Engineering Sciences
ISSN: 1308-7231
Article ID: 1A0476

Status : Research Article
Received: 11.06.2021
Accepted: 25.10.2021

Beyza Özpalas
Kilis 7 Aralık University, beyzaozpalas@kilis.edu.tr, Kilis-Turkey
Emir Ayşe Özer
Hatay Mustafa Kemal University, ayseozer@mku.edu.tr, Hatay-Turkey

DOI	http://dx.doi.org/10.12739/NWSA.2021.16.4.1A0476	
ORCID ID	0000-0001-9211-7916	0000-0001-7776-9625
Correspoding Author	Emir Ayşe Özer	

OPTIMIZATION OF PROCESS PARAMETERS FOR PEANUT MILK BASED ON NUTRITIONAL AND SENSORY CHARACTERISTICS

ABSTRACT

In the recent century, consumers demand in the area of food products have changed significantly with lifestyle modifications related to change in the eating habit. Based on the consumers` demand, the food industry and scientists focus on plant based functional foods that prevent nutrition related with disease, economic and environmental awareness. This study, therefore, aim to optimize process parameters for peanut milk and to evaluate the effect of its on proximate composition and sensory properties of peanut milk. The statistical analyses were carried out using response surface methodology (RSM). The nutritional (moisture, ash, fat, protein, carbohydrate and energy content), and sensory properties (appearance, colour, texture, flavor, aftertaste, overall acceptability and affordability) of produced peanut milk were evaluated. The experimental results indicate that optimized process parameters are soaking time 15 hours, water ratio 4.86 times, water temperature 68℃, with 99% overall acceptability. This study concluded that peanut milk is an alternative to milk and milk-based beverage for people with lactose intolerance or milk allergy.

Keywords: Peanut Milk, Respond Surface Methodology, Vegan Milk, Plant Based Beverage, Functional Food

1. INTRODUCTION

The primary role of diet in healthy nutrition is to consume necessary and sufficient amounts of nutrients for growth, development, maintenance of life and protection of health. Recent studies show that diet may have an important role not only in the formation and development of optimum health, but also in reducing the risk of some diseases [1 and 2]. With modern life style and with the decrease in physical activity lead to increase in the consumption of ready to eat foods which can cause health problems such as Type 2 diabetes, digestive system discomfort, obesity and cardiovascular diseases [3 and 4].

The functional food sector is growing rapidly in parallel with the development of food and nutrition science, with consumers' understanding of the diet/disease relationship, increasing aging of the population and treatment costs [4 and 5]. With the support of the development of the functional food sector by the governments and the change in consumer awareness and production models, there is an increase in innovative food production. The functional beverage market worldwide is growing by 10% every year. The functional beverage market, which was 128.66 billion dollars in 2019, is estimated to increase to 158.28 billion dollars in 2023. In many studies, it has been determined that functional foods are effective in preventing and delaying the formation of diseases such as Type 2 diabetes, immune system, cardiovascular diseases, hypertension,

How to Cite:
Özpalas, B. and Özer, E.A., (2021). Optimization of Process Parameters for Peanut Milk Based on Nutritional and Sensory Characteristics. Engineering Sciences, 16(4):136-150, DOI: 10.12739/NWSA.2021.16.4.1A0476.

digestive system diseases [6, 7, 8 and 9]. As a result of scientific studies, the increase in consumer awareness of the relationship between nutrition and health and the trend of functional food consumption has led the food industry to develop new products [10]. One of them is functional drinks. Functional drinks; It can be classified as sports and performance drinks, energy drinks, milk-based drinks (probiotic, mineral and protein added), vegetable, fruit juices and plant based beverages [11 and 12]. Recently, consumers are turning to plant-based diets and products that include grains, legumes, seeds, nuts, fruits and vegetables for a variety of reasons, including ideological (e.g. concern for animal welfare), increased healthy life expectancy, and economic and environmental awareness [13, 14, 15 and 16]. For these reasons, various trends such as veganism, vegetarianism, lacto-vegetarianism and ovo-vegetarianism have emerged. Plant-based milk substitutes are one of the important food groups that are irreplaceable in the food industry, as they are used as a basic ingredient in many vegan food products such as yogurt, cheese, kefir, butter, ice cream. In addition, there is a growing need for plant-based milk substitutes and beverages are great alternative of dairy products and beverages by consumers who are lactose intolerant or allergic to cow's milk.

According to research by [17], 65% of the world's population has a decrease in digestion of lactose. In East Asia, 70-100% of people suffer from lactose intolerance. This disease is also seen in West African, Arab Jewish, Greek and Italian populations. In addition, people may choose plant-based milk substitutes for a variety of health-related reasons. For example, while heavy consumption of animal foods causes cardiovascular diseases and increased cholesterol, cereals, legumes, seeds and nuts are placed in the functional and nutraceutical food class due to their diet, vitamins, minerals and antioxidants [18]. In addition to the role of a plant-based diet in reducing cardiovascular disease, observed in a study [19] that a diet rich in soybean and nut plant-based foods reduces the risk of neurodegenerative disorders such as Alzheimer's disease. In addition, it is stated that plant-based milk substitutes have positive effects on health due to rich antioxidant activity and fatty acid that reduce the risk of cardiovascular diseases, cancer and diabetes [20].

Peanut is one of the important oilseeds among the world. It is highly rich in monounsaturated fatty acid, proteins, fibre, carbohydrate, vitamins and minerals such as calcium, iron, magnesium and zinc. Moreover, compared to other nuts, peanut is more affordabilty and avaiability. For these reasons, the demand for peanut beverages has been gradually increased in a few years. Peanut milk with acceptable nutritional value has been developed in several studies [21, 22 and 23]. However, the result of the studies shows unpleasent sensory properties such as undesirable taste, chalky mouth-feel, beany flavors. Therefore, it can be said that there is a still challenges particularly with sensory characteristic of peanut based beverages. Keeping in the view, the present study is aim to optimize process parameters for peanut milk and to evaluate the effect of its on nutritional and sensory properties.

2. RESEARCH SIGNIFICANCE

In parallel with the increase in the number of people with lactose intolerance, veganism and healthy eating awareness in recent years, the needed for plant based beverage has gradually increased. However, the kinds of plant based beverage commercially are limited in food market. Peanut milk production which is optimized in this study, may be an alternative commercial plant based beverage. Moreover, this product can be used in a new functional food development.

3. MATERIALS AND METHODS

Peanuts were purchased Osmaniye Peanut Research Institute and stored at 4 in refrigerator until use. All chemicals and reagents were analytical purity.

3.1. Determination of Suitable Parameter Ranges for Peanut Milk

It is planned to develop peanut milk increased nutritional value and overall acceptability. Preliminary trials and pre-sensory panels were carried out to determine the range of production parameters of peanut milk. As a result of preliminary studies, soaking time (5-15 hours), dilution rate (3-7 times), dilution temperature (25-75℃) selected as independent variables.

3.2. Experimental Design for Peanut Milk

It is designed according to Response Surface Method, which is an experimental design method. For the optimization of high nutritional value and overall acceptability, experiments were conducted according to a central composite design containing three independent variables which dictated 20 experimental runs. The experiments at a central point for five in order to calculate to the repeatability of the method. Independent variables used to determine optimum peanut milk were soaking time, water rate, and water temperature. The level of different variables is shown in Table 1.

Table 1. Experimental design of independent variables of peanut milk

Independent Variables	Code	-1	0	+1
Soaking Time (Hours)	X_1	15	10	5
Water Ratio (Times)	X_2	7	5	3
Water Temperature (℃)	X_3	75	50	25
-α:-1.68				+α:+1.68

Sample	X_1	X_2	X_3
1	15	3	75
2	15	7	25
3	5	7	75
4	10	5	50
5	10	5	50
6	10	5	50
7	5	3	75
8	1.6	5	50
9	10	5	50
10	5	3	25
11	15	3	25
12	10	1.6	50
13	10	5	50
14	10	5	50
15	18	5	50
16	15	7	75
17	10	8	50
18	10	5	92
19	5	7	25
20	10	5	8

3.3. Peanut Milk Preparation

Peanut milk was produced with modifying the methods reported by Laso et al., Sakthi et al., and Siddeeg et al (24, 25 and 26). Peanut milk was produced according to the experimental design in Table 1. First of all, the seeds to be used in the study were roasted at 135°C for 30 minutes in a forced air circulation machine (Ceselsan Machine CS-025-KFP). Then, the seeds separated from their shells were weighed and before being soaked in 0.5% $NaHCO_3$ for different soaking time (1.6-18 hours).

After that, seeds whose holding period expired were washed with tap water and added different amount of water at different water temperature. The mixture (peanut and water) was transferred to a hand blender (Tefal Mastercut, 500W) for griding process. After the grinding process, the slurry was extracted by the cheese cloth by hand and the amount of milk obtained was calculated. According to the amount of milk, xantham gum was added and homogenization was applied at 20 rpm for 5 minutes. After the homogenization process, pasteurization was applied at 85℃ 15 minutes. Finally, it was stored in a deep freezer in sterile containers (100 mL) to be used in the analysis. The peanut milk production flow chart is shown in Figure 1.

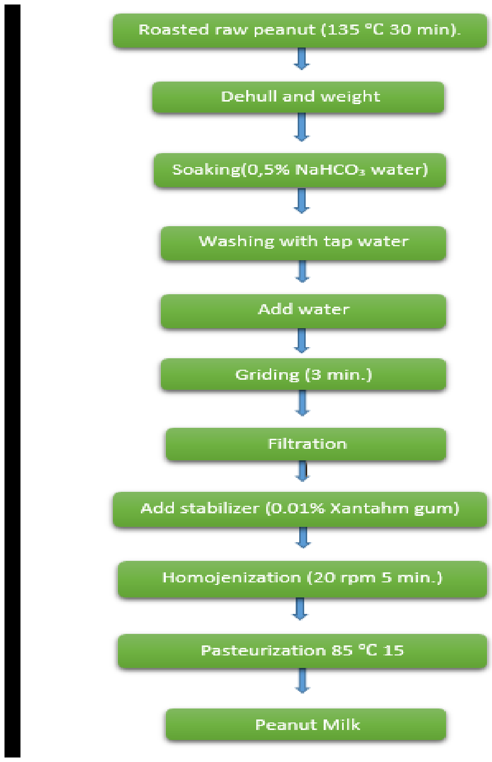

Figure 1. Production flow chart of peanut milk

3.4. Nutritional Composition

Dry matter, ash, fat, protein was determined by employing a standard method of analysis [27]. The total carbohydrate and energy content of plant based beverage was calculated by using the following equations (1) and (2) [28]:

$$\text{Carbonhydrate } \% = 100 - (\text{moisture}\% + \%\text{protein} + \%\text{ fat} + \%\text{ash}) \quad (1)$$

$$Energy = 4\,(\%\,Protein\ content\ of\ plant\ based\ beverage + \%\,carbonhydrate\ content\ of\ plant\ based\ beverage) + (\%\,fat\ content\ of\ plant\ based\ beverage) X\ 9 \quad (2)$$

3.5. Sensory Analyses

The sensory evaluation of the plant based functional beverage was conducted using 10 trained panelists from Hatay Mustafa Kemal University Food Engineering Department. Samples were coded with three-digit numbers and positioned randomly. The sensory evaluation sheet was provided to the panelist and was asked to assess the appearance, colour, texture, flavour, aftertaste, overall acceptability and affordability according to their preferences on a 1-5 hedonic scale. According to the scale; 1: bad, 2: not enough, 3: acceptable, 4: good, 5: very good. All sensory evaluations were conducted at room temperature and water was served to panelists for mouth cleaning between the evaluations of the samples [29].

3.6. Statistical Analyses

In determining the effects of independent variables on dependent variables, the Central Composite Design of the Response Surface Method was used for variance analysis. Soaking time, water ratio and water temperature has been determined as independent variables for experimental design. Design expert packaged software of version 7.0 program was used for statistical analysis (Chemical analyses were performed in triplicate and two replications for sensory evaluation.

4. RESULTS AND DISCUSSION

4.1. Nutritional Composition

The result of moisture, dry matter, ash, fat, protein, carbohydrate and energy content of peanut milk are summarized in Table 2.

4.1.1. Dry Matter

Dry matter is one of the important technical parameter in food characterization. The % dry matter value in peanut milk samples was found to be between 9.3% and 25.31%, with an average of 13.6%. As a result of analysis of variance, the effect of water ratio on % dry matter was found to be significant ($p<0.01$). As the water ratio increase, the dry matter in the samples decrease linearly and the decreased was to be statistically significant significantly ($p<0.01$). Similarly, in a study, it was found that dry matter of almond milk decreased as water ratio increases [30].

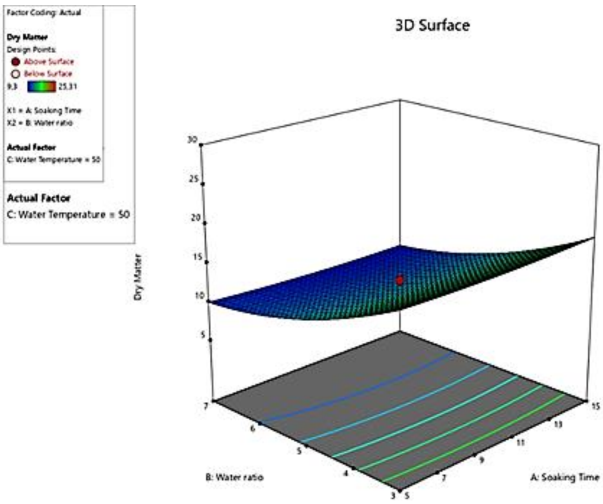

Figure 3. Response plot showing the effect of soaking time, water ratio and water temperature on the dry matter of peanut milk samples

4.1.2. Ash Content

Data in Table 2 showed that the ash content of samples was ranged from 0.19 to 0.56% an average of 0.26%. These results were similar with results founded by Jain et al., [31] peanut milk ranged from 0.16 to 0.28. The result of variance analysis, the effects of water ratio on peanut milk samples was found to be statistically important ($p<0.01$). Ash content in samples decreased slightly with the increased water ratio in beverage. The effects of the water ratio on the ash content are shown in Figure 4 the 3D plot.

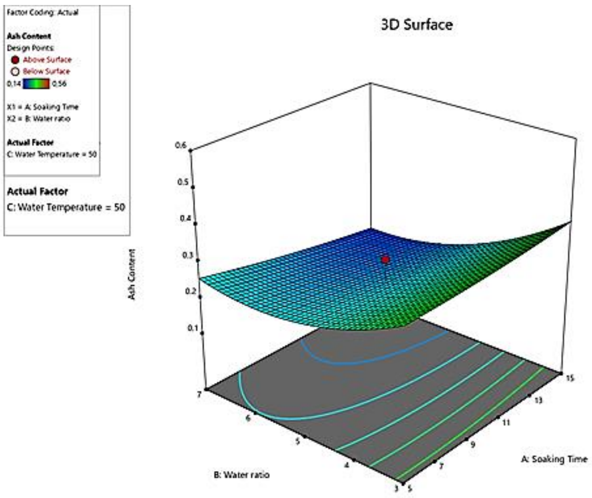

Figure 4. Response plot showing the effect of soaking time, water ratio and water temperature on the protein of peanut milk samples

4.1.3. Fat Content

Sample number 12 has the highest fat value (9.7%) and sample number 2 has the lowest fat value (5%). The response surface plot (Figure 5) showed that the effect of variables on fat content. The effects of soaking time, water ratio, water temperature were found statistically significant ($p<0.01$). The fat values of beverages increased slightly with the increased water temperature ($p<0.01$). The results of fat content obtained in this study in close agreement with to increase in fat content with increased temperature reported by Jain et al., [31]. Moreover, the increased of water ratio in peanut milk samples lead to decrease fat content and this decrease was found to be statistically significant ($p<0.01$). Fat content in samples increased with the soaking time increased and this rising were found statistically significant($p<0.01$).

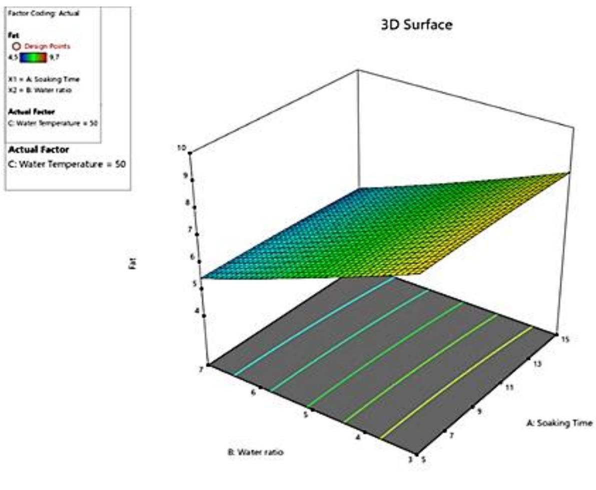

Figure 5. Response plot showing the effect of soaking time, water ratio and water temperature on the protein of peanut milk samples

4.1.4. Protein content

The protein content values varied from 2.3 to 6.25%. The response surface plot (Figure 6) shows the effects of variables on protein content in peanut milk samples. The increasing in water ratio in samples can lead to decrease significantly protein content in samples ($p<0.01$). These results were similar to results found by, was reported protein content of soy milk in ranged from 3.8 to 6% [32]. The effects of soaking time and water temperature has no affect on protein content in peanut milk samples.

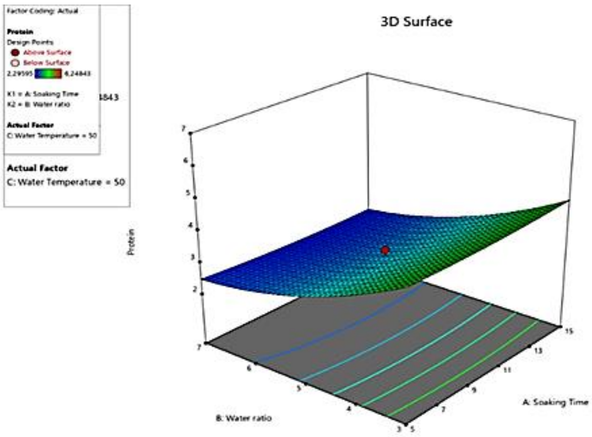

Figure 6. Response plot showing the effect of soaking time, water ratio and water temperature on the protein of peanut milk samples

Table 2. Nutritional properties of peanut milk

Sample	Dry Matter %	Ash %	Fat %	Protein %	Carbohydrate %	Energy (Cal.100^{-1} mL)
1	18.27±0.03	0.34±0.01	8.5±0.01	4.51±0.02	4.92±0.02	114±0.02
2	9.65±0.03	0.21±0.03	5.0±0.02	2.38±0.01	2.06±0.02	63±0.02
3	9.8±0.02	0.21±0.01	5.6±0.02	2.42±0.02	1.57±0.01	66±0.02
4	11.67±0.0	0.21±0.02	6.9±0.01	2.88±0.03	1.68±0.02	80±0.03
5	11.5±0.03	0.21±0.03	6.8±0.03	2.84±0.01	1.55±0.02	80±0.03
6	11.7±0.01	0.19±0.02	6.9±0.03	2.89±0.03	1.72±0.01	81±0.01
7	16.9±0.02	0.33±0.02	8.7±0.02	4.17±0.01	3.70±0.01	110±0.02
8	14.81±0.04	0.35±0.01	7.1±0.01	3.66±0.02	3.70±0.02	93±0.02
9	12.96±0.02	0.22±0.01	6.9±0.01	3.20±0.03	2.64±0.01	86±0.01
10	17.52±0.02	0.26±0.02	8.3±0.03	4.33±0.03	4.63±0.01	111±0.02
11	18.7±0.05	0.41±0.03	8.1±0.02	4.62±0.01	5.57±0.02	114±0.03
12	25.31±0.04	0.56±0.03	9.7±0.01	6.25±0.01	8.80±0.01	148±0.02
13	12.91±0.03	0.29±0.01	6.9±0.02	3.19±0.02	2.53±0.02	85±0.01
14	11.66±0.02	0.21±0.01	6.9±0.02	2.88±0.01	1.67±0.02	80±0.01
15	12.18±0.02	0.16±0.01	6.7±0.03	3.01±0.03	2.31±0.02	82±0.02
16	10.72±0.03	0.17±0.02	5.4±0.02	2.65±0.02	2.50±0.01	69±0.02
17	9.3±0.04	0.24±0.01	4.5±0.02	2.30±0.01	2.26±0.02	59±0.03
18	13.34±0.02	0.14±0.03	7.3±0.03	3.29±0.01	2.61±0.02	89±0.02
19	9.74±0.03	0.24±0.03	5.2±0.02	2.40±0.02	1.90±0.02	64±0.02
20	13.29±0.02	0.29±0.02	6.1±0.01	3.28±0.01	3.62±0.02	83±0.01
21*	13.10±0.04	0.20±0.03	7.2±0.01	4.0±0.02	1.7±0.02	88±0.02

*Peanut milk sample produced according to optimum process parameters

4.1.5. Carbohydrate

The results of the carbohydrate content in peanut milk samples ranged from 1.55% to 8.80%. The response surface plot (Figure 7) shows that the rising water ratio leads to a decrease significantly in carbohydrate content in samples ($p<0.01$). Similarly, the result was found in the study which the carbohydrate content of peanut milk ranged from 3.3% to 7.5% [26]. Another studies reported similar results that increasing of water ratio can decrease the carbohydrate content [30]. The comparable, outcome of the studies shows that the content of carbohydrates was found in peanut milk 8.9%, 7.5% respectively [33 and 34].

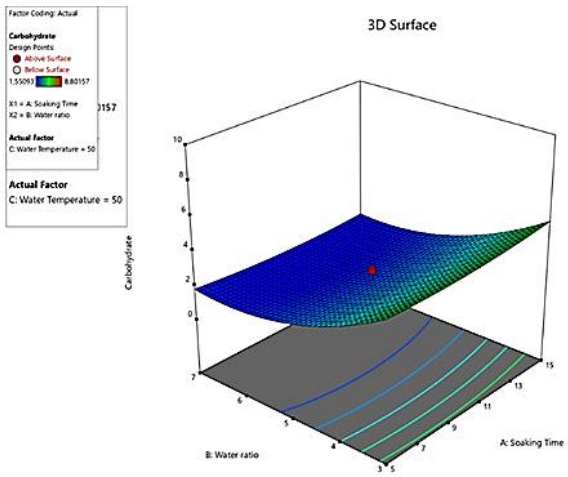

Figure 7. Response plot showing the effect of soaking time, water ratio and water temperature on the carbohydrate of peanut milk samples

4.1.6. Energy Content

As it can be seen in Table 2 the energy content of peanut milk samples ranged between 59 and 148kcal. As the water ratio increases in samples, there was a significant decrease in energy content ($p<0.01$). This finding corresponded to previous study which show increase water ratio in almond milk leads to decrease energy content [30]. The effects of the soaking time, water ratio and water temperature on the protein of samples are shown in Figure 8 the 3D plot. As a result of variance analyses soaking time and water temperature did not effect on the energy content of peanut milk samples. According to compositional analyses of optimized product, 13.10% dry matter, 0.20% ash, 7.2% fat, 4.0% protein, 1.7% carbohydrate and 88kcal/100mL energy were found. Cow’s milk contain nearly 12% dry matter, 3.7% fat, 3.3% protein, 65kcal/100mL energy. Compare to cow milk, optimized peanut milk similar protein value. However, optimized peanut milk has lower carbohydrate, higher fat content and energy value. While the percentage optimized product’ energy from protein, fat and carbohydrate were found 18.3%, 73.9%, 7.8% respectively, cow’s milk energy from protein, fat and carbohydrate 21.4%, 46%, 29% respectively. Nevertheless, of the 3.7g fat in cow’s milk, nearly 63% is saturated fat and 29% is monounsaturated fatty acids (MUFA). The content of MUFA (50%) and polyunsaturated fatty acids (PUFA)(37%) is considerably higher compare to saturated fatty acid in optimized peanut milk (13%). Both, MUFA and PUFA were found to have benefical health impacts on controlling cancer formation and cardiovascular events [35].

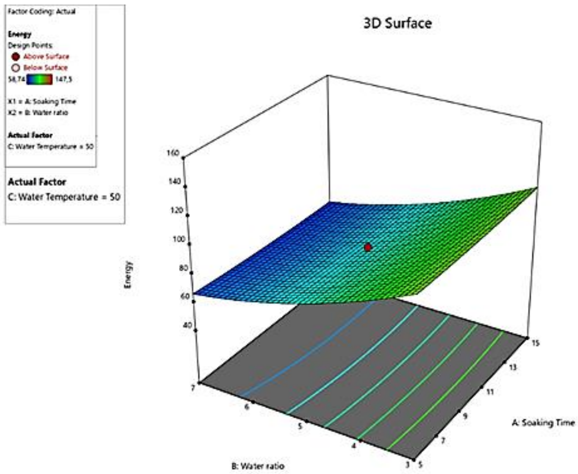

Figure 8. Response plot showing the effect of soaking time, water ratio and water temperature on the energy content of peanut milk samples

4.2. Sensory Analyses

Sensory evaluation of peanut milk samples is summarized in Table 3. The scores for appearance, colour, texture, flavor, aftertaste, overall acceptability and affordability were ranged from 3.1 to 4.7, 3.4 to 4.7, 1.9 to 4.4, 2.10 to 4, 2.4 to 4, 2.3 to 4 and 2.20 to 4 respectively based on the panelist assigned for each parameter using a 5- point hedonic scale. There were significant differences between peanut milk samples in terms of colour, consistency, overall acceptability and affordability. However, the statistical results indicate that no differences in appearance, flavour and aftertaste were found between peanut milk samples in terms of the soaking time, water ratio and water temperature. As it can be seen from Figure 9, the effect of the water ratio in the samples was found to be statistically significant on the score given to colour in the sensory evaluation ($p<0.05$). As the increase in water ratio, the score is given to colour increase. The effects of variables on the score given to consistency of the samples is shown in Figure 10. According to the analysis of variance, the effect of the soaking time was found to be significant in the scoring given by the panelists on the consistency ($p<0.05$). With the increase in soaking time, the scores of the panelists for consistency also increased. As it can be seen in Figure 11, the effect of water ratio was found to be significant in the scoring given on overall acceptability in sensory evaluation ($p<0.01$). In addition, the water temperature affected positively the score given by the panelists and this effect was found to be statistically significant ($p<0.05$). The effect of variables on affordability is shown in Figure 11. The effect of water ratio in the scoring given on affordability in sensory evaluation was found to be significant ($p<0.05$). Furthermore, the water temperature affected the score given by the panelists, and this effect was found to be statistically significant ($p<0.05$). Sample number 18 the highest score for overall acceptability and affordability.

Table 3. Sensory scores for plant based functional peanut milk samples

Sample	Apperance	Colour	Consistency	Flavor	Aftertaste	Overall Acceptability	Affordability
1	4.4±0.70	4.4±0.50	4.1±0.80	3.5±1.00	3.6±1.00	3.6±1.00	3.6±1.00
2	4.0±1.10	4.0±0.90	3.8±1.10	2.9±0.70	3.0±0.90	3.0±1.00	2.8±0.60
3	4.2±0.50	4.1±1.30	3.9±0.90	2.7±1.20	2.7±1.20	2.7±1.10	2.7±1.30
4	3.9±0.70	4.2±1.00	3.5±1.00	3.6±1.30	3.5±1.20	3.4±0.90	3.5±0.90
5	4.1±0.90	4.2±0.70	4.0±0.60	3.6±0.80	3.6±1.30	3.4±0.80	3.5±0.90
6	3.9±1.20	4.1±0.60	3.4±0.80	3.4±1.40	3.4±1.40	3.5±1.00	3.5±1.00
7	4.2±0.90	4.1±0.80	3.9±0.50	3.6±1.20	3.8±0.70	3.6±1.00	3.5±0.90
8	3.9±0.90	4.3±0.90	3.4±0.80	3.1±1.20	3.1±1.30	3.3±1.10	2.9±1.10
9	3.9±0.70	4.1±1.10	3.9±0.90	3.6±0.80	3.7±1.30	3.7±1.00	3.6±0.90
10	4.3±0.90	3.9±0.70	3.5±1.00	3.6±0.80	3.3±1.30	3.3±1.10	3.3±1.10
11	3.7±1.60	4.0±1.40	3.4±1.30	2.9±0.70	2.8±1.20	2.9±0.70	2.8±0.60
12	3.1±1.20	3.4±1.10	1.9±0.90	2.8±1.00	2.8±0.70	2.5±0.90	2.4±0.80
13	4.2±1.00	4.5±0.90	3.6±1.10	3.0±1.00	3.1±1.00	3.1±1.10	3.1±1.10
14	4.2±1.10	4.1±1.30	4.4±0.70	2.7±1.20	2.6±1.00	2.9±0.70	2.6±1.20
15	3.9±1.20	4.2±0.60	3.5±1.00	3.6±0.80	3.5±1.20	3.4±0.70	3.5±1.00
16	4.7±0.50	4.7±0.50	4.0±1.00	2.6±1.20	2.9±1.00	3.0±1.00	2.7±1.10
17	4.3±0.90	4.6±0.70	4.0±0.60	3.0±1.00	3.2±1.00	3.0±1.00	3.1±1.10
18	4.1±0.70	4.2±0.80	4.1±0.80	4.0±1.00	4.0±1.00	4.0±1.00	4.0±1.00
19	4.5±0.90	4.6±0.80	3.4±1.10	3.2±1.00	3.4±0.70	3.4±0.70	3.1±0.90
20	3.7±1.40	4.3±0.70	3.4±1.30	2.1±0.80	2.4±0.80	2.3±0.90	2.2±1.00

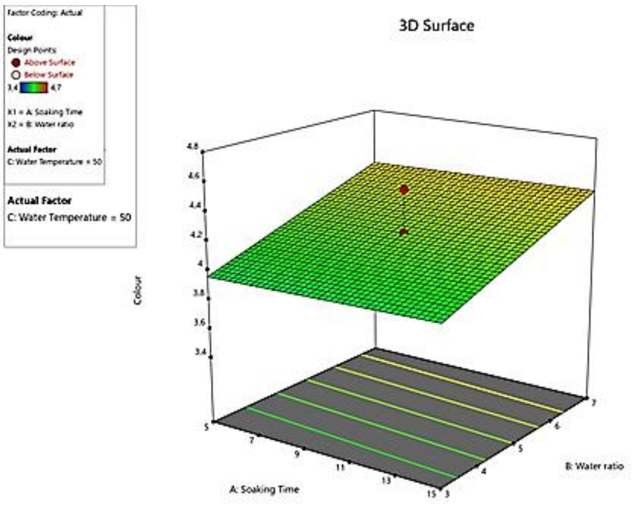

Figure 9. Response plot showing the effect of soaking time, water ratio and water temperature on the score given to colour of peanut milk samples

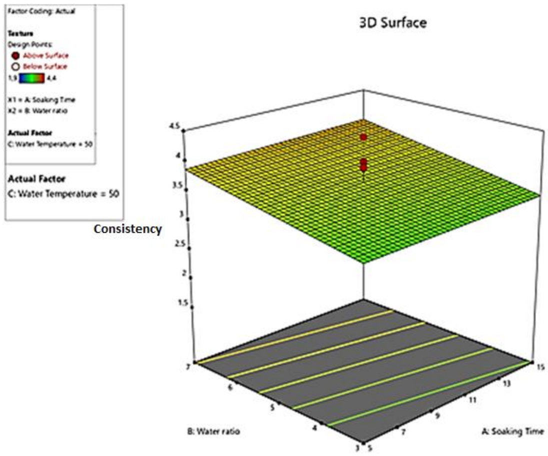

Figure 10. Response plot showing the effect of soaking time, water ratio and water temperature on the score given to consistency of peanut milk samples

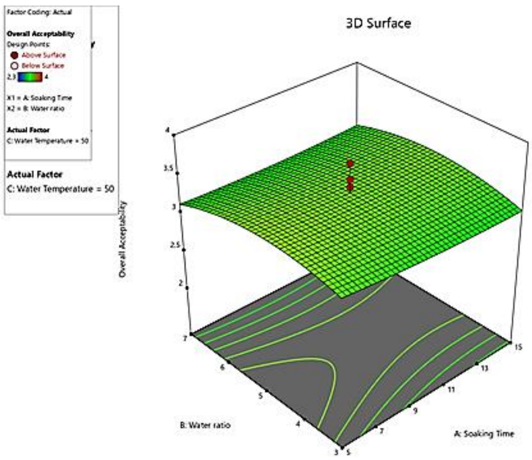

Figure 11. Response plot showing the effect of soaking time, water ratio and water temperature on the score given to overall acceptability of peanut milk samples

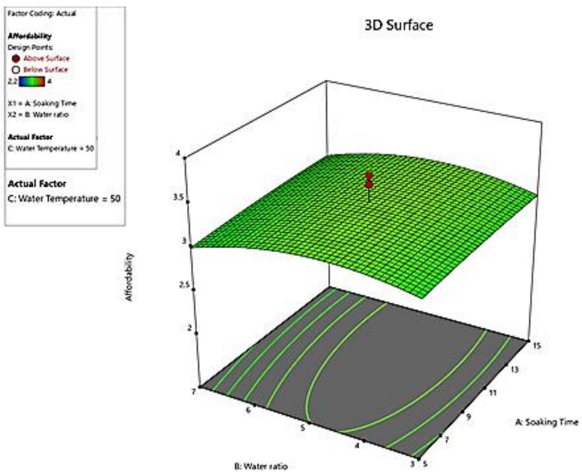

Figure 12. Response plot showing the effect of soaking time, water ratio and water temperature on the score given to affordability of peanut milk samples

4.3. Optimization of Peanut Milk

The optimisation of peanut milks was analysed by design expert packaged software of version 7.0 programme and optimal conditions were determined. Optimisation was determined by selected in range of fat and maximum values of dry matter%, overall acceptability scores and their combination. Peanut was optimisated as 14.78% of dry matter, %7.04 of fat content, 15 hours soaking time, 4.86 times water ratio, 68.01℃ water temperature. These optimum parameters were obtained selected based on the highest desirability value is determined 0.99 (Figure 13).

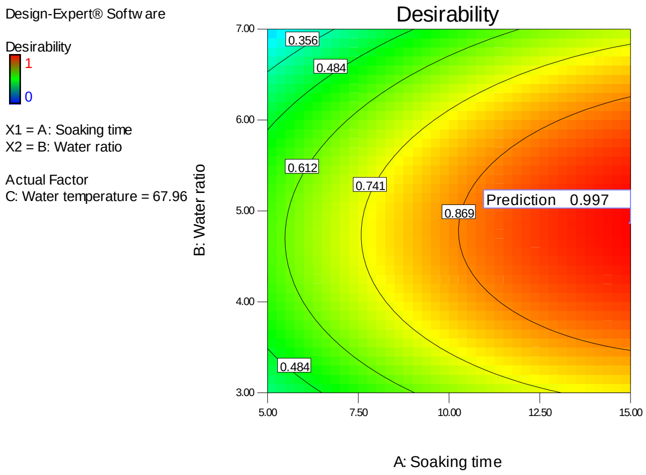

Figure 13. Response surfaces for the impact of soaking time, water ratio, water temperature on desirability

5. CONCLUSION AND RECOMMENDATIONS

In this study, different process parameters (soaking time, water ratio, water temperature) were evaluated in order to reach optimum process parameters. Sensory evaluation revealed that peanut milk production produced with optimum process condition is highly acceptable in properties of appearance, colour, consistency, flavour. The optimized peanut milk production chosen by the software was soaking time 15 hours, water ratio 4.86 times and water temperature 68.01℃ that gives the value of dry matter 14.78, ash 0.20, fat 7.04, protein 4.5, 4.04 carbohydrate and 4.28 overall acceptability. The values of optimized peanut milk produced according to optimize process parameters is 13.10 dry matter, 0.20 ash, 7.2 fat, 4 protein, carbohydrate 1.7 and 88kkcal/100mL, is close to values of getting from software. Peanut milk is a plant-based milk as an alternative to cow's milk, as it contains protein, minerals and essential fatty acids, except for individuals allergic to peanuts. In order to increase the consumption of the produced peanut milk, it can be both flavored and used in new functional foods. It can be concluded that peanut milk is recommended for does not contain lactose suitable for those with lactose intolerance, vegetarians, elders, cardiovascular, diabetic patients. Further studies are recommended to develeop a new product development and its in vivo and in vitro nutritional quality.

NOTICE

This study is derived from an ongoing doctoral thesis (Beyza Ozpalas).

CONFLICT OF INTEREST

The authors declared no conflict of interest.

FINANCIAL DISCLOSURE

This study was funded by Hatay Mustafa Kemal University, Scientific Research Projects Commission (Project Number:20.D.014).

DECLARATION OF ETHICAL STANDARDS

The authors of this article declare that the materials and methods used in this study do not require ethical committee permission and/or legal-special permission.

REFERENCES

[1] Ghoshal, G., (2019). Chapter 4-Beverages: A potential delivery system for nutraceuticals. Nutrients in of Beverages, 12, 1111-1142.
[2] Köten, M., (2020). Influence of roasted and unroasted terebinth (Pistacia terebinthus) on the functional, chemical and textural properties of wire-cut cookies. Food Science and Technology, 41:245-253.
[3] Granato, D., Branco, G.F., Nazzaro, F., Cruz, A.G., and Faria, J.A., (2010). Functional foods and nondairy probiotic food development: Trends, concepts, and products. Comprehensive Reviews in Food Science and Food Safety, 9(3):292–302.
[4] Shori, A.B., Baba, A.S., and Muniandy, P., (2019). Potential health-promoting effects of probiotics in dairy beverages. In Value-Added Ingredients and Enrichments of Beverages; Grumezescu, A.M., Holban, A.M., Eds., Academic Press, 173–204.
[5] Daou, C. and Zhang, H., (2012). Oat Beta-Glucan: its role in health promotion and prevention of diseases. Comprehensive Reviews in Food Science and Food Safety 11:355-65.
[6] Sevilmiş, G., (2013). Yükselen Trend: Fonksiyonel Gıdalar. AR&GE Bülten, 39-46.
[7] Chandrasekara, A. and Shahidi, F., (2018). Herbal beverages: Bioactive compounds and their role in disease risk reduction-A review. Journal of Traditional and Complementary Medicine, 8(4):451-458.
[8] Butu, M. and Rodino, S., (2019). Fruit and vegetable-based beverages—Nutritional properties and health benefits. Natural Beverages, 13:3033–3038.
[9] Mustafa, S.M. and Chua, L.S., (2020). Green technological fermentation for probioticated beverages for health enhancement. In Biotechnological Progress and Beverage Consumption, 407–434.
[10] Otles, S. and Cagindi, O., (2012). Safety considerations of nutraceuticals and functional foods. In Novel technologies in food science, 121-136.
[11] Orrù, S., Imperlini, E,. Nigro, E., Alfieri, A., Cevenini, A., Polito, R., Daniele, A., Buono, P., and Mancini, A., (2018). Role of functional beverages on sport performance and recovery. Nutrients, 10, 1470.
[12] Arı, Y., (2018). İzotonik içeceklerin sporcularda dayanıklılık performansı ve toparlanma seviyeleri üzerine etkileri. Gazi Üniversitesi Sağlık Bilimleri Enstitüsü. Doktora Tezi.
[13] Janssen, M., Busch, C., Rödiger, M., and Hamm, U., (2016). Motives of consumers following a vegan diet and their attitudes towards animal agriculture. Appetite, 105:643–651.
[14] Sebastiani, G., Herranz Barbero, A., Borrás-Novell, C., Alsina Casanova, M., AldecoaBilbao, V., Andreu-Fernández, V., and García-Algar, O., (2019). The effects of vegetarian and vegan diet during pregnancy on the health of mothers and offspring. Nutrients, 11(3).

[15] Fonteles, T.V. and Rodrigues, S., (2018). Prebiotic in fruit juice: Processing challenges, advances, and perspectives. Current Opinion in Food Science, 22:55-61.
[16] Vita, G., Lundström, J.R., Hertwich, E.G., Quist, J., Ivanova, D., Stadler, K., and Wood, R., (2019). The environmental impact of green consumption and sufficiency lifestyles scenarios in Europe: connecting local sustainability visions to global consequences. Ecological Economics, 164:106322.
[17] U.S. National Library of Medicine (2020). Lactose intolerance. Genetics Home Reference.
[18] Omoni, A.O. and Aluko, R.E., (2005). Soybean foods and their benefits: Potential mechanisms of action. Nutrition Reviews, 63(8):272–283.
[19] Pistollato, F., Iglesias, R.C., Ruiz, R., Aparicio, S., Crespo, J., Lopez, L.D., and Battino, M., (2018). Nutritional patterns associated with the maintenance of neurocognitive functions and the risk of dementia and Alzheimer's disease: A focus on human studies. Pharmacological research, 131, 32-43.
[20] Aydar, E.F., Tutuncu, S., and Ozcelik, B., (2020). Plant-based milk substitutes: Bioactive compounds, conventional and novel processes, bioavailability studies, and health effects. Journal of Functional Foods, 70, 103975.
[21] Isanga, J. and Zhang, G., (2009). Production and evaluation of some physicochemical parameters of peanut milk yoghurt. LWT-Food Science and Technology, 42(6):1132-1138.
[22] De Albuquerque, E.M.B., Almeida, F D.A.C., Gomes, J.P., Alves, N.M.C., and Da Silva, W.P., (2015). Production of "peanut milk" based beverages enriched with umbu and guava pulps. Journal of the Saudi Society of Agricultural Sciences, 14(1):61-67.
[23] Abou-Dobara, M.I., Ismail, M.M., and Refaat, N.M., (2016). Chemical composition, sensory evaluation and starter activity in cow, soy, peanut and rice milk. Journal of Nutritional Health & Food Engineering, *5*(3):1-8.
[24] Laso, M., Thompkinson, D.K., and Rani, R., (2019). Development of dietetic sweet spread using soy and peanut milk based Channa. The Pharma Innovation Journal 2019, 8(2):321-328.
[25] Sakthi, T.S., Meenakshi, V., Kanchana, S., and Vellaikumar, S., (2020). Study on standardisation and quality evaluation of peanut milk by different processing methods. European Journal of Nutrition & Food Safety, 60-72.
[26] Siddeeg, A., Salih, Z.A., Ammar, A.F., Saeed, N.S.M., Howladar, S.M., and Alzahrani, F.O., (2020). Production of peanut milk and its functional, physiochemical, nutritional and sensory characteristics. Annual Research & Review in Biology, 79-88.
[27] AACC Approved Methods of American Association of Cereal Chemists International, St. Paul, MN, USA, (1990).
[28] Gibson, R.S., (1990). Principles of nutritional assessment. Oxford Press.
[29] Meilgaard, M.C., Civille, G.V., and Carr, B.T., (1999). Sensory evaluation techniques. 3rd ed. Boca Raton, FL: CRC Press.
[30] Ceylan, M.M. and Özer, E.A., (2020). Optimisation of Almond Milk Producing Using Response Surface Method. Journal of Agriculture, *3*(1):6-32.
[31] Jain, P., Yadav, D.N., Rajput, H., and Bhatt, D.K., (2013). Effect of pressure blanching on sensory and proximate composition of peanut milk. Journal of Food Science and Technology, 50(3):605-608.

[32] Nelson Somogi, L.R., (2000). Chemical, physical and sensory characteristics of soy milk as affected by processing conditions. Journal of Food Science, 57:401–405.
[33] Laswai, H.S., Thonya, N., Yesaya, D., Silayo, V.C.K., Kalwa, K., Mpagalile, J.J., and Ballegu, W.R.N., (2009). Use of locally available flavouring materials in suppressing the beany taste in soy milk. African Journal of Food Agriculture Nutrition and Deveoplement, 9(7):1548-1560.
[34] Hayes, M.G., Fox, P.F., and Kelly, A.L., (2005). Potential applications of high-pressure homogenization in processing of liquid milk. Journal of Dairy Research. 72:25–33.
[35] Vanga, S.K. and Raghavan, V., (2018). How well do plant based alternatives fare nutritionally compared to cow's milk?. Journal of Food Science and Technology, 55(1):10-20.