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Effects of Different Processing Parameters on Proximate Composition and Sensory Qualities of Soymilk

Folorunso A. A.[1, *], Omoniyi S. A.[2], Habeeb A. S.[1]

[1]Department of Nutrition and Dietetics, Federal Polytechnic, Bida, Niger State, Nigeria
[2]Department of Home Science and Management, Federal University, Gashua, Yobe State, Nigeria

Email address

kunlefolly2@yahoo.com (Folorunso A. A.)

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Abstract

The study evaluated the effects of different processing parameters on proximate composition and sensory qualities attributes of soymilk. Soymilk was prepared using three different soaking times, milling times and boiling times, and combination of these parameters were used to formulate nine different soymilk samples. The soymilk samples were subjected to proximate and sensory analyses. There were significantly different ($p<0.05$) in moisture, crude protein, crude fat, carbohydrate and energy (calorie) contents of the soymilk samples. The data for the proximate composition ranging from 69.38 to 72.65%, 11.14 to 14.49%, 1.87 to 3.12%, 00.1 to 0.85%, 0.25 to 0.85%, 10.81 to 15.61% and 114.35 to 132.88Kcal for moisture, crude protein, crude fat, ash, crude fibre, carbohydrate and energy (calorie) contents respectively. There was no significant difference ($p > 0.05$) in value obtained for flavour, viscosity, colour and overall acceptability of the soymilk samples. The data for sensory analysis ranging from 3.15 to 4.35, 3.05 to 4.05, 3.15 to 3.85, 2.95 to 4.10 and 3.30 to 4.25 for taste, flavour, viscosity, colour and overall acceptability respectively. The study showed that all the processing parameters used in the study reduced the beany taste and flavour of the soymilk samples which led to the acceptable of all the sensory qualities by the panelists.

Keywords

Soymilk, Processing Parameters, Beany Taste, Proximate Composition, Sensory Qualities

1. Introduction

Soybeans (*Glycine max*) are grown all over the world in both temperate and tropical climate. Soybean is one of the richest and cheapest sources of plant protein that can be used to improve the diet of millions of people, especially the poor and low income earners in developing countries because it produces the greatest amount of protein used as food by man [1].Soybean is a cheap source of quality protein that is superior to all other plant foods because it has good balance of the essential amino acids and it contains a reasonable amount of methionine [2]. Soybean is an excellent source of protein (35-40%), rich in calcium, iron, phosphorus and vitamins, and also the only source of all the essential amino acids [3]. It also contains isoflavones, which have been linked to reduced risk of most hormone associated health disorders [4].

Among the numerous soy food items, soymilk had been the first product ever prepared and consumed by human since long ago [5].

Soymilk not only provides protein but also is a source of carbohydrate, lipid, vitamins and minerals [6]. Soymilk is a healthy drink and is important for people who are allergic to cow milk protein and lactose [7]. However, soymilk is usually characterized with beany taste; improvement in the flavour of soymilk will therefore go a long way in improving its acceptability and consumption. A lot of study has been done in the bid to remove the beany flavour in soymilk using flavouring and enzymes [7]. [8] reported that processing of soybeans using various form of heat treatment improve texture, palatability, as well as nutritional and sensory quality characteristics and that the degree of improvement depends on the on the temperature, moisture content and duration of heating.

Some people do not enjoy the taste of original soymilk, as it contain beany taste hence, manufactures now offer flavoured soymilk. In order to get rid of beany taste and flavour without cause great reduction in nutritional composition of soymilk, there is need to use good processing parameters to produce nutritious soymilk that will be acceptable by consumers. Also, over heating of soymilk to eliminate trypsin inhibitors activity to a great extent can cause damage to amino acids, as well as loss in all nutritional value of soymilk. Many methods have been reported for the production of good quality, bland tasting and flavoured soymilk. However, the processing methods that will produce high quality of soymilk and also produce good nutritious food that acceptable among consumers are critical for the development of soy based product. Also, little work has been reported on effect of the different combinations of specific production operations such soaking time, milling time, blanching among others on proximate composition and quality attributes of soymilk. Thus, there is need to vary processing parameters such as soaking time of soybean seeds, milling time of soybean seeds and boiling times of the soymilk. This study is aimed to produce soymilk from combinations of different soaking times of soybean seeds, milling times of soybean seeds and boiling times of the soymilk, and then determine the proximate composition and sensory qualities of the soymilk samples.

2. Materials and Methods

2.1. Materials

Soybean seeds were obtained from National Cereals Research Institute, Badeggi, Niger state, Nigeria while sugar was purchased from the Central market, Bida, Niger state.

2.2. Processing Methods of the Soymilk

Different processing parameters were combined for the production of the soymilk samples. The soybean seeds were soaked at different times (30, 60 and 90 minutes), milled at different times (5, 10 and 15 minutes) while soymilk was boiled at different temperature (60, 80 and 100°C) [Table 1]. However, the three different soaking times, milling times and boiling temperatures brought nine (9) different soymilk samples (Table 2). The method described by [9] was used for the production of soymilk.

Table 1. *Different soaking time, milling time and boiling temperature for the production of Soybean.*

Soaking time (minutes)	Milling time (minutes)	Boiling temperature (°C)
30	5	60
60	10	80
90	15	100

Table 2. *The combination of soaking time, milling time and boiling temperature for nine different soymilk samples.*

Sample	Soaking time (minutes)	Milling time (minutes)	Boiling temperature (°C)
1	30	5	60
2	60	10	60
3	90	15	60
4	30	5	80
5	60	10	80
6	90	15	80
7	30	5	100
8	60	10	100
9	90	15	100

2.3. Proximate Composition Determination

The methods [10] were used to determined moisture content, protein content, crude fat, crude fibre and ash while carbohydrate content was determined by difference. Energy values were calculated according to method described by [11].

2.4. Sensory Evaluation of Soymilk Samples

The soymilk samples were evaluated for taste, flavour, texture, colour and overall acceptability. A panel consisting of 50 judges who are Students of department of Nutrition and Dietetics, Federal Polytechnic, Bida, Niger State were asked to indicate their preference for taste, flavour, texture, colour and overall acceptability using a 5-point hedonic scale where dislike extremely = 1, dislike moderately = 2, like fairly = 3, like moderately = 4 and like extremely = 5.

2.5. Statistics Analysis

All analyses were done in triplicate. Statistical analysis was done using Analysis of variance (ANOVA) was carried out and where there is significant difference, means were separated using Duncan's multiple range test. Statistical analysis was carried out with the use of SPSS version 21.0 software.

3. Results and Discussion

Table 3 shows the proximate composition of the soymilk samples. They were significantly different ($p<0.05$) in moisture, crude protein, crude fat, carbohydrate and energy (calorie) contents of the soymilk samples. The proximate composition ranging from 69.38 to 72.65%, 11.14 to 14.49%, 1.87 to 3.12%, 00.1 to 0.85%, 0.25 to 0.85%, 10.81 to 15.61% and 114.35 to 132.88Kcal for moisture, crude protein, crude fat, ash, crude fibre, carbohydrate and energy (calorie) contents respectively. The highest moisture and ash contents were observed in soymilk sample (30min: 5min: 100°C) while the highest crude fat and energy contents were observed in soymilk sample (60min: 10min: 80°C). However, the highest protein, crude fibre and carbohydrate contents were observed in soymilk sample 90min:15min: 80°C, 30min: 5min:60°C and 60min: 10min: 60°C respectively. The result showed that all the soymilk samples have high protein content irrespective of the processing parameter. The value obtained for protein, crude fibre and carbohydrate contents of the soymilk samples were higher than the results of protein, crude fibre and carbohydrate contents of the soymilk reported by [5]. However, the moisture and crude fat contents of soymilk

reported by [5] were higher the values obtained for soymilk samples in this study. Also, the value obtained for protein and carbohydrate contents of the soymilk samples were higher than the results of protein and carbohydrate contents of the soymilk reported by [12].

Table 3. *Proximate composition of soymilk samples.*

Soymilk samples (Soaking time: Millingtime: Boiling time)	Moisture content (%)	Protein (%)	Crude fat (%)	Ash (%)	Crude fibre (%)	Carbohydrate (%)	Energy (Kcal/100g))
30min: 5min:60°C	70.62±0.70^{ab}	13.98±0.20^{abc}	1.87±0.34^{c}	0.80±0.03^{a}	0.85±0.01^{a}	11.88±0.52^{ab}	120.27±4.36^{abc}
60min: 10min:60°C	69.52±0.88^{a}	12.07±0.13^{de}	2.00±0.15^{c}	0.10±0.01^{a}	0.70±0.01^{a}	15.61±0.64^{a}	128.72±4.39^{ab}
90min: 15min:60°C	72.43±0.41^{ab}	11.14±1.45^{e}	2.12±0.10^{bc}	0.01±0.03^{a}	0.65±0.02^{a}	13.65±1.82^{ab}	118.24±1.37^{bc}
30min: 5min:80°C	71.27±2.23^{ab}	12.33±0.28^{d}	2.00±0.15^{c}	0.80±0.01^{a}	0.45±0.01^{a}	13.15±2.38^{ab}	119.92±9.77^{bc}
60min: 10min:80°C	69.38±1.06^{b}	12.89±1.03^{d}	3.12±0.06^{a}	0.60±0.00^{a}	0.70±0.01^{a}	13.31±2.02^{ab}	132.88±4.47^{a}
90min: 15min:80°C	70.67±0.72^{ab}	14.49±0.47^{a}	2.68±0.71^{ab}	0.60±0.01^{a}	0.75±0.01^{a}	10.81±1.91^{b}	125.32±11.36^{abc}
30min: 5min:100°C	72.65±2.10^{a}	13.17±0.01^{bcd}	1.91±0.12^{c}	0.85±0.01^{a}	0.30±0.00^{a}	11.12±1.96^{b}	114.35±8.91^{c}
60min: 10min:100°C	70.92±3.15^{ab}	12.92±0.23^{cd}	2.37±0.63^{bc}	0.13±0.01^{a}	0.25±0.01^{a}	13.41±4.02^{ab}	126.65±9.50^{abc}
90min: 15min:100°C	70.68±0.71^{ab}	14.07±0.07^{ab}	2.09±0.02^{bc}	0.15±0.01^{a}	0.55±0.01^{a}	12.46±0.66^{ab}	124.93±2.75^{abc}

Means with different superscripts in the same column are significant different ($p<0.05$)

Table 4 shows the sensory qualities of the soymilk samples. There were no significant difference ($p > 0.05$) in value obtained for flavour, viscosity, colour and overall acceptability. The data for sensory analysis ranging from 3.15 to 4.35, 3.05 to 4.05, 3.15 to 3.85, 2.95 to 4.10 and 3.30 to 4.25 for taste, flavour, viscosity, colour and overall acceptability respectively. The result revealed that all the sensory qualities (taste, flavour, viscosity, colour and overall acceptability) of all the soymilk samples were acceptable by the Panelists. However, the soymilk sample (90min: 15min: 100°C) has the highest mean score for taste, flavour texture and overall acceptability. Also, soymilk sample (60min: 10min: 100°C) has the highest mean score for the colour. This result showed that soymilk sample (90min:15min:100°C) was rated highest in terms of sensory qualities of the soymilk samples and this revealed that this processing parameter has better effect on the reduction of beany taste and flavour of soymilk than other processing parameters. The study showed that all the processing parameters reduced the beany taste and flavour of the soymilk samples to minimal level.

Table 4. *Sensory qualities of soymilk samples.*

Soymilk samples (Soaking time: Milling time: Boiling time)	Taste	Flavour	Texture	Colour	Overall acceptability
30min: 5min: 60°C	3.64±0.99^{ab}	3.44±0.99^{a}	3.46±1.00^{a}	3.51±0.89^{a}	3.74±1.11^{a}
60min: 10min: 60°C	3.64±1.14^{ab}	3.44±0.94^{a}	3.46±0.75^{a}	3.51±1.08^{a}	3.74±1.08^{a}
90min: 15min: 60°C	3.65±0.62^{ab}	3.35±1.10^{a}	3.45±1.04^{a}	3.50±1.05^{a}	3.80±1.10^{a}
30min: 5min: 80°C	3.60±0.75^{ab}	3.45±0.85^{a}	3.40±0.60^{a}	3.30±1.00^{a}	3.30±0.88^{a}
60min: 10min: 80°C	3.65±0.88^{b}	3.15±0.94^{a}	3.15±0.77^{a}	3.45±0.81^{a}	3.55±0.60^{a}
90min: 15min: 80°C	3.65±0.75^{ab}	3.10±1.00^{a}	3.40±0.95^{a}	2.95±0.72^{a}	3.60±0.93^{a}
30min: 5min: 100°C	3.15±0.59^{b}	3.05±0.76^{a}	3.20±0.59^{a}	3.50±0.79^{a}	3.45±0.64^{a}
60min: 10min: 100°C	3.85±0.92^{ab}	3.95±0.91^{a}	3.80±0.99^{a}	4.10±0.86^{a}	4.20±0.76^{a}
90min: 15min: 100°C	4.35±6.73^{a}	4.05±1.01^{a}	3.85±1.10^{a}	3.90±0.76^{a}	4.25±1.39^{a}

Means with different superscripts in the same column are significant different ($p<0.05$)

4. Conclusion

The study showed that all the soymilk samples produced from nine different processing parameters have high protein content with processing parameter (90min: 15min: 80°C) having a better effect on the protein content of the soymilk. Also, all the processing parameters used in the study reduced the beany taste and flavour of the soymilk samples which led to the acceptability of all the sensory qualities by the panelists.

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