

Quality Characteristics and Sensory Evolution of Yogurt Supplemented with Soy Milk and Goji Berry Extract

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Abstract

This study was conducted to investigate the possibility of producing functional yogurt from blends of toned and soy milk using goji berry extract. Different combinations were prepared with soy milk and goji berry extract. The addition of the soy milk and aqueous extract of goji berry by different concentration was significantly changed the organoleptic and physicochemical properties of yogurt. The functional yogurt (TS2G1) with 20% soy milk and 5% goji berry extract were recorded highest (7.32) overall acceptability on the bases sensory evaluation. Based on the present results the further studies can be proposed for production of functional yogurt with soy milk and goji berry extract, as potential natural antioxidant source.

Key words: Soy milk, Goji berry (*Lycium Barbarum*), Yogurt, Lactic acid bacteria's, Properties, Sensory.

1. INTRODUCTION

Yogurt is fermented milk product obtained by the lactic fermentation of milk by the activity of *Lactobacillus Delbrueckii* ssp. *Bulgaricus* and *Streptococcus Thermophiles*. It is a major product of milk consumed in all around the world due to its nutritional properties, unique flavor and digestibility. Its effect of improving the intestinal environment and enhance the immunity of the body [1]. As a dairy product it has a desirable effect on consumer health [2]. According to the standard of the Codex, YOGURT as a fermented product of milk contains a maximum 50% of non-dairy ingredient. They product have been endorsed as a dietary supplement. The previous research investigated the fermented products help to control of blood cholesterol in the human body [3, 4]. The component of YOGURT (sphingolipids, conjugated linoleic acid and butyric acid) plays an important role as a anti-cancer [5]. YOGURT can be enriched or nutrients develop with milk powder, minerals, proteins, vitamins, and fruits and fruit juice.

Goji berry (*Lycium Barbarum*) Solanaceae is a traditional plant as a functional foods and herb medicinal. It is also known as Chinese "wolf berry" and Chinese "boxthorn" and species belongs to Solanaceae family. The 'Goji' name is an extrapolation of a number of native words and it was coined by the Tanaduk Botanical Research Institute (TBRI) in 1973 [6]. The goji berry is most nutrition rich plants on earth, it is a rich source of bioactive compounds such as vitamin-A, B-complex, vitamins-C, polysaccharides, carotenoids, polyphenols including tannins, lignans, flavonoids (hyperoside, Quercetin, Isoquercitrin, Rutin) and other phenolic compounds or 18 essential amino acid and betaine [7]. Betaine is the most components of the goji berry; it is also called as choline metabolic products Trimethyl Glycine (TMG). Zeaxanthin carotenoids found in goji berry which representing 60% of the total carotenoids in the fruits [8]. This type of study also observed by different author [9]. Goji berry also contain 21 trace minerals such as copper, germanium, iron, selenium, and zinc etc. The carotenoids are very useful and effective in controlling and preventing chronic disease such as skin cancer and cardiovascular disease and protect the oxidative damage in human body. Many researchers used the mathematical modeling in different field to solve real life problems. [10-35]. Soybean is a rich source of protein (40%), Soy products may reduce effectively the risk of various diseases like heart attack, diabetes, blood pressure and cancerous diseases. In addition, of good quantity of protein, significant amount of glycemic index and less amount of saturated fatty acid. Soybean also contains significant amounts of Isoflavone (Diadzein, Genistein, and Glycetein) compound a derivative of female hormone estrogen, which inhibit the menopausal symptoms. Soy products are an important source of many nutrients, including Isoflavone, dietary fiber, oligosaccharides, proteins, trace minerals and vitamins. The direct

fortification of dairy products with vegetable proteins has been increasing because of the low price of vegetable proteins as compared to animal proteins, low fat product nutritionally healthy value regarding the lactose intolerant.

2. MATERIALS AND METHODS

The soybean seeds and commercial grade cane sugar were procured from the local market of Kundli, Sonipat (Haryana). Toned milk purchase from the tuck shop (Mother dairy brand) and goji berry fruits were purchased online from amazon.com from Pune Maharashtra.

Preparation of soy milk

Soy milk was prepared by the soy bean soaking for 16 hours with potable water and washed with tap water, grinding and steeping with water for 4-5 hours at room temperature. In the steeping process 100g of soy bean mixed with 100 ml. water. To obtain soy milk the prepared mixture filter through double layer muslin cloth. The prepared soy milk pasteurized for 10 minutes at 85°C and stored for further use.

Goji berry extract

5gm. Goji berry fruit mixed with 50 ml. of water and homogenized (Polytron PT 3100 D) and centrifuge at 10000 rpm. for 10 minutes and filter through Whatman paper no. 40 and pasturized for 5 minute at 95°C stored in refrigerator temperature.

Starter culture

The starter culture *Lactobacillus delbrueckii* ssp. *Bulgaricus* and *Streptococcus thermophiles* procured from NDRI Karnal, Haryana.

3. RESULTS AND DISCUSSION

Manufacture of yogurt

The yogurt was manufactured with different combination of soy milk (SM), toned milk (TM) and goji berry extract. The combinations were as follows:

Table 1: Various Combinations of Yoghurt

S. No.	Experimental code	Different Blended Ratio
1	T	Toned milk (100%)
2	TS1	Toned milk (90%) +Soya milk (10%)
3	TS2	Toned milk (80%) +Soya milk (20%)
4	TS3	Toned milk (70%) +Soya milk (30%)
5	TS2G1	Toned milk (80%) +Soya milk (20%) + Goji berry (5%)
6	TS2G2	Toned milk (80%) +Soya milk (20%) + Goji berry (10%)
7	TS2G3	Toned milk (80%) +Soya milk (20%) + Goji berry (15%) [should it be total 100%]

The toned milk was heated at 90 °C for 5 minutes and rapidly cools at 42°C. The combination of YOGHURT was prepared with 10%, 20% & 30% soy milk and inoculated with 2% starter culture (*Lactobacillus delbrueckii* ssp. *Bulgaricus* and *Streptococcus thermophiles*). Three sets of YOGHURT (T5, T6 & T7) were then added with goji berry juice extract 5%, 10% and 15%. The prepared material incubated at 42-46°C for 4-6 hours. After incubation cool and stored at 4°C for further analysis.

Physico-chemical analysis

Prepared yogurt samples were subjected to their proximate analysis (moisture content, protein, acidity, PH and total soluble solids), calorimetric value of color in terms of L* a*, b*, and sensory characteristics and anti-oxidant activity.

Moisture content

Moisture content of yogurt samples was analyzed by the simple weight differences Method. (Moisture= fresh weight-dried weight/sample fresh weight x 100).

Protein

The protein content was determined by the Micro Kjeldhal method (AOAC 1995).

Titration acidity

Titration acidity of pomegranate seed was determined by using NaOH titration method. The pomegranate seed were crushed manually to extract juice. 25 ml. juice extract was titrated with 0.01N NaOH solution. Phenolphthalein indicator was used to mark the end point of titration. The Titration acidity was calculated using following formula

$$\text{Acidity (\%)} = F \times T \times 0.1N \text{ NaOH} \times 100 \times 100 / L \times M$$

Where, F is factor of acid (citric acid) which is equal to 0.0064.

pH

The pH of prepared yogurt samples was measured with the help of pH meter. The instruments was calibrate with standard buffer solutions i.e. pH 7 and pH 4. Samples reading were recorded in three replicate.

Total soluble solids

Total soluble solids of the yogurt samples were measured by using a digital Refractometer (Model: ATAGO RX-5000) and expressed in terms of °brix. The measurement of TSS were determined at 25±2°C

Color

Color properties of samples were measured by using a Handheld Chroma meter (CR-400, Konica Minolta, Japan) at 25°C and were recorded in the CIE L*, a*, b* scale. (Hutchings, 1994) “L*” represents the lightness index (“0” for black to “100” for white), “a*” represents greenness and redness (“+100” for red and “-80” for green) while, “b*” represents for yellowness and blueness (“+70” for yellow and “-80” for blue). All of the samples were analyzed in triplicate and average values were reported.

Sensory Evaluation

Sensory evaluation (appearance, color, flavor, body & texture and overall acceptability) of prepared YOGHURT with soy milk and goji berry juice extract were evaluated by a semi trained persons using 9-point hedonic scale on the bases of like and dis-like.

Table 2: Characteristics of Soy-Yoghurt and Goji berry

Characteristics	Body and Texture	Flavor	Color	Overall Acceptability
T	4.92±1.913	6±1.470	5.24±0.709	5.72±1.15
Soy-Yoghurt				
TS1	4.88±1.715	5.72±1.184	5.52±0.640	5.44±0.85
TS2	4.96±1.612	5.44±1.203	5.28±0.601	5.92±0.89
TS3	4.52±1.552	5.04±1.216	5.24±0.650	4.92±0.62
S.E.				
*P-value				
Goji berry Soy-Yoghurt				
TS2G1	6.84±1.084	7.4±0.693	7.12±0.863	7.32±0.67
TS2G2	5.52±1.300	5.96±0.916	5.8±0.693	6.12±0.76
TS2G3	5.24±1.556	5.32±0.926	5.84±0.784	5.72±1.04
S.E.				
*P-value				

*Mean value of (n=25) shows significant differences (P<0.05) using ANOVA.

Values are means of 25 replicates ± standard error

Product acceptance on their sensory evolution is a very important for the consumer’s preferences. The sensory characteristics of different combinations of yogurt are represented in table no. bases on the mean score of body & texture, flavor, color and overall acceptability. It was recorded the overall all acceptability of different samples of yogurt was in range of 4.92- 7.32. The mean score for color, flavor and body and texture was recorded 5.24-7.12, 5.04-7.4 and 4.52-6.84 respectively. The prepared yogurt with blending of 20% of soymilk, 80% toned milk and incorporated 5% goji berry extract scored highest sensory score based on 9 hedonic scale. The maximum overall acceptability and sensory score were recorded in TS2G1 (7.32) yogurt sample followed by TS2G2 (6.12). The lowest score was recorded in TS1 (Toned milk 90% +Soya milk 10%) sample of yogurt. On the bases of this study, it was revealed that 20% replacement of toned milk with soy milk and fortified 5% goji berry extract is highly acceptable.

Table 3: Colour of prepared different combinations of yogurt

Sample	L*	a*	b*	ΔE
T	84.45±0.12	-4.29±0.15	2.39±0.14	11.25±0.19
TS1	89.59±0.25	-3.72±0.13	8.48±0.57	7.66±0.28
TS2	87.58±0.14	-4.05±0.25	6.3±0.39	8.74±0.46
TS3	84.25±0.19	-3.75±0.36	3.28±0.71	11.17±0.81
TS2G1	78.11±0.54	-4.57±0.40	-8.8±0.69	24.33±0.54
TS2G2	76.73±0.56	-7.07±0.84	24.27±0.28	28.19±0.27
TS2G3	74.34±0.74	-8.8±0.64	26.98±0.65	32.14±0.41

The colour of prepared different combinations of yogurt was recorded in terms of L*, a*, b* and ΔE. The highest value of L*(lightness) was observed in TS1 sample (89.59) (table 3), followed by TS2 (87.58) and the lowest recorded in TS2G3 (74.34), it may due to the addition of 30% soymilk and 15% goji berry.

Table 4: Colour difference of yogurt samples

Sample	Fat (g/100gm)	Protein (g/100gm)	pH	Acidity (%)	Moisture Content (%)	TSS (°brix)
T		3.5±0.21	6.1±0.0035	0.47±0.707	65.34±0.81	22.21±0.042
TS1	2.56±0.03	3.9±0.09	5.9±0.282	0.45±0.141	73.07±0.88	23.27±0.565
TS2	2.67±0.05	4.2±0.65	5.9±0.3535	0.41±0.181	72.81±0.54	25.04±0.298
TS3	2.63±0.09	4.7±0.32	6.2±0.2474	0.4±0.212	70.87±0.59	26.51±0.047

TS2G1	2.58±0.07	4.0±0.38	5.9±0.2121	0.58±0.070	76.41±0.26	19.35%±0.033
TS2G2	2.64±0.03	4.4±0.66	5.8±0.289	0.59±0.381	76.47±0.78	18.03%±0.076
TS2G3	2.57±0.04	4.7±0.47	6.0±0.141	0.6±0.585	77±0.57	17.66%±0.021

The a* (redness) values of the yogurt samples were found in negative response (table 3). The highest and lowest value of B* were observed in TS2G3 (26.98), and TS2G1 (-8.8) respectively. The highest total color difference was recorded in TS2G3 (32.14) followed by TS2G2 (28.19). Lowest color difference was observed in TS1 (7.66) followed by TS2 (8.74) (table 4). The color difference of yogurt samples may be due to the addition of goji berry extract and soy milk.

4. CONCLUSION

Goji berries and Soy milk enhanced the sensory quality of traditional yoghurt and raised customer acceptability. During storage, quality parameters (chemical parameters) were maintained. Goji berries boosted lactic acid bacteria development and preserved yoghurt's prebiotic properties throughout storage. When goji berries were introduced, concurrent microflora (contaminants) emerged. Based on the current findings, this study advocates that more research into the development of functional yoghurt with soy milk and goji berry extract as a viable natural antioxidant source might be recommended. The findings of this study provide evidence that soy milk and goji berries may be used to boost probiotic levels in yoghurt.

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