

## Editorial

# Can We Achieve Micronutrient Adequacy and Cognition in Children Through Millets?

Kommi Kalpana\*

Department of Nutrition, St. Francis College for Women, India

\*Corresponding author: Kommi Kalpana, Assistant Professor, Department of Nutrition, St. Francis College for Women, Hyderabad, India. Tel: +919390359343; E-mail: palem.kalpana@gmail.com

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Malnutrition is an important public health problem and has a serious, long-term consequence which includes delay in motor, sensory, cognitive, social and emotional development in children [1]. Malnourished children are less likely to perform well in school [2] and more likely to grow into malnourished adults at greater risk of disease and early death [3]. Inadequate intake of food, both in quality and quantity, and high requirements due to growth combined with a high burden of infectious diseases has often resulted in nutrient deficiencies among vulnerable groups, especially children [4,5]. Poverty, illiteracy, poor hygiene and sanitation, hookworm infestation, ignorance of parents and poor food security are major predisposing factors of nutrient deficiencies. Low consumption of vegetables and animal foods are the major causes of micronutrient deficiency, especially for people belonging to low income groups [6].

Micronutrients such as Zinc, iron, iodine, folic acid, Selenium, vitamin B<sub>12</sub> and long-chain PUFA plays a crucial role in cognitive function [7-9] as these nutrients are involved in metabolic processes such as production of enzymes or essential cofactors, which are crucial to brain growth and development [10-12]. Poor diet is positively associated with low intakes of these nutrients and compromise the health and development of many school-age children worldwide. Therefore, it is important to enhance consumption of healthy foods by increasing variety of foods that are rich in beneficial compounds to improve nutrient deficiencies.

Millets are small-seeded with different varieties such as sorghum (*Sorghum bicolor*), pearl millet (*Pennisetum glaucum*), finger millet (*Eleusine coracana*), kodo millet (*Paspalum setaceum*), proso millet (*Penicum miliaceum*), foxtail millet (*Setaria italica*), little millet (*Panicum sumatrense*), and barnyard millet (*Echinochloa utilis*) are important food crops and chief energy source for the people of arid and semiarid regions of the world. Until the recent past, millets were considered as poor man's staple diet and widespread use of millets was hindered by the presence of peri-

carp, dark pigmentation, policies, processing equipments and technologies. The economic importance of millets is increasing, due to their important contribution to national food security and potential health benefits.

Millets are rich in protein, fibre, B-vitamins, calcium, phosphorus, iron, zinc, and magnesium and phytochemicals including tannins, phenolic acids, anthocyanins, phytosterols and policosanols [13,14]. In addition, millets have many benefits which include reduction of overweight and obesity, diabetes, cardiovascular diseases, cancer, cataract, diverticulosis & diverticulitis and celiac disease [15-17]. However, there is a huge concern about the low availability of nutrients arising from the presence of antinutrients such as phytate, polyphenols and oxalate, is one the factor limiting the quantity of millets [18,19]. Research evidence suggests that processing methods such as germination, fermentation, malting soaking, milling, baking, popping, parboiling and extrusion cooking can enhance the bio availability of protein and micro nutrients [20-23]. Other agricultural interventions such as bio fortification also increase nutrient density in crops and bio-availability of micronutrients [24, 25].

Millets are nutritionally comparable or even superior to staple cereals such as rice and wheat [26]. Considerable research studies suggest that nutrient adequacy can be achieved and deficiencies can be altered with millets. The acceptability of millet foods was very good with the children in the school midday meal programme [27]. Incidence of Protein-Energy Malnutrition (PEM) may be lowered by an increase in bio-availability of millet amino acids [28] and improved nutritional status in terms of weight gain, lowered nutritional deficiency symptoms and decreased morbidity in children with supplementation of sorghum recipes [29]. Iron deficiency may lead to delayed mental and physical development, negative behavioural consequences, reduced auditory and visual function, and impaired physical performance in children. A study published by Kodkany, et al. (2013) [30] shows that pearl mil-

let contains more iron can provide young children with their full daily iron needs. Nazni, et al. (2010) [31] also shows an increase in height, weight, hemoglobin and improved cognition with supplementation of Ragi biscuits for a period of 3 months in children aged between 2-3 years. The impact of sorghum diet on serum micronutrient status in terms of hemoglobin, ferritin, calcium, retinol binding protein, folic acid of school children showed a positive impact with the inclusion of 60% sorghum + 40% rice diet for a period of 8 months than a rice based diet alone [32].

Henceforth, it is concluded that cognition can be improved with micronutrient adequacy through inclusion of millets in our diet. Biofortification of millet crops is found to be useful, thus research should be continued to ameliorate micronutrient inadequacy. Research on the cognitive benefits of various millets in all age groups should be explored.

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