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Studies on Cooking Qualities of Minor Millets

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ABSTRACT: *Millets differ from one another by their grain type, size, appearance, morphological features, taste etc. India is the hub for the small millets with the total production of 10.91MT in 2013 according to FAO. Millets are underutilized and neglected crops owing to their lower preference driven by affluence, longer time and efforts involved in processing and ignorance of millet nutrition and cooking. Due to lack of knowledge on cooking and value addition, consumers prefer not to purchase millets. This study focuses on the evaluation of cooking qualities of minor millets such as little millet, foxtail millet, barnyard millet, kodo millet and proso millet. The cooking qualities like cooking time, water uptake ratio, solid loss, grain elongation during cooking, and gelatinization temperature were analysed for the minor millets. Cooking qualities of minor millets determines the food product development, value addition and utilization of millets in the home and industrial application thus a boon to the consumers and producers.*

Key words: *cooking qualities, cooking time, grain elongation, gelatinization temperature, minor millets, solid loss and water uptake ratio.*

INTRODUCTION

Millets are small seeded grasses, well suited for 'dry farming'. They are called as "Bombshells of Nutrition". India is the largest producer of many kinds of millets in the world. The total millet production in India is about 10.91MT **[1]**.

Millets are rich in protein, fat, micronutrients such as calcium, iron, zinc, thiamine, riboflavin and folic acid and manifolds of fiber content when compare to other staple foods like rice and wheat **[2]**. Millets are highly nutritious, non-glutinous and not acid forming foods. Hence they are soothing and easy to digest. They are considered to be the least allergenic and most digestible grains available. Compared to rice, especially polished rice, millets release lesser percentage of glucose and over a longer period of time **[6]**. Millets have been reported for several potential health benefits such as preventing cancer and cardiovascular diseases, reducing tumor incidence, lowering blood pressure, risk of heart disease, cholesterol and rate of fat absorption, delaying gastric emptying, and supplying gastrointestinal bulk **[8, 3]**.

Though millets are highly nutritious and healthy food, they are not utilized as a regular food in our diet. Traditionally, millets are utilized in our diet as *porridges, kali, roti,* fermented foods, etc. Now they are incorporated into many processed foods and traditional foods. But millets do not replace even a part of utilization of other staple foods like rice and wheat. This is due to ignorance of cooking of millets among the individual or home maker. It is essential to know the cooking qualities such as time required to cook the grain, water requirement for complete cooking, solid loss during cooking, grain elongation and gelatinization temperature before going to cook or process of any type of grain. This study focuses on determination of cooking qualities of minor millets such as little millet (*samai*) foxtail millet *(Tenai),* barnyard millet *(Kudhiraivali),* kodo millet (*Varagu),* and proso millet *(Pani varagu),* which gives an idea to cook and utilize the nutritious and health promoting millets in our regular diet.

MATERIALS AND METHODS

The millets procured from the local shops in Karaikudi, Sivagangai district. The study was carried

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out in Food Processing Research and Training Centre, Dryland Agricultural Research Station, Chettinad. The cooking qualities such as cooking time, water uptake ratio, solid loss, grain elongation during cooking were determined by the method described by **[7],** and gelatinization temperature was determined by the method given by **[5 and 4].** Triplicate samples were taken for each treatment and the mean value arrived.

COOKING TIME

Cooking time of each millet type was determined by boiling 2.0 g of whole millet grains from each millet type in 20 ml of distilled water, removing a few grains at different time intervals during cooking and pressing them between two glass plates until no white core was left. Optimum cooking time was taken as the established cooking time plus two (2) additional minutes.

WATER UPTAKE RATIO

The water uptake ratio was determined by cooking 2.0 g of whole millet grain from each type in 20 ml distilled water for a minimum cooking time in a boiling water bath and drain the superficial water from the cooked millet. The cooked samples were weighed accurately and the water uptake ratio was calculated as the ratio of final cooked weight to uncooked weight of the grain and converted to percentage. Water uptake ratio = (weight of cooked millet sample / weight of uncooked millet sample) × 100.

SOLIDS IN COOKING WATER

This was determined by drying an aliquot of the cooked water in an evaporating dish to evaporate the water. The weight of the empty petri dish (W1) and weight of petri dish with aliquot (W2) was recorded. The petri dish with aliquot was kept at hot air oven till complete drying of water from the solids. The weight of petri dish with aliquot after drying was recorded as (W3). The amount of solid in cooking water was calculated as W3-W1.

GRAIN ELONGATION DURING COOKING

Grain elongation during cooking was determined by calculating the difference in grain length before and after cooking. The length of ten grains of each millet type was recorded and the average was calculated. The grain length before cooking was noted as (L0) and after cooking was noted as (L1). Grain elongation was then calculated as L1-L0.

GELATINIZATION TEMPERATURE

Gelatinization temperature was indexed by alkali spreading test **[5]**. The degree of spreading of individual millet kernel in weak alkali solution (1.7% KOH) at room temperature (32±2°C) was evaluated on a 7-point numerical scale **[4]**. Ten intact milled grains were placed on a petridish to which 15 ml of 1.7% KOH was added. The grains were carefully separated from each other and incubated at ambient temperature for 23 hrs to allow spreading of the grains. The degree of spreading is measured using a seven – point scale as follows:

1 – grain not affected; 2- grain swollen; 3- grain swollen, collar incomplete and narrow; 4 – grain swollen, collar complete and wide; 5- grain split or segmented, collar complete and wide; 6 – grain dispersed, merging with collar; and 7 – grain completely dispersed and intermingled.

Table 1
The range of gelatinization temperature with respect to alkali spreading value

Category	*Alkali spreading value (ASV)*	*Temperature ranges (°C)*
Low	6-7	55-69
Intermediate	4-5	70-74
High	2-3	75-79

RESULTS AND DISCUSSION

The cooking qualities such as cooking time, water uptake ratio, solid loss in cooking, grain elongation and gelatinization temperature of food grains are important determinants for utilization in any food product. The results of studies on cooking qualities of millets are given in Table 2.

The cooking time varies with the type of grains, ageing, hardness and size of the grains. The results revealed that cooking time of little millets and barnyard millet were same as about 10 min. Similar results observed by Veena et al., (2005) **[9]** who stated that barnyard millet exhibited excellent cooking attributes and the cooking time ranged from 8-12 min. Foxtail millet and kodo millet takes about 9 minutes to cook. Proso millet needs longer time (14 min) when compare to other grains. The longer the cooking time for the grains like proso millet might be due to the larger the size of the grains.

Water uptake ratio determines the volume of water required to cook the grains. The results of the study shows that 100 g of millets requires 367, 250, 337, 333 and 175 g or ml of water for little millet, foxtail millet, barnyard millet, kodo millet and proso millet respectively.

Table 2
Mean values of cooking qualities of minor millet grains

Millet grains	*Cooking time (min)*	*Water uptake ratio (%)*	*Solids in cooking (%)*	*Grain elongation (%)*	*Gelatinization temperature (°C)*
Little millet (LM)	10.0	367	5.25	12	75-79
Foxtail millet (FTM)	11.0	250	2.4	5	>79
Barnyard millet (BYM)	10.0	337	5.9	10	70-74
Kodo millet (KM)	11.0	333	5.5	4	55-69
Proso millet (PM)	14.0	175	4.75	14	55-69

The solids in cooking water for all the millets range between 2.4 and 5.9 g /100 g. The loss was higher for the grains like little millet, barnyard millet and kodo millet *ie.* 4-6g %. The percent loss in solids was minimum for foxtail millet (2.4g %). This might be due to hard seed coat of the foxtail millet.

The mean values of percent grain elongation was observed higher for the grains like barnyard millet (10%), little millet (12%) and proso millet (14%) and it was minimum for the grains like kodo millet (4%) and foxtail millet (5%).

Gelatinization temperature for the millet grains were noted from the corresponding 1-7 scale numerical scores. From the millet grains studied, it was observed that gelatinization temperature for kodo millet and proso millet was in the range between 55-69°C. For the other grains the GT value was 70-74°C (barnyard millet), 75-79°C (little millet) and >79°C for foxtail millet. Foxtail millet was not disturbed with 1.7 % alkali during 23 hours incubation period.

SUMMERY

It may be concluded from the study that all millets can be cooked within 10 minutes except proso millet which needs 12 min for cooking. The ratio of millet and water for cooking varies with different types of millets and size of millet grain. Larger size millet grains took less quantity of water and small seeded millet grains took higher quantity of water for cooking. The solid loss during cooking of minor millets is less than six per cent. Grain elongation and gelatinization temperature varies with the type of millet and size of the millet.

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