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Evaluation of functional and sensory characteristics of probiotic incorporated millet based instant health mix

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Abstract

The purpose of the study was to develop a millet based instant health mix by incorporating a probiotic *Lb. rhamnosus* GG and to evaluate its functional and sensory characteristics. Instant health mix prepared from Millet (ragi, sorghum and pearl millet) and green gram (3:1) was found to be most acceptable for its thin consistency and less sedimentation (8.0) and high nutritive value of protein (19.13g/100g), fibre(5.96g/100g), calcium(298.25mg/100g) and iron(6.57mg/100) respectively. The survival of probiotic strains of *Lb. rhamnosus* GG was evaluated during storage period showed that there was no loss in total number of added viable cells and it was retained for 3 months in the prepared probiotic product. Sensory characteristics of the product secured a highest score for its overall acceptability of 8.3.

Keywords: Millets, health mix, probiotic, functional, sensory

1. Introduction

Probiotics are the live microorganisms which beneficially affect the host by improving its intestinal microbial balance (Mali *et al.*,2020) [13]. They are well-known as “health friendly bacteria”, which exhibit various health beneficial properties such as prevention of bowel diseases, improving the immune system, for lactose intolerance and intestinal microbial balance, exhibiting antihypercholesterolemic and antihypertensive effects, alleviation of postmenopausal disorders, and reducing traveller’s diarrhoea (Lye Huey Shi, *et al.*, 2016) [8].

Probiotics are live microbes that can be formulated into many different types of product, including foods, drugs and dietary supplements. Regular consumption of high levels of probiotic bacteria is required to confer health benefits. It is important that the organisms remain viable in the food product until the time of consumption and be present in significant numbers in order to confer benefits to the consumer.

Consumers today are highly conscious of nutritionally rich, functional and therapeutic foods. Considerable interest has recently been focused on the development of probiotic and protein enriched fermented dairy products. The idea of using microbes to promote good health and to prevent disease is a method of tackling through natural and biotic applications to daily food (Shilpa Huchchannanavar *et al.*, 2015) [11].

Lactobacillus rhamnosus GG is one of the most monitored probiotic strains. It belongs to Gram-positive, non-spore-forming, non-motile, catalase-negative, facultatively anaerobic or microaerophilic and mesophilic bacteria. The metabolism of *Lb. rhamnosus* GG is facultative heterofermentative (Jyoti *et al.* 2003) [7]. It enhances human natural resistance and healthy digestive system and inhibits the adhesion of some pathogenic bacteria. It relieves the syndromes of gastro-intestinal tract irritation tract, atopic dermatitis, and cow milk allergy (FAO/WHO 2001; Collado *et al.* 2007; EFSA 2011) [5,2,4]

In the view of popularity of probiotic and its therapeutic use, probiotic food products were formulated from millet which will enhance the availability of nutrients. Taking into consideration of nutritional and therapeutic values of probiotics an attempt has been made to develop millet based instant health mix containing to *Lactobacillus rhamnosus* GG. The viability of the culture, functional and sensory characteristic of the developed product were also studied.

Materials and Methods**Raw materials**

Millets (sorghum, bajra and ragi), green gram, sugar, skim milk powder, flavouring agents required for the preparation of instant health mix were purchased from the local market.

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Starter culture

Freeze-dried *Lactobacillus* cultures (NCDC 347 *Lactobacillus rhamnosus* GG) purchased from culture collection, ICAR-National Dairy Research Institute, Karnal, were activated in MRS broth and 12% skim milk powder. Purity was checked by gram staining and acidity measurement. Active cultures were preserved in 30% glycerol stock and stored at -20°C. Selected culture was lyophilized using skim milk powder/pectin as cryoprotectant. Cell load was standardized to add in millet based instant health mix.

Preparation of malted millet flour

Millet (Ragi, Sorghum and Bajra) and legumes (Green gram) at the ratio of 3:2 were washed and soaked for 12 hours in fresh water at room temperature and then drain off the excess water. Tie in a muslin cloth keep for 48 hours for germination at room temperature. After germination they were Shade dried for 20-24 hours at room temperature. Then the roots and shoots were separated and roasted at temperature 70 -75 °C, then grind to make fine flour.

Preparation of Probiotic instant health mix

The malted flour (both millet and legume) were extruded in pasta maker. The extruded malted flour were steamed for 15 mins and dried at room temperature. Then it was grind into powder and sieve through 6 mesh sieve. For 100g extruded flour add 50 g skimmed milk powder, 2 cardamom / vanilla powder, 2g salt and 50g powdered sugar, 0.1g stabilizer and 1 % probiotic culture. All the ingredients were mixed well. Packed in MPP and stored at room temperature.

Functional properties

Bulk density

Bulk density was determined by Jones *et al.*, 2000 method. The volume of 100 g of the sample was measured in a measuring cylinder (250 ml) after tapping the cylinder on a wooden plank until no visible decrease in volume was noticed, and based on the weight and volume, the apparent (bulk) density was calculated.

Swelling capacity

The swelling capacity was determined by the method described by Okaka and Potter (1977) [10]. 100 ml graduated cylinder was filled with the sample to 10 ml mark. The distilled water was added to give a total volume of 50 ml. The top of the graduated cylinder was tightly covered and mixed by inverting the cylinder. The suspension was inverted again after 2 min and left to stand for a further 8 min and the volume occupied by the sample was taken after the 8min.

Water absorption

The water absorption capacity of the sample was determined by the method of Sosulski *et al.* (1976) [12]. One gram of sample mixed with 10 mL distilled water and allow to stand at ambient temperature (30 ± 2°C) for 30 min, the centrifuged for 30 min at 3000 rpm or 2000 × g.

Chemical analysis

Instant health mixes were analyzed for Moisture, energy, carbohydrate, protein, fat, fibre, calcium, phosphorus and iron by using standard procedure (AOAC 2000) [1].

Sensory analysis: The sensory evaluation for instant health mix was carried out using 9 points hedonic scale. Samples

were evaluated for color, taste, appearance, and overall acceptability.

Viability of *Lb. rhamnosus* GG in millet based instant health mix during Storage

The viability of *Lb. rhamnosus* GG in millet based instant health mix was determined using the total plate count method at 1-week intervals during 6 months of storage. *Microbiological analysis of the beverage*. Viable *Lb. rhamnosus* GG bacteria was enumerated by spread plate count technique on MRS (De Man, Rogosa, Sharpe agar) (Hi Media - India). Plates were incubated as inverted position at 37 °C in an anaerobic condition using an anaerogen sachet for 24 h. Spread plate count technique on Potato dextrose agar (Hi Media - India) was used to measure yeast and mold count (Collins *et al.*, 2004) [3].

Results and Discussion

Proximate composition of the probiotic Instant health mix

Proximate composition of the Instant health mix was analysed according to the AOAC (1980) method.

Table 1: Proximate composition of the Instant health mix

Sl. No	Chemical Composition	In 100 g
1	Moisture (%)	9.2
2.	Energy (Kcal)	824.17
3.	Carbohydrate (g)	176.1
4.	Protein (g)	19.13
5.	Fat (g)	4.85
6.	Fiber (g)	5.96
7.	Calcium (mg)	298.25
8.	Phosphorus (mg)	240.00
9.	Iron (mg)	6.57

The nutritional value of the final product plays a vital role in enhancing the consumer acceptance of the product. The proximate composition of instant health mix were analysed and data were presented in the table.1. The results of the study shows that the high protein (19.13g/100g) and fibre (5.96g/100g) respectively. Nishad *et al* (2017) [9] reported that the protein and fibre content of the health mix ranges from 17.08 to 23.18 % and 5.04 to 8.50 % respectively.

Functional properties of Instant health mix

The functional properties of instant health mix such as bulk density, water solubility index (WSI) and swelling index (SI) were determined by using standard methods.

Table 2: Functional properties of Instant health mix

Sl. No	Physical properties	Instant health mix
1.	Bulk density	0.9 g/cm ³
2.	Water solubility index	9.1%
3.	Swelling index	1.07 %

Bulk density is depended upon the particle size of the samples. The study shows that bulk density of instant health mix 0.9g/cm³. Water solubility index measures the rate and extent to which the component of powder material or particles dissolves in water. The water solubility index of the instant health mix was found to be 9.1 per cent. Swelling capacity of the instant health was 1.07 per cent, which indicates there is minimum swelling power in the health drink. Bulk density, water solubility index and swelling were calculated as 0.85 g/cm³, 9 and 1 per cent, respectively (Parvathi *et al.*,2015) [14]

which is in accordance with the result of the present study.

Sensory evaluation of Instant Health mix

The health drink prepared from instant health mix was

evaluated for its sensory characteristics such as appearance, colour, flavour, taste. Consistency and over all acceptability by using 9 hedonic scale.

Table 3: Sensory evaluation of Instant Health mix

Sl. No	Sensory attributes	Score
1.	Appearance	8.5
2.	Flavour	8.1
3.	Consistency	8.0
4.	Taste	8.3
5.	Overall acceptability	8.3

The health drink was evaluated by various attributes and secured a score value ranges from 8.0 to 8.5. The health drink prepared from instant health mix was found to be most acceptable and preferred by the consumers for its consistency was neither viscous nor thin and less sediment nor acceptable

colour.

Viability of *Lb. rhamnosus* GG in millet based instant health mix during Storage

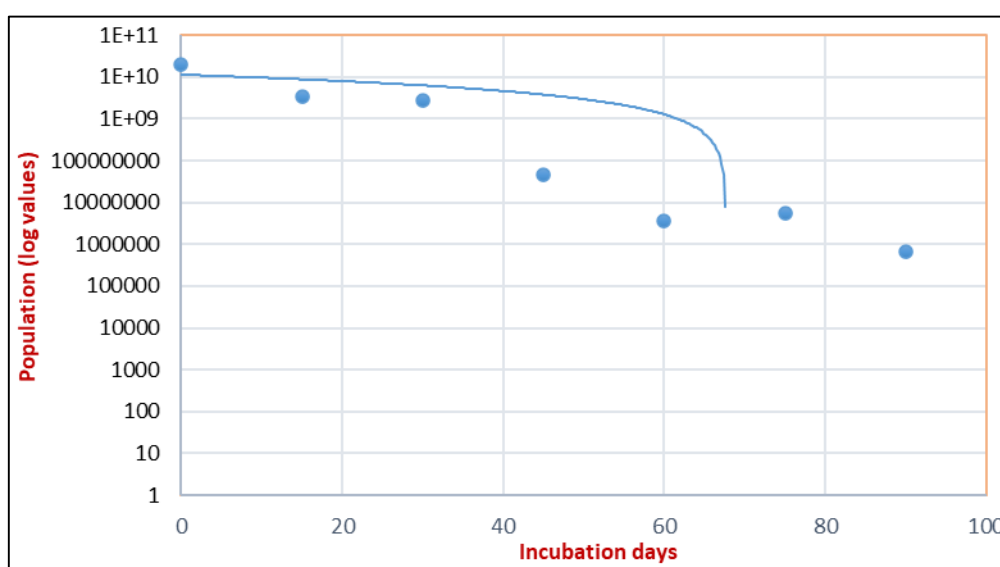


Fig 1: Viability of *Lb. rhamnosus* GG in millet based instant health mix during Storage

The *Lb. rhamnosus* GG added millet based instant health mix were stored at room temperature for 90 days. Bacterial population of these samples were evaluated during storage. Results were presented in the Fig .1. shows that the bacterial population during storage at 0 day was 57×10^{10} cfu/g for health mix, The survival of probiotic strains of *Lb. rhamnosus* GG was evaluated during storage period showed that there was no loss in total number of added viable cells and it was retained for 3 months in the prepared probiotic product. The linear values in the graph shows that the population start decreases at 60th day.

Conclusion

The effect of *Lb. rhamnosus* GG in millet based instant health mix on the functional and sensory characteristics of millet based instant mix was studied. The developed mix was highly nutritious and it had complete instant energy source of protein and energy for the daily requirements and the addition *Lb. rhamnosus* GG with millet act as probiotic for improving the gut health. The overall accept ability score was high and the shelf life of 90 days without any preservative at room temperature. This study is able to suggest the suitability of millet as a viable delivery vehicle for probiotic culture. The probiotic culture grew above the minimum level required for

probiotic effects. Inoculation with the probiotic culture has an impact on the organoleptic and functional properties of the instant health mix.

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