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Research Article

STUDY ON POST HARVEST PROCESSING TO ENHANCE MILLING QUALITY OF LITTLE MILLET (*Panicum sumatrense*)

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Abstract: Millets are gaining importance nowadays because of its nutrition and health benefits. Millets are widely cultivated all over the world and some parts of India. Millets are mostly rain fed crops and used as food and fodder. Little millet (*P. sumatrense*) also called Indian millet since it is an origin of India. Little millet is cultivated in 2-5 months period and harvested during fifth month when it attains maturity. Millets are processed to remove husk to get grain and cooked as rice and sometimes may grind into flour and used in culinary. Millets are important because of its nutrients mainly protein, fibre, minerals such as calcium, phosphorus, iron and some essential amino acids. The present study was carried out to standardize parboiling of Little millet, drying, milling properties and storage quality and retention of nutrients. De-hulling of Little millet is a cumbersome process since husk and bran layers are bound tightly on the endosperm and their removal needs a special treatment. To ease the milling process, these millets were subjected to hydrothermal treatment. Whole Little millet was soaked at different temperatures of 60, 70 and 80°C soaking time (2, 2 1/2 and 3 h) and this was followed by steaming process (30 min). The resulting millet is dried, dehusked and decorticated through milling processing in a centrifugal de-huller. Parameters such as head rice recovery and percentage of loss were observed. The results showed that the water absorption capacity of soaked Little millet was 50%, 45% and 40% respectively. Parboiling was carried out until the millet cooks and till the husk opens and it was absorbed that the time taken to parboil was 30 minutes. Drying Time was absorbed that it took two days to dry the grain with 10% moisture. The milling quality of Little millet showed better head rice yield with 72.18, 74.57 and 75.20 percentage for different soaking temperatures respectively. The broken millet percentage with 3.23, 3.28 and 3.20 for different soaking temperature respectively with increasing storage capacity upto six months without any deformation.

Keywords: *Little Millet, Parboiling, Processing, Milling, Dehusking, Dehulling*

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Introduction

Millets are important crops for dry land farmers. They are highly nutritious and climate compliant crops. But due to drudgery in preparation, their consumption is decreased over the years in India. Millets provide all nutrients essential for health and growth of mankind and now it is promoted for nutrition security. Little millet is very small in size when compare to other millets and cultivation process is similar to proso millet. Millets contain more digestive fibre compared to rice and wheat. This helps in slow release of energy, thereby increasing physical efficiency [1]. Like other cereals millets also supply a significant amount of energy around 70-80%, they are rich source of minerals and 'B' vitamins which helps in the process of digestion of food. Thus, millets offer solution for people suffering from malnutrition in India [2]. Processing of millets is a tiresome process requires special machineries to remove outer layer. Technology used for converting the grain into edible form and thereby enhancing quality is known as processing [3]. Millets can be consumed by processing them into rice, flour, sprouting, ready to eat food and fermented foods. Processing methods such as soaking, drying, dehulling and cooking will change the anti-oxidant activity and remove the anti-nutritional properties [4]. Processing is essential to improve the quality of millet, to increase nutritional characteristics, sensory properties and ease of cooking and to increase palatability. There are several traditional processing methods were followed to enhance the quality of millets and bio availability of micro nutrients. These include soaking, fermentation, thermal and mechanical processing, drying and dehusking. Secondary process includes milling, flaking, popping, roasting and flour making [5,6].

Dehulling and dehusking removes almost 40-50% of impurities and anti nutritional factors that inhibits the digestion quality of millet and enhances the nutritional quality and consumer acceptance [7]. The objective of this study was to optimize parboiling process of Little millet among farming community of Kancheepuram district of Tamil Nadu

Materials and Methods

Millets production in Kancheepuram district is around 331 ha (950 ha) mainly finger millet and followed by other millets like foxtail millet, Barnyard millet and little millet. Farmers grow millets and sell it as such without any processing and get poor market price for millets. Processing technologies used for improving the edible and nutritional characteristics of millet as well as challenges, limitations, and future perspectives to promote millet utilization as food for a large and growing population. Therefore, with value-added strategies and appropriate processing technologies, the millet grains can find a place in the preparation of several value-added and health food-products, which may then result in high demand from large urban populations and non-traditional millet users.

Parameters assessed

Soaking: Ten kg of whole millet grain was initially soaked in 20 litres of water with various temperatures of 60, 70 and 80°C for two hours, threehours and4 hours.
Water absorption capacity-It was assessed by draining excess water after soaking period.

Parboiling (Steaming): The soaked grain was steamed using the parboiling unit made of cast aluminium. The steaming time was assessed and it was 30 minutes.
Drying: Excess water was drained and dried in the sun about for one day and shade for one day and maintained moisture with 10%.
Milling process: This operation was carried out with the huller (decorticator) and time taken for single process was 3 minutes. The latter were separated from bran with a hand winnowing process. The process was repeated for three times. After decortication, whole millet grains were separated from broken millets. The milling millet yield and the percentage of broken grains were calculated. Milling yield of millet is expressed in percentage by the ratio of weight of the millet with husk on the weight of the unhulled millet grain

$$Milling\ millet\ yield\ (\%) = \frac{Weight\ of\ The\ Husked\ Grain(g)}{Weight\ of\ The\ Unhulled\ Grain(g)} \times 100$$

The broken percentage is the ratio of the weight of broken grains on the weight of husked grains.

$$Broken\ Millet\ (\%) = \frac{Weight\ of\ The\ Broken\ Grain(g)}{Weight\ of\ The\ Milled\ Grain(g)} \times 100$$

Shelf life study: The parboiled and milled Little millet was packed in gunny bags and assessed storage period.

Results and Discussion

Millet parboiling was standardized by considering the milling millet yield, the percentage of broken millet grains, storage of parboiled and milled millet. The result of dehusking trials is presented in the [Table-1].

Table-1 *Parameters used in parboiling of little millet*

Parameters	Temperatures		
	60°C	70°C	80°C
Soaking time	2 hours	2 1/2hours	3 hours
Water absorption capacity	50%	45%	40%
Parboiling Time	30 minutes	30 minutes	30 minutes
Drying time	2 days	2 days	2 days

It was observed that 50, 45 and 40% of water absorbed during soaking period against different temperatures. Excess water from parboiled millet was completely drained using bamboo basket and it was sun dried and followed by shade drying. It was absorbed that it took two days to drain the grain with 10% moisture. Traditionally, dry, moistened or wet grain is normally pounded with a wooden pestle in a wooden or stone mortar. Moistening the grain by adding about 10% water facilitates not only the removal of fibrous bran, but also the separation of germ and endosperm [8]. During steaming, the starch is gelatinized at temperatures below 80°C applied for 4 hours. Under 70°C, the gelatinization carried out and followed by a progressive drying lead to a compaction of the starch and a hardening of the grain thus allowing the parboiled millet to better resist the abrasion during the milling. The improvement of milling millet yield may be due to the increased binding effect of starch with gelatinization and melted protein bodies from the steaming process seal the fissures. The dried millet maintains the recommended moisture content of 10% [8, 9].

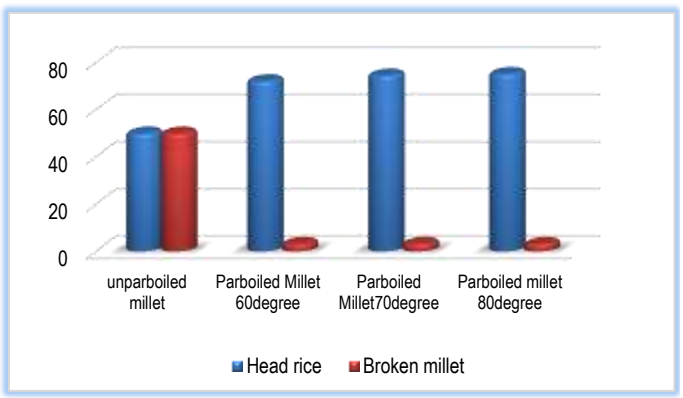

Fig-1 Comparison of Milling Process of Parboiled vs Un parboiled Millet

Milling millet yield

The milling millet yield in unparboiled sample was 50. 37 %. The milling millet yield of the parboiled samples was higher than those of the unparboiled millet. The yields were of 72.18; 74.57and 75.20 % respectively for 60, 70 and 80°C. From this study, it was proved that the 3 temperatures 60, 70 and 80°C would be the most suitable for millet parboiling by considering the best milling millet yield. [Fig-1] represent the milling process of parboiled and un parboiled millet.

Parboiling of millet

Drying of Millet

Dehulling process

Percentage of broken millet grains

The percentage of broken grains was lower in the parboiled millet (14% maximum at 80°C) than in the untreated millet (24.14%). Considering all the parboiled millets, it was observed that the soaking temperature influences the broken millet rate. At the temperatures of 60, 70 and 80°C, the corresponding broken proportions were 3.23; 3.28 and 3.20% respectively. It is revealed that for the soaking temperatures comparable to those of the gelatinization of the starch, the broken percentage was due to temperature of the water. Beyond the gelatinization temperature (above 70°C), it is observed that the percentage of the broken millet increases again, even if it remains lower than those of the un parboiled millet.

Storage of the Milled Little millet

Parboiled and dehusked little millet with various soaking temperature are packed in food grade pouches and gunny bags and stored at room temperature showed better keeping quality by six months without any deformation. Thus, parboiling also increases keeping quality of millet apart from increasing the cooking quality.

Conclusion

Parboiling is commonly used to improve the milling quality and the nutritional quality of millet. It is revealed from the study the little millet was soaked at various temperatures such as 60, 70 or 80°C for 2,3 and 4 hours of steaming time. The milling millet yield is improved and the broken millet grains are decreased. Storage of milled millet grain also increased due to hydrothermal process. Thus, it proves that any millet post-harvest process mainly parboiling before milling process reduces broken rice percentage and improves milling quality.

Application of research: Training programme on use of parboiling unit specially designed for cooking millets and other processing techniques including drying, dehusking, storage and marketing of the product were imparted to the farm women of the selected villages.

Research Category: Front Line Demonstration programme

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Study area / Sample Collection: Kannimangalam and Perungaranai villages of Kancheepuram District, Tamil Nadu, India

Cultivar / Variety name: Little Millet (*Panicum sumatrense*)

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
Ethical Committee Approval Number: Nil

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