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Geranium (*Pelargonium graveolens*) Flavored Boza

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Abstract

Fermentation technology is one of the oldest and most economical methods of food production and preservation. Fermented foods are widely produced and consumed worldwide because of their beneficial effects on human health. These effects are known to result from the functional components of the foods in question and their high absorption. Boza, which is obtained from various cereals such as millet, maize, rice, wheat, is a traditional fermented beverage. It has a characteristic sweet-sour taste, light yellow color and acidic-alcoholic odor. Depending on the raw material used in production and the fermentation method applied, the quality characteristics of the boza may also differ from. Boza has an important place among traditional fermented beverages due to its taste, flavor and nutritional value. The aim of this study is offered a different and new flavor to the market which is available as an alternative to boza. In this context, two kinds of boza were obtained by adding the geranium (*Pelargonium graveolens*) plant before and after fermentation. The geranium plant which will be used in the production of geranium flavored boza is supplied as ready from the market. Geranium plant was added to the boza at a rate of 1.33 %. In the literature review, it has been seen that the geranium used in our study has many functional properties such as tranquillizer, removing stomach and intestinal gases and reducing parasites. Sensory evaluation analysis was carried out by comparing the different characteristics of the two types of boza with simple boza. 25 % of the participants who participated in sensory evaluation preferred simple boza, 33 % followed by post-fermentation boza and 42 % followed by pre-fermentation boza. When the sensory properties of the geranium flavored boza were evaluated as a whole, it was seen that the boza sample which was added geranium before fermentation was sensory acceptable.

Keywords: Boza, geranium (*Pelargonium graveolens*), rose geranium, fermented beverage.

1. Introduction

1.1. Purpose

In the production process of geranium (*Pelargonium graveolens*) flavored boza product, geranium plant was added as well as raw materials of boza unlike existing production process. Being different taste and flavor is one of the new features of the product. Within the scope of this study, two types of boza were obtained as "Boza production by normal production technique by adding geranium to boza raw materials" and "Adding geranium to boza produced by normal production". It is aimed to achieve a different flavour by changing the formulation of the market available boza.

1.2. Boza Definition and Properties

According to Turkish Standards Institution (TS 9778), boza is defined as "A product which is made by adding drinkable water to cereals such as millet, maize, wheat, and rice. The sugar is then added to allow alcohol and lactic acid fermentation. Boza can be classified as sweet or sour boza depending on its acid content" [1].

The most important factors influencing the physicochemical properties of boza are the types and amounts of cereals and cereal products as a raw material used in boza production, fermentation time and temperature. Particularly, extended fermentation time results in higher amounts of total acidity and lower pH [2].

During the fermentation, two different kinds of fermentation happen simultaneous: Alcohol fermentation and lactic acid fermentation [3]. Microorganisms liable for alcohol fermentation in boza are yeasts (*S. cerevisiae*, *S. carlsbergensis*, *C. tropicalis*, *C. pararugosa*, *C. diversa*, *C. boidinii*, *C. lactiscondes*, *C. lambica*, *C. norvegica*, *C. inconspicua*, *Pi. fermentans*, *Pi. norvegensis*, *R. mucilaginoso*, *R. araucariae* and *T. delbrueckii*) and lactic acid bacteria, LAB, (*Lb. confusus*, *Lb. fermentum*, *Lb. plantarum*, *Lb. cryniformis*, *Lb.*

sanfrancisco, *Lb. coprophilus*, *Lb. paracasei subsp. paracasei*, *Lb. brevis*, *Lb. acidophilus*, *Lb. rhamnosus*, *Leu. mesenteroides*, *Leu. oenos*, *Leu. raffinolactis*, *Lc. lactis*, *P. pentosaceus* or *Weissella (W.) confusa* [4,5].

With the fermentation process increases the free acidity value in boza, decreases the pH value and the product gains a characteristic flavor be allied to with metabolite products generated by lactic acid bacteria. While the pH value in non-fermented boza is in the range of 4.1-6.7, it decreases to 4.0 or more below by fermentation [6].

According to the Turkish Boza Standard (TS 9778), total dry matter and total sugar (as saccharose) content should be minimum 20 and 10 %, respectively, and ethyl alcohol content should not exceed 2 % by volume in both sour and sweet boza. Total titratable acidity by means of lactic acid should be 0.2-0.5 % in sweet boza and 0.5-1.0 % in sour boza. On the other hand, volatile acidity by means of acetic acid is allowed up to 0.1 % in sweet boza and 0.2 % in sour boza [1].

Within 100 milliliters of boza; 240 kilocalories energy, 57.5 grams carbohydrates, 3.5 grams protein, 0.5 grams fat, 29 milligrams calcium, 1.3 milligrams iron, 97 milligrams phosphorus, 1 milligram zinc, 0.09 milligrams thiamine (vitamins B₁), 0.05 milligrams riboflavin (vitamins B₂), 1.16 milligrams niacin are comprised [7].

Boza is generally consumed in winter. Although there is no formal history, the season of boza as cultural begins in mid-September and ends in mid-May. Due to its rich content of carbohydrates, proteins, vitamins A and E, vitamins B₁ and B₂, phosphorus, zinc, iron and niacin, boza is a good energy source for young people, pregnant women, nursing women, athletes and those who want to gain weight. Boza is a beverage rich in calorie content. For this reason, attention should be paid to the quantity when consuming. Boza, which is known for its effects on diseases which come in the winter season such as flu or cold, also increases the human breast milk. Thanks to the yeast that boza contains, its benefits such probiotic effect, supporting the health of the digestive system, preventing the formation of carcinogenic materials in the body, mind opening and relieving fatigue, calming stress and good for coughing can be seen [8].

The cooling impact of lactic acid enables boza to be consumed in the summer months; in addition to this, the high temperatures during that season result in rapid growth of present microflora, and as a result, in dramatic changes in sensorial attributes. Thus, boza is a suitable beverage for winter [9]. The shelf life of the boza is quite short, up to 15 days. At every stage of the fermentation; boza can be consumed until the pH drops to about 3.5 [10]. Caputo ve ark. [11], the shelf life of the boza when stored at +4 °C is between one or two weeks. One or two weeks later, they stated that the acidity of the product increased and could not be consumed. The shelf life of the boza produced using probiotic starter culture has been reported as 12 days at 4 °C [6,11].

1.3. Geranium (*Pelargonium graveolens*)

Geranium (*Pelargonium graveolens*) belongs to the Geraniaceae family. Geranium is an erect, much-branched bush, that can reach a height of up to 1.3 meters and a sprawl of 1 meters. Round-shaped, green-colored and abundant hairy bodies become woody in time. When the deeply recessed, ornate leaves are crushed, they release other scents such as fruit and mint. Light or dark, pink or white colourful fragrant flowers bloom from summertime to autumn. Geranium species grow in all kinds of soil provided that it is abundant sunny. *Pelargonium graveolens*, commonly known as rose geranium is one of more than 250 species within the *Pelargonium* genus and that are endemic to the southern parts of Africa. In Turkey, various *pelargonium* species are very common in the Aegean and Mediterranean regions as ornamental plants. The known composition of the geranium plant involves bitter substances such as tannin, volatile etheric oils and ceranine. Geranium plant has benefits such as relieving indigestion, facilitating digestion, removing excess gases in the stomach and intestinal and preventing diarrhea. It is objectionable to use in the first 3 months of pregnancy. Therefore, it is suggested that pregnant women should not use geranium flavored boza, but it is suitable for nursing mothers [12].

The volatile oils of black pepper, clove, geranium, nutmeg, oregano and thyme are evaluated for antibacterial activity against 25 different genera of bacteria. These included animal and plant pathogens, food poisoning and deterioration bacteria. The volatile oils exhibited important inhibitory effects against all the organisms under test while their major components demonstrated various degrees of growth inhibition [13].

Geranium (*Pelargonium graveolens*) is used for its antimicrobial activity in the food industry. Geranium is demonstrated potential in many different studies for its abundance of positive benefits. These benefits are found antibacterial, antifungal and antioxidant activity, and others [14].

2. Materials and Methods

Raw cereal materials; rice, maize, millet and wheat, as indicated in Turkish Standard TS 9778, and sugar are achieved from local markets.

Boza is a fermented cereal based beverage; millet, maize, rice, rye, oats and wheat grains such as is grinded and is cooked by adding water. It is then produced by fermenting lactic acid with yeast by adding sugar. The boza has a intense consistency, a light yellow color, a sweet-sour taste and an acidic-alcoholic odor.

The geranium (*Pelargonium graveolens*) plant which will be used in the production of geranium flavored boza is supplied as ready from the market.

2.1. Boza Production Technology

Preparation of Raw Materials: From the raw materials is used in the production of boza selected millet is cleaned of foreign materials, broken into semolina size pieces, and is sifted to remove hull and bran at grading screen.

Boiling: Water is first putted into the an open or steam jacketed stainless steel boiler and boiled. Then, The semolina obtained is added to the drinkable water and mixed continuously to prohibit agglomeration. Millet, maize and wheat can be putted together in the boiling process. Millet, maize and wheat mixture should be putted into the boiler and boiled at the same time. Only bulgur can be used as raw material. After the raw materials is putted into the boiler, they slowly take up water and swelling, intumescency and begin to get viscosity increment (pasting). The boiling boiler is continuously mixed. Boiling water is added again instead of the water lost during boiling. The boiling process takes 2-8 hours.

Cooling: Cooling time changes between 2-12 hours.

Straining: The raw boza that is obtained after boiling the raw material filtered with brass sieves. Liquid that is passed from wood barrel at sieve is called as unsweetened raw boza. Undrained solid part is used for animal feed.

Sugar Addition: According to Turkish Food Regulations, boza should involve a minimum of 15 % of granulated sugar (saccharose). In this way, for an efficient fermentation, up to 20 % sugar is added to raw boza.

Fermentation: The sweetened raw boza is putted into wood barrels. Boza (2-3 %) from a previous batch as yeast should be used as the starting culture. The mixture is left to ferment in wood barrels. Inoculated mixture is incubated at 15-25 °C for approximate 24 hour before it is prepared for use. Two different types of fermentation happen synchronically during boza fermentation. The first; alcohol fermentation that generates carbon dioxide bubbles and increases the volume. The second; lactic acid fermentation that generates lactic acid and gives the acidic character to boza. Due to the increase in volume during fermentation, the wood barrels should not be filled completely. Alcohol fermentation yeasts are *Saccharomyces carlsbergensis*, *Hansen* and *Saccharomyces cerevisiae* yeasts. If alcohol fermentation occurs more than 24 hours, the amount of alcohol increases. Lactic acid fermentation bacteria are *Streptococcus sp.*, *Micrococcus varians migula*, *Lactobacillus sp. bacteria*. The pH value of raw boza is 4.1-6.7 and the pH value of ripe boza is 3.9-4.0.

Dilution: The purpose of the dilution is to bring the indense and viscous boza after fermentation to a consistency which appropriate for the consumer's desire. 20 grams of geranium plant leafs are boiled in 500 milimeters of water. Boiled water is added to the boza obtained by adding the geranium plant leafs after fermentation. Boza is diluted with boiled water added.

Storage: After the fermentation, boza is cooled to refrigerator temperature and should be consumed within 3-5 days.

Within the scope of this project, two kinds of boza are obtained by adding the geranium (*Pelargonium graveolens*) plant before and after fermentation.

In case the geranium plant leafs are added before fermentation; geranium plant leafs are added into the boiler at the boiling process. Essence of geranium plant leafs is provided to pass into the sugarless raw boza. At the end of the boiling process, essence of geranium plant leafs is taken out from the boiling vessel.

In case the geranium plant leafs are added after fermentation; at the end of fermentation the geranium plant leafs are boiled in water. Essence of geranium plant leafs are provided to pass into water. The obtained water from essence of geranium plant leafs are added to the boza. Thus, the acquired intense consistency is provided to be diluted.

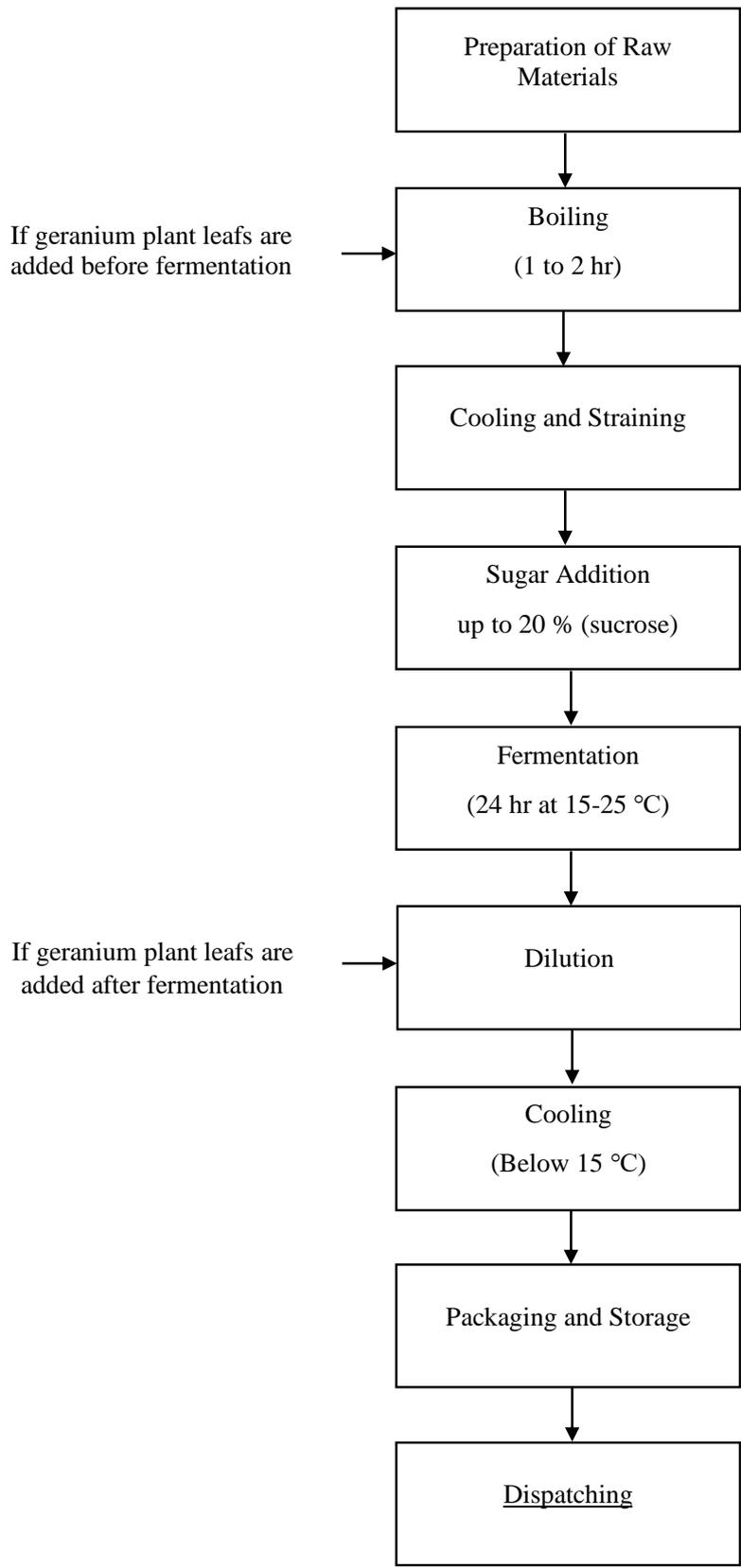


Figure 3. Geranium (*Pelargonium graveolens*) Flavored Boza Production Flow Chart

3. Results and Discussion

Within the scope of this study, two types of boza were obtained as "Boza production by normal production technique by adding geranium (*Pelargonium graveolens*) plant to boza raw materials" and "Adding geranium plant to boza produced by normal production". In addition, the simple boza sample was obtained. The formulation of the geranium flavored boza product was obtained as 16.67 % bulgur, 16.67 % sugar, 3.33 % rice, 1.33 % geranium plant and 62 % water. 25 % of the participants who participated in sensory evaluation preferred simple boza, 33 % followed by post-fermentation boza and 42 % followed by pre-fermentation boza. When the sensory properties of the geranium flavored boza were evaluated as a whole, it was seen that the boza sample which was added geranium before fermentation was sensory acceptable.

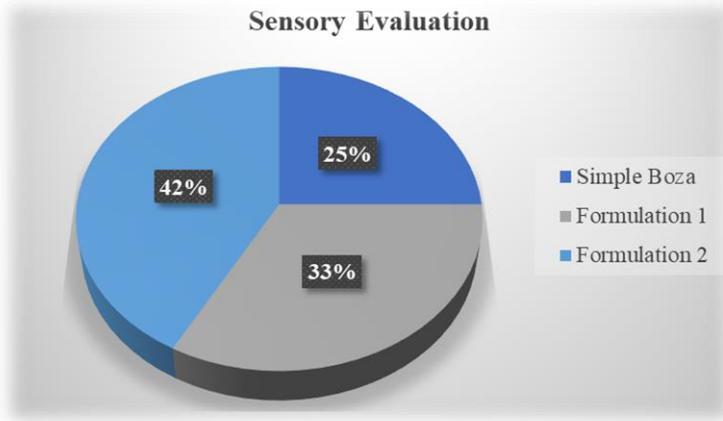


Figure 4. Sensory Evaluation Analysis Result

4. Conclusion

In this study; with the addition of geranium plant into the boza that is a traditional beverage, geranium (*Pelargonium graveolens*) flavored boza aroma that is like in market not lower than standard product quality, showing antimicrobial effect, will benefit human health and has flavor, odor, color, aroma that does not disturb the consumer was obtained.

Within the scope of the project, two different formulations were had a go at by adding the geranium plant to the boza before and after fermentation. As a result of the sensory evaluation analyzes, it were observed that the color, consistency and appearance of the product was similar to the products sold in the market and had a new flavor and aroma.

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