

**MILK PRODUCTION AND HANDLING ON THE  
ACCRA PLAINS BY THE FULANI HERDSMEN**



BY

**PHOEBE LOKKO**  
**FOOD RESEARCH INSTITUTE**  
**P.O. BOX M.20**  
**ACCRA**

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## SUMMARY

The study discussed milk handling and processing activities of 20 Fulani households living in the Accra plains. Men and boys did the milking of the cows, by hand. Milk yield varied with season and with herd size. The milk was sold fresh or processed into other products. Woagashie, is a plant enzyme coagulated soft cheese, which could be consumed fresh, dried or fried. Nyarmie is a spontaneous fermentation of pasteurized milk product which is whipped and added to gari, banku, rice or fula and consumed as a meal. Cream was also collected and churned into butter, which is boiled into ghee, which is sold or used for cooking. The marketing of milk and milk products was done by the women and the money was used for the upkeep of the home. The constraints were many as production practices were purely traditional and very unhygienic. Marketing and spoilage problems arose whenever there was excess of milk and the milk has to be discarded, as there were no cooling systems. The homesteads were made up of several large compounds, which contain several huts. Rectangular kraals, constructed from wood were situated within the homesteads. There were shelters for young calves, goats and poultry and a cooking place for the women. It is hoped that the traditional milk products could be made more popular to the general public by introducing good hygienic practices during processing.

2.1 The family

2.2 The compound

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Milk is one of the most valuable animal products in sub-Saharan Africa and it is produced in most agricultural production systems. While some of the milk produced is consumed as fresh milk, a considerable portion is processed into various products such as butter, ghee, cream, cheese and fermented milk (Odiako, 1988).

Much of the milk produced by rural small holders is consumed on farm, using traditional technology. Farmers in the Ethiopian highlands produce sour milk, butter and cheese for sale (Odiako, 1988). The Maasai in Kenya prepare ghee from their milk (Van Soest, 1987). The Fulani in Ghana prepare a plant enzyme coagulated cheese called "Waagele" from fresh milk (Odiako, 1988; Odiako, 1990).

While the processes used have not been studied in extensive scientific investigations, they appear to be effective methods of converting milk into stable marketable products.

A pressing need exists to alleviate hunger and malnutrition in this country. The provision of adequate supplies of protein derived partly from plant and animal sources is of great importance in improving the diet of children. Over 95% of milk and milk products consumed in Ghana are imported whereas in Nigeria, over 80% of the total daily

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A pressing need exists to alleviate hunger and malnutrition in this country. The provision of adequate supplies of protein derived partly from plant and animal sources is of great importance in improving the diet of children. Over 95% of milk and milk products consumed in Ghana are imported whereas in Nigeria, over 80% of the total dairy

consumption is accounted for by domestically produced products (Jansen, 1991).

The Ghanaian environment and livestock production practices have so far been unable to support a thriving dairy industry. (Clottey, 1968).

## Milk Production

### 0.1 Objectives of the Study

*The objectives of the study were*

- i) To study the milk production and processing activities on the Accra Plains.
- ii) To evaluate the methods used for processing milk and milk products
- iii) To look at the socio-cultural characteristics of the Fulani, living in the Accra Plains who are principal producers of milk and milk products.
- iv) To assess the need for intervention that will improve the performance of the local milk industry by developing methods that will improve the technology and introduce hygienic practices.

### 0.2 Methods of Study

A questionnaire was developed and used. Observation and personal discussion with the herdsman and their wives also gave information about different activities of the Fulani. A total of twenty questionnaires were administered.

0.3 The Study (91) The tall grass and bushes keep ranches and Fulani settlements in the Accra Plains were identified. The settlements were situated in the Ga rural areas in several villages between 25 and 35 km west of Accra. From indigenous cattle breeds kept by Fulani people who basically are an ethnic

## 1.0 Milk Production

### 1.1 The Accra Plains

Ghana can be divided into three main vegetation areas, namely, The Northern Savanna, lying north of latitude  $6^{\circ}$  and the  $8^{\circ}$  and the Accra Plains lying south of latitude  $6^{\circ}$  and located on the eastern half of the country.

The climate is humid and the temperature range is between  $15^{\circ}\text{C}$  -  $34^{\circ}\text{C}$ . The average mean daily temperature is  $29^{\circ}\text{C}$ . Rainfall distribution is concentrated in a major (May-July) and a minor (October-November) season. (Walker, 1967).

The land is relatively flat with gently undulating slopes of 0-5%. The soil is poor ranging from deep sands to heavy clays. The vegetation is grassland dotted with thorn shrubs in thickets and isolated trees.

The grassland of the Accra plains supports a thriving traditional cattle-grazing system. It carries about 200,000 herd of cattle which constitute about 20% of the National Cattle population feeding. There was plenty of grass for the cattle to feed on



(Okanta, 1991). The tall grass and bushes keep ranches and farmsteads out of sight.

Local production of milk in Ghana is mostly from indigenous cattle breeds kept by Fulani people who basically are an ethnic group found all over west Africa pre-occupied with animal rearing.

The farmsteads visited did not have names. Probably, it was because either the owners never thought about it or they wanted to remain anonymous.

## 1.2 Herd Size

The average number of cattle per-farm was two hundred with two bulls to service the cows. Two herdsmen, either hired or family members, took care of this number of cattle. The highest number of cattle found was two thousand (2,000) herd and the lowest number was twenty (20). The breeds of cattle were the white Fulani and the Sanga. The bulls were indispensable for reproduction but the cows were preferred for bearing the young and producing milk. The milk was also sold.

## 1.3 Herd Management

The cattle grazed on grass and did not have supplementary feeding. There was plenty of grass for the cattle to feed on

during the rainy season but in the dry season, the cattle were made to travel long distances between 5 to 10 kms each day in search of fodder and water. They bred during the dry season and gave birth during the rainy season. The calves were fed on their mother's residual milk and tried to eat grass as well. Orphaned calves were fed with milk from beer bottles.

Some farmers were forced to sell the calves and cattle during the dry season in order not to lose the calves through starvation or drought.

#### 1.4 Animal Health

The cattle suffered from skin diseases. They had ticks all over their bodies. These ticks were occasionally picked by birds that followed the cattle. The cattle could also be seen swinging their tails and shaking their bodies to ward off flies.

The usual visits of the veterinarians were once in every two weeks.

#### 1.7 Milk Handling

There was no set up for milk collection in the Agribusiness. Marketing of milk and milk products was done by the farmers.

#### 1.5 Remuneration

The Fulani hired helping hands were remunerated in cash or in kind. Some were provided with a quantity of maize and milk.

Others were given money and milk. The third category got a quantity of maize, some money as well as milk every month.

1.6 **Milking**

The milking of cows was by hand. The cows were milked once a day between twelve noon and one in the afternoon. Milking was done by men and boys; occasionally the women also milked the cows. The milk was collected into either calabash or an enamel bowl. Milk yield varied with season and with herd size. During the rainy season, when the cattle had easy access to both fodder and water, a herd size of one hundred and fifty cows could produce twenty litres of milk a day. This quantity of milk could be reduced to two or four litres in the dry season. Several occasions were recounted when excess milk had to be thrown away in the rainy season because it could not be sold or processed. Containers for milk stored were varied. They included calabash, plastic buckets, enamel buckets and enamel bowls.

1.7 **Milk Handling**

There was no set up for milk collection in the Accra Plains. Marketing of milk and milk products was done by the farmers themselves. The fresh milk was first strained and sold to customers. Cream was also collected from a quantity of milk, which had been left standing for a while. The cream was either churned to produce butter or boiled with spices to produce

"ghee" which was either sold or used for cooking in the home. Natural fermentation took place when the fresh milk was left over night. This fermented milk was called "nyarmie" and it was for home consumption. The "nyarmie" was whipped and added to gari, banku, rice or fula and consumed as a meal. The milk was processed into "woagashi", a plant enzyme-coagulated soft cheese. This cheese could be eaten fresh, dried or fried. It could be stewed or put into soups.

## 1.8 Marketing of Milk and Milk Products

Women were responsible for the marketing of the milk products. Farmers' wives also took part in milk marketing. They used the money for the upkeep of the home. The products were either taken to the markets for sale or sold in the home to customers and traders. The milk was stored in large aluminium containers and plastic drums.

## 1.8.6 Marketing problems arose when the milk was sold

## 1.9 Problems and Constraints

1.9.1 The average daily milk yield per cow was about 1 litre (Okanta, 1991). There was no formal milk collection arrangement. There should be some genetic improvement of indigenous cattle breeds through selection for better milk yields.

1.9.2 The handling and production practices were purely traditional and there had not been any improvement whatsoever in the traditional processing of the milk.

1.9.3 The handling practices were not hygienic. There were a lot of flies and no special place for milking. The extension officers could help in this area to teach clean milk production.

1.9.4 The processing methods were limited and not varied. Other appropriate milk processing methods could be introduced to vary the products and widen the market.

1.9.5 There was a problem with butter production during the hot season. It had to be done at dawn when it was coolest. It entailed waking up very early in the morning.

1.9.6 Marketing problems arose whenever there was excess milk. This could be solved by setting up milk collection points where the excess milk would be disposed off. This set up would help the farmers improve upon the quality of their milk because the milk quality would be assessed before the milk is accepted.

## 2.0 On Farm Study of Traditional Milk Processing Techniques - A Case Study

### 2.1 The Family

Several days were spent with a Fulani household to observe milk-processing methods. The farmstead was situated at Katamanso and the household was made up of the head of the house, a Fulani called Fuseini, his wife called Fati and their seven children. The eldest child was fourteen years old and the youngest child was six months old.

### 2.2 The Compound

The compound comprised a two-roomed rectangular mud house with thatch roof for the family, two round huts made of thatch with a hanging straw mat at the entrance for four hired helpers and shelters for young calves, goats and poultry. There were two granaries and a large enclosure for the cattle and another enclosure for farming.

### 2.3 Milk Production

One hundred and fifty herd of cattle were driven into the compound at around twelve noon on a day in September 1992. The cows to be milked were identified by releasing their calves, which were kept in a separate place. The calves which walked directly to their mothers, were tied to the parent to initiate the flow of milk.

The cows were hand milked into calabashes and enamel bowls by two men and two boys. The milk collected was poured into an aluminium bucket. The milk from the different cows were pooled together and handed over to the wife Fati.

She strained the milk using an aluminium strainer, to get rid of flies, pieces of straw, dung, and other foreign materials in the milk.

## 2.4 Preparation of Woagashi

### 2.4.1 Utensils

- Iron pot or a deep pan (5 gal. Or 22.5 litres capacity)
- Source of fire (tripod stove) with firewood
- White plastic bucket (1 gal. capacity of 4.5 litres)
- Aluminium strainer
- Wooden mortar and pestles
- 1 litre plastic measuring cup
- 1 calabash
- 2 large enamel basins
- 20 small "woagashi" baskets
- Metal rack

#### 2.4.2 Method

- Six plastic bucketful and 2 beer bottles or (29.5 litres) milk were measured into the clean aluminium pot and placed on the fire.
- A plastic cup was used to remove (1 gal. and 2 beer bottles) of the hot milk when the temperature was 80°C. This was for home consumption.
- About 1 litre of prepared Sodom Apple plant extract was added to the milk on the fire as a curdling agent.
- The milk was then held at a constant temperature, by removing the burning wood, for twenty minutes.
- The curd was heated to boiling after coagulation, whey was released during this process and there was complete product sterilisation as well as enzyme deactivation. The boiling took another twenty minutes.
- The soft curd or "woagashi" was moulded in small woagashi baskets of 10cm diameter, which also drained the whey from the curd.
- The woagashi cakes were removed from the baskets and placed in a covered basin. Some whey was poured



over the pieces to keep them moist. The product was then ready for consumption or sale. at such high temperatures.

## 2.5 Observations Made *was used to test the firmness of the curd.*

### 2.5.1 Preparation of Curdling Agent *boil for twenty minutes.*

The extract used as the curdling agent was the stem of *Calotropis procera* or Sodom Apple plant. Between 450 and 500gm of the stem was cut into small pieces and pounded in mortar, a litre of water was added and sieved.

2.5.3 The extract was then added to the milk. The stem should be young and tender and the extract should be slightly bitter. A dry stem would give poor results. The addition of a little common salt to the extract enhanced the curdling process.

*No flavonoid was extracted and the colour was not green.*  
The leaves of the plant were not used because apart from imparting the green colour to the woagashi which should be whitish in colour, it also gave a bitter taste to the product. Milk could be used instead of water for the extraction of the curdling agent.

### 2.5.2 Coagulation/Curdling *and from the treatment.*

The milk was coagulated only, at pasteurisation temperatures. No coagulation took place during boiling or sterilisation temperatures. It is possible that the

enzymes could be deactivated and the curd made very unstable if the milk coagulated at such high temperatures.

The finger was used to test the firmness of the curd. The curd was brought to the boil, for twenty minutes, which completely sterilised and deactivated all enzymes present in the milk. The boiling helped with flavour development and texture improvement.

### 2.5.3 Processing

Very little firewood was needed for the woagashi preparation. At least, 4-5 litres of milk was always left for home consumption. Visitors, arriving at the house during milk processing time were served with hot milk. No thermometers were used and yet the pasteurisation temperature was always more than 68°C.

Woagashi baskets were very fragile and so were not regularly washed. (The thin canes used in weaving them got broken easily).

The hot whey drained from the "woagashi" was very popular with the domestic animals, as well as lizards and flies. These also picked at the little pieces of woagashi left in the baskets.

A stick was used to bring the grains of butter together. This butter production was always done in the morning when the weather was cool. The butter obtained was very soft and the recovery was less. It was kept in water as the evaporation of

## 2.6 Preparation of "Nyarmie" - cool.

As mentioned earlier, at least, 4.5 litres of milk was left daily for the household. This was taken from the pasteurised milk before the addition of the plant extract.

This milk was covered and kept overnight. There was natural fermentation resulting in the formation of curdled milk. This milk was stirred vigorously or whipped with a special stick to give a smooth but thick product. This fermented milk was called Nyarmie.

## 2.7 Preparation of Butter

The preparation of butter was demonstrated on the farm. Fresh milk was allowed to stand overnight for cream to rise to the top. The cream was carefully removed and stored. This collection of cream was repeated for three days with 3 different batches of fresh milk. The cream was poured into a special gourd, which was stoppered with corncob. The gourd was shaken vigorously for seven minutes. The butter separated from the buttermilk. The mixture was poured into a bowl. The gourd was rinsed with water into the bowl.

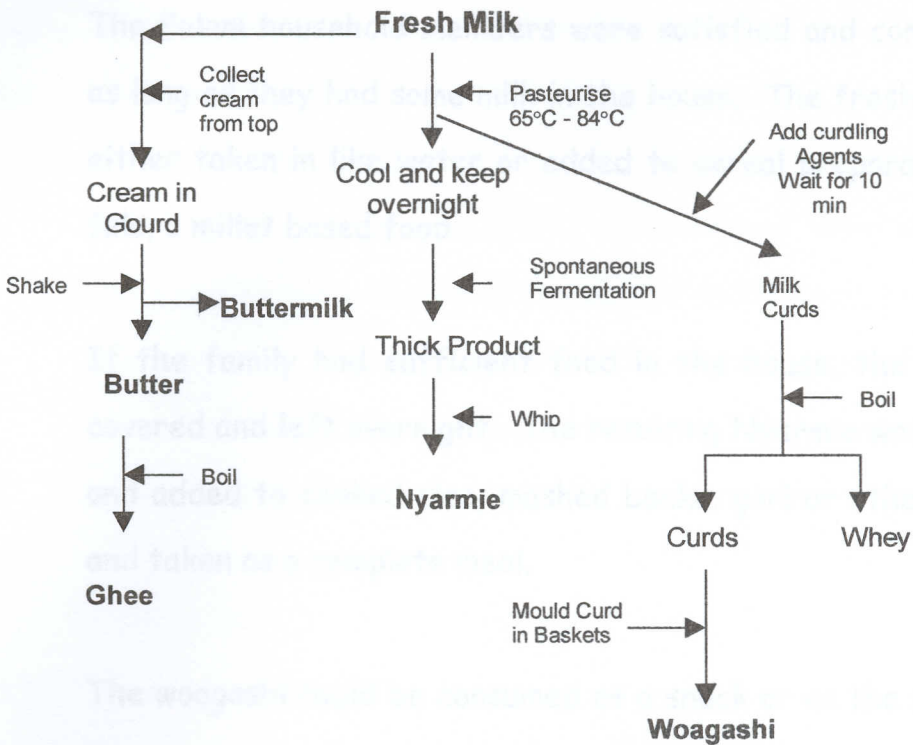
A stick was used to bring the grains of butter together. This butter production was always done in the morning when the weather was cool. The butter obtained was very soft and the recovery was low. It was kept in water as the evaporation of the water kept the butter cool.

The butter prepared was heated until all the water was driven off. The resulting product called ghee was bottled and kept for food preparation.

## 2.8 Tools and Equipment

Very simple tools and equipment were used during the processing of milk. Prominent among them were calabash, gourds, wooden spoons, plastic and enamel buckets, iron and aluminium pots and wooden stirrers.

## TRADITIONAL PREPARATION OF MILK PRODUCTS



### 2.10 Marketing of Milk Products

Milk products are either sold on the farm or in the market. The fresh milk is mainly purchased by consumers like doctors and ladies. The Houses and other public institutions buy fresh and processed milk from rural

A complete study is being undertaken at the Food Research Institute on the marketing of milk products in the Accra Plains.

## 2.9. Utilization and Consumption of Milk Products

The Fulani household members were satisfied and comfortable as long as they had some milk in the house. The fresh milk was either taken in like water or added to cereal preparations like fula, a millet based food.

If the family had sufficient food in the house, the milk was covered and left overnight. The resulting Nyarmie was whipped and added to cooked rice, mashed banku, gari or other cereals and taken as a complete meal.

The woagashi could be consumed as a snack or as the source of protein in stews or soups. It could be fried, dried or smoked and added to stews or soups. Smoked or dried woagashi could be stored for months. It could be coloured red or pink, fried and cut into pieces and sold.

## 2.10 Marketing of Milk Products

Milk products were either sold on the farm or in the market. The fresh milk was mainly purchased by foreigners like Indians and Lebanese. The Hausas and other Fulanis patronised the fresh and processed milk as well.

A complete study is being undertaken at the Food Research Institute on the marketing of milk products in the Accra Plains.

### 3.0 Socio-cultural Characteristics of the Fulani People

#### 3.1 Tribe and Religion

All the 20 farmers interviewed were Fulanis but not all of them were cattle owners. Six of the farmers had their own cattle while ten of them had been contracted to look after cattle for other people. Four farmers had their own cattle and in addition looked after cattle belonging to others. Some of the other ethnic groups who owned cattle in the area were Gas, Adas and Hausas.

#### 3.2 Housing

The Fulani lived in different housing environments. They ranged from houses constructed from mud or clay with thatched roofs, wooden houses, mud houses with cement plastering to walled sandcrete block houses with slated roofs.

The homesteads were made up of one to several large compounds. A compound was made up of several huts and it might house one family or several families.

Only two houses out of the twenty surveyed had potable water and these two houses were situated at Ashale Botwe. Five other families had access to potable water, again from the same

village. The others fetched water from one of the several dams which had been constructed in the area.

The kraals were situated close to the houses so that the cattle could easily be observed. The kraals were rectangular shaped and made of wood. There could be as many as four kraals on one compound. Other structures on the compound were grain threshing places, shelters for young calves, goats and poultry, a cooking place for the women and one or two thatched walled granaries in which grains were stored.

### 3.3 Marital Status, Family Life and Literacy Rate

The head of the compound was the eldest male member of the extended family. All the farmers were married with six of them having more than one wife. The significance of the number of wives in Fulani culture was that, nursing cows were shared and each wife got the milk in turn, thus the more wives a man had, the less earnings a wife got from sales of product compared to if she were the only wife. (Ali et. al., 1991).

It was also common for a Fulani man to marry his first cousin, so they married within the family. Eight farmers however had inter-married with either Ga, Ada or Hausa women.

All the women were illiterates. A few of the men have had a western type of education but the rest had Islamic education.



They were all sending their children to school as they had realised that illiteracy was a handicap.

One farmer had a couple of his children at the University of Ghana, Legon. Male children were expected to go herding with male adults as soon as they were old enough for the task. Female children on the other hand were expected to learn house keeping and milk processing. All the farmsteads had access to primary and JSS education.

The average household size was fifteen made up of father, mothers, children and sometimes other members of the extended family. Three couples however did not have any children.

#### 3.4 Distribution of Labour with the Family

All the respondents stated that cooking, child bearing and care, washing, water fetching, and collection of firewood and marketing were tasks for women. The women were expected to process milk into different products and to market the products. They reared sheep, goats and chickens for sale. There was however, a lot of cooperation among the women in each household. The men and children helped in the household by collecting firewood, purchasing foodstuffs and going on errands. The families farmed during the rainy season and produced maize and few vegetables.

Amrahia farm who treated the animals when they were sick. The animals were put under routine programmes for treatment of ticks and waste infestation. There was a laboratory on the farm, equipped

### 3.5 Family Health microbiology

The Fulani women were very beautiful and shapely and the men very handsome with curly hair. Some were fair while others were dark. They all had beautiful pointed noses. The most common disease was malaria. They drank the extract of boiled neem leaves to combat the disease. They also suffered from nausea but there was no explanatory reason for that.

and an attendant.

The different farmers wanted different types of assistance for themselves and their families. Those who had running water wanted electricity. Others wanted pipe borne water while others asked for medicines to administer to themselves whenever they fell sick.

Fulwood milk collection 3.6 The Fulanis were not the only people keeping cattle on the Accra

### 3.6 The Experimental Farms

The Fulanis were not the only people keeping cattle on the Accra Plains. There were two experimental farms, one belonging to the Ministry of Agriculture at Amrahia and the other belonging to the Faculty of Agriculture, University of Ghana. The management of their cattle and milk production was compared to that of the Fulani people.

On the Amrahia farm, there were 200 heads of cattle being reared.

The animals on the experimental farms were better looked after than the Fulani cattle. There was one veterinary doctor attached to the

Amrahia farm who treated the animals when they were sick. The animals were put under routine programmes for treatment of ticks and worm infestation. There was a laboratory on the farm, equipped for parasitology and microbiology.

Although the University of Ghana (ARS), Legon station, has just a few cattle, made up of pure Sokoto, pure West African Shorthorn and Jersey crosses, they were not ready for milking then. The station had 3 stockmen looking after these cattle and maintained a 3-man team of veterinary officers made up of one surgeon, one technician and one attendant.

The cows on the Amrahia farms on the other hand were machine milked twice a day, at 5.30 a.m and 3.00 p.m. The herring bone system of milking was used. While the Fulanis collected their milk into calabashes, enamel bowls and buckets, the Amrahia Farms, used Fulwood milk collecting jars, The average daily milk production per cow from the Fulani and Amrahia farms was 1 litre and 5 litres respectively. In Northern Nigeria, the average daily milk yield from the cattle was 0.74 litres which was less than in Ghana (Ali and Karri, 1993). All these variations were due to the breed type as well as proper care of the animals.

On the Amrahia farm, there were 200 heard of cattle being cared for by three herdsmen. These men were employed by government and provided with working gear as an incentive.

## 4.0 Discussion

The animals on the farm did very well because they got good fodder during the dry season and grazed during the rainy season. There were paddocks on the farm where the animals grazed. The cattle got supplements as well. Each animal got a kilo of concentrate daily during milking. The calves were bucket fed with milk. The cattle on the Amrahia farm also got a lot of rest - grazing only between 7.30 a.m and 11.00 a.m.

The recipe for the processing of milk was passed on from

The Fulani cattle were weak and lean and tired from long treks in search of grass and water.

### 3.7.1.1 Milk Storage

The Fulani cattle farmers did not have refrigeration facilities. They held and sold milk at ambient temperatures. On the other hand, milk from Amrahia farms was held in bulk tanks and cooled to 4°C and marketed without further treatment. Therefore the milk sold by the Fulani farmers had very short shelf life because the milk was highly susceptible to contamination by microorganisms. How short a time the milk could be held without refrigeration, and under unhygienic environment would be the focus of our next study.

allowed to reach ambient or temperatures of 30°C or above in Ghana. The extent of the Listeria problem was reported to be at 45°C to 50°C (DANIEL, 1992). There is a significant variation in different countries. Other lists are available against 20°C

## 4.0 Discussions *Calotropis procera* An example is the leaf of the periwinkle

### 4.1 Milk Processing

The traditional way of processing milk had not changed over the years. No other new milk product had been developed.

Traditionally, butter, fermented milk and cheese were produced. There was very little information available on the cheeses made at the farm level.

The recipe for the processing of milk was passed on from parents to children through observation and practical experience.

The quality of the farm made cheese was not constant because the ingredients and techniques used were not standardised.

Cultures were not used in traditional cheese production.

The cheese woagashi was consumed very soon after processing primarily because of the immediate requirement of the family and partly because of the poor shelf life of the products under ambient temperatures.

In Benin, during the cheese preparation, the milk was not allowed to reach pasteurisation temperatures as was done in Ghana. The extract of the *Calotropis procera* plant was added at 45°C to 50°C. (O'Connor, 1992). There were slight variations in different countries. Others also use curdling agents other

than *Caltropis procera*. An example is the leaf of the pawpaw tree (*Carica papaya*).

#### 4.2 Socio-cultural Characteristics of the Fulani

The survey has given an overview of the Fulani background mode of operation and their constraints. Though the survey was limited to the Accra plains, the picture might not necessary be different from other studies on Fulanis made in other African countries. A few points emerge, on the whole from this study.

- i) Contrary to common understanding, the Fulanis of the Accra Plains were settled in one location, abandoning their traditional nomadic mode of living (movement from place to place). This traditional movement was not the only aspect of their lives that has been affected. They were building permanent houses as well, establishing business and educating their children - both males and females.
- ii) The Fulani women were very active and industrious. There were, however, varying degrees of males participation in tasks in the home. Most significant was rearing of animals where most men did participate. The handling and marketing of milk was entirely a female affair. Jobs like firewood collection and milking had both male and female participation. These same observations were made by researchers in Northern Nigeria (Ali et.al, 1991).

v) From the above discussion, it has been established that there is more work to be done in the field of traditional milk processing and traditional products have to be introduced to the general public.

vi) Measures should be taken to increase milk yield by reducing or those factors that cause fall in milk production.

## 5.0 Conclusion

In conclusion, the study has looked at the socio-cultural characteristics of the Fulani people living in the Accra Plains. It has also examined and discussed milk production and processing activities. It has shown that there is need to upgrade the processing technologies and introduce hygienic practices during processing.

## 6.0 Recommendations and Areas for Further Research

- i) Woagashi and other traditional milk products are not very popular with most Ghanaians. They could be prepared and made palatable by adding spices, sugar, salt, etc.
- ii) Work should be done on the processing of woagashi to increase the shelf life. It could be pressed into a semi-hard cheese or additives could be added to prevent spoilage.
- iii) Production of other kinds of cheese could be introduced to the villages. These could be prepared under adequate supervision and the shelf life could be prolonged.
- iv) There can be considerable loss of curd particles during the separation of curd and whey. This matter should be addressed.

- v) Environmental sanitation and good hygienic practices should be encouraged among the Fulani people.
- vi) Measures should be taken to increase milk yield by reducing or eliminating those factors that cause fall in milk production.
- vii) Simultaneously, Fulanis should be helped to enhance those conditions that favour increased milk production like water, supplements, fodder, proper care of the animals and good hygienic practices.

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## ACKNOWLEDGEMENT

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**ACKNOWLEDGEMENT****PICTURES**

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# PICTURES



A PHOTO OF THE... (text is extremely faint and illegible)





A herd of cattle at Katamanso



milking

Milking

collected milk



Collected Milk



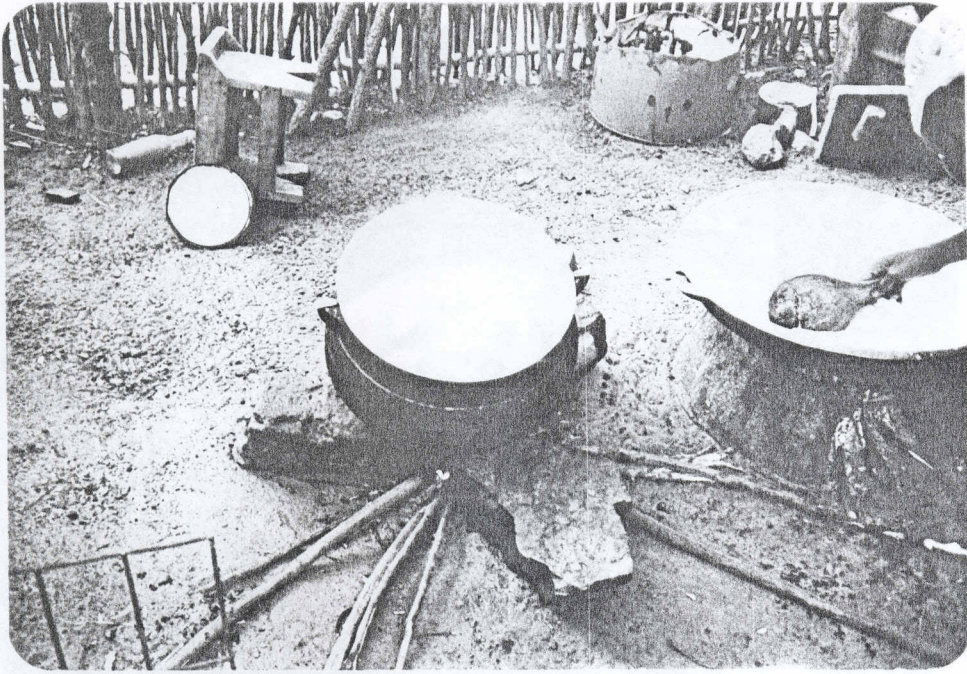
Collected Milk



*Measuring of volume of milk*  
Measuring of volums of milk



*Processing area*  
Founding of curdling agent  
Milk Processing Area



Heating of milk for processing



Pounding of curdling agent

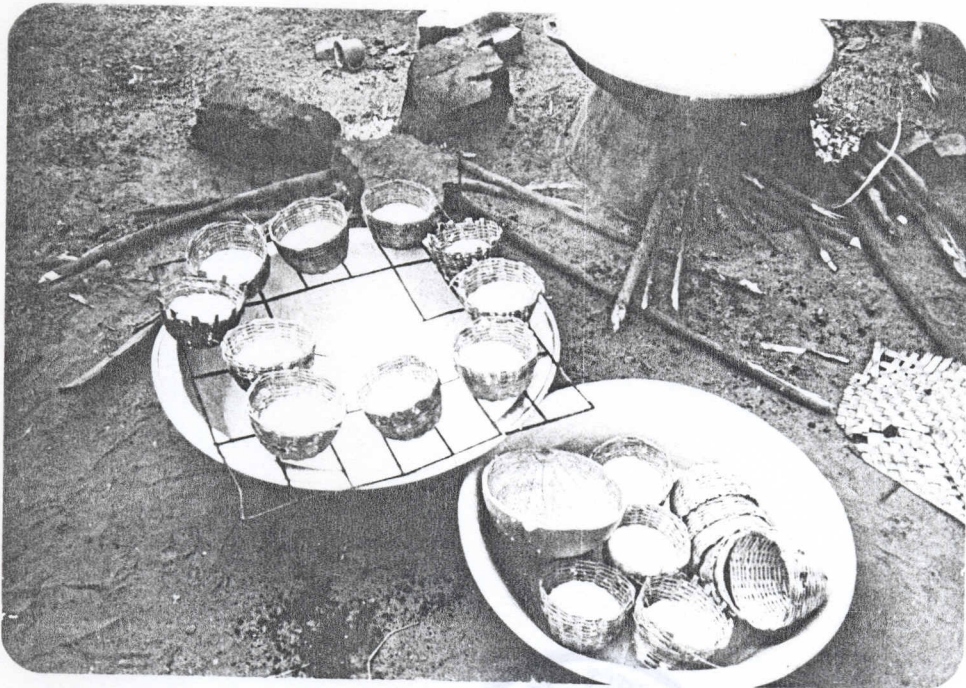




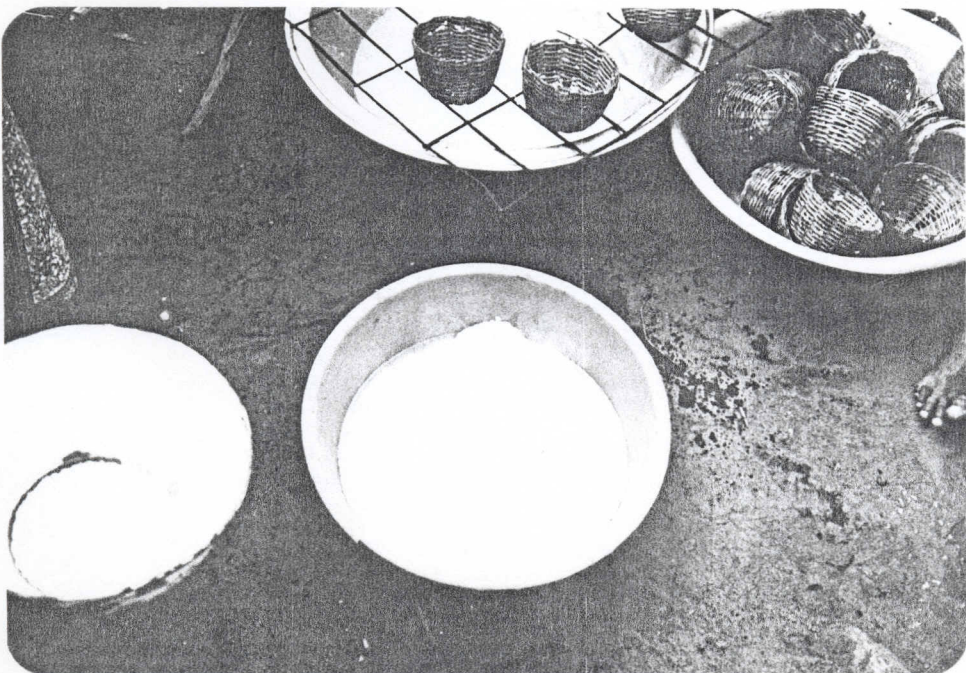
Woagashie Baskets



Pouring hot curds into baskets



Draining of curds



Woagashie in bowl