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Physico-Chemical, Sensory Attributes and Microbial Analysis of Yoghurt Made From Powder Milk and Tiger-Nut Milk Blend

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Abstract

Yoghurt is a fermented milk product produced by bacteria fermentation of milk which is consumed all over the world. This study investigated the physico-chemicals, sensory attributes and microbial analysis of yoghurt made from powder milk and tiger-nut milk. Powder milk-tigernut milk yoghurt was produced in the following ratio and coded. ABE (90:10), FBE (80:20), DCF (70:30), BDI (60:40), BEG (50:50) and EFE (100% powder milk as control sample). The results revealed that the protein, fat, ash and the total energy content of the yoghurt were all increased as the level of the tiger-nut milk in the yoghurt increased. The moisture content ranged from 84.24 to 92.15%. There were significant different ($p \leq 0.05$) in the total carbohydrate content, the total carbohydrate ranged from 0.35 to 10.67%. The pH of the sample BEG and EFE was not significantly different ($p \leq 0.05$), so also ABE and DCF. However, the EFE had the lowest pH value. The total solids ranged from 12.09 to 16.31% with sample EFE having the highest value of 16.31% total solids. Titratable acidity (TTA) ranged from 1.04 to 6.02% with EFE having the highest value of 6.02% TTA. The results of the colour parameters revealed that EFE had the highest value for lightness (L*) and colour intensity (ΔC) of 85.58 and 87.88 respectively. There were significant different ($p \leq 0.05$) in the hue angle (H*=tan b*/a*) as the level of the H* increased with the increased level of the tiger-nut milk. The value of a* (redness/greenness) decreased as the tiger-nut milk increased while the b* value (blueness/yellowness) was risen and fallen as the tiger-nut milk increased. The delta-chroma value (ΔC) of ABE had the highest value of 19.89. The microbial results under refrigeration temperature at 4°C showed that as the level of the tiger-nut milk increased, the microbial loads increased particularly on the total viable bacterial count (TVC). The total fungal counts (TFC) also showed a similar trend but the EFE had the highest count of 6.10×10^3 cfu/ml during the fourth week of the storage. The total coliform counts (TCC) was detected only on the sample BDI and BEG throughout the storage period below the limit of detection (LOD) of microbial count. However, the microbial loads of all the samples were within the acceptable limit. The sensory quality of the samples showed that there were significant different ($p \leq 0.05$) in all the parameters analyzed. The highest taste, colour aroma and overall acceptability was recorded for ABE while, the mouth feel was recorded for FBE

Keywords: Yoghurt; Physic-chemical; Microbial; Sensory attributes; Tiger-nut milk; Powder milk

Introduction

Milk is said to be a complete food with significant amounts of essential nutrients required by children and adults for growth, development and well being[1]. However, milk is highly perishable and prone to microbial spoilage due to its high moisture and nutrient profile. Yoghurt is a fermented milk product that evolved empirically some centuries ago. Yoghurt provides an opportunity to extend the shelf-life of milk and preserve its nutrients for human consumption due to its acidic properties. More also, yoghurt is a functional food that contains probiotics, prebiotics and synbiotics. Probiotics are live microbial feed supplements that beneficially affect the host animal by improving its intestinal

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microbial balance[2]. Prebiotics as ''non-digestible food ingredient that beneficially affects the host by selectively stimulating the growth and/or activity of one or a limited number of bacteria in the colon''. Agbon, C.,[3] reported that symbiotic is a combination of probiotics and prebiotics that beneficially affects the host by improving the survival and the implantation of live microbial dietary supplements in the gastro-intestinal tract by selectively stimulating the growth and/or by activating the metabolism of one or a limited number of health promoting bacteria. Yoghurt production involved the standardization and pasteurization of milk to be fermented to 72°C for 30 minutes, cooled to 43°C and inoculated with mixed culture of *Lactobacillus bulgaricus* and *Streptococcus thermophillus* and held at this temperature for 4 – 6 hours. Yoghurt has high nutritionaland therapeutic properties that promote health in human body. Anderson, J (1994) and Bamishaiye, E (2011)[4,5] reported that the higher nutritional value of these products has been attributed to the increased production of certain nutrients and to the pre-hydrolysis of major milk components by lactic starter cultures, rendering them more digestible.

Tiger nut (*Cyperus esculentus L.*) belongs to the family cyperaceae. It is a cosmopolitan perennial crop which belongs to the same genus as the papyrus plant which is very common in seasonally flooded wetlands[6,7]. Tiger-nuts have many varieties all over the world. In Nigeria, there are three varieties; black, brown and yellow but only the brown and yellow are readily available in the market. Bystron, J., et al., (2004)[8] reported that tiger nut consumption can help prevent heart disease and thrombosis and is said to activate blood circulation. Tiger-nuts are rich in energy content such as (starch, fats, sugars, and proteins) along with high content of soluble glucose and oleic acid[7,9]. However, when the milk juice is extracted from tiger-nut it is given different names vis a vis the location where is made up from such as Atadwe in Ghana, Horchata in Spain. This tiger-nut milk are sweetened and consumed in summer time[9]. Tiger nut is an under-utilized crop that was reported to be high in dietary fiber content for treatment and prevention of cardiovascular diseases and also contain protein of high biological value[10,11]. However, the cost of dairy milk and its derivative products are on the high side in the developing countries. This has brought about low consumption of dairy milk and milk products that demands for the processing of milk from the different seeds and nuts[7]. This study was therefore carried out to evaluate the physico-chemical, sensory and microbiological analysis of yoghurt produced from powder milk-tiger-nut milk.

Materials and Methods

Fresh Tiger-nuts and sachet powder milk (peak) were purchased from the Bodija central market, Ibadan, Oyo state, Nigeria. The chemicals and equipment used were of analytical grade and were obtained from food technology laboratory, University of Ibadan, Ibadan, Oyo State.

Preparation of tiger-nuts milk

Tiger-nuts were picked to remove the bad nuts and other foreign materials that may affect the quality of the tiger-nuts milk and washed thoroughly with a tap water. Thereafter, the tiger-nuts was soaked over-night in a clean a clean water so as to soften the fibre and facilitate ease milling. The tiger-nuts was removed from the water and allowed to drain. About 1kg of the tiger-nuts was milled with (5.8L) of tap water in a (master chef blender) and the slurry was filtered using muslin cloth to extract the milk. The resultant tiger-nut milk was thoroughly shake and allowed to stand for 30 minutes so as to allow the starch molecules to settle out to prevent gelatinization during pasteurization. The supernatant (tiger-nut milk) was decanted and pasteurized at 72°C for 15 minutes then allowed to cool.

Preparation of milk solution

About 1kg of powder milk was weighed together with 300g of sucrose and reconstituted into (3L) of distilled water. The sucrose was allowed to dissolved and thoroughly mixed together to have a homogeneous milk solution. The milk solution was pasteurized at 72°C for 15 minutes and allowed to cool.

Preparation of the blends (powder milk-Tiger-nut) and production of powder milk-tiger-nut yoghurt

Powder milk and tiger-nut milk were prepared in the following ratio 90:10, 80:20, 70:30, 60:40, 50:50 and 100:0 as the control sample (vol/vol). Each blend were prepared into previously sterilized jars for pasteurization and pasteurized at 72°C for 15 minutes in the water bath. The jars were allowed to cool to 45°C and then inoculated with a mixed culture of *Lactobacillus bulgaricus* and *Streptococcus thermophilus* (Yogurment starters). The inoculated samples were allowed to ferment in an incubator set at 42°C for 10 hours. Thereafter, the samples were allowed to cool to 5 – 6°C, stirred and kept under refrigerated condition at 4°C for further analysis.

Physico-chemical analysis

Moisture content, ash content, crude protein, fat content, crude fibre, pH, total solid and total titratable acidity were determined according to standard methods[12]. Total carbohydrate was determined by difference and energy was determined using the modified Atwater factors thus; (% protein x 4) + (% fat x 9) + (% CHO x 4) as reported by Haug, A., et al. (2007)[13].

Colour determination

Colour was evaluated using a Chroma meter CR-410, Japan. A known quantity of the samples was placed in the quartz cell. The colour characteristics including (L*) Lightness, (a*, ± redness/greenness), (b*, ± blueness/yellowness) were measured. From these parameters, Hue angle (H*), Delta Chroma (ΔC), colour intensity (ΔC) was calculated. The samples were analyzed in triplicate[14].

$$H^* = \tan^{-1} b^*/a^*,\ \Delta C = (a^* + b^*)^{0.5},\ \Delta E = [\Delta L^{*2} + \Delta a^{*2} + \Delta b^{*2}]^{0.5}$$

Microbial analysis

The samples produced were kept under refrigeration temperature at 4°C. Microbial analysis of the sample was determined by the method described by Hunt, M., et al. (1991)[15]. Pour plate method was used, the nutrient agar (NA), potato dextrose agar (PDA) and MacConkey agar used for isolation of bacteria count, fungal count and coliform count, respectively were prepared according to the manufacturer's instructions. Microbial analysis was conducted every week for the period of one month.

Sensory evaluation

All the samples were evaluated for sensory characteristics such as colour, taste, Mouth feel, aroma and overall acceptability using twenty (20) man panel drawn from the food technology department, university of Ibadan. Yoghurt samples were identified by three-digit random numbers and presented to the panel in a random manner[16]. A nine-point hedonic scale ranging from 9 (like extremely) and 1 (dislike extremely) was used. The overall acceptability of the samples was determined as the average scores for sensory characteristics.

Statistical analysis

Data obtained was subjected toanalysis of variable (ANOVA) using the statistical package for social sciences (SPSS 2.0 VERSION). Duncan multiple range test (DMRT) was used to separate the means where significance differences existed. All analyses were done at 95% confidence level (p < 0.05).

Results and Discussion

Physico-chemical properties

The results of the physic-chemical properties of powder milk-tiger-nut milk yoghurt were presented in the table 1. There was a significant different at (p<0.05) in the protein content of the samples. The BEG sample had the highest protein content of 7.10%, the protein content of the samples increased with the increasing level of tiger-nut milk. This could be as a result of high protein profile of the tiger-nut as reported by Mian, M., et al. (1987)[17]. The fat and the ash content of the samples also show a similar trend with the protein. The BEG had the highest fat and ash content of 0.81 and 1.21% respectively. However, the fat and ash content of the blended samples is higher than that of the control sample (EFE). This could be attributed to the high lipid content of the tiger nut as reported by Mosquera, L., et al. (1996) and Ojobe, T., et al. (1983)[18,19]. On the other hand, the high ash content signifies that blended samples had higher mineral content than the control sample. The moisture content showed a significant different (P < 0.05). The moisture content ranged from 83.68 – 92.15%. This could affect the shelf stability of the products by encouraging the growth of microbial activities if not store under refrigeration system. There was a significant different (p < 0.05) in the total carbohydrate content of the sample. The total carbohydrate ranged from 0.35 – 10.67%. The blended sample ABE had the highest total carbohydrates compared to the control sample with 9.94%. The pH result revealed that there was significant different (p < 0.05) among the samples. The pH ranged from 3.94 – 4.51. The control sample EFE had the lowest pH value of 3.94 and this could be attributed to high lactic acid due to the presence of the lactose sugar in the control sample during fermentation by lactic acid bacterial[20]. The total solid reported in this work ranged from 12.09 – 16.31%. These values are in range with the value of 14.50 – 17.52 % reported by Rita E, S. (2009) and Schmdt, K., (2001)[21,22]. The total energy of the samples revealed that the blended samples BDI had the highest total energy value of 398 kcal. This could be attributed to the high fat content in the tiger-nut milk which is an evident to the total energy of the sample. This corroborates with report of Temple, V., et al. (1990)[23]. Total titrable acidity (TTA) showed that there was no significant difference (p < 0.05) between the sample FBE and DCF, so also with BDI and BEG. The control sample (EFE) had highest TTA value of 6.02% compared to the blended sample samples. However, the TTA range reported in this work is higher than the range reported by Schmdt, K., et al. (2001)[22]. TTA was reported as percentage lactic acid.

Colour parameters

The results of the colour parameters of the tiger-nut milk- powder milk yoghurt (L*, b*, a*, hue angle, deltachroma and colour intensity) is shown in the table 2. The L* (lightness) values varied significantly (p ≤ 0.05) from one another in all the samples. The EFE had the highest value of 85.58. The increase in the value of L* increases as the level of power milk in the yoghurt increasing and this could be attributed to the off-white colour of the peak milk. The value of a*(redness/greenness) revealed that there were no significant different (p ≤ 0.05) between DCF and BDI while there were significant different on the other samples. The value of a* decreased as the level of the tiger-nut milk increased. The results of b* (blueness/ yellowness) ranged from 16.30 to 17.45 and there was risen and fallen even as the tiger-nut milk increasing. The BDI had the highest value of 17.45. The hue angle (H*= tan-b*/a*) showed that there were significant different (p ≤ 0.05) in the entire sample as the level of H* increases with the increasing level of tiger-nut milk and the value ranged from 58.81 to 68.61. The results of the deltachroma (ΔC) revealed that there were not significant different between the ABE and EFE, so also between FBE, DCF and BEG. The colour intensity (ΔE) shows that there were no significant different (p ≤ 0.05) between

Table 1: Shows the physico-chemicalproperties of the yoghurt made from the powder milk and tiger-nut milk blends

Sample	Protein %	Fat %	Ash %	Moisture %	Total CHO %	pH %	Total solid %	Total energy (Kcal)	TTA %
ABE	3.44 ± 0.00^{f}	0.67 ± 0.00^{d}	0.92 ± 0.03^{d}	84.24 ± 0.01^{c}	10.67 ± 0.1^{a}	4.05 ± 0.01^{c}	15.71 ± 0.00^{b}	357 ± 0.0^{f}	1.07 ± 0.01^{c}
FBE	4.31 ± 0.01^{c}	0.68 ± 0.10^{dc}	1.11 ± 0.01^{c}	84.89 ± 0.01^{d}	9.01 ± 0.01^{c}	4.24 ± 0.01^{d}	15.11 ± 0.01^{c}	363 ± 0.01^{d}	1.16 ± 0.01^{b}
DCF	4.94 ± 0.02^{c}	0.69 ± 0.01^{c}	1.12 ± 0.01^{c}	85.93 ± 0.01^{c}	8.31 ± 0.01^{d}	4.36 ± 0.01^{c}	14.07 ± 0.01^{d}	370 ± 0.01^{c}	1.17 ± 0.01^{b}
BDI	5.62 ± 0.27^{b}	0.71 ± 0.01^{b}	1.16 ± 0.01^{b}	92.15 ± 0.01^{a}	0.35 ± 0.01^{f}	4.51 ± 0.01^{a}	14.85 ± 0.93^{c}	398 ± 0.01^{a}	1.07 ± 0.01^{c}
BEG	7.10 ± 0.05^{a}	0.81 ± 0.01^{a}	1.21 ± 0.01^{a}	87.95 ± 0.01^{b}	3.58 ± 0.01^{c}	4.41 ± 0.01^{b}	12.09 ± 2.18^{c}	387 ± 0.01^{b}	1.04 ± 0.01^{c}
EFE	4.71 ± 0.01^{d}	0.72 ± 0.01^{b}	0.94 ± 0.02^{b}	83.68 ± 0.02^{f}	9.94 ± 0.01^{b}	3.94 ± 0.01^{b}	16.31 ± 0.01^{f}	360 ± 0.01^{c}	6.02 ± 0.02^{a}

Means with different superscript in each column are significantly different (p<0.05). Values are mean of the samples ± Standard Deviation of the triplicates Determination. ABE= 90% Powder milk + 10% Tiger-nut milk; FBE= 80% Powder milk + 20% Tiger-nut milk; DCF= 70% Powder milk + 30% Tiger-nut milk; BDI= 60% Powder milk + 40% Tiger-nut milk; BEG=50% Powder milk + 50% Tiger-nut milk; EFE= 100% Powder milk.

(DCF, BDI and BEG) while there were significant different in the samples ABE, FBE and EFE. THE EFE had the highest colour intensity. This could be as a result of the powder milk in the yoghurt compared to the blended samples.

Microbial analysis

The results of the microbial analysis were presented on the table 2, 3 and 4 respectively. Total viable Count (TVC) were showed on the table 2, there were no visible growth of TVC during the day zero (0). This could be attributed to good manufacturing practices during the processing. On the first of the storage there were less than limit of detection (LOD) of the total viable count on the sample FBE and DCF while sample ABE and EFE (control sample) had no visible growth. However, sample BDI and BEG had microbial loads of 3.20×10^2 and 4.46×10^2 cfu/ml during the first week respectively. The resurfacing back of the bacterial could be that they have repaired themselves from the damage during the pasteurization[24]. More also, from the week two there was also less than limit of detection of microbial load on the sample ABE, FBE and DCF with a load of < 6 cfu/ml, < 22 cfu/ml and < 10 cfu/ml respectively while sample BDI,BEG and EFE had 5.06×10^2, 8.73×10^2 and 4.30×10^2 cfu/ml respectively. From the third and fourth week of the storage, the microbial trend showed increase as the level of tiger-nut milk is increasing. This could be as a result of the dominating bacterial of the tiger-nut that may have repaired them after pasteurization. The total fungal count (TFC) of the sample during first week showed similar trend with the total viable count but only sample BEG had microbial of 3.60×10^2 cfu/ml while sample EFE (control sample) had no visible growth. The results from the week two to the fourth week of the storage period also showed that the total fungal counts increases with the increasing level of the tiger-nut milk. However, from the third week and the fourth of the storage period, the sample EFE (control sample) had the

Table 2: Colour parameters of the yoghurt made from the powder milk and tiger-nut milk blends

Sample	L*	a*	b*	Tan-1b*/a*	ΔC	ΔE
ABE	83.48 ± 1.11^{b}	9.64 ± 0.14^{b}	17.40 ± 0.25^{a}	61.01 ± 0.57^{e}	19.89 ± 0.29^{a}	85.82 ± 1.15^{b}
FBE	78.90 ± 0.27^{c}	8.46 ± 0.04^{c}	16.30 ± 0.07^{c}	62.56 ± 0.02^{d}	18.36 ± 0.08^{c}	80.92 ± 0.17^{c}
DCF	76.38 ± 0.84^{d}	7.49 ± 0.09^{d}	16.44 ± 0.21^{c}	65.50 ± 0.02^{c}	18.07 ± 0.23^{c}	78.49 ± 0.87^{d}
BDI	76.81 ± 0.78^{d}	7.43 ± 0.08^{d}	17.45 ± 0.20^{a}	66.94 ± 0.03^{b}	18.96 ± 0.22^{b}	79.12 ± 0.81^{d}
BEG	75.99 ± 0.20^{d}	6.71 ± 0.03^{e}	17.14 ± 0.18^{ab}	68.61 ± 0.18^{a}	18.41 ± 0.17^{c}	78.18 ± 0.20^{d}
EFE	85.58 ± 0.04^{a}	10.28 ± 0.03^{b}	16.98 ± 0.01^{b}	58.81 ± 0.06^{f}	19.85 ± 0.02^{a}	87.88 ± 0.05^{a}

Means with different superscript in each column are significantly different ($p<0.05$). Values are mean of the samples ± Standard Deviation of the triplicates Determination. ABE= 90% Powder milk + 10% Tiger-nut milk; FBE= 80% Powder milk + 20% Tiger-nut milk; DCF= 70% Powder milk + 30% Tiger-nut milk; BDI= 60% Powder milk + 40% Tiger-nut milk; BEG=50% Powder milk + 50% Tiger-nut milk; EFE= 100% Powder milk.

Table 3: Total viable count (TVC) during the day of production and storage periods of the yoghurt made from powder milk and tiger-nut milk blends.

Sample	Day zero (cfu/ml)	Week 1 (cfu/ml)	Week 2 (cfu/ml)	Week 3 (cfu/ml)	Week 4 (cfu/ml)
ABE	*	*	< 6	4.00×10^3	4.20×10^3
FBE	*	< 10	< 22	5.16×10^3	7.0×10^3
DCF	*	< 18	< 10	5.80×10^3	8.10×10^3
BDI	*	3.20×10^2	5.06×10^2	6.90×10^3	8.15×10^3
BEG	*	4.46×10^2	8.73×10^2	7.80×10^3	8.0×10^3
EFE	*	*	4.30×10^2	5.40×10^3	4.60×10^3

ABE= 90% Powder milk + 10% Tiger-nut milk; FBE= 80% Powder milk + 20% Tiger-nut milk; DCF= 70% Powder milk + 30% Tiger-nut milk; BDI= 60% Powder milk + 40% Tiger-nut milk; BEG=50% Powder milk + 50% Tiger-nut milk; EFE= 100% Powder milk. *= No visible growth<= Less than microbial limit of detection (LOD)

Table 4: Total fungal count (TFC) during the day of production and the storage periods of the yoghurt made from powder milk and tiger-nut milk blends

Sample	Day zero (cfu/ml)	Week 1 (cfu/ml)	Week 2 (cfu/ml)	Week 3 (cfu/ml)	Week 4 (cfu/ml)
ABE	*	< 16	3.40×10^2	3.10×10^3	3.70×10^3
FBE	*	< 18	3.70×10^2	3.60×10^3	3.70×10^3
DCF	*	< 23	4.00×10^2	4.00×10^3	3.80×10^3
BDI	*	< 14	4.26×10^2	4.20×10^3	4.40×10^3
BEG	*	3.60×10^2	4.60×10^2	4.30×10^3	4.70×10^3
EFE	*	*	4.20×10^2	4.40×10^3	6.10×10^3

ABE= 90% Powder milk + 10% Tiger-nut milk; FBE= 80% Powder milk + 20% Tiger-nut milk; DCF= 70% Powder milk + 30% Tiger-nut milk; BDI= 60% Powder milk + 40% Tiger-nut milk; BEG=50% Powder milk + 50% Tiger-nut milk; EFE= 100% Powder milk. Key *= No visible growth, < Less than microbial limit of detection (LOD).

highest total fungal growth of 4.4 x 10^{3} and 6.1 x 10^{3} cfu/ml respectively. The increase in fungal growth of the sample EFE might be attributed to the effect of low pH of the sample that said to have favored the growth of some yeast[25]. The results of the total coliform counts (TCC) were presented on the 4. The coliforms count analysis was conducted on the day zero (0), first week and the fourth week of the storage periods. The results revealed that there were no coliform detected during the day zero on the entire sample even of the first and the fourth week of the storage periods. However, there were less than limit of detection of (LOD) value of < 6 cfu/ml, < 18 cfu/mland < 21 cfu/ml on the sample BEG during the day zero, first week and fourth week respectively while, the sample BDI had < 13 cfu/ml on the fourth week. The presence of the coliform on the samples might be as a result of increasing level of the tiger-nut milk and this could be arising from the soil flora where the tiger-nut was grown.

Sensory attributes

Sensory scores were presented on the table 5. The sensory scores revealed various significant differences in the all the parameters analyzed. However, the highest taste, colour, aroma and overall acceptability were recorded for ABE while the mouth feel was recorded for FBE. This report shows that the blended samples were accepted organoleptically by the panelist than the control sample EFE. This is in agreement that consumers prefer yoghurt from composite tiger-nut milk.

Conclusion

The result revealed that yoghurt prepares from powder milk and tiger-nut milk blend would be nutritious and safe if prepared under good hygienic condition and stored under refrigeration system. This product will help to reduce the level of underutilization of tiger-nut and thereby form a basis for new product to the dairy industry.

Competing Interests

The authors declare that they have no competing interest

Author's Contribution

This work was carried out in collaboration between all the authors. Author OJUKO, O.O designed the study, performed the statistical analysis, wrote the protocol, wrote the first draft of the manuscript and managed literature searches. Authors ADEWALE, A.T and OGECHI, A.N managed the analysis of the study and literature searches. All authors read and approved the final manuscript.

Table 5: Total coliform counts during the day of production, first and the fourth week of the storage period of the yoghurt made from powdered milk and tiger-nut milk blends.

Sample	Day zero	Week 1	Week 4
ABE	*	*	*
FBE	*	*	*
DCF	*	*	*
BDI	*	*	< 13 cfu/ml
BEG	< 6 cfu/ml	< 18 cfu/ml	< 21cfu/ml
EFE	*	*	*

ABE= 90% Powder milk + 10% Tiger-nut milk; FBE = 80% Powder milk + 20% Tiger-nut milk; DCF = 70% Powder milk + 30% Tiger-nut milk; BDI = 60% Powder milk + 40% Tiger-nut milk; BEG = 50% Powder milk + 50% Tiger-nut milk; EFE = 100% Powder milk. Key. *= No visible growth, < = Less than microbial limit of detection (LOD)

Table 6: Sensory attributes of the yoghurt made from powder milk and tiger- nut milk blends

Sample	Taste	Colour	Mouth feel	Aroma	Overall acceptability
ABE	6.45±0.01^{a}	7.10±0.10^{a}	6.52±0.03^{b}	7.22±0.02^{a}	6.80±0.10^{a}
FBE	6.30±0.01^{b}	6.56±0.02^{b}	6.67±0.12^{a}	6.71±0.01^{b}	6.57±0.022^{b}
DCF	5.06±0.02^{d}	6.17±0.03^{c}	5.71±0.01^{c}	5.71±0.01^{c}	5.62±0.03^{d}
BDI	5.34±0.03^{c}	5.44±0.01^{d}	5.64±0.02^{d}	5.64±0.02^{d}	5.77±0.03^{c}
BEG	3.95±0.05^{a}	4.35±0.01^{f}	4.25±0.05^{f}	4.25±0.05^{f}	4.30±0.10^{f}
EFE	4.65±0.01^{a}	5.23±0.03^{e}	4.87±0.03^{e}	4.87±0.03^{e}	4.96±0.02^{e}

Means with different superscript in each column are significantly different ($p<0.05$). Values are mean of the samples± Standard Deviation of the triplicates Determination. Key. ABE= 90% Powder milk + 10% Tiger-nut milk; FBE= 80% Powder milk + 20% Tiger-nut milk; DCF= 70% Powder milk + 30% Tiger-nut milk; BDI= 60% Powder milk + 40% Tiger-nut milk; BEG=50% Powder milk + 50% Tiger-nut milk; EFE= 100% Powder milk.

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