



## Value Addition in Millets

(\*Roopal Mishra)

Department of Post harvest Process and Food Engineering, JNKVV, Jabalpur, M.P.

\*Corresponding Author's email: [agriculturescientific1995@gmail.com](mailto:agriculturescientific1995@gmail.com)

### Abstract

Although millets have an outstanding nutritional profile, their use as food is still limited to traditional consumers and economically disadvantaged segments of society. Incorporating less popular millets is crucial for diversifying food supplies and ensuring nutritional security, as well as combating increasing climatic uncertainties and life-threatening diseases. The gluten-free characteristic of protein, along with its bioactive components that possess therapeutic properties and its high concentration of micronutrients, renders it a highly suitable option for the development of various functional and value-added food products. A variety of millet-based value-added products, such as cookies, cakes, pasta, and infant foods, are currently being sold on the market. These items are attracting the interest of both financially well-off individuals and health-conscious members of society. This chapter presents a concise overview of many procedures, both traditional and functional, that have been used to generate ready-to-eat (RTE) millet value-added food products. It also highlights the distinctive properties of these products.

### Hon'ble Prime Minister highlights the importance of millets

Food processing also holds solutions to nutrition security. For example, our coarse grains and millets have high nutritional value. They can also withstand adverse agro-climatic conditions. They can be called 'nutrition rich and climate smart' crops. Can we take up a venture based on these? This will raise incomes of some of the poorest of our farmers, and also enhance our nutrition levels. Such products, shall, of course, find resonance across the world."

### Introduction

Millets are a collection of crops with small seeds that were likely the first food plants cultivated by humans. Due to their remarkable resilience in the most challenging climatic circumstances worldwide, these crops have earned the designation of "famine crops" throughout the semi-arid tropics and drylands of Africa and Asia. The important millets cultivated in African and Asian countries include Sorghum (*Sorghum bicolor*), pearl millet (*Pennisetum glaucum*), finger millet (*Eleusine coracana*), foxtail millet (*Setaria italica*), barnyard millet (*Echinochloa frumentacea*), kodo millet (*Paspalum scrobiculatum*), proso millet (*Panicum miliaceum*), and little millet (*Panicum miliare*). Although millets have a high nutritional content, their hard seed coat, presence of anti-nutritional agents, low digestibility, and limited bioavailability of micronutrients pose significant challenges in their processing and cooking. Without primary, secondary, and tertiary processing technologies, value-added ready-to-eat millet products are not easily accessible in the market for nutritional diversification. The increasing recognition of the nutraceutical benefits of millets has created an opportunity for their marketing and branding through the production of high-quality value-added goods. Hence, this page succinctly outlines the processing methods,

their impact on nutritional content, and various conventional and enhanced products to fully harness the true potential of millets as remarkable grains.

### Millets as Nutri-Cereals

The government rebranded jowar, bajra, ragi, and other millets as "Nutri Cereals" due to their high nutritional value, eliminating the term "coarse cereals".

The objective of this action is to eliminate a persistent idea that these grains are of lower quality compared to rice and wheat, despite their greater health advantages.

Millets have significant potential to make a large contribution to the food and nutritional security of the country. They are not only rich in nutrients, but also have the ability to withstand climate challenges and exhibit distinctive nutritional qualities.


### Major and Minor Millets



### Processing of Millets

Millets are subjected to processing. Processing refers to a range of processes that transform raw millet grains into a form that is suitable for consumption, while also improving their quality. Primary processing processes can be used to turn small millet grains into a range of edible forms, including rice, flour, sprouts, salted ready-to-eat items, flaked products, popped products, porridge, and fermented food. This section provides a description of several processing processes.

1. **Dehulling:** The initial and primary phase in millet processing is dehusking or decortication, which is facilitated by a highly durable seed coat. Historically, millets have been processed by manually crushing them to remove the outer husk. Traditional millstones used for the process of dehusking and grinding millet grains typically consist of a handheld tiny stone and a bigger flat stone put on the ground. The interaction between these grinding stones leads to the dehulling and grinding of millet grains. Typically, it takes 4-5 iterations to fully remove the husks using this procedure. The conventional approach to Dehulling is arduous and time-consuming, resulting in a low Dehulling yield. Centrifugal dehulling systems, a recent innovation, have been implemented to address the issues commonly encountered with previous techniques. The dehulling yield, ranging from 72% to 76%, surpasses the percentage of dehulled grains, which stands at 50%, achieved using the conventional compounding approach. Dehulling or decortication is a process that decreases the overall mineral content of the grains, but increases the bioavailability of calcium, iron, and zinc by 15, 26, and 24 g/100 g, respectively. Additionally, it improves the digestibility of protein by decreasing the presence of anti-nutritional compounds such as phytic acid, polyphenols, and tannins.




**Dehulling**

**Dehulling** – Upon cleaning of millet grains, the grains are dehulled – the outer indigestible husk layer from the grains , improving its overall digestibility.

**Increased :**  
Protein digestibility  
Starch digestibility  
Mineral Bioavailability

**Decreased :**  
Protein  
Dietary/crude fiber  
Fat  
Vit.E  
Iron  
Calcium  
Phenolic content  
Ant-nutrients (phytate, tannins)

Little Millet



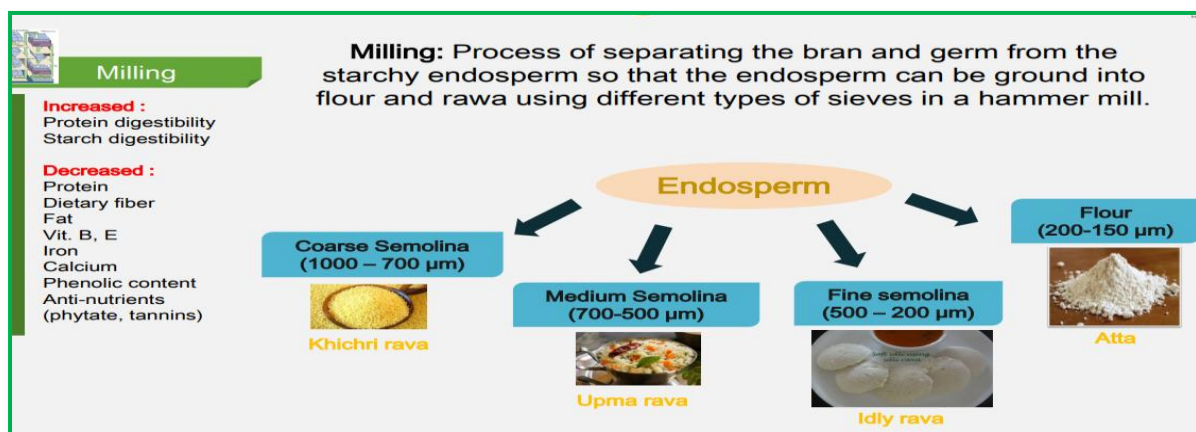
Whole grain      Dehulled rice

Proso Millet



Whole grain      Dehulled rice

2. **Milling:** The primary constraints to the effective use of millets as value-added products are their coarse texture, tough outer covering, presence of coloured seeds, acidic or bitter flavour, and limited shelf life of processed goods . Hence, it is imperative to employ appropriate milling techniques to enhance the value and promote the commercialization of products derived from millet. Several processing procedures, including as pearling, debranning, and chemical treatment, have been shown as effective methods to address these constraints and enhance customer acceptability.



## Value Addition

### Conventional culinary recipes

- Breakfast options include Idli, Dosa, Idiappam, Rotti, Pittu, Upma, Adai, Porridge, Khakra, Paniyaram, and Chappathi.
- Desserts: Halwa, sweet kolukattai, Adhirasam, Kesari, Nutritious ball, and Kheer.
- Snacks: Vadai, Pakoda, Ribbon pakoda, Omapodi, Murukku, Thattu vadai, Hot kolukattai, and Vadagam.

**Bakery products:** Individuals of all age groups have a fondness for various bakery items due to their flavor, appearance, and digestibility. Any occasion of joy is lacking fulfillment without the inclusion of bakery goods. The popularity of bakery products is increasing steadily. In contemporary times, individuals have less time to allocate towards preparing breakfast. As a result, they often opt for bread, buns, or biscuits as a substitute for other types of food. They are a plentiful source of munchies and so widely accessible. Various proportions of small millets, ranging from 10% to 50%, were used to replace refined wheat flour in order to standardize the recipes for bread (20%), cake (30%), cookies (50%), soup sticks (20%), and khari (40%).



# Baking



Baking

- Millet Cookies/bread and cake are popular ready-to-eat products
- Millet cookies/ cake is prepared using 100% millet flour blended with other ingredients and bread is prepared by replacing 50% wheat with millet flour.

**Increased :**

Protein digestibility  
Mineral absorption  
Starch digestibility  
Fibre

**Decreased :**

Amino acids  
Vitamins  
Anti-nutrients  
(phytate, tannins)

**Advantages and Uniqueness of this technology/ Product**

- Used as breakfast food
- It is rich in magnesium, zinc, iron, dietary fibre and protein.
- Shelf life: Millet biscuits - 6 months, Millet Bread - 6 days and Millet Cake has - 4 days when packed in MET packets.



Millet Doughnuts



Millet bread



Millet cookies



Millet cashew Cookies





Millet Burger

**Pasta products:** Pasta dishes such as vermicelli, noodles, and macaroni are widely enjoyed by youngsters in today's society, as well as by individuals of various age groups, due to its flavorful taste, affordable cost, and simple preparation process. Pasta serves as an ideal base for nourishing and fulfilling meals, typically accompanied by nutrient-rich food companions, such as fiber-rich vegetables and beans, heart-healthy fish and monounsaturated oils, antioxidant-laden tomato sauce, and protein-packed cheeses, eggs, poultry, and lean meats. In order for little millets to effectively compete with significant cereal foods, it is necessary to develop preprocessed or alternative millet-based food products. Vermicelli, noodles, and macaroni were produced using refined wheat flour and mixed with small millets at a 30% inclusion rate.

**Flaked and popped products:** Popped and flaked cereals are widely consumed breakfast options, predominantly derived from corn. Through appropriate processing techniques, it

may be possible to create popped meals and flakes using millets. These Ready-To-Eat goods are highly sought after due to their crisp and brittle feel. Millets are particularly well-suited for the creation of flakes and popped items due to their relatively compact size and rapid hydration. The little millets were processed by flaking and popping, and a range of recipes were standardised. Small millet flakes can be transformed into many value-added goods such as aval uppma, kitchadi, payasam, masala flakes, boli, sweet balls, lemon bath, tamarind bath, and tomato bath. Value-added goods derived from popped small millets include uppma, bhelpoori, masala corn.





## Puffing

- Millet puffs are RTE (ready to eat) snacks developed using puff gun machine

**Advantages and Uniqueness of this technology/ Product**

- They are rich in **protein**
- Serve as inflight snack or generic evening snack
- The shelf life is for 2 months when packed in airtight MET pouches at ambient temperatures.


Puffing

**Increased :**


Protein  
Iron  
Protein digestibility  
Starch digestibility  
Phenolic content

**Decreased :**


Dietary fiber  
Fat  
Vit. B, E  
Calcium  
Anti-nutrients  
(phytate, tannins)




Sorghum Puffs




Foxtail millet Puffs



Pearl millet Puffs



Kodo millet Puffs



Proso millet Puffs

**Ready-to-eat Food Mixes:** In contemporary society, where individuals lead fast-paced lives and time is highly valued, "Instant Foods" hold significant importance in people's daily routines. The word 'instant food' refers to food that is quick and handy to make, as well as being hygienic, free from microbial contamination, and easy to consume. In contrast to the past, when people would consume their meals in a luxurious and leisurely manner, the current trend has shifted towards simpler and more easily digestible foods. Therefore, the presence of these foods satisfied all the requirements of contemporary human beings. The selection comprised of traditional South Indian morning dishes, namely adai, pittu, idiyapam, kali, roti, and kesari. The standardisation of instant mixes of these traditional items with the inclusion of small millets was achieved.

### READY-TO-COOK FOODS BASED ON MILLETS



Millet Upma



Millet Sambar Mix

- Based on unpolished millets (little and foxtail)
- Healthier meal replacer for regular sambar rice/upma made out of fibre depleted polished rice/ wheat semolina.

## Conclusion

In conclusion, value addition in millets is a critical and promising avenue for enhancing the appeal and nutritional significance of these ancient grains. As a group of highly resilient and

nutritious crops, millets have the potential to play a pivotal role in addressing global food security and nutrition challenges. Value addition in millets involves a range of processes and innovations, such as the development of millet-based products, fortification, processing techniques, and diversifying their uses in the food industry. This not only enhances the economic value of millets but also makes them more accessible and appealing to consumers. However, challenges exist, including the need for investment in research and development, infrastructure, market linkages, and consumer awareness. Overcoming these challenges requires collaboration among governments, research institutions, NGOs, and the private sector to create an enabling environment for value addition in millets. In a world where dietary diversity and food security are pressing issues, the resurgence of millets through value addition is a step towards ensuring access to nutritious and sustainable food choices for people globally. Moreover, it aligns with the broader goal of promoting sustainable agriculture and preserving traditional food systems. As consumers become more health-conscious and environmentally aware, the value of millets and their positive impact on both individuals and the planet is likely to continue growing.

### References

1. Akingbala JO (1991) Effect of processing on flavonoids in millet (*Pennisetum americanum*) flour. *Cereal Chem* 68:180–183
2. Antony U, Sripriya G, Chandra TS (1996) Effect of fermentation on the primary nutrients in finger millet (*Eleusine coracana*). *J Agric Food Chem* 44:2616–2618
3. Arora S, Jood S, Khetarpaul N (2011) Effect of germination and probiotic fermentation on nutrient profile of pearl millet based food blends. *Br Food J* 113(4):470–481
4. Dahlin K, Lorenz K (1992) Protein digestibility of extruded cereal grains. *Food Chem* 48:13–18
5. Desikachar HSR (1975) Processing of maize, sorghum and millets for food uses. *J Sci Ind Res* 43:231–237