of college students whose intake decreases on weekends, it made no significant difference which day was used. Houser and Bebb (1981) collected data in a rather more comprehensive study from 3 populations and analyzed it for seasonal variations, working-holiday variations, and daily variations.

Dietary data were collected over 3-day periods monthly for 12 months. A dietary history of 73 participants was completed at the end of the year. The results suggested that a representative food intake must include both weekend days and weekdays, that a single day's record will represent a 3-day period, and that infrequent sampling throughout the year will provide a more representative sample than will short-term sampling.

Similarly, Leverton and Marsh (1939) concluded that representative dietary intake data must include weekend intake data, as they found that weekend dietary habits contributed most of the variation in food intake. In their

study they compared dietary intake between weekdays and weekend days of 23 college women who coupled records of weighed intake for either 7 of 10 days. On the other hand, during both the first and second U.S. Health and Nutrition Examination Surveys (HANES I & II) - sample sizes of 30 000 and 27 000 respectively - the collection of foods eaten on weekends was precluded (National Centre for Health Statistics, 1983). The reason given for this omission in these major studies was to eliminate unusual food intakes (Youland and Engle, 1976). It was considered that weekend food consumption would possibly consist of larger and more varied meals because the family is together, the homemaker spends more time in food preparation, guests are entertained and weekend grocery shopping is done. They also point out that weekend eating patterns may include more snacks and a difference in the types or amounts food consumed for some individuals, due to less time spent at home, attendance at various types of entertainment, and the practice of sleeping longer hours. Obviously age, income, religious practices and cultural patterns play an important role in determining food intake over weekends, and in Cape Town with its many cultural groups, there may be a large variation between different groups.

The caloric and nutrient intake of week and weekend days was compared (Richard and Roberge, 1982) using 3-day food records, both women (n=174) and men (n=185) were found to consume significantly more energy and a higher level of alcohol during the weekend days than during the weekdays. In

general, however, the authors found that the significant increase in energy intake did not correspond to a significant increase in other nutrients. Nevertheless, the results imply that there may well be a significant change in liquid consumption during weekends.

Rider et al. (1984) however found a high correlation between values for the intake of major nutrients as determined by 24-hour recall and by 3-day weighed diet diary. Their study included 86 men and women aged 30 to 65. They concluded that although an individual intake may vary widely from day to day, the 24 hour recall was as good as a 3-day record of intake for estimating the mean of the group. It is not mentioned though, whether weekend days were included in their study.

The time of the year may play a significant role in influencing the intake of foods and drinks. Rasanen (1979) concluded from his study on 1 033 children that two 24-hour recalls repeated in different seasons appear to minimize the respondent burden and increase the relevance of the data for surveys of groups of children. Rush and Kristal (1982) also considered the possibility of repeated 24-hour recalls in their survey of 520 pregnant women. They concluded that where a change in intake can be anticipated (as occurs in the course of pregnancy) the repeated 24-hour recall is reliable enough for large scale field studies, and that this is the best available dietary measurement tool for such research.

Sex differences in response to the 24-hour recall method have been reported in two studies. However, although this may be a pitfall, there is no apparent indication as to how this could be overcome. Beaton et al. (1979) conducted a comprehensive study to examine sources of variance in 24-hour recalls with a sample of 30 male and 30 female respondents. Different interviews were used on different days of the week. The authors found that the greatest source of variance lay in the strong sex difference in absolute nutrient intake and a strong day effect in females.

However, Campbell and Dodds (1967) found in a study of groups of older people, that women tended to have better recall of the calories and nutrients than did men. Similarly, Rider et al. (1984) in their comparison of 24-hour recall, 3-day weighed diet diary, analysis of 3-day composite food and measurement of certain biochemical parameters (n=86 men and women, aged 39-65) found that correlations were low for comparisons of means of males for most parameters. Individual correlations for reported protein intake and biochemical parameters were lower for males than for females. The authors concluded that male subjects may require more attention to ensure accuracy of reporting (and specimen collection).

The effect of age on memory was also investigated by Campbell and Dodds (1967) when the 24-hour recall of 100 individuals 20 to 40 years old was compared with that of 200

individuals over 65 years of age. Results indicated that younger respondents living at home remembered better than older ones in institutions, even though in the latter case food intake is likely to be more repetitious and stereotyped. Meredith et al. (1951) evaluated dietary records of 94 rural school children by comparing it with actual intake. Using a very strict criterion, only 6 children accurately identified the number type and amount of food items eaten. However if the combination of mother and child is used for the 24-hour recall of the child, this problem can be alleviated to some extent, as the mother is invariably largely responsible for preparing and providing the child's meals, (especially in the case of very young children who are inarticulate and/or have no sense of time). Koh and Caples (1979), in their study of the nutrient intake of low income black families, interviewed both parents.

Children and possibly adolescents in particular tend to have many snacks between meals, when such items as sweets, chips and cold drinks are consumed. Cresswell et al. (1983) emphasize the importance of prompting of possible eating times and purchase opportunities (i.e. using pocket money) of such items during the 24-hour recall. In their investigation of the dietary pattern of 270 third-year secondary schoolgirls in Glasgow, they found that additional snacking was prevalent, especially in the evenings.

Since parents need not necessarily be aware of their children's intake (in addition to what is seen to be

consumed at meal times) children must always be interviewed as well.

(f) Cost-efficiency and other practical considerations

The 24-hour recall, being an interview method, has many important advantages over other methods. The foremost are the representativeness and the large size of the sample. The respondents can be chosen by random sampling, which is not always possible with other methods (Pekkarinen, 1970). Since interviewing only takes 15 to 60 minutes per respondent, on an average 30 minutes in most surveys, it is possible to collect a large sample using a small number of investigators. An experienced interviewer is able to interview 10 to 12 persons per day in one place. The method is also inexpensive when compared to other methods, since it does not require large numbers of trained personnel with all necessary equipment.

The interview causes only slight personal inconvenience to the respondents, which is an advantage, if the survey is to be repeated to record e.g. seasonal variations (or for some other reason). The method is not believed to change the normal diet of the respondents. However, this is not quite certain, since respondents may give untruthful information on purpose. For this reason it is important to use cross-checks (Pekkarinen, 1970).

A drawback of the interview method is that it makes larger requirements on the personal characteristics of the

investigator than any other method. For this reason special attention must be paid to the selection of interviewers. In a cross cultural situation (as is found in Cape Town), if interviewers are selected so as to reflect the cultural group they will be investigating, they will be able to explain what is required of the respondents in a manner which is meaningful to them and they will know how to elicit the required information and record it in a standardized format. In this way, not only are cultural and religious barriers overcome, but problems inherent in dealing with respondents with a generally low level of education (who may only be semi-literate) are also dealt with. The 24-hour recall has been used successfully in several studies including respondents of different cultures (Richardson et al., 1982; Farris et al., 1984) and with low income groups (Koh, 1979).

The suitability of the 24-hour recall method is further justified by the practical advantages for the respondent; he does not have to search his memory over a long period of time or keep a record of this intake, as is the case with the food frequency interview and the diet history (which therefore suffer from inaccuracy). It does not cost him anything, other than a little of his time, at his own convenience. He does not even have to exercise much mental effort as the interviewer will prompt his memory and record the data. There is thus a low respondent burden, and consequently a high response rate.

(g) Local Studies

Relatively few studies have been published in South Africa involving large samples of the semi-literate sector of the population. Unfortunately in the few which exist, the motivation for the choice of method is not supplied, and the method used is not well described. The 24-hour recall appears to predominate in studies which attempt to quantify food intake.

The one study which did not include the use of the 24-hour recall method is one involving a series of dietary surveys (Lubbe, 1973) of a total of 2 164 Pretoria school children from four racial groups (i.e. White, Black, Coloured and Asian). The dietary surveys involved two techniques, one of which was a newly devised "modified dietary history" (MDH) method applied to all subjects, and the other an extensive 7-day "precise weighing" (PW) technique applied to a sub-sample of 30. The MDH method, which has been devised by the NNRI, had been proved (Lubbe, 1968) to be at least as satisfactory for obtaining reliable data as the PW method. However this is based on the "habitual" intake, the aim being to obtain a typical menu for an average day. (In the pilot survey which was conducted for this study, it was found that individuals did not understand what was meant by "usual" intake, because intake is so variable). Lubbe also mentions that items listed in the day's menu are then weighed, but she does not explain what procedure is followed when these items are not present in the household.

Walker et al. (1982) investigated the breakfast habits of 4 717 South African pupils aged 16 to 18 years. The sample included rural and urban Black, Indian, European-African-Malay and White pupils. The pupils were interviewed by means of simple food frequency questionnaires. From this, qualitative data was obtained. However, in order to obtain quantitative data on nutrient intake, a 24-hour recall was administered to a sub-sample of pupils. Obviously the food frequency questionnaire was not quantifiable, and the 24-hour recall was the most suitable technique for obtaining the necessary quantitative data.

The 24-hour recall method was also used by Richardson et al. (1982) in the Transvaal on a total of 1 601 Black, Coloured, Indian and White pupils aged 8 to 17 years in a study aimed at determining the variety of food items consumed by South African school children.

In yet another investigation of school children (Steyn, 1983) in which the sucrose consumption and dental health of 843 12-year old White, Coloured, Black and Indian Cape Town pupils was studied, the 24-hour recall was also chosen.

The Coris baseline study (Rossouw et al., 1983) on risk factors of ischaemic heart disease includes only Whites, but it is of interest that the 24-hour recall method was selected for determining dietary intake. This was administered by interview to a 12% sub-sample of

approximately 860 males and females between the ages of 15 and 64 years.

However in a study of risk factors for coronary heart disease (Steyn et al., 1985) which included coloured people in the Cape Peninsula, a dietary questionnaire was administered, which included a 24-hour dietary recall. This cross-sectional study included a random sample of 976 males and females aged 15 to 64 years. No information regarding the validity of the method is provided.

Conclusions

In the light of the above discussion and review of the literature, the following general conclusions were drawn in the context of this study :

(i) The 24-hour recall is a suitable, practical cost-effective tool for the proposed dietary intake assessment.

(ii) The validity of the method will largely be ensured by a large sample size.

(iii) 24-hour recalls should include weekday and weekend data and should be conducted during different seasons.

(iv) Information from the person preparing the food must be compared with that of other members of the household - particularly in the case of young children and the elderly. This would serve as a cross-check.

(v) Respondents - children and teenagers in particular - should be prompted as to possible eating and drinking periods and purchase opportunities, as "unstructured" snacking habits may result in certain items being forgotten.

CHAPTER 4

METHODOLOGY

1. DESIGN OF FIELD WORK

It was thus decided to administer a 24-hour recall to each member of randomly selected households in areas representing different cultural and socio-economic groups. Trained interviewers administered the questionnaires, ensuring that week and weekend data was obtained. Two surveys were conducted - one in summer, the other in winter, to account for seasonal variation in dietary intake.

2. SAMPLING

A sample of 100 appropriately chosen households was taken from each of the areas accommodating the following cultural socio-economic groups :

(i) Low income 'Coloured

(ii) Middle income 'Coloured'

(iii) Low income White

(iv) Middle income White

It was decided to exclude Black groups mainly since they form a small proportion of the Cape Town population. This is indicated in Table 6, which has been drawn up according to the Central Statistical Services' unpublished 1980 Census Data.

TABLE 6 POPULATION BREAKDOWN OF GREATER CAPE TOWN - 01 STATISTICAL REGION

Group	Total Number	Percentage of Total
Whites	470 676	33
'Coloureds'	760 609	53
Asians	16 683	1
Blacks	182 882	13

Central Statistical Services (1985)

Furthermore, there would be problems associated with a survey of the Black group because of a language barrier as well as significant cultural differences in eating habits. There is also a high crime rate in black areas, which would be hazardous for interviewers. These factors would have lent an unwarranted degree of complexity to the study.

The Asian group was also excluded, as Asians constitute only 1% of the Cape Town population.

Because there was a limited number of interviewers available and since the majority had no transport, they were essentially confined to specific geographical areas, i.e. near to their own homes. Consequently, this limited the number of strata (i.e. four basic strata) and enforced cluster sampling.

However, the chosen sampling procedure would be sufficiently representative of the cultural composition of Cape Town. A total of 300 to 400 households was included per season, and each member of the household was interviewed.

Preliminary results of the 1980 census were not available at the time of the survey, so it was not possible to ensure that the age distribution of the sample followed that of the census. Comparison was only possible later and adjustments could only be done retrospectively.

For logistical purposes, it was convenient to use the household as a basic sampling unit, as access could be gained to a group of people in one visit. Furthermore, the validity of dietary data was enhanced, as the person preparing the meals could give valuable information on food intake of individuals in the household, methods of preparation and portion sizes. The recalls within each household could be compared to check whether a reasonably consistent pattern emerged.

Interviewers were instructed to take every second or third house on streets in certain demarcated areas. If there was no response, they were to go to the next second or third house. Since the interviewers were in almost daily contact with project staff, it was thus possible to monitor the sampling procedure and to deal with queries as they arose.

Figure 1 is a map of Cape Town with areas covered in the survey indicated. A demographic description of these areas, is included in Appendix C1.

3. THEORETICAL VALIDATION OF QUESTIONNAIRE DESIGN AND INTERVIEW PROCEDURE

It is not always possible in dietary surveys to use elaborate and time-consuming investigation methods. Practicable, easily managed, economical and reasonably valid and reliable methods are desirable, and should be developed. The dietary interview method seems to satisfy these criteria (Karvetti and Knuts, 1981). It is quite clear that the more complex the procedure, the more difficult it is to recruit

subjects, and the more likely it is that the procedure will modify the consumption patterns (Hegsted, 1982).

In evolving a suitable technique to investigate the food intake of families, Nettleton and Nelson (1980) considered the following criteria to be necessary:

1. Accuracy of individual measurement
2. Ease of recording
3. Least subject motivation required
4. High cooperation rate in a random sample.

The procedure ultimately developed is to a large extent determined by the educational standard of the respondents (Pekkarinen, 1970). Methods which require a high degree of involvement by the subjects, may also introduce sample bias as only the more literate and numerate individuals may participate (Nettleton and Nelson, 1980). A complex procedure applied to a semi-literate population would be confusing, time-consuming and generally frustrating for both interviewers and respondents and thus may not even yield valid results.

Format of the Questionnaires

There are basically two formats which could be used for a 24-hour recall questionnaire:

(a) a closed format where foods are preregistered and precoded
(b) an open format

In (a) it is necessary to anticipate foods and dishes which could be consumed and to list them all. This yields a lengthy questionnaire which the interviewer has to page through to locate appropriate items. This can be time-consuming, and may limit validity as the interviewer is in a sense forced to make a choice from set responses which may deviate greatly from what the subject actually consumed.

With (b) the interviewer merely lists all items actually consumed. The subjects are asked to recall all the foods and amounts eaten meal by meal during the day preceding the interview, including all foods, snacks and drinks consumed between meals. The interview proceeds from the first morning meal to the last snack before the subject went to bed that evening (Karvetti, 1981). Coding is completed at a later stage.

This method has been used successfully (Karvetti and Knuts, 1981; Nettleton and Nelson, 1980; Lai, 1982; Rossouw, 1983) and under the circumstances of this study, seemed most appropriate. In addition to the advantages outlined above, there was also the consideration that it was the most simple and straightforward method - particularly necessary for the semi-literate sector of the population studied. Furthermore this simplicity gave the interviewers the time in which to concentrate on recording each item as accurately as possible. Because of the valuable experience all the interviewers have had in conducting interviews, they were able to draw on this in explaining the purposes of the

survey and procedure to be followed, in terms which were meaningful to the respondents.

The Recording of Foods

Since the 24-hour recall is a retrospective interview of foods already eaten, it is impossible to weigh the items. Respondents must therefore describe portion sizes (with the assistance of the interviewer) so that weights may be assigned to them. Food models can be of great benefit in this respect, as they permit easy and rapid identification of food items. The commercially made ones are particularly useful as the weight of each item is inscribed on the model. Unfortunately these were unobtainable for this study.

Household or homely measures for recording items have however been used in several studies for estimating group intakes (St. Jeor et al., 1983). The loss of accuracy makes them unsuitable for determining true individual intakes (Young, et al., 1953; Bransby, Daubney and King, 1948; Eppright et al., 1952). Pekkarinen (1970) describes the use of household measures as being "a reasonably accurate estimate of the total food intake", in her review of methods and techniques.

Comparative studies have shown that generally estimates of group intakes based on household measures are slightly greater than those obtained by the weighed inventory methods (Bransby, Daubricy and King, 1948; Eppright et al., 1952). However, these were early studies. A more recent

investigation by Nettleton and Nelson (1980) compared household measures to a semi-weighed method (whereby the total quantity of food prepared is weighed while its distribution between family members is recorded in household measures) and found that for their sample of 38 individuals (from eight families), the mean group differences were less than 5 per cent for all nutrients. They found that the over-estimates for certain nutrients were considerably smaller than those reported in the much earlier studies. They attribute this smaller difference between household measures and weighed intakes to the large number of commercially prepared foods which are now available. Pre-packed foods have their weights inscribed on them, and thus serve as accurate food models. This is in marked contrast to 25 to 30 years ago when there was more home preparation and baking. They thus concluded that the use of household measures was a suitable technique to assess group intakes as cooperation rates would be high.

In practical terms, Pekkarinen (1970) describes the use of household measures as follows :

"The amounts consumed are expressed in household measures, such as glasses, cups, slices, bits, spoons, portions, etc., since very few people can estimate amounts directly in weights. When the interviewing takes place in the homes of the respondents, as is mostly the case, the amounts mentioned can be checked and then converted into weights".

However, conversion to weights by the interviewer would not have been practical in this study, as it would have required fairly intensive training, and would have taken up more of her working time. Her time was at a premium, as the average interviewer was kept extremely busy merely tracing household members.

Consequently the household method favoured was that first described by Branaby and Wagner (Marr, 1971) and later adapted by Nettleton and Nelson (1980). This method required all food to be recorded in household measures; cups and glasses used for beverages were calibrated by volume. The spoons normally used in the household were calibrated by volume. The weights of described portions were estimated from real foods.

A further modification of this method was used in this study. Volumes of items were ascertained and conversion to weights done subsequently. This is described in another section.

In order to assist respondents in their determination of portion sizes, it was decided to adapt the use of "graduated food models" as described by Moore et al. (1967) : "A series of visual models were arranged in 'piles', glasses, ordinary cups, slices or packages to resemble the usual manner of serving. For realism, various sizes of cups, mugs and glasses were collected, and to reduce each series to three, unused or unpopular sizes were gradually discarded. Volume

models of ordinary cooked foods were confined to three types: rice, kidney beans and green noodles. These were left uncooked as it was felt they looked sufficiently like a cooked vegetable to serve as a model. Hot paraffin was used to coat and thus firm the models which were arranged in a pile, representing a serving on a plate. Three volumes were used - teaspoon, desert spoon and tablespoon. The authors also describe how meat and cake models were made. In testing the effectiveness of the models, it was found that both men and women tended to raise their estimates of usual-size servings when offered the food models. This encouraged confidence in their use, since it has been the experience of the Interdepartmental Committee on National Development that respondents in dietary surveys frequently under-estimate rather than over-estimate individual food intakes when the recall method is used, as compared with the weighed food method (i.e. part of the flat slope syndrome). The nutritionists also believed that the models improved agreement between husband and wife, and perhaps accuracy regarding usual size of servings. Furthermore much time was saved.

Only certain aspects of this method were adopted in this survey. This is also described in another section.

To enhance identification of snack foods during studies of children, using the 24-hour recall, Farris et al. (1984) used a Product Identification Notebook. However, it was felt in this study that empty containers of commonly used

commercial products would be more effective, as there would be no confusion about the size if respondents could identify the actual container. Interviewers were also given a list of additional items with their volumes.

To improve the accurate identification of food items, interviewers were also asked to describe briefly the method of food preparation (i.e. boiled, fried, etc.) and the origin of food (fast food, home-made, etc.) as described by Richard and Roberge (1982).

Interviewing the Family

It became clear from the outset, that while the head of the household's permission was necessary for entry to be gained, the cooperation of the housewife was vital. Not only was she mainly responsible for food preparation, but was also in a position to enlist cooperation of all members of the family. The cooperation rate would need to be at least as good as the rate for weighed surveys, around 70 per cent (Marr, 1971) for it to be regarded as successful.

The housewife or mother was also the informant for young children, although as is recommended by Koh and Caples (1979) for subjects aged six to twelve years, both the parents and the child should be interviewed.

One advantage of interviewing families in their homes, was that invariably several individuals could be interviewed in one visit. Furthermore, during that visit containers used

could be measured and interviewers could be shown typical foods used. Facilities available for food preparation could be inspected and discussions could be held in this context about methods of food preparation. This procedure has been recommended in several studies (Hopkin and Ellis, 1980; Youland and Engle, 1976; Nettleton and Nelson, 1980; Pekkarinen, 1970).

Interviewers, if specifically trained, can also help to "uncover" snacks or between meal consumption by probing (Youland and Engle, 1976). Moreover cross-checks with other members of the family can also assist in the identification of previously forgotten items.

Frank et al. (1977) and Cresswell et al. (1983) report on the value of linking activities and times to foods eaten when prompting respondents, e.g. :

- "During school break, did you eat or drink anything?"
- "Were any of your favourite shows on T.V. last night? Did you eat or drink anything while you watched T.V.?"

Mentioning locations or situations which are often accompanied by eating can help respondents to recall easily forgotten foods, e.g.:

- "Did you have a snack when you first got home after school/work?"
- "Did you go to a meeting, football game or party last night? Did they serve refreshments?"

In this way a picture is gained of the family lifestyle which makes cross-checking easier and more valid.

4. PROCEDURE IN THE DEVELOPMENT OF THE QUESTIONNAIRES

The questionnaires are included in the Appendix. They are self-constructed and were formulated according to the variables to be measured and in keeping with the abilities of the interviewers concerned. The questionnaires are in some respect like an interview schedule, as the interviewers were given a framework in which to operate but used their own words for explanations, and to elicit the required information for which they were trained.

Each respondent's questionnaire had a section where personal and demographic data could be entered in set or closed responses. An open format was however chosen for the 24-hour recall section.

Separate questionnaires were also drawn up for each household to record household composition data, as well as other demographic variables. This was later used for cross-checks.

The First Drafts

These were checked by peer review, for face and content validity before being printed.

They were then initially pre-tested to determine whether the questionnaires actually "worked" and whether sufficient space was provided for all the entries.

The questionnaires were then again pre-tested by an experienced interviewer (who had taken part in a previous unpublished study on liquid consumption) in an area where respondents were of a low educational standard and where crime was rife and the rate of alcoholism high. It was thought that if the questionnaires worked in such an area, they should be suitable in areas with fewer social problems.

Five households were approached in this testing phase, and the following aspects were assessed :

(i) the type of response, as it was not possible to predict the extent to which people could be expected to cooperate

(ii) The quality of response, i.e. the internal consistency of the completed questionnaires and diaries

(iii) the relevance of the questions and format to the overall objectives

(iv) the degree of accuracy and detail which could reasonably be requested, and whether this was appropriately recorded for analysis

(v) the average time taken per interview and per household

(vi) the means by which "volume of utensil", and portion size data could be collected

(vii) who should be interviewed when respondents are unable to give the information accurately themselves (e.g. in the case of very young, very old or even retarded)

(viii) the way in which information on alcohol consumption could be elicited

(ix) any significant and unforeseen problems.

It was found after checking the questionnaires thoroughly, that they worked well, and that the proposed methods of recording portion sizes and volumes were sufficiently accurate.

The Second Drafts

The actual interviewers who participated in the survey piloted these drafts. Each of them tested the questionnaires of five households. In this way, they were tested on a total of 20 families in four different areas. The questionnaires were assessed by checking the above-mentioned aspects. As it was not necessary to make any changes, the final set of questionnaires for the actual survey was then printed.

The Final Set of Questionnaires

The final set of questionnaires was printed on different coloured paper to avoid confusion and to permit differentiation at a glance. They consisted of the following:

(a) The Placement Questionnaire

This was designed so as to provide information on the household composition, as well as the age and sex of each member of the household. This questionnaire was completed by the interviewer once the head of the household had agreed

that all members of the household would participate in the survey. It enabled the interviewer to check that all members of the household had been interviewed, and served as a cross-check in the subsequent editing and coding phases. It also assisted the persons who checked up on the interviewers.

(b) The Recall Questionnaire for Children and Adults

This was designed to repeat some of the placement information to avoid any confusion if the questionnaires were separated. By comparing the placement questionnaire with the set of recall questionnaires, it was not only possible to ensure that each household was complete, but also to sort out any discrepancies in information. For example, at times the head of household did not admit to all the people living in the house, in the fear that the information would result in the rental being increased. Some individuals gave incorrect ages, which was then contradicted by other members of the family. However, once the information was consistent, it was regarded as correct.

Modified completion instructions were included to jog the memory of the interviewer.

For the actual 24-hour recall, where appropriate, the actual individual was asked to remember his/her intake on the previous day. For very small children, the mother would have to supply the information, and for children up to the age of about 12 years, both mother and child were interviewed.

In the case of old people, who were perhaps senile or suffered from memory loss, the housewife or housekeeper was consulted exclusively, or as well. In all of these cases the interviewer had to use her discretion. It did not seem advisable to specify a standardized approach, as the situation varied among areas and households. The interviewers were also encouraged to discuss any such problems with the project staff.

The 24-hour recall section was completed in such a way as to yield the following information :

- The total food intake for a 24-hour period expressed in household portions, which was subsequently converted to grams. Particular attention was given to the accuracy of measurement of fluid intakes, and tap-water based foods, as the interviewer measured the vessels and serving utensils used.
- Sufficient space was provided to enable the interviewer to describe the breakdown or composition of drinks in particular, to facilitate accurate analysis e.g. 75ml coffee with creamer. (This contains 75ml tap water).
- The type of food or drink consumed at specified times of the day, on the particular day of the week.
- Whether the food or drink was consumed at home or elsewhere.
- The method of preparation of the food or drink, for accurate analysis, e.g. homemade ginger beer will

contain domestic tap water, whereas the commercial variety would not.

N.B. As has been mentioned, the interviewers merely had to record total intake as reported by the respondents as accurately as possible. No categorization of information was expected at this stage. This was done subsequently by individuals with a nutritional background.

(c) The Questionnaire for Babies

The mothers of babies were interviewed, the babies being defined as "children not fully weaned". This was designed to give information on the type of feed or feeds given to the baby (which might or might not contain tap water). The quantity, frequency and variety of each food item of the previous day's intake were recorded in the recall section.

(d) Interviewers' Instructions

Comprehensive instructions were formulated and given to the interviewers in two sections.

- Addendum A contained an outline of the procedure to be followed, as well as a checklist of the items each interviewer had to take with her when conducting interviews.
- Addendum B was drawn up to be used as a reference on how food items were to be recorded.

All this information was however dealt with during the training sessions.

5. INTERVIEWER SELECTION AND TRAINING

The selection of interviewers is frequently determined by the availability of suitable candidates. In this case it was not possible to obtain the services of people with a nutritional background; neither was it possible to use food models (which would have made for greater accuracy in the determination of portion sizes).

It was thus important to plan the study and the procedure to be followed by the interviewers in keeping with these limitations. Similarly, the training programme had to be designed so as to be as simple as possible (an overload of information can be confusing), and yet it had to prepare the interviewers to cope with all the requirements of the study.

Selection of Interviewers

The best interviewers available were those employed on an ad hoc basis by the Human Sciences Research Council (H.S.R.C.). These individuals are given a basic background in research methods and are specifically trained to conduct interviews in surveys. Their work is continually appraised according to strict criteria, and only the most reliable workers are employed on a regular basis. They therefore gain valuable experience in all types of situations and are very versatile and receptive to training.

The Regional Representative of the H.S.R.C. was approached, the requirements of the survey discussed, and selection of

interviewers was subsequently made according to the following criteria :

- interviewers had to have sufficient maturity to be able to deal with the somewhat personal nature of the information required, and to handle the intrusion into the privacy of homes (mainly in the evenings when everyone was at home)
- experience was also essential to enable individuals to cope with the complexity of the survey, i.e. the accurate description and measurement of food items. Those with experience in nutritional surveys were given preference.
- potential candidates had to belong to the same cultural group as the respondents, as this would give them insight into cultural eating patterns and cooking methods. They would also be able to communicate more effectively (particularly in areas where a vernacular is spoken) and would be sensitive to nuances in expression.
- it was considered essential that interviewers be mothers as this would help them to understand the family situation (or household unit) and the implications of food preparation by the housewife (or according to her instructions!)
- logistical considerations were also important for convenience as well as because of transport costs where the interviewer actually worked in the area in which she lived

- it was necessary that interviewers should be prepared to go out in the late afternoons and evenings.

A preliminary meeting was held with the selected interviewers, and the requirements of the survey and the terms of payment were discussed with them.

In this way, interviewers were selected and dates were made for the training sessions.

The Training of the Interviewers

The training or briefing of the interviewers was done by means of verbal explanations (with the aid of an overhead projector), a role play simulation of an interview, and certain practical exercises.

In this way, the following aspects were covered :

- An explanation of the objectives of the survey.
- The method of completing the questionnaires so that they could be analyzed.
- Guidelines as to conducting a 24-hour recall.
- A demonstration of portion sizes in terms of household measures in the context of the proposed analysis. Actual foods were used for this.

This was then followed by a 'familiarizing' stage, when two households were approached by each interviewer. This revealed individual problems experienced by them. The questionnaires were carefully marked and any problems or inaccuracies were dealt with. Another familiarizing stage

then took place, when each interviewer had to conduct interviews in a further 2 to 3 households and thus prove that she had overcome her initial problems before she commenced with the actual survey. In this way the procedure followed by all the interviewers was standardized.

Each interviewer was equipped with the following, to enable her to make accurate qualitative and quantitative assessments of total intake :

- a set of measuring utensils
- a calibrated measuring jug
- empty containers for identification of commercial products
- dry ingredients (to enable respondents to indicate portion sizes).

A file containing a letter of introduction from the University, a map, a copy of the signed contract, and various forms for record keeping were also supplied to each interviewer. A set of large envelopes was included with all the questionnaires, so that the set of questionnaires for each household could be put into a separate envelope which was then clearly marked (i.e. area, household number, address).

6. PROCEDURE IN THE MONITORING OF INTERVIEWERS

As has been mentioned, the survey interviews as such did not commence until each interviewer had proved that she was able to fulfill the requirements of the survey.

Generally, the interviewers were then seen weekly, when completed forms were checked and adherence to protocol monitored. They were however in telephonic contact with project staff almost on a daily basis, as they were encouraged to discuss problems and queries as they arose. They were also asked to discuss their insights into the responses of the interviewees. Notes were kept of such comments, as possible explanations for trends which may have subsequently been revealed by the analysis.

At certain stages in the surveys, checks were conducted by independently trained interviewers who did not know the original interviewers personally. A random 10% of the sampled households was usually checked, but in certain cases where the accuracy of the interviewer or interviewers was possibly suspect, this was increased to 20%. During the check-ups, parts of the interviews were repeated, and the respondents were asked questions as to how the original interview had been conducted (e.g. how much care was taken in measuring portions, sizes, etc.). Notes were made of comments made by respondents. Comparisons between the original set of questionnaires and the subsequent ones, very clearly revealed whether the first interviews had been properly conducted or if any short cuts had been taken. Where there was any doubt, the original questionnaires were rejected the interviewers asked to stop.

7. TIME SCHEDULING

Two surveys were conducted. The first took place during the winter months of July and August of 1983, and the summer survey was carried out in February and March 1984.

Interviews were conducted on Mondays to ridays as interviewers could not be expected to work on Saturdays and Sunday This provided 24-hour recalls from Sundays (i.e. the day prior to Monday) to Thursdays (the day before Friday) and thus ensured that there was one weekend day and a spread of week days. A tally was kept of the questionnaires to ensure that there was an even spread of interviews for each day. Two month ends were also thus included in each survey to account for the variation in intake which frequently occurs owing to the relative amount of money available for food in the course of a month, and cultural events.

8. THE USE AND APPLICATION OF FOOD COMPOSITION TABLES

Widdowson and McCance (1943), in their discussion on the scope and limitations of food tables, wrote : "There are two schools of thought about food tables. One tends to regard the figures in them as having the accuracy of atomic weight determinations, the other dismisses them as valueless on the grounds that a foodstuff may be so modified by the soil, the season, or its rate of growth that no figure can be a reliable guide to its composition. The truth, of course, lies somewhere between these points of view". Bransby et al. (1948) cite large differences between calculated and chemically analyzed nutrient values for individuals. More

recently Groover et al. (1967) were concerned about 'the remarkable inaccuracy of data from dietary surveys in our field studies'. They carried out a series of tests comparing analysis and calculation in different situations and concluded that if quantitative statements are to be made, dietary survey data should be checked with actual calorimetric determinations. On the other hand, Buzina et al. (1966) found that 'the values obtained by calculations from tables of food composition are not significantly different from those obtained by the chemical analysis of replicate meals collected during the same 7-day period'. Pekkarinen (1967) using a food table composed largely of analytical data of local foods, found close agreement for individuals between the calculated values and chemical analysis for protein, fat and energy. She concluded that because agreement was so good, 'chemical analysis is not necessary for the control of calculations'. There were differences, however, between the analyzed and calculated values for polyunsaturated fatty acids.

These conflicting statements inevitably raise the question, can tables of food composition be used for determining the consumption of individuals? Whiting and Leverton (1960) reviewed the literature and compared the results from concurrent analysis and calculation of some 300 weighed diets. They examine briefly the errors inherent in laboratory analysis, and discussed the compilation of food tables. The authors concluded that the comparison of results from the two methods of processing the same data showed that

for protein and calories the calculated values for more than 50% of the total number of cases fell within a range of 10% of the analyzed value. In 1966 Engels et al. (Pekkarinen, 1970) referred to the 'better analytic methods and techniques which are available at the present time'. He also concluded that changes in culinary and table practice may also affect the comparisons made between analyzed data and data based on food tables. It is important, therefore, that the food tables used should be appropriately matched to the foods which are eaten (Marr, 1971). It has been noted that when calculation and analysis have been found to agree, the research workers are using 'a food table composed largely of analytical data of local foods' (Pekkarinen, 1967).

It can thus be deduced from this examination of the literature that absolute agreement for every individual is not achieved. Also, of course agreement is better for some nutrients than others. However, because there is a close association between the calculated and analyzed values it is possible to compare individuals' intakes relative to each other and to compare groups of individuals both in terms of means and at the extremes of the distribution for some nutrients (Marr, 1971).

Certainly food composition tables have been used in some major American studies. For example, they were used in the Ten-State Nutrition Survey conducted from 1968 to 1970 (Schwerin et al, 1981) and in both the first and second U.S. Health and Nutrition Examination Surveys (HANES I and II)

carried out from 1959 to 1970 and 1976 to 1980 respectively (National Centre for Health Statistics, 1983; Youland and Engle, 1976).

Furthermore it is important to use tables which are composed of local foods i.e. local commercially produced foods as well as local recipes.

Because the moisture content of foods is one of the easiest components to determine accurately, and also possibly subject to little variation, it was decided to use food composition tables to calculate the liquid intake from the 24-hour recall data in this study. The Food composition Tables of the National Research Institute for Nutritional Diseases (Gouws and Langenhoven, 1981) which incorporates local information, were used for this purpose.

9. EDITING AND CODING

The questionnaires for the 24-hour recall were designed so that codes could be entered directly next to each food item. This made it possible to check the codes against the original entries made by the interviewers. Four codes were entered next to each food item :

- the relevant food code from the NRIND Food Composition Tables (Gouws, Langenhoven, 1981)
- the mass of the item in grams
- the category of the moisture content (see categories (a), (b) and (c) under "Objectives")
- whether the item was consumed at home or elsewhere.

Procedure followed in editing and coding:

As has been mentioned, regular contact was maintained with the interviewers, who then submitted completed questionnaires at regular intervals. Several editing and coding phases then followed.

(i) Upon receipt of questionnaires by the researcher, they were personally checked for completeness and for a reasonable degree of consistency within family units. At this stage, the more obvious defects were spotted and where necessary, sets of questionnaires were rejected and additional households approached to replace them.

(ii) In the subsequent coding stage a more detailed check was possible, and again where necessary, questionnaires could be rejected. However, in most cases seemingly impossible or unlikely responses could be queried with and were explained by the relevant interviewer, and these comments were noted. In this coding phase, each food item was assigned a code, the portion size converted to a mass expressed in grams, and a third code added which categorised the liquid component of the item. This coding was carried out by the author and two other coders with a sound knowledge of food preparation, who were trained and supervised by the author. These coders were also in constant contact with project staff to query unusual items which cropped up, and in this way standardization was achieved.

(iii) The final manual editing and coding phase was carried out by a third coder, (also trained and supervised), who had a qualification in Home Economics, and thus an understanding of food analysis as well as food preparation. This coder again edited all the questionnaires, again checking for consistency and also checked the actual codes against the food items, and finally the conversion of the portion size to mass. This coder had also been an interviewer in both surveys and was thus familiar with the procedure, and had insight into the problems encountered. She queried seemingly unlikely responses and/or codes with the author, and at times referred them back to the interviewer. This stage thus further guaranteed that the data had been looked at critically, and that the coding was in fact standardized.

(iv) The coded data was then entered on to a separate sheet which was drawn up in a format suitable for punching.

(v) The data was additionally checked for consistency and valid codes by a computer programme. Extreme or unusual values for parameters were checked against the original questionnaires.

Standardization of portion sizes

Standardization was necessary in the case of solid and some semi-solid foods. Liquids were easily and accurately measured, as the respondents could indicate which vessel had been used, or which commercial product had been consumed,

and the interviewer was then able to measure the volumes, using a measuring jug (and water). However, 'a slice of cake', or 'a large chop' and 'a piece of sausage', was open to wide interpretations, and thus subject to far more error. This problem was overcome in the following ways :

(i) interviewers were supplied with dry rice and oats which they used to simulate the portion size of certain food items (e.g. servings of porridge, vegetables). Once the respondents had indicated the size of the portion by heaping the rice or oats, the volume was measured and recorded.

(ii) standard meat portions ('large, medium and small'), slices of bread and cake, and fruit and vegetable sizes (where these are eaten whole), were measured out and shown to the interviewers in the briefing session. In this way consensus was gained as to what constituted a large, medium or small irregularly shaped solid food, which could not be measured in terms of volume.

(iii) a standard reference table was drawn up (Robinson, 1972) for use in converting household portions to gram weights for computerization. (The NRIND Food Quantities manual (Langenhoven et al., 1986) which has such standard tables for South African conditions, was not available at the time the analysis was performed).

Note that although the measurement of these solids is somewhat rough, these foods generally have a low moisture

content, and their contribution to a liquid intake is relatively low. However, the liquids and semi-solids which were more significant to the study were far more accurately measured.

Major Assumptions Made

(i) Assumptions were necessary when either the respondent or the interviewer was unsure about the way in which the components of certain drinks were proportioned (for example, how much milk was added to a cup to tea or coffee, to "whiten" it?). A small number of informal experiments was carried out to estimate the average volumes of, for example, milk in tea, and squash. These assumptions are indicate below:

Tea/Coffee with milk to whiten:

20ml milk in 'tea cup' (capacity 125-150ml)

40ml milk in mug/'coffee cup' (capacity 200-250ml)

75ml in large mug (capacity 300ml+)

Cordial mixed with water:

25% of volume consumed - cordial

75% of volume consumed - tap water

The interviewers were always able to provide the total volume consumed but not necessarily the proportions of components.

(ii) Assumptions were also made in assigning the code for the category of the water in foods and fluids (i.e. categories (a), (b) and (c) mentioned under "Objectives"). These assumptions were only applicable

in the case of mixtures where the components could not be separated out. (If separable, they were listed separately with the appropriate water category code next to each item).

For example, homemade "stew" is a combination of meat and vegetables in a tap-water based gravy - all mixed in unknown proportions. If the food code for "meat and vegetable stew" was used, it was essential that only one water category code be assigned to it, even thought he gravy fell under category (a) - local tap water, and the moisture content of the meat and vegetables fell under category (c) - non-drinking water.

In all these cases the water category code of the component present in the greatest proportion was used. In the case of stew, this was category (a), as the tap water based gravy is the major component.

10. ANALYSIS OF THE DATA

The National Research Institute for Nutritional Diseases (NRIND) food tables (Gouws and Langenhoven, 1981) are also available on magnetic tape in a form directly usable in computer analysis.*

The data from each questionnaire was processed by a computer program which read the code item for each food entity and its quantity and then calculated the amount of water and protein in that entity using the NRIND food tables. The water content was categorised as :

(a) tap

(b) commercial beverages

(c) water bound in food

and the amounts for each category were added for each individual. The total protein consumption was also calculated for each individual for an independent check of the validity of the consumption data. Each individual's age, sex, area of residence and type of environment was recorded in the same data record as the liquid and protein consumption records.

The output from this program was further analyzed by the BMDP package of statistical programs (Dixon, 1983) to produce the results given in the next chapter.

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CHAPTER 5

RESULTS AND DISCUSSION

1. INTRODUCTION

(a) Choice of sampling areas

For each of the two surveys done (i.e. Summer and Winter), approximately 100 appropriately chosen households were taken from areas accommodating each of the following socio-economic groups. This thus yielded a total of 300 to 400 households per survey.

(i) Middle income 'Coloured' - Surrey Estate; Greenhaven,

(ii) Low income 'Coloured; - Bonteheuwel; Grassy Park, Hanover Park,

(iii) Middle income White - Gardens; Llandudno; Milnerton,

(iv) Low income White - Brooklyn.

The choices of these areas were based on information on socio-economic status from the 1970 population census as the 1980 census data was not available at the time. Areas were chosen which were in close proximity to the homes of interviewers for logistical purposes, and to ensure that the interviewers would be familiar with cultural habits of the respondents (Figure 1). The demographic characteristics of these areas included in the survey are given in Appendix C1. The resulting sample thus included a cross-section of the cultural composition of Cape Town.

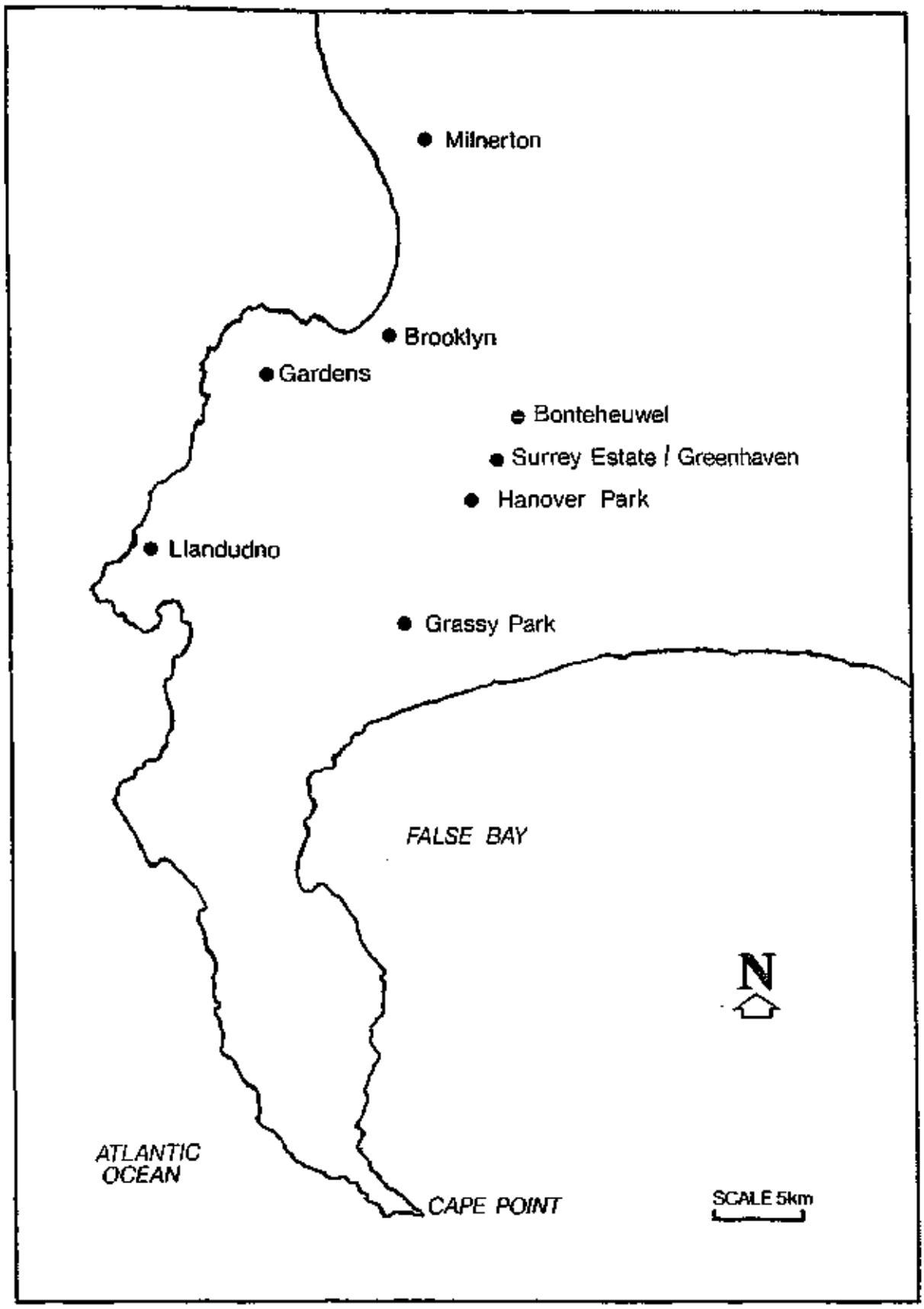

FIGURE 1 AREAS SAMPLED IN GREATER CAPE TOWN

(b) Division into Population Groupings

It was decided to distinguish between 'Whites' and 'Coloureds' because of cultural difference in eating habits.

In fact, cultural differences subsequently proved to have a stronger influence on consumption patterns than income, thus making the distinction meaningful.

This is illustrated in Table 7, where it can be seen that the difference between the groups was greater than differences within the groups.

(c) Sample based and Standardized rates

A difference exists between the age and sex distribution of the population, as reflected in the 1980 census and that sampled in the survey.

The age distribution of the sample and the population are compared in Tables 8 and 9.

To ascertain the effect of the bias, both the mean liquid consumption from the sample figures, and age standardized mean consumption figure based on the census population (Appendix C, Table C2), were calculated. Typically a difference of less than 10% between the two sets of figures was found. These results are found in Tables 10 and 11.

TABLE 10 MEAN LIQUID CONSUMPTION (BOTH SEXES COMBINED)(mℓ/hd.d)

	Whites	'Coloureds'
Tap water consumed at home	1062	718
Tap water consumed away from home	221	115
Commercial Beverages consumed at home	152	92
Commercial Beverages consumed away from home	64	38
Water bound in food consumed at home	536	216
Water bound in food consumed away from home	95	45
Total Tap Water consumed at home	1283	834
Total Commercial Beverages consumed at home	217	130
Total Water bound in food consumed at home	631	262
Total Liquid consumed at home	1751	1027
Total Liquid consumed away from home	380	333
Total Liquid consumed	2132	1226
Ratio of Tap water consumed at home to Tap water consumed away from home	.839	.881
Ratio of Total Liquid consumed at home to Total Liquid consumed away from home	.835	.860
Ratio of Total Tap water consumed at home to Total Liquid consumed consumed	.480	.590
Protein consumed (g/hd.d)	68	50

TABLE 11 STANDARDIZED MEAN CONSUMPTION FIGURES FOR GREATER CAPE TOWN (ml/head.day)

	White Males	White Females	White Both sexes	Coloured Males	Coloured Females	Coloured Both sexes	Total Population
Tap water consumed at home	1024	1169	1099	703	743	724	868
Tap water consumed away from home	316	165	238	158	86	122	167
Commercial beverages consumed at home	206	100	151	117	79	98	118
Commercial beverages consumed away from home	115	32	73	64	21	43	55
Water bound in food consumed at home	602	460	529	237	207	223	340
Water bound in food consumed away from home	123	77	100	57	37	47	67
Total protein consumed	81*	56*	69*	57*	44*	51*	58*
Total tap water consumed	1341	1335	1338	862	830	846	1035
Total commercial beverages consumed	322	133	225	182	102	141	173
Total water bound in food consumed	726	538	629	294	245	270	408
Total liquid consumed at home	1331	1731	1538	1058	1031	1045	1234
Total liquid consumed away from home	556	276	411	281	147	213	289
Total liquid consumed	2391	2008	2192	1340	1179	1258	1616

TABLE 7 MEAN TOTAL LIQUID CONSUMED (mℓ/hd.d)
DISTRIBUTION BY SOCIO-ECONOMIC GROUP, SEASON AND SEX

	Winter Survey (1983)			Summer Survey (1984)			Percent. Increase
	Male	Female	Both	Male	Female	Both	
High Income Whites	1925	1799	1857	2372	2083	2220	19.5%
Low Income Whites	2303	2030	2160	2620	2031	2306	6.8%
High Income 'Coloured'	1346	1226	1280	1425	1233	1322	3.3%
Low Income 'Coloured'	1120	1099	1109	1211	1119	1160	4.6%
All Groups	1803	1634	1712	1992	1677	1824	6.5%

Footnote: The terminology 'total liquid consumed' is strictly the sum of the water content of tap water, commercial beverages and water bound in food.

TABLE 8 PERCENT DISTRIBUTION OF SAMPLE

Age	White Male	White Female	Coloured Male	Coloured Female
1 - 4	3.0	2.8	5.1	4.2
5 - 11	7.4	7.7	9.7	8.5
12 - 17	8.2	6.5	5.7	7.4
18 - 30	7.0	9.3	11.8	15.2
31 - 34	16.0	21.0	9.2	13.4
35+	5.3	5.8	4.1	5.5
	46.8	53.2	45.7	54.3
	100%		100%	

TABLE 9 PERCENT DISTRIBUTION OF 1980 CENSUS POPULATION 01 REGION

Age	White Male	White Female	Coloured Male	Coloured Female
1 - 4	3.1	3.0	4.9	4.8
5 - 11	5.9	5.5	8.8	8.5
12 - 17	5.0	5.1	7.9	7.4
18 - 30	11.4	11.6	12.8	13.1
30 - 34	14.8	15.2	11.5	12.8
35+	8.0	11.3	3.1	4.3
	48.2	51.8	49.0	51.0
	100%		100%	

(d) Measures of Central Tendency - Discussion

A decision had to be taken as to which measure of central tendency was best to use - particularly in the light of the literature review, in which several researchers highlighted the problem of the flat slope syndrome (code p 28), a phenomenon reported with the use of the 24-hour recall method.

Skewness is the degree of asymmetry, or departure f m symmetry, of a distribution. If the frequency curve of a distribution has a longer 'tail' to the right of the central maximum than to the left, the distribution is said to be skewed to the right or to have positive skewness. If the reverse is true it is said to be skewed to the left or to have negative skewness.

A measure of skewness, Pearson's second coefficient of skewness is defined as:

Skewness = 3.(mean-median/(standard deviation)

The various categories of liquid consumption which were measured had a positive skewness from which one would conclude that the mean would be greater than the median. This can be seen in Tables 12 and 13.

In calculating the median, only the ordering of the results is considered, while in calculating the mean, the magnitude of each result is used.

TABLE 12 MEASURES OF CENTRAL TENDENCY - WHITES

	Males		Females		Both sexes	
	Mean	Median	Mean	Median	Mean	Median
Tap water (Total) mℓ/hd.d	1270	1153	1295	1120	1283	1134
Commercial Beverages (Total) mℓ/hd.d	302	96	141	45	216	64
Water bound in Food (Total) mℓ/hd.d	727	677	546	482	631	556
Total liquid mℓ/hd.d	2300	2112	1983	1832	2132	1946
Protein (Total) (g/hd.d)	81	77	57	53	68	63

TABLE 13 MEASURES OF CENTRAL TENDENCY - 'COLOUREDS'

	Males		Females		Both sexes	
	Mean	Median	Mean	Median	Mean	Median
Tap water (Total) mℓ/hd.d	835	781	833	748	834	758
Commercial Beverages (Total) mℓ/hd.d	167	79	98	48	130	62
Water bound in Food (Total) mℓ/hd.d	283	223	243	190	261	204
Total liquid mℓ/hd.d	1286	1210	1175	1130	1226	1165
Protein (Total) g/hd.d	55	50	44	40	49	43

It is by no means clear that the calculation of a median would be exactly correct for the flat slope syndrome. In practice, as can be seen from Tables 12 and 13, the difference between the mean and the median is about 10% or less for total liquid and protein consumption. The situation becomes more complicated when looking at the more detailed subcategories, for example, commercial beverages consumed away from home. The distribution of consumption is bimodal with close to 50% of the sample having a consumption for this category of zero. In such a case, the median could display an extreme value (i.e. zero, if more than half the cases had zero consumption) or be exceedingly unstable between the two modes if slightly less than half the sample had zero consumption.

Furthermore, the 24-hour recall would tend to underestimate consumption (i.e. due to under-reporting) although the extent of the under-reporting is not quantifiable. In such a case, a measure of central tendency, which would over-estimate somewhat, would be preferable to one which under-estimates. The combination then, of the mean with the 24-hour recall with probable under-reporting is probably most pragmatic. Moreover, the mean is the most commonly used measure of central tendency and is more familiar to calculate and interpret than the median.

2. SOCIO-ECONOMIC FACTORS

It was found that the main differences among the various socio-economic groups were not according to income but rather in terms of population groupings.

This is clearly evident in Table 7 in which quantities for total liquid consumed are tabulated for the winter and summer surveys for the four categories of socio-economic groupings.

Of the three categories of liquid (i.e. tap water, commercial beverages and water bound in food), the greatest difference between Whites and 'Coloureds' is found with water bound in food. This is shown in Table 14 below and is possibly due to the observed high intake by Whites of 'natural' fruit juices, flavoured yoghurts and milk. This reflects perhaps the trend of regarding commercial beverages as being 'synthetic', and thus 'unhealthy'. Furthermore there was more valid reporting of alcoholic beverages, some of which have a water base classified as 'water bound in food' e.g. wines, spirits. There was a corresponding drop in the consumption of total tap water amongst this group. (See Table A1 in the Appendix A).

In general 'Coloured' consumption is considerably lower than that of Whites - a consistent finding for both sexes during both seasons. See Appendix A, Tables A1 to A12.

TABLE 14 TOTAL WATER BOUND IN FOOD CONSUMED (mℓ/hd.d)
DISTRIBUTION BY SOCIO-ECONOMIC GROUP, SEASON AND SEX

	Winter Survey (1983)			Summer Survey (1984)		
	Male	Female	Both	Male	Female	Both
High Income Whites	827	629	719	858	634	740
Low Income Whites	530	398	461	683	510	591
High Income 'Coloured'	318	258	285	370	299	332
Low Income 'Coloured'	189	180	184	236	220	227
All Groups	531	411	466	572	435	499

3. SUMMER AND WINTER CONSUMPTION

It was found that summer consumption was higher than winter consumption, for all groups and for both sexes. The intake of high income Whites particularly, increased by as much as 20%. This is illustrated in Table 7. The intake of low income Whites was increased by only 7% and that of high and low income 'Coloured' by 3% and 5% respectively.

For seasonal differences in consumption of all categories of liquid in terms of socio-economic groups, including intake at home and away, for all categories - see Appendix A, Tables A1 to A12.

Seasonal consumption for Whites and 'Coloureds' by age is presented graphically in Figures 2 to 7.

In general, seasonal differences are not very marked for the 'Coloured' Group. This is not so for Whites where very considerable differences are found - particularly in the case of commercial beverages, but also for water ound in food. Age trends for both groups are similar.

There is an anomaly for 'Coloured' summer intake which is apparently inexplicable as there was no obvious bias in the reporting (Figure 3).

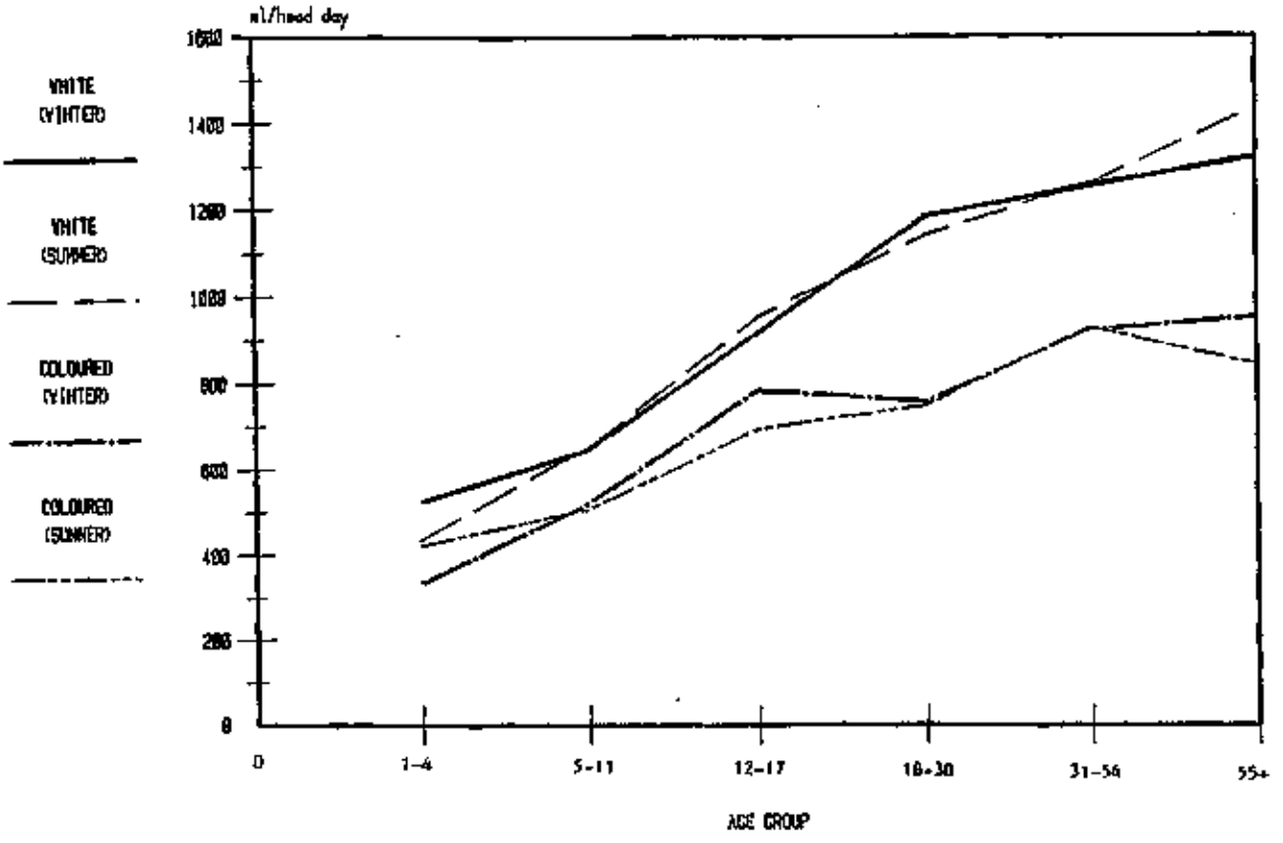

FIGURE 2 TAP WATER CONSUMED AT HOME BY SEASON, AGE AND POPULATION GROUP

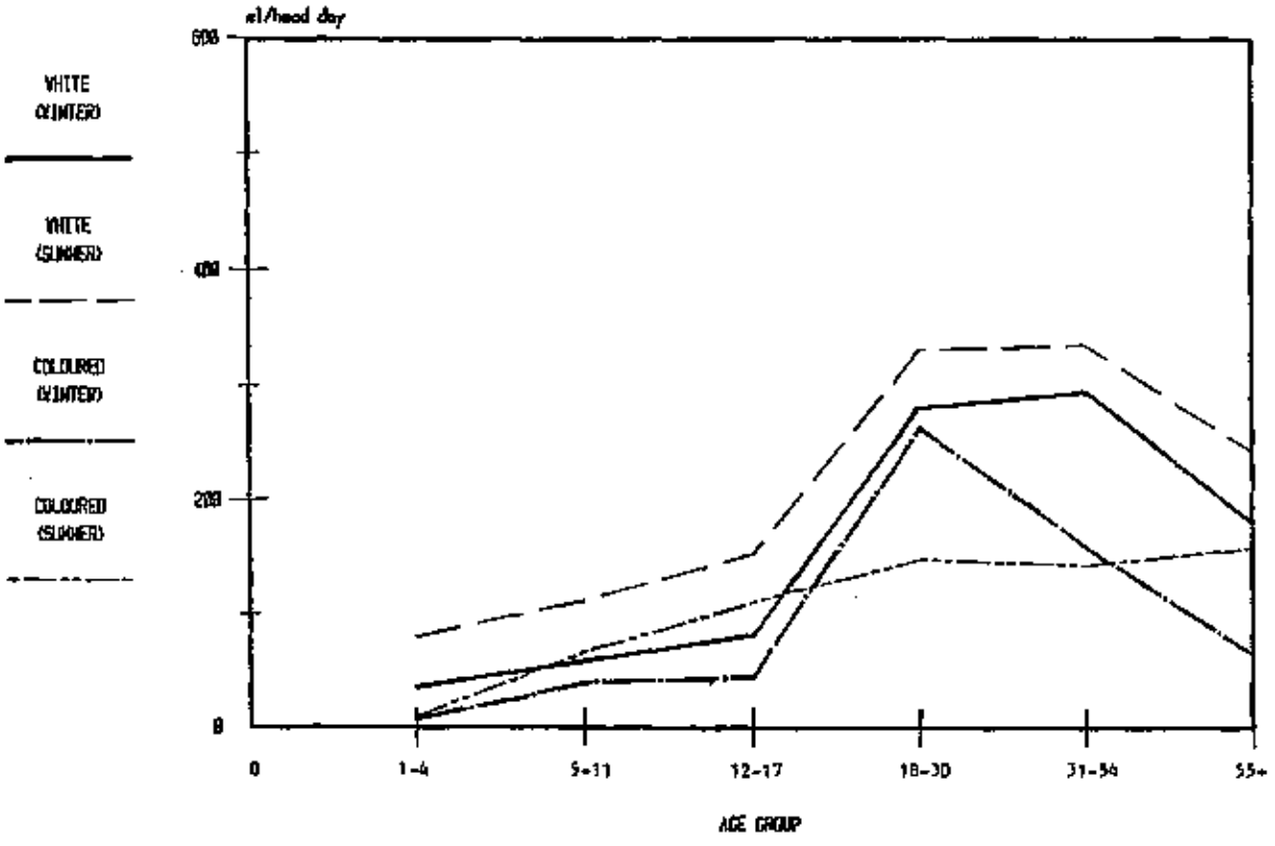

FIGURE 3 TAP WATER CONSUMED AWAY FROM HOME BY SEASON, AGE AND POPULATION GROUP

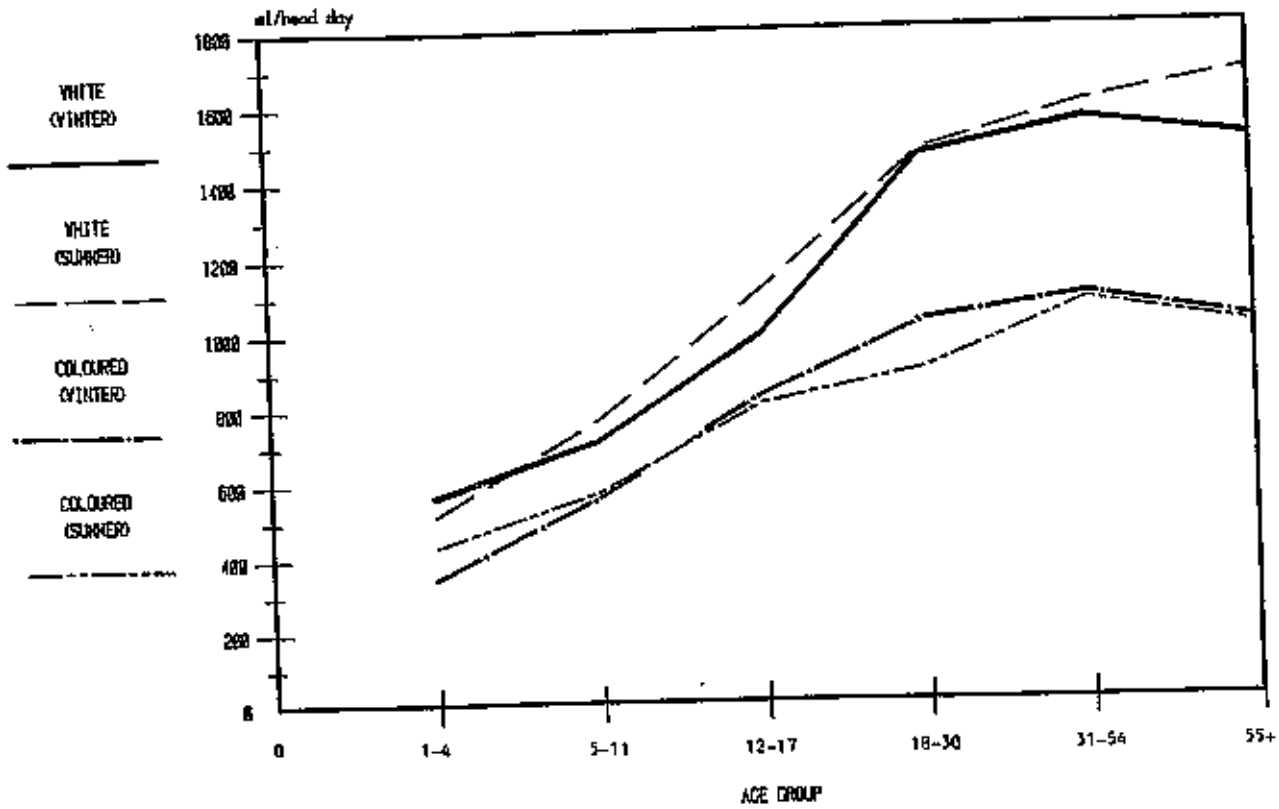

FIGURE 4 TOTAL TAP WATER CONSUMED BY SEASON, AGE AND POPULATION GROUP

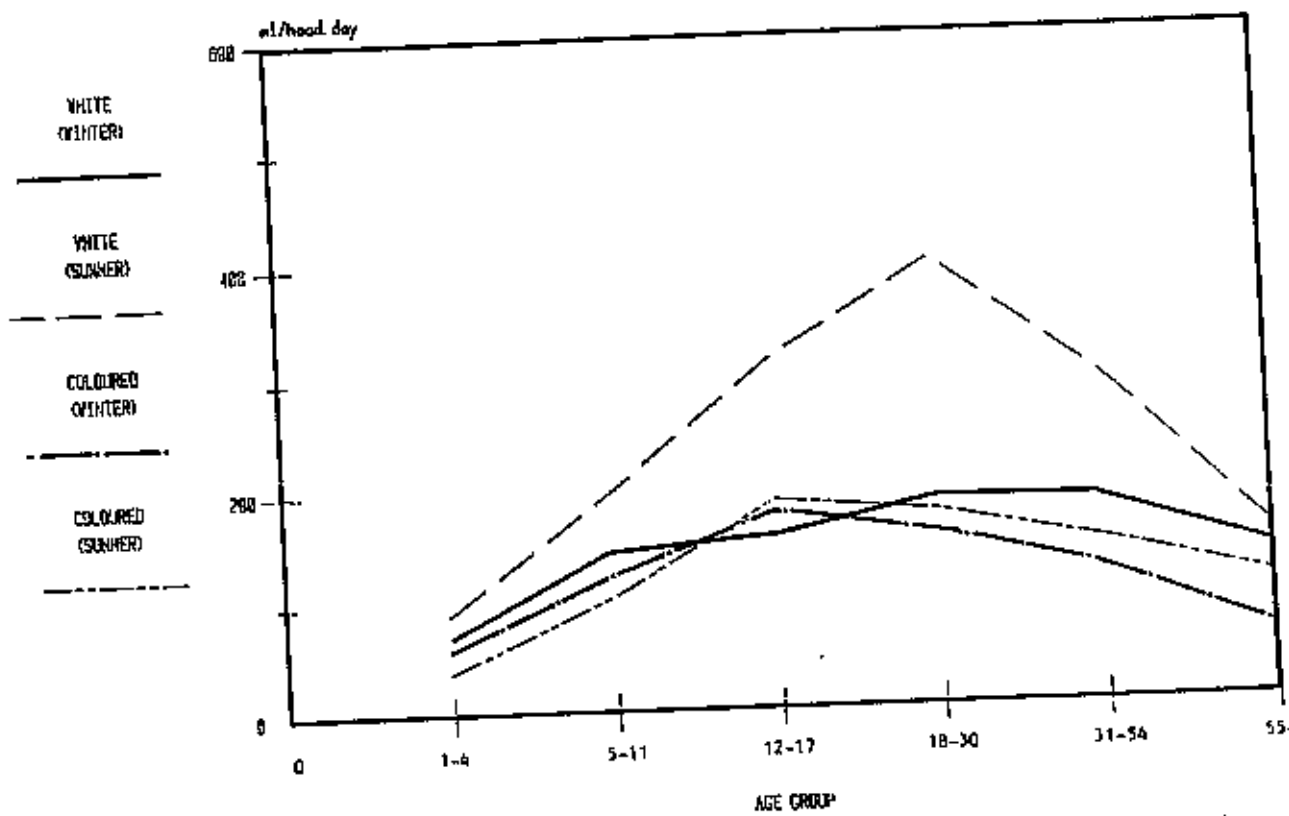

FIGURE 5 TOTAL COMMERCIAL BEVERAGES CONSUMED BY SEASON, AGE AND POPULATION GROUP

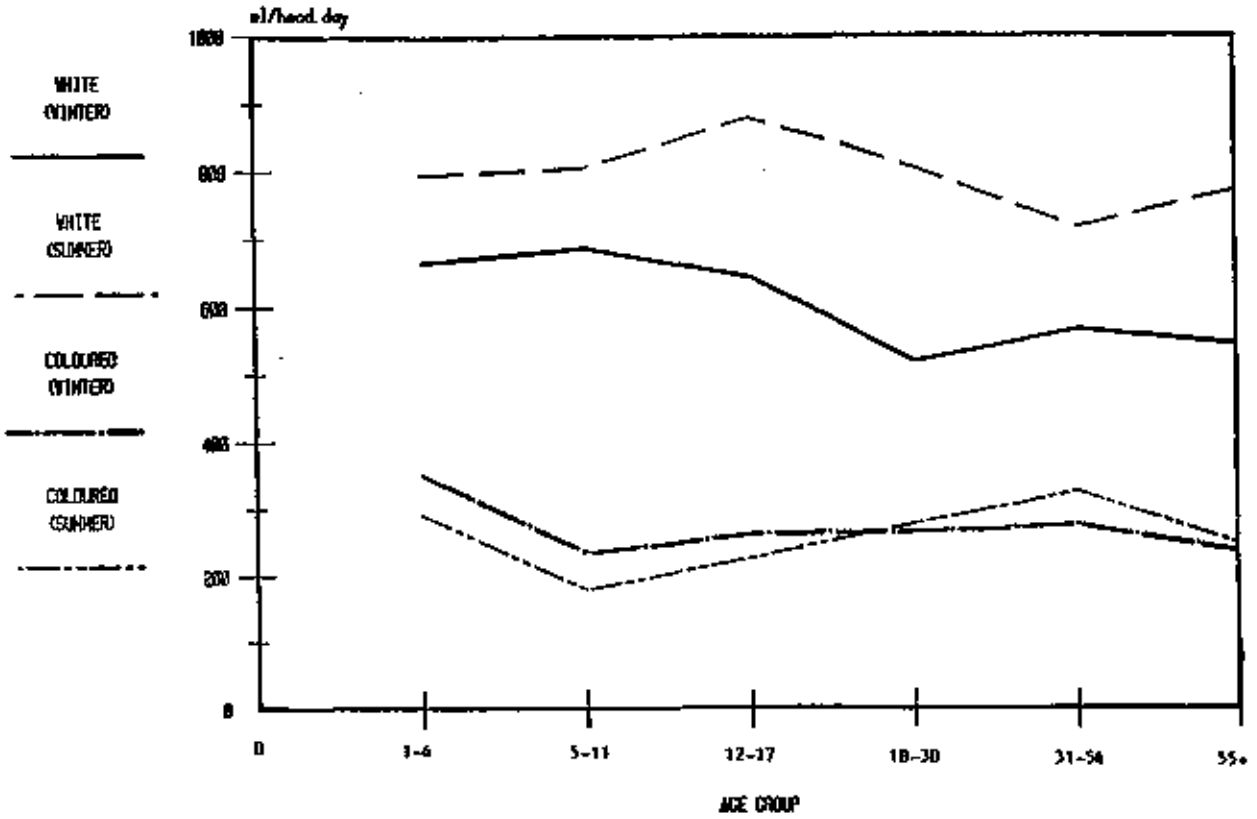

FIGURE 6 TOTAL WATER BOUND IN FOOD CONSUMED BY SEASON, AGE AND POPULATION GROUP

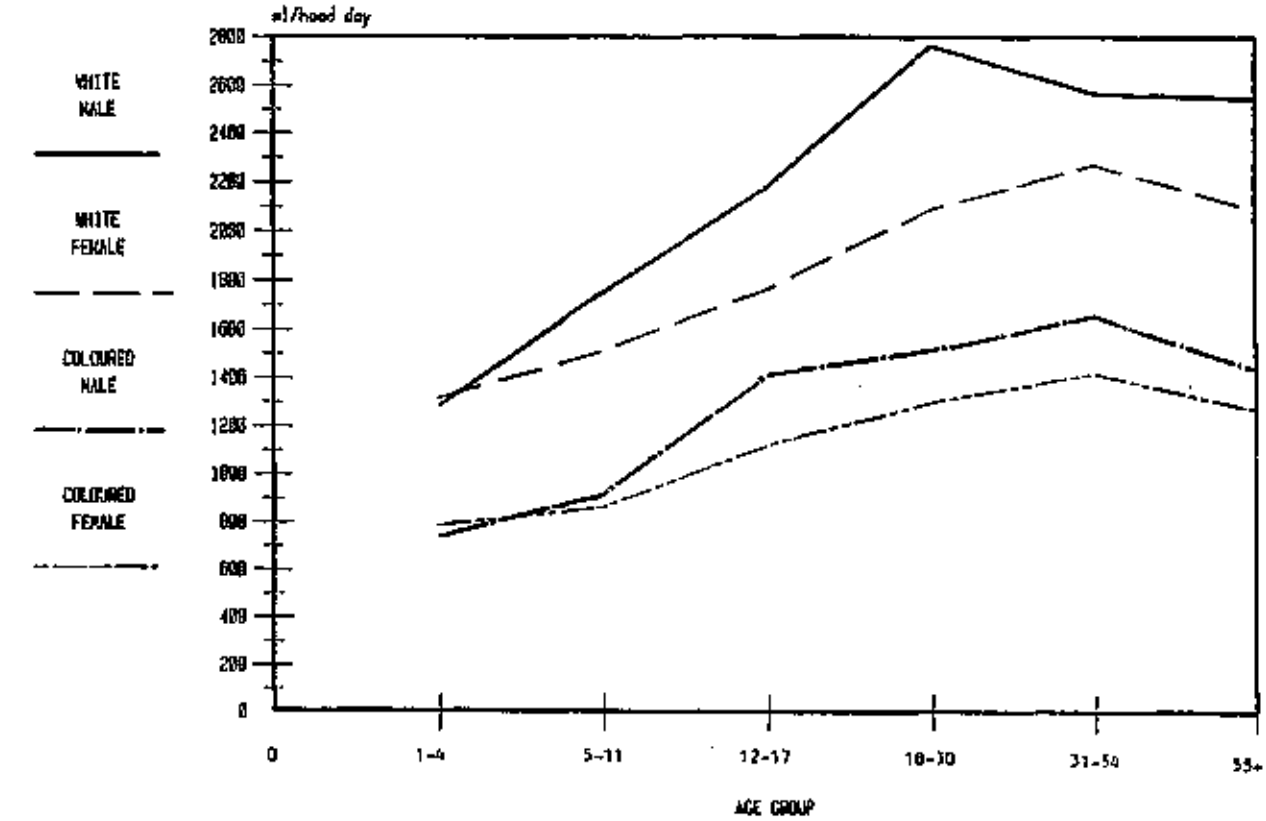

FIGURE 7 TOTAL LIQUID CONSUMED BY SEASON, AGE AND POPULATION GROUP

4. CONSUMPTION FOR 'COLOUREDS' AND WHITES BY AGE

Combined data from both surveys was analyzed for various categories of liquid by age and sex for the 'Coloured' and White population groups.

The data is presented graphically in the following figures :

Figure 8 Tap water consumed at home

Figure 9 Tap water consumed away from home

Figure 10 Commercial beverages consumed at home

Figure 11 Commercial beverages consumed away from home

Figure 12 Water bound in food consumed at home

Figure 13 Water bound in food consumed away from home

Figure 14 Total tap water consumed

Figure 15 Total commercial beverages consumed

Figure 16 Total water bound in food consumed

Figure 17 Total liquid consumed at home

Figure 18 Total liquid consumed away from home

Figure 19 Total liquid consumed.

5. HOME AND AWAY RATIOS

Epidemiological surveys investigating the possible health effects of the variations in the water supplies often base their studies on both the water quality and health effects at the place of residence (i.e. the de jure address) of the subjects (Beresford, 1984; Nellor, 1984; Isaäcson and Sayed, 1986).

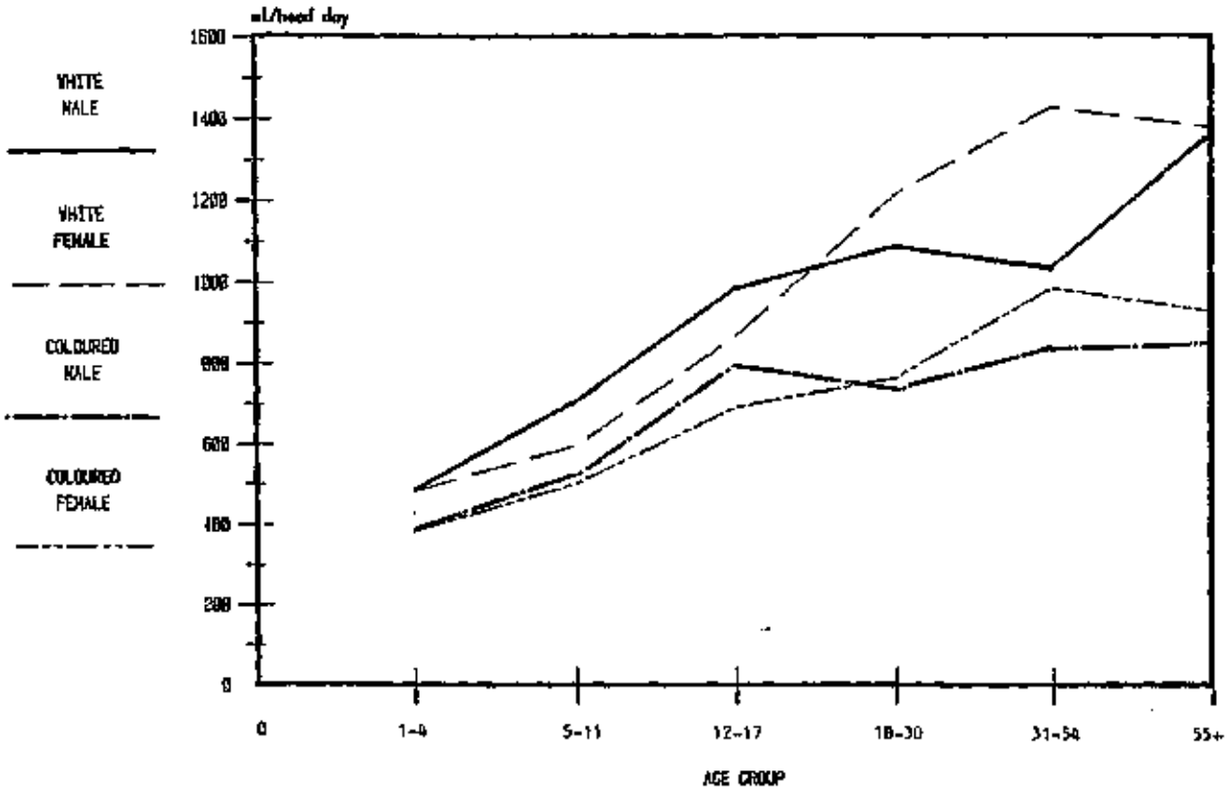

FIGURE 8 TAP WATER CONSUMED AT HOME BY SEX, AGE AND POPULATION GROUP

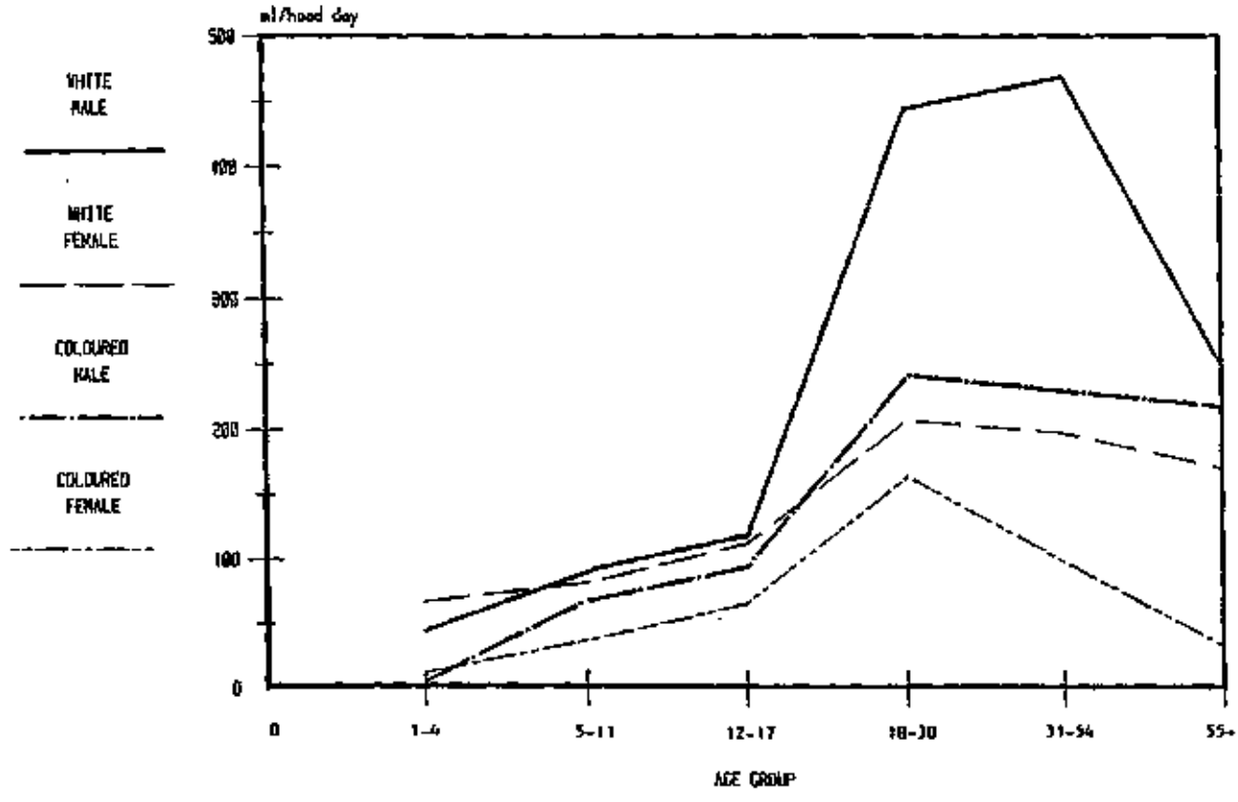

FIGURE 9 TAP WATER CONSUMED AWAY FROM HOME BY SEX, AGE AND POPULATION GROUP

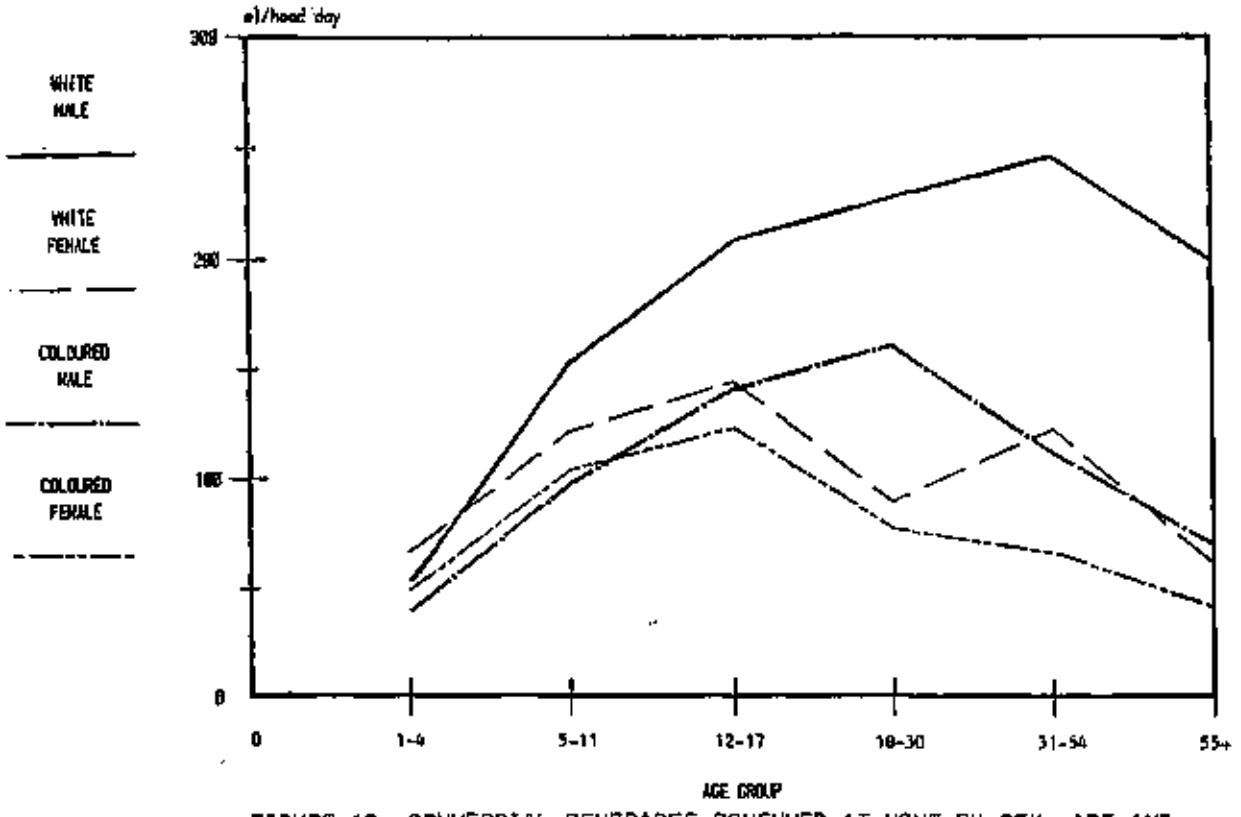

FIGURE 10 COMMERCIAL BEVERAGES CONSUMED AT HOME BY SEX, AGE AND POPULATION GROUP

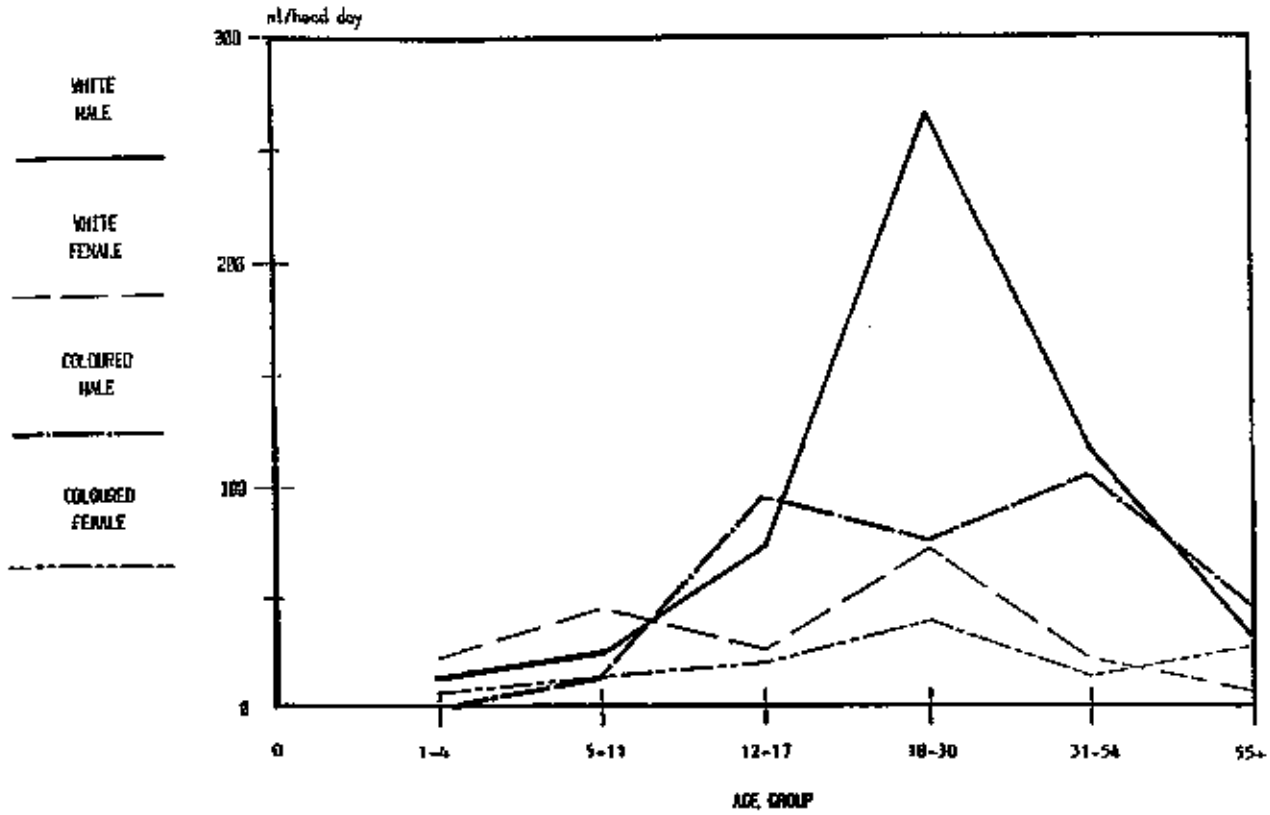

FIGURE 11 COMMERCIAL BEVERAGES CONSUMED AWAY FROM HOME BY SEX, AGE AND POPULATION GROUP

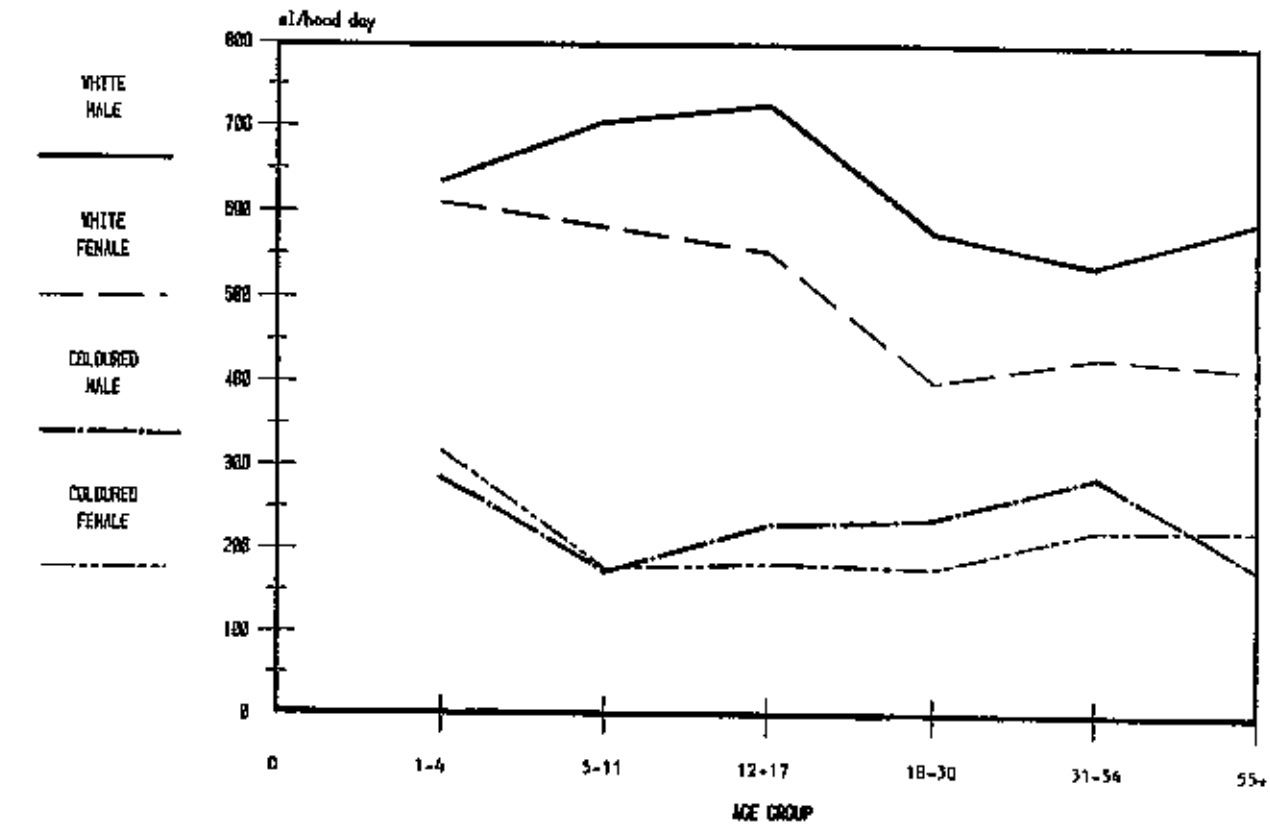

FIGURE 12 WATER BOUND IN FOOD CONSUMED AT HOME BY SEX, AGE AND POPULATION GROUP

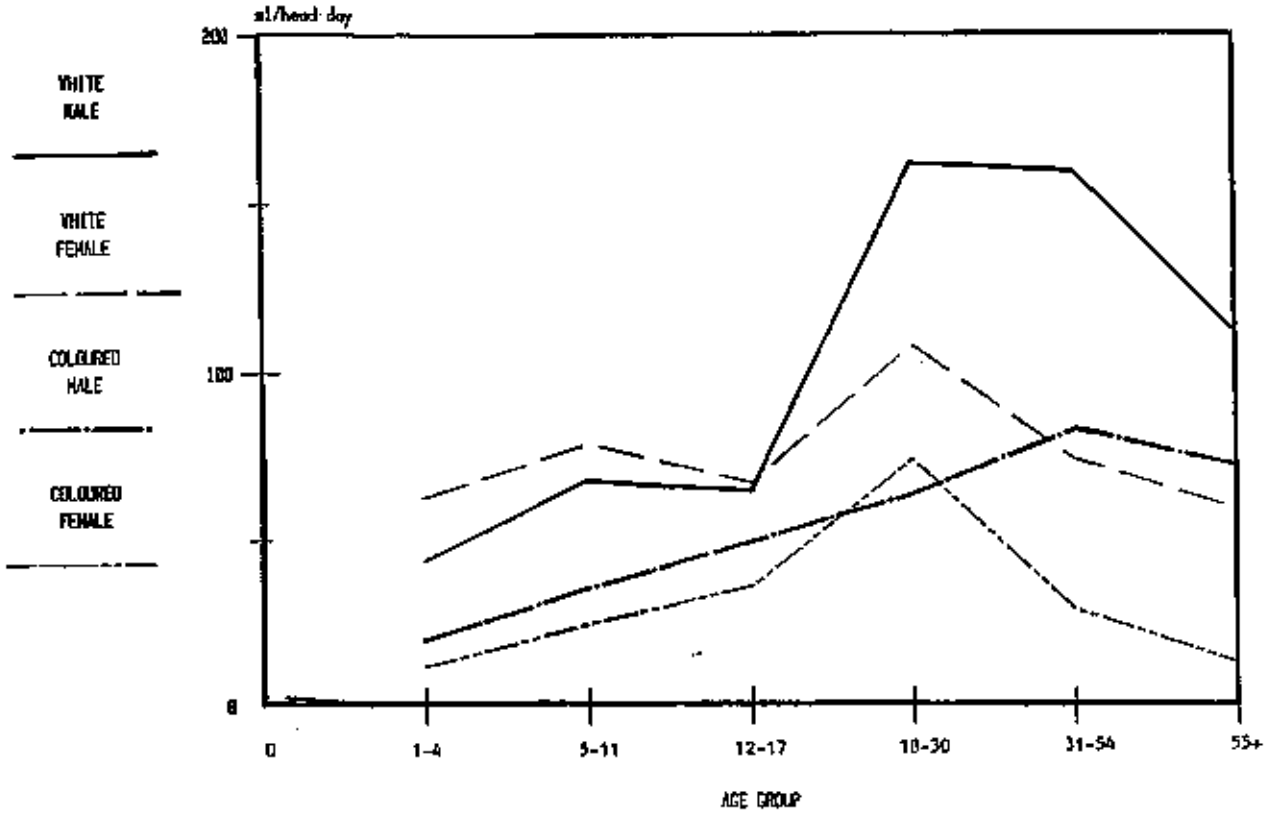

FIGURE 13 WATER BOUND IN FOOD CONSUMED AWAY FROM HOME BY SEX, AGE AND POPULATION GROUP

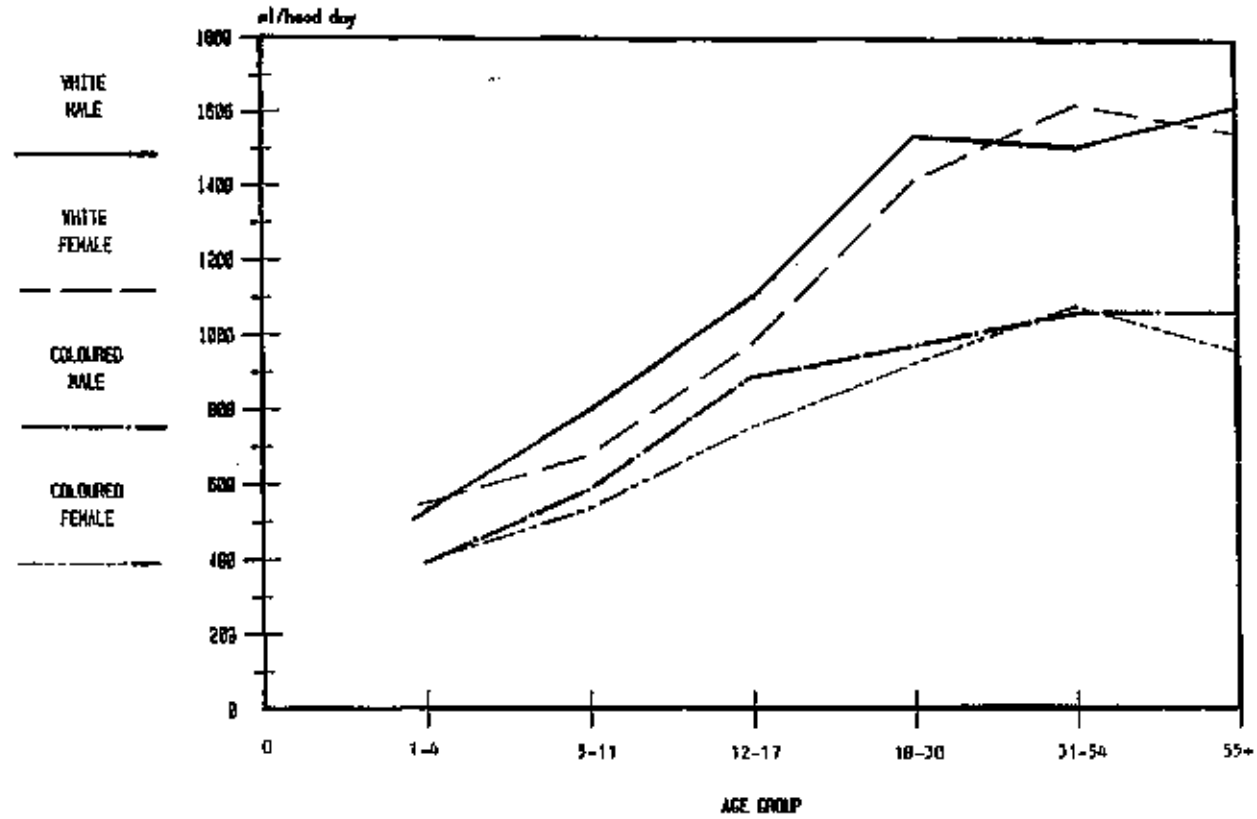

FIGURE 14 TOTAL TAP WATER CONSUMED BY SEX, AGE AND POPULATION GROUP

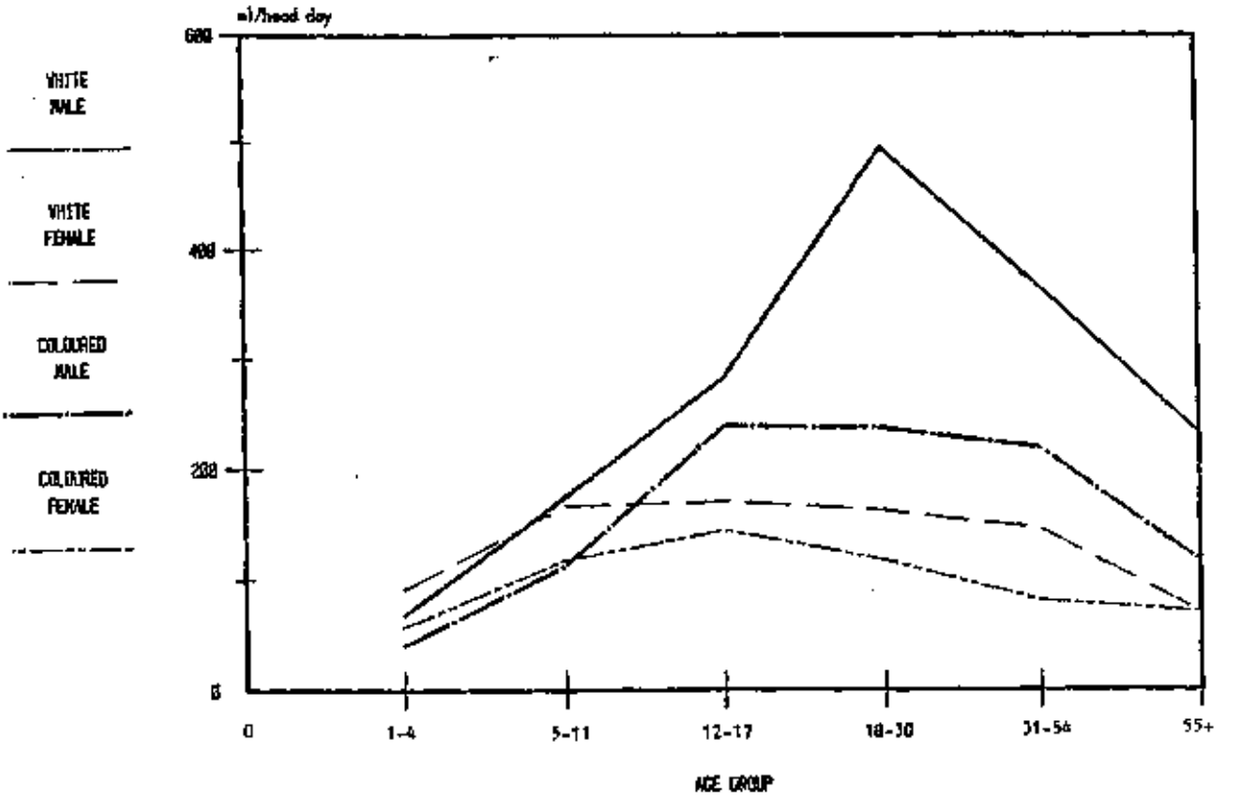

FIGURE 15 TOTAL COMMERCIAL BEVERAGES CONSUMED BY SEX, AGE AND POPULATION GROUP

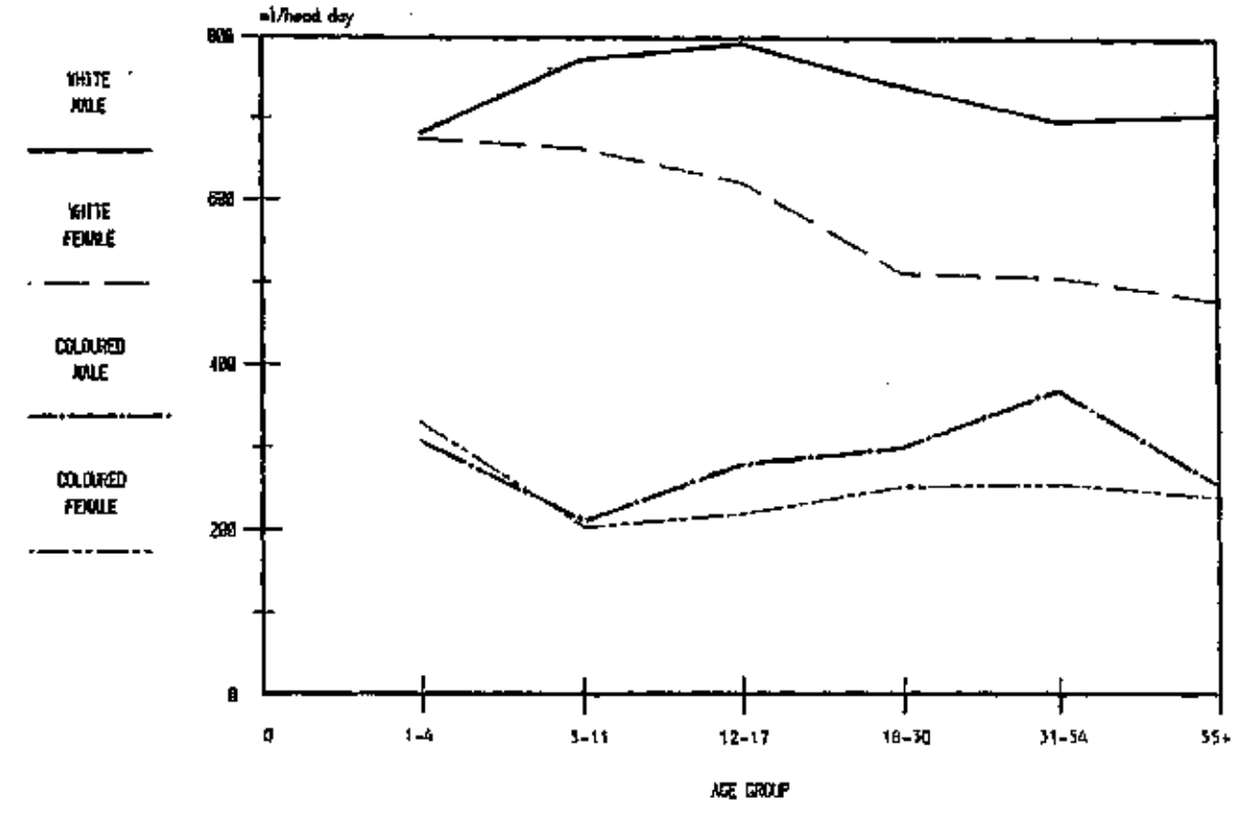

FIGURE 16 TOTAL WATER BOUND IN FOOD CONSUMED BY SEX, AGE AND POPULATION GROUP

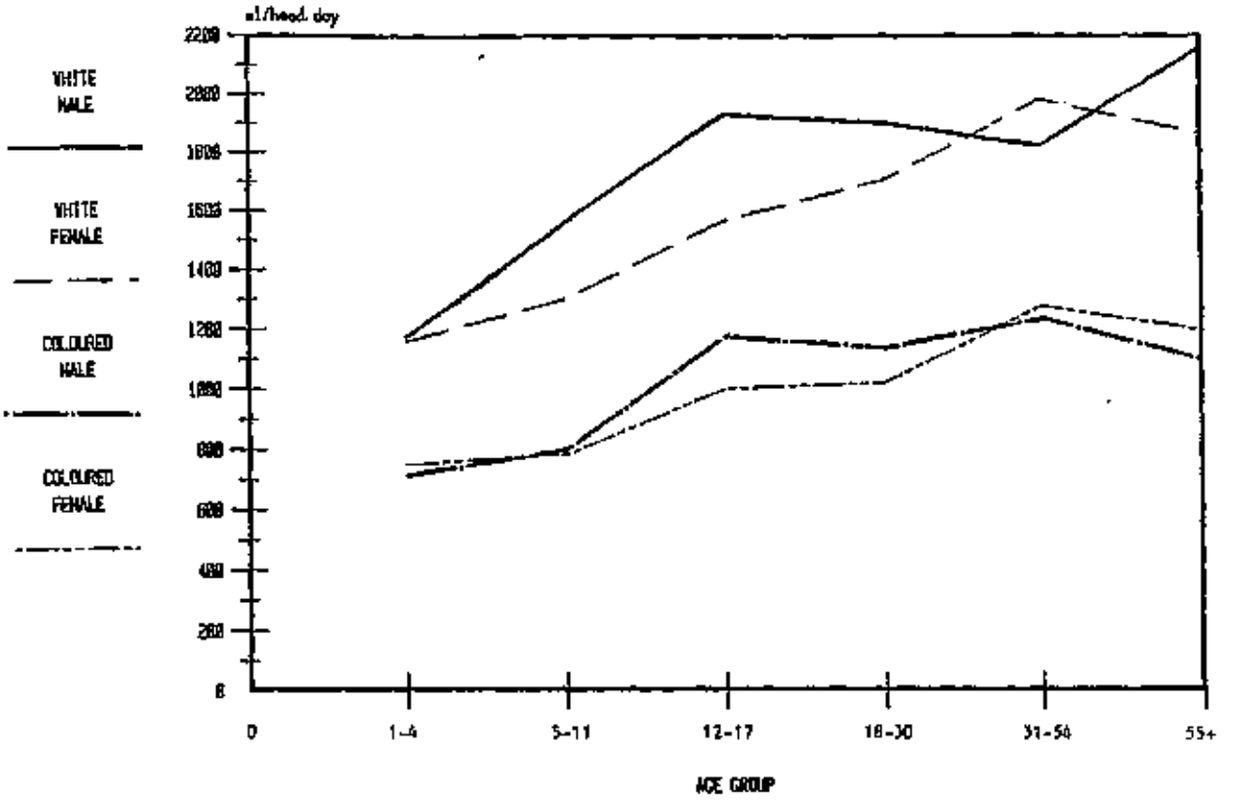

FIGURE 17 TOTAL LIQUID CONSUMED AT HOME BY SEX, AGE AND POPULATION GROUP

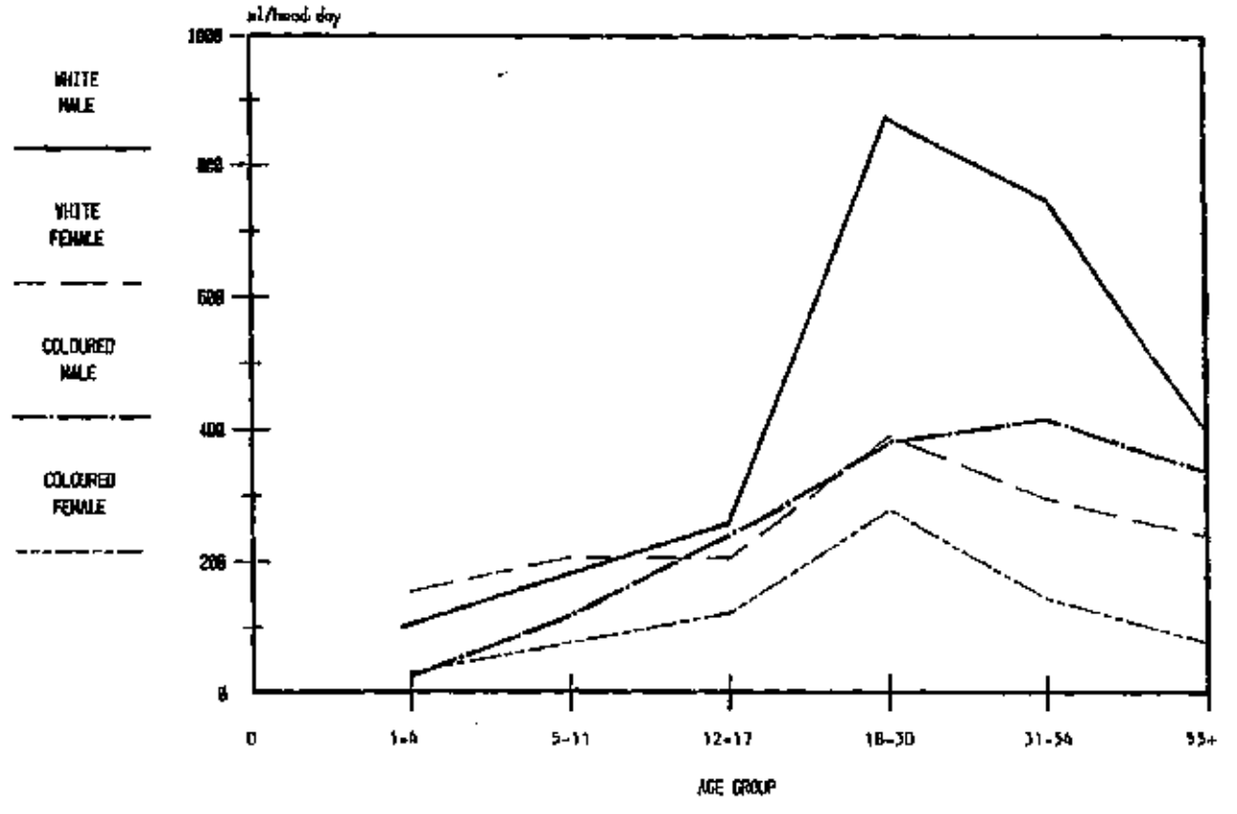

FIGURE 18 TOTAL LIQUID CONSUMED AWAY FROM HOME BY SEX, AGE AND POPULATION GROUP.

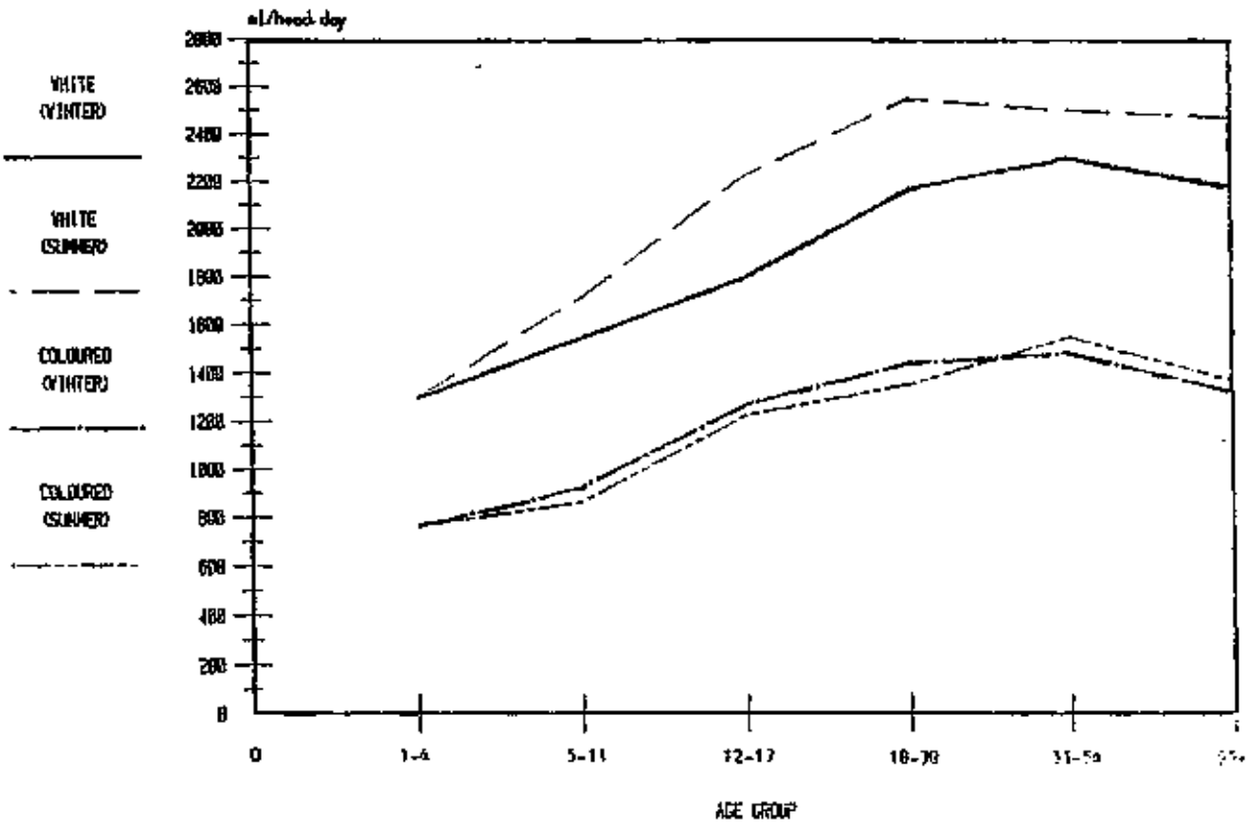

FIGURE 19 TOTAL LIQUID CONSUMED BY SEX, AGE AND POPULATION GROUP

As not all water is consumed at home, the ratio of home to away consumption will give an indication of the extent to which this phenomenon can confound the experimental design.

The mean ratios for:

(i) tap water consumed at home to tap water consumed away is given in Table 15

(ii) total liquids consumed at home to total liquids consumed away is given in Table 16

(iii) the ratio of tap water consumed at home to total liquid intake is given in Table 17

It should be noted that these ratios show much less variation than the mean consumption figures. In particular, the amount of liquid consumed from the tap at home is about one half of all liquid consumed from various sources.

6. WEEKDAY AND WEEKEND EFFECTS

Although one weekend day, namely Sunday, was included in the study, the possibility existed that the weekend effect might be greater on Fridays and Saturdays. To investigate this, a small sample comprised equally of high and low income Whites was interviewed on their Friday and Saturday intakes. The aim of this pilot study was to determine whether there was a marked increase in intake over these days corresponding to increased socializing. Unfortunately due to civil disturbances in the 'Coloured' areas it was not possible to include this group in the investigation.

TABLE 15 RATIO OF TAP WATER CONSUMED AT HOME TO TAP WATER CONSUMED AWAY FROM HOME

DISTRIBUTION BY SOCIO-ECONOMIC GROUP, SEASON AND SEX

	Winter Survey (1983)			Summer Survey (1984)		
	Male	Female	Both	Male	Female	Both
High Income White	.824	.922	.877	.762	.843	.806
Low Income White	.829	.863	.847	.803	.845	.825
High Income 'Coloured'	.855	.921	.892	.810	.857	.835
Low Income 'Coloured'	.798	.856	.827	.885	.926	.908
All Groups	.832	.899	.868	.815	.870	.845

TABLE 16 RATIO OF TOTAL LIQUIDS CONSUMED AT HOME TO TOTAL LIQUIDS CONSUMED AWAY FROM HOME

DISTRIBUTION BY SOCIO-ECONOMIC GROUP, SEASON AND SEX

	Winter Survey (1983)			Summer Survey (1984)		
	Male	Female	Both	Male	Female	Both
High Income White	.830	.909	.873	.789	.851	.822
Low Income White	.809	.850	.830	.784	.836	.812
High Income 'Coloured'	.817	.906	.866	.785	.837	.813
Low Income 'Coloured'	.739	.831	.785	.879	.909	.896
All Groups	.812	.885	.851	.812	.862	.839

TABLE 17 RATIO OF TAP WATER CONSUMED AT HOME TO TOTAL LIQUID CONSUMPTION DISTRIBUTION BY SOCIO-ECONOMIC GROUP, SEASON AND SEX

	Winter Survey (1983)			Summer Survey (1984)		
	Male	Female	Both	Male	Female	Both
High Income Whites	.356	.495	.431	.349	.504	.403
Low Income Whites	.525	.632	.581	.441	.522	.484
High Income 'Coloured'	.543	.635	.594	.461	.554	.510
Low Income 'Coloured'	.510	.625	.568	.599	.652	.629
All Groups	.476	.589	.537	.459	.559	.512

The results are tabulated in Table 18. Although there is an apparent difference in intake, it does not imply that there is a pronounced overall weekend effect, except in the consumption of commercial beverages on Saturdays particularly.

It can thus be concluded that the margin of error induced by extrapolating mean daily intake from the Sunday to Thursday data, could not be too great - for Whites at least. Saturdays form after all only one seventh of all the days in a week.

It can be seen from the similarity of the protein intake data that the pilot sample was sufficiently representative of the survey sample for a comparison to be made.

7. PROTEIN CONSUMPTION

Protein intake by socio-economic group for both sexes and seasons is presented in Table 19 and is shown graphically for both surveys combined in Figure 20.

This served as an independent check, making it possible to determine whether there was a meaningful result, i.e. whether marked under- or over-reporting had occurred.

TABLE 18 LIQUID CONSUMPTION (mℓ/hd.d)

COMPARISON OF WEEKDAY AND WEEKEND DATA OF BOTH SEXES COMBINED

	Friday		Saturday		Mean Sunday-Thursday	
	Mean	SEM	Mean	SEM	Mean	SEM
Tap water consumed at home	**911**	**83**	**1169**	**110**	**1062**	**18**
Tap water consumed away from home	290	68	92	32	221	10
Commercial beverages consumed at home	200	37	368	83	152	6
Commercial beverages consumed away from home	71	21	185	59	64	4
Water bound in Food consumed at home	355	29	454	59	536	9
Water bound in Food consumed away from home	106	31	86	28	95	5
Total Tap water consumed	**1202**	**95**	**1262**	**109**	**1283**	**21**
Total Commercial Beverages consumed	275	44	553	108	217	7
Total Water bound in Food consumed	461	36	541	63	631	9
Total Liquid consumed at home	**1468**	**96**	**1992**	**151**	**1751**	**20**
Total Liquid consumed away from home	468	91	365	83	380	13
Total Liquid consumed	1936	109	2357	144	2132	21
Protein consumed (g/hd.d)	**65**	**5**	**76**	**5**	**68**	**1**

Sample: Low and high income Whites, n Males = 45; n Females = 55

SEM = Standard Error of the mean

TABLE 19 TOTAL PROTEIN CONSUMED (grams)
DISTRIBUTION BY SOCIO-ECONOMIC GROUP, SEASON AND SEX

	Winter Survey (1983)			Summer Survey (1984)		
	Male	Female	Both	Male	Female	Both
High Income White	86	61	72	73	53	63
Low Income White	82	57	69	83	56	69
High Income 'Coloured'	59	45	51	63	46	54
Low Income 'Coloured'	56	44	50	48	41	44
ALL GROUPS	74	54	63	67	50	58

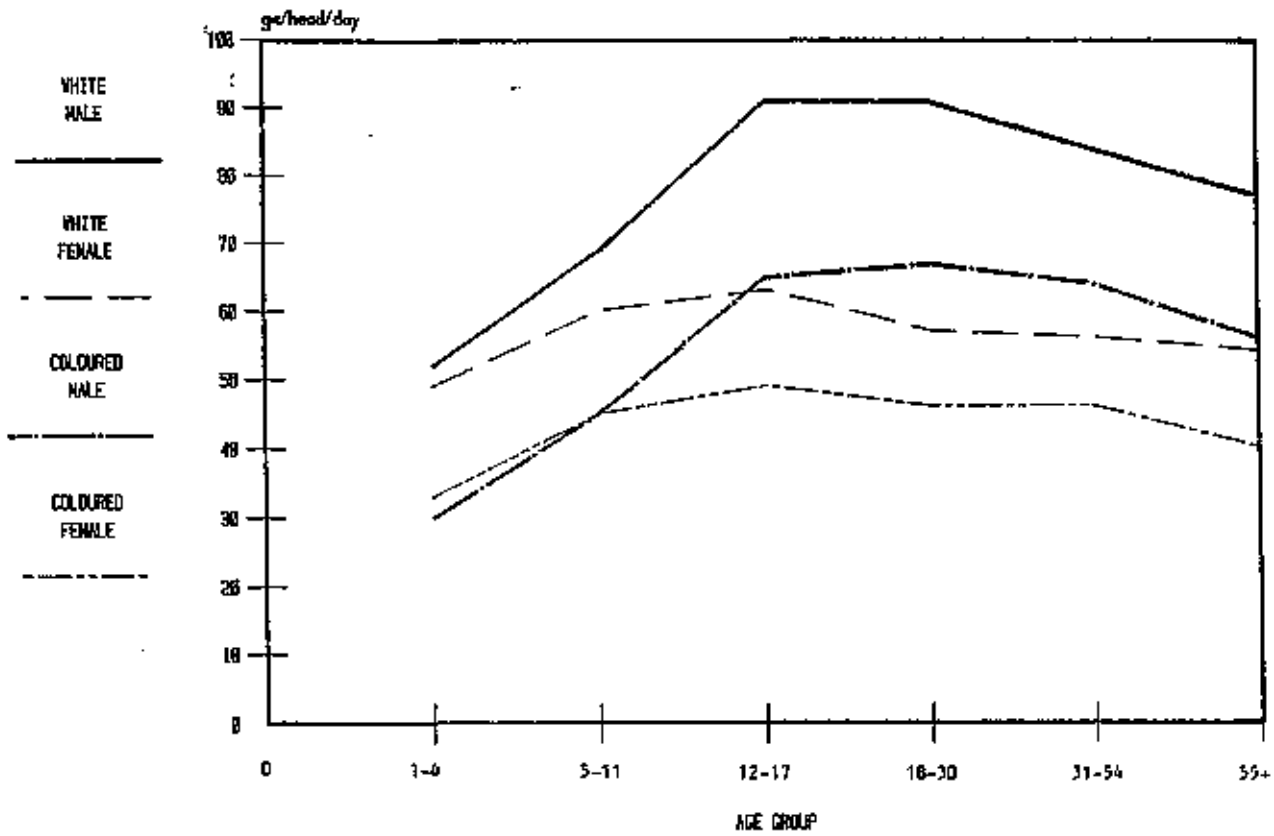

FIGURE 20 PROTEIN CONSUMED BY SEX, AGE AND POPULATION GROUP

Comparison of protein intake data with other studies shows that the survey figures are realistic, being within the ranges covered by other studies (Koh and Caples, 1979; Lubbe, 1973; National Center for Health Statistics, 1983).

The standardized methodology of reporting and recording all food items and then subjecting them to the same food tables, obviates any possible bias which would yield a better recording of protein than of liquids.

CHAPTER 6

DISCUSSION AND CONCLUSIONS

The traditional 2 liter intake which tends to be reported in the literature would be a useful approximate measure for the White population group, since the mean total liquid intake for Whites (excluding babies) was found to be 2.192 litres. However, although not always specified in the literature, the implication is that this 2 liter consumption figure excludes so-called 'solid' foods, which were included in this study. Certainly, water as a 'solid' food component has not been included in any of the large surveys which have been reported so far, and according to Lafontaine (1975) this can contribute as much as 1 000 ml to total liquid intake. The British survey (Hopkins and Ellis, 1980) which is the most comprehensive study to be found in the literature, only includes 'drinks' and reported a mean liquid intake (excluding babies) of 1.8 litres per head daily. Because of such major discrepancies in the methodology between this survey and the few other studies which exist, it is not possible to draw direct comparisons between them.

The most striking feature of the present work was that the total liquid intake of 'Coloureds' was found to be consistently lower than that of Whites for all age groups. This difference is reflected clearly in the mean liquid intakes for the two groups, which were 2.192 litres and 1.258 litres per head per day for Whites and 'Coloureds'

respectively. It is not possible to pinpoint the reason for this, from the results of the study.

However, because the difference between the cultural groups was found to be far greater than that between income groups, the lower intake of 'Coloureds' may well have a cultural basis. Certainly, no gross under-reporting of items consumed occurred, as the figures obtained for protein consumption (which was used as an index) were very compatible with other local studies. Alcohol consumption was definitely under-reported amongst the 'Coloured' group, since it hardly appeared at all on questionnaires, even amongst those who were not Muslims. On the other hand, high alcohol consumption was frequently reported amongst the White population. Nevertheless, the absence of alcohol intake alone amongst 'Coloureds' would not account for this large discrepancy in intake between the two main population groups, as the difference was consistent for all age categories. Information on the height, weight and level of activity of individuals may have yielded an explanation for this finding, and is worth consideration in any future research.

'Coloured' intake was consistently lower than that of Whites for all ages, for each of the three categories of water used in this work, namely:

(i) local tap water

(ii) non-local tap water (commercial beverages)

(iii) water bound in food.

This is clearly illustrated in Figures 4 to 7 and again implies that there was no gross bias in reporting. It must also be pointed out, that the validity of the information on the questionnaires was checked by independent field workers, in order to eliminate under- or over-reporting.

Similar trends of intake were found for individuals up to the age of 11 for all groups, followed by very divergent trends for each group from then on. This phenomenon was also reported in the British study. The largest difference between the two main cultural groups was found between the ages 18 to 30, particularly amongst males. Alcohol intake of the young working male may well be a predominant feature of this.

Trends of intake by age for 'Coloureds' for tap water intake and total liquid intake were found to be very similar to those in the British study, and the actual consumption figures are very comparable.

Consumption was found to be greater during summer than during winter for all groups and for both sexes. This was to be expected, and was also a finding of the survey in Britain.

Although consumption of liquids increased on Friday evenings and during Saturdays, there was no apparent pronounced weekend effect amongst White males and females.

Unfortunately, it was not possible to obtain weekend data for 'Coloureds'.

The ratio of the consumption of tap water at home to the total water consumed, is approximately 0.5. Although the absolute amounts consumed vary widely between the groups, this ratio is much more stable.

In any experimental design to ascertain the health effects of water consumption, which is based on the residential address of the individuals in the population, this ratio would be a confounding factor.

In spite of the lack of reporting alcohol intake amongst the 'Coloured' population, it is not apparent that there should be a selective bias to under-report liquids. The interviewers recorded total intake, and the 'solid' food intake (as reflected by the protein consumption figures) was very comparable to other local studies. Furthermore, the intake of liquids was more accurately determined than the intake of protein rich foods. This was by virtue of the fact that the volumes of the drinking vessels could be measured, whereas most 'solid' foods were assessed in terms of household measures.

This study has been carried out in the greater Cape Town area. It would have to be replicated in other areas to ascertain whether the values obtained for liquid consumption are representative of the country as a whole.

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APPENDIX A

DETAILED NUMERICAL TABULATIONS OF LIQUID CONSUMPTION BY SOCIO-ECONOMIC GROUP, SEASON AND SEX

TABLES A1 - A12

TABLE A1 TOTAL TAP WATER CONSUMED (mℓ/hd.d)
DISTRIBUTION BY SOCIO-ECONOMIC GROUP, SEASON AND SEX

	Winter Survey (1983)			Summer Survey (1984)		
	Male	Female	Both	Male	Female	Both
High Income White	882	1071	984	1184	1285	1237
Low Income White	1526	1533	1529	1513	1309	1404
High Income 'Coloured'	886	873	879	830	819	824
Low Income 'Coloured'	723	806	766	820	806	812
All Groups	1060	1124	1098	1127	1091	1108

TABLE A2 TOTAL COMMERCIAL BEVERAGES CONSUMED (mℓ/hd.d)
DISTRIBUTION BY SOCIO-ECONOMIC GROUP, SEASON AND SEX

	Winter Survey (1983)			Summer Survey (1984)		
	Male	Female	Both	Male	Female	Both
High Income White	216	98	152	329	163	242
Low Income White	246	98	168	423	210	309
High Income 'Coloured'	141	95	115	224	115	165
Low Income 'Coloured'	208	112	159	154	93	120
All Groups	203	98	146	292	149	216

TABLE A3 TOTAL WATER BOUND IN FOOD CONSUMED (mℓ/hd.d)
DISTRIBUTION BY SOCIO-ECONOMIC GROUP, SEASON AND SEX

	Winter Survey (1983)			Summer Survey (1984)		
	Male	Female	Both	Male	Female	Both
High Income White	827	629	719	858	634	740
Low Income White	530	398	461	683	510	591
High Income 'Coloured'	318	258	285	370	299	332
Low Income 'Coloured'	189	180	184	236	220	227
All Groups	531	411	466	572	435	499

TABLE A4 MEAN TOTAL LIQUID CONSUMED (mℓ/hd.d)
DISTRIBUTION BY SOCIO-ECONOMIC GROUP, SEASON AND SEX

	Winter Survey (1983)			Summer Survey (1984)			Percent. Increase
	Male	Female	Both	Male	Female	Both	
High Income White	1925	1799	1857	2372	2083	2220	19.5
Low Income White	2303	2030	2160	2620	2031	2306	6.8
High Income 'Coloured'	1346	1226	1280	1425	1233	1322	3.3
Low Income 'Coloured'	1120	1099	1109	1211	1119	1160	4.6
All Groups	1803	1634	1712	1992	1677	1824	6.5

TABLE A5 TAP WATER CONSUMED AT HOME (mℓ/hd.d)
DISTRIBUTION BY SOCIO-ECONOMIC GROUP, SEASON AND SEX

	Winter Survey (1983)			Summer Survey (1984)		
	Male	Female	Both	Male	Female	Both
High Income White	704	962	844	869	1121	1002
Low Income White	1198	1355	1280	1172	1109	1139
High Income 'Coloured'	723	790	760	636	701	671
Low Income 'Coloured'	585	678	633	702	738	722
All Groups	852	1002	932	876	951	916

TABLE A6 TAP WATER CONSUMED AWAY FROM HOME (mℓ/hd.d)
DISTRIBUTION BY SOCIO-ECONOMIC GROUP, SEASON AND SEX

	Winter Survey (1983)			Summer Survey (1984)		
	Male	Female	Both	Male	Female	Both
High Income White	177	108	140	315	163	235
Low Income White	327	178	249	340	200	265
High Income 'Coloured'	162	82	118	193	117	153
Low Income 'Coloured'	137	128	132	118	67	90
All Groups	216	122	165	251	139	191

TABLE A7 COMMERCIAL BEVERAGES CONSUMED AT HOME (mℓ.hd.d)
DISTRIBUTION BY SOCIO-ECONOMIC GROUP, SEASON AND SEX

	Winter Survey (1983)			Summer Survey (1984)		
	Male	Female	Both	Male	Female	Both
High Income White	146	81	111	217	132	172
Low Income White	157	67	110	292	155	219
High Income 'Coloured'	91	75	82	133	83	106
Low Income 'Coloured'	108	68	88	117	78	95
All Groups	130	74	100	199	116	155

TABLE A8 COMMERCIAL BEVERAGES CONSUMED AWAY FROM HOME (mℓ/hd.d)
DISTRIBUTION BY SOCIO-ECONOMIC GROUP, SEASON AND SEX

	Winter Survey (1983)			Summer Survey (1984)		
	Male	Female	Both	Male	Female	Both
High Income White	69	17	41	112	31	69
Low Income White	88	31	58	131	54	90
High Income 'Coloured'	49	19	33	90	32	59
Low Income 'Coloured'	56	44	71	36	14	24
All Groups	72	24	46	93	33	61

TABLE A9 WATER BOUND IN FOOD CONSUMED AT HOME (mℓ/hd.d)
DISTRIBUTION BY SOCIO-ECONOMIC GROUP, SEASON AND SEX

	Winter Survey (1983)			Summer Survey (1984)		
	Male	Female	Both	Male	Female	Both
High Income White	694	570	627	726	539	627
Low Income White	451	325	385	566	429	493
High Income 'Coloured'	255	224	238	307	237	270
Low Income 'Coloured'	143	142	142	192	188	190
All Groups	443	357	397	477	367	419

TABLE A10 WATER BOUND IN FOOD CONSUMED AWAY FROM HOME (mℓ/hd.d)
DISTRIBUTION BY SOCIO-ECONOMIC GROUP, SEASON AND SEX

	Winter Survey (1983)			Summer Survey (1984)		
	Male	Female	Both	Male	Female	Both
High Income White	132	59	92	131	94	112
Low Income White	79	73	76	117	81	98
High Income 'Coloured'	62	33	46	62	61	62
Low Income 'Coloured'	45	37	41	43	31	37
All Groups	88	53	69	94	68	80

TABLE A11 TOTAL LIQUID CONSUMED AT HOME (mℓ/hd.d)
DISTRIBUTION BY SOCIO-ECONOMIC GROUP, SEASON AND SEX

	Winter Survey (1983)			Summer Survey (1984)		
	Male	Female	Both	Male	Female	Both
High Income White	1546	1613	1582	1813	1793	1803
Low Income White	1807	1748	1776	2031	1694	1851
High Income 'Coloured'	1071	1091	1082	1078	1021	1048
Low Income 'Coloured'	837	889	864	1013	1004	1008
All Groups	1426	1434	1430	1553	1435	1491

TABLE A12 TOTAL LIQUID CONSUMED AWAY FROM HOME (mℓ/hd.d)
DISTRIBUTION BY SOCIO-ECONOMIC GROUP, SEASON AND SEX

	Winter Survey (1983)			Summer Survey (1984)		
	Male	Female	Both	Male	Female	Both
High Income White	379	185	274	559	289	417
Low Income White	495	282	383	589	336	454
High Income 'Coloured'	275	135	198	346	211	274
Low Income 'Coloured'	283	210	245	198	114	152
All Groups	376	200	281	438	241	333

APPENDIX B

DETAILED NUMERICAL TABULATIONS OF LIQUID CONSUMPTION BY AGE, SEX AND POPULATION GROUP

TABLES B1 - B13

Note: There is some loss of precision in estimating the standard error of the mean (SEM) because the sample used in this survey was not a simple random one but was clustered within households. Jacknife statistical techniques indicate this loss of precision to be less than 25%. In this appendix the SEM has been calculated assuming simple random sampling. To include the effect of clustering, multiply these values by 1.25.

TABLE B1 TAP WATER CONSUMED AT HOME (mℓ/hd.d)
DISTRIBUTION BY AGE, SEX AND POPULATION.GROUP

WHITE MALE:

AGE GROUP:	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	508	490	709	986	1089	1037	1368
Standard Error of the Mean	146	62	55	55	81	43	81
Number of Persons in the Survey	10	50	125	137	118	268	89

WHITE FEMALE:

AGE GROUP:	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	261	484	599	866	1211	1426	1377
Standard Error of the Mean	90	59	46	50	66	44	83
Number of Persons in the Survey	12	47	129	110	157	353	97

COLOURED MALE:

AGE GROUP:	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	595	388	526	797	734	838	848
Standard Error of the Mean	80	42	24	52	47	52	61
Number of Persons in the Survey	22	56	106	62	128	100	45

COLOURED FEMALE:

AGE GROUP	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	518	385	503	692	764	985	928
Standard Error of the Mean	96	34	28	35	33	47	48
Number of Persons in the Survey	24	46	92	81	166	146	60

TABLE B2 TAP WATER CONSUMED AWAY FROM HOME (mℓ/hd.d)
DISTRIBUTION BY AGE, SEX AND POPULATION GROUP

WHITE MALE:

AGE GROUP:	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	68	44	91	118	444	468	249
Standard Error of the Mean	68	18	17	24	52	31	44
Number of Persons in the Survey	10	50	125	137	118	268	89

WHITE FEMALE:

AGE GROUP:	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	79	67	82	112	207	197	170
Standard Error of the Mean	63	28	14	21	35	17	36
Number of Persons in the Survey	12	47	129	110	157	353	97

COLOURED MALE:

AGE GROUP:	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	26	5	68	94	241	228	217
Standard Error of the Mean	21	3	12	34	24	27	50
Number of Persons in the Survey	22	56	106	62	128	100	45

COLOURED FEMALE:

AGE GROUP	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	24	12	37	66	164	98	33
Standard Error of the Mean	24	7	7	13	19	19	12
Number of Persons in the Survey	24	46	92	81	166	146	60

TABLE B3 COMMERCIAL BEVERAGES CONSUMED AT HOME (mℓ/hd.d)
DISTRIBUTION BY AGE, SEX AND POPULATION GROUP

WHITE MALE:

AGE GROUP:	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	6	54	153	208	228	246	199
Standard Error of the Mean	3	10	25	24	33	25	37
Number of Persons in the Survey	10	50	125	137	118	268	89

WHITE FEMALE:

AGE GROUP:	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	17	67	121	144	89	122	61
Standard Error of the Mean	9	14	16	20	11	11	10
Number of Persons in the Survey	12	47	129	110	157	353	97

COLOURED MALE:

AGE GROUP:	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	23	40	98	141	161	112	70
Standard Error of the Mean	14	6	10	18	24	21	16
Number of Persons in the Survey	22	56	106	62	128	100	45

COLOURED FEMALE:

AGE GROUP	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	3	49	104	123	77	66	41
Standard Error of the Mean	1	7	11	17	9	8	6
Number of Persons in the Survey	24	46	92	81	166	146	60

TABLE B4 COMMERCIAL BEVERAGES CONSUMED AWAY FROM HOME (mℓ/hd.d)
DISTRIBUTION BY AGE, SEX AND POPULATION GROUP

WHITE MALE:

AGE GROUP:	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	.9	13	24	72	266	118	31
Standard Error of the Mean	.9	9	6	13	48	16	21
Number of Persons in the Survey	10	50	125	137	118	268	89

WHITE FEMALE:

AGE GROUP:	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	.1	23	45	26	72	22	7
Standard Error of the Mean	.1	14	12	7	15	5	3
Number of Persons in the Survey	12	47	129	110	157	353	97

COLOURED MALE:

AGE GROUP:	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	.02	.6	14	95	75	105	45
Standard Error of the Mean	.01	.4	3	25	12	24	16
Number of Persons in the Survey	22	56	106	62	128	100	45

COLOURED FEMALE:

AGE GROUP	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	.02	7	14	20	39	14	28
Standard Error of the Mean	.02	7	5	6	7	6	14
Number of Persons in the Survey	24	46	92	81	166	146	60

TABLE B5 WATER BOUND IN FOOD CONSUMED AT HOME (mℓ/hd.d)
DISTRIBUTION BY AGE, SEX AND POPULATION GROUP

WHITE MALE:

AGE GROUP:	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	333	636	706	727	577	537	592
Standard Error of the Mean	161	54	37	51	38	27	42
Number of Persons in the Survey	10	50	125	137	118	268	89

WHITE FEMALE:

AGE GROUP:	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	370	610	582	553	401	431	418
Standard Error of the Mean	121	44	37	43	22	15	34
Number of Persons in the Survey	12	47	129	110	157	353	97

COLOURED MALE:

AGE GROUP:	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	157	287	173	230	236	287	180
Standard Error of the Mean	59	35	16	20	21	28	18
Number of Persons in the Survey	22	56	106	62	128	100	45

COLOURED FEMALE:

AGE GROUP	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	183	317	177	183	178	225	226
Standard Error of the Mean	53	33	15	19	14	16	33
Number of Persons in the Survey	24	46	92	81	166	146	60

TABLE B6 WATER BOUND IN FOOD CONSUMED AWAY FROM HOME (mℓ/hd.d)
DISTRIBUTION BY AGE, SEX AND POPULATION GROUP

WHITE MALE:

AGE GROUP:	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	30	44	68	65	161	159	111
Standard Error of the Mean	30	13	12	13	26	15	24
Number of Persons in the Survey	10	50	125	137	118	268	89

WHITE FEMALE:

AGE GROUP:	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	.3	63	79	67	108	74	59
Standard Error of the Mean	.3	22	11	14	19	8	12
Number of Persons in the Survey	12	47	129	110	157	353	97

COLOURED MALE:

AGE GROUP:	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	2	20	36	49	64	83	72
Standard Error of the Mean	2	10	6	20	10	17	19
Number of Persons in the Survey	22	56	106	62	128	100	45

COLOURED FEMALE:

AGE GROUP	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	1	12	12	36	74	29	13
Standard Error of the Mean	1	8	8	9	11	5	6
Number of Persons in the Survey	24	46	92	81	166	146	60

TABLE B7 TOTAL LIQUID CONSUMED AT HOME (mℓ/hd.d)
DISTRIBUTION BY AGE, SEX AND POPULATION GROUP

WHITE MALE:

AGE GROUP:	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	848	1181	1569	1922	1985	1820	2160
Standard Error of the Mean	162	66	56	68	93	57	92
Number of Persons in the Survey	10	50	125	137	118	268	89

WHITE FEMALE:

AGE GROUP:	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	649	1162	1304	1564	1702	1980	1858
Standard Error of the Mean	148	69	51	62	74	48	95
Number of Persons in the Survey	12	47	129	110	157	353	97

COLOURED MALE:

AGE GROUP:	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	776	715	798	1169	1132	1237	1099
Standard Error of the Mean	80	42	31	56	58	61	63
Number of Persons in the Survey	22	56	106	62	128	100	45

COLOURED FEMALE:

AGE GROUP	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	697	752	785	999	1020	1277	1196
Standard Error of the Mean	428	41	32	43	36	49	54
Number of Persons in the Survey	24	46	92	81	166	146	60

TABLE 88 TOTAL LIQUID CONSUMED AWAY FROM HOME (mℓ/hd.d)
DISTRIBUTION BY AGE, SEX AND POPULATION GROUP

WHITE MALE:

AGE GROUP:	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	100	102	184	256	872	747	392
Standard Error of the Mean	100	30	26	38	83	42	66
Number of Persons in the Survey	10	50	125	137	118	268	89

WHITE FEMALE:

AGE GROUP:	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	79	155	207	205	389	294	237
Standard Error of the Mean	63	43	27	33	52	24	45
Number of Persons in the Survey	12	47	129	110	157	353	97

COLOURED MALE:

AGE GROUP:	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	29	26	120	240	380	416	336
Standard Error of the Mean	23	13	16	55	31	48	63
Number of Persons in the Survey	22	56	106	62	128	100	45

COLOURED FEMALE:

AGE GROUP	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	25	32	77	122	278	143	75
Standard Error of the Mean	25	17	12	17	28	25	28
Number of Persons in the Survey	24	46	92	81	166	146	60

TABLE B9 TOTAL LIQUID CONSUMED (mℓ/hd.d)
DISTRIBUTION BY AGE, SEX AND POPULATION GROUP

WHITE MALE:

AGE GROUP:	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	948	1283	1753	2179	2768	2568	1552
Standard Error of the Mean	148	67	58	80	113	55	106
Number of Persons in the Survey	10	50	125	137	118	268	89

WHITE FEMALE:

AGE GROUP:	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	728	1318	1511	1769	1091	2275	2095
Standard Error of the Mean	149	58	47	65	81	48	88
Number of Persons in the Survey	12	47	129	110	157	353	97

COLOURED MALE:

AGE GROUP:	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	805	742	918	1409	1513	1654	1435
Standard Error of the Mean	81	41	30	69	57	69	67
Number of Persons in the Survey	22	56	106	62	128	100	45

COLOURED FEMALE:

AGE GROUP	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	723	785	862	1121	1298	1420	1271
Standard Error of the Mean	92	39	34	44	36	48	56
Number of Persons in the Survey	24	46	92	81	166	146	60

TABLE B10 TOTAL TAP WATER CONSUMED (mℓ/hd.d)
DISTRIBUTION BY AGE, SEX AND POPULATION GROUP

WHITE MALE:

AGE GROUP:	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	577	534	800	1105	1534	1506	1618
Standard Error of the Mean	146	64	60	64	102	50	83
Number of Persons in the Survey	10	50	125	137	118	268	89

WHITE FEMALE:

AGE GROUP:	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	340	552	682	978	1418	1624	1548
Standard Error of the Mean	131	62	47	53	76	45	82
Number of Persons in the Survey	12	47	129	110	157	353	97

COLOURED MALE:

AGE GROUP:	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	622	393	594	892	976	1066	1066
Standard Error of the Mean	82	42	25	54	49	60	62
Number of Persons in the Survey	22	56	106	62	128	100	45

COLOURED FEMALE:

AGE GROUP	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	535	398	540	758	928	1084	962
Standard Error of the Mean	101	34	28	38	36	46	47
Number of Persons in the Survey	24	46	92	81	166	146	60

TABLE B11 TOTAL COMMERCIAL BEVERAGES CONSUMED (mℓ/hd.d)
DISTRIBUTION BY AGE, SEX AND POPULATION GROUP

WHITE MALE:

AGE GROUP:	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	7	68	177	280	494	365	230
Standard Error of the Mean	3	13	25	29	62	29	44
Number of Persons in the Survey	10	50	125	137	118	268	89

WHITE FEMALE:

AGE GROUP:	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	17	91	167	170	162	145	69
Standard Error of the Mean	9	18	20	21	20	12	11
Number of Persons in the Survey	12	47	129	110	157	353	97

COLOURED MALE:

AGE GROUP:	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	23	41	113	237	236	217	116
Standard Error of the Mean	14	6	11	30	26	32	26
Number of Persons in the Survey	22	56	106	62	128	100	45

COLOURED FEMALE:

AGE GROUP	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	3	57	118	144	117	80	70
Standard Error of the Mean	1	9	12	17	11	10	15
Number of Persons in the Survey	24	46	92	81	166	146	60

TABLE B12 TOTAL WATER BOUND IN FOOD CONSUMED (mℓ/hd.d)
DISTRIBUTION BY AGE, SEX AND POPULATION GROUP

WHITE MALE:

AGE GROUP:	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	363	681	774	793	739	696	703
Standard Error of the Mean	157	54	38	52	41	29	52
Number of Persons in the Survey	10	50	125	137	118	268	89

WHITE FEMALE:

AGE GROUP:	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	370	674	662	621	510	505	477
Standard Error of the Mean	121	41	36	42	26	16	33
Number of Persons in the Survey	12	47	129	110	157	353	97

COLOURED MALE:

AGE GROUP:	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	160	307	210	279	300	370	253
Standard Error of the Mean	58	34	17	26	23	33	24
Number of Persons in the Survey	22	56	106	62	128	100	45

COLOURED FEMALE:

AGE GROUP	0	1-4	5-11	12-17	18-30	31-54	55+
Mean Liquid Consumption mℓ/head.day	184	329	203	219	252	255	239
Standard Error of the Mean	53	33	18	21	16	17	33
Number of Persons in the Survey	24	46	92	81	166	146	60

TABLE B13 TOTAL PROTEIN CONSUMED (g/hd.d)
DISTRIBUTION BY AGE, SEX AND POPULATION GROUP

WHITE MALE:

AGE GROUP:	0	1-4	5-11	12-17	18-30	31-54	55+
Mean	54	52	69	91	91	84	77
Standard Error of the Mean	22	5	2	3	3	2	4
Number of Persons in the Survey	10	50	125	137	118	268	89

WHITE FEMALE:

AGE GROUP:	0	1-4	5-11	12-17	18-30	31-54	55+
Mean	28	49	60	63	57	56	54
Standard Error of the Mean	5	2	2	2	2	1	2
Number of Persons in the Survey	12	47	129	110	157	353	97

COLOURED MALE:

AGE GROUP:	0	1-4	5-11	12-17	18-30	31-54	55+
Mean	28	30	45	65	67	64	56
Standard Error of the Mean	3	2	1	5	2	3	4
Number of Persons in the Survey	22	56	106	62	128	100	45

COLOURED FEMALE:

AGE GROUP	0	1-4	5-11	12-17	18-30	31-54	55+
Mean	30	33	44	49	46	46	40
Standard Error of the Mean	8	1	1	2	1	2	2
Number of Persons in the Survey	24	46	92	81	166	146	60

APPENDIX C

DEMOGRAPHIC CHARACTERISTICS OF SAMPLED AREAS

TABLES C1 - C2.

APPENDIX C1 DEMOGRAPHIC CHARACTERISTICS OF SAMPLED AREAS ACCORDING TO THE 1980 CENSUS

Area	Income and Population Group	% Muslim
Surrey Estate	High Income, Coloured	60.8
Greenhaven	High Income, Coloured	60.8
Bonteheuwel	Low Income, Coloured	15.7
Grassy Park	Low Income, Coloured	15.9
Hanover Park	Low Income, Coloured	47.1
Gardens	High Income, White	-
Klandudno	High Income, White	-
Milnerton	High Income, White	-
Brooklyn	Low Income, White	-

Central Statistical Services (1985 a,b)

TABLE C2 POPULATION OF GREATER CAPE TOWN ACCORDING TO THE 1980 CENSUS USED FOR AGE STANDARDIZATION

Age Group	White Male (thousands)	White Female (thousands)	Coloured Male (thousands)	Coloured Female (thousands)
1-4	14.24	13.79	37.06	36.38
5-11	27.31	25.68	66.41	64.06
12-17	23.15	23.83	59.24	56.24
18-30	53.12	53.88	96.84	98.46
31-54	68.54	70.67	86.40	96.54
55+	37.14	52.60	23.71	32.56
Total*	223.51	240.46	369.67	384.23
	463.97		753.90	

*Total over 1 year of age

Interpolated from Central Statistical Services 1985a.

APPENDIX D

SPECIMEN QUESTIONNAIRES:

1. The Placement Questionnaire
2. Questionnaire for Adults and Children
3. Questionnaire for Unweaned Babies

DEPARTMENT OF COMMUNITY HEALTH, UNIVERSITY OF CAPE TOWN

THE PLACEMENT QUESTIONNAIRE

WATER CONSUMPTION SURVEY

Interviewers Name :- ..... Address of Household :-

Date of Interview :- ....

Time of Interview :- From.....To..... .....

Household No. :- .....

---

1. Good morning/afternoon/evening. I've come on behalf of the University of Cape Town. We're conducting a study on the amount and type of foods people eat and drink, in order to find out how much water is being consumed in one form or another.

   Explain that all foods and drinks contain some water, and what a survey is, if necessary.

   The study is being commissioned by the Department of Community Health, and what we would like you, and the members of your family to do, is to give me details of all you had to eat and drink yesterday. This should take about 15 minutes per person.

   This information is strictly confidential and none of it will be linked to any individuals.

   SHOW RESPONDENTS QUESTIONNAIRE, EXPLAINING BRIEFLY HOW IT MUST BE COMPLETED. ASK THE FAMILY TO TAKE PART IN THE SURVEY.

   Willing to participate?

   YES ☐ NO ☐

   If no, reason/s if possible :- .....

   .....

   .....

2. Now I'd just like to collect a few details about yourselves.

RECORD HOUSEHOLD COMPOSITION DETAILS, IN GRID BELOW.

For each member of the household, state :-

(i) their relationship to head of household, e.g. wife,son, cousin, aunt, guest.

(ii) their age in years.

(iii) sex.

(iv) only for infants aged under 3 years - whether fully or partially weaned.

	RELATIONSHIP TO HEAD OF HOUSEHOLD	AGE LAST BIRTHDAY	SEX M	SEX F	INFANTS AGED UNDER 3 YEARS ONLY FULLY WEANED	PARTIALLY WEANED	UNWEANED
1.	Head of Household						
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							
11.							
12.							
13.							
14.							
15.							
16.							

3. Measure glasses

USE FOR CODING ONLY

DEPARTMENT OF COMMUNITY HEALTH, UNIVERSITY OF CAPE TOWN

QUESTIONNAIRE FOR ADULTS AND CHILDREN

24-HOUR RECALL

Interviewer :- ..... Questionnaire No.

Respondent :- ..... Male

Age :- ..... Female

Occupation :- ..... Environment :- .....

Area :- ..... Household No.

Date :- ..... Weekday Recorded .....

RECORD ALL FOOD ITEMS CONSUMED YESTERDAY IN ML. OR HOUSEHOLD MEASURES AS ACCURATELY, AND AS NEATLY AS POSSIBLE

	Food Item		Amount	Home or Away	Preparation :- Homemade? Fresh, frozen, or canned Boiled, fried or baked
Early morning					
At breakfast					
Mid-morning					

	Food Item		Amount	Home or Away	Preparation :- Homemade? Fresh, frozen or canned Boiled, fried or baked	USE FOR CODING ONLY
Lunch						
Afternoon						
At tea time						
Evening meal						
During the evening						

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	Food Item		Amount	Home or Away	Preparation :- Homemade? Fresh, frozen, or canned Boiled, fried or baked
Late at night					
Extras					

Comments :-

Ask respondent how much water was consumed,

Alone :-

With pills :-

After brushing teeth :-

Enter this appropriately.

USE FOR CODING ONLY

DEPARTMENT OF COMMUNITY HEALTH, UNIVERSITY OF CAPE TOWN

QUESTIONNAIRE FOR UNWEANED BABIES

24-HOUR RECALL

Interviewer :- ..... Questionnaire No. [ ][ ][ ][ ]

Respondent :- ..... Male [ ]

Age :- ..... Female [ ]

Area :- ..... Household No. [ ][ ][ ]

Date :- ..... Weekday Recorded .....

POSE THE FOLLOWING QUESTIONS BEFORE RECORDING THE RECALL

---

1. At present, is your baby :-

   breastfed .....

   artificially fed .....

   both .....

2. If artificially fed at all :-

   (Mark only that which is applicable)

   (i) What type of milk do you use?

   fresh .....

   evaporated/condensed/powdered .....

   both .....

   (ii) How many bottles/drinking cups do you give your baby per day? (State number and milk type/s).

   ..... bottle/s of .....

   ..... cup/s of .....

   (iii) What is the capacity of the bottle/s and/or cup/s (in ml)?

   .....

RECORD ALL FOOD ITEMS CONSUMED YESTERDAY IN ML. OR HOUSEHOLD MEASURES AS ACCURATELY AS POSSIBLE

USE FOR CODING ONLY

	Food Item		Amount	Home or Away	Preparation :- Homemade? Fresh, frozen, or canned Boiled, fried or baked
Early morning					
At breakfast					
Mid morning					
Lunch					
Teatime					

	Food Item		Amount	Home or Away	Preparation :- Homemade? Fresh, frozen, or canned Boiled, fried or baked	USE FOR CODING ONLY
Evening meal						
During the evening						
Late at night						

Comments :-

Ask respondent how much water was consumed alone, or with medicine:-

APPENDIX E

SURVEY SAMPLE SIZES

TABLE E1

TABLE E1 SURVEY SAMPLE SIZES

	Winter n=1393		Summer n=1445	
	Males	Females	Males	Females
High Income Whites	198	238	210	234
Low Income Whites	198	220	188	213
High Income Coloured	189	231	88	100
Low Income Coloured	56	60	187	223