



Production and Nutritional Quality of Traditional Indian Millet Mixture of Rice, Pearl Millet and Urad Dal

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ABSTRACT

Millet mix was prepared for its traditional values. The prepared sample was analyzed for its chemical and nutritional value, and by using the cost-efficient method, the nutritional content of the final product was enhanced. The improved sample was checked for its nutritional content. The objective is to make a comparison between standard and enhanced samples. Three ingredients were prepared in a powdered form of a sample in four different ratios. The standardized ratio of the ingredients used to make the samples were found by using organoleptic tests. In the standardized ratio normal (S1) and nutrition enhanced (S2) samples were prepared using the three ingredients. For nutrition enhancement, the method of sprouting was used. Various tests were conducted for the standardized sample to verify its nutritional content, commercializing ability, microbial analysis, phytochemical analysis etc. The nutritional content Analysis of the normal and nutrition enhanced samples (S1) and (S2) was done. The sample (S2) was nutritionally rich when compared to the normal sample (S1). All other test had more or less coinciding results for both the samples (S1) and (S2). By comparing the nutritional content, a conclusion arrives that the sample (S2) is nutritionally rich when compared to (S1). Microbial and Physical properties results show that the product is efficient to be commercialized and stored to a specific period without microbial contamination in powdered form. The nutrient-rich mass is suitable for all age group.

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INTRODUCTION

Today, health is a significant concern in our day-to-day life. Nutritious and health beneficial products are in high demand. Nearly 50% of the Indian

kids are mal-nutritious, mostly due to poverty. Our research has given a solution to tackle both the ends of the rope. Millets have immense health benefits that can help us overcome the current lifestyle diseases at an affordable cost even for the economically weaker section. Keeping this in mind, a new innovative idea of making a value-added multigrain mix is introduced. The significant cereals and millets consumed in India are rice, wheat, johar, maize, bajra and ragi. These grains are the primary source of energy in Indian diets contributing nearly 78-80% of daily intake of the majority of Indians. Since cereals & millets are the cheapest, widely available source of energy, their contribution to energy intake is highest among the families who cannot afford much for food, and it decreases with increasing income. Millets have immense health benefits as

they are rich in phytochemicals and nutrients, particularly beneficial to overcome the current lifestyle diseases. Millet based products are economically viable, and also highlights the excellent medicinal and nutritional qualities. Cereals/millet are also a source of some nutrients like calcium and iron. One of the most significant reasons for this study was to develop a low cost and value-added malt foods which are easy to prepare and are affordable.

Masa (Nkama and Malleshi, 1998) is a fermented puffed batter of rice and different millets of our choice. It is cooked mostly as dosa or idly. Masa is consumed in various form by all age groups in the southern states of India. Protein-energy malnutrition has been identified as one of the most critical problems in India. Attempts have been made to devise strategies for combating this nutritional problem. Nutritious food of high protein and energy value based on millet mix combinations has been suggested. A combination of cereals and grain legumes in the traditional preparation of masa will have improved nutritive value. The highly beneficial millet bajra (Malik, 2015) is chosen. Rice is included for its carbohydrate content (Verma and Shukla, 2011; Rohman et al., 2014) and urad dal for its high protein content (Kamboj and Nanda, 2018). Combining these three ingredients we've given a useful product to satisfy the nutritional need of a human body in all dimensions.

Methodology

Source of raw material and reagents used

1. Rice, pearl millet (Bajra), urad dal were purchased from the local market.
2. All the chemicals and reagents used were of analytical grade.

Standardization of millet flour blend

The millet mix was standardized using rice, pearl millet (bajra) and urad dal in four different proportions. The detail of the standardization of the blend is given (Table 1).

Processing of millet flour blend

The raw materials obtained from the local market were sorted and cleansed from foreign matter contaminants. The raw materials were portioned into four different ratios, as mentioned in (Table 1). All four samples were powdered. The best ratio was chosen, and the ingredients were portioned to that ratio. The method for increasing the nutritional content (Chavan et al., 1989) in a cost-efficient manner was chosen as sprouting. Now the measured quantity of pearl millet was soaked in water for some time and was allowed to germinate overnight. For

better sprouting (Mensah et al., 1991), the germination time can also be extended. The sprouted millet is shade dried for 24 hours. Rice, sprouted bajra and urad dal are ground together. The two standardized samples of masa millet mix one with normal and other with sprouted bajra in combination with rice and urad dal was then stored (MPP packaging) under ambient condition. These two powdered samples were taken for further research.

Preparation of millet flour blends

The powdered sample is mixed with water to get a batter-like texture and is allowed to ferment overnight for at least 12 hours.

Sensory evaluation and formulation of the millet flour blends

FAO, WHO (Organization, 1985), UNU have specified daily protein and energy requirements of people of different category. According to that nearly one fourth of the energy needs of a person is to be satisfied at breakfast. Traditional Indian masa being a breakfast dish (Badi et al., 1990) will satisfy these specified standards. The four samples mentioned in (Table 1) were allowed to undergo organoleptic test. In organoleptic test the following characters were tested namely texture, colour, odour and taste. Nearly 80% of the volunteers have opted for the fourth sample. So we chose the sample with the ratio 2:2:1 of rice: bajra: urad dal for further research.

Laboratory preparation of millet flour blend

The millet flour blend was prepared in the laboratory as described in (Figure 1). The chosen proportion (rice: bajra: urad dal = 2: 2: 1) was taken as a base. Two different samples were prepared in that ratio (Table 2). Required amount of water was added to the sample to get batter texture and was allowed to ferment for 12 – 15 hours. The fermentation was allowed to take place at room temperature (27 5°C).

Product properties

Bulk density

Method used – (Narayana and Rao, 1984)

A grated cylinder tubes were weighed and flour sample filled to 5ml without much disturbance. The contents were weighed and difference in weight determined. The bulk density is mathematically represented by the following formula with the unit gram per ml.

$$\text{Bulk density} = \frac{\text{Weight of the sample taken}}{\text{Volume occupied by the sample}}$$

Tap density

Method used – (Narayana and Rao, 1984)

Table 1: Standardization of millet flour blend

S.No	Ingredients	Sample 1	Sample 2	Sample 3	Sample 4
1	Rice	1	2	1	2
2	Pearl millet(Bajra)	1	1	2	2
3	Urad dal	1	1	1	1

Table 2: Composition of 2 different samples

Sample 1	Sample 2
Rice	Rice
Normal pearl millet	Sprouted pearl millet
Urad dal	Urad dal

Table 3: Phytochemical analysis

Phytochemicals	Sample 1	Sample 2
Saponin	-	-
Alkaloid	+	+
Phenol	-	-
Flavonoid	+	+
Tanin	+	+

Table 4: Microbial specifications

Microbes	Agar used(mg/l of water)
E.coli	Maconkey agar(49.53/1l)
Salmonella	Brilliant green agar(58.09/1l)
Staphellococcus	Manital salt agar(111/1l)
Pseudomonas	Pseudomonas agar((45.3/1l)+10ml glycerol)

Table 5: Result of product properties

Product properties	Millet flour blend Sample 1	Millet flour blend Sample 2
Bulk density	0.4545	0.4167
Tapped density	0.625	0.7142
Hausner ratio	1.3751	1.7142
Swelling index	1.5	1.5

Table 6: Proximate composition results

Si. No	Proximate composition	In 100g of Sample 1	In 100g of Sample 2
1	Protein	26.8013 g	39.6508 g
2	Carbohydrate	9.2326 g	14.2043 g
3	Fat	1.0948 g	20.294 g
4	Ash	1.3846% w/w	1.3505% w/w
5	Energy	153.81 k. calories	397.6 k. calories
6	Moisture	9.0015% w/w	9.1802% w/w
7	Calcium	112.35 mg	63.75 mg
8	Iron	3.89 mg	20.11 mg
9	Magnesium	9.094 mg	8.256 mg
10	Fibre	1.89 g	3.89 g

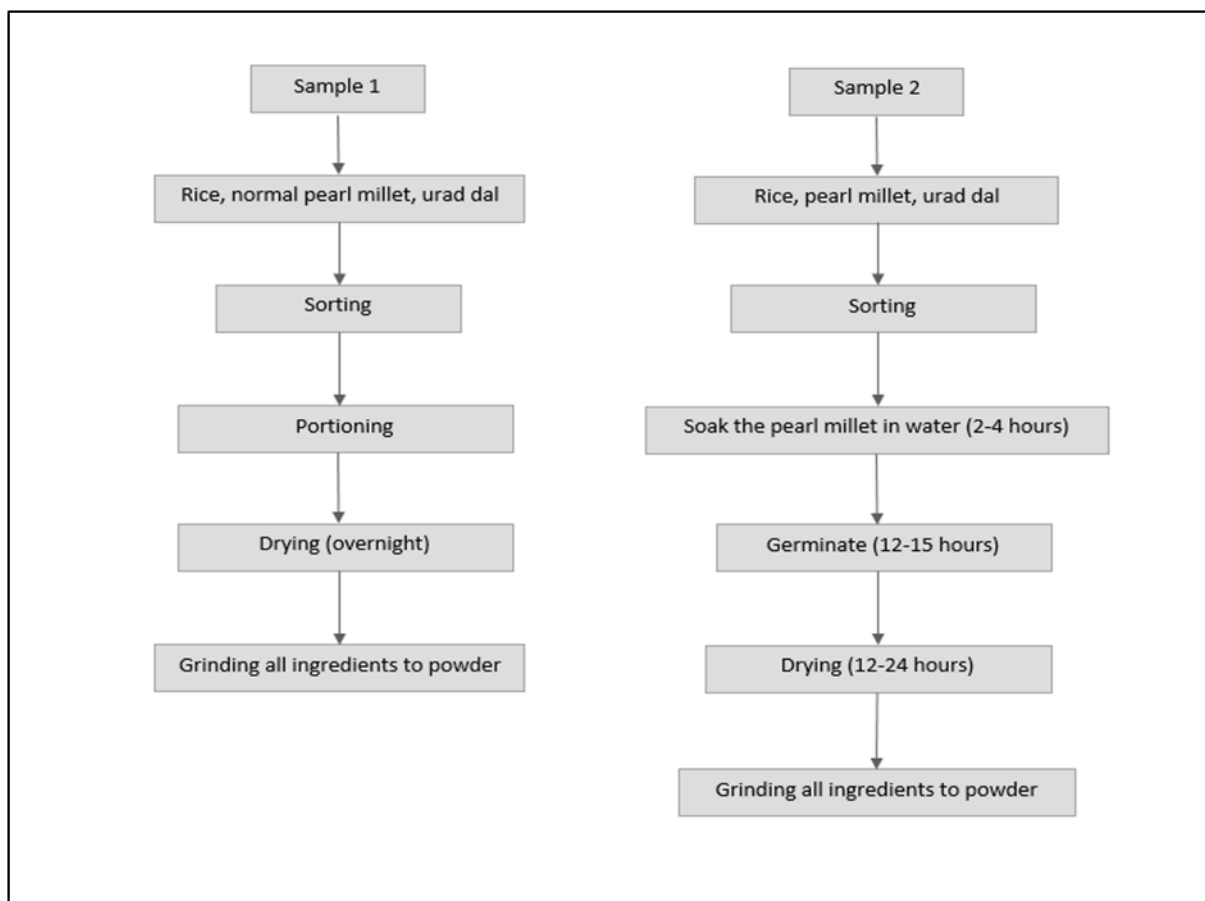


Figure 1: Millet Flour Blend Preparation

A grated cylinder tubes were weighed and flour sample filled to 5ml by constant tapping until there was no further change in volume. The contents were weighed and difference in weight determined. The bulk density is mathematically represented by the following formula with the unit gram per ml.

$$\text{Tap density} = \frac{\text{Weight of the sample taken}}{\text{Volume occupied by the sample}}$$

Hausner ratio

The hausner ratio is a number that is correlated to the flowability of a powder or granular material.

$$\text{Hausner ratio} = \frac{\text{Tapped density}}{\text{Bulk density}}$$

Swelling index

Method used - (Abbey and Ibeh, 1988)

1g of flour sample was weighed into 10ml graduation measuring cylinder. 5ml of distilled water is added to the powdered sample in the cylinder without disturbing it much.

The volume occupied by the sample is recorded. The sample was allowed to stand undisturbed in water for 1 hour and volume occupied after swelling is recorded.

$$\text{Swelling index} = \frac{\text{Volume occupied by the sample after swelling}}{\text{Volume occupied by the sample before swelling}}$$

Phytochemical analysis

The phytochemicals are naturally present in the plants and shows biologically significance by playing an essential role in the plants to defend themselves against various pathogenic microbes by showing the antimicrobial activity by inhibition or killing mechanisms. The phytochemical tests done for the prepared samples is mentioned in (Table 3).

Saponin

The extract of both the samples were taken in two different test tubes. Few ml of distilled water is added to the samples and is mixed well. The foam formation assures the presence of Saponin.

Alkaloid

The extract of both the samples were taken in two different test tubes. 4 to 5 drops of con. HCl is added. Then a few drops of picric acid is added to the samples. The formation of yellow precipitate assures the presence of the phytochemical alkaloid.D

Phenol

The extract of both the samples were taken in two different test tubes. 4 to 5 drops of methanol and few drops of ferric chloride (). The formation of the

dark green colour precipitate assures the presence of phenol.

Flavonoids

The extract of both the samples were taken in two different test tubes. A few drops of sodium hydroxide solution to the sample. If the solution turns yellow then the presence of flavonoid is assured.

Tanins

The extract of both the samples were taken in two different test tubes. A few drops of con. and lead acetate is added. The formation of white precipitate assures the presence of tannin.

Microbial analysis

The microbial analysis is done to verify if the sample supports the growth of microbes. If the sample is contaminated with microbes it becomes unsuitable for human consumption. Tests were done to check for the presence and growth of some concerned microbes like E.coli, Salmonella, Staphellococcus and Pseudomonas. The result of microbial analysis is given in (Table 4).

Chemical analysis

Moisture, protein, fat and ash contents of samples were determined according to AACC methods 44-15A, 46-11A, 30-25 and 08-01 respectively. The total carbohydrate was determined by gravimetry. Mineral contents of the sample were determined by atomic absorption using an air acetylene flame. Phosphorous content was determined colourimetrically and calcium content was determined by a titrimetric method.

Results and discussion

The result obtained from the present investigation are summarized below.

Product properties

Bulk density is dependent upon the particle size of the samples (Parvathi *et al.*, 2015). The value of millet flour blend obtained from the study of two samples were found to be 0.4545 g/cm³ and 0.4167 g/cm³. The tapped density of the samples 1 & 2 are 0.625 g/cm³ and 0.7142 g/cm³. The swelling index of the samples was very low which indicates there is no swelling power in the samples. The result of product property test are given in (Table 5).

Chemical composition

The nutritive value of the millet flour blend was calculated (Nkama *et al.*, 1995). The moisture content of both the samples were 9.0015% w/w and 9.1802% w/w. Other minerals and nutritive content of both the samples are given in (Table 6)

CONCLUSIONS

In conclusion it can be stated that rice and pearl millet are staple food of India. Apart from meeting just the food requirements of the population it is important to consider their nutritional requirement also. We should make maximum use of the nutritional and medicinal values of the traditional food items of our country. Specific food items that are easily available in a particular region is easily acceptable by the population therefore this research is done to enhance the nutrition of such food substances. This will also contribute to the food basket of the nation in addressing the food security.

Millet based products are economically viable and also it highlights the excellent medicinal and nutritional qualities. In this research the sprouted sample is highly nutritive than the ordinary sample. We can enhance the nutrition of the available ingredients in an affordable manner. These ingredients are also easily digestible in nature. The millet millets flour blend can be stored up to six months (MPP packaging) without loss of nutrition.

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Authors Contributions

The authors declare that both authors contributed equally to this research article

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Conflict of Interest

The authors declare that they have no conflicts of interest for this study.

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