Nutrition in contemporary South Africa#

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Abstract

In South Africa, both under- and over-nutrition exist. At national level, more than half of the females are either overweight or obese, while children suffer from under-nutrition. Childhood malnutrition starts early in life, with the first two years being the most vulnerable period. Chronic malnutrition (as indicated by the prevalence of stunting) is a bigger problem than acute malnutrition (as indicated by the prevalence of wasting). Stunted children have a higher risk for being overweight. At national level, 33.3% of preschool children are vitamin A deficient, 21.4% are anaemic and 5.0% suffer from iron deficiency anaemia. Prevalence figures for childhood malnutrition differ between and within provinces. South African children consume a maize-based diet that is inadequate in energy and of low nutrient density. Inadequate intake of micronutrients starts during infancy. Strategies to address micronutrient malnutrition include high-dose vitamin A supplementation, food fortification, biofortification and dietary diversification. The availability of a greater variety of nutritious foods at community and household level can be increased through mixed cropping, the introduction of new crops, the promotion of underexploited traditional food crops, and home-gardens. A broad multifaceted comprehensive health intervention programme is needed to address childhood malnutrition.

Keywords: nutritional status, adults, children, dietary diversification, South Africa

Malnutrition defined

Malnutrition includes both under-nutrition and over-nutrition (Fig. 1). Over-nutrition refers to excessive intake of energy and/or macronutrients. Under-nutrition can be divided into protein-energy-malnutrition and micronutrient deficiencies. Globally, the most important micronutrient deficiencies are iron, vitamin A, iodine and zinc. In this paper, anthropometric status of adults and children, childhood micronutrient malnutrition and dietary intake of children within South Africa are discussed. The purpose is not to exhaust all nutritional studies published, but to give a general overview of the prevalence of malnutrition in South Africa, and the consequences thereof. Furthermore, strategies to address micronutrient malnutrition are discussed, with the focus on dietary diversification because of its relevance to dietary intervention with leafy vegetables.

Nutritional status can be assessed by dietary, anthropometric, biochemical and clinical methods. Ideally, a combination of methods should be used when assessing nutritional status using standardised techniques. For meaningful interpretation of nutritional assessment, indicators of socio-economic conditions, cultural practices, health statistics, food-related behaviour, and knowledge, attitudes and practices should be considered additionally.

Dietary intake can be measured either quantitatively (by describing intake in terms of energy and nutrients) or qualitatively (by describing intake in terms of foods). Information on

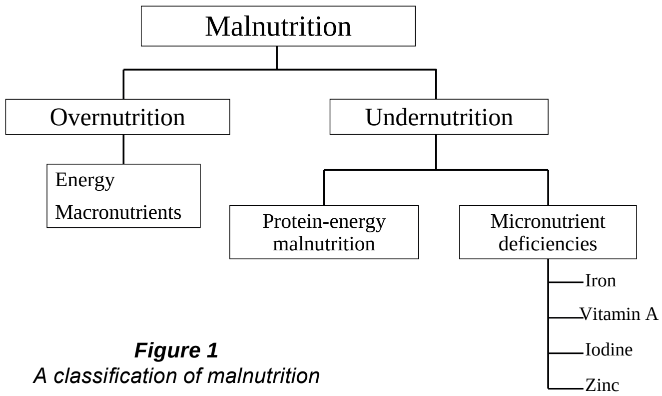

Figure 1
A classification of malnutrition

dietary intake *per se* should not be used to classify a person or population as malnourished – it can, however, identify an at risk state.

Anthropometric measurements (such as height and weight) are used to construct indices for malnutrition that are then compared to reference values or standards.

Laboratory methods can detect marginal nutrient deficiencies before clinical signs appear. These methods include biochemical tests (which indicate nutrient levels in a particular tissue, but may fail to reflect the total body content of the nutrient), and functional biochemical, physiological or behavioural tests (which measure the extent of the functional consequences of a nutrient deficiency).

Clinical signs of malnutrition occur during the advanced stages of malnutrition, but they are non-specific and should always be confirmed by biochemical indicators.

South Africa has a quadruple burden of disease. These are infectious diseases associated with under-development, poverty and under-nutrition; chronic diseases linked to over-nutrition and a western type of diet and lifestyle; the HIV/AIDS epidemic;

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and the burden of injury-related deaths (Steyn et al., 2006a). Under- and over-nutrition co-exist.

Anthropometric status of South African adults

The body mass index (BMI) provides a good reflection of the energy status of adults and is calculated as follows:

$$BMI = \frac{weight\ (kg)}{height\,(m)^2}$$

The World Health Organization defined underweight as BMI<18.5; normal weight as 18.5≥BMI<25; overweight as 25≥BMI<30; and obesity as BMI≥30 (WHO, 1998).

The South African Demographic and Health Survey of 2003 showed that over-nutrition is prevalent among South Africans, particularly women, with 52.3% being either overweight or obese at national level (SAHDS, 2003). Smaller studies have shown pockets of severe female overweight/obesity. In a rural area in KwaZulu-Natal, for example, 76.9% of the females were either overweight or obese (Oelofse et al., 1999).

Determinants of overweight and obesity in South Africa include age, level of education, ethnicity, and area of residence (Puoane et al., 2002). The prevalence of obesity is higher in urban areas than rural areas (SADHS, 1998). With the rapid urbanisation that is taking place in the country, the prevalence of obesity in adults is expected to increase further (Vorster et al., 2000). Bourne et al. (2002) summarised dietary data available from urban and rural studies from 1940 to 1992 and concluded that the diets of the Black South African population shifted towards an atherogenic Western diet. According to Steyn et al. (2006a), the high prevalence of overweight and obesity in the adult population reflects the westernised eating pattern.

The black population constitutes 79% of the South African population (Statistics South Africa, 2004). The acceptance of overweight and obesity in the black population could make it difficult to prevent or treat obesity. Senekal et al. (2003) suggested that specific ethnic characteristics, such as obesity tolerant attitudes, should be taken into consideration when developing weight management programmes.

Nutritional status of South African children

The most significant currently available national data on nutritional status of South African children is from the South African vitamin A Consultative Group (SAVACG) study from 1994 (Labadarios et al., 1995) and the National Food Consumption Survey (NFCS) of 1999 (Labadarios et al., 2000). The results of the National Food Consumption Survey – Fortification Baseline (NFCS-FB) from January 2005 were not yet released at the time when this paper was finalised (March 2007).

Anthropometric status

National anthropometric data are available for six-month to six-year old children for 1994 (Labadarios et al., 1995) and one- to nine-year old children for 1999 (Labadarios et al., 2000). These data showed that at the national level there is a low prevalence of wasting (<5%), a low (<10%) to medium (10-20%) prevalence of underweight, and a medium (20-29%) prevalence of stunting, according to criteria defined by the World Health Organisation (Gorstein et al., 1994).

Wasting, reflected by low weight-for-height, is a measure of acute malnutrition. Causes include inadequate food intake, poor feeding practices, disease and infection, or mostly, a combination of these factors (Cogill, 2003). Wasting in individuals and populations can change rapidly with changes in the availability of food or disease prevalence. **Underweight**, reflected by low weight-for-age, is a measure of both chronic and acute malnutrition, yet it cannot distinguish between the two. **Stunting,** reflected by low height-for-age, is a measure of chronic malnutrition. The onset of stunting is often associated with the age of the introduction of complementary feeding (Brown et al., 1995). Stunting does not change rapidly, and it may be irreversible in children older than two years (Cogill, 2003). Stunting is associated with a number of long-term factors such as chronic insufficient protein and energy intake, frequent infections, sustained poor feeding practices, and certain micronutrient deficiencies, particularly iron and zinc (Cogill, 2003).

Children living on commercial farms are severely affected, and the prevalence of malnutrition is higher in the rural areas, compared with the urban areas. Prevalence figures of malnutrition differ between (Labadarios et al., 1995; 2000) and within provinces (Smuts et al., 2004).

Stunting is associated with poverty (Cogill, 2003) and poor socio-economic conditions (Gorstein et al., 1994). Because of its socio-economic dimension, stunting should be viewed in a broader context and not merely in a narrow nutritional sense (Zere and McIntyre, 2003). It has been suggested that integrated interventions include socio-economic variables, such as sanitation, housing, literacy and employment (Walsh et al., 2002) and improved caring capacity of mothers (De Villiers and Senekal, 2002) if the overall prevalence of stunting is to be decreased.

Stunted children typically have multiple functional disadvantages that persist throughout childhood. These include suboptimal cognitive development and school achievement (Chang et al., 2002; Mendez and Adair, 1999). They also tend to have increased risk of morbidity and impaired immune function (Pelletier, 1994).

The prevalence of stunting and underweight increases significantly from the first to second year of life, there after it remains fairly constant (Smuts et al., 2004; Oelofse et al., 1999). The period 6 to 24 months, in particular, carries a great risk of growth faltering and malnutrition, because of the inadequate nutritional quality of complementary foods and the increased risk of infections due to the decline in breastfeeding.

Anthropometric status should be evaluated in terms of both stunting and overweight. In the NFCS, 6% of one- to nine-year old children were overweight and childhood obesity was higher in urban areas, particularly for children of well-educated mothers (Labadarios et al., 2000). Secondary analysis of the NFCS data showed that stunting was associated with an increased risk of being overweight (Steyn et al., 2005). Mamabolo et al. (2005) showed that 19% of three-year-old children residing in the central region of Limpopo province were both stunted and overweight. Stunted girls seem to be at risk of relatively greater fat deposition, especially in the abdominal area (Kruger et al., 2004).

Micronutrient deficiencies

Micronutrient malnutrition is also called ‘hidden hunger’ as the consequences thereof often go unnoticed. Three micronutrient deficiencies have captured most of the world’s attention in the last decade, namely, vitamin A deficiency, iron deficiency anaemia and iodine deficiency disorders. Zinc deficiency has also recently come to the forefront. Multiple micronutrient deficiencies tend to interact and cluster and often occur in the same child

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TABLE 1
Prevalence of vitamin A and iron deficiency in 6-71-month-old children in South Africa in 1994 as determined by the SAVACG study (Source: Labadarios et al., 1995)

Province	Sample size N[a]	VAD[b]	Anaemic[c]	Iron depleted[d]	Iron deficiency anaemia[e]
		% of sample			
South Africa	4 206 - 4 494	33.3	21.4	9.8	5.0
Rural	2 107 - 2264	37.9	21.1	8.3	4.6
Urban	2 032 - 2 169	25.1	20.7	12.1	5.4
Eastern Cape	457 - 498	31.1	20.6	5.0	2.4
Free State	601 - 646	26.8	17.1	6.8	3.9
Gauteng	332 - 390	23.5	16.3	9.2	3.8
KwaZulu-Natal	474 - 516	38.0	10.4	13.4	3.5
Limpopo	552 - 578	43.5	34.2	11.0	9.1
Mpumalanga	461 - 500	33.0	27.7	11.5	7.0
Northern Cape	475 - 513	18.5	21.5	10.9	6.5
North-West	462 - 553	32.0	24.5	8.1	5.0
Western Cape	392 - 413	21.0	28.6	16.4	8.2

[a] *Sample size varies for the different indicators*
[b] *Vitamin A deficient; serum retinol <20 µg/dℓ*
[c] *Haemoglobin < 110 g/ℓ (haemoglobin is not a sensitive indicator of iron status as the levels only drop in the third stage of iron deficiency. It is also not a specific indicator of iron deficiency as other micronutrient deficiencies, parasitic infections and certain diseases also affect haemoglobin concentrations (Gibson, 2005; WHO, 2001).*
[d] *Ferritin < 12 µg/dℓ (serum ferritin reflects iron stores; it is an acute phase reactant and is therefore elevated in response to any infectious or inflammatory process (WHO, 2001).*
[e] *Hb < 110 g/ℓ and Ferritin < 12 µg/dℓ*

(Ramakrishnan and Huffman, 2001). This paper will report on vitamin A and iron only, because of availability of reliable national data and potential suitability for dietary intervention with regards to leafy vegetables.

The prevalence of vitamin A and iron deficiency in six-month to six-year old children as determined by the SAVACG study in 1994 is given in Table 1. With regards to vitamin A deficiency, Northern Cape (18.5%) and Western Cape (21.0%) had the lowest prevalence, while KwaZulu-Natal (38.0%) and Limpopo (43.5%) had the highest prevalence. With regards to anaemia, KwaZulu-Natal (10.4%) had the lowest prevalence, while Western Cape (28.6%) and Limpopo (34.2%) had the highest prevalence. Those living in rural areas and with poorly educated mothers were most affected.

As was the case in earlier studies (Vorster et al., 1997), smaller studies (Faber et al., 2001; Oelofse et al., 1999; Sickle et al., 1998) showed that there are pockets within the provinces where the prevalence of vitamin A deficiency and iron deficiency is substantially higher than that reported at provincial level.

Vitamin A deficiency

Vitamin A deficiency is caused by a habitual diet that provides too little bioavailable vitamin A to meet physiological needs (Underwood, 2000). Vitamin A from foods of animal origin, for example dairy products, liver and egg yolks, is in the form of preformed vitamin A, which is the most bioavailable dietary source of vitamin A. Foods of animal origin are often out of the financial reach of resource poor households, and many households rely on yellow/orange-fleshed vegetables, dark-green leafy vegetables and yellow/orange-fleshed non-citrus fruit as their main source of vitamin A. Estimates suggest that more than 80% of dietary intakes of vitamin A in Africa are from plant foods (WHO, 1995). Vitamin A in plant foods is in the form of provitamin A carotenoids, predominantly β-carotene. Provitamin A carotenoids in vegetables and fruit achieve vitamin A activity when they are converted to retinol in the body. Several factors influence the bioavailability and bioconversion of provitamin A carotenoids (Castenmiller and West, 1998; De Pee and West, 1996). These include the food matrix, size of the food particles eaten, food preparation methods that disrupt the food matrix to different degrees, the presence of fibre (inhibits carotenoid absorption), dietary fat (enhances absorption) and of bile salts and pancreatic enzymes in the intestinal lumen (enhance digestion), and the nutritional status of the individual. The food matrix and the presence of dietary fat are of particular importance.

Rapid growth and frequent infections, which cause ineffective utilisation of the vitamin, are also critical factors for vitamin A deficiency (Underwood, 2000).

Population groups vulnerable for vitamin A deficiency are children younger than five years; children with measles, acute or prolonged diarrhoea, acute lower respiratory infection, and severe protein-energy-malnutrition; children living under poor socio-economic conditions; non-breastfed infants; and pregnant and lactating women (Ahmed and Darnton-Hill, 2004).

Vitamin A deficiency is associated with a loss of appetite and poor child growth, as well as an impaired immune response with lowered resistance against infection (Gibson, 2005). Children who are vitamin A deficient are more likely to die than well-nourished children. Of the estimated 125 million preschool children who are vitamin A deficient globally, approximately 1 to 2.5 million die annually as a consequence thereof (ACC/SCN, 2000). In 2000 an estimated 3 000 deaths because of diarrhoea in children less than four years old in South Africa were attributed to vitamin A deficiency (Steyn et al., 2006a). Improving vitamin A status of young children can reduce the mortality rate by 23% in vitamin A deficient populations (Beaton et al., 1993).

Xerophthalmia collectively refers to all eye manifestations of vitamin A deficiency. The earliest eye-related sign of vitamin A deficiency is night blindness. This can progress to structural eye damage, namely, conjunctival xerosis (dryness of the membranes) and Bitot's spots (foamy white patches), followed by corneal xerosis (dryness of the cornea) and, in severe cases, keratomalacia (softening of the cornea). This may eventually result in impairment of vision or irreversible blindness (E-Siong 1995).

Vitamin A deficiency impacts on mortality of women of reproductive age. In 2000 an estimated 519 maternal deaths in South Africa were attributed to vitamin A deficiency (Steyn et al., 2006a).

Iron deficiency and iron deficiency anaemia

Iron deficiency develops when the intake of bio-available iron does not meet requirements or when excessive physiological or pathological losses of iron occur. Dietary factors influencing the bio-availability include the type of iron (heme iron versus non-heme iron), phytate, polyphenols and certain vegetable proteins (inhibit non-heme iron absorption); calcium (inhibits both heme and non-heme iron); and vitamin C, organic acids and animal tissue, e.g. meat, fish and poultry (enhance non-heme iron absorption) (Gibson, 2005).

The prevalence of iron deficiency varies greatly according to age, gender, and physiological, pathological and socio-economic conditions (WHO, 2001). Physiological iron requirements increase during periods of rapid growth and pregnancy. Increased physiological losses occur during menstruation, sensitivity to cow's milk, parasitic infections in the gastrointestinal tract and malaria. Premature and low birth weight infants are at high risk because of low body stores (Yip, 2001; WHO, 2001). Iron deficiency is particularly prevalent in infants, children and pregnant women (Gibson, 2005) and is most common among groups of low socio-economic status (Gibson, 2005).

Consequences of a poor iron status include impaired psychomotor development and cognitive performance in children; reduced work capacity, productivity, physical activity, aerobic capacity and endurance capacity; impaired immune status and lowered resistance to infection; impaired growth of infants and children; impaired temperature response to a cold environment; increased risk of heavy metal (e.g. lead) poisoning in children; increased overall infant mortality; and for pregnant women, increased maternal mortality, prenatal and perinatal infant loss and prematurity (WHO, 2001; Gibson, 2005). In 2000 an estimated 3 000 or more perinatal deaths in South Africa were attributed to iron deficiency anaemia (Steyn et al., 2006a).

Nutrient intake and food consumption for South African children

A report by Steyn et al. (2006a) stated that westernised eating patterns are reflected by the high prevalence of overweight and obesity in the South African adult and child population, despite the fact that stunting and chronic energy deficiency affect a large number of infants and children. This section will focus on the dietary intake of children.

Nutrient intake

The NFCS of 1999 showed an adequate protein intake. The NFCS further showed that a large number of children had an inadequate intake of energy, vitamin A, vitamin C, thiamine, riboflavin, niacin, vitamin B_6, vitamin B_{12}, folic acid, calcium, iron and zinc. Rural children were worse off than urban children. Food insecurity, whether due to poor food accessibility or availability, was directly related to an inadequate dietary intake and increased levels of stunting and underweight (Labadarios et al., 2000).

Inadequate intake of micronutrients starts during infancy. Oelofse et al. (2002) showed that particularly iron and zinc intakes were low during infancy. Faber (2005) reported that the complementary foods consumed by rural infants were of low nutrient density, especially for iron, zinc and calcium.

Foods consumed

As expected, the NFCS highlighted maize as the most frequently and consistently consumed food item by one- to nine-year old children, followed by whole milk and brown bread (Labadarios et al., 2000). Cereals were consumed by 99% of all children. The average daily consumption of cereals is 493 g for one- to five-year-old children, 559 for six- to nine-year-olds and 690 to 879 g for children ten years and older when taking the groups of consumers into consideration (Nel and Steyn, 2002). Fruit and vegetable consumption among South African children is low because of poor access and availability (Labadarios et al., 2000). Dietary diversity, which can be used as an indicator of the micronutrient adequacy of the diet, was shown to be low for South African children, and the low dietary diversity was associated with poor child growth (Steyn et al., 2006c).

Strategies to address micornutrient malnutrition

Within the Department of Health, the Integrated Nutrition Programme was initiated in 1995. It aims to ensure optimum nutrition for all South Africans by preventing and managing malnutrition. The objective within the focus area of micronutrient malnutrition is the elimination of micronutrient deficiencies. The specific targets to be reached by 2007 refer to a prevalence of 19% for vitamin A deficiency, 7.5% for iron deficiency and 5% for iodine deficiency (Labadarios et al., 2005). The major strategies to address micronutrient deficiencies are briefly discussed.

Supplementation refers to either universal supplementation, whereby large doses of vitamin A are distributed to all children of defined age (and other designated groups) within communities in specified regions according to a pre-established time schedule, or to targeted supplementation, whereby large doses of vitamin A are distributed through contacts between high-risk individuals and the existing health service infrastructure and/or community-based health programmes (Gillespie and Mason, 1994). Supplementation is considered a short-term strategy to address micronutrient deficiencies. The South African vitamin A supplementation programme forms part of the routine immunisation program (i.e. the EPI), maternal health, and the integrated management of childhood illnesses (i.e. the IMCI).

Food fortification refers to the addition of micronutrients to accessible and affordable foods that are regularly consumed by a significant proportion of the population at risk (Gillespie and Mason, 1994). The NFCS identified the most commonly consumed foods, which would be the most appropriate vehicles for fortification. As a result, fortification of two staple foods, namely maize meal and wheat flour was legislated in October 2003. Although this paper focuses mostly on vitamin A and iron, it should be noted that mandatory iodisation of household salt was introduced through revised legislation in December 1995.

In the case of ***biofortification*** staple crops are bred for increased mineral and vitamin content (Bouis et al., 2000). HarvestPlus, an international, interdisciplinary research programme, seeks to reduce micronutrient malnutrition through

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breeding staple crops for better nutrition. The vitamin A for Africa (VITAA) initiative promotes the production and consumption of orange-fleshed sweetpotato to address vitamin A deficiency in Sub-Saharan countries, including South Africa. The Vegetable and Ornamental Plant Institute of the Agricultural Research Council (ARC-VOPI) has an extensive breeding programme for orange-fleshed sweetpotato. The aim of the breeding programme is to breed for high β-carotene content, good yield, wide adaptability, good taste, good storability, drought tolerance and disease and pest resistance. Varieties fulfilling these criteria are taken through off-station yield trials and tasting and selection trials. The results of these trials are used to define cultivar recommendations for specific geographical areas in the country. A randomised controlled trial that was done by the Medical Research Council showed that the vitamin A status of primary school children improved after they consumed 1/2 cup of boiled and mashed orange-fleshed sweetpotato, Resisto variety, for 53 school days (Van Jaarsveld et al., 2005).

Dietary diversification/modification refers to a variety of approaches that aim to increase the production, availability and access to micronutrient-rich foods, the consumption of micronutrient-rich foods, and/or the bioavailability of micronutrients in the diet (Ruel, 2001). The scope of dietary modification is broad and it can be achieved through, for example:

- Horticultural approaches such as home-gardens
- Behaviour change to improve consumption through communications, social marketing or nutrition education
- Improved methods of food preparation, preservation and cooking that preserve micronutrient content.

Dietary modification is a long-term strategy that complements supplementation and food fortification programmes. It has been argued that dietary modification through successful promotion of behaviours that provide for adequate intake, together with ensuring availability of supply, is likely to be both sustainable and affordable (Ruel, 2001).

Nutrition education can stimulate the demand for certain foods, but the individuals must have the means and opportunities to act on that knowledge. In the Ndunakazi project in South Africa, caregivers of all the children were exposed to nutrition education, regardless whether they had a project garden or not. Yet, children from households with project gardens had a better vitamin A status than children who did not have a project garden at household level (Faber et al., 2002). This suggested that access to a supply was critically more important than education without ready access.

Bio-availability of the nutrients needs to be considered. Methods of food preparation, preservation and cooking therefore need to be given attention. The loss of micronutrients during preparation can be measured though retention studies. Van Jaarsveld et al. (2006), for example, showed that 83-92% of β-carotene is retained after cooking orange-fleshed sweetpotato, Resisto variety, for 30 min.

The availability of a greater variety of nutritious foods at community and household level can be increased through mixed cropping/diversification of crops; the introduction of new crops; the promotion of underexploited traditional food crops; and home gardens (FAO, 1997).

Diversification of the crops to increase the variety of foods in the diet across and within food groups is recommended internationally and dietary diversity is recommended as an objective to be included in each country's food-based dietary guidelines (FAO/WHO, 1998). 'Enjoying a variety of foods' has been recommended in the South African food-based dietary guidelines (Maunder et al., 2001).

Promotion of mixed cropping can increase the availability of a greater variety of nutritious foods, extend the harvesting period and help alleviate seasonal food shortages, and is associated with potential yield improvements and reduced risk of crop failure (FAO, 1997:Chapter 5).

Introducing new crops: The nutrient content of the crop and its potential contribution towards the nutritional requirements of the target population are predominant considerations in the selection of crops to promote. Breeders, agronomists and nutritionists should collaborate to evaluate potential nutritional attributes of the crops (FAO, 2001). Crops selected should be easy to grow and cook, and be palatable (Chakravarty, 2000). Consumer preferences in terms of the characteristics of the crop, e.g. colour, dry matter content, texture and flavour are important.

Indigenous foods: Indigenous vegetables require minimum production input; people are accustomed to them and know how to cultivate and prepare them. African leafy vegetables grow quickly and can be harvested within a short period of time. They grow on soils of limited fertility; provide good ground cover; are relatively drought tolerant; and are often cultivated without pesticides or fertilisers (Shiundu, 2002). Campaigns promoting these vegetables should focus on the younger generation, as they have less knowledge regarding wild green leafy vegetables (Modi et al., 2006).

Home gardens: In developing countries, home gardens are usually implemented to increase household production of fruits and vegetables as a way of supplementing the cereal-based diet of rural households. Few home-garden projects have the objective to increase household income (Ruel, 2001). This is also the case in South Africa, as was shown in a study in the Eastern Cape where the main purpose of home-gardens was to produce crops for household consumption (Mabusela, 1999).

Home-garden projects usually focus on crops that are rich sources of vitamin A. Several studies have shown that such crops have the potential to address vitamin A deficiency. Consumption of cooked sweetpotato (Jalal et al., 1998; Haskell et al., 2004; Van Jaarsveld et al., 2005), carrots (Haskell et al., 2005) and pureed green leafy vegetables (Takyi 1999; Haskell et al. 2004; Haskell et al. 2005) has been shown to improve vitamin A status.

Preventing malnutrition by addressing its causes

Adequate dietary intake is essential for good nutrition. It may, however, not be sufficient, because the presence of disease can result in reduced bioavailability or increased needs or nutrient losses and can thus also be an immediate cause of malnutrition (Stratton et al., 2003).

Apart from food (insufficient household food security), two additional, inter-related underlying causes of malnutrition are important: inadequate care on the one hand, and insufficient health services and an unhealthy environment on the other hand. Using the UNICEF conceptual framework for malnutrition as adapted by the Department of Health (Fig. 2) as basis for approaching the problem of malnutrition means acknowledging that malnutrition has many causes. To achieve the national nutrition targets thus requires implementation of multi-sectoral (different types of interventions by different

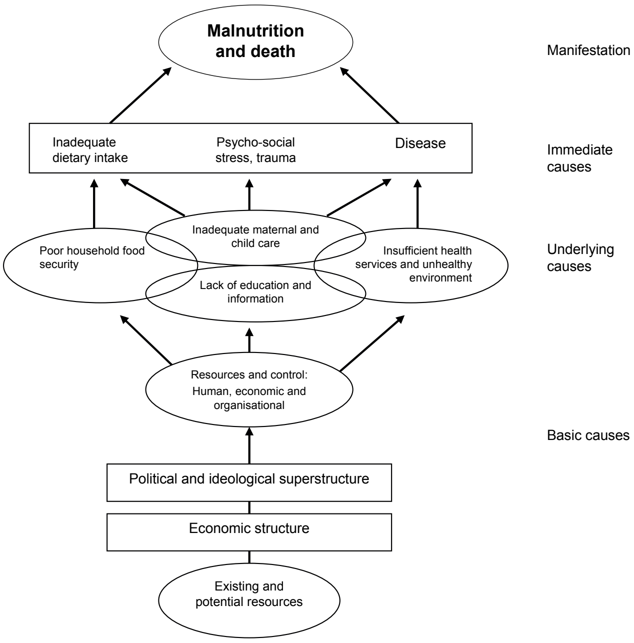

Figure 2
UNICEF conceptual framework of causes of malnutrition and death in children, as adopted by the South African Department of Health (Source: Department of Health, 1998)

disciplines or departments, e.g. Health and Agriculture) and multi-level (directed at immediate, underlying and basic causes) interventions. Nutrient deficiencies are interrelated, and a broad multifaceted comprehensive health intervention programme is therefore needed to address childhood malnutrition (Coutsoudis et al., 1994).

Concluding remarks

South Africa has a problem of chronic malnutrition, rather than acute malnutrition. Childhood malnutrition starts early in life and often coincides with the introduction of complementary feeding. Childhood malnutrition, in terms of stunting and underweight, doubles from the first to the second year of life. The prevalence of malnutrition varies among the provinces, and pockets of severe malnutrition exist within the provinces. Micronutrient malnutrition in terms of vitamin A and iron deficiency is widespread, with rural areas being affected more than the urban areas. Female obesity is high, and urban areas are worse than rural areas.

An inadequate dietary intake is considered one of the major causes of micronutrient deficiencies. Steyn et al. (2006b) stated that it is unlikely that food fortification would fully compensate for a significant inadequate dietary intake particularly for younger children who cannot eat large portions of fortified staple foods at a time. Eating rich sources of specific nutrients remains the only long-term sustainable solution. A whole diet approach is advisable, in contrast to a single food-focus. Many countries work at the improvement of dietary diversification through home gardens and agricultural support. The ultimate aim should be to empower communities to help themselves address the issues of under-nutrition through the utilisation of crops that are indigenous to their environment. Measures to enhance the potential nutritional outcomes of agricultural interventions are described by Wenhold et al. (2007).

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