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Nutritional and medicinal potentials of yoghurt produced from cowmilk incorporated with moringa leaves (*Moringa oleifera)*

Ajibili Monday[1], Emmanuel Titus Friday[2]*, Taiwo Abayomi Abraham[3], Jonah Achile Caleb[3] and Owemidu, Idowu Olumorin[3]

[1]Department of Food, Nutrition and Home Sciences, Kogi State University, Anyigba, Nigeria.
[2]Medical Biochemistry Department, College of Health Sciences, Kogi State University, Anyigba, Nigeria.
[3]Department of Physiology, Faculty of Basic Medical Sciences, Kogi State University, Anyigba, Nigeria.

*Corresponding author. Email: friday.et@ksu.edu.ng

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ABSTRACT: This study was carried out to determine the nutritional and medicinal potential of yoghurt produced from cowmilk incorporated with moringa leaves (*Moringa oleifera*). 10 ml of moringa filtrate was incorporated into the yoghurt samples in different quantities (1 g/100ml, 0.5 g/100ml, 0.25 g/100ml). The six samples (A1, A2, A3, B1, B2, & B3) were assessed for their proximate composition, phytochemical component and sensory properties. The proximate analysis for samples A1 – B3 were found to be: Carbohydrate (1.56-10.61%), protein (6.56-10.26%), fat (1.81-3.29%), crude fibre (0.10-0.96%), Ash (0.30-1.37%) and moisture content (79.02-85.31%). The phytochemical analysis for sample A1-B3 were; Tannin (3.24-5.36%), total phenol (10.91-18.91%), flavonoid (2.50-5.38%), alkaloid (1.20-2.40%) and Saponin (0.19-0.63%). The sensory attribute values of samples A1-B3 were; appearance/colour 6.87-7.53, flavour/aroma 7.33-7.80, taste 6.80-8.07 and overall acceptability 7.07-7.64. It was found that sample B1 has the highest value for the overall acceptability hence the most preferred among the six products. Analysis of variance (ANOVA) method was used in determining the result of the hypothesis, $p<0.05$ was considered significant. Based on the results from this study, the addition of moringa leaf filtrate into yoghurt is achievable thereby increasing the quality of the yoghurt and making it a more desirable food.

Keywords: Cowmilk, medicinal potentials, *Moringa oleifera,* nutritional potentials, yoghurt.

INTRODUCTION

Yoghurt is a dairy product produced as a result of the fermentation of milk using bacteria. Yoghurt is defined by the Food and Drug Administration (FDA) as a fermented dairy product derived from the fermentation of milk by two species of bacterial cultures *Streptococcus thermophilus* and *Lactobacillus bulgaricus* (FDA, 2017). Yoghurt is one of the most popular fermented dairy products worldwide which has great consumer acceptability due to its health benefits other than its basic nutrition. In general, yoghurt is considered a nutrition-dense food due to its nutrient profile and is a rich source of calcium that provides significant amounts of calcium in bio-available form (Ghosh *et al*., 2022). In addition, it provides milk proteins with a higher biological value and provides almost all the essential amino acids necessary to maintain good health (Weerathilake *et al.,* 2014). Yoghurt is considered a probiotic carrier food that can deliver significant amounts of probiotic bacteria into the body which can claim specific health benefits once ingested.

The consumption of yoghurt in Nigeria has increased

tremendously so much so that lots of beverage industries are producing it in commercial quantities for millions of the populace who have embraced this fermented food product as part of their daily diet (Dublin-Green *et al*., 2008). Yoghurt, a fermented milk product consumed by large segments of the population either as a part of diet or as a refreshing beverage is one of the oldest fermented milk products known. Adolfsson *et al.* (2004), stated that it is nutritiously balanced containing almost all the nutrients present in milk in a more assimilable form. It is obtained by lactic acid fermentation of milk through the action of a starter culture containing *Streptococcus thermophilus* and *Lactobacillus bulgaricus*. Human consumption of yoghurt has been associated with tremendous health benefits due to the improvement of gastrointestinal functions and disease risk reduction following its daily consumption (Heyman, 2000). It is believed to promote good gum health and facilitate the absorption of calcium, thus preventing osteoporosis, possibly because of the probiotic effect of lactic acid bacteria present in it (Jackson *et al.,* 2001).

Different brands and forms of yoghurt are available in the market: stirred, strained, set, frozen, sweetened or flavoured and liquid yoghurt. The quality of yoghurt in local markets varies from one producer to another. Poor quality milk, unhygienic practices associated with the process involved and the use of a “wild type” starter culture give rise to poor grades of yoghurt (Moh *et al*., 2017). However, the inclusion of non-dairy ingredients has been found to improve yoghurt quality, create new brands of yoghurts and modulate the perception of consumers.

Moringa (*Moringa oleifera*).is a type of local medicinal Indian herb which has turned out to be familiar in tropical and subtropical countries (Boulal *et al*., 2021). The leaves are rich in minerals like calcium, potassium, zinc, magnesium, iron and copper, vitamins like beta-carotene of vitamin A, vitamin B such as folic acid, pyridoxine and nicotinic acid, vitamins C, D and E and other essential phytochemicals such as tannins, sterols, terpenoids, flavonoids, saponins, anthraquinones, alkaloids and reducing sugar present along with anti-cancerous agents like glucosinolates, isothiocyanates, glycoside compounds and glycerol-1-9-octadecanoate (Berkovich *et al.,* 2013). Moringa leaves also have a low calorific value and can be used in the diet of the obese. Extracts from the leaves are used to treat malnutrition and augment breast milk in lactating mothers. It's also packed with antioxidants, substances that can protect cells from damage and may boost the immune system. (Rajbhar *et al*., 2018). It is used as a potential antioxidant, anticancer, anti-inflammatory, antidiabetic and antimicrobial agent (Gopalakrishnan *et al.,* 2016). Incorporating this leave (*M. oleifera*) into the yoghurt will increase the nutritional value as well as medicinal benefits. This study aimed to investigate the nutritional and medicinal potential of yoghurt produced from cow milk incorporated with Moringa leaf (*Moringa oleifera*).

MATERIALS AND METHODS

List of materials/equipment and reagents

The following equipment and reagents were used: Pot, Bowl, turning stick, sieve, cooking gas, weighing scale and spoons. The reagents used include Ethanol, Chlorofoam, Sodium nitrite, Aluminium chloride, Follin Ciocalteu reagent, Sulphuric acid, Kjedahl Protein catalyst, Sodium hydroxide, Boric acid, Protein indicator, Petroleum Ether, Hydrochloric acid. All the reagents and chemicals used were of analytical grade obtained from BDH. Milk, sugar and starter culture were purchased from Anyigba market, Dekina LGA in Kogi State, Fresh Moringa leaves were collected from a nearby garden within the Kogi State University community, Anyigba.

Sample collection and preparation

Freshly collected moringa leaves used in this study were dried at ambient temperature, and continuous turning of the leaves was done to avert fungal growth for two weeks. The leaves were kept away from high temperatures and direct sunlight to avoid destroying the active compounds present in them. The dried leaves were ground to a fine powder using a mechanical grinder (ARDAKI electric blender).

Extraction and processing of moringa leaves

The moringa leaves were divided into six portions. Three samples (A1–A3) were extracted to obtain the liquid and used in the production, the extraction was done with 100 ml of boiled water. Samples were added to the boiled water, and allowed to cool before filtering, 10 ml of the filtrate was used in the production of yoghurt while the other portion of fine powdered moringa leaves was weighed into (1.0, 0.5 and 0.25 g).

Production of yoghurt

Yoghurt was produced using the method described by Amanze and Amanze (2011) (Table 1). 500 g of powdered cow milk (fresh) was added to two litres of water and mixed thoroughly, followed by the addition of 10 g of sugar, after which the mixture was pasteurized for 30 minutes at 95°C, after pasteurization the mixture was homogenized to obtain uniformity, and the mixture was allowed to cool. After cooling, 5 g of starter culture was introduced into the mixture to allow fermentation or incubation for 5-8 hours at a temperature of about 43°C while maintaining the pH at 4.5. A starter culture containing *Lactobacillus bulgaricus and Streptococcus thermophilus* was used in this yoghurt production.

Table 1. Proportion table for the production of yoghurt.

Samples	Moringa Leaves	Yoghurt (ml)
Sample A1	1g/100ml (10ml of extract into 90ml yoghurt)	90
Sample A2	0.5g/100ml (10ml of extract into 90ml yoghurt)	90
Sample A3	0.25g/100ml (10ml of extract into 90ml yoghurt)	90
Sample B1	1g into 100ml of yoghurt	100
Sample B2	0.5g into 100ml of yoghurt	100
Sample B3	0.25g into 100ml of yoghurt	100

Proximate composition

Proximate analysis was carried out on the yoghurt to determine its nutritional composition. The moisture, ash, protein, crude fibre, fat and carbohydrate contents of the produced yoghurt were determined using the analytical method described by the Association of Official Analytical Chemists (AOAC, 2010).

Phytochemical analysis of the Moringa leaf

The phytochemical analysis was carried out using standard methods following the method of Banu and Cathrine (2015) to determine the presence of phytochemicals such as; steroids, terpenoids and anthraquinones, alkaloids, tannins, saponins, flavonoids and phenolic compounds

Test for sterols

The test was performed based on the method described by Solihah *et al.* (2012). 2.0 ml of concentrated sulphuric acid was added to 2.0 ml of the plant extract. The formation of red precipitate indicated the presence of sterol.

Test for terpenoids

2.0 ml of chloroform was added to 5 ml of the plant extracts, evaporated on the water bath and then boiled with 3 ml of H_2SO_4 concentrated. The presence of a grey colour indicates the presence of terpenoids.

Test for anthraquinones

10 ml of benzene was added in 6 g of the samples in a conical flask, soaked for 10 minutes and then filtered. Further 10 ml of 10% ammonia solution was added to the filtrate and shaken vigorously for 30 seconds and pink, violet, or red colour indicates the presence of anthraquinones in the ammonia phase.

Quantitative analysis of phytochemical components

Test for alkaloids

Alkaloids were quantified by the method described by Agoreyo *et al.* (2012). Five grams of the sample was weighed into a beaker followed by the addition of 200 ml of 10% acetic acid. The mixture was covered and allowed to stand for four hours before filtering. The filtrate was concentrated using a water bath (i-therm, model AI7482) at 100ºC to one-quarter of the original volume.

Followed by the addition of a few drops of concentrated ammonium hydroxide until precipitation was formed. After settlement, the extract was filtered and the precipitate was washed with dilute ammonium hydroxide and then dried and weighed. The percentage of total alkaloid was calculated as;

$$\%\text{weight} + \text{Alkaloid} = \frac{\text{Residual}}{\text{Weight of sample}} x\ 100$$

Test for flavonoid

The flavonoid content of the sample was determined according to the method of Kaviarasan and Anuradha (2007). Total flavonoid content was measured by the aluminium chloride colourimetric assay. The reaction mixture consists of 1 ml of extract and 4 ml of distilled water was taken in a 10 ml volumetric flask. In the flask, 0.30 ml of 5% sodium nitrite was treated and after 5 minutes, 0.3 ml of 10% aluminium chloride was mixed after 5 minutes. 2 ml of 1M sodium hydroxide was treated and diluted to 10 ml with distilled water. The absorbance for test and standard solutions was determined against the reagent blank at 510 nm with a UV/visible spectrophotometer. The total flavonoid content was expressed as mg of QE/g.

Test for saponins

The method of Gupta *et al.* (2013) was used to determine the saponin content of the plant. 20 grams of plant sample

was put into a conical flask and 100 ml of 20% ethanol was added. The solution was heated over a water bath at 100ºC for 4 hours with continuous stirring at 55ºC. The solution was then filtered and the residue was re-extracted with another 200 ml of 20% ethanol. The combined extracts were reduced to 40 ml over a water bath. The concentrate was transferred into a 250 ml separating funnel and 20 ml of diethyl ether was added to the extract and vigorously shaken. The aqueous layer was recovered while the ether layer was discarded and the purification process was repeated. 60 ml of n-butanol was added, and the combined extract was washed twice with 10 ml of 5% NaCl. The remaining solution was heated in a water bath and after evaporation. The sample was dried in the oven at 105ºC.

Test for tannins

The presence of tannin was determined using the method of Follin-ciocalteu. About 0.1 ml of the sample was put into a flask containing 7.5 ml of distilled water and 0.5 ml of follin-coicalteu phenol reagent. 1 ml of 35 % Na_2Co_3 solution was added to 10 ml of distilled water. The mixture was shaken well and kept at room temperature for 30 minutes. Absorbance was measured against the blank at 725 nm with a UV/visible spectrophotometer. The tannin content was expressed in terms of mg of GAE/g of the sample.

Test for total phenol

The presence of phenol was determined using the method of follin-ciocalteu, 5 g of sample mixed with 50 ml of 50% ethanol and left for three hours. After which it was filtered, then, 1 ml of filtrate was added to 9 ml of distilled water in a 25 ml volumetric flask, followed by the addition of 1 ml of Follin Ciocalteu reagent for 30 minutes. 10 ml of 7% Na_2Co_3 was added, and the mixture was made up to 25 ml before incubating for 30 minutes at room temperature. Total phenol content was expressed as gallic acid equivalent GAE.

Sensory evaluation

A consumer acceptance test was conducted on the yoghurt using fifteen panellists consisting of Staff and Students from the Department of Food, Nutrition and Home Sciences at Prince Abubakar Audu University. The product (yoghurt) was evaluated for sensory properties such as colour, taste, flavour and overall acceptability of the yoghurt using a 9-point hedonic scale that will read from; like extremely (9), like very much (8), like moderately (7), like slightly (6), neither like nor dislike (5), dislike slightly (4), dislike moderately (3), dislike very much (2), dislike extremely (1). The panellists were instructed not to make comments during evaluation, to drink water after evaluating the yoghurt sample and as well make comments in the questionnaire provided for them.

Statistical analysis

The results obtained from proximate analysis, phytochemical analysis and sensory evaluation were subjected to statistical analysis. Differences between means were assessed using analysis of variance (One-way ANOVA) and the means were separated using SPSS Software Version 16.0.

RESULT AND DISCUSSION

Proximate analysis

The proximate composition of yoghurt samples is given in Table 2. There were significant differences ($p<0.05$) among samples in all the parameters being determined. The samples contain high moisture content which was found to be above 78%. The moisture content of the samples ranged from 78.15 to 85.31%. Sample A3 had the highest moisture content of 85.31% while sample B1 had the lowest moisture content of 78.15%. This result is in agreement with previously reported values of 78.62 to 82.41 as stated by Igbabul *et al.* (2014).

The protein content of the samples ranged between 6.56 and 10.26%. Sample B3 had the lowest protein content of 6.56% while sample A1 incorporated with 10 ml of moringa extract had the highest value of 10.26%. There was a significant difference ($p<0.05$) with the quantity of Moringa extract added. According to Adebayo and Ojo (2012), the increase in protein content would be useful in eliminating the challenges of protein deficiencies among all age groups.

The crude fibre content of the samples ranged between 0.16 and 0.96%. It was observed that there was a decrease in the crude fibre content as the level of addition of moringa extract decreased. Fibre content improves textural properties and structure and reduces lipid retention and caloric content by acting as a bulking agent (Larrauri, 1999).

The carbohydrate content of the samples ranged between 1.56 and 10.61%. Sample B3 incorporated with 0.25 g of moringa powder had the highest carbohydrate content of 10.61% while sample A1 incorporated with 10 ml of moringa extract (1 g/100ml) had the lowest value of 1.56%. Yoghurt is therefore important because it contains simple sugar which is easily absorbed by the body. This is in line with the work of Mckinley (2005), who stated that simple sugar is easily absorbed by the body, therefore, making yoghurt ideal for people with lactose mal-digestion.

Table 2. Proximate composition of yoghurt produced from cowmilk incorporated with moringa leave (*M. oleifera*).

Sample code	Moisture content	Ash (%)	Crude fibre (%)	Fat (%)	Protein (%)	Carbohydrate (%)
A1	82.20±0.14^{c}	0.50±0.00^{c}	0.19±0.01^{c}	3.29±0.01^{a}	10.26±0.02^{a}	1.56±0.16^{d}
A2	84.95±0.07^{b}	0.37±0.35^{d}	0.16±0.00^{c}	3.15±0.07^{a}	9.54±0.00^{b}	1.82±0.03^{d}
A3	85.31±0.01^{a}	0.30±0.00^{d}	0.10±0.00^{d}	3.20±0.42^{a}	8.73±0.02^{c}	2.61±0.02^{c}
B1	78.15±0.07^{f}	1.37±0.03^{a}	0.96±0.00^{a}	2.17±0.01^{b}	7.37±0.02^{d}	9.98±0.09^{b}
B2	78.42±0.02^{e}	1.30±0.00^{a}	0.93±0.01^{a}	2.00±0.00^{b}	7.11±0.02^{e}	10.24±0.07^{b}
B3	79.02±0.02^{d}	1.17±0.03^{b}	0.82±0.02^{b}	1.81±0.01^{b}	6.56±0.00^{f}	10.61±0.02^{a}

Note: Data is represented as mean ± standard deviation, Means in a column with the same superscript are not significantly different (p<0.05). **Samples**; A1-A3: 100ml yoghurt and 10ml of Moringa Extract each (1g/100ml, 0.5g/100ml & 0.25g/100ml). B1-B3: 100ml yoghurt and Fine Powdered Moringa (1g, 0.5g & 0.25g).

Table 3. Phytochemical composition of yoghurt produced from cowmilk incorporated with moringa leaves (*M. oleifera*).

Sample code	Tannin	Total phenol	Flavonoid	Alkaloid	Saponin
A1	3.24±0.28^{d}	14.41±0.12^{c}	3.56±0.00^{d}	1.40±0.00^{c}	0.63±0.01^{a}
A2	2.40±0.02^{e}	12.16±0.16^{d}	3.11±0.15^{e}	1.25±0.07^{cd}	0.56±0.01^{b}
A3	2.18±0.00^{f}	10.91±0.12^{e}	2.50±0.08^{f}	1.10±0.00^{d}	0.41±0.01^{c}
B1	5.36±0.14^{a}	18.91±0.12^{a}	5.38±0.07^{a}	2.55±0.07^{a}	0.34±0.01^{d}
B2	4.98±0.28^{b}	15.66±0.23^{b}	2.40±0.00^{a}	2.40±0.00^{a}	0.20±0.01^{e}
B3	4.70±0.02^{c}	14.58±0.12^{c}	2.15±0.07^{b}	2.15±0.07^{b}	0.19±0.00^{e}

Note: Data is represented as mean ± standard deviation. Means in a column with the same superscript are not significantly different (p<0.05). **Samples**; A1-A3: 100ml yoghurt and 10ml of Moringa Extract each (1g/100ml, 0.5g/100ml & 0.25g/100ml). B1-B3: 100ml yoghurt and Fine Powdered Moringa (1g, 0.5g & 0.25g).

The fat content of the yoghurt sample decreased with a decrease in the addition of moringa extract. The fat content of the samples ranged between 1.81 and 3.29%; this shows that the moringa extract increase the fat content of the product thus adding to the fat content of the product. It has been reported that the percentage of fat content plays a vital role in yoghurt since it improves the texture, appearance, flavour and taste of yoghurt (Oladipo *et al.,* 2014). According to USDA (2001), yoghurt samples with more than 3.25% fat content should be labelled yoghurt; yoghurt with fat content between 0.5-2.0% should be labelled as Low-fat yoghurt and yoghurt with less than 0.5% fat content should be labelled non-fat yoghurt.

The ash content in the sample indicates the mineral content in this product, the ash content of the samples ranged between 0.30 and 1.37%. Sample A3 incorporated with 10 ml moringa extract (0.25 g/100ml) had the lowest ash content of 0.30% while sample B1 incorporated with 1 g of moringa powder had the highest value of 1.37%. The high ash content of the samples could be an indication of an increase in the mineral content as reported by Begum *et al.* (2013).

Table 3 shows the result of tannin, total phenol, flavonoid, alkaloid and saponin of yoghurt incorporated with extract and fine powder of moringa leaves (*M. oleifera*). The result of the phytochemical analysis for tannin, total phenol, flavonoid, alkaloid and saponin shows that there were significant differences (p>0.05) between the six samples. There were significant differences among samples in all the parameters being determined. The tannin content of the samples ranged from 2.18 to 5.36%. Sample B1 incorporated with 1 g of powered moringa leave had the highest tannin content of 5.36 while sample A3 incorporated with 10 ml of moringa extract (0.25 g/100ml) had the lowest value of 2.18%.

The total phenol content of the samples ranged from 10.91 to 18.91%. Sample B1 incorporated with 1g of powdered moringa leaves had the highest total phenol content of 18.91% while sample A3 incorporated with 10 ml of moringa extract (0.25 g/100ml) had the lowest value of 10.91%. The flavonoid content of the samples ranged from 2.50 to 5.38%. Sample B1 incorporated with 1 g of powdered moringa leaf had the highest flavonoid content of 5.38% while sample A3 incorporated with 10 ml of moringa extract (0.25 g/100ml) had the lowest value of 2.50%.

The alkaloid content of the samples ranged from 1.10 to 2.55%, sample B1 with 1 g of powder moringa leaves had the highest alkaloid content of 2.55% while sample A3 incorporated with 10 ml of moringa extract (0.25 g/100ml) had the lowest value of 1.10%. Alkaloids have anti-microbial and anti-fungal activities or properties, flavonoids

Table 4. Qualitative test for bioactive components of yoghurt produced from cowmilk incorporated with moringa leave (*M. oleifera*).

Sample code	Steroid	Anthraquinones	Terpenoid
A1	+	+	-
A2	+	+	-
A3	+	+	-
B1	+	+	-
B2	+	+	-
B3	+	+	-

Note: (+) indicate present, while (-) means absent. **Samples;** A1-A3: 100ml yoghurt and 10ml of Moringa Extract each (1g/100ml, 0.5g/100ml & 0.25g/100ml). B1-B3: 100ml yoghurt and Fine Powdered Moringa (1g, 0.5g & 0.25g).

Table 5. Sensory properties of yoghurt incorporated with moringa leaves (*M. oleifera*).

Sample code	Appearance/Colour	Flavour/Aroma	Taste	Overall acceptability
A1	7.01±1.22[a]	7.33± 1.18 [a]	6.80±1.42 [a]	7.07±1.01 [a]
A2	7.53± 1.06 [a]	7.73 ± 1.28 [a]	7.73±1.28 [a]	7.64±0.88 [a]
A3	7.53± 0.99 [a]	7.33 ± 1.23 [a]	7.67±1.29 [a]	7.56±0.89 [a]
B1	7.00± 1.07 [a]	7.80 ± 1.21 [a]	8.07±0.88 [a]	7.64±0.87 [a]
B2	7.27± 1.03 [a]	7.53 ± 0.99 [a]	7.80±1.01 [a]	7.55±0.79 [a]
B3	6.87 ± 1.25 [a]	7.47 ± 0.99 [a]	7.67±1.18 [a]	7.40±0.83 [a]

Data is represented as mean ± standard deviation, Means in a column with the same superscript are not significantly different ($p<0.05$). Samples were evaluated on a 9-point hedonic scale (9= liked extremely and 1= disliked extremely). **Samples**; A1-A3: 100ml yoghurt and 10ml of Moringa Extract each (1g/100ml, 0.5g/100ml & 0.25g/100ml). B1-B3: 100ml yoghurt and Fine Powdered Moringa (1g, 0.5g & 0.25g).

have a role in preventing liver peroxidation and anti-cancer properties (Saxena *et al.,* 2013). Alkaloids are also effective in reducing headaches resulting from hypertension (Ayitey-Smith and Addae-Mensah, 1977).

The saponin content of the samples ranged from 0.19 to 0.63%. Sample A1 incorporated with 10 ml of moringa extract (0.25 g/100ml) had the highest saponin content of 0.63% while B3 incorporated with 0.25 g of moringa powdered had the lowest value of 0.19%. The result shows that sample B1 with the formulation of 100 ml of yoghurt incorporated with 1 g of fine powdered moringa leaves had the highest tannin, total phenol, flavonoid and alkaloid contents. Phytochemicals present in samples are an indication of medicinal quality. The result showed the present and appreciable amount of bioactive components that are medicinally useful and help improve health.

Table 4 shows the result of the qualitative test for steroid, anthraquinone and terpenoid of yoghurt incorporated with extract and fine powder of moringa leaves (*M. oleifera*). The result shows the presence of steroids and anthraquinone in all the samples (A1-B3) and the absence of terpenoids in all the samples. Because of the presence of steroids in the yoghurt samples, the yoghurt will help in the regulation of cholesterol metabolism and due to the presence of anthraquinone in the yoghurt samples, the yoghurt can serve as a laxative. According to Portalatin *et al.* (2012), one of the most common medicinal uses of anthraquinone is to bring about constipation relief through its laxative effects. Anthraquinones are thought to increase the amount of fluid in the colon and may also serve to stimulate colon contractions.

Sensory evaluation

Table 5 shows the result of the sensory score for appearance/colour, flavour/aroma, taste and overall acceptability of yoghurt incorporated with extract and fine powder of moringa leaves (*M. oleifera*). The result of the sensory evaluation shows that in appearance/colour, Sample A2 and A3 (sample incorporated with moringa extract 0.5 ml and 0.25 ml) had the highest acceptability, in flavour/aroma, B1 (sample incorporated with 0.5 g moringa powder) was more acceptable among the sample while sample B1 (sample incorporated with 1 g moringa powder) considered more acceptable to the panellist compared to other products. Overall, A2 and B1 were more acceptable to the panellist. However, statistically, the result of the sensory scores for appearance, flavour, taste and overall acceptability of the samples shows that there is no significant difference ($p<0.05$) between the six samples.

Conclusion

The research work reveals the nutritional level and medicinal importance of the new product. Based on the result of this study, it can be concluded that the incorporation of moringa leaves into yoghurt samples had a significant effect on the nutritional quality and medicinal benefits of the yoghurt samples. The evaluation of the sensory attributes of the sample shows that there is no significant difference between the six samples but sample B1 which has a composition of 100 ml yoghurt with 1 g moringa powdered incorporated has the highest value for overall acceptability, hence it is the most preferred among the samples. Also, the results from this research reveal that yoghurt can be incorporated with non-dairy products such as plants containing phytochemical components to make it a functional food product. The product is not only rich in nutritional value but it also has bioactive components that have medicinal potential. Thus, the addition of non-dairy products into yoghurt increases its nutritional and medicinal qualities.

Recommendation

Based on the findings of this research, the following are recommended:

1. Extract from moringa leaf can be incorporated into yoghurt production for nutritional and medicinal purposes.
2. Sensitization on the consumption of yoghurt with medicinal benefits such as the product of this research should be encouraged.
3. Further nutrition studies should be carried out and the effects of incorporating non-dairy and anti-nutrients into yoghurt should be investigated.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest

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