MedCrave
Step into the World of Research

Journal of Nutritional Health & Food Engineering

Research Article

Open Access

CrossMark

Effect of yoghurt–milk enrichment with whole soy bean flour

Abstract

The potential of symbiotic yoghurt enrichment with soybean flour was studied yoghurt control Sample A: 100% Milk powder (Dano) and o% whole soyabean flour ,Sample B: 90% milk powder (Dano) and 10% whole soybean flour, Sample C: 80% milk powder (Dano) and 20% whole soybean flour, Sample D: 70% milk powder (Dano) and 30% whole soybean flour, Sample E: 60% milk powder (Dano) and 40% whole soy bean flour were produced respectively. The proximate composition, physical, chemical properties and sensory evaluation were determined using standard methods. The results on proximate obtained showed increase in values for moisture (77.79-89.34)%, protein (3.06-9.23)%, fat content (1.57-3.97)% and fiber content (0.18-2.45)%.A reversed trend was observed for ash and carbohydrate values. The physiochemical analysis results obtained showed decrease in total solids (22.21-10.66)%, total solid non-fat (201.64-6.70)%, TTA (1.34-0.78)%, viscosity (10.54-0.86) Pa.s and P^{H} with observed increased from (4.5-5.13). The sensory evaluation result showed that there were no significant difference p>0.05 between the control and sample B in appearance but there were significance difference p<0.05 between the control and the enriched sample in terms of aroma, taste, mouthful and overall acceptability. It was observed that substituting 10% whole soybean flour with powdered milk gave the yoghurt the ranked characteristic as the control, whole yoghurt in terms of general acceptability.

Keywords: soybean, flour, yogurt-milk, enrichment, physiochemical

Volume 9 Issue 3 - 2019

Amove J,[1] Ogori AF,[2] Aondoakaa PI[3]

[1,3]Department of Food Science and Technology, Federal University of Agriculture, Nigeria
[2]Department of Home Science, Faculty of Agriculture, Federal University, Nigeria

Correspondence: Ogori Akama Friday,Federal University Gashua Department of Home Sciences Faculty of Agriculture, Pmb1005 Yobe State, Nigeria, Tel 2340708510611, Email ogorifaraday@gmail.com

Received: November 05, 2019 | **Published:** November 15, 2019

Introduction

Consumer interest in healthy eating is shifting towards the potential health benefits of specific food known as functional foods. There has been a considerable interest in functional foods over the past years due to the increasing cost of health care,[1] relatively less residue effect and naturally dietary supplement associated with functional foods,[2] the growing global concern on nutrition and personal health, consumer interest in the relationship between diet and health, and the rising interest in attaining wellness through diet.

Probiotics and prebiotics are evolving nutritional concepts in the development of dairy foods particularly functional yoghurt.[3] Probiotics are described as cultures of live microorganisms that are beneficial to health while prebiotics are non-digestible food components that enhance viability of desirable gut bacteria and reduce risk of gastrointestinal diseases or disorders. Recent studies or research attention is focused on the combined use of probiotics and prebiotics generally known as symbiotic, to get their synergistic health properties. Combination of probiotics active culture and prebiotics non digestible food ingredient, beneficially affect the host by improving the survival of live microbial dietary supplement by stimulating the activity of colon bacteria.

Yoghurt is a coagulated milk product, which results from lactic acid fermentation of milk by probiotics *Lactobaczllusbulgarzcus*and *Streptococcus thermophilus*. The beneficial effect of yoghurt containing live and active culture on the digestion of lactose in patient who suffers from lactose intolerance is well documented, also the risk of colon cancer and other gastrointestinal diseases which are prevalent in many developed and developing countries is inversely correlated to intake of dietary fiber (a prebiotic). Products such as yoghurt that does not naturally contain fiber[4]is being researched for the possibility of fiber being added to it to reduce the risk of colon cancer and other chronic diseases and improve the health status of the consumers.[4] Although the addition of novel fibers to milk products such as yoghurt is seldomly reported.[5]

Soybean has good potential for-application in the functional food industry, as it contains a large protein, isoflavones, protein oligosaccharides etc.[6] Whole soybean flour is a good source of dietary fiber because it contains relatively high fiber content. Alteration in dietary protein intake have an important role in prevention and management of several forms of kidney disease. Studies have shown that the consumption or partial substitution of soy protein for animal protein usually decreases hyperfiltration in diabetic persons and may reduce urine albumin excreation (proteinuria)[7] and reduces the risk of heart disease by lowering low density lipoprotein.[8]

Soybeans have been used in the production of yoghurt, to the best of my knowledge little or no study investigated the quality of whole soybean incorporated symbiotic yoghurts. This present study aimed to investigate the potential of producing acceptable symbiotic (functional) yoghurt enriched with whole soybean flour. This study is significant because dairy products such as yoghurt is not a good source of fiber[4] and also, over the past years diet or food has become increasingly processed or refined leading to greatly reduced fiber content,[9] and consequently reduced fiber intake by consumers. Consumers are often advice to switch to eating style more like vegetarianism to obtain recommended intakes. This would have been remedy for low fiber intake but such radical changes in eating patterns are not likely. Since youghurt is highly consumed in our modern society and relatively less expensive, whole soy enriched symbiotic youghurt can therefore serves as an important vehicle to supply fiber (probiotics), lactic acid bacteria (probiotics) and soy protein to consumers and thus reduced the risk of gastrointestinal and cardiovascular diseases. Also, nutritionally, soybean is packed with lots of nutrients such as high quality protein, essential lipid, some vitamins and minerals, other nutrient.[10] Partial substitution of milk with whole soy flour can maintain or improved the nutritional and sensory value of youghurt.

Materials and method

Raw materials

The soybean seeds and commercial powdered milk were obtained from Wadata Market in Makurdi. The freeze-dried starter culture was purchased from modern market in Makurdi. Portable water was strictly used throughout the experiment.

Production of whole soybean flour

Whole soybean flour was prepared was prepared according to the method described by[11] with modifications. The procured soybean seeds were thoroughly sorted and washed to remove dirt and other extraneous materials such as sands, sticks, leaves and debris. It was then oven dried. The soybean were toasted and milled into fine flour using milling machine (Figure 1). The flour was packed and sealed in polyethylene bags until it was used.

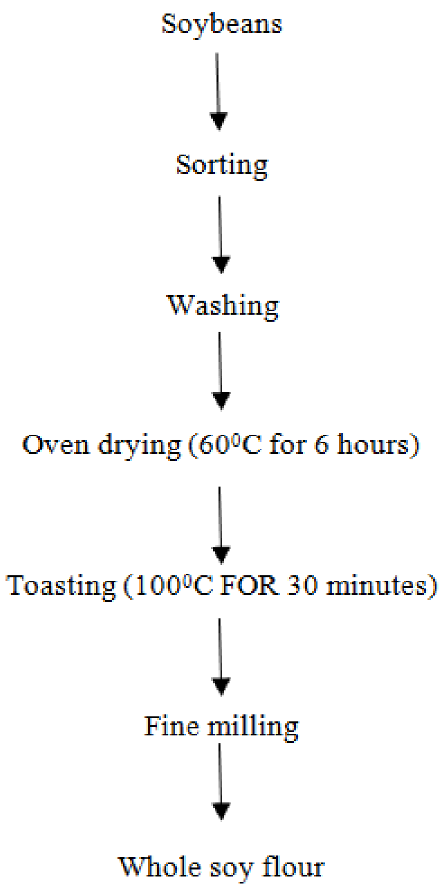

Figure 1 Flow chart for the production of whole flour.

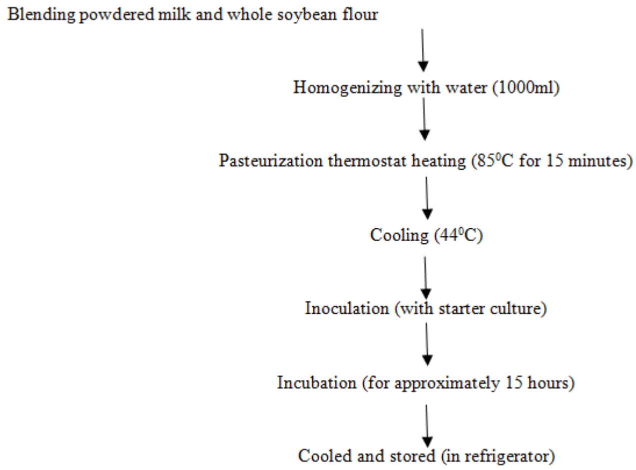

Figure 2 Flow chart for the production of yoghurt enriched with whole soybean flour.
Source: adapted from Ndife (2014).

Blend formulation

(Table 1)

Table 1 Blends formulation of enriched yoghurt

Samples	Milk powder (g)	Whole soybean flour (g)
A	100	0
B	90	10
C	80	20
D	70	30
E	60	40

Source: adapted from Olaniyan and Ademola (2015)
Key:
Sample A: 100% Milk powder (Dano) and o% whole soyabean flour
Sample B: 90% milk powder (Dano) and 10% whole soybean flour
Sample C: 80% milk powder (Dano) and 20% whole soybean flour
Sample D: 70% milk powder (Dano) and 30% whole soybean flour
Sample E: 60% milk powder (Dano) and 40% whole soy bean flour

Production of enriched whole yoghurt

The whole soybean flour was blended with the powdered milk at different levels of powdered milk substation of 0%, 10%, 20%, 30% and 40%, using portable water to produce milk-slurries and was labeled as sample A (control), B,C and D respectively.

The whole soybean-milk mixture was heated at 85⁰C for 15 minutes to kill undesirable microorganism that can influence product quality and safety and partially break down the milk proteins. The samples were then cooled to 44⁰C. Commercial freeze dried mixed culture of *L. bulgaricus, S. thermophilus*and *L. acidophilus* was used to inculcate each of the whole soybean-milk slurries at the same temperature of 44⁰C. This was inculcated for approximately 15 hours to allow for fermentation and rapid production of lactic-acid by the inoculated bacteria which coagulated the milk. The yoghurt samples produced was cooled rapidly to 10⁰C and refrigerated throughout the period of analysis.

Methodology

Proximate analysis

Moisture content determination

The moisture content was determined by oven drying method as described by.[12] In this process, 2g of the sample was dried in a hot air oven to a constant weight at 100^{0}C. The lost in weight was determined and recorded as the moisture content and was expressed as;

$$Moisture\ = W_2 - W_2 x100$$

W_2-W_3

Where;

W_1= weight of crucible

W_2= weight of crucible + sample test portion

W_3= weight of crucible + dried sample

Ash content determination

The ash content was determined by the direct heating method as described by 10. In this method, 5g of each of the samples was measured into a crucible of known weight and evaporated to dryness on steam bath. The sample was then burnt to ash in a muffle furnace at 550^{0}C until ash is carbon free. It was then cooled in a desiccator and the weight of the ash was determined. The % ash content was calculated as;

$$\%\ Ash = W_2 - WX\ 100$$

W1-W

Where;

W= weight of crucible

W_1=weight of crucible and sample test portion

W_2= weight of crucible and ash

Protein content determination

The formol titration method as described by Shagufta et al.[13] was used to determine the crude protein content. 10ml of the sample was measured into Erlenmeyer flask. 1 ml of phenolphthalein and 0.4ml of neutral potassium oxalate solution were added into the flask, mixed and kept for two minutes. This procedure eliminated the disturbing effect of soluble calcium salts, as reacted calcium oxalate was. The mixture was then titrated against 0. 1N NaOH using phenolphthalein as an indicator until a permanent faint pink colour was observed. 2ml of 40% formalin (formaldehyde) solution was then added to the neutral solution in the flask. This mixture was again titrated as above with 0.l NaOH using phenolphthalein as indicator. The volume of the NaOH used was recorded. The first titration value was not required but the second was noted. The correction for the slight acidity of formalin was determined by titrating 2mln 40% formalin added to 10ml of distilled water. The percentage of protein in the sample was calculated by multiplying the volume of 0. 1N NaOH (already corrected for slight acidity of formalin by the fomol factor as follows;

$$Protein\ = \left(TV\ - \ Blank\right) \text{ X } 1.95$$

Where;

TV = Second titration value

1.95= formol factor

Fat content determination

The ether extraction method as described by[12] was used to determine the fat content. In this method 10g of the sample was weighed into a round bottom flask. 1.5Ml NH4OH, 3 drops of phenolphthalein indicator and 10ml of 95% alcohol were added into the flask and missed thoroughly for first extraction, 25mL ethyl ether was added to the flask and stoppered with cork and shaken very vigorously for l minute after which the stopper was removed. 25ml. petroleum ether\ vas then added and the flask stoppered again with cork and shaken vigorously for l minute. The ether solution (phase) was decanted into a conical flask of known weight. For second extraction (using the aqueous phase in first extraction). The same process was repeated using 5mL 95% alcohol. l5mL ethyl ether and l5mL petroleum ether. For third extraction. Addition of 95% alcohol was omitted and the procedure used for second extraction was repeated. Ether solution for second and third extractions was decanted into same conical flask used for first extraction. Extracted fat in the conical flask was dried to constant weight in forced air oven at 100°C. lt was then cooled in a desiccator and the weight of the fat was finally determined. The fat content was calculated as follows;

Where;

W_1 = weight of conical flask

W_2 = weight of conical flask + fat

W_S weight of sample used

Crude fiber determination

The crude fibre was determined by the method described by.[12] lt was determined as the fraction remaining after digestion with standard sulphuric acid and sodium hydroxide under careful controlled condition. 5g of the sample was weighed and fat was extracted using ether extraction method. The fiber sample was boiled in 500ml of 1.25% sulphuric acid solution for 30 minutes followed by the addition of 100ml of 1.25% sodium hydroxide solution. The beaker was heated and the boiling allowed to continue for another 30 minutes under same condition. Finally the fiber was extracted and was be allowed to drain dry before being transferred to a crucible where it was dried in the oven at l05°C to a constant weight. The sample in the crucible was incinerated at 550°C until all carbonaceous matters were burnt. The crucible containing the ash was then cooled in the desiccator and weighed. The weight of the fiber was determined be difference and calculated as a percentage of the weight of sample analyzed as;

$$\%\ Crude\ fibre\ = W_2 - W_1 X100$$

W_3

Where;

W_1= Weight of crucible and ash

W_2 = Weight of sample and crucible before ash

W_3: Weight of sample used

Determination of carbohydrate content

The total was determined by difference method as described by[13]

The carbohydrate contents (2013) as follows;

$$CHO\ = \ 100\%\ —\ \left(ash\ +\ protein\ +\ fat\ +\ moisture\right)\ \%$$

Citation: Amove J, Ogori AF, Aondoakaa PI. Effect of yoghurt–milk enrichment with whole soy bean flour. *J Nutr Health Food Eng.* 2019;9(3):97–103.
DOI: 10.15406/jnhfe.2019.09.00333

Physicochemical Analysis

Determination of total solids

The total solid was determined by the method described by[12]. 3g of the sample was weighed into a pre-weighed dry crucible. The test portion was pre-dried for 25 minutes on steam bath and then dried for 3 hours at l00°C in forced draft air oven. The total solids content of the sample is weight of dried milk residue as % original milk weight and was calculated as;

$$\%\ total\ solids\ = w2 - w1 X\ 100$$

W1-W

Where:

W= weight of dish

W1 = weight of dish and sample test portion

W_2= weight of dish and dry sample

Determination of Total Solids-Non-fat, the total solids-non-fat was determined as described by[12]. The total solids-non-fat of the sample is the difference between total solids and fat contents and was calculated as;

% Solids-Non-fat= total Solids — % fat Content

Determination of titratable acidity

The acidity was determined by the titrimetric method as contain in[12]. 20g of the sample was diluted with 40ml. of CO_2-free water and mixed thoroughly. 2mL phenolphthalein indicator was added into the mixed solution. It was titrated against standard sodium hydroxide solution (0.1M NaOH) to first persistent pink for complete neutralization. The acidity was calculated as:

$$Acidity\ = V \times 0.0090\ \times\ 100$$

20

Where;

V = volume ml.) of the 0.1 M NaOH required for complete neutralization.

Determination of viscosity

The viscosity of each sample will be determined using the method of Kip et al.,[14] as described by Olagbunju et al.[15] In the process the spindle of the viscometer will be inserted into the samples at 10pm and the reading on the viscometer will be recorded after 3 minutes.

pH determination

The P^H was determined by the method described by Igbabuletal.[16] Where 10g of the sample was dissolved in 100mL of distilled water. The mixture was left to equilibrate for 3 minutes at ambient temperature. The P^H was then determined by putting the probe of the PH meter in the sample and then recording the result displayed on the P^H meter.

Sensory evaluation

The samples were coded and sensory evaluation of the coded yoghurt was carried out by 20 panelists. They tested the samples based on the following attributes; appearance, aroma, mouth-feel, taste, and over all acceptability of the sample using a 9 point hedonic scale, where 9 indicates extremely like and extremely dislike as described by.[17]

Statistical analysis

Analysis of variance (ANOVA) was performed on the data obtained to determine differences at 5% probability level of significance, while LSD test was used to separate the means. All statistical analysis of data was performed using SPSS (version 20.0) software.

Results and discussion

Proximate composition

The result of the proximate composition parameters analysed for the yoghurt samples is presented in Table 2. From the result, the moisture content range from (77.79)% in sample A to 89.34% in sample E. this was dependent on the production of powdered milk to whole soybean flour used. Plain youghurt (sample A) had the lowest moisture value (77.79)% compared to the enriched youghurts (sample B, C, D and E) respectively. There was significant difference (P< 0.05) in the moisture content of plain youghurt and enriched youghurt. However, the moisture contents of sample A, B, C, and D fell within the moisture content range (78.2-87.1)% of nine commercial youghurts evaluated by.[18]

Table 2 Proximate composition of whole soybean enriched yoghurt

Parameters	Samples					LCD
	A	B	C	D	E	
Moisture %	77.79±1.84^d	80.67±1.27^0	82.48±0.73^c	86.29±1.04^b	89.34±0.76^a	2.19
Ash %	1.40±0.82^a	0.56±0.03^b	0.53±0.01^b	0.47±0.02^b	0.39±0.05^b	0.67
Crude protein %	3.06±0.23^c	4.88±1.69^{bc}	6.11±0.45^{abc}	6.76±0.90^{ab}	9.23±3.83^a	3.51
Fat (%)	1.57±0.25^c	3.31±0.46^b	3.53±0.19^{ab}	3.67±0.24^{ab}	3.97±0.15^a	0.51
Crude fiber (%)	0.18±0.02^e	0.73±0.33^d	1.21±0.20^c	1.73±0.16^b	2.45±0.24^a	0.39 1.98
Carbohydrate (%)	16.19±1.76^a	10.59±1.20	7.36±0.72^c	2.80±0.92^d	0.11±0.18^e	

Values are mean±SD triplicate determinations. Values with different superscript within the same row are significantly different (P< 0.05)
Sample A: 100% Milk powder (Dano) and o% whole soyabean flour
Sample B: 90% milk powder (Dano) and 10% whole soybean flour
Sample C: 80% milk powder (Dano) and 20% whole soybean flour
Sample D: 70% milk powder (Dano) and 30% whole soybean flour
Sample E: 60% milk powder (Dano) and 40% whole soy bean flour

The ash content of the samples range from 0.39% in sample E to 1.40% in sample A. there was significant difference (P< 0.5) in the ash content of the plain yoghurt (sample A)and the enriched sample (B, C, D and E) respectively. The ash content decreased as the concentration of whole soybean flour increased. This may be attributed to the relatively low mineral content of soybean. The total mineral content of whole soybean is reported to be 4.90% [19]while that of powdered milk (Dano) is 5.43%.[13]

The protein content of the samples ranged from 3.06% in sample A to 9.23% in sample E. the value of protein content increased as the proportion of whole soybean flour increased. This could be due to the high protein content of soybean. Ndife,[3] reported that the protein content of soybean is about 12 times of milk. There was no significant difference (P< 0.05) in the protein content of sample A (plain yoghurt), B and C while sample A, D and E vary significantly (p< 0.05) in their protein content. The protein contents of samples D and E were relatively high as compared to the 5.0% mean protein content of five commercial yoghurts evaluated by Igbabulet al.,[16] A clinical study conducted by[20] showed that substitution of soy protein for animal protein decreases hyperfiltration in diabetic persons and may reduce urine albumin excretion (proteinuria).

The fat content of the sample ranged from 1.57% in sample A to 3.97% in sample E. there was significant difference (P< 0.05) in the fat content of the plain yoghurt (sample A) and the enriched yoghurts (sample B, C, D and E). The value of fat content increased as the proportion of the whole soybean flour increased. Soybean has a high oil content which is rich in polyunsaturated fats.[14] Lokuruka,[10] reported that as a result of the considerable unsaturation of soybean and its products is critical for human health. As shown in Table 2, the crude fiber of samples ranged from 0.18% in sample A to 2.45% in sample E. There was significant difference (P< 0.05) in the crude fiber content of all the samples. Incorporation of whole soybean flour into yoghurt had significantly increased (P>0.05) the fiber contents of the enriched yoghurts (sample B, C, D, and E) compared to that of the plain yoghurt (sample A), hence good for ulcer patients. This agrees with result on other whole soy substituted products by other researcher.[16] Whole soybean contains fibers which are indigestible polysaccharides[10] that could serve as prebiotics and play and important physiological role in disease prevention.[21]

The carbohydrate content of the samples ranged from 0.011 % in sample E to 16.19% in sample A. there was significant difference (P> 0.05) in the carbohydrate content of all samples. The carbohydrate content decreased as the concentration of whole soybean flour increased. Carbohydrate (Lactose) is the major constituents of milk that is converted to lactic acid during fermentation. Also, soybeans have relatively low carbohydrate content compared to milk. Thus, the conversion of lactose to lactic acid and the increase in proportion of whole soybean milk account for the decrease in carbohydrate content as observed in the result (see Table 1). This result corresponds with observation of Ndife et al.[3] that incorporation of coconut milky water in yoghurt decreased the carbohydrate content.

Physicochemical properties

The physical and chemical properties of the whole soybean enriched yoghurts are shown in Table 3. The total solids and total solids non-fat of the samples ranged from 10.66% in sample E to 22.21% in sample A and from 6.70% in sample E to 20.64% in sample A respectively. The total solids are an indication of the dry matter content of yoghurt samples while total solids not-fat indicates the fraction of the total solids that is not fat and constitute of protein, carbohydrate and minerals. There were significant differences (P<0.05) in the total solids and total solids not-fat of the plain yoghurt (sample A) and those of the enriched yoghurts (sample B, C, D and E). The total solids not-fat of the plain yoghurts were relatively high compared to those of the enriched yoghurts as they decrease in yoghurt samples enriched with whole soybean flour. These result agreed with findings of Ndife et al.[3] who also observed a similar trend in yoghurt samples enriched with coconut-cakes.

Table 3 Physicochemical properties of whole soybean enriched yoghurts

Parameters	Samples					LSD
	A	B	C	D	E	
Total slides (%)	22.21±1.84^a	19.33±1.29^b	17.52±0.73^b	13.71±1.04^c	10.66±0.76^d	2.19
Total solids not-fat (%	20.64±1.59^a	16.03±1.57^b	14.00±0.91^b	10.03±0.99^c	6.70±0.88^d	2.24
pH	4.50±0.00^d	4.90±0.00^c	5.00±0.00^b	5.10±0.00^a	5.13±0.06^a	0.00
Titratable acidity (%)	1.34±0.05^a	1.23±0.02^b	0.96±0.02^c	0.84±0.03^d	0.78±0.02^c	0.00
Viscosity (Pa.s)	10.54±0.02^a	8.13±0.03^b	5.70±0.02^c	3.28±0.01^d	0.86±0.02^c	0.00

Values are means±SD triplicate determinations. Values with different superscript within the same row are significantly different (P<0.05)
KEY:
LSD=least significant difference
Sample A: 100% Milk powder (Dano)
Sample B: 90% milk powder (Dano) and 10% whole soybean flour
Sample C: 80% milk powder (Dano) and 20% whole soybean flour
Sample D: 70% milk powder (Dano) and 30% whole soybean flour
Sample E: 60% milk powder (Dano) and 40% whole soy bean flour

Table 4 Mean scores for sensory properties of whole soybean enriched yoghurts

Parameters	**Samples**					**LSD**
	A	**B**	**C**	**D**	**E**	
Appearance	8.30^{a}	7.35^{ab}	6.95^{bc}	6.40^{bc}	6.25^{c}	0.96
Aroma	7.65^{a}	5.30^{bc}	5.60^{b}	4.25^{ed}	3.70^{d}	1.07
Taste	7.35^{a}	5.10^{bc}	5.35^{b}	4.20^{ed}	3.90^{d}	1.06
Mouth feel	6.65^{a}	5.60^{b}	5.55^{b}	4.70^{bc}	4.45^{c}	0.94
Overall acceptability	7.35^{a}	5.75^{b}	5.70^{b}	4.55^{c}	4.10^{c}	0.87

Means with different superscript within the same row are significantly different (P<0.05).
Key:
LSD=Least significant difference
Sample A: 100% Milk powder (Dano) and o% whole soyabean flour
Sample B: 90% milk powder (Dano) and 10% whole soybean flour
Sample C: 80% milk powder (Dano) and 20% whole soybean flour
Sample D: 70% milk powder (Dano) and 30% whole soybean flour
Sample E: 60% milk powder (Dano) and 40% whole soy bean flour

The result of the P^{H} of the different yoghuhrt samples as presented in Table 3 showed that, the PH value ranged from 4.50 in sample A to 5.13 in sample E. there was significant difference (P< 0.05) in the P^{H} of plain yoghurt (sample A) and the enriched yoghurts (sample A) and enriched yoghurts (sample B, C, D and E). The pH value increased as the concentration of whole soybean flour increased and the plain yoghurt had the lowest value (4.50) when compared with the enriched yoghurts. This could be due to more availability of lactose to fermenting bacterial. Tomovska et al.,[22] reported that most producers have a set point between P^{H} 4.0 and 4.6 in order to prevent the growth of any pathogenic organisms. The P^{H} values of the enriched samples are above this set point. However, these values are within the p^{H} range (4.53-5.11) of five commercial yoghurt samples evaluated by Igbabul et al.[16] The titratebleacidity of the samples ranged from 0.78% in sample E to 1.34% in sample A. There was significant difference (P<0.05) in the titratable acidity. The enriched yoghurt samples had lower titratable acidity values than the plain yoghurt. This could also be attributed to relatively low availability of lactose in the enriched samples. However, these values are above the minimum titratable acidity of 0.6% require by food standard code for plain yoghurt.[16]

The viscosity of samples ranged from 0.86 pa.s in samples ranged from 0.78% in sample A. There was a significant difference (P<0.05) between the viscosity of all the samples. These viscosities are reasonably low compared to the viscosity of four commercial yoghurts samples (34.05, 37.51, 31.26, and 99.51 Pa..s) reported by Igbabule et al.[16] who further stated that, the viscosity of commercial yoghurt is usually enhanced by addition of stabilizers and thickeners such as modified or natural starches, pectin, edible gums.

Sensory properties

The mean sensory scores of the organoleptic evaluation and acceptability for the different yoghurt samples are presented in Table 3. From the result, sample A (Plain yoghurt) had the highest score (8.30) for appearance and was significantly different (P<0.05) from sample C, D, and E. sample A and B did not vary significantly (P<0.05) in their appearance. The appearance was influenced by colour appeal, the panelist showed preference for the lighter and white colour of sample A without soybean enrichment.The aroma and taste of sample A (plain yoghurt) where significantly different (P<0.05) from those of the enriched samples (B, C, D, and E). The enrichment of the yoghurts with whole soybean flour resulted in lower aroma and taste scores. Sample A had the highest scores of 7.65 and 7.35 for aroma and taste, while sample E had the lowest scores of 3.70 and 3.90 for aroma and taste respectively. This may be attributed to the beany flavor of the soybean. WHO/FAO,[23] reported that products have had limited consumer acceptance because of its undesirable or beany after taste.

The sensory scores for mouth-feel as it relates to texture were influenced by the addition of whole soybean. The mean score for mouth-feel of sample A (6.65) was significantly different (P<0.05) from those of the enriched samples (B, C, D, and E). The enriched yoghurts had lower score when compared to plain yoghurt (sample A) mainly due to their poor consistency (flowing nature).The plain yoghurt had the best overall acceptability rating of 7.35 and was significantly different from the enriched yoghurts. Sample B with 10% whole soybean substitution rank next to the plain yoghurt (sample A) with over all acceptability rating of 5.75 and was not statistically different (P<0.05) from sample C.

Conclusion

Based on the findings of this study, fibre, fat, and moisture contents of the enriched yoghurts flour mixture were significantly higher than those of the control. The protein content was significantly increased at 30% and 40% level of substitution of whole soybean flour into milk. On the other hand, ash and carbohydrate contents of the enriched samples were significantly lower than those of the control. Hence an excellent diet source for obese, diabetes and colon cancer patients. The physiochemical properties competed favorably with the control. The enriched soybean yoghurt produced were generally acceptable sensorially.

Acknowledgments

None.

Conflicts of interest

The author declares there is no conflict of interest.

References

1. Siro I, Kapolna B, Lugasi A. Functional Food. Product Development, marketing and consumer acceptance. A review. *Appetite.* 2008; 51(3):456−467.
2. Ansari S, Chauhan B, Kalam N, Kumar G. Current concepts and prospects of Herbal Nutraceutical: A review. *J Adv Pharm Technol Res.* 2003;4(1): 4.
3. Ndife J. Production and Quality Assessment of Functional Yoghurt Enriched with Coconut. *International Journal of Nutrition and Food Sciences.* 2014;3(6):545−550.
4. Ares G, Baixauli R, Sanz, T. Influence of Dietary fiber Addition on the Properties of Probiotics Yoghurt. *Food Hydrocolloids.* 16(3): 311−328.
5. Sendra E, Kuri V, Fernandez−Lopez J, et al. Viscoelastic properties of orange fiber enriched yoghurt as a function of fibre dose, size and thermal treatment. *LWT− food science and technology.* 2010;43(4):708−714.
6. Bau TR, Garcia S, Ida EI. Evaluation of a Functional Soy Product with Addition of Soy Fiber and Fermented with Probiotic Kefir Culture. *Brazilian Archives of Biology and Technology.* 2014;57(3):402−409.
7. Anderson JW. Beneficial effects of Soy Protein Consumption for Renal Function. *Asia Pacific Journal of Clinical Nutrition.* 2008; 17(SUPPL.1):324−328.
8. Jenkins DJA, Mirrahimi A, Srichaikul K, et al. Soy Protein Reduces Serum Cholesterol by both Intrinsic and Food Displacement Mechanisms. *J Nutr.* 2010;140(12):2302S−2311S.
9. Yangilar F. The Application of Dietary Fibre in Food Industry: Structural Features, Effects on Health and Definition, Obtaining and Analysis of Dietary Fiber: A review. *Journal of Food and Nutrition Research.* 2013;1(3):13−23.
10. Lokuruka M. Soya Nutritional Properties. *African Journal of Food and Agricultural Nutrition Development.* 2010;10(4):2439−2459.
11. Milhail L, Zoran PS. Polymerization of Soy Bean Oil with Superacids. *Soybean−Application and Technology.* 2011;365−387.
12. AOAC. Official method of analysis 15th edition, assou of official analytical chemist Washington D.C. 2005.
13. Shagufta F, Ashif S, Muzaffar K, et al. Determination of Chemical Composition of Milk Marketed in Quetta Pakistan. *Int J Adv Res Biol Sci.* 2016;3(5):98−103.
14. Anas Al-Nabulsi, Reyad Shaker, Tareq Osaili, et al. Sensory Evaluation of Flavoured Soy Milk−based Yoghurt: a Comparism between Jordanian and Malaysian Consumers. *Journal of Food Science and Engineering.* 2014;4,:27−35.
15. Olagbunju A, Muhammed A, Aliyu S, et al. Nutritional values of powdered Milk Commercially CONSZUMED in Journal West Africa. *International of Food Nutrition and Safety.* 2013;4(2):55−61.
16. Igbabul B, Amove J. Physicochemical, Microbiological, Sensory Properties and Storage Stability of Plant-based Yoghurt Produced from Bambaranut, Soybean and Moringa oleifera Seed Milks. *American journal of food science and Nutrition.* 2006;6(4):12−18.
17. Ihekoronye A I, Ngoddy PO. Integrated Food Science and Technology for the Tropics. (2nd ed.), Macmillan Publishers Ltd. London.
18. Olugbuyiro JAO, Oseh JE. Physico−Chemical and Sensory Evaluation of Market yoghurt in Nigeria. *Pakistan Journal of Nutrition.* 2011;10(10):914−918.
19. Anas Al-Nabulsi, Reyad Shaker, Tareq Osaili, et al. Sensory Evaluation of Flavoured Soy Milk−based Yoghurt: a Comparism between Jordanian and Malaysian Consumers. *Journal of Food Science and Engineering.* 2014;4,:27−35.
20. Anderson KE, Lu LJ, Grady JJ, et al. Effects of soya consumption for one month on steroid hormones in premenopausal women: implications for breast cancer risk reduction. *Cancer Epidemiol Biomarkers Prev.* 1996;5(1):63−70.
21. Farzana T, Mohajan S. Effects of incorporation of soy flour to wheat flour on nutritional and sensory quality of biscuits fortified with mushroom. *Food Sci Nutr.* 2015;3(5):363−369.
22. Eke MO, Olaitan NI, Sule HI. Nutritional Evaluation of Yoghurt-Like Product from Baobab (Adansonia digitata) Fruit Pulp Emulsion and the Micronutrient Content of Baobab Leaves. *Advance Journal of Food Science and Technology.* 2013;5(10):1266−1270.
23. World health Organization and Food and Agricultural Organization of the United State. Codex Standard for Fermented Milks−CODEX STAN−243−2003, Codex Alimentarius. 2011;56−58.