



Research Article

SENSORY EVALUATION AND ACCEPTABILITY OF SOY -YOGURT WITH DIFFERENT GROUPING OF TREATMENTS

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Received May 23, 2017; Accepted June 19, 2017; Published July 07, 2017;

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Cite This Article: Raeisi, A., Farshbaf Derhami, V., Hosseini, A., Dehghani, S. (2017). Sensory Evaluation and Acceptability of Soy -yogurt with Different Grouping of Treatments. *Frontiers in Food & Nutrition Research*, 3(1). 1-6

ABSTRACT

Yoghurt produced from soy milk are considered to have poor consumer acceptability and sensory attributes. Development in flavor and texture of soy milk yogurt needs a grouping of treatments. The present study employed some treatments including thermal, added flavor essence, sweetener, and animal's milk-based products to develop soy milk yoghurt.

Proximate analysis and consumer studies were carried out on the 10 soy milk yogurt formulations. The current study proposed that Gorgan 3 soybean variety created better soy yogurt than Pershing variety. By adding animal's milk-based products on soy yogurt can be improved taste and also make a good texture. Adding fruit (banana and orange) flavor essences and colors with sweetener (sucrose) increases the reception of the soy yogurt. Samples of soy yogurt formulations with the most preferred sensory attributes were the samples containing 1% skimmed milk powder; 2% sucrose with orange flavor essence; and 2% sucrose with banana flavor essence.

KEYWORDS: Flavor essences, Sensory evaluation, Soy-yogurt, Sweetener

INTRODUCTION

Soybean products have many health profits include covers all vital amino acids that are necessary for the good development of the body, decrease of menopausal symptoms and risk for heart diseases and cancers[1].

Lower saturated fat and whole fat content, low carbohydrate content, no cholesterol and free of lactose are the advantages of soymilk in comparison to full fat cow's milk[2-3]. Furthermore, soymilk can be a suitable source of protein, iron, thiamine and niacin[4]. These enormous benefits interested a lot of studies on produce suitable diet from soybean such as soy daddawa[5] and soy-yoghurt[6].

Soy yoghurt is one of the products of soy milk that produce on the basis of lactic acid fermentation. Several distinct nutritional advantages would offer to this lactic acid fermentation of soymilk. However, improved flavor and texture and increases nutritional properties of soymilk yogurts are the important goals on the consumers' acceptability and shelf-stability of soy-yoghurt. Due to this regards, a lot of studies were done in different area of the world[4,7,8]. Up to now, a few studies have been conducted on the related subjects of soy-yoghurt in Iran such as Iranian consumer appeal and select the suitable soybean variety. Therefore, the present study employed some treatment methods such as thermal treatment, added flavor essence, sweetener, and animal's milk-based products to develop soy milk yoghurts. The products were sensorially analyzed and validated to determine which product that is appealing and acceptable to consumers.

MATERIALS AND METHODS

Thermal treatment

The use of thermal process can have positive effects on the taste of soy yogurt, soy milk in this study was under two heating process is as follows:

- i. Pasteurized heated to 80 °C for 10 minutes and permitted to cool slowly to a temperature of about 45°C and then inoculation starter.
- ii. Pasteurized heated to 100 °C for 5 minutes and permitted to cool slowly to a temperature of about 45°C and then inoculation starter.

Production of soymilk and yoghurt fermentation

Soybean seeds (Pershing and Gorgan3 varieties) were obtained from soy farms from the north of Iran. Commercially obtainable yoghurt starters and other requirements were acquired from the local stores. The method of Mital et al. (1974) [9] was used to produce soymilk.

The extracted milk was moved into a jar and pasteurized heated to 100°C for 5 minutes and permitted to cool slowly to a temperature of about 45°C.

The cooled homogenized soy milk were inoculated with 2.5% commercial yoghurt starter (CH1; Chr. Hansen company, Denmark) that contain 50:50 mixture of *Lactobacillus bulgaricus* and *Streptococcus thermophilus*. The mixture was stirred well and retained at a temperature of 41°C for a period of 3hours. At the end of the incubation period, the output was yoghurt.

Chemical stabilizer

ULLA-8610 as stabilizers (Palsgaardvej 10, DK-7130 Juelsminde, Denmark) with five concentration samples to obtain the minimum standards were used. Basic yogurt formulations are listed in Table 1.

Adding dairy base products to soy yogurts

First formulation for dairy base yogurts was yogurts containing milk were made by 20 or 30 % milk mixed with 77.5% and 66.5% soy milk, respectively. For produce two samples, we used 2.5% of the starter.

Second formulation for dairy base yogurt was manufactured with adding 0.5, 1, 1.5, 2, 2.5 or 3% (w/w) skimmed milk powder to samples with 2.5% of the starter and 97.5% soy milk.

Finally, whey powder was added with 1% and 2% ratios to samples with 2.5% of the starter and 96.5% and 95.5% soy milk, respectively.

All the above productions incubated for 3 hours at a temperature of 41°C.

Adding sweeteners to soy yogurts

Yogurts were manufactured with 1 or 2% (w/w) lactose or 1 or 2% (w/w) sucrose.

Adding Fruit flavor essence to soy yogurts

Banana, orange and strawberry flavor essence yogurts prepared and fruit flavor essences were obtained from Barij Essence, Inc. (Barij Essence Pharmaceutical Company, Iran).

Two different formulations used for production fruit flavored yogurts with each fruit flavor essences that first formulation manufactured with 0.5 % fruit flavor essence, 0.1% **fruit color**, 1% skimmed milk powder, 2.5% of the starter and 96% soy milk. Second formulation made with 0.5 % fruit flavor essence, 0.1% **fruit color**, 2% sucrose, 2.5% of the starter and 96% soy milk.

Experimental design

Two experiments were conducted with twice repeats. The effect of sweetener type (lactose, sucrose) and sweetener concentration (1, 2%) and stabilizers concentrations were studied in one experiment. In a subsequent experiment, fruit flavor essence and adding dairy base material effects were determined. Yogurts were made in a 3 x 3 factorial experiment (flavor type by dairy base products) in a randomized complete block design. Based on results from the first and second experiments, ten formulation were selected for final evaluations (Table 2).

Sensory assessment

Panelists (n = 10) were university students; 6 were female and 4 were male and ages ranged from 20 to 25 years. All panelists signed a human subject consent form before participating in the study.

Panelists of the present study focused on optimizing flavor, texture and visual attributes were included. Panelists marked responses on 7-point numerical intensity scales using the universal references described by Meilgaard et al. (1999) [10] anchored on the left with “not” and on the right with “very”. This 7-point hedonic scale was used to assess the yogurt samples for flavor, texture visual attributes, and overall acceptance.

Yogurts were presented under natural lights in ten-ounce sample cups with plastic lids with digit codes. Panelists had free access to water and unsalted crackers throughout assessments. Panelists assessed yogurts in a balanced presentation design with five samples evaluated within each experiment in duplicate.

Statistical Analysis

Likelihood ratio test were used for analyzing between the samples (SPSS statistical software v.19). P<0.05 was considered as statistically significant. The first and second experiments were analyzed using a general linear model (PROC GLM) of the Statistical Analysis System software (SAS Institute, Cary, NC).

RESULTS

Sensory assessment of the treatments

Chemical stabilizer

The chemical stabilizer with a ratio of 0.5% to soy yogurt production showed maximum panelists' acceptability. Nevertheless, it with a ratio of 0.75 and 1% provided the desired effect on the production of soy yogurt.

Dairy base products

There was no significant difference between the two soy yoghurt produced from mixture of animal milk (2.5% fat) with a ratio of 20 and 30% and soy milk.

Adding skimmed milk powder with ratios of 1.5, 2, 2.5 and 3 % to soy yogurt productions showed favorite effect on the texture of soy yogurt and panelists' acceptability. Nevertheless, adding skimmed milk powder with a ratio of 2.5 % provided the maximum panelists' acceptability.

Whey powder was added with 2% ratio to soy yogurt presented the higher sensory evaluation scores in comparison of 1% whey powder added.

Thermal treatment

There was significant difference between the effects of the two thermal treatment methods. In the other word, the texture and panelists' acceptability of soy yogurt that produced from soy milk underwent 100°C for 5 minutes thermal treatment were more improved than another thermal treatment. On the other hand, the soy yogurt samples were incubated for 3 hours presented the highest sensory evaluation scores.

Sweeteners

The results of the effect of sweeteners on the improvement of soy yogurt flavor were showed yogurt containing 2% sucrose had better panelists' acceptability than others.

Fruit flavored yogurts

Three formulation used for production fruit flavored yogurts (including Strawberry and Banana flavor essence with skimmed milk powder and Banana flavor essence with sucrose) showed significantly better panelists' acceptability than other formulations. Nevertheless, the formulation made with Banana flavor essence with sucrose had highest panelists' acceptability.

Soybean variety

Our result showed that Gorgan 3 soybean variety created better texture and panelists' acceptability of soy yogurt than Pershing variety.

The treatments with highest ranking test are listed in Table 3.

Sensory assessment of the ten final yogurt formulations

Based on results from the first and second experiments, ten formulations were selected for final evaluations (Table 2). According to the consumer acceptance test, based on flavor acceptance, yogurt samples numbers 2, 3 and 10 were the most preferred yogurt by consumers (Table 4). There were no significant differences among these samples in terms of flavor acceptance scores.

The yogurt sample number 3, 5 and 10 had higher acceptance scores among yogurts in terms of color attribute (Table 4). There were no significant differences among these samples in this regard. But, all the three samples showed significant higher color acceptance scores than sample numbers 2 (control).

Based on the ranking test of odor attribute the yogurt sample number 2, 3 and 10 had higher scores than that of the other yogurt samples (Table 4).

In addition, yogurt sample number 2, 3, 4 and 10 had more texture acceptance scores than others (Table 4). However, texture acceptances of yogurt sample number 3 and 4 were significantly different than control yogurt (sample number 2) (Table 4).

At the end of the evaluation, the overall opinion was asked for each sample and based on the ranking test, yogurt sample number 2, 3, 4 and 10 had highest Panelists' acceptability. On the other words, the Samples of soy yogurt formulations with the most preferred sensory attributes were the samples containing 1 % Skimmed milk powder; 2 % sucrose with flavor essence and *color* of orange; and 2 % sucrose with flavor essence and *color* of banana.

Adding skimmed milk powder with a ratio of 2.5 % provided the maximum Panelists' acceptability.

Whey powder was added with 2% ratio to soy yogurt presented the higher sensory evaluation scores of the panelists.

The Samples of soy yogurt formulations with the most preferred sensory attributes were the samples containing 1 % Skimmed milk powder; 2 % sucrose with flavor essence and *color* of orange; and 2 % sucrose with flavor essence and *color* of banana.

Table 1: Basic soy yogurt formulations

Ingredient	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Soy milk (%)	97.5	97.25	97	96.75	96.5
Yoghurt starter (%)	2.5	2.5	2.5	2.5	2.5
Stabilizer (%)	0	0.25	0.5	0.75	1
Ingredient	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Soy milk (%)	97.5	97.25	97	96.75	96.5
Yoghurt starter (%)	2.5	2.5	2.5	2.5	2.5
Stabilizer (%)	0	0.25	0.5	0.75	1



Table 2: Ten yogurt formulations for final evaluations

Ingredient	Sample 1	Sample 2	Sample 3	Sample 4 *	Sample 5*	Sample 6*	Sample 7*	Sample 8*	Sample 9*	Sample 10*
Soy milk (%)	97	-	96	93.5	94.5	94.5	96.5	95.5	94.5	94.5
Yoghurt starter (%)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Stabilizer (%)	0.5	-	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lactose (%)	-	-	-	-	-	-	-	1	2	-
Crystalline sucrose (%)	-	-	-	2	2	2	-	-	-	2
Skimmed milk powder (%)	-	-	1	-	-	-	-	-	-	-
Milk (%)	-	97.5	-	-	-	-	-	-	-	-
fruit flavor essence(%)	-	-	-	0.5	0.5	0.5	0.5	0.5	0.5	0.5
fruit color	-	-	-	0.1	0.1	0.1	0.1	0.1	0.1	0.1

* The samples 4, 5 and 8 were made with flavor essence and *color* of orange, the samples 6 and 7 were made with flavor essence and *color* of strawberry and the samples 9 and 10 were made with flavor essence and *color* of banana.

Table 3: The treatments with highest ranking test

Treatment	Attribute	Ranking test (score)
Chemical stabilizer	2%	6.7
Incubation time	3 hr.	5.5
Skimmed milk powder	2.50%	7
Thermal treatment	100 oC for 5 min	5.5
Whey powder	2%	5.2
Sweeteners (sugar)	2%	4.2
Fruit flavored	0.5 % Banana flavor essence, 0.1% Banana color, 2% sugar, 2.5% of the starter and 96% soy milk	4.4
Soybean variety	Gorgan 3	4

Table 4: Consumer acceptance of yogurts

Attribute	Yogurt sample number				
	2 (Control)	3	4	5	10
Color	2.8a	5.7c	-	6.1c	5.9c
Texture	2.9a	4.5c	4.9c	-	4.1c
Flavor	4	4.7	-	-	4.3
Odor	370%	4.8	-	-	4.5
Ranking test*	3.9c	4.6c	3.9c	1.6a	4.1c

a–c: Means in the same row followed by different letters represent significant differences ($P < 0.05$).

DISCUSSION

Soy protein contains all the essential amino acids and some phytochemicals, such as isoflavones and bioactive polypeptides, which has been revealed to offer health benefits [11,12].

Furthermore, Soymilk has been used by some part of the population including people suffering of lactose intolerance and vegetarians. Soymilk yogurt as a fermented product from soymilk may suggest a good alternative for those people.

The soy products such as soymilk yogurt have low acceptability ratings [13,14] that might have been several reasons including unappealing flavor, form, odor and low known about health benefits of soy foods [14]. On the other hand, resolving these concerns with improve consumer education and knowledge of soy health benefits also increased acceptability scores[15]. Furthermore, Lactic acid fermentation of soymilk for the production a yogurt-like product can improve its sensory attributes such as reduce “beany” flavor [2] and the concentration of n-hexanal compound [16] which to be responsible for the unpleasant off-flavors of soybean-based products.

Several attempts tried to production of yogurt-like foods with soymilk and improve soy yogurt by enrichment with lactose, sucrose or skimmed milk and etc.[2,17,18].

Therefore, the purpose of this study was to assess some treatment methods such as thermal treatment, added fruit flavor essence, sweetener to develop soy milk yoghurts and increase acceptability of soymilk yogurts among Iranian consumers.

DRAKE et al.[19] presented yogurts containing sucrose had higher flavor quality scores than yogurts with fructose. According to our findings, yogurts containing sucrose especially the yogurt containing 2% sucrose had higher panelists' acceptability scores than yogurts with lactose. Similarly, Trindade et al. (2001) [2] concluded that soy yogurt using the homogenised soy milk with 2% sucrose addition and fermented for 6 h were showed better sensory quality.

Also, our results present that panelists prefer sucrose enrichment, which is in agreement with Trindade et al. (2001) [2] and Estevez et al. (2010) [20].

On the other hand, Wang et al. (2002) [21] showed that the structure of fermented soymilk by *S. salivarius* spp. *thermophiles*, which enriched with sucrose have higher viscosity than those enriched with fructose. Similarly, our findings also presented that the texture of soy yogurts, which enriched with sucrose have higher panelists' acceptability than others. In the same way, other results [17] described treatment with sucrose rather than glucose addition showed better masking influence on the usual bear flavor of soy derived products.

Fruit flavors are identified to interact with basic tastes and can increase or decrease perception of basic tastes [22]. Fruit flavors decreased soy aromas, soy flavors, and astringency in yogurts containing soy protein [19]. Drake et al. [19] observed a significant interaction between fruit flavor essence and soy protein concentration for soy aroma

perception. Similarly, according to our findings, the formulation of soy yogurt made with fruit flavor essences and color had highest panelists' acceptability. Furthermore, Drake et al. [19] indicated that strawberry and lemon flavors were equally effective in decreasing soy aromas. Osundahunsi et al. [23] evaluated sensory quality of soy yoghurt samples that made with fruit-colour/flavour and mashed pineapple, pawpaw and orange chunks (with 5% ratios). They concluded that strawberry color/flavor soy-yoghurt had the highest sensory attributes scores in comparison to other samples. Nevertheless, they compared strawberry color/flavor soy-yoghurt with different mashed fruit chunks but they didn't compare it with pineapple, pawpaw and orange color/flavor. Our results showed that soy yogurt with orange and banana flavor essences and colors had significantly higher panelists' acceptability scores than soy yogurts with strawberry flavor essence and color. A possible explanation for this inconsistency may be due to different people's palate in all over the world.

The qualities of soy products derived from soymilk may also be affected by the thermal treatment on soymilk. Extra heating mostly leads to the destruction of amino acids and vitamins, browning and the development of cooked flavor [24]. Kwok and Niranjana [24] concluded that higher temperature heating and UHT treatment may provide optimum processing conditions. In the present study a significant difference was between the effects of the two thermal treatment methods on the texture and panelists' acceptability of soy yogurt. The soy yogurt made from the soy milk samples underwent 100°C for 5 minutes thermal treatment were presented better sensory evaluation scores than another one.

CONCLUSIONS

In conclusion the current study suggested that Gorgan3 soybean variety created better soy yogurt than Pershing variety. Adding skimmed milk powder; whey powder in Soy yogurt can improve sensory attributes. The use of sucrose as sweetener in soy yogurt make higher panelists' acceptability than other sweeteners. Banana and orange flavor essences and colors were more panelists' acceptability in yogurts containing 2% sucrose than strawberry flavor essence and color.

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