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EFFECT OF BLANCHING ON THE PHYSICO-CHEMICAL AND SENSORY PROPERTIES OF SOYMILK

EJIM, M.N AND OMACHI B.A
Department of Nutrition and Dietetics, Federal Polytechnic, P.M.B, 55, Bida, Niger State.

ABSTRACT

In this study, soybean seeds were blanched at 70^{0}C and 95^{0}C each for 15 and 30 minutes respectively. The blanched seeds were dehulled and oven dried at 100^{0}C for 40 minutes and milled into soyflour. The soyflour samples were each dissolved in cold water at 20^{0}C and hot water at 100^{0}C to obtain soymilk resulting in to eight samples. After that, the eight soymilk samples were pasteurized at 72^{0}C for 15 seconds and allowed to cool. The samples of soymilk were subjected to physico-chemical and sensory quality analysis. The effect of varying blanching temperature and time on the pH of soymilk showed no significant difference (P>0.05) among samples with values ranging from 6.15 -6.50 the total titratable acidity (TTA) reduced

Introduction:

Soybeans are excellent sources of protein both in quality and quantity. According to Ayo *et al.,* (2011) soybeans contribute approximately 20% protein to diet of animals and humans. Soybean contains 35 – 40% protein with all the indispensible amino acids Serreme*t al.,* (2011). For thousand years, the Chinese and people in the neighboring countries consumed soybeans in various form including Tofu, Soy sauce, Miso among others. Like soymilk, soy foods are

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significantly (P<0.05) among all sample as values ranged between0.41-0.21The effect of blanching soybean seeds on the sensory properties of soymilk showed that flavor increased with increase in blanching temperature and time. The values ranged between 6.55 and 7.95 for cold water extracted soymilk and 6.85 to 8.35 for hot water extracted \soymilk.The score for mouth feel also increased with increase blanching temperature and time. The values ranged between 6.40 to6.70 and 6.75 to 7.75 for cold and hot water extracted milk respectively on a nine point hedionic scale. The general acceptability of soymilk products increased significantly (P<0.05) as blanching temperature and time increased. Though all the soymilk products were acceptable, sample H blanched at 95^0C, 30mins, hot water extraction was most accepted by the panelists.However, the scores for appearance decreased significantly (p<0.05) with increase in blanching temperature and time with scores ranging from 8.35 to 6.60. Therefore, blanching of soybeans using different temperature and time combinations resulted to milk of high physico-chemical and sensory qualities.

Keywords: Soymilk, Blanching, Physico-chemical and Sensory properties.

becoming some of the fastest growing categories in the food industry. Despite the benefits derived from soy proteins, proper processing of soybeans in various products is important to remove trypsin inhibitors and lipoxygenase enzyme. The greatest setback to the general acceptability of soymilk from soybean is the beany off flavor (Oloye, 2014). The concept of soymilk preparation to minimize the beany off flavor is based on specific principles. The critical variables include the temperature at which blanching is set and the temperature of water used for milk extraction. The

manipulation of these variables leads to obtaining soymilk with variable physico–chemical, sensory, rheological and microbiological quality characteristics. Various methods have been used to minimize the beany off flavor including simple oriental traditional method, Chinese village procedure, Japanese soymilk procedure, stage by stage extraction (Netherlands) method, steam Infusion method, and University of Agriculture Makurdi method. These methods considered the volume of water used in soaking and time to stop the process. The methods also considered water added to the slurry and extent the resulting slurry is handled prior to soymilk extraction. In this study, soymilk is to be made from soyflour prepared at varying blanching temperature and time which is yet to be addressed by research. The advantage of making milk from flour is that the flour can be easily stored, there is somewhat less of a beany flavor problem, it is easier to ship dry flour long distance than to ship liquid milk or even whole soybean and this avenue becomes the most feasible for popularizing soymilk consumption. Hence this research is aimed at investigating the effect of blanching on the quality of milk from soyflour.

MATERIALS AND METHODS

Source of Materials:

Samsoy 2, soybean variety used for the study was obtained from national Cereals Research Institute (NCRI) Badeggi, Niger State. The water used for processing was obtained from the borehole at the University of Agriculture Makurdi, Benue State.

Production of Soymilk from Soyflour

Soybean were sorted to remove dirt and stones, soaked for 18 hours and dehulled. Dehulled grains were blanched using water bath (model No: JB 5/110976) at 70^0C for 15 minutes and 30 minutes and

95^{0}C for 15 minutes and 30 minutes. The grains were placed in an oven (Model No MC – 1953) and allowed to dry at 100^{0}C for 40 minutes. The dried samples were milled to soyflour using attrition mill (model No: ABC 33. Hanson). The soyflour were dissolved (1:3) in cold water at 20^{0}C and hot water at 100^{0}C respectively for 10 minutes to extract soymilk which was filtered using a muslin cloth (0.5mm) and pasteurized at 72^{0}C for 15 seconds as presented in Figure 1.

Determination of Physico-chemical Properties

Determination of pH

The pH of the soymilk was measured with a calibrated digital pH meter (model pH B – 3, Shanghai Sanxin Meter Factory, Shanghai China).

Determination of Viscosity

Viscosity was measured at 27±1^{0}C using a Rotational Brookfield Viscometer (Model LV DV – II + Pro, Brookfield Engineering Labs, Inc. Middleborg MA, USA) and Viscosity readings taken at 60 revolutions per minute.

Determination of Total Titrable Acidity (TTA)

Twenty five milliliters (25ml) of the sample was pipetted into conical flasks and two drops of 0.1N phenolphthalein indicator added. The mixture was treated against 0.1N NaOH until the first permanent pink colour appeared. The titratable acidity was the calculated and expressed as percent lactic acid (AOAC, 2005).

Determination ofBrix

Digital table refractometer (DR600-T) automatically controlled to 20^{0}C was used to determine the Brix of the soymilk samples.

Sensory Evaluation

Ten untrained panelist comprising of staff and students of University of Agriculture Makurdi were used for the evaluation of the quality parameters (flavor, mouth feel, colour, and general acceptability) of the soymilk samples. The panelists were asked to indicate their preference using a nine-point Hedionic scale with 9 and 1 representing 'Liked Extremely' and 'Disliked Extremely' respectively (Iwe, 2007).

Experimental Design:

2×2x2 factorial comprising of blanching temperatures of 70°C and 95°C, blanching time of 15minutes and 30minutes using cold and hot water for extraction as shown in Figure 2.

Statistical Analysis

The GENSAT statistical programme (Rothamsted Experimental Statron, 2007) was used for the analysis. Data were subjected to analysis of variance (ANOVA) and the difference between means were assessed by the least significant difference (LSD).

RESULTS AND DISCUSSION

Table1: Effect of Blanching Soybean Seeds on the Physico-chemical Properties of Soymilk

	Cold H_2O Extraction					Hot H_2O Extraction				
Parameters	A	B	C	D		E	F	G	H	LSD
pH	6.15[a]±0.1	6.20[ab]±0.4	6.24[ab]±0.1	6.30[ab]±0.1		6.32[ab]±0.2	6.36[ab]±0.0	6.40[ab]±0.2	6.50[b]±0.1	0.15

TTA (%)	0.41 ^{a}±0.1	0.34 ^{a}±0.03	0.30^{a}± 0.02	0.29 ^{a}±0.2		0.28 ^{a}±0.00	0.26 ^{a}±0.02	0.24 ^{a}±0.00	0.21 ^{a}±0.1	0.12
BRIX (%)	3.78 ^{a}±0.2	4.02 ^{a}±0.1	4.21 ^{a}±0.1	4.30 ^{a}±0.3		4.35 ^{a}±0.1	4.40 ^{a}±1.2	5.11 ^{ab}±0.1	6.20^{b} ±0.2	0.04
Viscosity MPas	2400^{e} ±3.0	2300^{d} ±6.0	2250^{d}± 14.0	2000^{c} ±12.0		2020^{c}± 6.0	1800^{b} ±10.0	1750^{ab} ±20.0	1700^{a} ±28.0	0.00

Values are means ± SE of duplicate determinations, means in the same row not followed by the same superscript are significantly different at 5% level (P<0.05)

Key

A – Blanched at 70^{0}C, 15mins, Cold water for dissolving/extraction
B – Blanched at 70^{0}C, 30mins, Cold water for dissolving/extraction
C – Blanched at 95^{0}C, 15mins, Cold water for dissolving/extraction
D – Blanched at 95^{0}C, 30mins, Cold water for dissolving/extraction
E – Blanched at 70^{0}C, 15mins, Hot water for dissolving/extraction
F– Blanched at 70^{0}C, 30mins, Hot water for dissolving/extraction
G – Blanched at 95^{0}C, 15mins, Hot water for dissolving/extraction
H – Blanched at 95^{0}C, 30mins, Hot water for dissolving/extraction
LSD- Least significant differences

Effect of Blanching on the Physico-chemical Properties of Soymilk

A low acid food is defined as a food having a pH of more than 4.6 while high acid food is defined as a food with pH value of 4.6 or lower. (Kesenkas *et al*.,2011). The pH of soymilk droped with increase in blanching temperature and time.However.samples A, B, C and D extracted using cold water produced soymilk with lower pH ranging from 6.15 to 6.30 than samples E, F, G and H ranging from 6.32 to 6.50.

Rehman*et al.* (2007) reported that the pH at room temperature is.7 meaning that there are about 10-7 moles of H+ per liter of water at room temperature. As the temperature increases, the ability of water to ionize in this way increases and so the concentration of H + in the solution will increase hence the pH will drop. Kesenkas*et al*.(2011) further stated that the pH of soymilk increased because the concentration of hydrogen ions increased. The fact that all the pH values were below neutral (7.0) is an indication that microbial growth will not be encouraged in the soymilk samples. The values obtained are similar to the observations of Ikya*et al*. (2013) in Effect of cooking temperature on some quality characteristic of soymilk and Sang – Do *et al*. (2015) in Effect of Blanching and Germination of soybeans on the quality of soymilk.

Total titratable acidity (TTA) deals with, measurement of the total acid in a solution.(Miller, 2008). In this study, the total titratable acidity of soymilk products decreased with increase in blanching temperature and time. However, soymilk samples E, F, G, and H extracted using hot water produced soymilk with lower TTA values than samples A, B, C, and D extracted using cold water. Susu*et al.* (2013) in food quality improvement of soymilk reported that acids are volatile to high temperature thereby causing a reduction in the total titratable acidity of soymilk made from shot – time germinated soybeans. The observations in this study are similar to the findings of kesenkas*et al*. (2011) in physico-chemical, microbiological and sensory characteristic of soymilk.

One of the most common uses of brix today is determining dissolved solids (sugar levels) in fresh produce. (Marcela *et al*., 2013). There is a direct correlation between plant's Brix value and its taste (Jeelani *et al.,* 2014). In this study, there was progressive increase in the Brix level as processing temperature and time increased. This could be attributed to the report by Marcela (2013) that rise in the

carbohydrate content of the soymilk products with increase in processing temperature and time increased the brix level. However, values obtained in this experiment were similar to the findings of Mamta*et al.*(2015).

There was decrease in the viscosity of soymilk samples with increase in blanching temperature and time. However soymilk products extracted using hot water had lower viscosity values ranging from 2020-1700MPas. The decreasing trend might be attributed to the observations of Mamta*et al.*(2015) that liquids show a reduction in viscosity with increasing temperature because the attractive binding energy is reduced and therefore the viscosity is reduced. Falade *et al*. (2015) further stated that in some liquids, a decrease of 1^0C already causes 10% increase viscosity.

Table 2: Effect of Blanching Soybean Seeds on the Sensory Characteristics of Soymilk

	Cold H_2O Extraction					Hot H_2O Extraction				
Parameters	A	B	C	D		E	F	G	H	LSD
Flavour	6.55^{a} ±0.13	6.60^{a} ±0.15	7^{b}.40 ±0.11	7.95^{c} ±0.11		6.85^{a} ±0.08	7.35^{b} ±0.19	7.65^{b}^{c} ±0.13	8.35^{d} ±0.12	0.00
Mouth feel	6.40^{a} ±0.13	6.53^{a}^{b} ±0.18	6.60^{c}^{d} ±0.17	6.70^{e} ±0.15		6.75^{a}^{b} ±0.18	7.00^{b}^{c} ±0.15	7.75^{d}^{e} ±0.16	7.70^{d}^{e} ±0.14	0.00
Appearance	8.35^{d}±0.13	6.90^{a}^{b} ±0.12	6.60^{a} ±0.11	6.60^{a} ±0.13		7.50^{c} ±0.14	7.05^{b} ±0.15	7.10^{b} ±0.10	6.60^{a} ±0.15	0.00

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General acceptability	6.50[a]± 0.14	6.85[a] [d] ± 0.18	7.45[bc] ± 0.15	8.40 [e] ± 0.11		7.85[c] ± 0.18	7.35[b] ± 0.11	7.95[d] ± 0.15	7.85[c] [d] ± 0.18	0.00

Values are means± SE of duplicate determinations. Means in the same row not followed by the same superscript letters are significantly different at 5% level (P<0.05)

Key

A – Blanched at 70°C, 15mins, Cold water for dissolving/extraction
B – Blanched at 70°C, 30mins, Cold water for dissolving/extraction
C– Blanched at 95°C, 15mins, Cold water for dissolving/extraction
D – Blanched at 95°C, 30mins, Cold water for dissolving/extraction
E– Blanched at 70°C, 15mins, Hot water for dissolving/extraction
F – Blanched at 70°C, 30mins, Hot water for dissolving/extraction
G– Blanched at 95°C, 15mins, Hot water for dissolving/extraction
H – Blanched at 95°C, 30mins, Hot water for dissolving/extraction
LSD-Least significant differences

Effect of Blanching Soybean Seeds on Sensory Properties of Soymilk

The scores for flavor, month feel, and general acceptability increased significantly (P< 0.05) with increase in blanching temperature and time. However, soymilk products extracted using hot water, obtained higher scores generally than those extracted using cold water. This meant that blanching at higher temperature of 95^0C for 30minutes produced the soymilk with improved flavor. This may be attributed to the findings of Oloye (2014) that enzyme inactivation by blanching at temperatures between 70^0C and 100^0C prior to grinding of the soybeans prevented formation of painty (oxidized) flavor in a bland product. This increase is in agreement with the report of Ikya *et al*.

(2013) in the effect of cooking temperature on some quality characteristics of soymilk. Tunde-Akintunde and souley (2009) reported similar scores in the effect of processing methods on the quality of soymilk.

The scores for month feel of the soymilk products continued to improve with increase in blanching temperature and time. This was in agreement with Ayo *et al*. (2007) who observed that high temperature blanching and grinding with hot water reduced a chalky mouth feel because the heat breaks down the grainy particles in the soybean on the contrary, Ikya *et al* (2013) reported that concentration made the soymilk heavier thus increasing the mouth feel, which became objectionable to the panelists. The mouth feel scores were similar to the findings of Wikens *et al*. (2007) in the effect of processing on oxidative off flavor of soymilk. Sang-Do *et al*. (2015) reported similar scores in effect of blanching and germination of soybeans on the quality of soymilk.

Food appearance is a critical factor for acceptance of food items by consumers (Bahare, 2009). The appearance of soymilk samples decreased significantly ($P<0.05$). This was in agreement with the report of Ayo *et al*. (2007) that millard browning reactions, which usually occur between reducing sugars and amino groups in proteins and amino acids. These reactions are encouraged by increase in temperature, pH and concentration of reactants are accompanied by destruction of some amino acids (Ikya *et al*., 2013).

Though all the soymilk products were acceptable, blanching at 95^0C for 30 minutes, using hot water for extraction gave the highest acceptability score of 8.40.

CONCLUSION AND RECOMMENDATIONS

The following conclusions were established from the study;

Organoleptically acceptable and nutritious soymilk was successfully produced from soyflour.

The physico-chemical parameters were also similar as the pH and Brix of the soymilk samples increased with increase in blanching temperature and time while the total titrable acidity and viscosity (TTA) decreased.

The sensory characteristics reveals that the judges preferred the flavour of sample H (blanched at a 95^0C for 30mins, hot water extraction) more than other samples.

Therefore, the result of the present study shows that soymilk produced from soy flour carries great organoleptic and nutritional advantage when placed in the market.

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