



Original research

Investigation of physicochemical and sensory properties of a Zoulang (*Eryngium caucasicum*) flavored yogurt

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ABSTRACT

Yogurt is the most important fermented dairy product. However, its per capita consumption in Iran is low. Production of flavored yogurt to create a variety of products can cause customer satisfaction and increase in per capita consumption. Flavored yogurt at three levels: 0.1, 0.3 and 0.5 were prepared by adding Zoulang aqueous extract. The systems were prepared by following a factorial design, analyzed after formulation and during three weeks of storage by studying three factors: extract with different levels, storage time and interaction between extract and time. The titratable acidity, pH, Water- holding capacity, color, and sensory properties were determined weekly over a period of 3 weeks. The results showed that the titratable acidity, pH, Water- holding capacity, color, and sensory properties have significantly changed ($p \leq 0.05$). Adding extract has improved sensory and physicochemical properties of flavored yogurt. Then we can use it to produce a new local and customer friendly product with medicinal and nutritional properties.

Keywords: Aqueous extract, Flavored yogurt, Sensory properties, Zoulang

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1. Introduction

The consumption of milk and its products in any society is one of the most important development indicators. The minimum amount of milk and dairy products which a person requires is 156 kg in a year, and the ideal consumption is 450 kg per capita consumption of milk in Iran is far from international standards. Certainly one of the reasons of low dairy consumption in Iran is the lack of diversity in these products. Due to high consumption of fermented dairy, Yogurt is one of our most important foods which provide a good source of calcium, Potassium, zinc and B vitamins such as riboflavin and pantothenic acid.

Food Codex Alimentarius Commission (1992) has defined plain yogurt as a lactic fermentation dairy products caused by two bacteria, *Lactobacillus bulgaricus*, and *Streptococcus thermophilus*. Flavored yogurt is coagulated milk product that obtains from the lactic fermentation of pasteurized milk with lactic acid bacteria, especially *Streptococcus salivarius* sub-species *thermophilus* and *Lactobacillus bulgaricus* sub-species *delbruecki* and other milk products, after adding flavor agents. Consumers are really concerned about the effect of flavorings on human health; the natural ingredients such as essential oils and plant extracts are known as the best flavors and preservatives in food. During the research in recent

years, anti-bacterial, anti-fungal, anti-viral and antioxidant activity of these components had been proven (Kalemba & Kunicka, 2003).

Zoulang plant with the scientific name *Eryngium caucasicum* Trautv is a perennial plant. It is found in abundance in forested areas of the north of Iran. In studies performed in several species of *Eryngium*, it is known to contain essential oil, terpenoides, saponins, flavonoids, coumarin, poly acetylene, and steroids. Extracts and compounds isolated from species *Eryngium* have demonstrated their potential role as a food and medicine (Wang et al., 2012). Zoulang is Relaxing, stimulating sexual impotence, improve hemorrhoids, rheumatic diseases and inflammation soothing, soothing the pain. This plant also plays a role in hematopoiesis due to folic acid and iron.

Several studies have been conducted in flavored yogurt production, including the effect of adding the chemical and sensory properties of turmeric powder to yogurt during 12 days at $5 \pm 2^\circ\text{C}$ (Mervat et al., 2007) and Study of sensory and consumer acceptance of yogurt fermented carrot juice (Cliff et al., 2013). Acid production during fermentation, physical properties (pH, syneresis, and color) and sensory properties (taste, mouth feel and color acceptance) yoghurt enriched with 1-3% of lentil flour were studied (Zare et al., 2011). Also, consumer acceptance of yogurt with spices was tested (Illupalayam et al., 2014).

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The aim of this study was formulation of Zoulang (*Eryngium caucasicum*) flavored yogurts and measuring their physicochemical and sensory properties.

2. Material and Methods

2.1. Material

Milk was prepared from the company of Pakban dairy products with 1.5 % fat, pH= 6.6- 6.7, density 1.028- 1.03 g/cm³. The mixed starter culture for yogurt was dried instant starter CH1, which was purchased from the company of Christian Hansen. Zoulang plant was collected by Babol farms and washed after pasturing and separating the unwanted parts. Then it was dried at room temperature keeping away from light for a week. 100 g of Zoulang was poured into a beaker of 1000 ml with freshly distilled water so that the water covered the Zoulang's surface; then it was shaken for 24 hours. After 24 hours the mixture was smoothed out with a filter paper. The excess solvents were removed using a vacuum evaporator. Then the extract was dried in the oven and was kept in the freezer until the test time (Jaltep and Stand 200L, Iran) at a temperature of -20°C.

The milk dry matter was measured 8.9%. Moreover, then it was reached to 12% by adding skim milk powder (Svelty, Nestlé, Toluca, Mexico) and homogenized by mechanical agitation. Then the milk was heated at 90 to 95°C for 15 min and cooled down by a water bath (Memmert, WNB14, German) to 47°C.

Yogurt samples were prepared by dissolving the Zoulang dried extract (0.1, 0.3 and 0.5 g/100 g) in milk at 47°C. The milk was inoculated with 0.08 g/1000cc of the two mixed microorganisms to start the fermentation process, and moved to a container volume of 50 ml. Samples were incubated at 40- 47°C to achieve the pH, to 4.6 (Memmert, INB500, German). Samples were immediately cooled to a temperature of 4-7°C and were stored in a refrigerator at 4 ± 1°C.

2.2. Physicochemical and sensory Analysis

Physicochemical characteristics were determined according to standard procedures (AOAC, 1984). To test water holding capacity, 5 g sample centrifuged at 4500 rpm for 30 min then the supernatant was separated and collected, and sediment mass weighed. Water holding capacity (WHC) is calculated using the following equation that in this sedimentary weight is WT and Wi is the initial weight of sample (Sahan et al., 2008).

$$\text{WHC} = (1 - (\text{WT} / \text{Wi})) \times 100 \quad (1)$$

Color Indicators L, a and b of all samples were measured by Hunter lab system (Spectrophotometer, olorflex, EZ, USA). The sensory evaluation was done by a 5-point hedonic.

2.3. Statistical Analysis

This research is completely randomized in a factorial design with three replications. Treatments included three levels of extract and three levels of storage time. The factorial design was used to determine the effects of various factors (Montgomery, 2012). Moreover, Tukey test was used to compare the means and study effects of factors.

3. Results and Discussion

According to Fig 1, adding extracts to yogurt, have a significant effect on pH ($P \leq 0.05$). The effect and interaction of extracts and storage time on pH was significant ($P \leq 0.05$). In the first day of storage, yogurt samples containing 0.5 % Zoulang extract had higher pH in comparison with other treatments and even control samples.

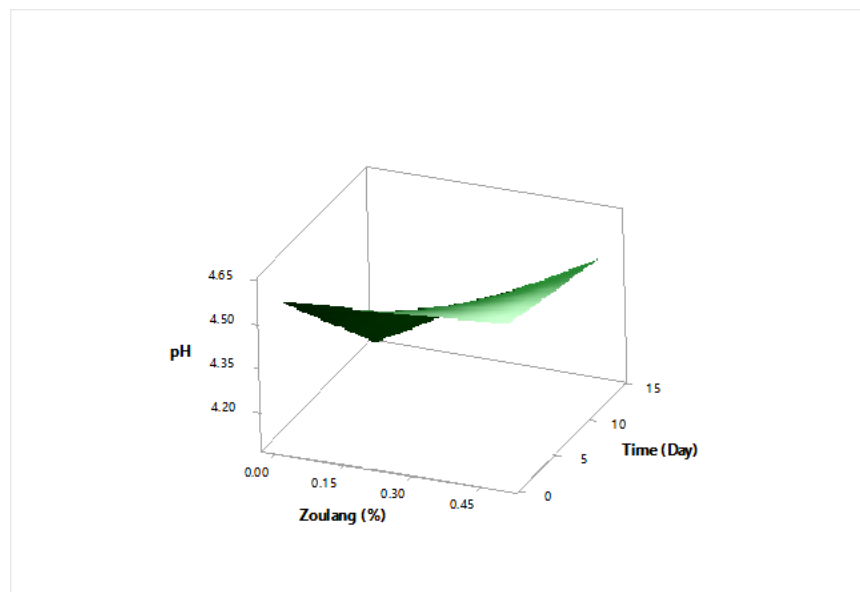


Fig. 1. Effect of different levels of extract (%) and storage time (days) on pH

As shown in Fig 2, titratable acidity showed a significant difference between different flavored yogurt formulations ($P \leq 0.05$). In the first and fourteenth days of storage time, by increasing the percent of extract, acidity decreased. By increasing of storage time, the acidity of all yogurt samples gradually increased. Most acidity was related to the control yoghurt samples on the fourteenth day of storage. The statistical analysis showed a significant difference in the WHC of yoghurts containing different percent of extract ($P \leq 0.05$). Fig 3 shows the maximum amount of WHC which was related to yoghurt samples containing 0.5% extract on the first day storage. This may be due to a good connection between the molecules of flavoring agents and water molecules, which help to increase the water holding capacity. In the seventh and fourteenth days of storage, by increasing

concentration of extract in yogurt samples, the WHC increased. In the fourteenth day storage, the WHC of the control samples was the lowest. Adding extract and storage time had a significant effect ($P \leq 0.05$) on index L (lightness or brightness) of yogurt samples (Fig 4.). By increasing the percentage of extract and storage time, index L of yogurt samples decreased. Significant differences were also found in the index a (green-red), among all yogurt samples ($P \leq 0.05$). Fig 5 shows that yogurt samples containing 0.5% extract, had the largest value for index a on the first storage day. The index a on the seventh storage day fell in comparison with the first day. In yoghurt samples containing extract, index a, reduced over time.

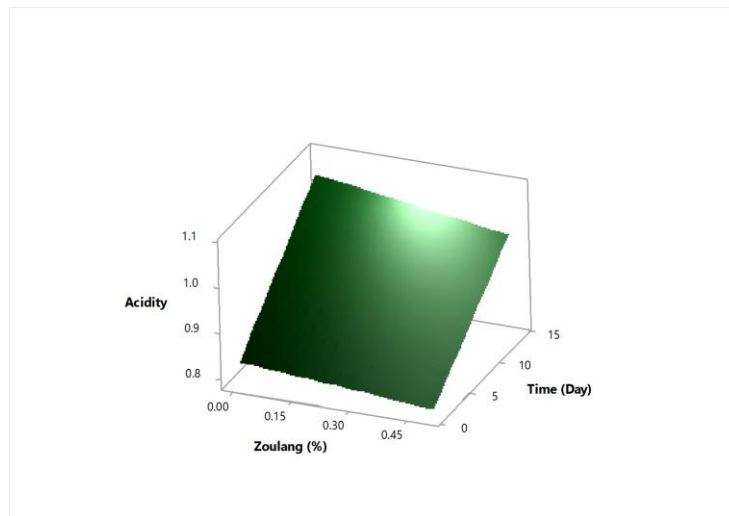


Fig. 2. Effect of different levels of extract (%) and storage time (days) on acidity

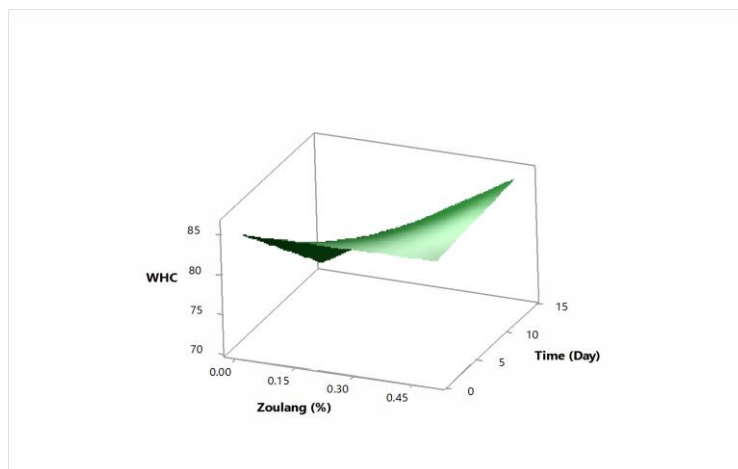


Fig. 3. Effect of different levels of extract (%) and storage time (days) on WHC

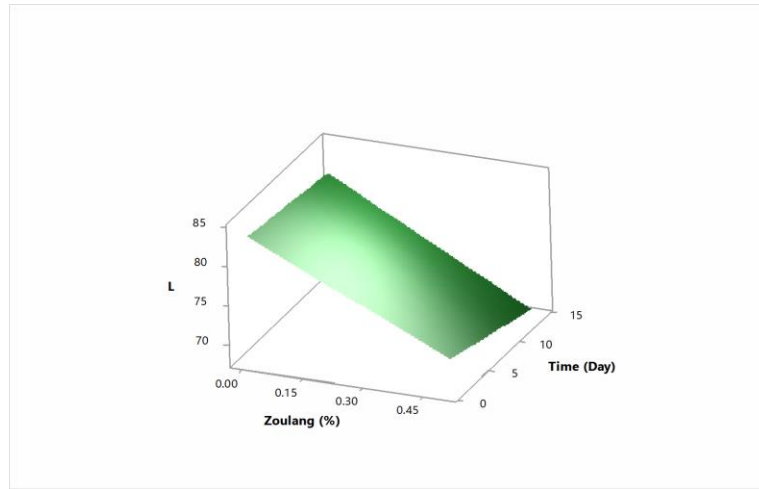


Fig. 4. Effect of different levels of extract (%) and storage time (days) on index L

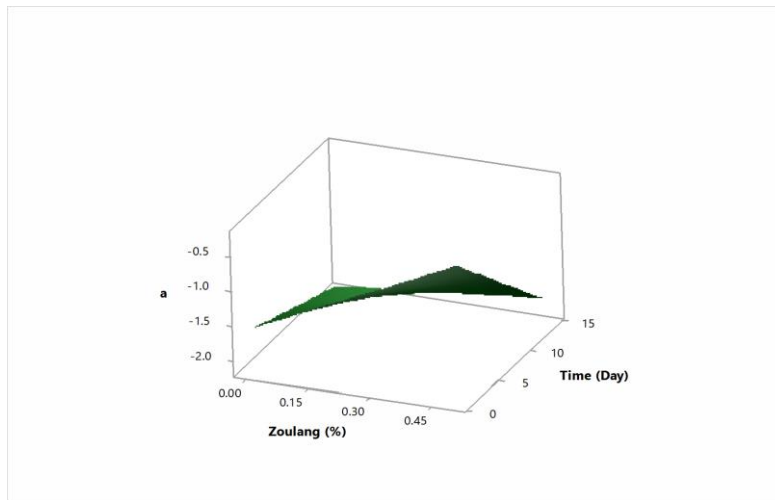


Fig. 5. Effect of different levels of extract (%) and storage time (days) on index a

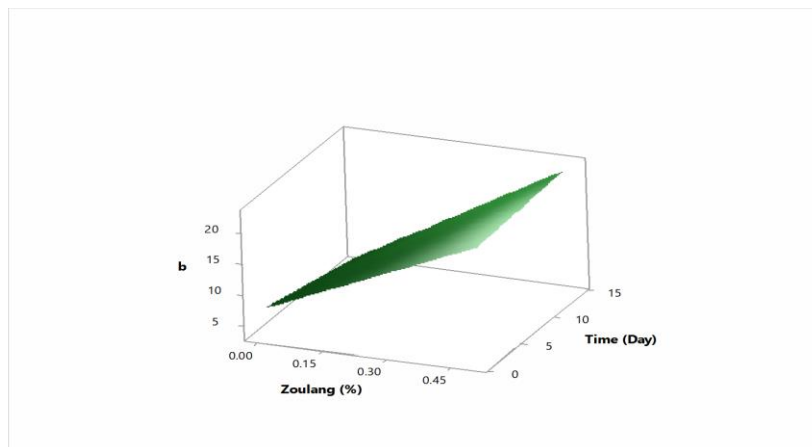


Fig. 6. Effect of different levels of extract (%) and storage time (days) on index b

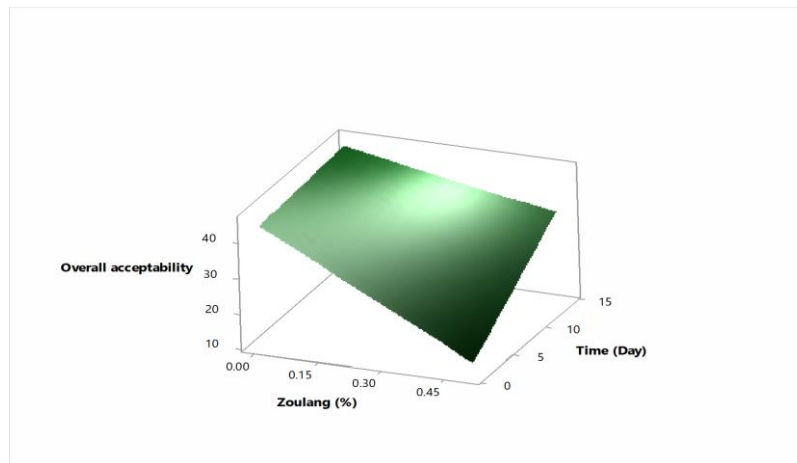


Fig. 7. Effect Effect of different levels of extract (%) and storage time (days) on index overall acceptability

According to Fig 6 adding extract to yogurt, had a significant effect on index b ($P \leq 0.05$). On the first day of the yogurt samples storage, by increasing the extract percentage, index b was increased. In the seventh and fourteenth days of storage, the index b increased by increasing the percentage of extract too. On the fourteenth day of storage, lowest and highest values of b respectively belonged to control samples and samples containing 0.5% extract. Significant differences were also found in sensory properties such as overall acceptability ($P \leq 0.05$). As we can see in Fig 7, on the first day of storage, the overall acceptability score of the yoghurt samples was decreased by increasing the concentration of extract. So that the least amount of score overall acceptability was observed on the first day of storage in yoghurt samples containing 0.5% extract. In the seventh and fourteenth days of storage, overall acceptability of yoghurt samples containing different levels of Zoulang extract improved.

4. Conclusion

In this study, the possibility of flavored yogurt production using Zoulang extract and studying its physicochemical and sensory properties were investigated. Due to specific taste of Zoulang, producing a new local and customer friendly product with medicinal and nutritional properties was expected.

According to the statistical analysis adding extracts to yogurt, have a significant effect on pH ($P \leq 0.05$). It is not similar to pH values reported by Aportela-Palacios, Sosa-Morales, and Vélez-Ruiz (2005), for yogurt containing fiber and calcium and isn't similar to Ramírez-Sucre and Vélez-Ruiz (2012) results. On the first day storage, yogurt samples containing 0.5 percent extract had higher pH in comparison with other values and even control samples. The lowest pH was related to blank samples and samples containing 0.1% extract on fourteenth days of storage time. Also on the first day of storage, by increasing the extraction percent, acidity decreased. Acidity showed significant difference among various flavored yogurt formulations ($P \leq 0.05$). It is similar to results reported by Ramírez-Sucre and Vélez-Ruiz (2012), for yogurt added by caramel. By increasing the storage time, acidity in samples containing different amounts of extract gradually increased. Most acidity was related to the control yoghurt samples, on the fourteenth day of storage. Over time, the proportion of bacilli and cocci bacteria will change and increase the number of bacilli will lead yogurt to be more

acidic. However, increasing the pH and decreasing the activity indicated that antibacterial properties of Zoulang reduced the activity of the bacteria and acid production (Wang et al., 2012).

The maximum amount of water-holding capacity was related to yoghurt samples containing 0.5% extract on the first day of storage. This indicates that a good connection probably has been created between the molecules of flavoring agents and water molecules, which help to increase the water holding capacity. The reducing amount of water holding capacity in the final day of storage can be related to enzymes activity on the casein micelles which was produced by starter bacteria during the storage time (Sahan et al., 2008).

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