

Novel and Traditional Way of Processing of Millets and its Health Benefits

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Abstract:- Millet represents a diverse crop providing food, animal feed, fodder for animals and also used as fuel. Due to its reduced consumption, the existing diversified processing technologies existing in market related to millet products were explored. Considering the market demand, the new trends in millet processing technologies has to be improved in all primary, secondary and tertiary processing methods as consumer acceptable Ready to eat (RTE) Ready to use (RTU) products. The novel processed millet products will have good consumer preference across age groups and with high nutritional value, convenience in marketing and shelf life. Millets is considered as base material for nutraceutical products and target at national and global level markets. This article aims at promoting millet to create awareness on health and nutritional merits of millet products and reinventing them as popular, convenient and healthy foods.

Keywords:- Millet - Value Added Products – Marketable Produce – Health Benefits.

I. INTRODUCTION

Millets are economically important crop that grows well in dry environment and are nutritionally superior foods. It has been an important staple food for millions of poor people in the dry and rainfed regions of the world (Saraswathi and Hameed 2022). Recently, millets are also termed as nutri-cereals, due to their high nutritional and mineral content protein, fat, dietary fibre, B-Vitamin, also calcium, iron, zinc, potassium, and magnesium. They are gluten-free, low glycaemic index alkaline-forming grain and also rich in phytochemicals and micronutrients and play a dynamic role in the body's immunological system. They also possess nutraceutical characteristics due to their antioxidants property and thus protect human health by reducing blood pressure, lowering the risk of heart disease, preventing cancer and

cardiovascular disease, diabetes, and decreasing tumor instances, among other things (Kanorwala *et al.* 2022). Value added products from millets have the potential to add value to business and has a large potential for growth, as consumers believe that millet based foods contribute directly to their health.

Millet has historically been transformed into a range of food recipe products by fermentation and malting. But throughout time, a paradigm change gives rise to many food products afresh commercially available goods. As the demand for new generation snacks fall into the following categories *viz.*, lower fat, baked, not fried, and high-fiber products, this can be highly possible by incorporating millets in many of the recipes. Thus there is wider scope for promoting millet-based value-added products among consumers.

Moreover, with urbanization and nuclear families becoming the norm, the burgeoning millet based food industry holds promise for successful processing and marketing at both the National and International levels.

II. PROCESSING INTERVENTIONS

Millets are highly nutritious, non-glutinous and non-acid forming foods and are hence soothing and easy to digest. Also, processing methods such as puffing, flaking, fermentation and malting can decrease the level of anti-nutrients, increase nutrient bio-availability and enhance carbohydrate and protein digestion. Hence, malted millet-based foods are considered ideal for development of weaning foods, supplementary foods, geriatric foods and other health foods. Processing of millets and making it as a value added products is greatly acceptable by consumers and also enhances the nutritional value and shelf life period . Some of the Millet Industrial products that is commonly seen is presented in Table 1.

Table 1. Common industrial products of millets

Millet name	Common industrial products
All millets	Dehulled millet, millet rice, parboiled millet rice ,millet flour ready to use products such as Puffed or Popped millets and Flaked Millets. Extruded products such as Vermicelli , Noodles . Baked Products Fermented Products like Malting and Weaning Foods Traditional Foods and Beverage fermented batters.
Sorghum	Jaggery (unrefined sugar), Malted sorghum , bakery, feed for poultry and animal , high fructose syrup,
Pearl millet	Dehulled millet, millet rice, parboiled millet rice ,ready to use products such as Puffed or Popped millets and Flaked Millets. Extruded products such as Vermicelli , Noodles Malting and brewing, feed for poultry and animal , starch, bakery, poultry and animal feed
Finger millet	Dehulled millet, millet flour millet rice, parboiled millet rice ,ready to use products such as Puffed or Popped millets and Flaked Millets. Extruded products such as Vermicelli , Noodles Malted baby foods, bakery and food for diabetics

III. HIGH DEMAND MILLET BASED TECHNOLOGIES

Convenience foods and ready-to-eat products have the largest growth potential with respect to processing of millets. In the export market millet products that have growing demand are extruded foods, convenience foods and millet flakes. Presently a very small percentage of these crops especially major and minor are processed into value added products. The demand for ready-to- cook and ready- to- eat foods are also on constant rise. For this purpose, there is introduction of new flour called Composite flour which is done by blending them with wheat flour after suitable processing (Singh *et al.* 2005). One of the possible ways of extending their utilization is possible with the combination of cereals, pulses, oilseeds and millets, many products can be developed such as extruded products (vermicelli and pasta), bakery products, savories, nutri-bar, *etc.* With the introduction of millet processing machines many products comes for commercialization with acceptable taste.

IV. VALUE ADDITION MACHINERY FOR MILLETS

For establishing a millet processing unit, the following machines are essentially required. The cost of purchase of these machineries range from Rs. 3-5 lakhs to 60-70 lakhs depending upon the capacity of the machines. The uses of these machines are as follows.

➤ *Destoner, Grader cum aspirator:*

Destoner are made for removing stones, Aspirator removes light weighted impurities and grader is to separate the grains based on its size. After the above process decortications has to be done.

➤ *Millet Decorticator/Millet Dehulling machine:*

Various Decortications/ Dehulling machineries are available in the market based on user capacity. The process involves, soaking of millets in 300 ml (weight /volume) 0.2 N HCL for 15 hours and washing twice with water to remove the hull. The grains are then scarified using the scarifier tool for one to three minutes can remove considerable amount of hull.

➤ *Millet Miller and Flour Sifter*

In milling, normally milling efficiency and shelling index are considered as the prudent parameters that influence the head yield for further processing. Single stage, double stage and multi mill type pulverizers are available. Based on the requirement one can choose the pulveriser. The rough and powdered flours are used in various value added food formulations such as halwa mix, adai mix, health mix or rawa. Flour sifter is used for sieving the grinded (powdered form) to get very fine powder and hence can be directly packeted or packeted after blending with other materials.

V. FUNCTIONAL AND NUTRITIONAL PROPERTIES OF MILLETS AND END USES

Millets classified as coarse grains called with different functional properties. Based on this property one can choose the millet for the specific end use products. Due to advancement in processing machineries any value added products could be prepared using any of the millets.

Table 2. Functional and nutritional properties of millets and their end uses

Millets	Functional Properties	Nutritional Properties	End uses
Sorghum	High hydration capacity Low swelling capacity High bulk density	fibre content is high	Oil fried Snacks Edible cutlery and Pasta
Pearl Millet	High water solubility High oil absorption capacity	Iron is high	millet milk Batter, all fermented products
Finger millet	High hydration capacity High viscosity	Rich in Calcium	Batter and all fermented products
Foxtail millet	High viscosity High water adsorption	High mineral ash	Porridge, sweet Snacks, Batter and all fermented products
Barnyard millet	High emulsion activity and stability High dough raising capacity	Rich in Iron	Batter, all fermented products and RTE-millet breads
Little millet	High water absorption index	Fat and Potassium content is high	Porridge, sweet Snacks and health mixes
Proso Millet	High hydration index	Zinc content is high	Pasta, Noodles, weaning foods and millet milk

A. Malting and weaning foods

When millets are malted and used there is significant increase in most of the nutrient composition such as fat, vitamins B, fibre, C and their availability, minerals also bioavailability of nutrients is improved along with the sensory attributes of the grains.

➤ Method

In malting germination is an important process and the temperature of 25 - 30 °C is found to be optimal. The weaning foods are prepared with the combination of 42% finger millet, 20 % legumes and 10 % groundnut. All these ingredients are germinated, dried, roasted, sieved to flour and with 28% additives such as sugar, oil, skim milk powder and vanillin are added.

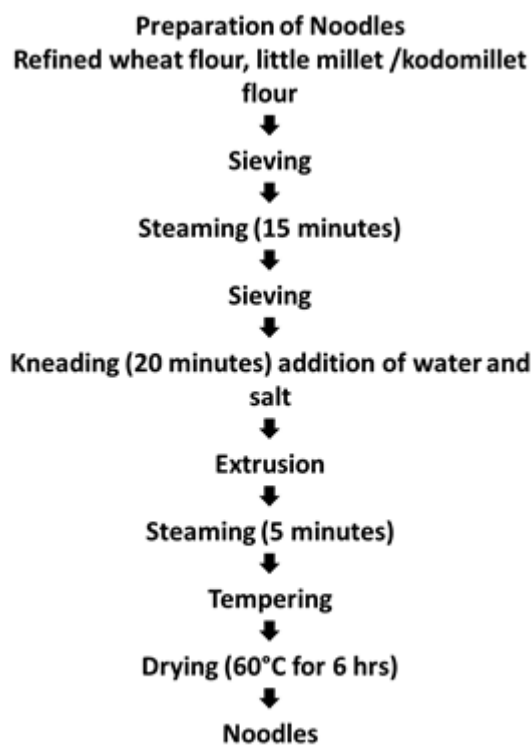


Fig. 1 . Flowchart for preparation of millet noodles

B. Preparation of millet milk

The finger millet and pearl millet is best suited for this preparation. With the proportion of 70% millets 15% green gram and 15% wheat, all these ingredients are soaked for 12 hours, sprouted for 48 hours then sundried and roasted, ground in grinding mixer and stored in air tight containers. To one cup of boiling water and I cup of milk two teaspoon of this mix are added to prepare millet milk. Similar products are standardized by (Mali *et.al.* 2020; Girija and Kamalasundari 2020)

C. Convenience foods

Extruded food products are commonly consumed convenience foods in most of the developing countries. A few of convenience foods are flakes, pasta spaghetti, macaroni, vermicelli and noodles. In general they are made using refined durum wheat flours. Multigrain flour, by combining wheat and millet flour in the ratio of 7:3 is one of the simple semi-finished products suitable for making chapatti (roti). In choosing the same flour with particle size less than 10-41 μ m and 41-300 μ m, it was found suitable for preparation of noodles, pasta puffed snacks by incorporating at 10 to 20% level. As in Fig 1 we have to prepare the process and the machinery Extruder of Fig 2 is used. Barnyard millet and proso millet can be added in much higher level at 20 and 15% respectively. The optimum level of addition of finger millet, foxtail millet and little millet was 10%. Millet based extruded snack foods are prepared using twin-screw extruder using different blends of cereal and millet combination or pulse based ones *etc.*



Fig. 2. Noodle making machine and millet noodles

D. Preparation of millet snack

Millet flour snacks are very common in South India especially barnyard, kodo millet. Little millet flour (75%) and Bengal gram flour(25%) along with water and salt to form dough are best suited for preparing is sev, mixture, murukku *etc.* The consistency varies based on the end product that these are extruded through different die and fried in oil

E. Bakery products

Bakery products are popular all over the world and are preferred one in all age groups and their production has risen by many folds due to varied taste. These products are sold with attractive package and longer shelf-life to suit easy marketing. Finger millet, barnyard millet, kodo millet, pearl millet and foxtail millet flour can be incorporated from 20 to 50 % in bakery items like bread, soup sticks, biscuits, nan-khatai, chocolate, cheese, muffins, *etc.* Sometimes edible cutlery are prepared using this technology.

F. Biscuits/ Cookies

Biscuits prepared from maida and using combination of any millet flour. These can be stored for 120 days when packed in double pack of polypropylene/ pearlesed BOPP and metalised polyester/ poly laminate. For preparation of Millet cookies, Millet flour 750 g, maida 500 g, icing sugar 300 g, Cake Margarine 650 g, corn flour 10g and baking powder 3g are the ingredients. Sieve the millet flour, maida, icing sugar, milk powder, Baking Powder *etc.*, Then the dough is then kneaded with cream, fat and sugar. Then add corn flour finely and moulded in to desired shapes. It is then baked at 180^o C for 15 minutes. Finally, it is cooled and packed.



Fig. 3. Kodo millet cookies

G. Procedure for preparation of millet bread /bun.

Refined flour, little millet and pearl millet flour were sieved to pass through a BS 60 mesh sieve. The flour was then heated at 80^oC for 2 hours in a hot air drier, cooled and were blended with Gluten replacers. For fermentation, dissolve 2 grams of sugar and 7 g of yeast in 100 ml of luke warm water and kept for 5 minutes. Flour was mixed by using yeast suspension and fat was added, mixed well and kneaded for 15 minutes. The dough was covered with a wet cloth and kept for one hour. The dough was then moulded to bread shape and transferred into the greased bread moulder for final proofing for 3 hours. The dough was then baked at 180^oC for 40 minutes and the gluten free bread were cooled and packed.

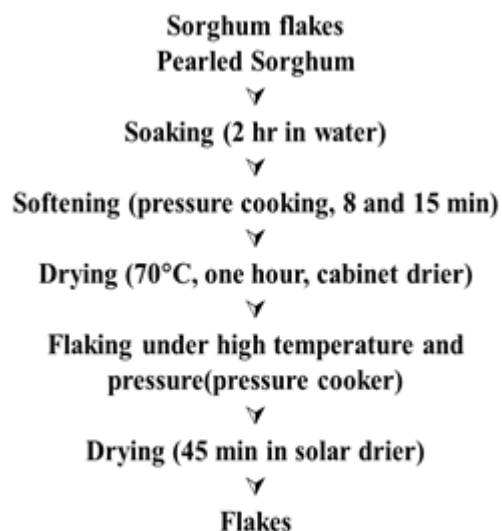


Fig. 4. Flow chart for preparation of Sorghum flakes

H. Preparation of flakes

Dehulled millets were soaked with water for 2 hours. As given in Fig:4 drain the water and roast it. The moisture of raw material mixture was adjusted to 10-15%. The grains were put into flaking machine the flakes was dried at 50 °C and packaging/

I. Millet breakfast

Millet based breakfast cereals can be prepared using flaking fermented batters and puffing. The flaked and puffed millets can be made into millet bar using a binding agent like sugar syrup or jaggery. This mixture can also be mixed with fruit candy/ roasted dry It is Ready To Eat (RTE) and is generally taken as a breakfast cereal along with cold or warm milk. This type of cereal would be nutritionally superior to single flakes alone. They are also normally fortified with the necessary vitamins and minerals to enhance their nutritional value.

VI. PREPARATION OF LADDU

Millet flours, nuts are roasted in dry pan and mixed with cardamom powder and groundnut powder and to add the powdered jaggery/sugar syrup and melted the ghee mix it and to make a delicious laddu.

VII. CONCLUSION

In the diverse Indian agribusiness sector, food-processing sector is particularly promising and is undoubtedly one of the largest potential markets for processed foods. Millet based food products offer a promise to enhance and ensure food and nutrition security, public health and agricultural sustainability. Appropriate inclusion of millets helps to achieve food and nutritional security of the population. The value chain interventions can be made sustainable by resolving specific

production constraints, by using the technology transfer of post-harvest processing developed in national and state institutes. Such value addition technologies will result in assured additional income and employment. Making millet food products that deliver convenience, taste, texture, color, and shelf-stability at economical cost for poor people is needed. In addition, for promoting utilization of millet grains in urban areas, it also open new markets for farmers. Entrepreneurship Development Programmes are given at most of the national and state institutes for processing of millets and marketing of millet-based products. Therefore, enhancing the nutritional quality of millet based value added product is essential to increase the quality of human health.

REFERENCES

- [1]. Adebiyi JA, Obadina AO, Adebo OA, Kayitesi E. Fermented and malted millet products in Africa: Expedition from traditional/ethnic foods to industrial value -added products. *Critical reviews in food science and nutrition* . 2018 ;58(3) :463 -474
- [2]. Bembem K, Agrahar -Murugkar D. 2020 Development of millet based ready -to -drink beverage for geriatric population. *Journal of Food Science and Technology*. Mar 23 ;57(9) :3278 -3283.
- [3]. Girija J. And S. Kamalasundari 2021 Effect of Packaging Materials on Storage Quality of Functional Beverage Mix, *Madras Agric. J.*, doi:10.29321/MAJ.10.00048
- [4]. Girija, J. Kamalasundari, S G. Hemalatha and T. Uma Maheswari 2020 Development of Functional Calcium Rich Beverage Mix for Lactose Intolerance People *European Journal of Nutrition & Food Safety* 12(5): 73-81
- [5]. Kamalasundari, S and M. R. Premalatha 2014 Development of High Fiber and Low Glycaemic Food For Weight Reduction *Asian Journal of Dairy and Food Science* Vol.33,2: 87-91
- [6]. Kanorwala B, Wadhawan N, Shekhawat P, Jain R. 2022 Significance of finger millet consumption on nutritional status and management of diabetes mellitus: A review. *the Pharma Journal* SP-11(12): 977-979
- [7]. Kiruthika, D PS Geetha, T Uma Maheswari, S Kamalasundari and A Kavitha Pushpam 2018 Development and quality evaluation of buttermilk based pearl millet beverage, *International Journal of Chemical Studies*, 6(3): 3453-3457
- [8]. Mali SD, Deshpande HW, Katke SD. 2020 Standardization and Quality Evaluation of Non -Dairy Probiotic Beverage Prepared from Finger Millet and Foxtail Millet. *International Journal of Current Microbiology and Applied Sciences* . Aug 10 ;9(8) :2118 -2123.
- [9]. Saraswathi R and Hameed RS (2022) Value Addition Influenced in Millet Products - A Review *Austin Journal of Nutrition and Food Science* i 10(1): id1161

- [10]. Sheela, P, Uma Maheswari T, Kanchana S, Kamalasundari S and Hemalatha G 2018 Development and evaluation of fermented millet based curd. *Journal of Pharmacognosy and Phytochemistry*, 7(4): 714-717.
- [11]. Singh.P.,SG.Singh.,S.Srivastava,P.Agarwal (2005) Physico-chemical characteristics of wheat flour and millet flour blends.*Journal of Food Science and Technology* 42(4):340-343
- [12]. Soni Mokshika, Dr. Nikita Wadhawan, Jigyasa Rahal and Jitendra Meghwal 2023 Benefits of millet based beverages and their traditional way of processing and utilization: A review *The Pharma Innovation Journal* 12(9)