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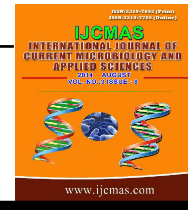

Original Research Article

Yield, composition and coagulation time of unsalted and salted soft cheese prepared from the milk of White Fulani cows

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A B S T R A C T

Keywords

Yield, Composition, Unsalted and salted soft cheese, Processing

The yield, composition and coagulation time of West African soft cheese “wara” prepared from the raw milk of White Fulani cows was determined. Milk was obtained from the White Fulani cows during one week period. The cows were milked twice daily, in the morning and evening, so as to obtain enough milk for the soft cheese production. The milk and soft cheese samples were analysed for fat, protein and moisture contents, and other milk constituents were also measured or calculated. The results showed that unsalted soft cheese had higher ($P<0.05$) yield of 19.26%, higher ($P<0.05$) whey volume of 666.03 mls but lower composition of total solids, 33.43%; fat, 12.68%; protein, 14.74%; casein, 13.62% and longer coagulation time of 16.75 minutes as compared to the salted soft cheese.

Introduction

The White Fulani or Banaji cattle were reported as the leading triple purpose (meat, milk and draught) breed in West Africa (Belewu, 2006). They also play an important role in the religion and social lives of the people. They serve as a reserve of family wealth and as a mark of respectability and status in the community. Cattle are well known to be the major source of milk worldwide, however, the milk production by local cattle breeds in Nigeria have been reported to be low due to the poor quality and insufficient feeds and feedstuffs especially during the dry season (Olafadehan and Adewumi, 2010). In Nigeria and other parts of West Africa, milk collected from the cow is first used to feed the calves. The remaining milk is then consumed by the farmers’ household and any surplus is made into butter or into an unripened soft cheese called “wara”. This unripened soft cheese is usually made by the addition of the extract from a plant, *Calotropis procera* to the whole milk from cattle (Belewu, 2006; Adetunji et al, 2008; Akinloye and Adewumi, 2014). During the processing of milk into cheese, pasteurization which involves the process of heating milk at a temperature of between 62 and 66°C, then holding it for 30 minutes and then cooling immediately to below 4°C is done to eliminate pathogenic organisms (Adetunji et al, 2008).

Salting of the cheese also may be done to add flavour, for preservation, also to slow down lactic acid production and to release whey at a faster rate through osmosis. Belewu (2006) outlined salting as one of the methods of preservation of cheese. Cheese was stated to be an excellent source of protein, fat and minerals such as calcium, phosphorus, magnesium, sodium and potassium (Tona et al, 2013). It was considered as a good and cheap source of animal protein. This study was therefore carried out to investigate the yield, composition and coagulation time of unsalted and salted soft cheese locally produced from the milk of White Fulani cows.

Materials and Methods

Site of the experiment

The experiment was carried out at the Dairy Cattle Unit of the Teaching and Research Farm, University of Ibadan, Ibadan, Nigeria.

Collection of milk and milk samples

Milk was collected from four experimental White Fulani cows into milking buckets. Samples of the milk were then collected into well labeled plastic bottles and transported in ice cooled container to the laboratory for chemical analysis. The remaining milk was measured using measuring cylinder and recorded, and then used for soft cheese manufacture.

Procedure for soft cheese manufacture

Calotropis procera (*C. procera*) leaves extract preparation

Matured fresh ***C.*** *procera* leaves were plucked cleansed thoroughly with water, cut into pieces and ground in a mortar with pestle to extract the juice. The extract was mixed with a little milk and sieved out. Four mls of the leaf extract was used in about 1000 mls of milk for the soft cheese preparation.

Soft cheese manufacture

The flow chart of soft cheese manufacture is shown in Figure 1. One thousand (1000) mls of milk was heated slowly to approximately 45 to 50°C in about 30 – 40 minutes. The milk was stirred gently during the heating process with a wooden spoon. Four mls of the leaf extract of ***C.*** *procera* was then added to the warm milk and the mixture was again heated with intermittent stirring to about 95°C and kept at this temperature until there was coagulation and the separation of curd and whey and the heating was stopped. The sign of coagulation was observed within the range of 9 to 20 minutes as from the time that the leaf extract (coagulant) was added. In the preparation of salted cheese, 8.0g of sodium chloride (common salt) was added before the milk coagulated while stirring to ensure an even distribution of the salt. The curd was then further boiled for 20 minutes to inactivate the leaf extract (coagulant) and to facilitate whey expulsion from the curd. The whey was then left to drain for 20 to 30 minutes by use of a small local raffia basket and the volume of whey was measured with a measuring cylinder and recorded. When the cheese was firm enough to retain its shape, it was removed from the raffia basket and weighed. To obtain samples of the cheese for laboratory analysis, the sharp end of a spatula was used to make 4 cuts radiating from the center of the cheese. Cheese yield (%) was calculated as weight of cheese divided by the weight/volume of milk used, multiplied by 100.

Analytical procedure

Raw milk and cheese samples were analysed for protein and fat by the methods of (AOAC, 2005). Total solids was determined by spreading out 2g of asbestos in the bottom of a porclain dish (heated, cooled in a desicator and weighed) and 10 mls of milk or 10g of soft cheese was run slowly into the dish and reweighed. The porclain dish was then heated over a water bath at 65^{o}C for 30 minutes and dried in a thermostatically steam-controlled electric oven to constant weight for the total solids. Cheese and milk samples were analysed for fat by the standard Gerber Method (AOAC, 2005). Protein contents were determined by the conventional Micro Kjeldahl method, solids-not-fat was determined by difference (% total solids – % fat). The percent lactose in the raw milk sample was calculated by difference (% lactose = % SNF - % Protein - % Ash). Casein contents of milk and cheese were estimated from fat content by the formula (% casein = % milk fat multiplied by 0.4) + 1.0 (Scott, 1981).

Statistical analysis

Data were compared using student's t-test. All statements of differences were based on significance at P<0.05 (SAS, 2002).

Results and Discussion

The proximate composition of the milk used for the processing of the unsalted and salted soft cheese is shown in Table 1. The 3.33% of fat observed was slightly lower than the 3.78 - 5.71% butterfat in the milk of grazing White Fulani cows fed poultry waste-cassava peel based diets reported by Ndubueze et al (2006). However, this met the 3% legal minimum standard approved by the British government in 1901 (Mpieri, 1983). The 3.16% milk protein and 10.48% total solids were slightly lower than the ranges of 3.7 – 3.8% milk protein and 13.5 – 13.7% total solids for the milk of grazing Bunaji cows reported by Olafadehan and Adewumi (2010). The value of 0.82% ash obtained in this study fell within the range of 0.82 to 0.99% ash obtained by Ndubueze et al (2006). This showed the presence of mineral elements in the raw milk.

The composition of unsalted and salted soft cheese processed from raw milk of White Fulani cows is presented in Table 2. The 33.43% total solids observed in the unsalted cheese is slightly lower than 36.36% total solids in the salted cheese. This is contrary to the report of O'Connor (1993) where total solids of salted cheese were lower than in the unsalted cheese. The difference probably could be attributed to the different forage and concentrate diets consumed by the lactating cows from which milk was obtained. The percentages of fat and protein were lower in the unsalted than in the salted cheese, and these showed that the salted cheese was more nutritious than the unsalted cheese.

Alalade and Adeneye (2006) stated that most thermal processing (such as occurs during cheese manufacture) have been found to leave heat-stable lipolytic enzymes almost intact, thereby influencing food quality and this led to an observed increase in fat content of cheese. Also, salting might probably have increased the total content of free amino acids in the cheese. This is in agreement with the finding of Garcia-Palmer et al (1997) who found that there was a progressive increase in the total content of free amino acids during the ripening of Mahon cheese.

Figure.1 Flow chart of soft cheese manufacture

Freshly collected raw milk

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Heat the milk slowly to 45- 50°C in about 30 - 40 min. while stirring gently (add salt for salted cheese)

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Add leaf extract (*C. procera*) to warm milk and mixture with intermittent stirring to about 95 °C

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Keep the mixture at 95 °C until there was coagulation with the separation of curd and whey and then stop the heating process

↓

Boil the curd (at 100 °C) for 20 min. to inactivate the (*C. procera*) leaf extract coagulant and to facilitate whey expulsion from the curd

↓

Pour the curd into small local raffia baskets for whey drainage and measure the volume of the whey with measuring cylinder

↓

Soft cheese may be stored in the whey for 2- 3 days

Table.1 Proximate composition of raw milk from White Fulani cows

Constituents	(%)
Fat	3.33 ± 0.53
Protein	3.16 ± 0.62
Total solids	10.48 ± 0.70
Solids-not-fat	7.15 ± 0.84
Lactose	3.17 ± 0.75
Ash	0.82 ± 0.01
Casein	2.42 ± 0.27

Mean values ± standard deviation

Table.2 Composition of unsalted and salted soft cheese processed from raw milk of White Fulani cows

(%)	Unsalted cheese	Salted cheese
Fat	12.68 ± 2.72^{b}	15.30 ± 1.97^{a}
Protein	14.74 ± 1.02^{b}	20.13 ± 2.33^{a}
Total solids	33.43 ± 3.14^{b}	36.36 ± 2.86^{a}
Solids-not-fat	20.76 ± 2.08	21.06 ± 2.43
Casein	13.62 ± 1.17^{b}	18.88 ± 2.47^{a}

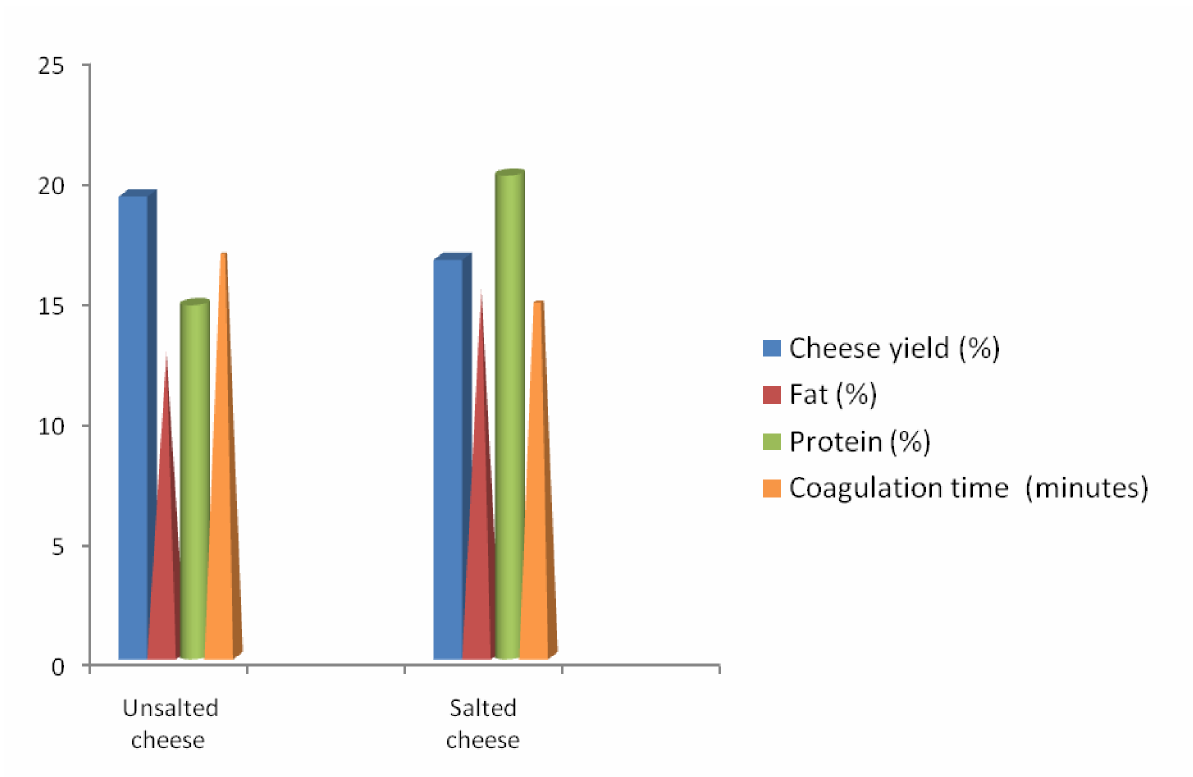
Mean values ± standard deviation; ^{a,b} values with different superscripts along the same row are significantly (P< 0.05) different; values without superscripts along the same row are not significantly (P> 0.05) different

Table.3 Cheese weight, cheese yield, whey volume and coagulation time of unsalted and salted soft cheese

	Unsalted cheese	Salted cheese
Cheese weight (g)	192.64 ± 8.31[a]	166.29 ± 11.43[b]
Cheese yield (%)	19.26 ± 3.14[a]	16.63 ± 2.86[b]
Whey volume (mls)	666.03 ± 36.62[a]	636.83 ± 28.94[b]
Coagulation time (minutes)	16.75 ± 0.70[a]	14.75 ± 2.90[b]

Mean values ± standard deviation; [a,b] values with different superscripts along the same row are significantly ($P < 0.05$) different

Figure.2 Cheese yield, fat and protein content and coagulation time of unsalted and salted soft cheese



There was higher nutrients content (fat, protein, total solids, solids-not-fat and casein) in cheese than in raw milk as revealed in Tables 1 and 2. This probably was due to the activities of bacteria in fermented milk products such as cheese, similar observation is reported in the work of previous researchers (Tona et al, 2013).

In Table 3 and Figure 2 are shown the cheese weight, cheese yield, whey volume and coagulation time of unsalted and salted soft cheese. There were significantly higher ($P<0.05$) cheese yield of 19.26% and whey volume of 666.03 mls of whey in the unsalted than in the salted soft cheese. There was 19.26% and

16.63% cheese yield obtained from the unsalted and salted cheese respectively. These values implied that the conversion of raw milk into soft cheese might not yield high profit when consumers are not willing to pay higher price for soft cheese. Thus, the production of soft cheese could be adopted only during periods of excess milk production. The lower volume of whey from salted than the unsalted cheese probably implied that the salted cheese retained more moisture but at the same time had lower mass than the unsalted cheese.

The coagulation time for the unsalted cheese (16.75 minutes) was longer than that of the salted cheese (14.75 minutes). This could be due to the mineral elements introduced into the milk through the addition of salt that hastened the coagulation of the salted milk. It could be concluded from the results of this study that non application of salt to White Fulani cow milk increased the percent yield of unsalted cheese, but resulted in lower percent fat and protein content than the salted cheese.

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