

# THE NUTRITIONAL CHALLENGES IN THE NEW SOUTH AFRICA

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## INTRODUCTION

In the Continent of Africa, all populations are poor to very poor; moreover, according to the World Health Organization (Calvani, 1992), impoverishment is likely to increase with diminishing funds and resources available for the combating of disease and the maintenance

of health. An American editorial wrote of 'Africa on the Precipice: an ominous but not yet hopeless future' (Elmore-Meegan & O'Riorden, 1993). A review from South Africa considered the outlook to be not wholly grim (Walker *et al.* 1994c).

South Africa, in most respects, is in a more favourable position than countries in the rest of the Continent. Nevertheless, a recent South African Health Review (Anon. 1995) indicated a distressing situation, which must be appreciated right at the start, as background for the descriptions and discussions which follow. In the Review attention was drawn to the fact that in the African population nearly 25% of households have a monthly income below R300; furthermore 75% of rural African households are living below the minimum wage level of R900 (One rand = 0.30 US dollars, or 0.18 UK pounds). About two-thirds of the African population are affected by poor health conditions, including overcrowding, lack of electricity, clean water and sanitation. Only about 20% of African households have a tap inside the home. Sixteen per cent of households have no toilet of any kind. Approximately 23% said they were too poor to feed their preschool children properly; but only 8% reported receiving food from a health facility.

An increasing proportion of Africans, nearly half the population, live in towns and cities. Among such people disorders/diseases of poverty have decreased; conversely, dental caries, previously very low, is now very high, as is also obesity among women; in addition, hypertension and diabetes are more prevalent than they are in the white population. Clearly, in South Africa, constituent populations, particularly Africans, are undergoing transition in diet and manner of life in varying degrees. This also applies to the Indian and coloured (European–African–Malay) populations, much more so than in the white population.

Hence, in order to portray the nutritional challenges facing the new South Africa, an account must be given of the pattern and severity of nutritionally related disorders/diseases, of insufficiency or imbalance on the one hand, and of excess and/or imbalance on the other. To provide balance and perspective, a description will be given not only of diets and dietary intakes, laboratory data, and associated morbidity/mortality patterns, but mention must also be made of highly important non-dietary factors, each of which has the power to diminish or enhance the benefits resulting from improvements in diet.

Accordingly, the following will be provided.

- (1) A brief history of South Africa's four constituent populations, especially Africans, their numbers, the country's resources, the general socioeconomic state, and the outlook.
- (2) Interethnic vital statistics.
- (3) A brief account, in the interethnic populations, of non-dietary lifestyle factors – poverty, smoking, alcohol consumption, physical inactivity. There will be a brief mention of the situation regarding parasitism and infections. These, of limited relevance in the health/ill-health picture of western populations, can be strongly disadvantageous in the Third World, especially in African populations, and can aggravate the ill-effects of poor diets, and prejudice the beneficial effects of an improved diet.
- (4) An account of past and present diets of the South African interethnic populations, and of the likely trends of their future food consumptions. In each population, some information will be given on laboratory data, reflective of nutritional and other states. In addition, general information will be provided on the respective health/disease patterns, particularly those concerning disorders/diseases of poverty on the one hand, and the lifestyle disorders/diseases of prosperity on the other.

- (5) A discussion regarding the encouragement of populations to conform to a prudent lifestyle, especially respecting diet. Salient questions to be addressed include – would changes, if adopted, really work? To what extent are Western populations complying? In South Africa, is the intended intensive education policy likely to be fruitless in the case of Africans, and of the other populations?
- (6) In the light of all of the information given, an endeavour will be made to set out the practical nutritional challenges to South African populations, principally to Africans, which will be confronted in the 21st century. Additionally, some measures, direct and indirect, which have a bearing on nutritional health/ill-health will be suggested and discussed.

It will be appreciated that the challenges facing South African populations are much the same as those facing other developing populations undergoing transition. Hence, some comparative information will be given on some other populations, developed and developing, when this is likely to add to the perspective of the challenges facing South Africa.

## GENERAL INFORMATION

### GEOGRAPHY

Of the earth's six continents, Africa holds a prominent position. It separates the Indian and Atlantic Oceans. Its land mass extends into the northern and southern hemispheres, and there is a very wide range of climate and therefore of vegetation. South Africa has an area one fifth that of the United States, but five times that of the United Kingdom.

### POPULATIONS AND THEIR HISTORY

Current populations number about 30–35 million Africans, nearly a million Indians, 3 million coloureds, and 5–6 million whites.

#### *The African population*

Historically, three main racial groups once roamed over the Continent (Coetzee, 1982; Van Rensburg, 1995). The Negroid people were black skinned, and left traces of their origin in the Congo basin; brown skinned Hamites stemming from the east lived mainly in the north; and copper skinned Bushmen, Khoisan or San, who can still be traced throughout the Continent; their descendants are nowadays very limited, both in regions of dwelling and in numbers. Contact between Negroes and Hamites resulted in a new race, the Negroid African. These people gradually moved southwards across the Limpopo River, and occupied the luxuriant eastern regions and the central plateau of South Africa. Toward the end of the 18th century, they began to settle in organized groups and then became divided into smaller units, each of which had its own cultural pattern and language. In South Africa, the present African population, as distinct from the San, came from central Africa in the 17th–19th centuries. In the far past the people were hunter-gatherers, who depended on indigenous foods and small game, as do the small groups of present day San or Bushmen living in north-western Botswana. However, within the last 150 years or so the way of life of rural Africans changed to one of pastoralism and dependency subsistence, with the rearing of cattle. It was women who tilled the land, sowed the seed, husbanded the plants, and eventually harvested and threshed the crop. The men were responsible for the cattle.

Unfortunately, erratic rainfall, low soil fertility, no fertilizer and no crop rotation, led to low harvests.

In recent times, major changes have taken place, for many rural Africans now work on white owned farms, or they migrate to towns and cities seeking employment. At present nearly half of the African populations are urban dwellers. Rurally, access to villages has greatly improved. Additional changes to the good include the store, the clinic, the school, improved water supply and transport to towns.

#### *'Squatter' populations*

'Squatter' is a name given to those who have lately arrived in urban centres from rural areas or from neighbouring countries, in search of better living conditions than those which they were experiencing, yet who are finding work and living accommodation almost non-existent. Their informal settlements consist of shacks built on any vacant ground, as near as possible to other habitations. They have little or no running water, no proper sanitation, and their other hygienic conditions are very poor. This population is increasing and numbers about 5 million.

#### *White population*

The arrival and settlement of Europeans in Southern Africa arose in part because many sailors *en route* from Europe to the Far East died from scurvy, due to lack of fresh food during the long voyages. Hence, in 1652, the Dutch East India Company established a settlement at Cape Colony to supply meat and fresh vegetables to the passing ships. The local Bushmen and Hottentots were of insufficient help to keep the gardens in supply, so that slaves were brought from the East to supplement their number. Portuguese, English and French settlers followed with families and they settled in other parts of the Cape. In 1820 a large number of British people settled in Port Elizabeth, and another colony set up in Natal. Friction between the British and Dutch resulted in the Great Trek of 1836–1838 by Dutch farmers (Boers) with their workers, who left the Cape for the Transvaal and Natal. When diamonds were found in Kimberley, and when gold was discovered later on the Witwatersrand, this brought thousands of Europeans of all races in quest of a fortune.

#### *Coloured population*

These people, European–African–Malay, originated from four stocks: slaves brought from East India to the Cape in the early 17th and 18th centuries, Hottentots, Bushmen, and whites. The first two groups made the greatest contribution. Additionally, in recent times there has been interbreeding with the African population. The coloured people, who have evolved over a period of 250 years, while still being modified by outside influences, are now a fairly stable population. For many generations these people have lived in small relatively distinct residential areas scattered throughout South Africa, especially in the Cape Peninsula.

#### *Indian population*

Historically, emigrations of Indians to South Africa took place mainly before or soon after 1900, principally from south and south-east India, from United Provinces and around Bombay. Indians were brought in primarily as workers on sugar plantations. At present, about 70% of the Indian population are Hindu, 20% Muslim, and 10% Christian. Most Indians dwell in cities or in small towns. The majority live in Natal, particularly in the region of Durban.

## FOOD PRODUCTION

The first responsibility of any country/community is to ensure its capacity to feed its population. In this regard South Africa, broadly, produces sufficient food (Van Rensburg, 1995). Recent droughts, however, which appear to be increasing in frequency, have necessitated the importation of a small proportion of its cereal needs, a practice which could well increase with the rise in population. While there is sufficient milk and dairy produce, consumption of milk by Africans is low, and that of butter and cheese very small. Consumption of meat is not large, but it would be higher were the foodstuff less expensive. Potatoes, vegetables and fruit, the supplies of which are ample, are relatively expensive, although this depends on where purchased.

Consumption of cereals and legumes has fallen. However, the dietary trend with Africans will undoubtedly be for still higher intakes of energy, fat, and protein, and a probable increase in vegetables and fruit.

## SOCIOECONOMIC BACKGROUND

In each of the populations there are poor, middle class, and wealthy. Among Africans, especially rural Africans, the poor are in the huge majority. There are also large proportions of poor in the Indian and coloured populations. The same pattern prevails respecting the proportions gainfully employed, large in the case of the white population, but small in the case of Africans.

## VITAL STATISTICS

For perspective, the salient questions are (1) how bad were vital statistics in the past?; (2) what are they like at present? and (3) what is the likely scenario in the future – in both developed and developing populations?

## INFANT MORTALITY RATE AND SURVIVAL

Historically, how bad was the situation in the past? First, in Europe, and regarding young children, in the time of Aristotle in the 5th century B.C. it was said that babies were not named for a week, since 'most' of them had died by then (Jackson, 1988). In the UK in the Middle Ages, according to the historian Barbara Tuchman, one or two out of three children died very young. As late as the mid 1800s, whereas gentlemen had an average age at death of 40 years, that of servants was 16 years (Smith & Egger, 1992). The very low survival time of servants was due to the exceedingly high mortality rate among the very young in that social class. Yet, in both the poor and more especially those better circumstanced, there were many who lived to a good old age. Thus, well known and well off men and women in classical Rome, also during the Renaissance period, have been shown to have enjoyed life spans which are little less than those prevailing at present. Clearly, in both past and present situations, provided a child survived early youth, and lived in fair socioeconomic circumstances, then he/she could certainly live long. Currently, in most western populations, 99% of babies born survive their first birthday. Present expectations of life at birth for men are 70–75 years, and for women 75–80 years. In South African populations, data on the infant mortality rate (IMR) and survival situations are summarized in Table 1 (Walker *et al.* 1994*d*).

Table 1. *Vital statistics of South African populations*

	Infant mortality rate per 1000 live births	Expectation at birth (years)	
		Males	Females
Whites	10	66	74
Indians	15–20	62	68
Coloureds	20–40	54	68
Africans		58	61
Urban	20–25		
Rural	40–80		

Regarding the current IMR, whereas that of the white population is 10/1000 live births, i.e. the mean percentage survival of such infants is about 99%, the IMR of urban African infants is 20–30 (Medical Officer of Health, 1994), i.e. survival is about 97–98%, and the rate is 90–95% even among rural Africans. What a far cry from the low percentages prevailing in past times. The survival data for the coloured and Indian populations are intermediate, 96–98%. However, in South Africa almost certainly a major rise in socioeconomic state and in advancement of health services will be required before the current IMR of Africans in big cities can be reduced to that of the white population. However, the IMR of rural dwellers, 50–100/1000 live births (Kale, 1995), can certainly be reduced.

Expectation of life is now 66–74 years for whites, but about 58–61 years for Africans, the values for the other two populations being intermediate (Kale, 1995). Comparative expectations of adults (both sexes) in poorer populations elsewhere are 69 years in Jamaica and China, but 60 years for Iran and Saudi Arabia, both oil-rich countries (Feachem, 1988). In the US, that of African Americans is still 8–10 years less than that of the white population (Keil *et al.* 1992). That of Aborigines in Australia is reported to be 10–20 years less than that of the general population (Smith & Douglas, 1995).

In brief, improvements in vital statistics in all South African interethnic populations are gratifying, but considerable improvement could still be made in rural Africans.

## NON-DIETARY FACTORS INFLUENCING HEALTH/ILL-HEALTH

### POVERTY

In all countries, whether in First World or Third World, the well circumstanced experience better health than the poor, and this dichotomy is increasing. As an example, in the combating of cancer in the US it has been asked 'Does war on cancer equal war on poverty?' (Gibbons, 1991). It was stated that Afro-Americans incur more cancer, not essentially because they are African, but because they are poor. When adjustment is made for income and education, the Africans have a lower cancer rate.

In African populations as a whole impoverishment hinders efforts to combat both infections and the diseases of nutritional deficiency and imbalance. The Government's feeding programme has not yet reached a substantial proportion of children. In the other populations, certainly there are proportions who are in dire need, but far less so than in the case of the African population (Medical Officer of Health, 1994).

There are high rates of crime, especially among the poor, a large proportion of whom are unemployed.

## SMOKING

The practice is associated with a higher risk of lung and of other cancers as well as coronary heart disease (CHD) and other diseases. In the US, smoking prevalences in white men and women are 28.6 and 24.6%, and in Afro-American men and women 27.2% and 27.8% (Anon. 1994a). Rates of years of potential life lost before 65 years due to smoking are twice as high for Afro-American men than for white men. There has been a marked fall in men and women, but no fall has been observed in US children (Devine & Vickers, 1995). In Swiss school pupils, smoking frequency is higher than it was in the past generation (McGregor, 1995).

In African populations, smoking used to be very uncommon, particularly among women. During 1971–1981, tobacco consumption rose by 41.5%, exceeding population growth, 23.4% (World Health Organization, 1987). In South Africa, in present day African adolescents, 23.7% of boys smoke, but only 0.8% of girls; among African men and women the proportion is 60% and 17% respectively (Strebel *et al.* 1989). Smoking intensity rises with increase in socioeconomic status.

In the other populations, the proportions of smokers, men and women, are: whites, 40.6 and 29.3%; coloureds, 49.7 and 33.0%; and Indians, 55.4 and 3.2% (Yach & Townshend, 1988).

## ALCOHOL

A high alcohol intake is associated, *inter alia*, with liver cirrhosis and the development of certain cancers. In Afro-Americans, the extent is similar to that in the white population (Klatsky *et al.* 1992). Interestingly, in the Russian Federation, primarily because of a major rise in alcohol consumption, the survival time of men has fallen to 59 years, the lowest of any developed country (Ryan, 1995).

In Africa, between 1961 and 1981, beer consumption in 15-year-olds rose six-fold (Oxorio, 1992). Consumption is rising considerably in some of the countries, although less so in others. During a WHO seminar held in Lagos, Nigeria, to discuss the problems of drug abuse in Africans, virtually all African participants singled out alcohol as the drug which was causing the most serious health and socioeconomic problems (Chinyadza *et al.* 1993). In Zimbabwe, alcohol consumption is increasing rapidly (McMaster, 1994). In South Africa, many authors have emphasized the enormous ill-health cost and suffering, and the likelihood of alcohol consumption rising further, especially among urban dwellers (Seftel, 1985). In rural and urban areas, while consumption of traditional cereal-based alcohol drinks, e.g. sorghum beer, still remains high, they are being replaced increasingly by western alcoholic drinks. Consumption is limited by cost (Seftel, 1985).

In the other populations, alcohol consumption is very high in coloured males and females; it is far less so among Indian females compared with males (Seftel, 1985).

## INACTIVITY

A low level of physical activity promotes the development of obesity, CHD, osteoporosis, and certain cancers – breast, colon, and prostate. Most western populations are almost wholly sedentary, compared with the high level of habitual activity of their ancestors (Pate *et al.* 1995). At present, a low and diminishing level of activity in school children has often been reported. In one recent study on adolescents, only 50% of boys and 30% of girls could do more than one pull-up (Committee on Sports Medicine & Committee on School Health, 1987). Rural Africans, and a large proportion of urban Africans, are very active physically. Many rural school children walk long distances to attend school, often 5–6 miles



daily (Walker *et al.* 1993*a*). Understandably, for the many urban dwellers employed in commerce and industry, the level of physical activity has fallen.

In the other populations, only small proportions can be considered physically active.

## PARASITISM AND INFECTIOUS DISEASES

### *Parasitism*

Helminthic infections include schistosomiasis, ascariasis, trichuriasis and ankylostomiasis, all of which are more common in some regions than in others. Helminthic infections, urinary and intestinal, affect a large proportion of the world's population, particularly Third World dwellers, especially those in Africa. Blood loss and hence iron loss, from hookworm and from *Schistosoma haematobium* infections, undoubtedly causes iron depletion, with associated anaemia (Walker & Walker 1994). Heavy infections are likely to diminish appetite, possibly cause malabsorption, and diminish physical activity and cognitive function. Unfortunately, definitive studies are few, so that specific allocation of blame for morbidity, whether due to helminthiasis, unsatisfactory diet, or other disadvantageous environmental factors, must be made with caution. It is important to note that despite the large proportions of African populations affected, evidence indicates that meaningful disabilities are demonstrable only in the heavily infected moieties. Unfortunately, apart from blood loss, information is limited regarding the loss of other nutrients, due to decreased appetite, from malabsorption, or for other reasons. That there are disadvantages in the heavily infected respecting impairment of activity and of cognitive function is undoubted. However, it is important to note that numerous reviews have cautioned against drawing firm conclusions over allocations of blame for disabilities, and virtually all writers urge the need for further research. This was also emphasized in a recent Report of a WHO Expert Committee (World Health Organization 1993*b*).

Recent research has produced excellent drugs and has greatly simplified therapeutic procedures (Warren, 1991). Unfortunately, re-infection always occurs (Hall *et al.* 1992). While intensive education is required on water supply, sanitation, and hygiene practices, the fact that impoverishment in Africa is nearly universal limits efforts to decrease infections. Obviously, greater accessibility to non-infected water is an indispensable public health measure. Research is needed on the maximum levels of helminthic infections which are still consistent with everyday good health (Walker & Walker 1994).

### *Infectious diseases*

Gastroenteritis, with protein-energy malnutrition, is a common cause of very young African children being admitted to rural hospitals (Walker *et al.* 1994*a*). Tuberculosis is a very common infection, possibly worsening; the rate detected is ten times higher than that in the white population (Steenkamp, 1991; Kale, 1995). Of tropical diseases, malaria is common regionally; there are about 10000 cases/year (Sharp & Freese, 1995).

### *Viruses*

Viruses include hepatitis B, which is becoming increasingly common, and promotes liver cancer. Human papilloma virus is also common and promotes cervical cancer (Herrero *et al.* 1990). The prevalence of persons infected with AIDS is rising. At Baragwanath Hospital, Soweto, Johannesburg, 6% of those admitted are infected. The proportion is 15% in Zambia. In Kwa-Zulu Natal, the proportion is also 15% (Sidley 1995). In Malawi, blood donors were found to be 35% positive for HIV (Van der Plas, 1995). The ramifications of this rising rate are of tremendous importance to national health/ill-health and prosperity.

*Comment*

As will have been apparent, any one of the non-dietary factors listed can aggravate the bad effects of a poor diet, and can lessen the positive effects of a good or improved diet.

**DIETARY PATTERNS AND INTAKES, LABORATORY VALUES,  
AND HEALTH/ILL-HEALTH CHARACTERISTICS****AFRICANS: RURAL AND URBAN***Indigenous foods*

In Africa, indigenous foods used to be the sole source of nourishment for all populations, especially of the hunter-gatherer type, but with the immigration of western populations, particularly to Southern Africa, the African diet has changed with the gradual introduction of processed foods, e.g. refined cereal products and sugar, and certain new vegetables and fruits (Walker & Stein, 1985).

In the past, cereal foods included *Sorghum vulgare* (kaffir corn), millet and, since the late 1800s, maize, which increasingly has replaced the former cereals (Coetzee, 1982). These grains were crushed by pounding, using a smooth stone and grinding stone, or by using wooden pestle and hollowed out tree trunk. Legumes included juko beans, mung beans, cow peas, and groundnuts. Vegetables and fruits included kaffir melon, watermelon, gourd, pumpkin. Among edible wild plants there were pigweed, purslane, lamb quarters, Black Jack. Edible wild fruits included sour plum, wild plum, Monkey apple, Kei apple, prickly pear. Of edible insects there were caterpillars, beetles, ants, and locusts. Other foods were honey, wild birds, and small game. This list of foodstuffs, in pattern, is much the same as are available in other rural populations in Africa.

Of indigenous foods, cereals contribute most of the carbohydrate and protein. Beans are high in fat and protein. Many of the plant foods are rich sources of minerals, especially calcium and iron, and of vitamins, especially vitamins A, B complex and C.

Dishes were prepared from green or dried mealies (maize), and samp, which is coarsely ground maize. Porridges (gruels) were made from mealie meal, millet, sorghum, and mealie rice, with fermented milk. Cereals were also made into dumplings. Simple dishes were stewed unripe sorghum or mealie ears, whole grain stews, and cooked cereal with sour milk. Cereals were also cooked with various mixtures of vegetables. Dried vegetable leaves (*morogo*) and mushrooms were consumed in season. Numerous dishes included beans and groundnuts. For meat there were wild birds, rodents and insects. Beverages included milk, mostly sour, light cereal beer, strong (intoxicating) beer, and other potent traditional beers.

*Hunter-Gatherers, Bushmen, Khoisan, San*

Among these people, there were differences regionally regarding the nature of the foodstuffs gathered. Of the most common foods were the fruit and nut of the mongongo tree; the tsi bean, a tuber weighing up to 10 kg, with seeds; the tsa plant, with its root swellings; and the all-purpose tsama melon (Lee, 1973). The latter was very important throughout low rainfall areas like the Kalahari Desert on account of its high water content. Mongongo flesh is a good source of carbohydrate, and the nut and tsi bean are good sources of fat and protein. On an average day, food collection habits were as follows. The women would gather wild leaves, fruits, roots, bulbs and water. The latter was often found in small quantities in forks of trees, and the wild melon pulp contained very large amounts of water. Water was reserved in ostrich eggs, and used only in cases of dire necessity. Rodents, snakes, tortoise and grubs were also found by the women. The men hunted

usually small animals. The food gathered was shared among all members of a group. This occurred especially when a large animal was killed. On such occasions, after eating, the people would spend the night in dancing. This sharing of food had very strong effects on the social organization within the group. Plant foods were not shared to the same extent.

In 1987 Hansen *et al.* (1993) carried out a health study on a population in the Dobe region; included in the sample were a number of the individuals who had been examined 10 years previously. The diet remained similar to that consumed formerly. There were fewer children below the 5th percentile of US National Center for Health Statistics (NCHS) reference standards (Hamill *et al.* 1979); the proportion was 5% in 1987, compared to 15% in 1976. This observation thus indicated a positive secular trend in height and weight, which has been associated with a measure of change from a hunting and gathering lifestyle to one of semi-pastoralism. The change described suggests that the shorter height of San is nutritionally rather than genetically determined. There was little evidence of acute malnutrition or starvation. The mean heights of men and women had increased significantly from those noted previously. Mean weight and body mass index (BMI) had increased, for men, from 47.9 to 48.9 kg and from 18.2 to 19.1 respectively, and for women from 40.8 to 42.6 kg and from 17.8 to 19.0, respectively. There was no rise in average blood pressure levels.

The children all appeared bright and healthy. Both children and adults were lean, and appeared to be in good health with no evidence of specific nutritional disease. The skin, hair and mucous membranes showed no abnormality, and there was no clinical evidence of anaemia. The teeth were worn, often down to the gums, but there was very little caries. Examination of the cardiovascular and central nervous systems revealed no abnormality. Characteristically, the women who were engaged in food gathering must have been very active. Their good state of health is likely to reflect their isolation from infections common to villages or other settlements as well as the somewhat increasing amount of food consumed.

*Comment on hunter-gatherers.* From the information given, it is clear that a higher measure of everyday good health is compatible with the diet and manner of existence of those San who still subsist as in the past. In strong contrast (O'Keefe & Lavender, 1989), the plight of the modern San in Namibia is grave and their future bleak. This population, in a more settled existence with access to other foods (e.g. refined cereals, sugar, etc.), is not likely to survive as an independent ethnic group. Almost inevitably they will become absorbed into local African communities, with deterioration in health, as the above authors reported.

#### *Settled rural dwellers*

A study of rural Venda adults, living in the Northern Province, has been made by Vorster *et al.* (1994). A porridge of maize meal and *morogo* (green leafy vegetable) is eaten more than once daily, sometimes alternately with other traditional maize dishes. The mixture was cooked with beans, peanuts or pumpkin. Peanuts, which are locally grown, are well liked and eaten often. Tea is the usual beverage. Brown bread is available sometimes, and is taken daily by some, without the addition of margarine or other fat. Dried mopani worms are considered a great delicacy by half of the local population and are taken once a week or so. Locusts, abundant in the spring, are eaten by nearly half the population. When available, some fruits are eaten four or five times a week, a remarkable change from the past. Most people drank *maphapfe*, which is home brewed beer, and *mabundu*, which is a thin fermented maize porridge; these are taken intermittently throughout the day, starting at breakfast time. Fish is eaten seldom, once or twice a month. Rice is eaten on Sundays.

Table 2. Mean ( $\pm$ SD) macro- and micro-nutrients in the diet of Venda Africans

Nutrient	Men (n = 20)	Women (n = 41)
Age (years)	36.6 $\pm$ 10.0	33.0 $\pm$ 6.9
Total energy (E) intake (kJ)	8.5 $\pm$ 4.3	8.1 $\pm$ 3.9
Total protein (g)	67.5 $\pm$ 28.6	66.1 $\pm$ 26.3
Plant protein (g)	45.6 $\pm$ 20.0	49.8 $\pm$ 18.4
Protein (% E)	13.2 $\pm$ 3.7	13.2 $\pm$ 2.7
Animal protein (g)	21.9 $\pm$ 17.1	16.3 $\pm$ 17.1
Total fat (g)	35.8 $\pm$ 20.4	49.7 $\pm$ 31.6
Fat (% E)	16.0 $\pm$ 8.7	23.3 $\pm$ 8.0
Saturated fatty acids (g)	8.6 $\pm$ 5.7	11.3 $\pm$ 8.6
Monounsaturated fatty acids (g)	11.4 $\pm$ 7.3	15.4 $\pm$ 10.8
Polyunsaturated fatty acids (g)	9.9 $\pm$ 6.1	14.5 $\pm$ 9.6
Cholesterol (mg)	111.6 $\pm$ 117.3	111.4 $\pm$ 192.3
Total carbohydrate (g)	303.6 $\pm$ 141.0	265.3 $\pm$ 80.1
Carbohydrate (% E)	60.8 $\pm$ 9.7	55.5 $\pm$ 8.8
Added sucrose (g)	21.7 $\pm$ 34.8	25.6 $\pm$ 22.7
Dietary fibre (g)	21.6 $\pm$ 11.2	24.3 $\pm$ 9.9
Calcium (mg)	634.0 $\pm$ 252	633.0 $\pm$ 282
Iron (mg)	21.4 $\pm$ 8.7	21.6 $\pm$ 8.1
Vitamin A (RE)	1400 $\pm$ 744	2192.0 $\pm$ 1646
Thiamin (mg)	1.7 $\pm$ 0.7	1.5 $\pm$ 0.5
Riboflavin (mg)	1.7 $\pm$ 1.0	1.3 $\pm$ 0.5
Niacin (mg)	17.8 $\pm$ 10.3	18.9 $\pm$ 9.6
Vitamin B <sub>6</sub> (mg)	0.5 $\pm$ 0.3	0.7 $\pm$ 0.6
Folic acid ( $\mu$ g)	77.7 $\pm$ 56.1	126.0 $\pm$ 86.5
Ascorbic acid (mg)	38.6 $\pm$ 29.3	54.6 $\pm$ 40.5

RE, retinol equivalents.

Meat, chicken, beef, or goat, also eggs, are eaten two or three times a week. Wild plants or 'spinaches' (*imifino*), in season, are important articles of diet. The nutrient composition of the diet is given in Table 2.

As would be expected, consumption of carbohydrate is high. In only 6 out of 61 subjects studied did carbohydrate supply less than 70% of energy. The intake of dietary fibre was not as high as expected, an average of 21 g daily. Some sugar in tea was usual. The diet was low in fat, supplying an average of 21% energy, with a high average polyunsaturated/saturated fatty acid ratio, 1:1.25. Fat intake came mainly from peanuts, some fat in meat, and occasionally sunflower oil. Calcium and iron intakes were higher than expected, due to the high intakes of spinaches (*imifino*). One popular wild leafy plant contains 264 mg calcium and 6.1 mg iron/100 g fresh weight. A more than adequate intake of vitamin A was attributable to the *morogo*; it provided 966 retinol equivalents of vitamin A per 100 g uncooked weight. In comparison with the National Research Council (1990) Recommended Dietary Allowances (RDA), mean intakes of vitamin B<sub>6</sub> and folic acid were low in both men and women. Vitamin C levels were also low due to the winter season when the study was undertaken.

The diet described was considered reasonably well balanced. The intakes of micronutrients, depicted as in short supply, are likely to be much higher during the summer months when more vegetables and fruits are eaten. Some laboratory and other measurements on this group of Venda Africans are given in Table 3.

Mean serum cholesterol levels for men and women were somewhat higher than expected, 4.7 and 4.4 mmol/l. These values are much higher than the mean levels for rural dwellers in Kenya, 2.9 and 3.2 mmol/l for men and women respectively (Erasmus *et al.* 1994). Levels

Table 3. *Laboratory and other data on Venda Africans*

Variable	Men (n = 20)	Women (n = 41)
BMI (kg/m <sup>2</sup> )	22.5 ± 3.1	25.4 ± 4.2
Blood pressure (mmHg)		
Systolic	125.8 ± 18.7	110.0 ± 7.8
Diastolic	74.7 ± 10.2	66.8 ± 6.9
Haemoglobin (mmol/l)	7.6 ± 0.8	6.7 ± 0.9
Total protein (g/dl)	8.4 ± 0.6	8.3 ± 0.7
Albumin (g/dl)	4.8 ± 0.5	4.5 ± 0.4
Serum cholesterol (mmol/l)	4.7 ± 1.1	4.4 ± 1.3
HDL cholesterol (mmol/l)	1.7 ± 0.7	1.7 ± 0.6
% HDL cholesterol of total cholesterol	38.7 ± 16.3	40.3 ± 15.5
Vitamin A (µg/l)	623 ± 193	510 ± 157

BMI, body mass index; HDL, high density lipoprotein.

for high density lipoprotein cholesterol are high. Mean levels of blood pressure were not high. Percentages with hypertension, i.e.  $\geq 90/160$  mmHg (World Health Organization, 1962), were 15 and 0% for men and women respectively.

Smoking was moderate in men, but absent in women who, however, were fond of snuff. Helminthic infections were not tested for, although they are likely to be of low occurrence in the highveld in comparison to the lowveld, e.g. in areas in Mpumalanga and Kwa-Zulu, where schistosomiasis and hookworm infestations are nearly endemic (Walker & Walker, 1994).

*Comment on rural Africans.* The rural dwellers of the past had two major health/disease problems. The first lay in securing sufficient food to eat. If there was enough, and it was varied as was usually the case, then the diet was certainly compatible with sustained good health. The second problem concerned the health of the very young, among whom mortality tended to be high at weaning time or soon thereafter, attributable in large measure to infections and to inadequate or incorrect feeding. Babies were often breast fed for up to three years.

In more recent times, however, there have been increased purchases of food, and much less reliance on home grown or gathered foodstuffs. The changes in diet, lifestyle and habitat have been accompanied by some improvements in health of the young, but some deterioration in the life track of adults. This has been particularly well manifested by the San in Namibia. But in all of the rural groups upon whom there is information, there have been rises in admissions to rural hospitals of patients with hypertension-related diseases and with diabetes.

#### *Urban Africans*

A dietary survey, made in 1990, was carried out by Bourne *et al.* (1993) in the Cape Peninsula on a series of 285 men and 264 women. Mean daily nutrient intakes are given in Table 4.

Of the foodstuffs consumed, white bread was favoured over brown. A fifth of the white bread eaten was home made. Men and women had averages of 11 and eight portions daily; these exceed the recommended minimum of four portions. One purchased slice of bread weighs about 40 g. Added fat did not exceed the recommended number of portions. Milk intake was low, less than half the recommended portions of milk per day. Cheese intake was negligible, indeed, 42% took no dairy products during the previous 24 h. Meat intake was

Table 4. Mean daily nutrient intakes of Africans aged 45–64 years in Cape Peninsula (mean  $\pm$  SD)

	Men (n = 285)	Women (n = 364)
Energy (E; kcal)	2022 $\pm$ 909	1386 $\pm$ 482
Energy (MJ)	8.5 $\pm$ 3.8	6.4 $\pm$ 2.0
Protein (g)	78 $\pm$ 51	49 $\pm$ 21
Protein (% E)	15 $\pm$ 3	14 $\pm$ 3
Plant protein (g)	31 $\pm$ 18	22 $\pm$ 10
Animal protein (g)	46 $\pm$ 49	28 $\pm$ 19
Fat (g)	57 $\pm$ 43	42 $\pm$ 25
Fat (% E)	30 $\pm$ 8	26 $\pm$ 9
Saturated fat	21 $\pm$ 18	15 $\pm$ 10
Monounsaturated fat	20 $\pm$ 18	15 $\pm$ 11
Polyunsaturated fat	10 $\pm$ 9	8 $\pm$ 5
Cholesterol (mg)	260 $\pm$ 270	174 $\pm$ 136
Carbohydrate (g)	266 $\pm$ 112	198 $\pm$ 73
Carbohydrate (% E)	54 $\pm$ 8	57 $\pm$ 10
Dietary fibre (g)	19 $\pm$ 13	13 $\pm$ 6
Sugar (g)	51 $\pm$ 39	38 $\pm$ 24
Calcium (mg)	522 $\pm$ 409	358 $\pm$ 208
Iron (mg)	10 $\pm$ 6	6 $\pm$ 3
Vitamin E (RE)	395 $\pm$ 691	577 $\pm$ 1075
Thiamin (mg)	1.04 $\pm$ 0.55	0.76 $\pm$ 0.32
Riboflavin (mg)	1.13 $\pm$ 0.68	0.81 $\pm$ 0.48
Niacin (mg)	15.1 $\pm$ 8.9	10.0 $\pm$ 5.7
Ascorbic acid (mg)	61 $\pm$ 150	32 $\pm$ 49

RE, retinol equivalent.

Table 5. Laboratory and other data on Africans aged 45–64 years in Cape Peninsula (Mean  $\pm$  SD)

	Men	Women
TC (mmol/l)	4.3 $\pm$ 0.8	4.6 $\pm$ 1.0
HDLC (mmol/l)	1.4 $\pm$ 0.4	1.4 $\pm$ 0.3
HDLC/TC ratio	31.5 $\pm$ 11	32.5 $\pm$ 9
Diastolic BP (mmHg)	84 $\pm$ 14	80 $\pm$ 12
Systolic BP (mmHg)	130 $\pm$ 18	122 $\pm$ 16
Number of cigarettes smoked per day	9.7 $\pm$ 9.8	4.0 $\pm$ 3.5
BMI (kg/m <sup>2</sup> )	26.0 $\pm$ 4.3	31.8 $\pm$ 5.3

BMI, body mass index; BP, blood pressure; HDLC, high density lipoprotein cholesterol; TC, total cholesterol.

adequate for men and women, 2.6 and 1.9 portions daily; 2 portions are recommended. Meat provided more total fat than the fat group of foodstuffs. Only about half the recommended four portions of fruit and vegetables was eaten daily; 29% had none at all. Understandably, there were low intakes of vitamin C and of  $\beta$ -carotene. Mean energy fell below the RDA for all groups; 53% of respondents had intakes below 67% of RDA. Total fat contributed 27% to total energy. Cholesterol intake averaged 217 mg daily. Some laboratory values and other data for urban Africans are given in Table 5 (Steyn *et al.* 1991).

Important features of change include the following. Compared with rural dwellers, the mean BMI in African women has risen to 31.8, i.e. more than half are obese, with BMI  $\geq$

Table 6. *Energy and nutrient intakes (mean  $\pm$  SD) of white males and females*

	Men	Women
Energy (E; MJ)	10.3 $\pm$ 3.4	6.3 $\pm$ 2.3
Protein (% E) total	15.5 $\pm$ 3.6	16.6 $\pm$ 4.4
Fat (% E) total	35.1 $\pm$ 6.9	36.5 $\pm$ 6.8
Saturated	13.6 $\pm$ 3.6	13.6 $\pm$ 3.9
Polyunsaturated	5.9 $\pm$ 2.7	6.7 $\pm$ 2.7
P/S ratio	0.48 $\pm$ 0.27	0.57 $\pm$ 0.38
Dietary cholesterol total (mg)	431 $\pm$ 272	254 $\pm$ 156
Carbohydrate (% E) total	44.8 $\pm$ 10.1	45.5 $\pm$ 8.6
Added sugar (% E)	12.3 $\pm$ 7.8	10.8 $\pm$ 7.1
Dietary fibre total (g)	18.0 $\pm$ 10.0	13.6 $\pm$ 7.1
Alcohol (% E)	4.3 $\pm$ 6.6	0.5 $\pm$ 1.9

30. The average BMI for men is lower, 26.0. Respective prevalences of diabetes are 2.3% and 5.2%. Hypertension (WHO criteria) now affects 23% of men and 27% of women (Seedat *et al.* 1982). In another study (Levitt *et al.* 1993), diabetes prevalence was 7.0% in those of 30 years and over. Smoking prevalences in men and women were 38 and 6% respectively.

*Comment on urban Africans.* The urbanization of Africans has been accompanied by a number of major health/disease changes. Infant mortality rate has decreased considerably, and survival time increased, but this is still 10–15 years less than that of the white population. There have been reductions in morbidity/mortality among the very young, with decreases in the occurrence of gastroenteritis, protein-energy malnutrition, and respiratory disease. Improvements in these respects became manifest in early 1980s. Among children, many shortfalls from NCHS Reference Standards (Hamill *et al.* 1979) remain, and are common in both rural and urban areas; however, the school children affected, in contrast to those under five years, do not appear to be essentially at greater risk of ill-health (Walker *et al.* 1989a, 1990, 1995).

The major deleterious changes are rises in dental caries, obesity in women, hypertension, diabetes, and certain cancers, breast and prostate – attributable in large measure to changes in diet and other environmental factors (Walker *et al.* 1994b). Such transitional changes, relating to increased proneness to diseases of prosperity, are particularly marked in some populations, such as Micronesian Nauruans (Hodge *et al.* 1993). These people now have very high prevalences of obesity, 34% for women and 35% for men, in contrast to the low prevalence rate in local African men. Moreover, their prevalence of non-insulin dependent diabetes is 13 times higher than that of white Australians.

Values recently published for Africans in an urban area in Bloemfontein include elevated levels for mean serum cholesterol of 4.8 and 5.1 mmol/l for men and women, respectively, age 45–64 years. These values are as high as those reported for populations in Mediterranean countries (Verschuren *et al.* 1995).

## WHITE POPULATION

The anthropometry, dietary habits, nutritional intakes and associated laboratory parameters have been well documented in major investigations undertaken on the health/ill-health experience of town dwellers in Cape Province, the CORIS studies

Table 7. Descriptive statistics of selected risk factors of white men and women

	Men	Women
Systolic BP (mmHg)	144.5 ± 21.9	149.3 ± 23.8
Diastolic BP (mmHg)	90.6 ± 11.8	91.3 ± 11.9
Smokers (%)	46.9	15.0
BMI (kg/m <sup>2</sup> )	27.1 ± 4.1	27.3 ± 5.3
Serum total cholesterol (mmol/l)	6.37 ± 1.21	6.89 ± 1.38
HDL cholesterol (mmol/l)	1.15 ± 3.1	1.44 ± 0.39

BMI, body mass index; BP, blood pressure; HDL, high density lipoprotein.

(Wolmarans *et al.* 1988; Rossouw *et al.* 1990). Data on nutrient intakes and on laboratory and other values are given in Tables 6 and 7.

Nutrient intakes resemble those reported for populations in the UK (National Food Survey Committee, 1991). Conspicuous features are a relatively high intake of fat, especially saturated fat, and a low intake of fibre-containing foods. It would appear, from local investigations, that few attempts are being made to conform to a prudent diet by lessening intakes of energy and fat, and by increasing the consumption of cereal foods, vegetables and fruit. The laboratory and other values are similar to those reported for other white populations.

*Comment on whites.* The current diet of the white population, and the non-dietary practices of smoking, alcohol consumption and physical inactivity, could all be improved in order to avoid or restrain the chronic diseases of this lifestyle. However, among all Western populations generally there is a reluctance to conform to a prudent diet (Bingham, 1991). That benefits can certainly result from dietary and non-dietary changes is well demonstrated by the better than average health of vegetarians (Knutsen, 1994), Seventh-Day Adventists (Snowdon, 1988) and Mormons (Enstrom, 1989).

## COLOURED POPULATION

### *Rural children*

Steyn *et al.* (1989, 1990*b*) reported an investigation on the anthropometry and food intake of a series of school children in the Richtersveld – an isolated semi-desert mountainous area in Northern Cape Province, with few basic health facilities and general poverty. Goat farming is the major agricultural activity with the majority of the population owning animals.

White sugar was the food item most frequently consumed by the participants. This was generally added to tea or coffee, with only a small amount of milk. Bread and margarine were the staple foods consumed frequently during the day, with goat's meat and rice being the most popular items at the main meal. Neither fruit nor vegetables appeared among the most frequently consumed food items. Other items, such as jams, sweets, and cold drinks, were popular.

It is of importance to note that the low intakes of most nutrients were not in general reflected by low values of components in the plasma. Only in respect of red cell folate were levels abnormally low. A third to a half of the pupils, boys and girls, had heights and weights for age below the 5th centile of US NCHS Reference Standards (Hamill *et al.* 1979).



Table 8. *Nutrient intake in Coloureds aged 15–65 years in the Cape Peninsula (Mean ± SD)*

	Men	Women
Energy intake (kcal/d)	2301 ± 896	1657 ± 765
Total protein intake (g/d)	84.6 ± 37.2	60.8 ± 28.7
Total fat intake (g/d)	96.3 ± 46.4	70.3 ± 40.0
Total fat intake (% of total energy)	36.9 ± 8.8	37.0 ± 8.3
Saturated fat intake (g/d)	29.9 ± 15.7	22.2 ± 13.9
Polyunsaturated fat intake (g/d)	22.9 ± 14.2	17.1 ± 11.4
Dietary cholesterol intake (mg/d)	363 ± 287	264 ± 223
Carbohydrate intake (g/d)	257 ± 115	191 ± 92
Carbohydrate (% of total energy)	45.0 ± 11.1	46.7 ± 9.5
Added sugar (% of total energy)	15.0 ± 9.0	16.4 ± 8.8
<i>Laboratory and other data</i>		
Systolic BP (mmHg)	135.5 ± 17.3	141.4 ± 25.8
Diastolic BP (mmHg)	91.2 ± 11.9	92.6 ± 16.0
Cigarette smokers (%)	57.9	39.4
BMI (kg/m <sup>2</sup> )	24.4 ± 3.7	30.2 ± 7.8
Serum total cholesterol (mmol/l)	6.09 ± 1.48	6.30 ± 1.26
Serum HDL cholesterol (mmol/l)	1.42 ± 0.44	1.52 ± 0.46
Non-fasting serum triacylglycerol (mmol/l)	2.75 ± 2.62	2.15 ± 1.21

BMI, body mass index; BP, blood pressure; HDL, high density lipoprotein.

### *Studies on adults*

Langenhoven *et al.* (1988) reported on meals and nutritional intakes of a series of coloured persons in the Western Cape. The meal pattern indicated very little or no breakfast. The midday meal consisted mainly of bread. There was a cooked supper, and heavy snacking between meals. The latter frequently comprised sandwiches with meat balls, Vienna sausages, polony, eggs or cheese, or commercially fried fish and chips. Snacks also tended to include large quantities of sugar and fat together, with the more nutrient-rich foods. Of the foodstuffs, the main source of energy was the meat group, which supplied 30%, followed by the cereal group, 24%, with sugar 16%, and alcohol 4%. Mean intakes of nutrients and laboratory values (Steyn *et al.* 1985, 1990a) are given in Table 8.

The chief dietary feature is a relatively high fat intake. Mean levels of cholesterol are relatively high. There is considerable obesity, principally in women. There are high prevalences of smoking in both sexes. Alcohol consumption is known to be high, particularly in the men.

*Comment.* The coloured population is increasingly approaching the nutrient intakes of the white population. Dietary changes are principally increased intakes of energy and fat. There are also rises in smoking and alcohol consumption among both men and women. Diseases such as CHD (Walker *et al.* 1993b) and certain cancers (Sitas & Pacella, 1994) are now apparently becoming almost as common as those prevailing in the white population. Their prevalence of diabetes is higher (Levitt *et al.* 1993).

## INDIAN POPULATION

### *Dietary patterns, intakes and health/ill-health*

At present the diet varies (Walker & Stein 1985). Broadly, Muslims are usually non-vegetarian, and eat all common foods save pork. Some Hindus are vegetarian. Carbohydrate is supplied largely by rice, roti (unleavened pancakes), white bread, potatoes

Table 9. *Laboratory and other data on Indians aged 45–54 years in Durban (Mean ± SD)*

	Men	Women
Serum total cholesterol (mmol/l)	6.28 ± 1.21	5.86 ± 1.23
HDL cholesterol (mmol/l)	1.26 ± 0.57	1.22 ± 0.37
HDL/TC ratio (%)	20.2 ± 8.1	21.5 ± 7.3
Triacylglycerols (mmol/l)	1.98 ± 1.24	1.89 ± 1.17
Systolic blood pressure (mmHg)	136.8 ± 17.6	136.4 ± 24.3
Diastolic blood pressure (mmHg)	86.8 ± 12.7	81.8 ± 11.8
BMI (kg/m <sup>2</sup> )	23.1 ± 3.5	28.8 ± 6.1
Cigarette smokers ≥ 10/d (%)	60.9	13.3
Fasting blood sugar		
0 h	6.0 ± 3.2	6.2 ± 2.9
2 h	8.3 ± 5.4	8.2 ± 5.4

BMI, body mass index; HDL, high density lipoprotein.

and sugar. Fat is derived from ghee (produced by heating butter and filtering through a cloth), although nowadays more vegetable oils and fat spreads are used. Milk, pulses and cereals are chief sources of protein for Hindu vegetarians. For Hindu non-vegetarians, mutton, chicken, fish, eggs, pulses and cereals are the main sources of protein. Consumption of beef is forbidden by their religion. Additionally, for all populations, spices, chillies, garlic, ginger and other flavourings are used as ingredients in everyday dishes. In a group of Indian male students in Durban (Booyens & De Waal, 1969), mean daily intakes were energy 8.6 MJ (2043 kcal), protein 64 g and fat 67 g. Carbohydrate foods contributed about 55–65% of energy, fat 25–30% and protein 10–12%.

The general patterns of meals among middle class Indians in Lenasia, Johannesburg, are as follows. Breakfast: tea with whole milk and sugar, toasted bread (white) with butter or margarine, jam and cereal foods. Midday: sandwiches (cheese and tomato, polony); leftover curry with roti or bread; housewives and school children would reheat leftover food. Evening: roti, meat (mutton, chicken), fish, rice, vegetables particularly tomato, onions, potatoes, and fruit two to three times per week, mainly apples, bananas. Vegetarians would have pulses in tomato and onion gravy.

Among preschoolers, a number of studies have reported high frequencies of low height and weight for age. Among school pupils, this lesser growth has also been reported (Walker *et al.* 1989*b*). Among older pupils, age 17–18 years, when growth has ceased, shortfalls in height and weight are very common. Since this phenomenon also occurs in pupils in high socioeconomic circumstances, it is judged that a genetic element is in operation. This behaviour has also been reported in Indian immigrants in the UK (Ulijaszek *et al.* 1979).

Among adults, obesity in women, although not in men, is very common (Seedat *et al.* 1990). Diabetes is more common than in the white population (Omar *et al.* 1985). The same applies to mortality from CHD (Walker *et al.* 1993*b*). This high rate, which also prevails among Indian immigrants in the UK (Bhatnagar *et al.* 1995), is not explicable on the basis of known risk factors (Feehally *et al.* 1993). All of the disorders/diseases that have been mentioned are far more common than among people living in India and Pakistan (Gupta *et al.* 1994). In Durban, Seedat *et al.* (1992) investigated the risk factors for CHD. A summary of findings is given in Table 9.

Most conspicuous are high values for obesity in women, for smoking in men, and for mean serum cholesterol and blood glucose values.

*Comment.* When Indians first migrated to South Africa, they strongly retained their

previous dietary habits and practices. This has continued to a large extent. However, major changes have been rises in intakes of energy, fat, and protein – changes which have been associated with more frequent disorders/diseases of prosperity.

### PERSPECTIVE OF DISORDER/DISEASE SITUATIONS LINKED WITH POVERTY AND WITH URBANIZATION AND WESTERNIZATION

Summaries of the health/disease situations in the interethnic populations are presented in Tables 10–12. In Table 10 the disadvantageous situations in the Africans, in the parameters depicted, are apparent. With urbanization the adverse situations are much less marked; they are apparent respecting protein–energy malnutrition, pellagra, and iron deficiency anaemia (yet Indians are in a worse position). Goitre occurrence is regional in the rural areas. The high rate of tuberculosis in Africans, especially in the coloured population, is conspicuous. The high and increasing prevalence of AIDS infection in Africans is disastrous and, alas, will be more so in the future.

Table 11 shows that dental caries scores of 10–12 year urban African children, very low in the past and still very low in rural areas, are now as high as or higher than those in corresponding white children (Walker *et al.* 1992). Obesity, previously uncommon, has increased considerably in African women, affecting nearly half, although this is not the case in men (Walker & Badenhorst, 1995). Femoral fractures are rare in African women, but are very common in white women (Solomon, 1979). Although in rural areas blood pressure levels have risen little, in urban areas the frequency of hypertension, 28% by WHO criteria (World Health Organization, 1962), is now higher than that in the white population, 25% (Seedat & Seedat, 1982). Diabetes was previously rare; yet in a survey made on rural elderly women the disease was detected in 7.5% (Walker & Walker, 1991), and in an urban population in Durban was 6.5% (Omar *et al.* 1993). At Hillbrow Hospital, Johannesburg, 6% of admissions of African adults were for diabetes (Dean & Gear, 1986). All of these situations resemble those prevailing in Afro-Americans (Van Itallie, 1985; O'Brien *et al.* 1989).

Diet-related cancers (Table 12) are or rather were nearly absent in rural areas, but rises are occurring in breast and prostate cancers, although not in colon cancer (Sitas & Pacella, 1994). Yet even in urban areas rates remain far lower than those in the white population (Walker, 1995*b*).

Regarding proneness to CHD, rises in serum cholesterol level have occurred. Yet despite its increasing commonness, like diabetes and smoking, it is remarkable that cases of CHD are extremely rare, indeed absent, in villagers (Walker *et al.* 1994*a*). Even in town dwellers cases are few (Walker & Stein, 1985). In 1994 there were 35 cases of CHD diagnosed at Baragwanath Hospital (3000 beds) in patients resident in Soweto, a population of about three million.

Non-dietary changes in Africans, particularly those in the big cities, include diminished physical activity and, in men, increases in smoking and alcohol consumption. Hence, it is nearly certain that the disease pattern of the more prosperous of local Africans, especially urban dwellers, in time will resemble that now manifest among transitional African immigrants in the UK and, ultimately, will approach the pattern displayed by Afro-Americans. Among the latter, mortality rate from CHD has now reached that of the white American population (Keil *et al.* 1993).

In the non-African populations, the higher burden of the diseases of prosperity will be apparent. In the Indian population, prevalence of diabetes and mortality rate from CHD are higher than in the white population. However, it is interesting that, in the case of the

Table 10. *Interethnic patterns of malnutrition and infections*

	African		White	Coloured	Indian
	Rural	Urban			
PEM	+++	+	-	-	-
Pellagra	++	-	-	-	-
Iron deficiency anaemia	+++	++	++	+++	++++
Goitre	++	-	-	-	-
Gastroenteritis	++	++	-	+	+
Helminthiasis	++++	+	+	+	+
TB/10 <sup>5</sup>		210	15	429	80
AIDS (%)		10-20			

Table 11. *Interethnic patterns of disorders/diseases of urbanization and prosperity*

	Rural Africans	Urban Africans	Coloureds	Indians	Whites
Dental caries	+	+++	+++	++++	+++
Femoral fractures	+	+	++	++	+++++
Obesity (females)	+	+++	+++	+++	+++
Hypertension	+	++++	++++	+++	+++
Diabetes	+	+++	++++	++++	+++
CHD	- <sup>a</sup>	+	+++	+++++	+++++
Stroke	+	++	+++	+++	++

<sup>a</sup> implies that occurrence is rare.  
CHD, coronary heart disease.

Table 12. *Cancer patterns in South African populations*

	Rural Africans	Urban Africans	Coloureds	Indians	Whites
Lung	- <sup>a</sup>	++	+++	++	++++
Breast	- <sup>a</sup>	++	+++	+++	+++++
Colon	-	+	++	++	+++++
Stomach	-	+	+++	++	++
Pancreas	-	+	++	+	+++
Liver	++ <sup>b</sup>	++	++	+	+
Oesophagus	++++ <sup>b</sup>	+++	++	+	+
Cervix	++	++++	+++	+	+

<sup>a</sup> Implies that occurrence is rare.

<sup>b</sup> Frequency of occurrence related to some regional but not nationwide populations.

coloured, Indian and white populations, there is evidence of a recent fall in CHD mortality rate (Steyn *et al.* 1990a). In this respect, to our knowledge any avoiding measures taken have been very limited.

### **CHALLENGES: WHAT ARE THE HOPES OF DIETARY AND OTHER CHANGES BEING MADE BY AFRICANS AND THE OTHER LOCAL POPULATIONS TO LESSEN THEIR SUSCEPTIBILITY TO DISEASES?**

#### **WHAT PRACTICAL GENERAL DIETARY CHANGES ARE URGED ON SOUTH AFRICAN INTERETHNIC POPULATIONS?**

The nutritional and other guidelines, in principle, are those advocated for western populations (U.S. Senate, 1977; Walker, 1980; Peterkin, 1990; Bingham, 1991). They apply to most urban Africans and to a lesser extent to rural Africans, and to the other populations. They are as follows:

- (1) Among urban dwellers, to eat less, to eat less fat, especially saturated fat, and to eat more of fibre-containing foods, especially cereals, vegetables and fruit.
- (2) To reduce the frequency of hypertension, again, principally in urban dwellers.
- (3) To reduce the frequency, or at least the intensity, of smoking in men.
- (4) To limit alcohol consumption.
- (5) To increase, or at least to maintain, present levels of physical activity.

#### **WOULD CHANGES WORK?**

In view of the various recommendations made, a fair question, especially from the point of view of the sceptic, is – could putting the clock back, dietarily and non-dietarily, really be counted upon to lessen susceptibility to the diseases of prosperity? Consideration of a number of situations indicates an affirmative response, although these concern wholly western populations. In the UK in 1910–1920 the diet was much lower in fat, and higher in fibre-containing foods, in fact almost double, compared with the present. Meat was seldom eaten more than once a week, and consumption of bread and potatoes, although not of vegetables and fruit, was high. In that context and at that period, the crude mortality rates from CHD (Morris, 1951) and cancer (Rush, 1925) were much lower than they are at present. In World War II, in certain European countries, military exigencies caused a measure of reversion to the diets of the past, namely, there were reductions in intakes of energy, fat and sugar, and rises in intakes of fibre-containing foods. Reports indicated that dental caries scores decreased (Toverud, 1949) and that mortality rates from diabetes (Trowell, 1973) and from CHD (Schettler, 1979) fell, only to revert to previous levels once prewar dietary and other conditions were resumed. The period of change, presumably, was too short to have had an effect on cancer incidence and mortality rates, apart perhaps from colon cancer (Powles *et al.* 1984).

It is noteworthy that a diet high in fibre and low in fat has been shown to cause regression in precancerous rectal polyps (DeCosse *et al.* 1989). Furthermore, a diet of this type has also been shown to cause regression of plaques in the coronary vessels (Ornish *et al.* 1990).

Clearly, in western populations, putting back the clock dietarily by some magnitude can evoke significant falls in the occurrence of diet-related diseases of prosperity. Additionally, there are segments of populations who do conform in measure to the prudent lifestyle.

When compared with the average, they have been found to have lower CHD and the cancers of prosperity, and to have greater longevity, e.g. vegetarians (Knutzen, 1994) Seventh-Day Adventists (Snowdon, 1988) and Mormons (Enstrom, 1989).

### HOW HAVE WESTERN POPULATIONS COMPLIED WITH RECOMMENDED CHANGES?

Before enquiring into the extent of the possible compliance of Africans to these recommendations, it is considered that to be practical a brief enquiry must be made into the measures of compliance which have occurred in western populations, with their higher level of understanding, to the self-same recommendations, some of which were put forward as early as the late 70s (US Senate, 1977).

#### *Energy intake*

A decrease in energy intake is deemed desirable for most western populations. The level has fallen in the UK (National Food Survey Committee, 1991), but not in the US or European countries. It is important to note that experimental studies on animals have shown that high energy intakes promote atherosclerosis and carcinogenesis, and *vice versa* (O'Connor & Campbell, 1987; Masoro, 1992).

#### *Fat intake*

The amount eaten has decreased in the US from supplying 40% to 34% energy (Anon. 1994*b*), but the proportion remains at 40% in the UK (National Food Survey Committee, 1991), and is correspondingly high in most European countries. As an example of selective change, it is interesting that among adolescents in Norway (Andersen *et al.* 1995), the fat intake has fallen considerably, to supply 32% energy. Notwithstanding, the mean daily energy intake reported for the boys studied is almost the highest extant, supplying 3750 kcal; the same applies in respect of their intake of protein, which averaged 125 g daily. In a recently published report in the UK on *Nutritional Aspects of Cardiology* (Coghlan, 1994), some of the dietary changes urged are illuminating. "A breakfast consisting of a bowl of cereal with semi-skimmed milk and two slices of toast covered with low-fat spread instead of two rashers of grilled bacon and a fried egg will 'save' 28 grams of fat," almost a third of the daily intake. The report also suggested "a halving of the nation's consumption of cakes, biscuits, soft drinks and chocolate". Such changes are virtually non-starters.

#### *Vegetable and fruit consumption*

In the US intakes are not rising (Patterson & Block, 1992), although recommendations, as in the UK (Bingham, 1991), are for doubling intakes.

#### *Situation among the young*

A study of toddler and infant schools in Southampton revealed that 72% of the former and 50% of the latter never drank plain water – squash was the most commonly consumed drink, thereby constituting a high energy supply (Petter *et al.* 1995).

Obviously, the young are the primary long term target for change. Among the children studied in the NHANES III investigation in the US, 72.3–93.4% exceeded the guidelines for total fat, namely, 30% energy (Kennedy & Goldberg, 1995). According to the recent US School Nutrition Dietary Assessment Study (Burghardt *et al.* 1995), a major approach to reaching this target is to amend the school lunch, namely, to "reduce the average meat serving from 2 oz. (56 g) to 1.5 oz. (42 g), eliminating high fat meals, high fat cheese, nuts,

and nut butters; eliminating high fat desserts and milk based desserts; and reduce sharply the use of added fats in food preparation.” However, it was revealed that in that country, currently, only 1% of school lunches comply with the foregoing. How will school children in general react to these well-meaning but nearly heroic patterns of change advocated? — doubtless with distaste. In Ireland, for example, where the mortality rate from CHD is nearly double that in the US, children have no intention whatever of altering their diet — high in chips, crisps, cakes, etc. (Strain *et al.* 1994). The latter’s vegetable and fruit consumption averaged under 200 g daily; much the same low intake has been reported for school children in Glasgow (Wrieden *et al.* 1993). A study group of the World Health Organization (1990) has urged a goal of 400 g/d of fruit and vegetables (excluding potatoes). It is noteworthy that this goal is well exceeded by populations in Mediterranean countries, Spain, Portugal, Greece and South Italy, which have lower than average mortality rates from CHD and diet-related cancers (James *et al.* 1989; Berrino & Muti, 1989).

#### *Pregnant women*

A number of studies have indicated that dietary advice during pregnancy is almost wholly unheeded (Prentice *et al.* 1987).

*Comment.* In the face of these limited responses made by Western populations to recommendations, not least of reasons being that a prudent diet is more expensive than an everyday diet (Cade & Booth, 1990; Claxton, 1995), it is judged that there are no grounds for considering that Africans might be more responsive.

### UNLIKELYHOOD OF CHANGES BEING ADOPTED BY AFRICAN AND OTHER POPULATIONS

For Africans, what is the present situation? Among African children and adults, intakes of energy, fat and protein, while still lower than those in developed populations, are rising, and intakes of fibre-containing foods are falling. Cereal products are refined; many people favour white rather than brown bread. As to vegetable and fruit comparison, in an investigation on rural school children, it was found that wild ‘spinaches’ and cooked cabbage were consumed about once a week by pupils age 6–10 years, and even less frequently by pupils age 11–14 years (Badenhorst *et al.* 1993). In an interethnic series of adolescents investigated in the Western Cape (Steyn *et al.* 1990c), of the six food items most frequently consumed neither vegetables nor fruit were listed by Africans. In both vitamin C and carotene-rich fruit and vegetables, the percentage of children who consumed one or more items daily was far higher in the white than in the coloured and African pupils; this prevailed in urban and especially in rural areas. As to adults, in a study made in 1988, 64% of whites, but no Africans, consumed the recommended four portions of vegetables and fruit daily. Among African adults in the Cape Peninsula (Bourne *et al.* 1994), it was reported that only about half the recommended daily helpings of fruit and vegetables was consumed, indeed, 29% of respondents reported no intake (the BRISK Study).

Smoking in western men and women has almost halved, yet among Africans the practice is already high in men and is still rising.

Physical activity has been progressively falling in most western populations, especially among children. While Africans, broadly, remain more active than whites, level of activity is likely to fall increasingly in urban populations.

In the other South African populations, the measure of responses being made to conform to a prudent lifestyle has not been investigated. However, from some unpublished studies

and from anecdotal information it is judged that only in the case of the white population, and mainly those in upper income brackets, are attempts being made to eat wisely, to reduce smoking and excessive alcohol consumption, and to increase level of activity.

### PARTICULAR NUTRITIONAL CHALLENGES FOR FUTURE ACTION

Information has already been given indicating that even poor populations have progressed greatly in improving their health. In support of this, in a recent WHO publication (Dhillon & Philip, 1994) it was emphasized that "the huge majority of countries have shown appreciable improvements in infant mortality rates, deaths among children under-five, and life expectancy. Life expectancy in 1994 had risen to 65 years for the world as a whole. Immunization coverage against childhood diseases increased dramatically between 1970 and 1992 from less than 5% to around 80%. Access to oral rehydration therapy had increased to approximately 74% by 1993." Understandably, current and future challenges involve action by the State or local health authorities, by the individual and community, and by both in concert.

### PREGNANCY AND LACTATION NEEDS

Nutritional needs, in terms of RDA (National Research Council, 1990) are likely to be met only in a very small proportion of Africans, and in somewhat larger proportions in the case of other ethnic groups. Yet, in terms of physiological needs, clinical or other sequelae resulting from lower intakes are not apparent (Poppitt *et al.* 1993). While the percentage of mothers with low birth weight (LBW) infants is about 13%, i.e. almost double that in the case of white mothers, 8%, the proportion attributable to inadequate nutrition is not known. In this connection, evidence indicates that the ill-health burden of LBW in the African infant is less than the corresponding burden in the white LBW infant, judging from the experience of Afro-American mothers (Rawlings *et al.* 1995). However, the converse is that African babies with very high birth weight are at greater risk than those of white mothers. Certainly, a small proportion of African mothers will profit from dietary supplementation, but not characteristically.

As a whole, the performance of African mothers in producing breast milk of satisfactory volume and composition is better than that of white mothers. Evidence is lacking that, apart from extremes, intakes of nutrients lower than RDA are prejudicial to lactation performance in African mothers (MacIntyre & Walker, 1994; Prentice *et al.* 1995).

### INFANT AND TODDLER NEEDS

This fraction is the most vulnerable of population groups, the one most requiring interventions which will reduce morbidity and mortality. The chief problems occur at weaning time and thereafter. Primary disadvantages are (1) inadequate energy content of mixtures (Walker *et al.* 1955), (2) inadequate protein content, and (3) frequent contamination with *E. coli* and other organisms. While (1) and (2) are due principally to lack of understanding, (3) is often attributable to lack of water and hygienic facilities. A common result is gastroenteritis. In many rural hospitals this infection, with pneumonia, is the commonest cause of admission of the very young (Walker *et al.* 1994a). How can these be remedied? While some educational help is forthcoming from clinics, instruction in hygienic practices should receive first emphasis at home and at school. There should be



telling posters in schools, at post offices, and at clinics. There should, moreover, be public hoardings with easily understandable messages. At present these sources of information are almost wholly absent; moreover, the nutritional component on present hoardings has little or nothing to do with the feeding of the very young. It must be stressed that the cost of advancing this means of help would be relatively small. There is also an equal lack of thrust regarding publicity for oral rehydration therapy. If only African mothers would be 'clued up' respecting these measures, as Cecily Williams (1954) urged long ago concerning hygiene practices, it would save a tremendous amount of sickness and many lives. These challenges, which are not costly and lie well within the powers of State and other health services to implement, are simply not being met.

The energy intake of African children during preschool years is low. A recent study indicated that the mean daily intake in rural 5-year-old children was roughly 1000 kcal, of urban children 1500 kcal, but of white children 2000 kcal (Cleaton-Jones *et al.* 1991). The problem regarding to what extent the low intake is due to lack of food on the table has been little researched; observations made during prospective studies, from preschool age to adolescence, would be really invaluable. Insufficiency of information in this field is a problem which affects numerous millions of the world's population, but it has received minimal attention.

Benefits of increased intake of vitamin A in combating measles, diarrhoea, and other disorders are now well established (Filteau *et al.* 1995).

### NEEDS OF SCHOOL CHILDREN

Numerous studies have shown that roughly a third of African school children lie under the 5th centile of US NCHS Reference Standards (Hamill *et al.* 1979). Much the same questions obtrude as in the case of the under fives – how much of this lesser growth is due to insufficiency of food and how much is attributable to adverse environmental circumstances. Although supplementation has been shown to be unquestionably beneficial in the case of the under fives (Pelletier *et al.* 1995), this is not the case with scholars. Moreover, while in the case of the under fives there is evidence that lesser growth prejudices cognitive state and physical ability, this is lacking in the case of lesser growth in school pupils (Walker *et al.* 1989*a*, 1990).

School feeding is a highly expensive means of intervention, and benefits to scholars are controversial, even in Third World populations (Rush, 1984; Walker & Walker, 1986), including a local study undertaken in Cape Province (Van der Westhuyzen & Steyn, 1992). That a proportion of our African school children are in need of nutritional intervention is of course undoubted. At the same time it is questioned whether the large proportion under the fifth centile of reference standards, who are classified as having mild to moderate malnutrition, are necessarily suffering from insufficiency of food, or are essentially at heightened risk, now or in the future (Walker *et al.* 1989*a*, 1990).

A further important and related point concerns lack of knowledge regarding the clinical state of health, as well as the previous history of health/ill-health, of those pupils categorized as malnourished. Data by Badenhorst *et al.* (1993) on 6–10-year-old malnourished African children in Northern Transvaal indicated few adverse clinical signs or symptoms (less than 2% were affected). Furthermore, it was considered that biochemical indicators of undernutrition, such as levels of serum albumin and transferrin, did not point to the presence of severe malnutrition. Clearly, far more information of this type is needed. The additional information required should include knowledge of the child's antecedents, experiences at weaning time and later, the mother's role, as well as aspects such as ongoing psychometric status. There are of course other needs, such as those for regular surveillance,

and for knowledge of food availability and food prices in rural areas. What are urgently needed are representative databases.

## PREVENTIVE MEASURES BY THE HEALTH AUTHORITIES

### *Food enrichment*

Since the diets of the huge majority of South African populations do not measure up to RDA, what contribution can be made by enrichment of staple cereals? At present, a large proportion of the bread eaten and some maize meals are enriched with thiamin, riboflavin, niacin, and folic acid. Other suggested additions include vitamin A, iron and calcium. A higher intake of vitamin A merits special attention (Filteau *et al.* 1995). The precise needs of these nutrients by our populations and subpopulations are not known with certainty, neither are the meaningful clinical signs of deficiency. However, until such knowledge is forthcoming, the additions described, which are not costly, could be beneficial. One problem regarding iron supplementation relates to iron overload in those Africans who still consume large amounts of adventitious iron derived from food preparation (particularly fermented cereal drinks) in iron utensils (Walker & Arvidsson, 1953). Evidence published twenty years ago indicated that very high retention (very uncommon) could promote liver cirrhosis, diabetes, scurvy, and osteoporosis (Bothwell *et al.* 1979). However, such early data have received no recent local confirmation. No attempt has yet been made to learn whether iron overload is of significant danger to health at the village level – in brief, there is no knowledge of whether the potential disadvantage affects 1 in 100, 1000, or 10000 of the population. The converse problem concerns iron supplementation to remedy widespread iron deficiency anaemia, usual in developing populations. Here again, knowledge is also lacking at the village level as to whether the usually mild iron deficiency anaemia detectably prejudices wellbeing. There are many unanswered questions in this field (Walker *et al.* 1994*e*).

The addition of an iodine compound to salt is a relatively straightforward matter and is already in operation. There are a number of goitrous regions in South Africa, not yet fully defined, but where there is no doubt of the need for this measure (Walker, 1995*a*), judging from the successful combating of iodine deficiency disorders in other parts of the continent (World Health Organization, 1993*a*).

Fluoridation of water supplies to combat the development of caries is now being investigated in a number of cities and towns. Other possibilities that have been put forward include the adding of fluoride to milk (Lennon *et al.* 1995) or to sugar (Bratthaal & Barmes, 1995).

### *Miscellaneous measures by health authorities*

The provision of a satisfactory water supply in rural areas is a measure high up on the State's list of priorities. This would certainly diminish ill-health from food and food vessel contamination. Likewise an extension of the provision of 24 h clinics could be very health promoting. The classic success story in this regard took place in The Gambia, whereby infant mortality in the series of villages studied in 10 years fell from 125 to 25 per 1000 live births (Lamb *et al.* 1984). Increasing facilities for the improvement of inoculations could be greatly beneficial – this measure also ranks high in the State's health services plan.

In the African village there must be a strengthening of health facilities, so that the message of hope offered is discernible to all (Walker *et al.* 1994*f*). The need for medical auxiliaries is undoubted. In parts of China where barefoot doctors were replaced by higher qualified personnel, sickness and death rates of young children actually rose (Zhu *et al.* 1989). In South Africa, since there will never, but never, be enough doctors and dentists,

use will have to be made of the services of health, dental, agricultural and other technical helpers. Health visitors could prompt mothers to take their young children to clinics if sick, and give advice to village authorities on water supply, litter and refuse disposal. Various auxiliaries could undertake straightforward dental treatment, give training in agriculture, advise on gardens at school, and at home popularize the 'hot box' (the old hay box) to save fuel, and do like tasks. Women with a measure of training, as urged by the Director-General of the WHO (World Health Organization, 1988), could greatly facilitate much of the foregoing. The intervention measures described need not be prohibitively expensive. To reiterate, extension of health education in its widest sense is perhaps of most importance. Cecily Williams (1954), of kwashiorkor fame, insisted that if African mothers could make the best use of what was actually at hand, both regarding food and local resources, there would be far less gastroenteritis, protein-energy malnutrition, etc.

In May 1994, when Parliament was officially opened by Mr Nelson Mandela, the new President of the country spelt out the new Government's view of a 'people-centred society'. He envisaged that among other things:

- (1) children under the age of six years and pregnant mothers with no medical aid would receive free medical care in state hospitals;
- (2) a nutritional feeding scheme would be implemented in every primary school where such a need existed;
- (3) electricity would be installed in 350000 homes during the 1994/95 financial year;
- (4) a campaign would be set in motion to rebuild townships, restore services and create jobs.

These and other measures form part of the great Rehabilitation and Developmental Programme which, once progressing, could go far towards lessening the preventable causes of sickness and death among the poor.

## CONCLUSIONS

From the information given on South African populations, it will be clear that formerly, among African hunter-gatherers, the diet broadly met physiological needs, in that sustained good health was possible. But in groups who subsequently adopted a more settled existence, the level of health deteriorated. The mass of rural Africans, some of whom produced most of their own food crops and livestock, although others purchased much of their food, experienced a large measure of good health. While adults were prey to infections, principally tuberculosis, at the same time they suffered relatively little from obesity, hypertension, diabetes, CHD and diet-related cancers. The exception was very young children who, from nutritional inadequacies and infections at weaning time and thereafter, suffered high losses from sickness and death.

However, in time rural dwellers have become partly westernized in lifestyle, particularly in diet. This has occurred even more in urban dwellers, particularly men, who have increased in smoking and in alcohol consumption. In this context, while there have been considerable reductions in morbidity and mortality among the very young, with associated lengthening of expectation of life, the changed situation has made increasingly prevalent the western disorders/diseases mentioned.

The situation depicted constitutes the dilemma of numerous developing populations in various stages of transition. There are major benefits to the young, but considerable disadvantages to the middle-aged and elderly owing to their becoming much more prey to

the killer disorders/diseases of prosperity to which, previously, their susceptibility was far less.

Clearly, the primary ongoing general challenges are – how can we still further add to the components of betterment? Equally, how can we retard, control or restrain the adverse components associated with ‘civilization’? Accordingly, the two nutritional challenges of transcending importance are, firstly, to improve the nutrition of the very young, particularly young Africans; and secondly, in all populations, to seek, even in limited measure, to preach and evangelize the benefits likely to be forthcoming from consumption of a prudent diet, and from conforming to other aspects of the prudent lifestyle. It is of importance to appreciate that responses, even from a small proportion, could confer major benefits to health in a large number of people, since the huge preponderance of developing populations are at risk to a varying extent.

Numerous incremental nutritional challenges have already been made clear. However, it must be realized that while a measure of prosperity may come to some African countries, impoverishment is and will continue to be all-pervading. Consequently, one of the many challenges implicit in this context is to seek to define, from field observations, the minimum ranges of intakes of nutrients which are still compatible with everyday good health at reproduction, in the young, and in the elderly.

Salient questions to be answered are – in school children, at what stage of lesser growth is good health prejudiced, then and in the future?; at what stage of low haematological values and of low iron reserves does iron deficiency really matter?; is it possible that calcium needs differ in different populations since signs of calcium deficiency are rare in Africans?; why do urban Africans suffer so little from CHD, or so little from colon cancer?; on the broader front, why do so many Africans keep well when their intakes of nutrients characteristically are far lower than RDA? Answers to these and associated questions are only possible from observations made in contexts of need, as in Africa.

Gratitude for financial support is expressed to the South African Medical Research Council, the National Cancer Association, the South African Sugar Association, the Anglo-American De Beer’s Chairmans Fund, and the Freda and David Becker Trust. Considerable assistance was given by Mrs B. F. Walker, Mrs Lesley Bourne, Mrs Janiene Halse, Ms Una MacIntyre, Mrs Welma Oosthuizen, Professor P. E. Cleaton-Jones, and Ms Jenny McKeown. Ms F. I. Sookaria typed the manuscript.

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