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QUALITY ATTRIBUTES OF CHEESE PRODUCED FROM GOAT'S MILK SUPPLEMENTED WITH COCONUT MILK

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ABSTRACT

Quality attributes of cheese produced from goat's milk supplemented with coconut milk was studied. Fresh goat milk was blended with coconut milk at varying proportions of 90:10; 80:20; 70:30; and 50:50. A 100% goat milk was used as control. Result showed that increase in the proportion of coconut milk (10-50%) resulted in significant ($p<0.05$) effect in quality parameters of cheese. Values ranged from 0.20-0.33% TTA; 6.40-6.69 pH. TSS declined from 1.14% in the control sample to 0.56% at 50% coconut milk substitution. The yield of cheese increased from 22.55 - 30.69% with increased coconut milk. Proximate composition of cheese was also influenced by increased proportion of coconut milk. Protein, ash, fibre and fat contents of cheese ranged from 12.94-14.49%; 1.28-2.08%; 0.03-1.79% and 15-40.41% respectively. Conversely, carbohydrate content of cheese decreased with increased coconut milk. Mineral contents of cheese showed maximum value of 74.03 mg/100g potassium, 41.60 mg/100g sodium and declined with decrease in coconut milk content, while magnesium content was highest (8.10 mg/100g) in cheese produced using 10% coconut milk supplementation. Potassium content of cheese was least (59.27 mg/100g) in control sample, but increased with increase coconut milk content. Microbial analysis showed that the product was safe for consumption. The blend of 90:10% of goat milk and coconut milk substitution was most preferred by panelists in terms of sensory parameters.

Contribution/Originality: Substitution of coconut milk in cheese production had significant effect on quality parameters of cheese studied. Physico-chemical properties, proximate composition, mineral content of cheese supplemented with coconut milk were determined. The acceptable level of coconut milk and goat milk blends for cheese production was established.

1. INTRODUCTION

Milk is regarded as an important food for infant and adolescent. This is due to the fact that milk serves as a good source of nutrients. It is equally an excellent medium for microbial growth (Akinyele, Fawole, & Akinyosoye, 1999). The cost of dairy milk and products has led to protein malnutrition as many could not afford it in developing countries.

The problem of protein malnutrition due to scarcity, high cost of milk and relative increase in population among others have led to sourcing for substitutes to address these challenges (Singh & Bains, 1988). However,

Elewa (2009) reported that milk substitute most be rich in protein, with satisfactory quality milk and should be able to play an important role in reducing protein malnutrition.

In many tropical regions, animal husbandry such as cow rearing is not common. However, goat, sheep rearing, among others are popular in these regions. The production of cow milk and products are limited, scarce and expensive (Fashakin & Unokiwedi, 1992). A remedy could be sought through combining fresh goat milk with plant milk from the drupe family in the production of traditional cheese-like product. This could offer very cheap source of milk, which can be used as substitute for whole milk in the production of cheese curds.

Cheese is a dairy product produced by coagulation of milk using acid or rennet, stirring and heating the curd, draining off whey, pressing the curd. It is further ripened or cured to obtain the final product. The essential ingredients in cheese making are milk and coagulants. Ripening or curing of the curd is one of steps in the development of texture and flavour of cheese (Ozcan & Kurdal, 2012). Cheese can also be made by coagulation of whole milk, skimmed milk, or full cream milk (Bodyfelt, Tobias, & Trout, 1998). The type of coagulant used depends on type of cheese so desired.

Goat cheese was one of the earliest made dairy products that were fermented by allowing raw milk to curdle naturally, draining and pressing the curds. Other techniques used are acid (lemon juice or vinegar) or rennet to coagulate the milk and obtain the curd. Production of cheese from goat milk has a long history. Cheese made from goat milk provides a good source of protein for people in several countries (Seifu, Buys, & Donkin, 2004). It was equally used as a mode of preservation of milk by the nomadic Fulani women of Nigeria. Nowadays, the practice is still in existence and exercised by others who have access to fresh goat milk. Cheese made from goat milk is lower in fat, calories and cholesterol. It also provides more calcium than cream cheese. It is consumed by just a few majority of Nigeria's population due to limited supply of raw goat milk and again the majority are unaware of the nutritional benefits, hence the need to create awareness and meet up with protein demand of the people.

Coconut milk is a good source of vitamins and contains medium chain fatty acids (Edem & Elijah, 2016a; Elijah, Udoh, & Edem, 2018). Coconut milk can be used in yoghurt production (Edem & Elijah, 2016b, 2016c).

This research work was aimed at evaluating the effect of supplementation of goat milk with coconut milk on the quality attributes of cheese.

2. MATERIALS AND METHODS

2.1. Materials Procurement

Goat milk was bought from Nasarawa Market, Uyo, Akwa Ibom State, Nigeria. The fresh goat milk was aseptically collected in 5-litre transparent keg and stored in a refrigerator. Mature coconut of the dwarf variety was bought from Akpan Andem market, Uyo, Akwa Ibom State, Nigeria. The coagulum (*Calotropis procera*) with the Herbarium Number, Harrison UUH3590 (Abak) was sourced from a village in Abak Local Government Area, Akwa Ibom State, Nigeria and dully certified by the Department of Botany/Ecological Studies, University of Uyo, Nigeria.

2.2. Coconut Milk Extraction

Method of Edem and Elijah (2016a) was adopted for extraction of coconut milk. The coconut milk was unshelled with a knife and the meaty portions removed, washed, and grated using a traditional coconut grater with particle size $\leq$ 1617 µm. The grated coconut was mixed with distilled water (1:1) in beaker and allowed to stand in water bath for 15 minutes at temperature 40 ^{o}C. The slurry was then pressed and filtered through cheese cloth to obtain coconut milk, as presented in Figure 1.

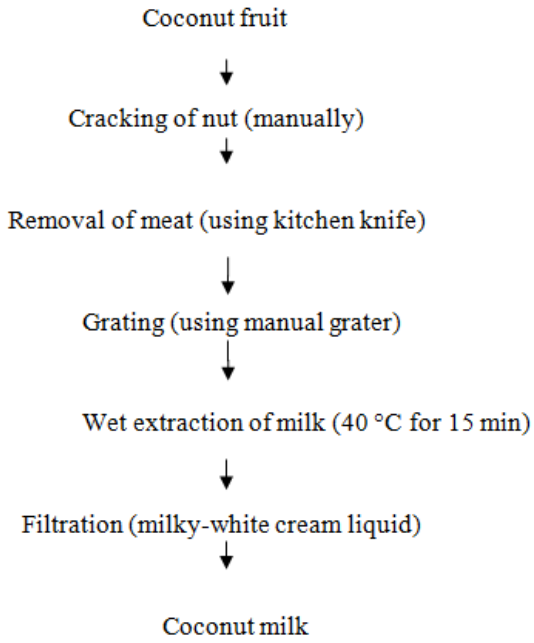

Figure-1. Flowchart of coconut milk extraction.

2.3. Goat Milk-Coconut Milk Cheese Production

Goat milk and coconut milk were pasteurized at temperature 90 ^{0}C for 30 minutes. Thereafter, allowed to assume temperature 39 $\pm$ 2 ^{0}C before being used for cheese production. Various blends of milk supplementation was produced as follows: A = 100 % goat milk; B = 90 % goat milk + 10 % coconut milk; C = 80 % goat milk + 20 % coconut milk; D = 70 % goat milk + 30 % coconut milk and E = 50 % goat milk + 50 % coconut milk. The flow diagram for cheese production is presented in Figure 2.

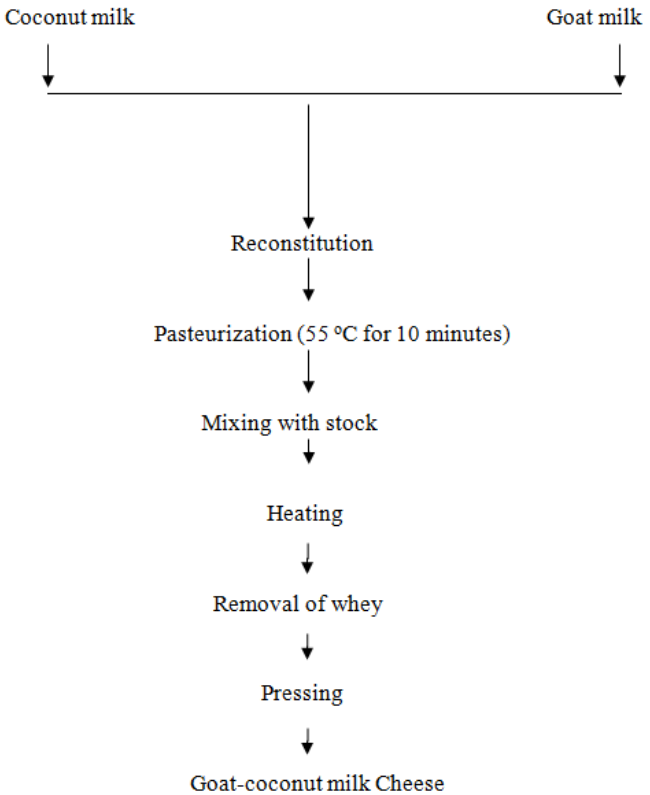

Figure-2. Flowchart for the production of goat milk -coconut milk Cheese.

2.4. Total Titratable Acidity (TTA)

Total titratable acidity was determined using the AOAC (2005) method. About 10 g of the sample was dissolved in 30 ml of distilled water in a beaker and stirred. The mixture was filtered into 100 ml standard volumetric flask. The filtrate was made up to 100 ml. A 10 ml sample of the filtrate was pipetted into a beaker and 1 drop of phenolphthalein was added. The mixture was titrated against standard 0.01 N Sodium Hydroxide solution until light pink colour was attained. The reading of the burette was recorded.

$$TTA = \frac{N(NaOH) \times \text{titre value} \times \text{lactic acid value} \times \text{dilution factor} \times 100}{10}$$

Where N = Normality of NaOH (0.01)

Lactic acid value = 0.09

Dilution factor = 10

2.5. pH Determination

pH was determined using pH meter (Unicam 9450, Cambridge, UK). About 1.0g of the cheese was dissolved in beaker containing 10 ml of distilled water and stirred. The electrode of the pH meter was dipped into the beaker and readings were obtained from the photo-detector on the pH metre.

2.6. Total Soluble Solids

This was determined using the AOAC (2005) method. A clean glass dish was dried in an oven (103-105 ^{o}C) until constant weight was achieved, cooled in a desiccators and weighed. About 2.0 g was dissolved in 50 ml distilled water. About 20 ml of filtered water sample was evaporated on a water bath at temperature 90 ^{o}C followed by oven drying at temperature 103 ^{o}C- 105 ^{o}C for about an hour. The glass was cooled in desiccators, reweighed and the increased weigh recorded.

2.7. Determination of Percentage Yield

Percentage yield of cheese was determined by method described by Igyor, Igbian, and Iorbo (2006). The yield of cheese from goat milk; coconut milk and goat milk blends was determined by the calculation as follows:

$$\text{Yield of Cheese (\%)} = \frac{W_2}{W_1} \times 100\%$$

W_1 = Weight (g), goat milk- coconut milk blends or whole milk used.

W_2 = Weight (g), cheese produced.

2.8. Mineral Determination

The analysis of minerals was done according to the AOAC (2005) procedures. The quantitative determination of minerals (P, K, Na, Mg) were done using beam atomic absorption spectrometer (Model S-929, Systonic, India). Working standards was used to establish calibration curve for each of the element to be determined. About 2.0 g of the sample was accurately weighed in a clean dry crucible. This was then transferred to hot plate in a fume cupboard and charred to burn off all the organic material until no more smoke was given off. It was then transferred using a pair of tongs into the muffle furnace at a temperature of 500 ^{o}C until it was fully ashed for 8 h. The sample (ash) was leached with 5 ml of 6 M HCI into a 100 ml volumetric flask and the volume was made up to 20 cm^{3} with distilled water. Also, the blank determination was carried out in a similar procedures described above, except for the omission of sample. The solution was then filtered through a Whatman No.1 filter paper and transferred into the AAS auto sampler vial for analysis of Magnesium (Mg), Phosphorus (P), Sodium (Na) and Potassium (K).

2.9. Proximate Analysis of Goat Milk-Coconut Milk Cheese

AOAC (2005) method was employed for the determination of proximate compositions of goat milk-coconut milk cheese.

2.10. Microbiological Analysis of Goat Milk-Coconut Milk Cheese

Method of Harrigan and McCane (1976) was employed. Exactly 1.0 g of the cheese was aseptically weighed and carefully introduced into 9 .0 ml of sterile distilled water. This was shaken manually in order to have a homogenous suspension. 1.0 ml of this was taken and introduced into the second tube followed with series of dilutions up to10^{-2} dilutions. 1ml was taken from 10^{-2} dilution and pour plated on: (a) Nutrient Agar and incubated at temperature 37 ^{o}C for 48 hours; (b) MacConkey Agar was used for the enumeration of total coliform organisms in the sample, the plates were incubated at temperature 35 ^{o}C for 48 hours; while (c) Sabouraud Dextrose Agar was used for the enumeration of mould and yeast in the samples. The plates were incubated at temperature 30 ^{o}C for 24 hours for yeasts and 3 days for mould.

Microbial counts were calculated as follows: $\frac{DF \times N}{W}$

Where DF = dilution factor.

N = number of colonies.

W = weight of sample used.

2.11. Sensory Evaluation

Sensory evaluation was conducted as reported by Kayode, Edem, Ogundun, Ajibola, and Kayode (2020). A 9-point (1= extremely dislike, 9 = extremely like) hedonic scale was adopted. Panelists with good sense of sensory characteristics were instructed to evaluate coded samples for colour, taste, texture, aroma and general acceptability.

2.12. Statistical Analysis

Data obtained from this study were subjected to Analysis of Variance (ANOVA) using Statistical Package for Social Sciences (SPSS) version 20.0. Where significant difference exists among the samples, means were separated using the Duncan test.

3. RESULTS AND DISCUSSION

3.1. Physico-chemical Properties of Cheese

Results of physico-chemical properties of goat milk-coconut milk cheese are presented in Table 1. Cheese produced using 100% goat milk (control) had lower TTA than cheese supplemented with coconut milk. However, TTA and pH increased significantly with increased percentage of coconut milk. The TTA and pH of the cheese produced from goat milk and coconut milk increased as the percentage of coconut milk increases. The increase in acidity could be attributed to the increased supplementation of coconut milk at different ratios. This result agreed with the work of Adedokun, Okorie, Onyeneke, and Anoruo (2013) who reported an increase in TTA of cheese as the inclusion of bambara milk increased in the cheese produced from cow and bambara milk supplementation. Elewa (2009) also reported a pH of 5.96 for Nigerian (unripened) soft cheese made from 100% cow milk.

On the other hand, cheese produced using 80% goat milk and 20% coconut milk had higher percentage yield than other cheese samples. This was followed by cheese produced using 10% coconut milk, 30% coconut milk, 0% coconut milk and 50% coconut milk in that order.

Table-1. Physico-chemical properties of goat milk– coconut milk cheese.

Sample	TTA (%)	pH (%)	Yield (%)	TSS (%)
A	0.20 ^{e} ± 0.02	6.40 ^{c} ± 0.04	22.55 ^{d} ± 0.01	1.14 ^{a} ± 0.01
B	0.23 ^{d} ± 0.01	6.42 ^{d} ± 0.01	26.38 ^{b} ± 0.01	0.94 ^{b} ± 0.01
C	0.26 ^{c} ± 0.05	6.61 ^{c} ± 0.02	30.69 ^{a} ± 0.01	0.75 ^{c} ± 0.01
D	0.29 ^{b} ± 0.02	6.66 ^{b} ± 0.01	22.89 ^{c} ± 0.01	0.71 ^{d} ± 0.01
E	0.33 ^{a} ± 0.02	6.69 ^{a} ± 0.01	11.34 ^{e} ± 0.01	0.56 ^{e} ± 0.01

Note: Values are means ± SD of triplicates determination. Means in the same column with different superscript are significantly different at P<0.05. A= Cheese produced using 100% goat milk (control); B = Cheese produced using 90% goat milk and 10% coconut milk; C= Cheese produced using 80% goat milk and 20% coconut milk; D = Cheese produced using 70% goat milk and 30% coconut milk; E = Cheese produced using 50% goat milk and 50% coconut milk; TSS = Total soluble solid; TTA =Total titratable acidity.

Table 1 also showed that cheese obtained using 100% goat milk had highest TSS value but decreased as the percentage of coconut milk supplementation increases. Cheese produced using equal blends (50:50) of goat milk and coconut milk had the lowest significant ($p<0.05$) total soluble solids. Total soluble solid of the cheese blends decreased with increased percentage of coconut milk. This may be attributed to increase in coconut milk content in the cheese. There was significant difference ($P<0.05$) in TTA, pH, TSS and yield among the cheese produced.

The percentage yield Table 1 of cheese increased as the percentage of coconut milk increased which may depends on the level of protein available for curdling by enzymes or acid, and a subsequent decrease in percentage yield from 30% inclusion of coconut milk. This result agreed with the work of Adedokun et al. (2013) who reported increase in percentage yield of cheese as the inclusion percentage of Bambara nut milk and cow milk supplementation increased. However, the decrease in percentage yield of cheese with decreased goat milk and increasing coconut milk agreed with the findings of Igyor et al. (2006) who reported a decline in the percentage of cheese yield as the percentage of soy milk inclusion increased in cheese.

3.2. Mineral Composition of Goat Milk-Coconut Milk Cheese

The results of the mineral compositions of cheese produced using whole goat milk and blends of goat milk and coconut milk are presented in Table 2. The result showed that there was significant difference ($p<0.05$) in mineral elements evaluated.

Table-2. Mineral composition of goat milk-coconut milk cheese.

Sample	Mg	K (mg/100g)	Na	P
A	3.98 ^{d} ± 0.01	74.03 ^{a} ± 1.02	41.60 ^{a} ± 0.02	59.27 ^{e} ± 0.01
B	8.10 ^{a} ± 0.02	20.33 ^{e} ± 0.20	17.19 ^{e} ± 0.02	61.06 ^{d} ± 0.02
C	4.60 ^{c} ± 0.02	47.33 ^{d} ± 0.20	27.19 ^{d} ± 0.02	64.46 ^{c} ± 0.02
D	2.00 ^{e} ± 0.02	61.74 ^{c} ± 0.12	36.40 ^{c} ± 0.02	66.25 ^{b} ± 0.02
E	4.90 ^{b} ± 0.02	62.20 ^{b} ± 0.20	33.20 ^{b} ± 0.01	69.92 ^{a} ± 0.02

Note: Values are means ± SD of triplicates determination. Means in the same column with different superscript are significantly different at P<0.05. A= Cheese produced using 100% goat milk (control); B = Cheese produced using 90% goat milk and 10% coconut milk; C= Cheese produced using 80% goat milk and 20% coconut milk; D = Cheese produced using 70% goat milk and 30% coconut milk; E = Cheese produced using 50% goat milk and 50% coconut milk.

The highest Magnesium content (8.10 ± 0.02 mg/100g) was obtained using 90% goat milk and 10% coconut milk (sample B). This was followed by cheese from equal blend of goat milk and coconut milk (50:50%), Cheese produced using 80% goat milk and 20% coconut milk, cheese obtained using 100% goat milk, and, cheese produced using 70% goat milk and 30% coconut milk. There was significant difference ($P<0.05$) in Mg contents among cheese samples.Cheese sample produced using 100% goat milk had significant higher ($P<0.05$) potassium and sodium content than cheese obtained from other blends of goat milk and coconut milk. However, cheese obtained using 90% goat milk and 10% coconut milk had the least potassium and sodium contents. Phosphorus content obtained from equal blend of goat milk and coconut milk was significant ($P<0.05$), and had value higher than other samples. There was significant increase ($P<0.05$) in phosphorus as the percentage goat milk increased. Cheese produced using 100% goat milk was lower in phosphorus content.The mineral contents examined showed that there

was an increase in potassium, sodium and phosphorus with increased percentage coconut milk. However, cheese produced using 100% goat milk was higher in Sodium and Potassium. Magnesium was found to be highest in cheese produced from 10% substitution of coconut milk. This result obtained differed from that of Lawal and Adedeji (2013) who reported a decrease in sodium content. The variations could be attributed to the differences in processing method that was used whereas that of the blended milk is attributed to the inclusion of coconut milk at various ratios. In addition, Onyeka (2008) reported that mineral elements are significance in human nutrition, as lack of these elements may lead to nutritional malfunction, while Elijah et al. (2018) reported that mineral elements are involved in various body activities. Thus, mineral elements are essential for human development.

3.3. Proximate Composition of Goat Milk-Coconut Milk Cheese

The result of the proximate composition of cheese produced is presented in Table 3. The protein, fat and fibre contents of cheese produced from 50:50 goat milk and coconut milk were higher than other samples, but decreased significantly with decrease in coconut milk content. This implied that addition of coconut milk increased protein, fat and fibre contents in cheese. The protein content was higher than the protein content as reported by Frazier & Frazier and Westhoff (1988) but however, lower than protein content (44.5%) reported by Fashakin and Unokiwedi (1992) for cheese with added melon milk. This difference can be attributed to differences is raw materials employed by the researchers (Belewu & Belewu, 2006). This result also showed that plant proteins should be encouraged in cheese production, as its consumption would help eliminate protein deficiencies (Adedokun et al., 2013).

Table-3. Proximate composition of goat milk-coconut milk cheese.

Sample	Protein	Fat	Ash (%)	Fibre	CHO
A	12.94 ^{e} ± 0.02	30.15 ^{c} ± 0.01	1.28 ^{d} ± 0.01	0.03 ^{e} ± 0.01	55.60 ^{a} ± 0.02
B	13.48 ^{d} ± 0.01	31.25 ^{d} ± 0.01	1.53 ^{c} ± 0.01	0.81 ^{d} ± 0.02	53.23 ^{b} ± 0.01
C	13.71 ^{c} ± 0.02	33.19 ^{c} ± 0.01	1.60 ^{b} ± 0.01	1.21 ^{c} ± 0.01	50.28 ^{c} ± 0.00
D	14.27 ^{b} ± 0.02	37.90 ^{b} ± 0.02	2.08 ^{a} ± 0.02	1.55 ^{b} ± 0.02	44.20 ^{d} ± 0.02
E	14.49 ^{a} ± 0.02	40.41 ^{a} ± 0.02	2.08 ^{a} ± 0.02	1.79 ^{a} ± 0.02	41.23 ^{e} ± 0.01

Note: Values are means ± SD of triplicates determination. Means in the same column with different superscript are significantly different at P<0.05. A= Cheese produced using 100% goat milk (control); B = Cheese produced using 90% goat milk and 10% coconut milk; C= Cheese produced using 80% goat milk and 20% coconut milk; D = Cheese produced using 70% goat milk and 30% coconut milk; E = Cheese produced using 50% goat milk and 50% coconut milk; CHO = Carbohydrate.

Also, increased fat content of cheese produced using goat milk and coconut milk blends may be due to high fat content associated with coconut milk. Amarasiri and Dissanayake (2006) reported coconut milk to be high in saturated fatty acids, particularly lactic acid. On the whole, fat is important source of energy in the human body (Onyeka, 2008). Similarly Akande et al. (2009) reported an increased fat in cheese produced from raw and roasted Bambara nut milk. In addition, the high fibre content in the cheese products is good for diabetic and obese patients.

Cheese produced from 50:50 and 70:30 goat milk and coconut milk blends did not differ significantly with respect to ash. However, the ash content of cheese decreased significantly as coconut milk content decreased further. The presence of ash is a measure of mineral elements in food stuff. Increase in ash with increasing proportion of added coconut milk would lead to high content of mineral elements and would therefore enhance the mineral intake of potential consumer. Uaboi-Egbenni et al. (2010) reported 0.6% ash content for fermented cheese sample. However, this study recorded over 1.0% and up to 2.08% of ash content in the cheese products. There was significant difference (P<0.05) in carbohydrate contents in the cheese samples. Cheese produced using 100% goat milk had highest value (55.60 ± 0.02%). Carbohydrate content of cheese decreased with increased coconut milk content. Low carbohydrate content could be due to increased amounts of protein, fat, ash and fibre in the cheese samples with increased supplementation with coconut milk. This agreed with the findings reported by Fashakin and Unokiwedi (1992) in cheese from cow milk and melon milk, but contrary to Adedokun et al. (2013) who reported increased total carbohydrate content as the bambara milk substitution increased.

3.4. Microbial Analysis of Goat Milk-Coconut Milk Cheese

The result of the microbial load of goat milk-coconut milk cheese is shown in Table 4. Table 4 indicated significant (P<0.05) difference in total bacteria counts of the cheese products.

Table-4. Microbial load of goat milk-coconut milk cheese

Parameter	A	B	Sample C	D	E
TBC (cfu/g)	$2.0^{d} \times 10^{2}$	$2.7^{b} \times 10^{2}$	$3.2^{a} \times 10^{3}$	$3.0^{a} \times 10^{3}$	$2.3^{c} \times 10^{2}$
TCC (cfu/g)	NIL	NIL	NIL	NIL	NIL
TFC (cfu/g)	NIL	NIL	$2.0^{a} \times 10^{2}$	$1.0^{b} \times 10^{2}$	NIL

Note: Values are means ± SD of triplicates determination. Means in the same column with different superscript are significantly different at P<0.05. A= Cheese produced using 100% goat milk (control); B = Cheese produced using 90% goat milk and 10% coconut milk; C= Cheese produced using 80% goat milk and 20% coconut milk; D = Cheese produced using 70% goat milk and 30% coconut milk; E = Cheese produced using 50% goat milk and 50% coconut milk; TBC = Total Bacterial Count; TCC = Total Coliform Count; TFC = Total Fungal Count.

Microbial density in the five cheese samples was low. This could be attributed to the good manufacturing practice such as pasteurization of the milk and milk blends, clean utensils and aseptically conditions observed during laboratory production. Total bacterial count was higher than fungal count in the cheese samples. This may be due to the fact that milk is a high proteineous food which can attract even environmental bacteria than fungi; fungi thrive well on high carbohydrate food. It was observed that cheese produced from 80:20 of goat milk and coconut milk blends had the highest bacterial count. Total fungi count of the cheese was also low and was observed only on cheese produced with 80:20 and 70:30 goat and coconut milk blends respectively, and was considered safe for human consumption. No coliform was detected in the cheese samples. This finding corroborated with the report of MacGraw (1977) who stated that processed milk should contain no trace of coliform.

3.5. Sensory Evaluation of Goat Milk-Coconut Milk Cheese

The result of the sensory evaluation of cheese produced is shown in Table 5. Results indicated that there was no significant difference (P> 0.05) in the appearance, taste, texture, aroma and overall acceptability between cheese produced from 100% goat milk (the control) and 90: 10 goat milk coconut milk blends but they differed significantly from other samples. Cheese produced from 80:20, 70:30 and 50:50 goat milk coconut milk blends were not significantly different (P> 0.05) from one another in taste and aroma. In terms of texture, cheese produced from 80:20 and 70:30 goat milk and coconut milk blends were not significantly different (P> 0.05) from each other but were more preferred by panelists to cheese produced from 50:50 goat milk and coconut milk blends.

In addition, cheese produced from 70:30 and 50:50 goat milk coconut milk blends was not significantly (P> 0.05) different with respect to appearance and acceptability. However, they were least preferred by the panelist cheese produced from 80% goat milk and 20% coconut milk blends.

Table-5. Sensory evaluation of goat milk-coconut milk cheese.

Sample	Taste	Texture	Appearance	Aroma	Acceptability
A	$8.25^{a} \pm 0.71$	$8.15^{a} \pm 0.74$	$8.05^{a} \pm 0.82$	$8.05^{a} \pm 0.75$	$8.55^{a} \pm 0.51$
B	$8.25^{a} \pm 0.63$	$7.90^{a} \pm 0.71$	$8.40^{a} \pm 0.68$	$7.40^{a} \pm 0.75$	$8.05^{a} \pm 0.68$
C	$7.10^{b} \pm 0.85$	$7.40^{b} \pm 0.75$	$7.05^{b} \pm 0.68$	$7.05^{bc} \pm 0.75$	$7.30^{b} \pm 0.73$
D	$6.90^{b} \pm 0.71$	$7.05^{bc} \pm 0.75$	$6.20^{c} \pm 0.83$	$7.00^{bc} \pm 0.64$	$5.95^{c} \pm 0.88$
E	$6.70^{b} \pm 0.57$	$6.80^{c} \pm 0.76$	$6.05^{c} \pm 0.99$	$6.80^{c} \pm 0.69$	$5.60^{c} \pm 0.99$

Note: Values are means ± SD of triplicates determination. Means in the same column with different superscript are significantly different at P<0.05. A= Cheese produced using 100% goat milk (control); B = Cheese produced using 90% goat milk and 10% coconut milk; C= Cheese produced using 80% goat milk and 20% coconut milk; D = Cheese produced using 70% goat milk and 30% coconut milk; E = Cheese produced using 50% goat milk and 50% coconut milk.

The results indicated that all cheese samples produced from goat milk-coconut milk blends were accepted by the panelist with preference to cheese produced using 10% coconut milk blend thus rated highest in terms of taste, texture, appearance and aroma, followed by cheese produced from 80:20 % of goat milk and coconut milk blends

respectively. However, cheese produced from 50:50 goat milk and coconut milk blends was less preferred and had the least overall acceptability. This result was in agreement with Adedokun et al. (2013) who reported significant differences in aroma, taste and texture of cow-bambara milk cheese blends.

4. CONCLUSION

The results of this study showed that substitution of goat milk with coconut milk improved both the organoleptic and nutritional properties of cheese. The inclusion of 10 - 20% coconut milk in goat milk should be encouraged in the production of cheese based on taste, acceptability and percentage yield and nutritional composition.

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