Review Article

Mainstreaming Millets: Reviving the Miracle Grain for Addressing Rising Burden of Non-Communicable Diseases

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Abstract

Millets have been known and grown in India since the Vedic times and have been part of traditional Indian diets ever since. Production and consumption of millets saw a considerable decline after the Green Revolution. The opportunity cost of substituting wheat and rice with millets is evident now with an incremental increase in the incidence and mortality of non-communicable diseases (NCDs) over successive decades. Food security, climate crisis, and the inherent resilience of the crop to grow in semi-arid climates have been some of the key factors that have been instrumental in reviving the millet story. Millets being rich in micronutrients, fibers, and a low glycemic index are ideally suited to address the rising burden of NCDs. Stewardship by the government in the form of policy inputs and creating a favorable ecosystem with the involvement of farmers, industry, and even consumers to mainstream the grain has seen a paradigm shift in the past decade. 2023 will be observed as the International Year of Millets by the United Nations which will provide the platform to not only advocate the health benefits attributed to the grain but also mainstream millets in the international arena.

Keywords: Climate crisis, food security, International Millet Year 2023, millets, non-communicable diseases

Introduction

In recent times, the narrative in the context of millets has seen a paradigm shift due to their rich nutritional profile and the ability to grow in semi-arid regions with minimum requirements of resources.[1] The nutritional, environmental and economic benefits of Millets and their relevance rightly recognised by the Government of India (GoI) observed 2018 as the year of millets with a two-pronged approach to revive the crop, encourage farmers, and create demand by increasing awareness. Leading the initiative further, GoI had moved a resolution in the United Nations declaring 2023 as the International Year of Millets. Tangible steps to promote millets have been taken by establishing centers of excellence to develop drought-resistant varieties, and streamlining supply chains by facilitating procurement under the National Food Security Act are some of the key initiatives taken by the government. Challenges in terms of processing, distribution, and acceptability among consumers require to be redressed to mainstream the grain. The need of the hour is to shift focus from **"calorie fundamentalism"** and move toward providing a diversified food basket by including millets in social welfare schemes like the Integrated Child Development Scheme (ICDS) midday meal program and public distribution system.[2] The classification of millets presented in the Table 1 provides an overview and categorizes millets into three broad groups viz major millets, minor millets and pseudo millets.

The Historical Perspective: Our Age Old Connect With The Millets

Ancient India has had a history of the consumption of millets, references to which can be found in the Vedic texts. The mention of millets in Yajurveda provides cues about assimilation and acceptance of the grain as part of the diet in pre-modern India.

During the medieval ages, credible evidence of millet consumption was found based on memoirs written by foreign travelers. Fernao Nuniz, a Portuguese traveler visited the

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Vijayanagar kingdom in the 16th century Anno Domini (AD) and, in a commentary on the prevalent culinary practices, reported in his travelogues about sorghum being consumed in southern India.

Abul Fazal too in his seminal work *Ain-i-Akbari* records that millets which included Sorghum, Pearl millet, Kodo millet, Barnyard millet, and Finger millet were cultivated as a *kharif* crop in the country.[1]

The Evolving Agrarian Challenges and the Need to Move to Climate-Resilient Agriculture

A report published in the Lancet has noted with alarm the rising temperatures, which are not only reducing crop growth duration but also impacting crop yields, which could undermine global food security by affecting supply chains.[4]

Climate prediction models developed by researchers at the International Food Policy Research Institute testify to the above statement and project a loss in yield of traditional cereal crops and tubers by more than 5% in the Indian subcontinent.[5]

A groundwater resource assessment report has documented that the majority of the districts in the state of Punjab have over-exploited the groundwater with water tables reaching critical levels. No water is disastrous for water-hungry crops like paddy. Phasing out paddy and substituting it with less water-intensive crops like millets could be one of the solutions to prevent a shortage of food grains in the future.[6]

In this context, the relevance of millets increases manifold as not only do they require comparatively less time to harvest but also with a negligible water footprint are favorably positioned to be chosen as a suitable alternative.

India can leverage the situation by harnessing her innate potential and knowledge to boost the production of traditional crops like millets. This could also pave the way for diverse agriculture by replacing the dual monocropping pattern of rice and wheat.

A shift to environmentally conducive agriculture is the need of the hour, which would mean an overhaul of the way farming is practised.[7]

The Glorification of Wheat: A Legacy of the Green Revolution

The Green Revolution in India saw unprecedented growth in the cultivation of rice and wheat.[8] Before the transition, traditional meals and recipes were derived from amaranth, barley, millet, and other grains.[9]

India in the sixth decade of the last century was surviving from "ship to mouth" under the PL-480 program. To redeem itself and achieve self-sufficiency in food grains, the country imported about 18,000 tonnes of wheat seeds from Mexico's International Maize and Wheat Improvement Center under the high yielding varieties Program. The impact of the new seeds was visible in a few years. In 1965, the country's farmers harvested about 12 million tonnes of wheat which further rose to 76 million tonnes by the end of the 20th century.[10] However, it all came with a cost, as the imported varieties of wheat needed more water, fertilizers, and aggressive pest control which adversely affected the environment.[11]

What was the gain of imported varieties of rice and wheat was the loss of our knowledge about our traditional crops, which were forgotten as the nation's priorities then were to produce more and prevent famine, and as a direct consequence of that, the area under millet cultivation has significantly shrunk since the inception of the Green Revolution.[12]

India Leads the World: Building an Enabling Environment with Solution-Driven Approaches for a Sustainable Millet Ecosystem

To create a favorable space and popularize millets among the population; the government has re-branded the grain as nutri cereals from coarse cereals with the aim to dispense myths pertaining to the inferior quality of the crop and also increasing awareness about its rich nutritional profile.[13]

The Initiative for Nutritional Security through Intensive Millets Promotion (INSIMP) is the flagship program of the government in which districts with large areas under millet cultivation with low crop yields have been chosen as high-priority districts with the allowance of additional monetary incentives for farmers to grow millets.[14]

An integrated framework with a **"Seven Sutra Model"** for streamlining inter-ministry co-operation and enhancing co-ordination has been proposed, which identifies and leverages upon the core competency of respective ministries.

To give impetus for the revival of the millets, 2018 was designated as the Year of Millets and 2023 will be celebrated as the International Year of the Millets.[15]

Results of state intervention along the entire spectrum of the value chain with a focus on providing solution-driven approaches by hand-holding and stewardship are reflected on the ground with the area under cultivation has seen steady growth since the past decade, which has propelled India into one of the top millet-producing nations with the country's share now being 80% of Asia's and 20% of the global millet production, respectively.[16]

Pitching Millets as an Alternative to Reverse the Epidemiological Transition and Triple Burden of Malnutrition: The Compelling Scientific Narrative

The Global Nutrition Report 2021 has brought to the fore salient points in the context of our changing eating preferences which

are leading to a quarter of all deaths among adults.[17] Dietary practices and physical inactivity are one of the modifiable contributing factors to the non-communicable disease (NCD) epidemic in India.[18]

Moreover, 6.8% of children and adolescents aged 5–19 years worldwide were obese in 2016 which had increased from 2.9% in 2000 and 4.9% in 2010.[19] Pooled data from 52 studies conducted in 16 of the 28 states has highlighted an alarming increase in the incidence of overweight and obesity in children and adolescents.[20] In adults too, the age-standardized prevalence of obesity has increased significantly from 2000 to 2016 across all the World Health Organization (WHO) regions with an estimated prevalence of about 13.1% globally.[19] The grimness of the situation could be judged by having a close look at the top five causes of disease burden in India in the last decade of the 20th century which were communicable, maternal, neonatal, and nutritional disorders (CMNNDs), and by 2016, three of the top five causes of the morbidity burden were directly attributed to NCDs.[21]

To quantify the same in numbers, the proportion of deaths attributable to NCDs in India has increased from 37.9% in 1990 to 61.8% in 2016 with a concurrent increase in disability-adjusted life years (DALYs) which has significantly increased for cardiovascular diseases and diabetes.[22]

Affluent states like Punjab reflect the true state of the picture with overweight and obesity being recorded at a staggering 28.6% and 12.8%, respectively. Prevalence of hypertension and diabetes as per estimates provided by studies in the state point at 40.1% and 14.3% prevalence, respectively.[23]

A systematic review of accrued evidence related to millets in the management of diabetes has demonstrated the efficacy of millets in achieving optimal glycemic control by decreasing fasting and post-prandial rise in blood glucose concentration and glycosylated hemoglobin (HbA1c) with studies reporting a reduction in blood glucose levels by 12–15% and HbA1c by 15%.[24]

Anitha *et al*.[24] reported Foxtail and Barnyard millet had a low glycemic index (<55), whereas Pearl millets, Finger millets, and Kodo millets had intermediate levels of glycemic index (55–69). The study has also found long-term consumption of millet helped in not only achieving decreased fasting but also post-prandial blood glucose levels. Millets are effective in lowering the glycemic index of a meal compared to milled rice or refined and can lower blood pressure when included in a regular diet.[25]

Studies on the effect of millets on lipid profile for periods as short as 21 days to four months have observed a reduction in levels of total cholesterol by 8%, triacylglycerol by 9.5%, low-density lipoprotein cholesterol (LDL-C) by 10%, and very low-density lipoprotein (VLDL) by 9% with a concurrent 6% increase in high-density lipoprotein (HDL).[26] Management of dyslipidemia through non-pharmacological interventions and recommending millets as a dietary alternative along with lifestyle modifications seems promising and could be further validated by conducting clinical trials.

Table 1: Classification of millets

Major millets	Minor millets	Pseudo millets
Sorghum	Foxtail millet	Amarnath
Pearl millet	Kodo millet	Kuttu
Finger millet	Barnyard millet	
	Little millet	
	Proso millet	

Ref: FSSAI document: Millets – the Nutricereals[3]

Micronutrient deficiency which constitutes the third element in the malnutrition triangle, and iron deficiency anemia continue to be a significant public health challenge for program managers with prevalence at 31.9% and 30.4% in children under five and adolescent girls, respectively.[27]

Data released by National Family Health Survey also demands more focused attention from policymakers with the trends of wasting, underweight, and stunting still at a staggering 19.3%, 32.1%, and 35.5%, respectively.[28] Millets as one of the interventions could be tried to tide the perennial problem of malnutrition.

Studies on the Impact of Sorghum Supplementation on Growth and Micronutrient Status of School Going Children in South India were conducted on 320 children (160 boys and 160 girls) aged between 9 and 12 years over a period of eight months in which the participants in the experimental group received a mixture of 60% sorghum and 40% rice and the control group being fed a rice-dominant diet found higher growth, hemoglobin levels, serum folic acid levels, calcium levels, and retinol-binding proteins in the intervention arm.[29]

An optimal combination of millets with legumes also provides high-quality complete protein, iron, and calcium. Studies have found that high iron-containing varieties of Pearl millet (Dhanashakti) when consumed adequately (200–300 g/day) could help reduce iron deficiency anemia.[30]

Conclusion

States like Punjab and other agricultural states have locked wheat-rice cycle for over six decades now and have to think beyond and look at a more sustainable model of agriculture. Research and funding in agriculture universities along with engagement with farmers need impetus to overcome the inertia of transition to millets as a suitable alternative.

The government's efforts to promote millets need to be complemented by the active participation of civil society. Professional associations like the World NCD Federation and nongovernmental organizations (NGOs) like the Pindi Foundation have taken steps in the direction of promoting millets under Operation Millet to generate awareness amongst citizens with a focus on advocacy and information, education, and communication (IEC) activities, capacity building, and

evidence generation. The need of the hour is pro-active participation from across the spectrum by providing a platform for promoting millets. Armed forces can take the lead by introducing millets in rations and setting an example for others to emulate.

When food intake is poor or unbalanced, the body's ability to function optimally is compromised, making it susceptible to diseases.

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Conflicts of interest

There are no conflicts of interest.

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