Effect of yoghurt–milk enrichment with whole soybean flour

Abstract
The potential of symbiotic yoghurt enrichment with soybean flour was studied yoghurt control Sample A: 100% Milk powder (Dano) and 0% whole soybean 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 Pw 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

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, relatively less residue effect and naturally dietary supplement associated with functional foods, 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. 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 Lactobacillus bulgaricus 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 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. Although the addition of novel fibers to milk products such as yoghurt is seldomly reported.

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 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 excretion (proteinuria) and reduces the risk of heart disease by lowering low density lipoprotein.

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 dietary fiber and also, over the past years diet or food has become increasingly processed or refined leading to greatly reduced fiber content, 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 yoghurt 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. 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 according to the method described by 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.

Blend formulation

(\text{Table 1})

<table>
<thead>
<tr>
<th>Samples</th>
<th>Milk powder (g)</th>
<th>Whole soybean flour (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>B</td>
<td>90</td>
<td>10</td>
</tr>
<tr>
<td>C</td>
<td>80</td>
<td>20</td>
</tr>
<tr>
<td>D</td>
<td>70</td>
<td>30</td>
</tr>
<tr>
<td>E</td>
<td>60</td>
<td>40</td>
</tr>
</tbody>
</table>

Source: adapted from Olaniyan and Ademola (2015)

Key:
Sample A: 100% Milk powder (Dano) and 0% 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 substitution 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 85°C 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 44°C. Commercial freeze dried mixed culture of \text{L. bulgaricus, S. thermophilus} and \text{L. acidophilus} was used to inculcate each of the whole soybean-milk slurries at the same temperature of 44°C. 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 10°C and refrigerated throughout the period of analysis.

\text{Figure 1} Flow chart for the production of whole flour.

\text{Figure 2} Flow chart for the production of yoghurt enriched with whole soybean flour.

Source: adapted from Ndife (2014).
Methodology

Proximate analysis

Moisture content determination

The moisture content was determined by oven drying method as described by. In this process, 2g of the sample was dried in a hot air oven to a constant weight at 100°C. The lost in weight was determined and recorded as the moisture content and was expressed as:

\[ \text{Moisture} = \frac{W_1 - W_3}{W_3} \times 100 \]

Where;

- \( W_1 \): weight of crucible
- \( W_3 \): weight of crucible + sample test portion
- \( W_2 \): 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°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;

\[ \% \text{Ash} = \frac{W_1 - W}{W} \times 100 \]

Where;

- \( W_1 \): weight of crucible and ash
- \( W \): weight of crucible and sample test portion
- \( W \): weight of crucible

Protein content determination

The formol titration method as described by Shagufta et al.15 was used to determine the crude protein content. 10ml of the sample was measured into Erlenmeyer flask. 1 ml of 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 0.1 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 0.1 NaOH already corrected for slight acidity of formalin by the formol factor as follows;

\[ \text{Protein} = \left( \frac{TV - \text{Blank}}{1.95} \right) \times 1.95 \]

Where;

- \( TV \): Second titration value
- 1.95: formol factor

Fat content determination

The ether extraction method as described by12 was used to determine the fat content. In this method 10g of the sample was weighted into a round bottom flask. 1.5MI 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 1 minute after which the stopper was removed. 25ml petroleum ether was then added and the flask stoppered again with cork and shaken vigorously for 1 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, 15ml ethyl ether and 15ml 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. It was then cooled in a desiccator and the weight of the fat was finally determined. The fat content was calculated as follows;

\[ \% \text{Fat} = \frac{W_2 - W_1}{W} \times 100 \]

Where;

- \( W_1 \): weight of conical flask
- \( W_2 \): weight of conical flask + fat
- \( W \): weight of sample used

Crude fiber determination

The crude fibre was determined by the method described by.12 It 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 105°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 a desiccator and weighed. The weight of the fiber was determined be difference and calculated as a percentage of the weight of sample analyzed as;

\[ \% \text{Crude fibre} = \frac{W_3 - W_4}{W_4} \times 100 \]

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 by13 The carbohydrate contents (2013) as follows;

\[ \text{CHO} = 100\% - (\text{ash} + \text{protein} + \text{fat} + \text{moisture})\% \]
Physicochemical Analysis

Determination of total solids

The total solid was determined by the method described by12. 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 100°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;

\[
\% \text{ total solids} = \frac{W_2 - W}{W_1 - W} \times 100
\]

Where:

\[W = \text{weight of dish}\]
\[W_1 = \text{weight of dish and sample test portion}\]
\[W_2 = \text{weight of dish and dry sample}\]

Determination of Total Solids-Non-fat, the total solids-non-fat was determined as described by13. The total solids-non-fat of the sample is the difference between total solids and fat contents and was calculated as;

\[
\% \text{ Solids-Non-fat} = \text{total Solids} - \% \text{ fat Content}
\]

Determination of titratable acidity

The acidity was determined by the titrimetric method as contain in14. 20g of the sample was diluted with 40ml of CO₂-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:

\[
\text{Acidity} = V \times 0.0090 \times 100
\]

Where;

\[V = \text{volume ml.} \text{ of the 0.1 M NaOH required for complete neutralization.}\]

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 yoghurt (sample A) had the lowest moisture value (77.79)% compared to the enriched yoghurts (sample B, C, D and E) respectively. There was significant difference (P< 0.05) in the moisture content of plain yoghurt and enriched yoghurt. However, the moisture contents of sample A, B, C, and D fell within the moisture content range (78.2-87.1)% of nine commercial yoghurts evaluated by15.

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 by16.

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.

Table 2 Proximate composition of whole soybean enriched yoghurt

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Samples</th>
<th>LCD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>Moisture %</td>
<td>77.79±1.84</td>
<td>80.67±1.27</td>
</tr>
<tr>
<td>Ash %</td>
<td>1.40±0.82</td>
<td>0.56±0.03</td>
</tr>
<tr>
<td>Crude protein %</td>
<td>3.06±0.23</td>
<td>4.88±1.69</td>
</tr>
<tr>
<td>Fat (%)</td>
<td>1.57±0.25</td>
<td>3.31±0.46</td>
</tr>
<tr>
<td>Carbohydrate (%)</td>
<td>16.19±1.76</td>
<td>10.59±1.20</td>
</tr>
</tbody>
</table>

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 0% whole soybean 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 soybean flour

DOI: 10.15406/jnhfe.2019.09.00333
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The ash content of the samples ranged 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% while that of powdered milk (Dano) is 5.43%.

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, 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. A clinical study conducted by 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 whole soybean flour increased. Soybean has a high oil content which is rich in polyunsaturated fats. Lokuruka, reported that as a result of the considerable unsaturation of soybean a high oil content is reported.

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. 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. who also observed a similar trend in yoghurt samples enriched with coconut-cakes.

### Table 3 Physicochemical properties of whole soybean enriched yoghurts

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Samples</th>
<th>LSD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>Total solids (%)</td>
<td>22.21±1.84</td>
<td>19.33±1.29</td>
</tr>
<tr>
<td>Total solids not-fat (%)</td>
<td>20.64±1.59</td>
<td>16.03±1.57</td>
</tr>
<tr>
<td>pH</td>
<td>4.50±0.00</td>
<td>4.90±0.00</td>
</tr>
<tr>
<td>Titratable acidity (%)</td>
<td>1.34±0.05</td>
<td>1.23±0.02</td>
</tr>
<tr>
<td>Viscosity (Pa.s)</td>
<td>10.54±0.02</td>
<td>8.13±0.03</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Samples</th>
<th>LSD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>Appearance</td>
<td>8.30</td>
<td>7.35</td>
</tr>
<tr>
<td>Aroma</td>
<td>7.65</td>
<td>5.30</td>
</tr>
<tr>
<td>Taste</td>
<td>7.35</td>
<td>5.10</td>
</tr>
<tr>
<td>Mouth feel</td>
<td>6.65</td>
<td>5.60</td>
</tr>
<tr>
<td>Overall acceptability</td>
<td>7.35</td>
<td>5.75</td>
</tr>
</tbody>
</table>

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 0% whole soybean 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 soybean flour

The result of the P\textsuperscript{4} of the different yoghurt 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\textsuperscript{4} 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.\textsuperscript{22} reported that the viscosity of commercial yoghurt is usually enhanced by addition of stabilizers and thickeners. Igbabule et al.\textsuperscript{16} reported that most producers have a set point between P\textsuperscript{4} 4.0 and 4.6 in order to prevent the growth of any pathogenic organisms. The P\textsuperscript{4} values of the enriched samples are above this set point. However, these values are within the P\textsuperscript{4} range (4.53-5.11) of five commercial yoghurt samples evaluated by Igbabule et al.\textsuperscript{16}. The titratable acidity 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.\textsuperscript{16}

The viscosity of samples ranged from 0.86 p.a.s in samples ranged from 0.78% in sample A. There was 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.\textsuperscript{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,\textsuperscript{22} 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


