



## **Cheese Processing, Marketing, Utilisation and Consumption in Burkina Faso**

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### **Authors' contributions**

*This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.*

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### **ABSTRACT**

Cheese is made in Burkina Faso since the colonial period. However, data on this product are virtually non-existent. A survey was carried out in four regions to identify and describe the different processing techniques, markets, and uses.

The results show that three different processing techniques are mostly used to produce the following cheese types: *wagashi*, *goat cheese* and *tome*, respectively in the Sahel, Center, Central Plateau and Buckle of Mouhoun regions. During the different processes, powder of *Calotropis procera* leaves, rennet and table salt are used for curdling. The investigations among producers, it has been shown that from an average quantity 35.9 liters per production of processed milk, we get

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5.2 kg of cheese. The product is preserved by sun-drying, cold storage, smoke-curing, roasting, or boiling in water containing panicles of sorghum. Good hygiene practices are a real concern; on over 65 producers surveyed, only one had few knowledge about food standards. Cheese is consumed directly fresh or as ingredients in cuisines. The price of cheese varies depending on the type of cheese. It is mostly eaten by all ages, 72% of adult and 68% of children. 78% of cheese consumers use it generally in households in the Mouhoun region, 98% in the Center region and 100% in the Sahel region.

*Keywords: Cheese; processing; marketing; consumption; Burkina Faso.*

## 1. INTRODUCTION

Cheese is a milk derived product that has a higher level of biochemical and nutritional value than raw milk. It is an excellent source of proteins, particularly essential amino acids and sulphur amino acids, fat, minerals (calcium) and vitamins. Cheese is produced in several countries in the world. There is more than 2,000 types of cheese around the world [1]. In Burkina Faso, the production of cheese in local level is negligible, the main part of cheese found in markets are imported. There is few studies focus on cheese in Burkina Faso. The more popular cheeses on the market are the "tomme" such as "mozzarella", "caciotta" and "ricotta" from Italy [2], goat cheese and traditional Fulani cheese called "wagashi"[3]. In 2007, the proportion of cheese consumers in Burkina Faso was less than 1% of the population [4]. In 2014 about 14.91% of households declared they consumed it in families [5]. The consumption of cheese increased and the imported volume also. From 311 million FCFA in 2009 it grew up to 395 million FCFA in 2012 [6]. This represents respectively about 140 tons and 216 tons. Various actors are involved in the value chain. There are craft processing units, traders in markets, restaurant owners and supermarkets. There is an increasing interest in cheese, a milk product. The consumption of milk products causes health problem because of the hygiene lack. This study, therefore, aims to evaluate the local production level, process and market and the constraints in the value chain to improve cheese production.

## 2. MATERIALS AND METHODS

### 2.1 Site Location and Description

The study was carried out in the main producing areas of local cheese in Burkina Faso. The concerned regions are: Centre, Plateau Central, Boucle du Mouhoun, and Sahel (Fig. 1).

### 2.2 The Survey Design

The investigation focused on cheese processing units, shops, restaurants, and consumers. The units using a local process or local milk for their cheese production was selected. Concerning shops and restaurants, those that use cheese as a raw material or sale it as final product was chosen. The consumption level of cheese in food habits is the consumers' criteria of select of choice.

The study included 65 cheese-processing units, 20 shops and restaurants and 267 consumers in the concerned areas.

Separate questionnaires were used for each category:

- The questionnaire for cheese processing units included aspects of cheese processes and management, good hygiene practices and good processing practices, knowledge and implementation of standards, cheese processing challenges and opportunities.
- The questionnaire for markets and restaurants included aspect as identification of the seller, price, conservation, alteration factors, utilisation and their appreciation of cheese;
- The questionnaire for consumers included their utilisation and appreciation of cheese, the origin of the cheeses consumed, the knowledge of local cheese, frequency and mode of consumption.

### 2.3 Data Analysis

Data collection, average and variance determination and graphics have been performed by using CsPro 4.0.

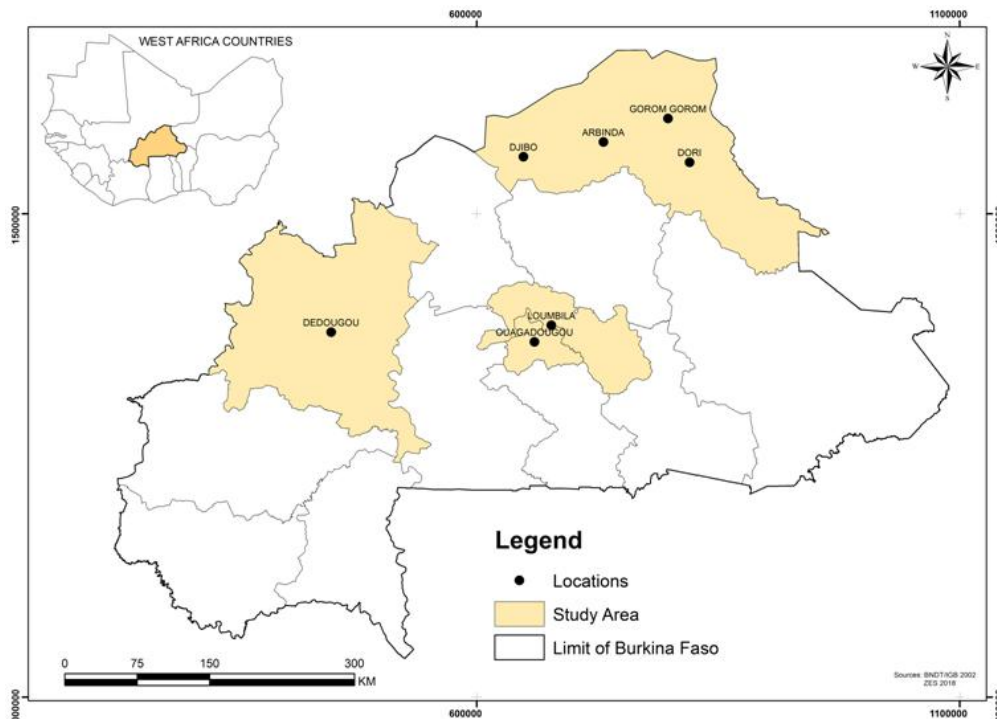


Fig. 1. Map of Burkina Faso with marked study areas

### 3. RESULTS

#### 3.1 Origins of Cheese Products and Characteristics of the Producers

Wagashi is recently introduced in Burkina Faso. About a decade ago. The study revealed four major varieties of cheese. The traditional Fulani cheese called "wagashi" mainly produce in Dori, Gorom-Gorom, Djibo and Arbinda (Sahel region). "Goat cheese" produced in Loubila (Plateau Central) and Kienfangué; "tomme" produced in Dédougou (Boucle du Mouhoun), Kienfangué and Ouagadougou (Centre), and "mozzarella" produced in Ouagadougou. About 89.2% of cheese producers are women and their age is ranged between 26 and 46 year. Among cheese producers, the rate of illiterate is 41%.

#### 3.2 Identified Processing Techniques

Indigenous cow cheese process (Fig. 2), European traditional cow cheese process (Fig. 4), and goat cheese process (Fig. 3) have been identified as the three main processing techniques. "Wagashi" is the Fulani traditional cheese which process in base on the indigenous cow cheese one (Fig. 2).

Wagashi is prepare using fresh milk. The collected fresh cow milk is first measured and then filtered to remove the impurities before heated in a pot. The temperature, the acidity level as well as the dilution one did not interest local cheese producer. *Calotropis procera's* leaves commonly called Sodom's apple, are washed, dried and crushed to be used for curdling. About 2 or 3 young leaves are use for a litre of milk. The powder is then mixed in a small quantity of filtered milk to prepare the coagulum. The coagulum is then filtered and added to the heated milk. The mixture is homogenised and carefully heated until coagulation. When the whey becomes transparent and yellow, and the curds rise from the bottom then, the cooking is stopped. The whey is then drained with sieve or basket. During this drainage step, the *wagashi* in the colander is carefully shaped. To produce a kilogram of cheese, 5 litres of milk is required.

Different ways are used to preserve the product: cooked in water containing salt and/or potassium, sun-dried, fried in oil, roasted, or cold stored. Sorghum panicles as use to get red colour of the final product.

Goat milk is use as raw material in cheese production only in Loubila and Kienfangué. The

process use is as describe in following figure. Goat milk is pasteurised salted and curdled during one day incubation.

European traditional cow cheese is also and only produced in Ouagadougou, Kienfangué, and Dédougou. The cow milk is pasteurised, rennet-curdled, pickled in brine and refined (Fig. 4).

### 3.3 Local Production Yield

The average of cheese production is about 130 kg per year per producer Burkina Faso. A quantity of 35.9 liters of milk is use to produce

5.2 kilograms of cheese. The monthly use of cow's milk in cheese manufacturing represent 97% of producer. Some use goat milk or camel milk. Concerning raw material preparation, 84% of producers do not keep their milk cool before making the cheese. Most of the time, the production is done weekly (24%), and monthly (22%). A few numbers of them produce it daily (3%). The main difficulties of cheese production are milk quantity (72%), equipment (57%), and preservation issues (46%). Some are even facing the problems of losing all their product because of lake of good practice use (15%).

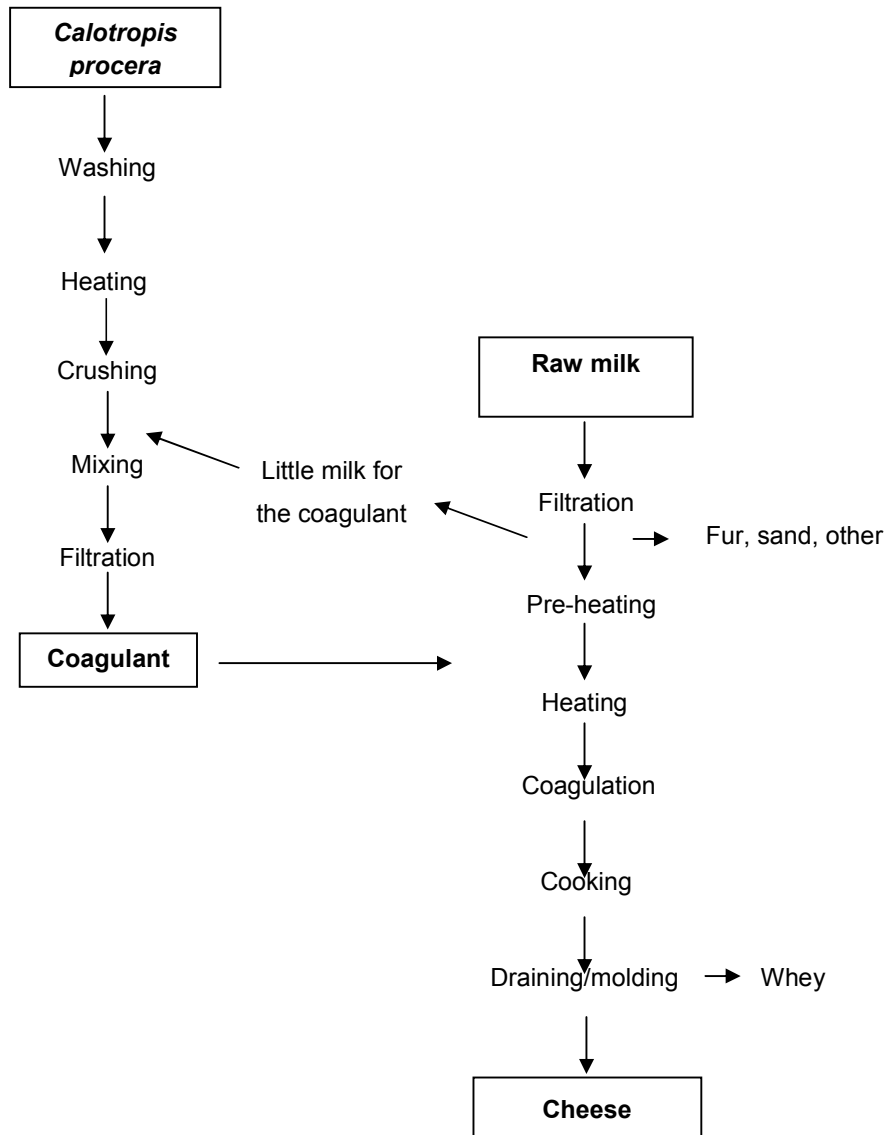
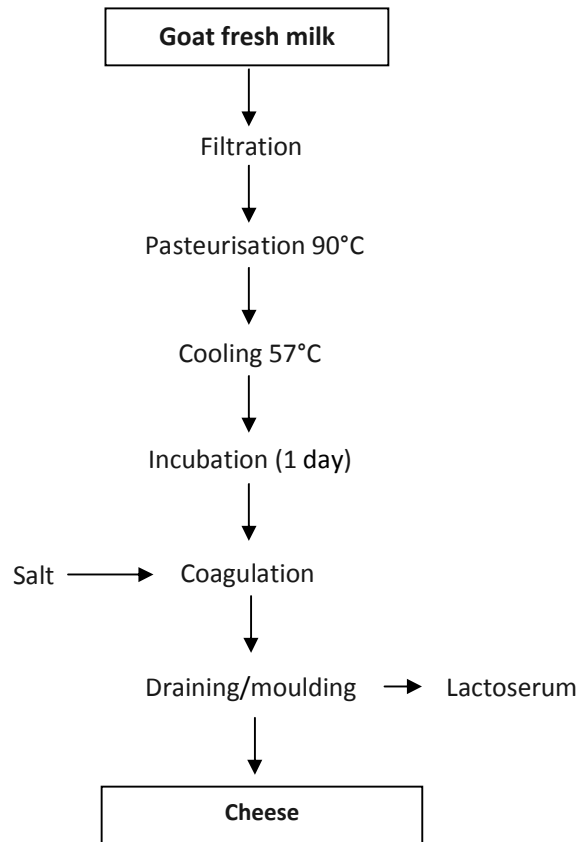


Fig. 2. Indigenous cow cheese or *Wagashi* cheese process flow in Sahel region of Burkina Faso



**Fig. 3. Goat cheese process flow as made in Loumbila and Kienfangué**

After production, some producers preserve their cheeses in the refrigerators. *Wagashi*'s is preserved at ambient temperature after different treatments. Its shelf life varies from a day to six months. Most sellers and restaurant keep their products in a refrigerator but about 20% observe alterations like drying, mould growth, change of taste, colour or smell.

All respondents' producers have been trained on cheese making and/or good manufacturing practices by governmental and non-governmental organisations. The international standards like Codex Alimentarius, ISO 9000 and ISO 22000 are known and used by only one producer.

### 3.4 Marketing

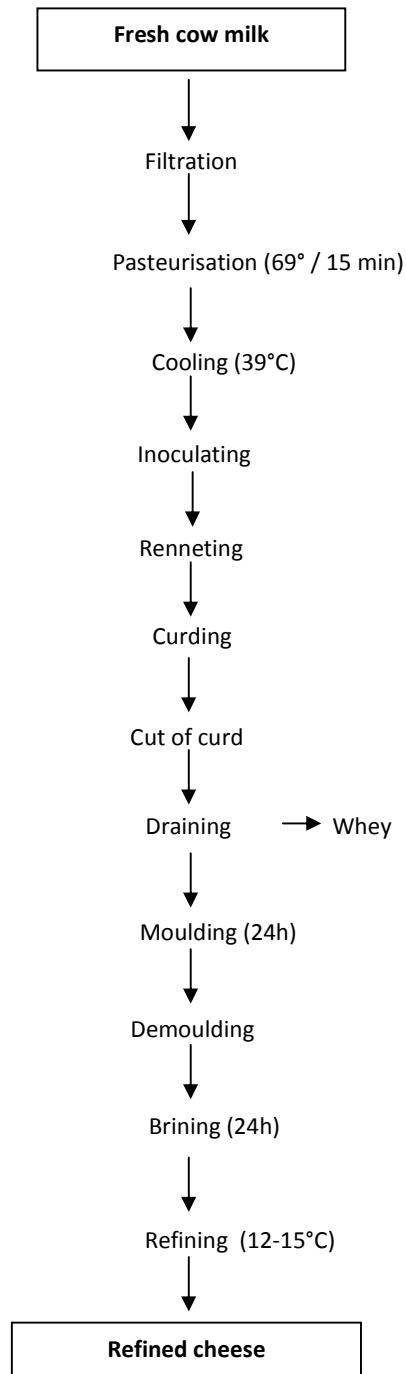
The price of cheese varies depending on the type. For 73% of producers, cheese production is profitable. The most important criteria of choice for the respondents consumer are the nutritional value (86%), then the aroma (62%), the

availability (51%), and its preservative properties (38%) (Fig. 5).

In the Centre and Boucle du Mouhoun regions the consumers buy cheese mainly in supermarkets (89 and 99%). In the Sahel region, the main point is a local market. Some consumers also buy cheese in the restaurants (certainly in dishes) and in the shops. 69% of sellers find that ignorance on local cheese disponibility influences the sale. On the market, 43% face conservation problems and 13% note a poor appreciation of the quality of local cheese by consumers.

### 3.5 Cheese Uses

According to the producers, all their cheeses are ready to eat product. 34% of them claim that their cheese may be used as ingredients in the manufacturing of other foods. These foods are mainly pizzas, gratins, crepes, chocolate spread, hamburger, salads, sandwiches, spaghetti, pies, hot and cold starters, pastries.



**Fig. 4. European traditional cow cheese process flow diagram as used in Burkina Faso**

All restaurants and super-markets use imported cheese mainly Emmental, Cheddar, Mozzarella, Roquefort, Gruyere, Parmesan, Gouda, Camembert. However, 45% of them sell cheese produced in Burkina Faso or incorporate it in their cooking recipes. Burkinabe mainly cheese

suppliers are the Loumbila, Kienfangué and Ouagadougou' units.

More than half of the managers estimate that cheese manufactured in Burkina is good for health (64%). The majority of cheeses' users

does not find it attractive, nor available. However 79% of them have confidence in its sanitary quality, 65% think that it can meet their expectations and nearly 95% are able to use it. The major reasons of the preference for the imported cheese are the high quality and the certified standard.

About 69% of the users do not have any appreciation of the local cheese because they don't know the product. Among those that know it and consume it, 24% appreciate its nutritional quality, 22% appreciate its hygienic quality and 11% appreciate the taste. But 19% find that it does not have a good taste, while 30% find that it is not attractive, and 27% estimate that it is not available.

### 3.6 Consumption

The investigation revealed that the local cheese consumers use Kienfangué goat cheese (Loumbila or Koubri's production stopped in time), the Moundasso cow cheese of Dédougou and the Fulani traditional cheese. 70% of cheese consumers do not know that there is some cheese made in Burkina Faso. They consume imported cheeses such as Brie goat cheese, Camembert, Cheddar, Emmental, Gruyere Gouda, mozzarella, Parmesan, etc. The Boucle du Mouhoun and Centre are the regions where the imported cheese is the most consumed with respectively 94 and 95.5%. In the Sahel region, the consumption of the Fulani traditional cheese is dominant (92%).



Fig. 5. Purchase criteria

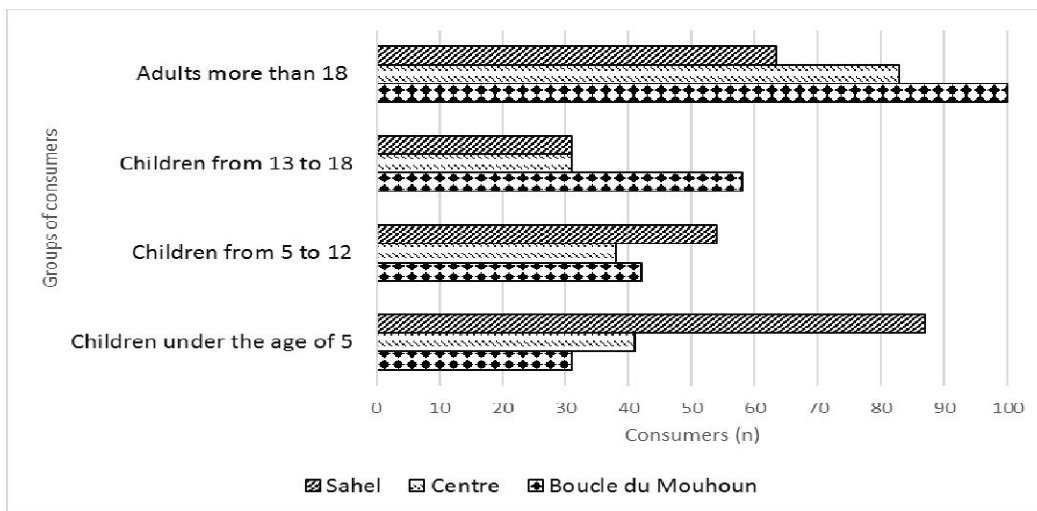


Fig. 6. Place of supply of cheese

The cheese is mostly consumed in families: 78% on the cheese' consumers in the Mouhoun consume mostly cheese in families, in the Centre region (98%) and in the Sahel region (100%). Cheese is consumed directly or as an ingredient in cooking other foods. Cheese is consumed more in a daily or weekly basis with respectively 34% of the respondents in the two cases.

Those who consume cheese the most are adults (72%), followed by children of less than 5 years (68%) and those between 6 and 12 years (48%).

In Sahel region, children are the ones who consume the most while in the Centre region adults are the main consumers.

Almost all the respondents are ready to use cheese produced locally if only it is improved (95%) in terms of hygiene, aroma, availability, quality and presentation (milling), packing, variety of use, disposition in cut, respect of the norms of production, suitability to the returns, and evolution from the artisanal production to a modern one.

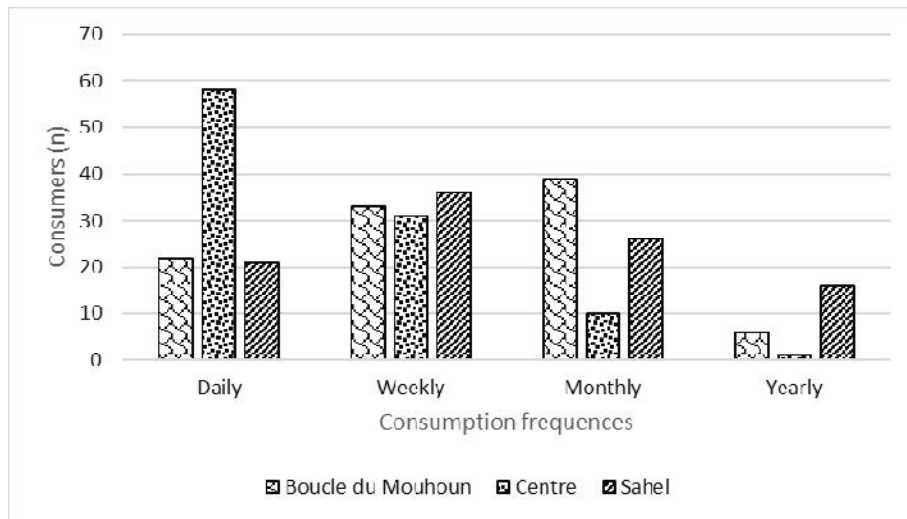


Fig. 7. Frequency of cheese consumption

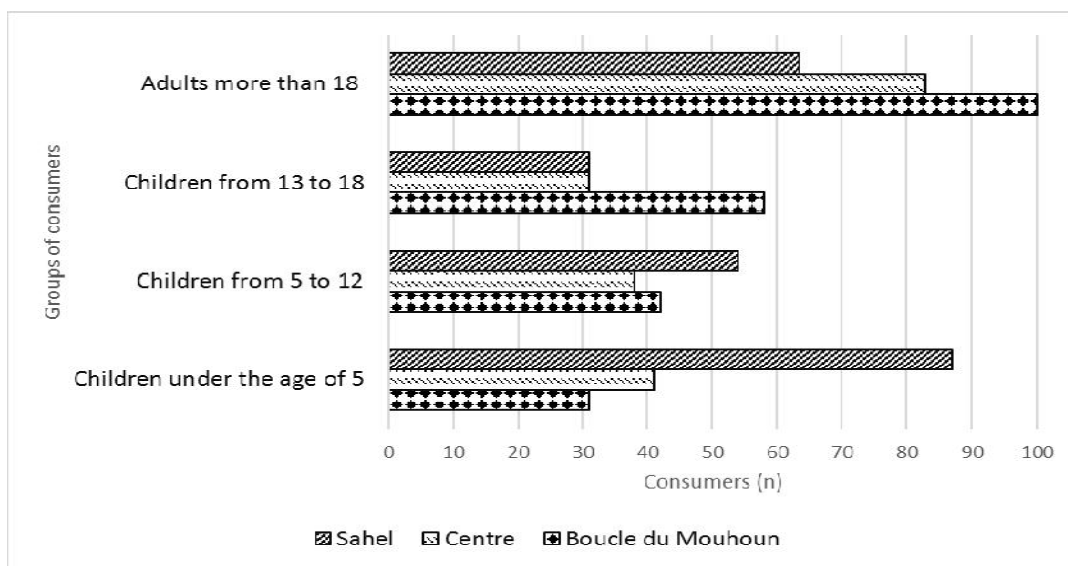
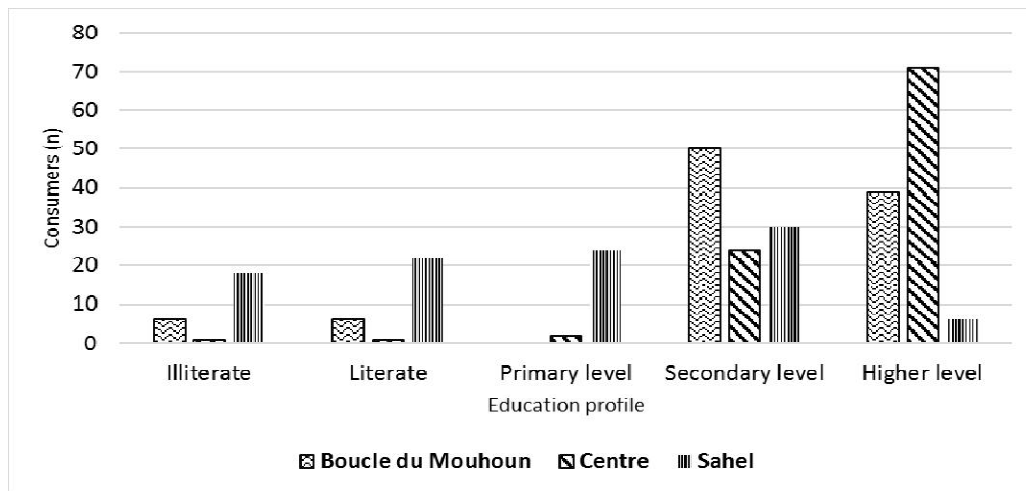


Fig. 8. Cheese consumers in households





**Fig. 9. Distribution of education/study level by region**

In the Mouhoun and Central areas, virtually all consumers are supplied in supermarkets (89 and 99%). In Sahel region markets are the main. Some consumers also stock up in restaurants (certainly in dishes) and in the shops. Those who consume cheese the most are adults (72%), followed by children under 5 years (68%), and those between 6 and 12 years (48%) and adolescents between 13 and 18 (33%). The most important purchasing criteria for respondents was the nutritional value (86%), followed by taste (62%), availability (51%) and retention (38%).

The majority of consumers conserve their cheese in a refrigerator (89%) and face alteration problems such as decay, drying of the crust, mould growth, etc. Before its consumption, "wagashi" is washed and boiled with water then it is cut into pieces and fried in oil. These pieces of fried cheese replace meat or fish in sauces.

Respectively 81% and 40% of Boucle du Mouhoun and Centre region respondents are civil servants. In the Sahel region most of the respondents are traders and housewives.

#### 4. DISCUSSION

*Wagashi*, fulani traditional soft cheese, was introduced in the Sahel in 2008 by the NGO "Eau Vive" to help transform milk for better conservation and to fight against food insecurity and children malnutrition in this region [3]. Milk fragility exposes it to rapid deterioration in the peasant environment, due to the low level of technology of preservation. This leads Fulani people to throw milk after milking in a period of

high production. However, in 2007, the 4 provinces of the Sahel region were at risk, characterised by cyclical food insecurity [7] and cheese appeared to be a solution. Indeed *wagashi* is an important dairy product to enhance the quality of the diet of populations [8] because it is a dairy product frequently made from cow's milk [9,10,11] and contains 33.84% protein, 31.45% fat, 61.70% moisture, 8.10% sugar, 4.14% Zn, 2.35% Mn, 4.7% Fe, and 7.3% Cu [12]. *Wagashi* is produced in border countries of Burkina Faso like Benin and Togo some time ago. However, communities did not import this food themselves despite the fact that milk is available in those communities. The social and cultural background of these communities is the main factor that justifies the appropriation of *wagashi* production by only women. The product derived from a traditional processing technology specific to the Fulani ethnic group [13], and is part of the traditional know-how of Fulani women [14]. Another reason may be the philosophy beyond *wagashi* introduction. The focus was women. The objective was for them to use their own production to increase the nutritional value of their children and their life conditions. The production process was then locally adapted to be easily use.

The processes use in cheese production in Burkina Faso is similar to the Nigerian [15], Beninese [16,17,14], and Ivorian's one [18]. The only difference is the use of *Calotropis procera* (Sodom apple) leaves extract as coagulant. However, according to Ogunshe et al. [11] and Aïssou et al. [14] leaves are use but always associate to the stems in Benin and Nigeria. The

colour of the final product also vary from one country or community to another. Soulé et al. [19] and Sessou et al. [20] show that the cheese manufactured in Benin, from which the technology in Burkina Faso is derived, is also coloured. However, according to Ayeni et al. [21] and Adetunji [15], traditional cheese manufactured in Nigeria is not coloured. It is conserved at ambient temperature after different treatments [22]. In Benin and Nigeria, white cheese is preserved in whey if it is not sold.

About European cheese, it throughout the world resulted from the colonization of Africa by European settlers who carried their cheesemaking skills with them [23]. European cheeses began to be made in Burkina Faso after the colonial period. Today it is the religious nuns of Dédougou and Koubri and the private societies in Ouagadougou, Loumbila and Kienfangué that produce this cheese. Their cheeses are shaped and packaged in a film, labeled and kept in refrigerators for ripening.

The use of cow's milk in the cheese dairy in Burkina Faso is due to its availability. The average production per cow per year is 110 liters for adult cows versus 60 liters for adult goats [24]. However, wagashi production level is very low compared to border countries. The proportion of cow's milk used in the cheese dairy in Burkina Faso is mainly due to its availability compared to the other type of milk. Goat milk [25] and camel are also used for cheese production. The supply of local cheese is low. The availability of milk, food habits, hygiene and marketing are factors that contribute to this low level of cheese production. The national production of milk is less than demand. There is a high demand in fresh milk in both market and supermarket. For Fulani women, it is easier to sell fresh milk that do not require a transformation process. Yoghurt made from local milk is also highly appreciated. And its production is not enough to compare to the demand. Yoghurt producer then collects available milk anywhere they can find it. This reduces considerably the availability of milk for wagashi production. In addition, it is not profitable for women to use powder milk as raw material like yoghurt producers. Cheese then wagashi is not part of Burkinabe food habits traditionally. Most of the cheese consumer in Ouagadougou are from high social class. The traditional way of local cheese production (without real treatment of the raw material and better conservation) is a hindrance for its adoption by this social class. Up to 15% of the production

is sometimes lost because of this problematic. It takes time for new food to be involved in food habit in a community. Eatable caterpillars, for example, is highly appreciated in the west some decades ago but are integrated in food habit in the other part of the country. For the local production level of wagashi to increase, time as well as awareness and better marketing strategies are important.

The difference of choice between customers is due to people food habit, their financial resources and education. Also, in the Sahel region, *wagashi* consumption is dominant due to the presence of Fulani in this area and their food habits. This could be reinforced by the fact that their purchasing power is higher for 81% of Boule of Mouhoun and 40% of Centre regions' respondents are civil servants. The ignorance of the product in many areas as well as the attractiveness and unavailability requires better marketing. Attié and gappal are also new in many communities' food habit. However, there are now more produced than consumed than wagashi or cheese in general. Wagashi benefit from training and support as these two processing sectors. These products impose themselves in the market throughout several marketing strategies. For example, it shell in a varieties of package according to the targeted consumer. Appropriate canal must be used for the promotion of this food and it largely used in communities.

Cheese produced in Burkina Faso is not well known because of the product is not available, and the consumer subjectively consider that the local cheese is of poor quality compared to the imported product. Burkinabe food habit in is poor in protein. For many people, the source of protein is mainly legume and little species of fish. The use of local cheese directly of in other food in them welcome. It will help people to balance their daily diet and prevent malnutrition among children. However, for it to happen, public demonstration of food preparation using cheese, sensibilisation. But the quality of this local food needs to be improved for the 95% (of those who require quality first) to interest themselves to it.

## 5. CONCLUSION

In Burkina Faso, cheese is usually made from cow's milk. The product raises interest in Burkina Faso. The processing is mainly manual, and the processors are mostly illiterate women.

Marketing is most often done by sellers in markets, shops and restaurants.

The use of cheese as ingredients in the manufacturing of other foods is a way to improve and develop the product locally. The improvement should be in terms quality and presentation, packing, the variety of use, disposition in cut, respect of the norms of production, suitability to the returns, and evolution from the artisanal production to a modern one. The processing needs to be improved by adapting the product to the recipes frequently preferred by consumers. Processing and marketing conditions must take into account good hygiene practices (GHP) and manufacturing practices (GMP) to improve the hygienic quality of local cheese. In this, the implementation of food standards is necessary.

### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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