# MICRONUTRIENT DEFICIENCIES AMONG SOUTH AFRICANS

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Since the discovery that micronutrients are essential nutrients, the growth of this field has been the subject of temporary excitement, continuing controversy, ridicule and confusion for the public and scientists alike. However, intensive research over the years has provided us with appropriate perspective regarding some crucial aspects of the essentiality of micronutrients and their role not only in relation to deficiency states but also in the prevention of disease. As such, early, mostly anecdotal, claims in the fields of therapeutics and prevention have been replaced largely by credible research data obtained from studies of robust and long-term design with evidence-based clinical outcomes (Fig. 1).

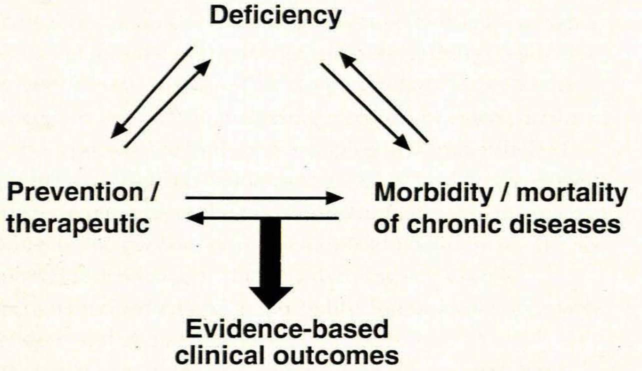


*Fig. 1. Micronutrients: perspectives and outcomes.*

The assessment of micronutrient status is based on the definition, in individuals or population groups, of the dietary intake of these nutrients, the determination of blood values and the occurrence of overt clinical manifestations of deficiency. Within the South African context, the latter is rather a rare occurrence and, from scanty available evidence, is occasionally seen in the severely malnourished individual or under defined adverse socio-economic and lifestyle situations as well as in disease states. In public health terms, most of the studies in this field have been limited, and the few that are available have been of a small scale and have addressed primarily regional/local issues. It is only recently that available data are being analysed collectively or national surveys are beginning to be commissioned.

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## MICRONUTRIENTS: DIETARY INTAKE DATA

In terms of dietary intake, the South African National Nutritional Status Study Group (SANNSS)[1] collectively analysed the results of 55 studies which met the inclusion criteria for the analysis, namely randomisation, ethnicity, age, and the type of database used for the analysis of the dietary data obtained. Apart from a low-energy intake in children and adolescents, especially in rural black populations, a general tendency for the westernisation of our diet was noted, with the traditional low-fat, high-fibre diet being replaced by a high-fat, low-fibre diet. This of course is in agreement with the increasing urbanisation which the country is experiencing as part of its transition. In terms of micronutrients (Table I), calcium and riboflavin intake was found to be low in black rural and urban settings as well as in the coloured and Indian population groups. These low intakes may be due to the infrequent consumption of milk and milk products, which are the richest sources of these nutrients. The intake of iron was also low in the very same population groups known to be vulnerable for iron deficiency, namely young children, adolescent girls and women. Similarly, zinc intake was uniformly low in all population groups of all ages, with the exception of white males. Overall, a similarly low pattern of intake was found for vitamin $B_6$, whereas folic acid intake was low in Indian and rural black women of child-bearing age. Vitamin C intake was low primarily in the black and Indian population groups as well as in coloured adolescents, with vitamin A intake being low in black children younger than 10 years of age and in urban black women.

**Table I. Micronutrients: dietary intake of South Africans**

| |
|---|
| Low intake of: |
| Calcium |
| Folate |
| Iron |
| Magnesium |
| Riboflavin |
| Vitamin A |
| Vitamin $B_6$ |
| Vitamin C |
| Zinc |

Although these data are very useful as broad trends and guidelines, they do have a number of obvious limitations, which can only be overcome when national data become available. Nevertheless, the reported low energy intake, especially in children, is of particular significance not only from the point of view of adequate growth, but also because of the current recommendations in the country to increase the energy density of foods eaten by children by adding energy-dense foods with a poor micronutrient content. Such practices can only accentuate the inadequacy of micronutrient intake, especially among individuals with a marginal micronutrient intake, and should only be implemented in conjunction with measures to increase micronutrient intake simultaneously. Furthermore and within the context of the available information, the generally true statement 'one can get all the micronutrients one needs from a balanced diet' can only be realistic if one has the financial means and one invests time and effort in eating correctly.

## MICRONUTRIENTS: BIOCHEMICAL DATA

In 1994 the South African Vitamin A Consultative Group (SAVACG) completed the first ever national survey in children 6 - 71 months of age,[2] which was commissioned and financed by the Department of Health and was also financially supported by UNICEF and Sight and Life International. The survey included 11 430 children in 18 219 households (19 003 families). The survey defined, among other parameters of nutritional and immunisation status, the vitamin A and iron status of these children. In terms of vitamin status, the national prevalence of vitamin A deficiency (serum vitamin concentration < 10 µg/dl) and marginal vitamin A status (serum vitamin A concentration < 20 µg/dl) was 33% and ranged from 18% in the Northern Cape to 43% in Northern Province (Fig. 2). Deficient and marginal vitamin A status combined was also significantly more prevalent in the rural (38%) than in the urban (25%) areas ($P < 0.001$). Furthermore, the prevalence of vitamin A deficiency and marginal vitamin A status was highest in older children within the age group studied, in those living in informal-type housing, and in those whose mothers were poorly educated. Children of mothers with no formal education or less than 5 years of such education were more than twice as likely to have a poor vitamin A status than children of mothers with a Standard 10 or higher level of education ($P < 0.0001$). On this basis and according to international criteria, this survey identified a serious public health problem of vitamin A deficiency in the population surveyed. By contrast, although at the national level the prevalence of mild, moderate and severe anaemia was 21%, 7% and 0.2% respectively, the prevalence of iron depletion or deficiency and of iron deficiency anaemia was 10% and 5% respectively (Table II). Of further interest was the finding of a relatively poor correlation ($r = 0.12$) between the haemoglobin and ferritin concentration (Fig. 3), a finding that implies the presence of underlying inflammation/infection, or alternatively the presence of folic acid or vitamin $B_{12}$ deficiency. In terms of age, the 6 - 24-month age group of children was the most severely affected. Also of interest was the finding that, as a group, children with marginal vitamin A status were at a significantly higher risk of also being anaemic (risk ratio (RR) 1.64; confidence interval (CI) 1.46; 1.84) and of having iron deficiency anaemia (RR 1.48; CI 1.14; 1.91). Children with vitamin A deficiency were at an even higher risk of being anaemic (RR 2.13; CI 1.73; 2.62).

**Table II. Micronutrients: iron status in children 0.5 - 6 years of age**

| Parameter | Prevalence (%) |
|---|---|
| Haemoglobin (Hb) (< 11 g/dl) | 21 |
| Ferritin (F) (< 12 µg/l) | 10 |
| MCV (< 73 fl) | 17 |
| Hb < 11; F > 12 | 16 |
| Hb > 11; F < 12 | 5 |
| Hb < 11; F < 12 | 5 |
| Hb < 11; F < 12; MCV low | 3 |

MCV = mean corpuscular volume.

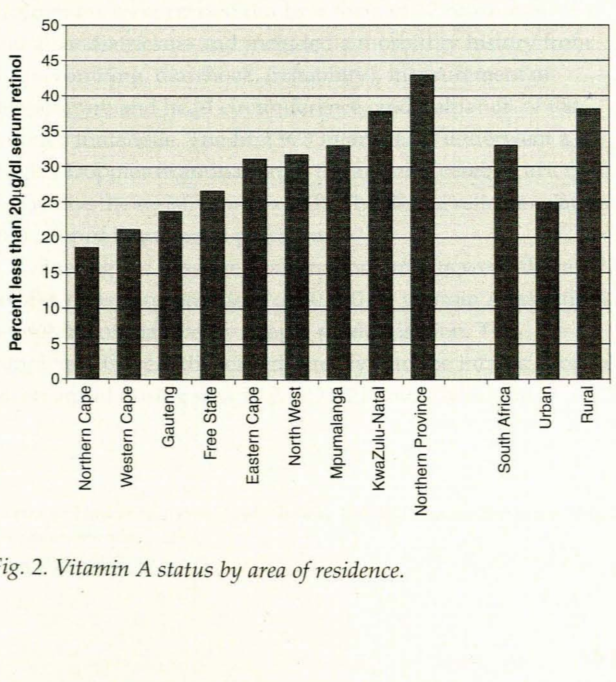


*Fig. 2. Vitamin A status by area of residence.*

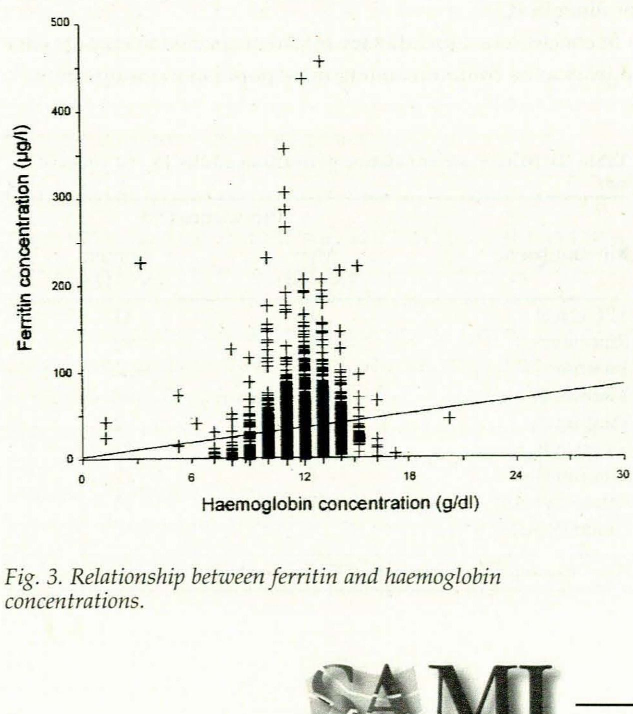


*Fig. 3. Relationship between ferritin and haemoglobin concentrations.*

Other smaller scale, regional/local studies ( D. Labadarios — unpublished data) indicate that the prevalence of anaemia in primary school children can be as high as 83%. Low serum iron in this age group of urban black children has been reported to be as high as 94%. However, on the basis of serum ferritin concentration and serum transferrin saturation, depleted iron stores or deficiency have been reported in up to 36% of children of all population groups. In rural black adolescents the prevalence of anaemia and iron depletion or deficiency has been documented in up to 26% of the populations studied. Severe anaemia is rather uncommon among pregnant women in the country, but collectively the available data indicate that iron depletion or deficiency is present in 20% of women, iron-deficient erythropoiesis in 22% and iron deficiency anaemia in 17%. Most studies, however, show that the prevalence of poor iron status increases with the duration of pregnancy. The few studies that have assessed folic acid status indicate that folic acid deficiency is present (5 - 35%) across all ages and ethnic groups.

Urbanisation in general is known to be associated with significant, and from the public health point of view very important, changes in dietary patterns and nutrient intake.[3] In South Africa, the reported westernisation in dietary patterns[1] of urbanising rural populations is a cause for concern, especially, among other aspects, its effects on micronutrient status. A recent study (D Labadarios, L Bourne, K Steyn, *et al.* — unpublished data) in a peri-urban population has found that up to 50% of women had an intake of < 67% of the recommended dietary allowances (RDAs) for energy, thiamin, riboflavin, vitamin C, vitamin $B_6$, vitamin A, vitamin E, folic acid and vitamin $B_{12}$. These findings indicate that this population was at high risk for multiple vitamin deficiencies, which was confirmed by blood vitamin analysis (Table III). The prevalence of deficiency varied from 2% for vitamin A to 73% for vitamin $B_6$.

In conclusion, a low dietary intake of specific micronutrients appears to be common among most population groups in the country, with rural and peri-urban populations being at higher risk. The available biochemical data are largely supportive of the low dietary intake of micronutrients. Policy formulation to address these inadequacies effectively is hampered by the inherent limitations of the available data and the lack of nationally representative data. In this regard, the recently commissioned national survey by the Department of Health on the food consumption patterns of children 1 - 9 years of age is an encouraging development which will undoubtedly contribute significantly to policy formulation for this vulnerable group of the population.

**Table III. Micronutrient status: peri-urban adults 15 - 64 years of age**

| Micronutrient | Prevalence (%) Men ($N$ = 44) | Prevalence (%) Women ($N$ = 125) |
|---|---|---|
| TPP effect | 36 | 41 |
| Riboflavin | 52 | 70 |
| Vitamin C | 47 | 22 |
| Vitamin $B_6$ | 73 | 67 |
| Vitamin A | 2 | 2 |
| Vitamin E | 39 | 33 |
| Vitamin $B_{12}$ | 0 | 2 |
| Folate (serum) | 18 | 13 |
| Folate (RBC) | 5 | 7 |

TPP = Thiamin pyrophosphate effect; RBC = red blood cells.

**References**


1. The South African National Nutritional Status Survey Group (SANNSS). *Nutrient intakes of South Africans: An analysis of the literature*. Isando, Johannesburg, 1995.
2. The South African Vitamin A Consultative Group (SAVACG). *Children Aged 6 to 71 Months of Age in South Africa, 1994: Their Anthropometric, Vitamin A, Iron and Immunisation Coverage Status*. Isando, Johannesburg, 1995.
3. Drewnowski A, Popkin BM. The nutrition transition: new trends in the global diet. *Nutr Rev* 1997; **55:** 31-43.