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PHYSICO – CHEMICAL AND ORGANOLEPTIC PROPERTIES OF YOGHURT MANUFACTURED WITH COW MILK AND GOAT MILK

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ABSTRACT

The proximate composition, microbilogical and sensory properties of yoghurt produced from cow milk and goat milk blend was investigated. Proximate composition of yoghurt samples with goat milk(100%.75%,50%,and 25%) substitution blend with cow milk revealed that goat milk yoghurt samples (100%) had the highest protein content (4.2%),Fat content(4.27%) and caproic(C_6),caprylic(C_8), Capric(C_{10}) and total solids(16.22%). 25% goat milk sample had the least protein content(3.75%),while 50% and 75% goat milk yoghurt samples had (3.49% and 3.29%) respectively.However,there were low carbohydrate content with 100% goat milk yoghurt samples(7.20%) and moisture content(83.78%) than the 25% goat milk yoghurt with 9.20% carbohydrate,85.14% moisture content 14.86% total solids respectively. Three (3) days microbiological analysis showed 6.67%logCfu/g in25% sample and 8.63logCfu/g in 100% sample of bacteria colony count. Lactic acid bacteria count was also determined and average result showed 6.89 and 6.62 for 25% and 100% goat milk yoghurt samples respectively. All the yoghurt samples showed zero result for coli form count. However, yeast and mould count results ranged from 2.59logCfu/g and 2.75Cfu/g for 25% and 100% yoghurt samples respectively. Sensory result of 100% goat milk samples was rated highest for taste and 25% goat milk samples was rated least($p<0.05$).50% and 25% samples showed no significant difference($p<0.05$) while 25% goat milk samples was significantly rated poor($p<0.05$).All Samples showed no significant difference($p>0.05$) for mouth feel and colour of yoghurt samples. Generally, goat milk yoghurt samples (100%),(75%),(50%) were mostly significantly preferred to 25% goat milk yoghurt sample at ($p>0.05$).

Keywords: Physicochemical, Microbiological, Organoleptic properties, yoghurt ,Goat milk, Cow milk.

INTRODUCTION

Yoghurt is a dairy food produced by fermentation of milk. The FAO/WHO Codex Almentarius Commission defined yoghurt as a coagulated milk product obtained by lactic acid fermentation through the action of *Lactobacillus bulgaricus and streptococcus thermophillus*_from milk with or without additions of milk powder, skin milk powder (Nothanon, 2002).To improve yoghurt texture, milk is now fortified with other materials such as nonfat dry milk (NDM), whey protein concentrate (WPC) and some other dairy or plant-based ingredients. Today, milk from at least nine different animal species is used commercially: Cow mare, ass, goat, buffalo, yak, ewe, camel and reindeer (Kroger et al .,1992, Tanine &Robinson 1985). These milks differ in composition from each other which considerably affect your yoghurt qualities for example, yoghurt made from milk of ewe, buffalo or reindeer is high in fat (6.5 – 11%) and has better consistency than that made from milk of cow, goat, and ass (1.4 – 4.0%) according to Nathanon(2002).

In Nigeria, yoghurt is mostly produced from cow milk. Following increasing demand for yoghurt in the past one decade and the ever rising cost of cow milk, yoghurt have become

exorbitant and unaffordable, especially by the low and middle class income earners. Efforts are made to discover a good dairy or non–dairy milk substitute for cow milk.

Goat milk has the potentials to be the alternative for total or partial replacement of cow milk. Goat milk is very nutritious, possessing higher protein content. It is also a good service of calcium, phosphorus and potassium. The fat globules are much smaller in goat milk and this might make it easier digestible. Unlike cow milk, there is no need to homogenize goat milk. The small fat globules account for why goat milk does not cream nearly as much as top as cow milk. Scientific studies show that some people that are allergic to cow milk can tolerate goat milk. The studies suggest that specific proteins known to cause allergic reactions are present in cow milk in significant quantities, yet largely absent in goat milk (Walstra et al., 1999).

Successful utilization of goat milk in yoghurt production will create variety, reduce cost and improve nutritional value. It will also increase the rearing and utilization of goat, it is currently reared is Nigeria only for the meat.

The study therefore aims at investigating the physiochemical, microbiological and organoleptic properties of yoghurt produced from partial and substitution of cow milk with goat milk.

MATERIALS & METHODS

Proximate Composition

The protein content of the yoghurt sample was determined by the kjedhal method (James, 1995). The ash contest was determined by the furnace incineration method of Pearson (1976).The total lipid was extracted with petroleum ether according to Pearson (1976).Moisture value was evaluated by the method of AOAC, (1990).

The difference method was adopted to calculate carbohydrate (lactose) by subtracting the percentage moisture, crude protein, fat and ash contents from 100%. The pH of the yoghurt samples was measured using a pH meter (Jenway, 3310 model). The tip of the electrode was dipped into the sample solution and allowed to stand for about five minutes before taking the reading. Titratable acidity (TA) was calculated by method of Ariahu et al., (1999), and expressed as lactic acid. Total solid – non-fat (SNF) value was computed by subtracting the %percentage fat content from the total solid content, while total solid was obtained by subtracting percentage moisture from one hundred (100%) percent.

Microbial Analysis

The total microbial lead of the samples was carried out by the method of Ogbulie et al.,(2011). Each sample was serially diluted in sterile, distilled water to obtain the inoculums. Aliquot of each dilution was cultured on Nutrient Agar (NA) for bacteria and on to MacConkey Agar (MA) for coliforns, while Sabourad Dextrose Agar (SDA) was used for isolation of fungi. Plates for bacteria and fungi were incubated at Refrigeration temperature and room temperature for 7days.

RESULT & DISCUSSION

The proximate composition of the yoghurt samples is shown in table 1 the control sample (100% goat milk) had the highest protein content of 4.27% while sample Be,T (25% goat milk) had the least protein contest of 3.75%. Yoghurt with 50% goat milk and 75% goat milk had protein content of 3.49% and 3.29% respectively. The study showed that protein content of yoghurt blends increased as percentage goat milk increased. The result agrees with

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the statement of Onimawo & Egbekun, (1998) who reported that goat milk contain more protein (3.75%) compared to 3.5% in cow milk. Goat milk contains much lower values and in some cases, none of the proteins alpha S1-casein, which is a major allergen in cow milk.

The fat contest of goat milk yoghurt (control) was the highest (4.27%) reflecting high fat content of the goat milk according to (Ihekoronye and Ngoddy, 1985) who gave set content of cow and goat milk as 3.7% and 4.1% respectively. The low fat content of the blend may also have been attributed of the low fat powdered milk used. Gregher, (1985) noted that fat plays an important role in improving the consistency of yoghurt while providing twice as much energy as same quantity of carbohydrates and protein. Goat milk contains a significantly greater proportion of short and medium chain triglycerides (MCTS) than cow milk fat which contributes to more rapid digestion. Goat milk is higher in caproic (C_6), caprylic (C_8) and capric (C_{10}) acids which total 16% compared to 7% in cow milk (www.dgc. . nz /about.html). They have been used to mal absorption symptoms and intestinal disorders (about/html).

The ash contest decreased slightly from 0.97% in goat milk yoghurt to 0.89% is sample GTB (25% goat milk). The ash value is on index of mineral contest which presupposes the goat milk yoghurt to be a better sauce of minerals for shower bone development, teeth formation and body functions (Trachoo & Mistry, 1998). Goat is reported to have calcium, phosphorous, and contains substantially more potassium, manganese, iron copper, and magnesium. The selenium in goat milk has been shown to have wove anti-oxidant activity (http://www.onething -goat-milk.com) .

The yoghurt samples generally had low levels of carbohydrates being least 7.20% in goat milk yoghurt (control) and highest (7.20%) in 25% goat milk yoghurt. The low carbohydrate content is expected because during fermentations, there is conversion of carbohydrate mostly lactose to lactic acid. This makes yoghurt an ideal dairy product for individuals with lactose intolerance (Ehirim & Ndimantang, 2004).Goat milk has a lower carbohydrate level, almost all of which is due to less lactose in the milk.

The moisture content of the yoghurt samples ranged from 83.78% in goat milk yoghurt to 85.14% in 25% goat milk yoghurt. Ahamd (1994) reported that moisture content of yoghurt should range between 82% and 84%, as much water in yoghurt makes it less viscous and affects texture and mouth feel.

The total solid content was highest is control sample (100% goat milk) with a value of 16.22% while yoghurt sample with 25% goat milk had the least value of 14.86%. These values closely agree with the findings of Hofi et al., (1994) who stated that yoghurts should have total solids of between 15% and 16%. However Muhammed et al., (2005) reported higher total solids of 17.11% in yoghurt. According to Weaver, (1993) low percentage of total solids in yoghurt can lead to malfunctions of the starter culture.

Microbiological Properties of Yoghurt Samples

According to the microbiological data on table 2, the total bacteria count issue of the yoghurt samples ranged from 6.67% log Cfu/g in 25% goat milk yoghurt to 8.63 log Cfu/g in control sample (100% goat milk). These values are lower than findings of Duru &Ozgunes (1981) who reported total bacteria count of 8.17 log Cfu/g for sweetened yoghurt, and an average total bacteria count of 8.30 log Cfu/g in strawberry –flavored yoghurt samples. The report recorded the lowest average of 8.14 Cfu/g total bacteria corresponding to one day storage time while the highest count of 8.40 log Cfu/g corresponded to 3 days storage. This means that among other factors, the total bacteria count of yoghurt could depend on ingredient formulation and storage time.

The lactic acid bacteria count, which plays a fundamental function in the production of yoghurt, was also determined in this study. The average lactic acid bacteria count ranged between 6.89 and 6.62 in sample GTB and GT respectively. These values are in line with the statement of Hoier (1987) that yoghurt should have lactic acid bacteria of 6.54 to 7.5 log Cfu/g. Con et al., (1996) obtained higher value 8.64 in sweetened yoghurt. According to the report, duration of storage played important role in the growth of lactic acid bacteria and decrease in numbers of lactic acid may be due to the accumulation of ambient lactic acid.

Analysis of all the samples for coliform gave zero result. This finding corraborated with the statement of Mac Graw (1977) who remarked that processed milk should contain no trace of coli form. However, Traine and Robinson (1981) recommended that satisfactory yoghurt should contain less than 0.1 x 10 Cfu/g. Duru and Ozqunes (1981) found coliform bacteria in 35% of the yoghurt solid commercially in Ankara, Turkey; while Ibrahim et al., (1989) found coliform bacteria to be present in 80% of all yoghurt sold commercially in Cairo, Egypt. Con et al., (1996) reported that according to the Turkish Standards Institute, a maximum count of 10 Cfu/g of coliform group bacteria is allowable in yoghurt.

In a study, all of the samples exhibited sizeable amount in yeast aid mold counts ranging from 2.59 log Cfu/log in 25% goat milk yoghurt to 2.75 CFU/g in control sample. Anott et al., (1974) showed that 26% of the yoghurt produced and sold in Ontario, Canada contained more that 3 log CFU/g of mold. Tamine et al., (1993) indicated that any yoghurt sample containing a 100 CFU/g yeast and would count was unacceptable. Yoghurt Standard recommended by Turkish Standards Institute stipulates that a maximum of 100cfu/g of mold is allowable in yoghurt sold commercially. A high yeast and mold count could be attributed to contamination from air and the carryover culture used for yoghurt production.

Sensory Properties of Yoghurt Samples

The sensory data is presented on Table 3.

The control sample (100% goat milk yoghurt) was rated highest for taste however, there was no significant difference between the control sample, 75% goat milk yoghurt and 50% goat milk yoghurt while 25% goat milk yoghurt was significantly rated the least ($P<0.05$). The high score for control sample may be attributed to fairly "goaty" taste observed in the yoghurt. This may not be out of reason, as there is also great preference for goat meat over cow milk meat because of its mique taste. The scores for aroma indicate that the goat milk yoghurt, 50% goat milk yoghurt and 25% goat milk yoghurt did differ significantly while sample GTB (25% goat milk) was significantly rated poor ($P<0.05$). The result followed the same trend for taste result. This close resemblance of aroma and taste results is not unusual since most panelists can differentiate taste and aroma. Ihekoroye and Ngoddy, (1985) reported that aroma is the sensation judged by the nostril while taste is evaluated by the tongue.

The goat milk yoghurt was scored highest for mouth feel (8.50) although all the samples did not show any significant difference ($p<0.05$). The higher rating of goat milk for mouth feel was attributed to higher protein content which formed better coagulum. Another reason could be done to lower moisture content. Ahamd (1994), reported that much water in yoghurt makes it less viscous and affect texture & mouth feel. There was no significant difference in the cooler of the yoghurt ($P<0.05$). Generally, Sample GTE (control), GTD (75% goat milk yoghurt) and GTC (50% goat milk yoghurt) were mostly significantly proffered to 25% goat milk yoghurt ($P<0.05$).

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CONCLUSION

According to the result of this study, the addition of goat milk to cow milk in yoghurt production improved both the organoleptic and nutritional property of yoghurt. The results further shows that good quality yoghurt can be produced from fresh goat milk

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APPENDIX

Table 1. Proximate Composition of Goat Milk and Skimmed Cow Milk Yoghurt

Sample	*Moisture*	*Protein*	*Fat*	*ASH*	*CHO*
CMA	86.66± 0.226	3.22+ 0.004	0.01+0.005	1.07+ 0.009	10.96+ 0.106
GMB	85.14+0.050	3.75+ 0.005	1.89+0.005	0.89+ 0.009	8.00+ 0.44
GMC	84.76+ 0.026	3.49+ 0.009	2.85+0.014	0.97+ 0.009	8.00+ 0.012
GMD	84.86+ 0.018	3.29+ 0.018	3.29+0.018	0.97+ 0.009	7.34+ 0.008
GME	83.78+ 0.014	4.27+ .018	4.27+0.018	0.97+ 0.009	7.20+ 0.034

Mean and Standard Deviation of Triplicates of Sample

(Cm) Col Milk (>) (%)		*(%)*	*Goat Milk (Gm)*
Key:	CMA	100	0
	GMB	75	25
	GMC	50	50
	GMD	25	75
	GME	0	100

Table 2. Results of Chemical Properties of Goat Milk –Cow Milk

Sample	*Titrable Acidity (%)*			*Ph*	*Total Sold*
A	0.82	+	0.005	4.90	
B	0.83	+	0.005	4.00	
C	0.92	+	0.005	4.50	
D	0.84	+	0.005	4.40	
E	0.095	+	0.005	4.50	

Samples. Cow Milk (Skimmed) Goat

Key:		
CMA	100% Cm	0% Gm
GMB	75% Cm	25% Gm
GMC	50% Cm	50% Gm
GMD	25% Cm	75% Gm
GME	0% Cm	100% Gm

Table 3. Esults of Microbiological Analysis of Yoghurt Sample (Log Cfu/G)

Bacterial Group	*A*	*B*	*C*	*D*	*E*
Total Plate count	6.85+ 0.471	6.67+ 0.471	6.90+ 0.471	6.90+ 0.471	8.63+ 0.471
Coliform count	Nil	Nil	Nil	Nil	Nil
Yeast and mould ount	2.58+ 0.04	2.59+ 0.05	2.60+ 0.05	2.64+ 0.05	2.75+ 0.05
Lactic Acid Bacteria count	6.74+ 0.47	6.62+ 0.94	6.87+ 0.47	6.89+ 0. 47	6.80+ 0.94

Mean Values + Standard Deviation of Samples

Key:		
CMA	100% Cm	0% Gm
GMB	75% Cm	25% Gm
GMC	50% Cm	50% Gm
GMD	25% Cm	75% Gm
GME	0% Cm	100% Gm

Cm = Cow milk
Gm = Goat milk

Table 4. Organoleptic Properties of Goat Milk and Cow Milk Yoghurt Samples

Samples	A	B	C	D	E	LSD
Taste	3.75+ 2.17^{b}	4.30+1.95^{b}	7.00+1.30^{a}	6.70+0.73^{a}	7.15+0.1^{a}	1.35
Aroma	3.65+ 2.15	4.65+1.62^{b}	6.55+1.49^{a}	6.85+1.28^{a}	6.75+0.99^{a}	1.03
Colour	5.25+1.67^{a}	5.80+1.12^{a}	6.7+0.95^{ab}	6.75+0.77^{ab}	6.95+1.12^{a}	1.03
Conssistency	2.20+ 2.23^{C}	4.15+1.53^{b}	6.20+1.20^{ab}	7.00+0.89^{ab}	8.50+0.97^{a}	5.82
Gen Acceptance	3.10+ 2.05^{c}	4.60+1.69^{b}	4.60+1.69^{b}	6.30+1.38^{a}	7.75+1.34^{a}	1.66 LSD

Means Not Followed By the Same Superscript on the Same Row

Significant Difference (P<0.05)

Key:	*%*	*%*
CMA	100	0
GMB	75	25
GMC	50	50
GMD	25	75
GME	0	100