Proximate and sensory evaluation of non-diary probiotic beverages made from tiger-nuts (*Cyperus esculentus* L.) and soy bean (*Glycine max*)

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Abstract

The need for non-dairy probiotic beverages has been on the rise due to various consumer needs and concerns. The current study measured the proximate composition of two non-dairy probiotic beverages (made of tiger nut milk and soymilk) as well as a control sample and determined which sample was most preferred on measures of appearance, mouthfeel, flavour, taste, odour and colour. Two non-dairy samples were prepared; soy (1:3 product-to-water ratio), tiger nut (1:3 product-to-water ratio) and a control sample made of milk using milk powder. Standard analytical procedures were employed for assessing the proximate and chemical properties of the samples in triplicates. The results of the study indicated that moisture, fat as well as protein were quantitatively the major components of the beverages while ash and crude fibre were found to be meagerly present. Computation revealed control having the highest carbohydrate as well as energy compositions of 14.71%, 458.73 kJ/g while soy milk and tiger nut milk beverages had 14.49%, 454.69 kJ/g and 14.42%, 452.81 kJ/g compositions respectively. Statistically the samples were not found to be significantly different (p<0.05) in moisture, fat, carbohydrate and energy compositions unlike protein, fibre, and ash compositions where the samples were found to be different significantly. It was concluded that soy and tiger nut non-diary probiotic beverages compared relatively well with the traditional milk beverage (control) an indication that the two products could compete with the traditional milk based probiotic beverages on consumer acceptability parameters.

Keywords: Beverage, Chemical composition, Non-diary, Probiotics, Titratable acidity, Tiger nuts

Introduction

The health and nutritional benefits of probiotic bacteria mainly *Lactobacilli* (Lactic acid bacteria - LAB) and *Bifidobacteria* species (Champagne, Gardner, & Roy, 2005; Lahtinen et al., 2006; Ranadheera, Baines, & Adams, 2010) are numerous, which are prevention and treatment of diarrheal diseases, systemic infections, enhancement of the specific parameters of the immune system, lowering the blood cholesterol level, improving the fermentation of non-digestible dietary residue, production of vitamin K, and absorption of ions (Albertini et al., 2010). One best ways to achieve these benefits from probiotics is to be prepared in the form of probiotic foods where these products will possess appropriate sensory properties in order to be accepted adequately by the consumer (Aguirre & Collins, 1993).

Apart from people consuming probiotics as fermented food products, now probiotics are added as supplements (Ranadheera et al., 2010), delivered into the gastrointestinal tract as food ingredients (Delzenne, Neyrinck, Bäckhed, & Cani, 2011) and dietary supplements as well as nutraceuticals in capsules (Ranadheera et al., 2010). In current times, probiotics are being produced mainly in the form of yoghurts which is a dairy product (Delzenne et al., 2011). The growing trend in vegetarianism (He & Hekmat, 2014) attributed to environmentalism, animal welfare, economic reasons, ethical considerations, world-hunger issues coupled with religious beliefs are the reasons put forward by several researchers (Fox & Ward, 2008) for people consuming a vegetarian diet tied with the many benefits that plant-based diets confer, including lower levels of saturated fat,
cholesterol, and animal protein, while offering higher carbohydrate, fibre, magnesium, boron, folate, antioxidant, carotenoid, and phytochemical intake (Fox & Ward, 2008). In our current study, two plant based ingredients (soybeans and tiger nuts) were used to produce probiotic beverages. Aside the benefit of probiotics in diets, these plants based ingredients have varying nutritional properties to offer to the consumers (Barnes, Harper, Bodyfelt, & McDaniel, 1991). Soybeans (Glycine max) are composed of 40% high-quality protein and 20% oil. Soybeans contain high levels of a number of phytochemicals and are specially noted for the cholesterol lowering effects of its protein. Among the numerous health-promoting compounds of soy, its flavones play a key role, including the prevention and treatment of cardiovascular disease, cancer, and osteoporosis, premenstrual and postmenstrual symptoms (Hashemi, Shahidi, Mortazavi, Milani, & Eshaghi, 2014). Also, tiger nut has a knot shape which come from the hazet nut family. The tuber's eaten raw or baked/roasted are about the size of eight peanuts and are abundantly produced in Ghana (Gambo & Da’u, 2014; Sanful, 2009). Tiger nuts are rich in oil (Mason, 2008) as well as vitamins C and E and minerals such as magnesium, potassium, calcium, iron which help to protect one from cancer and cardiovascular diseases (Adejuyitan, 2011; Ejoh & Ndjourenkeu, 2006).

Probiotic products are known to have medical uses in particular (Ringdahl, 2000) and for a variety of gastrointestinal conditions and in preventing antibiotic-associated diarrhoea. Probiotic products can be presented in large variety such as in the form of a set or stirred (drinking) yoghurt, plain, partly skimmed or skimmed, sweetened and flavoured forms (Imele & Atemnkeng, 2001; Rudrello, 2004) which can satisfy the present-day consumers preference of foods that promote good health and prevent disease (Khurana & Kanawjia, 2007). The increasing knowledge on the importance of beneficial bacteria in diet has given rise to the increased consumption of probiotic products. However, these probiotic products on the market do not meet the needs of all consumer groups since they are mostly produced as yoghurt (a milk product). To satisfy the food needs of all groups of people, non-dairy probiotic product becomes an obvious choice (Sethi, Tyagi, & Anurag, 2016). Meanwhile, there has been little work to assess the consumer acceptability of non-dairy probiotic products. Works done on non-dairy probiotic milk has ingredients limited to the geographical location of the researcher (Adejuyitan, 2011; Ejoh & Ndjourenkeu, 2006; Gambo & Da’u, 2014). Thus, the need to incorporate Ghanaian based ingredients into the production of the non-dairy probiotic beverages become apparent. In addition, these ingredients are less expensive and readily available in the Ghanaian markets compared to the cost of purchasing milk (Frimpong, 2015; Sanful, 2009). The objective therefore is to produce non-dairy beverage from non-dairy milk; tiger-nut milk and soy milk as well as to evaluate the sensory properties (appearance, colour, flavour, taste, odour and texture/mouth feel - consistency) of the variously fermented beverages.

Materials and Methods

Materials

The tiger nuts (Cyperus esculentus L.) and the soy beans (Glycine max) were sourced from the everyday market in Sunyani, Brong Ahafo region of Ghana. The probiotic tablets (Nordic Probiotics, Lot # 43599113) used were purchased from Normdic Naturals, Inc. (Watsonville, USA). Analytical grade chemicals were procured from the Central Biochemistry Laboratory at the Kwame Nkwame University of Science Technology (KNUST) (Kumasi – Ghana).

Non-dairy milk probiotic beverage production

The different probiotic samples were prepared using the method described by He and Hekmat (2014).

Soybean milk probiotic beverage preparation

Dried soybeans (Glycine max) were soaked overnight in a warm (37 °C) clean water. The soybeans were drained, dehulled, washed and blended with water in a 1:3 ratio (soybean:water) for 2 minutes using an electric Sanyo SM12M blender (MaxMart, Accra, Ghana). The resulting slurry was strained through a double lined cheese cloth to render soymilk 6% (w/v) (He & Hekmat, 2014). The milk was boiled at (100°C) for 15 minutes thereafter the sample was cooled to 37°C, probiotic capsules (6 capsules per 2 L) were then added and fermented at 37 °C for 8 hours.

Tiger nut milk probiotic beverage preparation

The tiger nuts were sorted, washed, soaked in water (put in refrigerator for 24 hrs.), drained and were blended with water in a 1:3 ratio (tiger-nut:water) for 2 minutes, using an electric blender (Sanyo SM-B12M) (MaxMart, Accra, Ghana). The resulting slurry was
strained through a double-lined cheese cloth to render tiger nut milk 6% (w/v) (He & Hekmat, 2014) which is a popular beverage called “chufa de horchata” in Spain and “atadwe milk” in Ghana. The milk was boiled (100°C) for 15 minutes, cooled to approximately 37 °C and probiotic capsules (6 capsules per 2 L) were then added and fermented at 37 °C for 8 hours.

**Probiotic (control) milk beverage preparation**

Probiotic beverage was prepared as described by Dirar (1993). Clean water was boiled (100°C) for 30 minutes, cooled to approximately 37 °C, blended with non-dairy milk powder in a 1:2 ratio respectively, for 15 seconds. The initial brix was increased to 16 using sucrose thereafter probiotic capsules (6 capsules per 2 L) were added and then was fermented at 37 °C for 8 hours. The probiotic beverages were stored at 4 °C pending analysis.

**Proximate and chemical determinations**

The proximate compositions (moisture, ash, crude fibre, protein, fats) as well as the chemical (pH and titratable acidity) properties of the non-diary probiotic beverages were determined in triplicates using the official methods of analysis (AOAC, 1990). Carbohydrate content was calculated by difference while energy content of the probiotic samples was calculated per Golly and Amadotor (2013) method.

**Sensory evaluation**

**Sensory panel selection**

Sensory evaluation or analysis of the probiotic beverages was conducted to assess consumer acceptability of the beverages using He and Hekmat (2014) protocol. A sensory panel size of fifteen (15) respondents was recruited via word of mouth comprising students from the Hospitality and Tourism department of Sunyani Technical University (STU). Participants of above 20 years were invited and made aware of the purpose of the study and those with one form of allergy or the other based on the sample compositions and some physiological conditions were excluded from the exercise. The 15 respondents (sensory panelists) were selected based on their ability to precisely distinguish the four-basic taste; sweet, sour, salty and bitter using standard solutions of sugar, vinegar, salt (NaCl) and coffee respectively. Three-digit codes were used to mask the identity of the solutions. Panelists were required to taste one solution at a time and rinse their mouth with purified drinking water which they had been provided with. They were provided with score sheet to distinguish the solution based on sweet, sour, salty and bitter tastes. Based on the results, they were invited later for the main sensory evaluation of the non-diary probiotic beverages.

**Sensory Sample Preparation for the Panel**

All three samples (control, soy, and tiger nut beverages) were produced on the same date and were stored at 4 °C. Each sample was distributed in 20 g portions in plastic cups and was presented in a balanced random order to reduce order bias. Three-digit codes SPY, YYG and TAG were used to mask the identity of the samples; Soymilk, Yohgurt and Tiger nut respectively. Panelists were ushered into the room one at a time and each panelist was seated in individual booths in the sensory testing area, separate from the preparation room. All panelists received three coded samples at 4°C in balanced random order. They were provided with a glass of water and the accompanying questionnaire (score sheet) on which to score the products based on appearance, colour, odour, taste, flavour, texture/mouthfeel (consistency) using a five-point hedonic scale ranging from one (1) to five (5) where 1 corresponded with dislike a lot, 2 - dislike a little, 3 - neither like nor dislike, 4 - like a little and 5 corresponded with like a lot. Before evaluating the products, panelists were instructed to assess the samples from left to right and to cleanse their palate with water between each sample. Panelists were also instructed not to speak to each other as they completed their questionnaire.

**Statistical analysis**

The data collected from the laboratory as well as the sensory evaluation were organized using Microsoft Excel Spreadsheet version 2013 and were analyzed using Minitab version 15. A one-way repeated measure analysis of variance (ANOVA) and Tukey-Kramer adjustment were used to analyze the proximate as well as the chemical composition of the beverages while a one-way repeated measures ANOVA and Tukey-Kramer adjustment were also used to compare differences amongst samples for each characteristics of appearance, colour, odour, taste, flavor and texture/mouthfeel (consistency).
Results and discussion

Proximate composition of probiotic beverages products

The proximate composition of the probiotic beverages; control (YYG) made from powdered milk, tiger nut milk (TAG) and soy milk (SPY) are shown in Table 1 below. Moisture, fat as well as protein were quantitatively the major components of the beverages (Table 1). Moisture ranged between 74.28% and 74.31% with tiger nut beverage being the highest and soy beverage with the least. For protein content the control had the highest composition of 8.41% followed by tiger nut beverage and soy beverage with 8.28% and 8.23% compositions respectively (Table 1). Fat content was also highest in soy beverage, the tiger nut beverage and finally the control with 1.85%, 1.81% and 1.77% fat compositions respectively. Ash and Crude fibre were found to be sparsely present (Table 1). Soy beverage had 0.89% of ash content being the highest among the three samples while 0.84% and 0.82% were the ash compositions in tiger nut beverage and control respectively. Fibre on the other hand was highest in tiger nut beverage (0.34%) followed closely by soy beverage with 0.31% and then sparingly present in control having 0.01% fibre composition (Table 1). Computation revealed control having the highest carbohydrate as well as energy compositions of 14.71% and 458.73% respectively while soy and tiger nut beverages had 14.49% & 454.69% and 14.42% & 452.81% compositions respectively. Statistically, the samples were not found to be significantly different (p>0.05) in moisture, fat, carbohydrate and energy compositions unlike protein, ash, and fibre compositions where the samples were found to be different significantly (p<0.05) as presented in Table 1 below.

All samples had high moisture contents ranging between 74.28% and 74.31% (Table 1). Tiger nut had the highest value (74.31%) then the control with (74.28%) and soymilk beverage which had the least value of 74.23%. The high moisture contents of the samples could affect the stability and safety of the products with respect to microbial growth and proliferation, hence, the products require cold storage for shelf-life extension. From Table 1, protein contents of the beverage samples ranged between 8.23% and 8.41% with yoghurt having the highest value and soy beverage the least respectively. A similar work done by Ukwuru, Ibeneme, and Agbo (2011) showed that protein increased with increase in tiger nut substitution. The results also agreed with the report of Belewu, Belewu, and Olatunji (2005) and Udeozor (2012) which state that protein content was higher for yoghurt and tiger nut milk than for soy milk. Eka and Ohaba (1977), also found similar protein increase in tiger nut. The protein content of tiger nut beverage recorded in the current research is slightly lower than that reported for Spanish tiger (8.45%) but relatively higher than the value reported for the African tiger nut (7.32%) as reported by Codina-Torrella, Guamis, and Trujillo (2015) and could be due to differences in extraction methods. Soy beverage also had relatively a comparable protein content as reported by Sethi et al. (2016) but far higher than 5.8% reported for soy milk beverage by Jeukendrup (2016). The high protein content of the control sample in the current research could be due to the use of evaporated milk powder in the preparation of the beverage which could have been a source of concentrated protein unlike the tiger nut and soy beverages that were prepared from the raw materials. From Table 1, fat content of the beverages was highest in soy beverage with 1.85% while tiger nuts and control beverages had 1.81% and 1.77% fat content respectively. The control having the least and significantly different fat content in this study was to be expected since preprocessed milk powder was used for the yoghurt and the fat content might have been reduced. As observed in the current study, the tiger nut beverage was reported to be rich in fat (1.81%) (Belewu, Belewu, & Bamidele, 2010) and the nut itself was reported to be composed of 25.50% of fat (Belewu & Abodunrin, 2006). The level in the beverage samples was higher than the minimum (3%) level required by the Codex Alimentarius and Ghana standards for fermented milk products (Passmore & Eastwood, 1986). The fat in the samples is a concentrated form of energy and protects the body by insulating it against temperature and environmental changes. The presence of fat provide avenue for fat soluble vitamins and essential fatty acids as well conjugated linoleic acids (CLA) found in the samples (beverages) which help to prevent colon and breast cancer as they are strong antioxidant constituents of milk fat (Harris, Park, & Isley, 2003). CLA also helps reduce the risk of heart disease by reducing the levels of prostaglandin PGE -2 (Harris et al., 2003). The Ash content ranged between 0.82% and 0.89%, with soy beverage having the highest value of 0.89% while tiger nut beverage and the control recorded the least value of 0.84% and 0.82% respectively as shown in Table 1.

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This finding agrees with the report of Ukwuru, Loveth, and Onokah (2008). Ash indicates the measure of minerals in a food commodity. The variation in ash content may be due to variation in inorganic compounds especially calcium as well as ion present in the milk extracted from soybean, tiger nut as well as the control. Fibre are the structural parts of plants and thus are found in all plant-derived foods. The low fibre content of the beverages could be due to straining of the milk using a double lined cheese cloth for the beverage production. The control had a significantly different and the lowest fibre content of 0.01% compared with 0.34% and 0.31% for tiger nut and soy milk probiotic beverages respectively. The low fibre content of the beverages agree with Aboel-Enein (2015) who also reported low fibre content for traditional beverages in Egypt. The non-diary probiotic samples had carbohydrate contents between 14.33% and 14.49%. Soymilk probiotic beverage had the highest value (14.49%) amongst all the samples while tiger nut milk probiotic beverage had 14.42% and control probiotic beverage having the least value (14.33%) (Table 1). Several works have confirmed the presence of high carbohydrate content in tiger nut reporting that tiger nuts contain more carbohydrates than the cow’s milk and soy bean milk (Sethi et al., 2016). High carbohydrate content of Tiger nut and Soy milk probiotic beverages could be probably due to high contents of protein and fat. The high carbohydrate content presents these non-diary probiotic beverages as relatively good sources of calories. Meanwhile, the energy value of the probiotic beverage was significantly higher in the control (458.73 kJ/g) compared to soy milk and tiger nut milk beverages of energy values of 454.69 kJ/g and 452.81 kJ/g respectively. The results in this research suggest a low energy value of the beverages compared with daily energy requirement of an average adult meanwhile about 10% of the energy needs of children could be obtained. Milk is generally known not to be high density energy food. The high moisture content of the beverages could be responsible for the low energy value (Fig. 1).

Chemical properties of the probiotic beverages

Titratable acidity (TA)

The titratable acidity of all the products satisfied the minimum recommended value of 0.6 °T set by Codex Standards for yoghurt and related products (Sánchez-Zapata, Fernández-López, & Angel Pérez-Alvarez, 2012). Fig. 2 shows the titratable acidity levels of all the beverages; soy (1.87 °T), control (1.80 °T) and tiger nut (1.81 °T) reported in this study are similar to that reported by Younus, Masud, and Aziz (2002). The latter study reported acidities in the range of 1.89 °T (soybeans), 1.76 °T (yoghurt) and (1.80 °T) tiger nut. The increase in total acidity causes an increase in the rate of acidification or pH reduction during the beverages production and this is alleged to improve the growth of Lactobacillus bulgaricus (Özer & Robinson, 1999; Yeganehzad, Mazaheri-Tehrani, & Shahidi, 2007). The acidity of the product determines the degree of survival of beverages bacteria in the course of storage and, later on, leads to changes in the beverages structure and viscosity as well as its sensitivity to syneresis (Savello
The acidity of beverages also could affect the overall flavour of products as explained in the work of Barnes et al. (1991). In Fig. 2, the values ranged from 1.79 °T to 1.88 °T. Soy probiotic beverage had the highest value (1.88 °T), followed by tiger nut (1.82 °T) while the control with 1.79 °T was the least value.

pH

The pH expresses the level of astringency produced as a result of the production of lactic acid by the action of Lactobacillus lactic on lactose in the beverages. The acidic pH of beverages ionizes calcium and the absorption of calcium in the intestine (Bronner & Pansu, 1999). Low pH in the non-diary beverages will reduces the inhibitory effect of phytic acid on calcium, increase of the concentration of Conjugated Linoleic acid (CLA) bioavailability with vitamin D playing a major regulatory role. The pH value for the beverage samples ranged between 3.69 and 3.86 in Fig. 2. The pH value for Soy probiotic beverage (3.86%) was higher than that of the control and tiger nut probiotic beverages which had 3.72% and 3.69% respectively. These pH values compared favourably with (Ukwuru & Ogbodo, 2011) who used tiger nut for the preparation of milk. They stipulated that tiger nuts could act as stimulant and tonic and it can be used in the treatment of indigestion, colic diarrhoea and dysentery. This shows that tiger nut is less acidic and implies that milk prepared from tiger nut will be acceptable to patient with ulcer and other related problems since it is less acidic.

Sensory evaluation

From Table 2, the sensory scores revealed various significant differences (p<0.05) in all the parameters evaluated. The non-diary probiotic beverages were evaluated by the fifteen (15) sensory panelists for the following attributes; appearance, odour, colour, taste, flavour and texture/mouthfeel (consistency). The beverages recorded mean scores that were statistically different in all the attributes assessed in the samples. The control scored the highest followed by tiger nuts and soy probiotic beverages with 4.8, 4.6 and 4.5 mean scores for appearance respectively (Table 2). For colour and flavour, both the control and soy probiotic beverages had the same score of 4.7 for the two attributes with tiger nut beverage also scoring the least (1.7) for both attributes Table 2. Again, both the control and soy beverages scored the same value of 4.5 for mouthfeel while tiger nut beverage yet again scored the least of 4.2 as presented in Table 2. Odour score was highest in the control (3.9) followed by tiger nut beverage with 3.7 and finally soy probiotic beverage with 3.6. Unlike the other attributes where tiger nut probiotic beverage scored the least values, for taste attribute tiger nut probiotic beverage scored the highest value of 4.3 followed by soy probiotic beverage with 3.9 and finally the control (3.3) being the least score for taste (Table 2). The appearance of the beverages refers to the level of visual appeal of the products obtained by fermenting the various milk substrates with relevant microbes. The appearance of a product will influence the amount and frequency of purchase. From Table 2, based on the judgment of the panel the two non-diary probiotic beverages (soy and tiger nuts) scored high marks (above 90%) similarly as the control. Intra-sample comparisons revealed that there was significant overall difference (p<0.05) among the samples.

For the attribute colour, several research or studies carried out display that the presence of probiotics in beverage does not affect its colour or consumer acceptance (Hekmat & Reid, 2006). Results from the acceptance test indicated that a potential market does exist for beverages containing probiotic beverages. The mean scores for colour ranged from 1.7 for tiger nuts beverage being the least score (Table 2) to the control and soy beverages both having 4.7 (Table 2).
In terms of colour changes, it may be due to the colour of the raw material and its geographical origin. There was a significant difference between the mean scores for colour of the products (Table 2). The odour is sensation produced when volatile compounds stimulate olfactory receptors in the nasal cavity and this may be due to the flavor or any essence added to the products during preparation. The mean score was highest in the control (3.9) and least in soy milk (3.6) (Table 2). Flavour is the total sensations resulting from stimulation of the chemical senses in the oral and the nasal cavities, namely taste, gustatory, olfactory and trigeminal receptors.

The flavour produced from the fermentation of the beverages is essentially due to the production of acetaldehyde and other volatile aromatic compounds resulting from the breakdown of carbohydrates by the relevant microbes. The result (Table 2) shows 94% of the sensory panelists adjudged soybean and control probiotic beverages as having the best aroma, followed by tiger nut beverage with only 34% acceptance for odour. Many researchers have applied individual response data from participants to assess whether consumers use flavour information when making purchase decisions of non-dairy probiotic beverages (Caswell & Mojduška, 1996) and found a positive correspondence. Taste as represented by flavour, aroma, and any other sensory characteristics may influence consumption of a product. If consumers find the taste acceptable or pleasant they are likely to increase their budget share allocated for purchase of such product. Moon, Kong, Lee, Raychaudhuri, and Hurwitz (1999), stated that taste appears to be a positive attribute influencing consumers’ buying behavior. From Table 2, the mean scores for taste were 4.3 for tiger nut beverage being the highest, 3.9 for soy probiotic beverage and the least being 3.3 for the control. This means that the taste of all the products was well appreciated by the panelist (Fig. 3). Meanwhile, tiger nut probiotic beverage having scored the highest is a significant indicator that it can be accepted by consumers comparatively same as soy probiotic beverage compared to the control. Differences in taste could be due to the addition of flavoring compounds or, in some cases, the extent of formation of flavour compounds during fermentation (Barnes et al., 1991) and also the type of the raw material.

Table 2 Sensory evaluation scores non-dairy probiotic beverages

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Appearance</th>
<th>Colour</th>
<th>Odour</th>
<th>Taste</th>
<th>Flavour</th>
<th>Mouthfeel</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPY</td>
<td>4.50±0.03a</td>
<td>4.70±0.06a</td>
<td>3.60±0.03a</td>
<td>3.90±0.03ab</td>
<td>4.7±0.06a</td>
<td>4.5±0.06a</td>
</tr>
<tr>
<td>YYG</td>
<td>4.80±0.07ab</td>
<td>4.70±0.09a</td>
<td>3.90±0.04a</td>
<td>3.30±0.01c</td>
<td>4.7±0.05a</td>
<td>4.5±0.02a</td>
</tr>
<tr>
<td>TAG</td>
<td>4.60±0.03b</td>
<td>1.70±0.01b</td>
<td>3.70±0.07b</td>
<td>4.30±0.01bc</td>
<td>1.7±0.02b</td>
<td>4.20±0.03b</td>
</tr>
</tbody>
</table>

Mean ± standard deviation

Means that share the same superscript (a, b, c) in the same column are significantly different (p<0.05)

SPY - Soy Probiotic Beverage, YYG – Control Probiotic Beverage, TAG -Tiger Nut Probiotic Beverage

The mouthfeel is an attribute of the beverages to flow without forming lagging insoluble particles on the inner side of the containers. It refers to the property of the beverages to exhibit smoothness and good flow properties. It was observed that 90% (mean score of 4.5 out of 5) each of the panelists accepted the mouthfeel of soy and the control probiotic beverages while 84% (mean score of 4.2 out of 5) accepted the texture of tiger nut probiotic beverage (Table 2). Mean scores for the mouthfeel of the control was the highest (4.5) similar to soymilk (4.5) and tiger nut scored the lowest (4.2) which are however good scores (Fig. 3). According to Barnes et al. (1991), it had been found that, the mouthfeel of the products were important factors in a consumer's purchasing decision. They also indicated that the mouthfeel concerns were for particular factor, especially the tactile sensation perceived in the oral cavity. The mouth feel of yoghurt has been known to be affected by the fat and carbohydrate contents of the product. A product with too low fat contents coupled with too
high carbohydrate content could result in a chalky texture while a product with too high fat content could also have an undesirable mouthfeel (Barnes et al., 1991; Lucey & Singh, 1997).

Conclusion

The result revealed that probiotic beverages prepared from tiger nut and soybean could be used as beverage for both the young and old people due to the high nutrient contents (protein, fat and carbohydrate as well as the energy value). Based on the sensory evaluation, the tiger nut and soybean probiotic beverages were also acceptable compare to the control (probiotic made from powdered milk), even though preference for tiger nut probiotic beverage was the least. This indicates that utilization of tiger nut will be enhanced when processed into beverage drinks. This study shows a promising marketability potential of non-diary probiotic beverages for vegetarians and individuals with lactose intolerance. The results also show an indication that the two non-diary probiotic products could compete with the traditional yoghurt probiotic beverage on the market. It is suggested that milk from tiger-nut and soybean be encouraged especially in Ghana to solve the problem of protein–calorie malnutrition in Ghana in particular and the world in general as these probiotic beverages also possess almost similar properties as that of cow milk and they are of cheap sources. It is recommended that further studies be conducted on the shelf life as well as packaging of the products. Also, characterization of the bioactive components of tiger nut from Ghana should be carried out to expose further the potentials of the commodity.

References

Emerging segment of functional beverages: a plastic properties of bovine and caprine yogurt gels.


