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# Impact of dietary modifications on malnutrition in rural community

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Dietary modification strategies to address malnutrition should, therefore, focus on the nutritional quality of the diet, rather than on energy content only. Animal foods are particularly rich sources of bio-available iron, zinc and vitamin A and these nutrients are difficult to obtain in adequate amounts from plant foods alone. Foods of animal sources (particularly muscle tissue) also enhance the absorption of the less bio-available non-heme iron. Dietary modification strategies need to be introduced from a very young age. In the developed world, commercially available baby products play an important role in meeting the nutritional requirements of infants, but in developing countries cost and possible contamination (bottle feeds) prohibit the use of baby products. Addition of small amounts of foods of animal sources can improve the nutritional quality of the diet, as well the nutritional status and functional outcomes of rural populations. A moderate increase in the consumption of animal source foods includes availability, affordability and lack of cold storage facilities. Adequate dietary intake is essential for good nutrition, but frequent infections can also lead to malnutrition. The underlying causes of malnutrition, *i.e.* inadequate care on the one hand and insufficient health services and an unhealthy environment on the other hand, should also, therefore, be addressed.

**Key Words :** Dietary, Modifications, Rural community, Cereals, Animal source foods

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## INTRODUCTION

Childhood malnutrition is highly prevalent in developing countries. Globally 35 per cent (3.5 million) of child deaths before the age of five years were attributed to under nutrition in 2004 (Faber, 2010). Stunting, severe wasting and intrauterine growth restriction had the highest disease burden, accounting for 21per cent of under-five death. Vitamin A and zinc deficiencies are the two micronutrient with the largest disease burdens. Vitamin A deficiency resulted in 6 per cent (0.6 million) of under-five deaths and zinc deficiency in 4 per cent (0.4 million) of under-five deaths (Black *et al*., 2008).

Rural communities generally consume a diet based mainly on plant-based staple foods. Animal sources foods are good source of vitamin A, vitamin $B_{12}$, riboflavin, calcium,iron and zinc. A low consumption of animal source foods predisposes rural communities to deficiencies in these micronutrients. In this paper efforts were made to illustrate the poor diet and consequences thereof in rural communities.

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**Dietary intake of infants and children:**

A study of 275 rural infants aged 6-12 months showed that the complementary diet consisted mostly of a porridge made with cereals meal (Jowar, Bajara, Maize, Oat and Wheat), which is a bulky food low in nutrient density. Using these cereal meals as complementary food is not unique to as it is used for infant feeding in majority. In the study, 17 per cent of the infants consumed animal products and 26 per cent consumed dairy products. These low intakes of animal and dairy products contributed towards the low nutrient density of the complementary diet for iron, zinc and calcium, which had nutrient densities half of that desired.

The poor diet persists during childhood. The diet of 1-9 year old children was predominantly cereal and pulses based and consumption of fruit, vegetables and foods of animal sources is low. At the national level, dietary intake was below 67 per cent of the recommended dietary allowances (RDA) for several of the micronutrients, including calcium, vitamin A, iron and zinc. Animal foods are particularly rich sources of

these nutrients and these nutrients are difficult to obtain in adequate amounts from plant foods alone. The diet generally low in iron and zinc content, but the absorption of these two nutrients is inhibited by the phytate present in cereal meal.

**Nutritional status of children:**

A survey indicates that 64 per cent of 1-9 year old children were vitamin A deficient, 28 per cent were anemic, 13 per cent had a poor iron status and 45 per cent had a low zinc status. Vitamin A deficiency' is associated with an impaired immune response with lowered resistance against infection were attributed to vitamin A deficiency. The majority of these deaths were accounted for by diarrhea diseases.

Iron deficiency in pregnant women is a risk factor for maternal and perinatal mortality. Maximum perinatal deaths are attributed to iron deficiency. Childhood malnutrition and maternal overweight co-exist in the same community and often within the same household. Dietary modification strategies to address malnutrition should, therefore, focus on the nutritional quality of the diet (particularly those micronutrients of greatest concern, namely iron, zinc and vitamin A), rather than on energy content only. Foods that are rich sources of highly bioavailable vitamin A are fish-liver oil, liver and egg yolk. Foods that are rich sources of bio-available iron are liver, kidney and red meat, followed by chicken and fish. Foods that are rich sources of zinc are meat, liver and fish. Majority of the Indian population not accepting the meat in their diet (Faber, 2010).

**Dietary modification to improve nutritional quality of the diet:**

Dietary modification refers to a collection of strategies that aim to increase the following:

–Production, availability of and access to micronutrient rich foods through, for example, agricultural approaches.

–Consumption of micronutrient-rich foods through behaviour change, which is achieved using communication, social marketing and nutrition education strategies.

–Bio-availability of micronutrients in the diet, through improved methods of food preparation, preservation and cooking.

**Infant feeding and fortified products:**

Dietary modification strategies need to be introduced from a very young age. Children aged 6-23 months are the most vulnerable in terms of childhood malnutrition for example, showed that the prevalence of childhood malnutrition doubled from the first to the second year of life. The nutritional quality of complementary foods offered during this period is often poor relative to nutritional requirements. Dietary modification strategies should, therefore, focus on improving the, nutritional quality of the complementary diet of infants in rural communities.

In the developed world, commercially available baby products play an important role in meeting the nutritional requirements of infants (Skinner *et al*., 1997; Fox *et al*., 2006). Iron fortified formula milk is a major source of dietary iron in the developed world (Soh *et al.*, 2002) and the use, therefore, can prevent anemia (Daly *et al.*, 1996). In communities of poor socio-economic status, however, contamination and incorrect preparation of bottle feeds are of concern and the use of formula milk is, therefore, not encouraged.

Whereas, infant cereals were shown to contribute significantly to the micronutrient intakes of infants (Fox *et al*., 2006), micronutrient deficiencies were observed in infants in an urban area where more than 80 per cent of the infants consumed fortified infant cereals. Dietary information showed that the infant cereals were used in diluted form (Oelofse *et al*., 2002). The intake of inadequate quantities of infant cereals was also shown for rural infants and it was argued that the high cost of these products prohibited an adequate intake (Faber *et al.*, 2001). In India, even the cost of most commercially available fortified infant cereals is a constraint for an adequate intake in poor communities. Dietary modification strategies that are more affordable are, therefore, needed.

**Inclusion of animal source foods:**

Foods of animal sources can supply multiple micronutrients, and the bio-availability of particularly iron and zinc is higher in animal source foods than in plant source foods.

Foods of animal sources (particularly muscle tissue) have a high content of bio-available helve iron. Addition of 25 g of animal food to a hone-prepared vegetable puree meal of 7-8 month old infants was shown to increase the absorption of non-heme iron. A small increase in non-veg intake at the age of 8 months prevents a decline in hemoglobin concentration in infants.

Inclusion of about 10 g of liver once per week over a 15-week period resulted in a significant improvement in serum retinol concentrations of 2-3 year old children. Liver has the additional benefit that is also a rich source of bio-available iron.

The effect of animal source food intake on micronutrient nutrition and growth and cognitive and behavioural outcomes was evaluated in a controlled school feeding trial in Standard 1. Baseline data showed inadequate micronutrient intakes, particularly for iron, zinc, vitamin A, vitamin B12 and calcium, and to a lesser extend riboflavin. Biochemical findings showed deficiencies of vitamin A, vitamin B12, iron, zinc and riboflavin.

Increased consumption of animal source foods in

developing countries will supply important micronutrient' and high quality protein to the diet of vulnerable populations. In a review paper, Randolph *et al*. (2007) stated that a moderate increase in the consumption of animal source foods will provide critical nutritional benefits without a significant increase in the risk of chronic diseases in the poor.

Besides from supplying essential micronutrients, certain animal source foods (particularly muscle tissue) have the additional benefit and that they enhance the absorption of the less bio-available non-heme iron when consumed in the same meal.

Porridge made with cereals specially maize meal is the most frequently consumed food item children and adults. Maize meal has a high phytate content, which is an inhibitor of non-heme iron absorption (Davidson, 1996). Including small amounts of animal source food (at least 50 g) in a phytaterich meal low in vitamin C content was shown to increase non-heme iron absorption. The absorption of non-heme iron can also be increased by, for example, including a vitamin C rich food in the meal or by excluding inhibitors of non-heme iron absorption from the meal. Tea, one of the five most frequently consumed food items by children contains tannins (an inhibitor of non-heme iron absorption), and regular tea consumption has been shown to be a risk factor for anaemia in infants (Faber, 2007). Replacing the tea with, for example, an orange (rich in vitamin C), at meal times could potentially have a beneficial effect on the non-heme iron absorption (Faber, 2010).

**Constraints for frequent consumption of animal source foods:**

The inadequate dietary intake of various micronutrients in rural communities is usually ascribed to the low consumption of fruit, vegetables and animal source foods. Although there is a rise in the production of livestock products, consumption of animal source foods remains at very low levels in the poorer Indian communities. Constraints for frequent consumption of these foods include orthodox altimades availability, affordability and lack of cold storage facilities.

**Availability:**

Availability of foods of animal sources in remote areas could be achieved through, for example, livestock. In rural or appropriate settings, the important role home based crops and livestock can make to the children's diet should be strengthened and promoted as feasible and appropriate. Therefore, the importance of agricultural interventions with nutritional outcomes is important.

In a review paper, Berti *et al.* (2004) identified five types of capital that agricultural interventions need to invest in order to improve nutritional outcomes. These were (i) natural capital (e.g. sustainable agricultural practices; intensifying existing systems; and diversifying by adding new systems), (ii) physical capital (e.g. land, tools, and livestock), (iii) social capital (e.g. using social and participatory processes), (iv) human capital (e.g. agricultural training; nutrition education; and gender considerations), and (v) financial capital (e.g. access to credit, grants, subsidies; value added products and marketing). Nutrition education was shown to be crucial for the success of agricultural interventions with nutritional outcomes.

**Affordability:**

Rural and urban women in Maharashtra (India) considered affordability as major constraint for frequent consumption of animal source foods. A study in a few villages in Katol tehsil distt. Nagpur of Vidarbha showed that, although 11 per cent of the caregivers regarded non-veg, on its own or in combination with other food items, as best food for the child, only 3-4 per cent of the caregivers usually bought chicken and other non-veg except meat for the household.

Dietary diversity can be used as an indicator of the micronutrient adequacy of the diet. In a study in one of the poorest village, households were grouped according to the dietary diversity of the diet consumed by the household. For households with low dietary diversity, "cereals, pulses, oilseeds and tubers" was the only food group that was consumed by at least 50 per cent of the households the day prior to the survey. These households (with low dietary diversity) were shown to be more impoverished in terms of household assets and had fewer saving accounts, compared to households consuming a diet with higher dietary diversity. It would, therefore, be difficult for these households to increase their consumption of animal source foods because of their limited economic ability to obtain a variety of foods. Dietary diversity are linked to socioeconomic characteristics.

Food prices have risen sharply during the recent past. As a result, the poor in developing countries will cope with the rise in food prices by decreasing the consumption of non-staple foods such as non-veg, dairy, fruit, vegetables and pulses. It is predicted that a 50 per cent increase in all food prices across the board (holding income constant) will result in a 40 per cent decline in dietary iron intakes.

**Cold storage facilities:**

Animal source foods are perishable and the lack' of electricity and cold storage facilities can affect their availability and access. Present, 65 per cent of urban households and 94 per cent of rural households did not have a working fridge or freezer in India. Owning a fridge was shown to be associated with households consuming a diet of higher dietary diversity. At the national level, a lack of cold storage facilities has been shown to be a risk factor for childhood malnutrition (stunting and/or underweight). The shelf-life of perishable foods such as, for example milk, can be extended

through fermentation, which is a processing method commonly used by households in India.

**Dietary intake within the broader context**

Although adequate dietary intake is essential for good nutrition, dietary intake is not the only factor affecting the nutritional status of rural communities, as frequent-infections can also lead to malnutrition. Apart from household food security, two additional underlying causes of malnutrition need to be addressed namely, inadequate care and insufficient health services and an unhealthy environment (UNICEF, 1990). For example, breastfeeding, immunization and regular growth monitoring are essential for good nutritional status of infants and small children. Safe water and sanitation are often lacking in rural communities, and aspects of hygiene and sanitation should, therefore, be addressed to ensure that the people get the full nutritional benefit from the food that they eat.

In summary, rural communities generally consume a plant-based diet. The low intake- of animal source foods predisposes these communities to micronutrient deficiencies, particularly iron, zinc and vitamin A, which are of public health significance in most developing countries. Consuming small amounts of animal source foods from a young age can potentially improve the nutritional quality of the predominantly plant-based diets of the poor. The feasibility of increasing the consumption of animal source foods will, however, depend on how successful the constraining factors can be overcome.

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