

Invited Commentary

Finger millet in nutrition transition: an infant weaning food ingredient with chronic disease preventive potential

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Micronutrient malnutrition in the context of the global nutrition transition presents unique nutrition intervention challenges. While the most common consequences (stunting, impaired neurocognitive development, increased child morbidity–mortality and maternal morbidity) persist, micronutrient malnutrition may also have an impact on diabetes and other chronic diseases⁽¹⁾. Under these circumstances, innovative dietary diversification to reinforce health promotion and disease prevention is needed. However, this can present a challenge particularly in those food-insecure households in developing countries that have limited access to fruits, vegetables and animal products. The strategy must therefore be expanded to intervene with other plant sources. In a paper published in this issue of the *BJN*, Shobana *et al.*⁽²⁾ provide evidence for hypoglycaemic, hypocholesterolaemic, nephroprotective and anti-cataractogenic properties of a ‘health-grain’, finger millet (African millet, ragi, *Eleusine coracana* L.).

Grown in arid regions of Eastern and Southern Africa, India and Nepal, finger millet (FM) was once the principal staple for poorer farming communities⁽³⁾. It is adaptable to higher elevations, and its small seeds have a long shelf life without insect damage, which makes them good reserves for famine-prone areas⁽³⁾. A generation after FM received ‘unfashionable’ nutritional status, the grain is gaining popularity⁽⁴⁾. FM is now being heralded as the ‘wonder-grain’ – it is delicious and nutritious, superior in mineral and fibre contents to rice, and is healthy for diabetics⁽²⁾. It is slowly digested and can be grown with environmentally friendly practices.

The micronutrient density of FM is higher than that of rice or wheat⁽⁵⁾. Malting FM improves Fe and Zn bioavailability, and FM flour has been established as an effective vehicle for fortification to provide bioaccessible Zn⁽⁶⁾. It is high in Ca, Fe and Mg⁽⁷⁾, and contains the amino acid methionine, which is lacking in the diets of food-insecure households who live on starchy staples such as cassava, plantain, polished rice or maize meal. Supporting the health properties reported by Shobana *et al.*⁽²⁾, the high Ca, high soluble fibre, low fat and low glycaemic index of malted FM more effectively (compared with rice and wheat) regulate blood glucose levels in diabetics⁽⁸⁾. The absence of gluten makes it suitable for gluten-sensitive individuals. Tannins in FM bind to proteins, carbohydrates and minerals, and decrease their bio-availability. However, these can be removed.

As Shobana *et al.*⁽²⁾ state: ‘apart from being a rich source of dietary fibre, phytate and minerals, the millet seed coat is a reserve of many health beneficial phenolic compounds’⁽²⁾. FM contains many flavonoids with antioxidant, anti-allergic, anti-inflammatory, anti-carcinogenic and gastroprotective properties^(9,10). Phenolic constituents in FM such as vanillic acid and quercetin inhibit cataract of the eye lens⁽¹¹⁾. This is significant because cataract is one of the three major causes of blindness worldwide, and diabetes is one of the major risk factors. Clinical trials should evaluate culturally tailored food formulations based on local FM processing technology.

With reference to local processing, malted FM (sprouted or germinated seeds) is a popular complementary food in parts of Africa and India^(12–16), with beneficial digestible attributes and improved mineral bioavailability⁽¹⁷⁾. Food scientists in Tanzania and India created malted products^(12–17), with malted FM as the prime ingredient. In southern India, paediatricians recommend FM for infants of 6 months and above because of its protein digestibility and micronutrient composition. Homemade ragi malt happens to be one of the popular infant foods and is consumed by children, as well as by pregnant and lactating women.

FM is appreciated by the people of eastern and northern Uganda, and is considered to be of ‘high social value’. They traditionally hold celebrations for the new harvest, and serve FM bread or hot porridge with either sugar or banana juice⁽³⁾. In India, it was, until recently, a principal cereal of the rural poor and the farming classes in Karnataka, Tamil Nadu and Andhra Pradesh, and in the Himalayas and Nepal. FM is now being popularised in India for its value-added nutritive value. This versatile grain has been incorporated into many types of foods. FM is ground and cooked into cakes, puddings or pancakes. It is used as a flavoured drink in festivals in India. It is converted to flour by roasting for the preparation of various food items or is made into flat-breads, including leavened dosa and unleavened roti. Malted FM flour is made into bread and other baked products. The flour is consumed by mixing with milk, boiled water or yogurt.

In addition to helping to address the nutritional security of the rural and urban poor, this grain could also be an appropriate choice for the elite who will benefit from its functional properties⁽¹⁸⁾. This high-methionine grain might also be beneficial in parts of the world (Latin America and North America) where it is now largely ignored. Current policies emphasising primary agricultural production must include

micronutrient outcomes and chronic disease prevention among their goals. Collaborations between cereal science researchers, public health nutritionists and farmers are encouraged. Local problems of malnutrition and chronic diseases can potentially be solved through food formulations using local technology⁽¹⁹⁾. That is exactly what the study of Shobana *et al.*⁽²⁾ does. This innovative well-designed study offers insights into the possible spectrum of anti-diabetic biochemical health effects of FM using an animal model. The authors lay a strong scientific foundation for further international level millet-based clinical trials to reduce malnutrition, as well as to prevent diabetes and its complications.

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