

Original Research Article

Study the Effect and Properties of Spray Dried Malted Milk Powder

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ABSTRACT

Keywords

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To study the effect and properties of spray dried malted milk powder and know the possibility of spray drying for developing ragi based malted milk powder the research was done in Deptt of Food Science and Technology, JNKVV, Jabalpur during the year 2014-15. The spray drying process was used with variable air inlet and outlet temperatures. Brown seed coat ragi were taken germinated malted and hence blended with cow's milk which was then spray dried. Three blends viz., 10%, 15%, and 20% slurry concentration were prepared. The bulk density (g/ml) and solubility index value of Ragi malt: cow milk powder ranged from 0.23 to 0.28 g/ml and 1.7 to 2.4 respectively. The chemical analysis of spray dried Ragi malt : cow milk powder contains Protein (4.38 to 5.21%), fat (3.52 to 3.75%) and Carbohydrate (11.6 to 19.9%). Sensory evaluation test of reconstituted spray dried ragi based malted milk powder shows that malted milk of 20% slurry concentration was best. The spray drying conditions viz., Temperature 205 °C, Ragi malt slurry concentration 20% and spray drying pressure of 3.5 Kg/cm² yields 250 g spray dried malted milk powder from 1000 ml cow milk blend. The product obtained can easily be reconstituted with water either at 30°C or 100°C giving a homogeneous solution. The spray dried powder is stable during storage in polyethylene package under room conditions till three months, giving a satisfactory reconstituted product.

Introduction

Finger millet (*Eleusine coracana* L. Gaertn) also known as *ragi* in Hindi is important millet grown extensively in various regions of India and Africa. It constitutes a staple food for a large segment of the population in these countries. It ranks sixth in production after rice, wheat, maize, sorghum and pearl millet (*bajra*) in India. Among the various methods of food processing, spray drying is

one of the most effective processes to extend the shelf life of product. This process offers the advantage of long term preservation, convenience in handling, storage, and consumption of food. Finger millet (Ragi) seeds are nearly globular or oval in shape and very small in size. The seed coat of the finger millet is an edible component of the kernel and is a rich source of

phytochemicals, such as dietary fiber and polyphenols (0.2 to 3%).

High fiber makes it suitable for diabetic patients due to low glycemic index (GI). It contains very high level of calcium and good amount of phosphorus, their availability is limited due to high phytate content. Nutritionally, finger millet is good source of mineral nutrients especially calcium, phosphorus and other micro nutrients. Finger millet contains about 5-8% protein, 1-2% ether extractives, 65-75% carbohydrates, 15-20% dietary fiber and 2.5-3.5% minerals. Brown ragi seeds are relatively high in tannin content which affects the protein digestibility Mahanna and Rajashekaran (1969).

Ragi has excellent malting quality. It improves digestibility and increases the availability of nutrients. It is resistant to fungal infection and helps in elaboration of alpha and beta amylase during germination and during roasting/ kilning a desirable aroma is developed, which makes it an ideal grain for preparation of malted foods. It has some of the inherent qualities which make it superior compared to other cereals and millets to qualify for malting and preparation of malted foods.

Traditionally the ragi malt is utilized for infant feeding purpose and also to prepare beverages either with milk or lukewarm water with the addition of sugar. This calls for development of an appropriate technology for preparation of spray dried ragi based malted milk powder.

The information on proper blending ratio of malted ragi flour and cow milk, optimum spray drying conditions for malted milk powder, are not available in literature to develop commercially viable product.

Materials and Methods

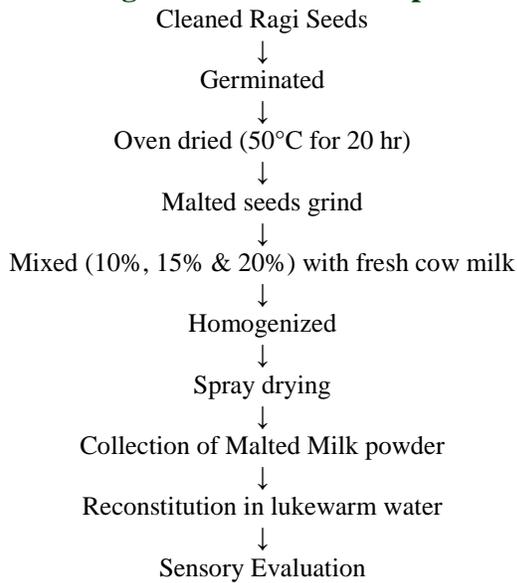
The Ragi malt cow milk slurry of pre-determined concentration was stirred well, filtered through sieves, sterilized and cooled at 4°C. The ragi malt milk slurries were dried in SMST Lab Model Spray Dryer following to standard procedure. To achieve best quality product, the spray dryer was operated at predetermined, spray drying conditions i.e. air inlet temperatures (175°C, 195°C and 205°C), slurry concentration (10%, 15% and 20%). The Spray dried malted milk powder was collected from stainless steel cyclone in a glass jar. It was packed in glass bottle and stored at room temperature for further analysis.

The samples of finger millet (ragi) were procured from Department of Plant Breeding and Genetics, College of Agriculture Rewa, JNKVV Jabalpur (MP). The samples were cleaned thoroughly packed in polyethylene bag and stored at ambient room temperature to prepare spray dried malted milk powder. Ragi malt was prepared by following the standard procedure as described by Malleshi and Desikachar (1979). Clean seeds of ragi were washed with 0.1% aqueous dispersion of lime and steeped in water at about 25°C for 24 hrs. The excess water was drained out and seeds were allowed to germinate for 3 days and non-germinated seeds were removed by sieving. The germinated seeds were dried in a hot air oven at 50°C for 20 hrs and rootlets were removed by brushing gently. The malted seeds were grind through 80 mesh (B.S.S) and were used to prepare spray dried malted milk powder.

The protein, fat and carbohydrate content in the sample were estimated according to the method of AOAC (1984). A simple hedonic rating test was used for sensory evaluation of spray dried ragi based malted milk

powder. The sensory quality attribute viz., color, taste, flavor and overall acceptability were evaluated on nine point scale, comprises of liked extremely to disliked extremely. The sensory score for each attributes were recorded and statistically analyzed according to procedure described by Ranganna (1991).

Flow diagram for preparation of Spray dried ragi based malted milk powder



Results and Discussion

The present investigation was planned for the preparation of ragi based spray dried malted milk powder; its sensory evaluation

was also conducted. The physical and functional properties of spray dried Ragi malted milk powder were as follows:

The finding presented in table 1 show that the minimum amount of spray dried ragi malt milk powder (100 gm) was obtained at inlet temperature $190\pm 5^{\circ}\text{C}$ and out let temperature $85\pm 5^{\circ}\text{C}$, and maximum (180 gm) at inlet temperature $205\pm 5^{\circ}\text{C}$ and outlet temperature $75\pm 5^{\circ}\text{C}$ and the pressure was $3.5\text{kg}/\text{cm}^2$ respectively. The finding presented in table 2 reveals that spray dried Ragi malt milk powder contains, protein (4.38 to 5.21%), fat (3.52 to 3.75%) and carbohydrate (11.6 to 19.9%). The difference in fat, protein, and carbohydrate, in different experimental product were due to variation of different component used for preparation of product. The minimum and maximum Protein, fat, and Carbohydrate of spray dried Ragi malt: cow milk powder was seen in experiment no 1, 3, 1 and 9, 8, 9 respectively. The results of hedonic rating test for different sensory attributes are given in table 3. The minimum and maximum score for color, flavor, taste and overall acceptability varied from 7.1 to 7.9, 4.7 to 7.4, 6.0 to 7.1 and 5.9 to 7.4 respectively. The general perception about the product was an acceptable by consumer.

Table.1 Yield and recovery of spray dried Ragi malt: cow milk powder

Expt. No.	Treatment Combinations	Yield and recovery
1.	S ₁ T ₁	40
2.	S ₁ T ₂	60
3.	S ₁ T ₃	110
4.	S ₂ T ₁	40
5.	S ₂ T ₂	70
6.	S ₂ T ₃	80
7.	S ₃ T ₁	160
8.	S ₃ T ₂	130
9.	S ₃ T ₃	180

Table.2 Chemical composition of spray dried Ragi malt milk powder

Expt. No.	Treatment Combinations	Protein %	Fat %	Carbohydrate %
1	S ₁ T ₁	4.38	3.55	11.6
2	S ₁ T ₂	4.40	3.58	11.8
3	S ₁ T ₃	4.45	3.52	12.1
4	S ₂ T ₁	4.77	3.62	16.3
5	S ₂ T ₂	4.80	3.65	16.8
6	S ₂ T ₃	4.85	3.65	17.3
7	S ₃ T ₁	5.16	3.70	18.8
8	S ₃ T ₂	5.19	3.75	19.4
9	S ₃ T ₃	5.21	3.73	19.9

Table.3 Sensory quality attributes of spray dried Ragi malt milk powder

Expt. No.	Treatment Combinations	Color (score)	Flavor (score)	Taste	Overall acceptability (score)
1	S ₁ T ₁	7.1	4.7	6.0	5.9
2	S ₁ T ₂	7.1	4.9	6.0	6.0
3	S ₁ T ₃	7.2	5.3	6.2	6.2
4	S ₂ T ₁	7.2	5.5	6.5	6.4
5	S ₂ T ₂	7.3	5.7	6.5	6.5
6	S ₂ T ₃	7.3	5.9	6.6	6.6
7	S ₃ T ₁	7.6	6.9	6.9	7.1
8	S ₃ T ₂	7.8	7.4	6.9	7.2
9	S ₃ T ₃	7.9	7.3	7.0	7.4

The yield of spray dried powder varies from 100 – 180 g at inlet temperature of 190±5⁰C and 205±5⁰C respectively. The pressure of 3.5 kg/cm² was maintained in whole experiment. The present findings are in conformity with reported value of Kumar (2006) and Jatav (2009). The spray dried malted milk powder contains Protein (4.38 to 5.21%), fat (3.52 to 3.75%) and Carbohydrate (11.6 to 19.9%). The similar findings were also reported by Sharma (2000) and Kumar (2006). The results of hedonic rating test for different sensory attributes viz., color, flavor, taste and overall acceptability was conducted. The color and appearance of powder varies from light

creamish with fine particles to yellowish with fine particles. The combination of higher temperature range treatment, exhibit yellowish color product. The fine particle appearance of is due to increase in pressure during spray drying. The findings are in conformity with the reported of De (1985) and Sharma (2000).

In conclusion, Ragi malt milk can be produced in powdered form with the aid spray drying. Suitable additives that have been identified in this paper are cow's milk and sugar. In view of these findings, the food industry should follow up by establishing an industrial scale plant for the

production of spray dried coconut milk. Judging by the inquiries and interest shown by the public in this product, it is envisaged that it will sell well.

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