

6. Status and Prospects of Value Addition of Millet

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Abstract:

Increasing sustainability problems regarding food production have led People to opt for and promote traditional food habits. Millets being one of the traditional foods of Indian history are defined as small-seeded annual cereals that are highly nutritious and possess good adaptability to marginal lands and soils with low fertility. Alongside its production benefits, it provides nutritional and health benefits by showing the potential for value addition of millets through the creation of products such as multi-grain flour, papad, and baked goods. For millets to be utilized relative to staple cereals like wheat and rice it is important to emphasize the importance of strengthening small and medium enterprises, developing processing machinery, and promoting the consumption of millets through government programs and Public Distribution systems. Additionally, addressing challenges such as processing efficiency, shelf life, fortification, grading, and packaging standards for millets would help in their value addition. Despite the nutritional benefits of millets and their potential to contribute to nutrition security and sustainable development goals, it is not an easy way to promote the cultivation of millets in India and elsewhere. The resources have shown a decline over the last few decades, which requires government attention. Hence the promotion of millets can play a significant role in the food and nutrition security of developing countries like India, and the mainstreaming of millets in public distribution systems and government programs can help in creating demand for millets in the market.

Keywords:

Millets, composite flour, traditional food, value addition, processing technology, ready to eat products.

6.1 Introduction:

Millets are defined as small-seeded annual cereals adapted to dryland agro-ecologies of the arid and semi-arid tropics and are produced in regions characterized by low to moderate rainfall (200-600 mm) and high temperatures (42-46°C). Millets also possess a good ability to adapt to marginal lands and soils with low fertility. Based on the grain size, millets have been classified as major millets which include sorghum and pearl millet while there are several small grain millets which include finger millet (Ragi), foxtail millet (Kangni), kodo millet (Kodo), proso millet (Cheena), barnyard millet (Sawan) and little millet (Kutki). Millets have been called Nutri-grains since they are rich in micronutrients like minerals and B-complex vitamins. Additionally, millets are also rich in health-promoting phytochemicals and can be used as functional foods. They provide food as well as fodder and can be mix-cultivated with pulses and vegetables.

Presently, there is a renewed interest in millet production for several reasons. Firstly, millets are highly nutritious (Rao et al. 2017), with high calcium, iron, potassium, magnesium, and zinc contents, besides other essential molecules such as vitamins, amino acids, and fatty acids (Nithiyantham et al. 2019). Millet foods are characterized to be potential prebiotics and can enhance the viability or functionality of probiotics with significant health benefits. Millet crops are known as ‘Nutri-Cereals’ alongside being climate-smart crops. Moreover, as millets are largely produced with low external inputs, especially chemicals, these are considered eco-friendly. Thus, millets can play a vital role in the livelihood of the poor and malnourished population, provide food and nutrition security, and help achieve the sustainable development goals of reducing poverty, zero hunger, and good health and well-being. However, despite such positive attributes and qualities of millets for present and future agriculture, their cultivation in India and elsewhere has been on the decline over the last few decades, which has attracted the attention of policymakers. India also gave a call to the United Nations to declare 2023 as the “International Year of Millets” to promote the production, value addition, and consumption of millets. Simultaneously, it deliberates on the multiple ways to stimulate the utilization and production of millets.

The pattern of utilization of millets varies across countries and regions. In the last two decades, the importance of millets as a food staple, particularly in developing countries like India has been declining due to various factors that include rising incomes, growing urbanization, and government policies favoring the production and consumption of fine cereals like rice and wheat. The demand for value-added

or processed food products (being promoted as health foods) from millets from urban consumers is also increasing albeit from a very low base.

6.2 Millet Production in India:

The Economic Survey of 2023 spotlighted India's robust millet production, noting its yield of over 50.9 million tonnes (MT), representing 80% of Asia's and 20% of global output. India's average yield of 1239.0 kg/ha slightly surpasses the global average of 1229.0 kg/ha. Millets, mainly a kharif crop in India, thrive in rainfed conditions, demanding fewer resources than other staple crops. Millet production is concentrated mainly in dry and arid regions where rainfall is low and erratic.

In India, millets are mostly cultivated in Karnataka, Andhra Pradesh, Tamil Nadu, Maharashtra, Odisha, Madhya Pradesh, Rajasthan and Uttarakhand states. This diversity across regions showcases the country's varied millet farming practices.

The rising population at the global level requires solving the problems related to food and health due to improper use of fast foods with high calories. The problems of obesity, diabetes, cardiovascular diseases, osteoporosis, depression, etc. are so-called general lifestyle diseases of the modern era. Many foods are available that are economically feasible and tasty but not healthy. At present, people are very conscious about health and millets are one of the best solutions to find highly nutritious foods packed with many health benefits. Millets form a relatively inexpensive source of nutrition, especially for the underprivileged population of India. Overlooking the wide range of benefits that millets provide, they have largely been missing from the staple crops due to inadequate knowledge of their benefits compounded by changing dietary habits.

There are many chronic illnesses and health problems in India today. According to NFHS-5 data (2019-20) in India, 190.7 million people are suffering from nutritional problems. 32.1% are suffering from undernutrition, 35.5% from stunting, and 19.3% from wasting. Millets are a rich source of many vital nutrients and hence, promise an additional advantage for combating nutrient deficiencies in third world countries. Millets have a higher mineral content than common cereals like wheat and rice. In India, calcium and iron insufficiency are extremely common and osteoporosis of bones affects a significant portion of the adult population. Finger millet has a calcium concentration that is around eight times higher than wheat making it the best food for preventing osteoporosis.

Certain nutrients, namely zinc and iron, are crucial for boosting immunity. Millets are a good source of riboflavin, niacin, and other B-complex vitamins. Despite the nutritional superiority and capabilities of millet farming systems, the area under millet production has been drastically depleting over the last two to three decades. The area under small millets has declined considerably in all the states where they were predominantly grown in the past.

The major reasons for losing the area under small millets cultivation are the introduction of high-yielding varieties of different crops, the shift from millets to more profitable crops, changing food habits and consumer preferences due to rapid urbanization and rising income levels, difficulty in processing of small millets, poor quality of the grains, lack of procurement and market support. In recent years, a lot of efforts have been taken by various government, and non-government organizations to promote millets as an important dietary choice especially to ensure nutrition security for all.

In the search for climate-resilient solutions, millets could be a crucial link in sustaining the food supply chain, especially for the less privileged parts. Millets are consumed by more than one-third population of the world. Processing has a method for the formulation of fortified and value-added products. Different primary and secondary processing methods are used for the formulation of different convenience foods including- ready-to-use, ready-to-cook, and ready-to-eat food products.

6.3 Processing of Millets for Preparation of Value-Added Products:

Millets are neither ready-to-eat nor ready-to-cook grains and invariably need some kind of processing for human consumption. Three major components of millets i.e. protective pericarp, starchy endosperm, and germ get partially separated or modified during processing. Some millets require multiple processing for optimization of grain recovery and optimization of polishing to retain their nutritional value.

The grains vary in terms of shape, grain surface, hardness, husk-grain bonding, etc. Several processing methods like decortication, heating, soaking, germination, and fermentation are used to reduce the content of anti-nutrients such as tannins, phytates, trypsin, amylase inhibitors, etc. Processing of millet grain initiates with husk removal as it consists of the hard seed coat. Cracked or broken grains, coarse meals, grits, and fine flour are the products of dry-milled whole grains. Millets can be processed into flour, and these flours can be used as it is or by mixing with other flours to produce value added food products.

6.3.1 Future Aspects of Value Addition of Millets:

The list below provides the names of value-added products that have the potential to be the future of the Indian diet-

A. multi-grain flour or composite flour:

The concept of multi-grain flour or composite flour is not new to mankind. Mixing of two or three types of grains or grains and pulses has been in practice since long ago depending upon the availability of such commodities locally or the food habits.

Multi-grain flour made by combining wheat flour and finger millet flour or other millets is one of the simple semi-finished products suitable for making chapatti (roti), as no meal is complete without Indian bread or roti. However, the colour of the chapatti is slightly dark, but these chapattis not only improve the taste but also help in controlling glucose levels in diabetic patients very efficiently. This meets the emerging nutritional needs of people in the face of preference for modern and healthy food habits, mass feeding, and social programs.

B. Papad:

The addition of millet as one of the basic ingredients along with other essential ingredients such as black or green gram, rice, maize, and spices can become a new adjunct for people. Papad from finger millet flour or other millet flour is also prepared in which it is used as base material mixed with spices and salt. It gives a little dark colour to the papad which again upon frying or roasting turns lighter with good consumer acceptability.

C. Puffing or Popping:

Puffing or popping of cereals is one of the popular traditional snack items taken either plain or with some spices or salts. Popping or puffing of millets may be a popular choice of ready-to-eat product with a pleasing texture and appealing flavour.

Popping of millets not only improves the nutritional value by inactivating some of the antinutritional factors but also enhances the protein and carbohydrate digestibility and improves the appearance, colour, taste, and aroma of the processed millets. The flour can be used for different types of ready-to-eat food preparations depending upon the taste and liking of the people.

D. Roasted millet flour:

Roasted millet grains can be converted into flour by simple grinding which can further be enriched with other additional ingredients. Various combinations of ingredients can be taken for the preparation of nutritious millet flour and mix well. The selection and combination of the ingredients are done based on the region and requirements of the target groups like children, pregnant and lactating mothers. The ingredients are selected in such a way that no further cooking is required.

E. Malted millet flour:

In Weaning foods, traditionally millet malt is utilized for infant feeding purposes and also to prepare beverages either with milk or with lukewarm water with the addition of sugar or jaggery. Ragi shows good malting characteristics and also malting of finger millet will improve its digestibility, sensory and nutritional quality.

Ragi has some of the inherent qualities that make it superior compared to other cereals for the preparation of malted foods. Malted flour is resistant to fungal infection and also elaborates the alpha and beta amylase during germination. In addition to these, finger millet is a good source of sulfur amino acids, and calcium.

F. Macaroni products:

The changing food habits of children, teenaged or adolescent age groups have created a good market for noodles, vermicelli, and pasta in India. The demand for millet macaroni products particularly the products made out of finger millet or pearl millet is growing due to awareness about its nutritional properties. Macaroni products also known as convenience foods, are prepared through a cold extrusion system which becomes hard and brittle after drying. The cooking of these noodles is very convenient and requires a few minutes. Several different combinations of millet flour blends can be explored in the preparation of these macaroni products retaining food values of ingredients and their availability.

G. Extruded products:

Extrusion technology is another novel way of transforming ingredients into value added products. Extruded products prepared from different cereals and millet grains are very popular nowadays among various age groups. The demand for extruded products is growing day by day.

The lifestyle change is also bringing a drastic change in the food habits and extruded foods being ready-to-eat products have become a good choice as snack foods. The different millet flour prepared from finger millet, pearl millet, sorghum, etc. exhibits good extrusion characteristics. The flour with 16-18% moisture content can extrude in the barrel temperature range of 100-120°C well with a good expansion index with crunchy, porous, and smooth surface texture. Like other preparations, this millet flour can be blended with other legume flours in appropriate proportion with further fortification of minerals and vitamins to design a balanced nutritional extruded food.

H. Bakery products:

Incorporation of different millet flour in the preparation of bakery products like biscuits, nan-khatai, muffins, and bread has been attempted and efforts are being made to standardize the recipe and product quality. Now these days, the baking industry is mainly occupied by the different value-added products of wheat.

Due to the high proportion of gluten, these products are not preferred by people suffering from celiac disease, especially in developed countries.

The use of millets in bakery products will not only be superior in terms of fiber content and micronutrients but also create a good potential for millets to enter the bakery world for a series of value-added products.

Flour of pearl millet and ragi flour are preferred for making biscuits and muffins. Recently demand has increased for millet-based baking products in urban or rural areas.

I. Fermented foods:

Fermented foods like dosa, dhokla and idli are popular in many parts of India. These are very common as breakfast foods and even as evening meals in the southern part of the country. Different small or major millet is widely used as one of the ingredients for these kinds of fermented foods. It not only improves the taste but at the same time enriches the food value in terms of protein, calcium, and fiber.

J. Millet Soup Mix:

Millets are also a good source of starch and possess a good thickening power. Instant soup mixes can also create a good market in millet growing region of India.

K. Ragi/ Barnyard millet Pakora:

Millet flour can be used instead of Bengal gram flour (besan) as a thickening agent while making pakoras.

L. Energy bars:

Food bars are considered snack food, with good sensory and nutritional characteristics due to their high content of proteins, carbohydrates, vitamins, and minerals. Millet based energy bars appear due to the necessity of having a product combining easiness and nutritional quality, to either improve or substitute snacks between meals, or simply healthily gain energy.

M. Millet based probiotic beverages:

A millet probiotic beverage helps in improving the gut microflora or helps to repopulate the colon when bacteria levels are reduced by antibiotics, chemotherapy, or diseases. These foods not only provide vital nutrients but also improve the body's resistance against pathogenic microorganisms but also provides several health benefits including the reduction of the level of serum cholesterol, the improvement of gastrointestinal function, the enhancement of the immune system, the suppression of diarrhoea in young children and the lowering of the risk of colon cancer.

N. Millet laddu:

Laddu is an Indian sweet made from a mixture of flour/semolina, powdered sugar, and shortening, which is shaped into a ball. Millet laddu mix is developed from different millet flour with the addition of powdered sugar, roasted groundnuts, dry fruits, and cardamom. The mix has to be mixed with ghee or milk to make round balls before serving.

O. Millet Khakhra:

Khakhra is a crispy version of roti, it is usually a cracker that is handmade and roasted to provide crunchiness. It is also a healthy snack which is a common recipe in the Rajasthani and Gujarati cuisines. Khakhra when prepared by using finger millet as a major ingredient provides much more nutrition in terms of protein, carbohydrates, minerals, and dietary fibers in comparison with the traditional khakhra that is made of wheat flour.

Other food like lai, khajoor/Thehus baddis, millet vada, Ragi khichadi, Sawan upma, other millets khichadi, halwa, burfi, khajur, namakpara, namkeen, shakkarpara etc. can be prepared by using different millet flour.

Multi-grain millet flour, flakes of sorghum and pearl millet, finger millet malt, sorghum semolina, and pasta, millets-based breakfast cereals, millets-based regional snacks, and fast foods, etc. are the commercially available millet products in India both in retail and online.

6.3.2 Challenges During Value Addition in Preparing Millets-Based Products:

B. Absence of Gluten:

Unlike the fine cereals, millets lack gluten (a protein present in wheat) in them which is an essential factor for value addition. Incorporation of wheat flour/refined flour in millet flour for value addition is possible to some extent but making some bakery products like bread, buns, etc. with 100 percent millet is still a challenge. Intense research efforts on exploring the processing techniques and blending/ fortification with other ingredients are necessary for addressing this challenge.

C. Enhancing shelf life of value-added products:

The current level of shelf life of millets is less compared to other major cereals. Bringing good taste and convenience with an increase of shelf life to at least 8-10 will give some hope to commercialize millets.

D. Primary Processing in Millets:

The primary processing machinery is still a challenge for millets. The major millets- Sorghum, Pearl millet, and Finger millet are the naked grains that do not have the outer coat and thus require no/minimal primary processing. But the minor millets such as little millet, kodo, proso millet, barnyard millet, etc., have an inedible outer coat called husk which needs to be removed in primary processing to make them suitable for human consumption.

As the minor millets are small and of varying sizes, the efficiency of current machinery is very low with the recovery of 70-80% of grain and the remaining being the un-hulled and broken grains. This inefficiency poses another difficulty in terms of separating un-hulled grains from the de-hulled grains.

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