

# Production and Consumption of Dried Meat in the City of ABEICHE (CHAD)

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**Abstract:** To understand the place of livestock products and byproducts in the supply of cities, a study was conducted in the city of Abeche using the method of sector analysis: production and consumption of meat dried. Surveys concerned 89 producers and 104 consumers. The information collected concerns the profile of the producers, the different manufacturing processes and the consumption patterns. This collected information was analyzed with XL-STAT 6.1.9 and also with the variance analysis (ANOVA) at the 5% threshold. The result shows that most of the production is done by women with an average age of  $31 \pm 1, 08$ . These producers are mostly traders. However, beef is much more sought after for processing at the expense of other meats for its yield and availability. The average drying time is 2 days during the dry season and 5 days during the rainy season. Two drying methods have been identified, the first of which is the mat and it is the most used and the second is the rope. From the point of view of hygiene, most producers do not respect hygiene rules and they use certain food additives (salt, oil, etc.) for processing. Regarding consumption, the "charmoute" is very popular with the population of Abechosies especially women with an average age of  $35 \pm 1.57$ . Most of these consumers are of the Muslim religion. It shows that 85.44% consume this meat with a frequency of consumption per week (70%). By cons, 5.83% consume for its poor preparation.

**Keywords:** Dried Meat, Production, Consumption

## 1. Introduction

An essentially agro-pastoral country practicing a diversified livestock farming, Chad bases its economy largely on the valuation of livestock products. The livestock sector, which accounts for 53% of the rural sector's GDP and supports around 40% of the rural population [32], contains 93.8 million livestock units and 34.6 million head of poultry. The total livestock is 73% of the total workforce, including 26.5% cattle, 28.2% sheep, 32.5% goats and 6.8% camels

[31]. Livestock products have a preponderant effect on the lives of the population. Thus, the value of the production of meat and milk is estimated at FCfa 155 billion in 2002. With significant development potential, animal husbandry represents around 50% of exports [32]. Movement of live cattle and animal products such as dried meat within the territory. In 2002, a total of 161,714 kg of dried meat (charmoute), controlled were the subject of commercial transactions (Abba, 2010). Despite its importance in the national economy and in food security, the Chadian breeding

remained still traditional through its production, processing and consumption systems. In all phases of the food chain, i.e. from production to processing, from marketing to consumption, households (consumers) express their demand in terms of perceived and sought-after quality [2].

For the population of Abeche, meat is a basic food followed by fish. Its consumption is daily in all households without exception of age. The city of Abeche produces an abundance of meat, but its population eats only poor quality ([5, 13]). For fish, the city is supplied by other provinces. In view of the large quantity of meat produced in this province, what would be the form of preservation for later consumption or even its export to other cities or countries?

Conservation allows sale out of season, at higher prices than during the harvest season [7]. The meat is processed in an ancient way in Abeche and represents the only traditional form of preservation. It comes in the form of “charmoute” dried meat, and is an essentially feminine activity. Another form of meat preservation is Kilichi [36] which is of Nigerian origin. This transformation is in the hands of men. The process of processing dried meat exists in the form of small workshops, women's groups and in households especially where we prepare smoked meat intended mainly for the Abechois market but also to other cities and countries. But what is the organoleptic and hygienic quality of this dried meat? Dried meats provide populations with precious proteins and provide them with appreciable income. For the eastern province, its average production is 17,890 kg for the destination of N'Djamena, especially in 2005 [32]. However, germs from excrement have been highlighted on dried meats sold in the city according to laboratory analyzes [36]. Preservation should be considered as a means of storing excess food available at certain periods to consume it during periods when food is scarce. However, the consumption of fresh food is always preferable because conservation reduces the nutritional

value of the products. In other words, preserved foods are less good for health than fresh foods [7]. The general objective of this work is to present the production and consumption of dried meats in the city of Abeche. Specifically: Identify methods of processing dried meats.

Assess the risks of contamination of production through processing to consumption

Determine the social criteria linked to production and consumption.

## 2. Material and Methods

### 2.1. Material

The material used consists of biological or animal and technical material.

#### 2.1.1. Description of the Study Area

The study took place in the urban area of the city of Abeche, over a period of 1 month. The city of Abeche is the capital of the province of Ouaddaï and is located between 13°48'584 '' north latitude and 20°50'139 '' east longitude. The study area is influenced by the intertropical climate with a dry season of 9 months and a rainy season of 3 months. The regime of these two seasons is defined by the fluctuations between the dry air masses of the North (the harmattan) and the humid air masses of the South-west (the monsoon). The average annual rainfall is around 300mm. The temperature of the province is variable according to the periods. The average annual temperature in Abeche is around 28°C with a variation in the cold season (December to February), between 16 and 35°C and in the dry season (April and May) between 25 and 41°C [5]. The city has six districts, about forty-six different districts.

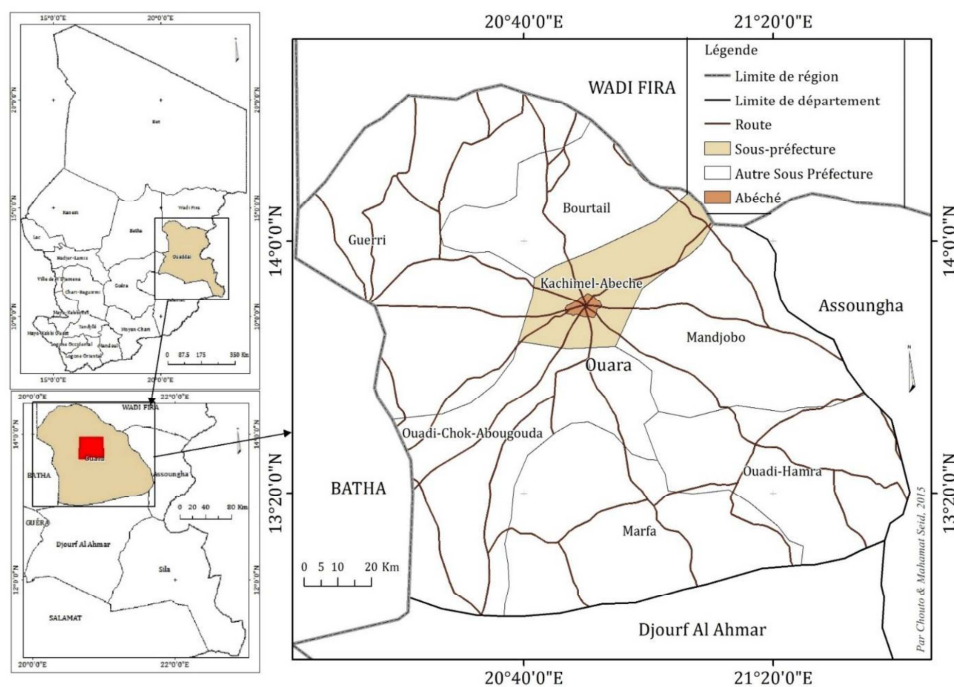


Figure 1. Location map of the study area (Source: Mahamat, 2015).

### 2.1.2. Biological Material

It consists of dried meats and dried fish.

#### 1) Dried meats

It is a very nutritious culinary product, prepared from thin slices (strips) of fresh meat in the sun's rays. Dried meat is also a traditional preparation from many regions of the world. It makes it possible to preserve the meat longer and to reduce in an extremely important way its weight and volume. These benefits have therefore made it a food of choice for travelers, explorers and nomadic peoples.

#### 2) Dried fish

They are obtained by drying in the sun's rays or by smoking. They come from other cities or are processed locally by women who sell fresh fish in the event of poor sales.

### 2.1.3. Technical Material

To achieve our objective, we also used technical materials, namely a survey sheet, the writing cases and the camera for taking the images.

## 2.2. Methods

The survey sheets made it possible to carry out the surveys or the field work (Annex). These surveys were conducted with producers and consumers of dried meat in order to collect information relating to the different stages of the preparation process, the consumption patterns of "charmout" and to determine the hygienic practices of the "charmout" preparation. These surveys were carried out after the preliminary surveys to locate the most concentrated areas of processing.

### 2.2.1. Type of Study

To achieve our objective, we used a cross-sectional type study to elucidate the processing and consumption practices of dried meat in the city of Abeche. Our study targets men and women producers of dried meat and also consumers of it.

### 2.2.2. Conduct of Investigations

Our study was carried out in three main stages: bibliographic research, field work (surveys) and data analysis from April 23 to May 23.

The surveys were conducted in the various boroughs and districts of the city, using a questionnaire as the main tool

(Appendices 1 and 2). This choice was dictated by the fact that "charmout" is consumed too much in this city. Producers were spotted crossing different neighborhoods targeting the city of Abéché while consumers were randomly taken from boroughs and neighborhoods (Appendix). The information obtained concerns:

1. for producers or processors:
2. raw materials and food additives;
3. types of meat for processing;
4. the origin of the meat;
5. duration and method of drying;
6. character of the production;
7. hygienic characters based on the ISHIKAWA rule
8. marketing criteria;
9. for consumers:
10. Preference for "charmoute";
11. the frequency of consumption of "charmoute";
12. preferred type of dried meat;
13. reasons for refusal or consumption;
14. cooking time.

### 2.2.3. Sampling

It was done in a random mode (poll, by cluster). Thus, we had to design 89 cards for producers and 104 cards for consumers.

### 2.2.4. Data Processing and Analysis

The data were entered with Microsoft office software and processed with XLSTAT and Analysis of variance (ANOVA) software. Descriptive parameters such as frequencies, sums, means, standard deviations but maximum and minimum values were used for the presentation of the results. The Newman-Keul test (SNK) was also used to determine the level of significance between the variables at the 5% level.

## 3. Results

### 3.1. Profile of Transformers

Meat processing is not only practiced by women but also by men. These people come from two religions with various professions (Table 1).

Table 1. Characteristics of producers.

Characters	Variables	Effective	%
King	Feminine	73	82,02
	Male	16	17,98
Religion	Christian	18	20,22
	Muslim	71	79,78
	Student	14	15,73
Profession	Student	1	1,12
	Household	28	31,46
	Trader	16	17,77
	Shopkeeper	30	33,71
	Age (years)		
	Minimum	Maximum	Standard deviation
	17,000	31,809	60,000
			±1,085

### 3.2. Distribution of Transformation Zones According to Neighborhoods

Meat processing varies depending on the neighborhood and is more practiced by certain districts (Figure 2).

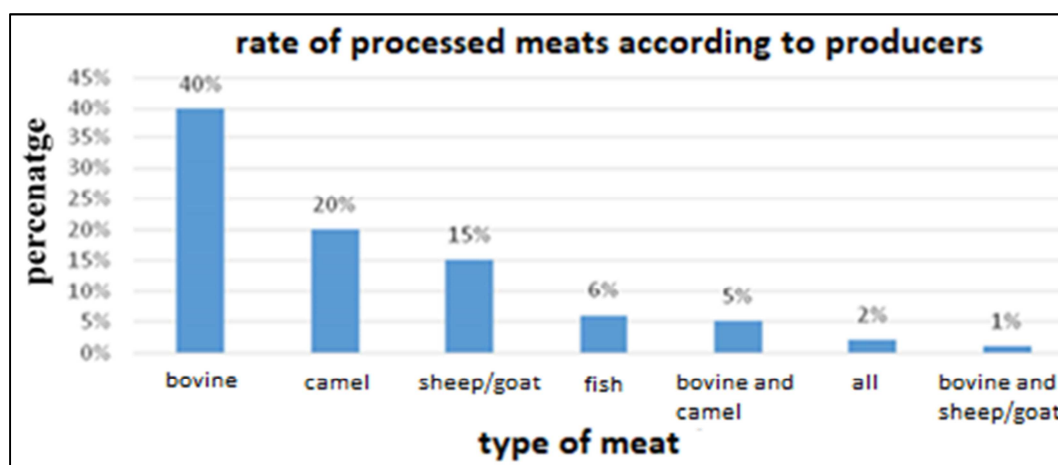


Figure 2. Distribution of transformation zones according to neighborhoods.

### 3.3. Types of Meat, Provenance and Character of Production

The majority of producers of dried meat specifically prefer beef for processing followed by camel meat. But there are also those who prefer all meats or two types of meat (Figure 3).

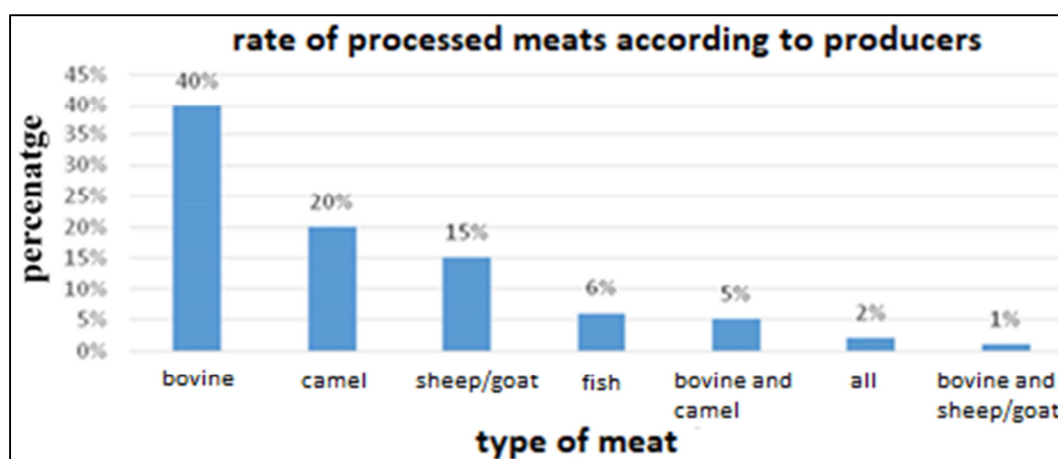


Figure 3. Proportion of production by type of meat.

The production of dried meat has two objectives: either for marketing or for family consumption. Most of the meat comes from the slaughterhouse followed by personal slaughter.

In the case of fish meats, they come from other cities. The reasons for choosing such types of meat are four: good yield, storage and quality, quantity and less risk of disease (Table 2).

Table 2. Character of production, provenance of meat and choice of meat.

Character	Variable	Effective	%
Character of production	Commercial	49	55,06
	family consumption	40	44,94
	Slaughterhouse	60	67,42
	Slaughterhouse and staff	5	5,62
Origin of meat	Market	3	3,37
	N'Djamena	2	2,25
	Oum-hadjjar	1	1,12
	Personal	18	20,22
Reason for choice of meat	Good yield	47	52,81
	Less risk of disease	1	1,12
	Storage and quality	33	37,08
	Storage et quantity	8	8,99

### 3.4. Average Drying Time During the Dry Season Depending on the Type of Meat, the Drying Method and the Additives Used

The average drying time varies depending on the season, type of meat and the drying method. The food additives used can also influence this duration (Tables 3 and 4). The values Sharing the same are not significantly different ( $p \leq 0.05$ ) for the two tables below.

**Table 3.** Drying variation during the dry season.

Character	Modalities	Drying time during the dry season $\pm$ standard deviation (d)
Type of meat	All	$\pm 2,000^a$
	Sheep/goat	$\pm 2,154^a$
	Cattle	$\pm 3,900^a$
	Fish	$\pm 3,000^a$
	Camel	$\pm 5,500^b$
Drying method	Mat and rope	$\pm 2,538^a$
	Rope	$\pm 2,756^a$
	Mat	$\pm 3,000^a$
	Nothing	$\pm 2,342^a$
Additives used	Salt	$\pm 2,833^a$
	Oil and salt	$\pm 3,280^a$
	Oil	$\pm 6,667^b$

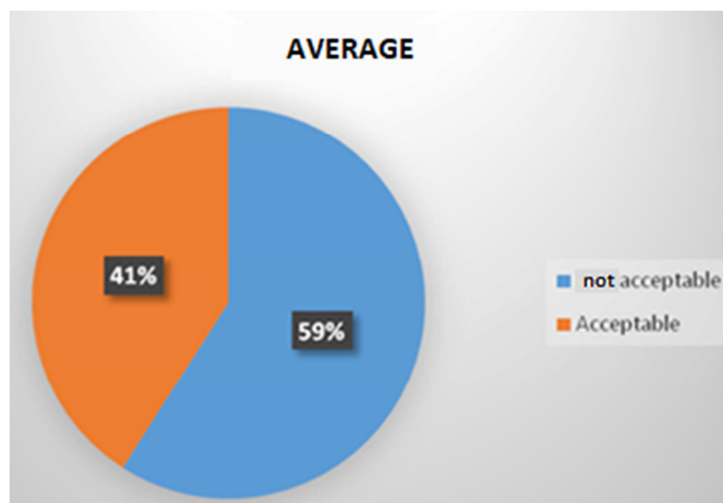
### 3.5. Average Drying Time During the Rainy Season Depending on the Type of Meat, the Drying Method and the Additives Used

**Table 4.** Drying variation during the rainy season.

Character	Modalities	Drying time during the dry season $\pm$ standard deviation (d)
Type of meat	All	$\pm 4,00^a$
	Sheep/goat	$\pm 4,45^a$
	Cattle	$\pm 5,59^a$
	Camel	$\pm 9,65^b$
	Fish	$\pm 7,60^c$
Drying method	Mat and rope	$\pm 5,08^a$
	Rope	$\pm 5,31^a$
	Mat	$\pm 5,79^a$
	Nothing	$\pm 5,03^a$
Additives used	Salt	$\pm 5,65^a$
	Oil and salt	$\pm 5,89^a$
	Oil	$\pm 11,17^b$

### 3.6. Assessment of Food Hygiene Practice at the Level of the Population Studied (ISCHIKAWA Rule)

The rule of hygiene is not respected by the majority of these actors.



**Figure 4.** ISCHIKAWA rule.

Indeed, this rule is based on the 5M: Material, Medium, Method, Material, Labor.

Evaluation of the net drying time per season, selling price

Seasonality totally influences the drying of meats by temperature and climate. The sale of dried meats is done by Coro of 2kg or by bag (Table 5).



Figure 5. The two drying methods (mat and rope or wood).

Table 5. Drying time / season and sale price.

	Drying time in dry season	Drying time in the rainy season	Sale price / bag (FCFA)	Sale price / bag / Coro (FCFA)
Minimum	1,00	3,00	20000,00	4500,00
Average	2,80	5,45	282763,16	5834,15
Maximum	5,00	10,00	500000,00	7500,00
Écart-type de la moyenne	±0,11	±0,16	±16984,32	±99,69

Consumer profile

Dried meat is appreciated by the majority of the population and religion is not opposed to its consumption.

Table 6. Consumer characteristics.

Character	Modalities	Effective	%
Kind	Feminine	54	51,92
	Male	50	48,08
Religion	Muslim	53	50,96
	Christian	51	49,04
Preference for dried meat	Yes	88	85,44
	No	15	14,55
Age (ans)	Average	maximum	Standard deviation
	18,00	35,62	80,00 ±1,57

Preferred type of dried meat and frequency of consumption

The most consumed dried meat is that of bovine whereas that of camel is less consumed and the majority of the population consumes this meat per week.

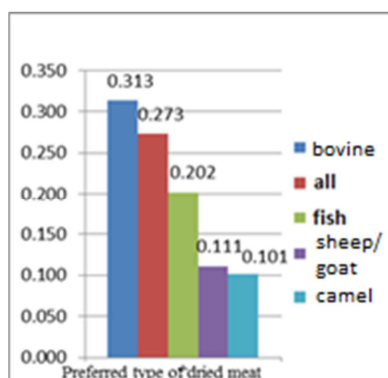


Figure 6. Most consumed dried meat .

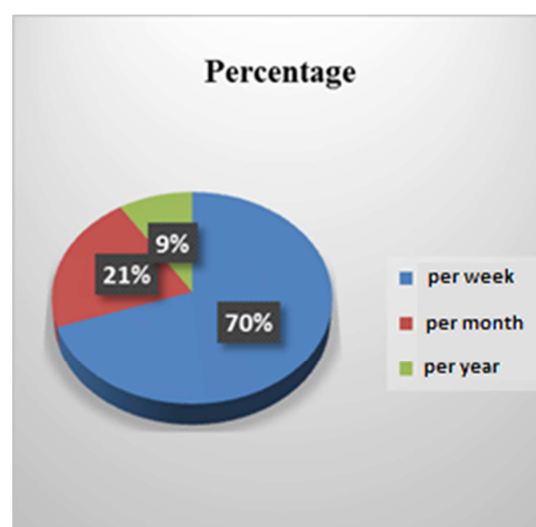


Figure 7. Frequency of consumption.



### Reasons for choice and storage

The reasons which bring the Abechoisis population to consume more the dried meat are the taste, quality and less

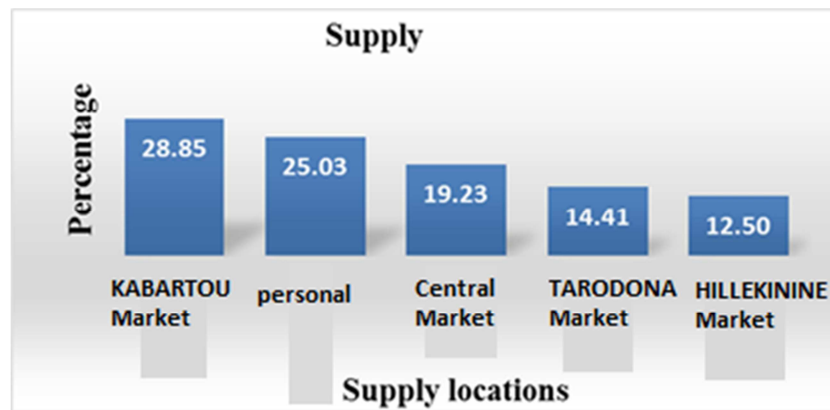
expensive but also the bad preparation causes problem with its consumption.

*Table 7. Reasons for choice and storage.*

Character	Modalitie	Effective	%
Motifs of choice	Good taste	47	45,19
	Good quality	35	33,65
	Poor preparation	6	5,83
	Less expensive	16	15,53
Storage	Yes	67	64,42
	No	37	35,58

### Supply locations, purchase price and price and discussion time

Most of the consumers get their supplies from the Kabartou market, followed by personal transformations.



*Figure 8. Supply locations.*

The purchase of dried meat is made by Coro, bag or in detail by consumers and at different prices. The cooking time is also elucidated.

*Table 8. Purchase price and cooking time.*

	Purchase price/Coro (FCFA)	Purchase price/bag (FCFA)	Other purchase price (FCFA)	Cooking time(min)
Minimum	5000,00	180000,00	250,00	15,00
Maximum	7500,00	360000,00	7000,00	60,00
Average	6035,71	273750,00	2159,02	40,04
Standard deviation	±102,80	±23140,68	±223,95	±1,28



*Figure 9. Exhibition of dried meat on the market (source: Djérambaye Sem, 2019).*

## 4. Discussion

Our study was carried out in the city of Abeche with the aim of making an inventory of the processing and consumption practices of dried meat. The results of the study

show that this activity is practiced mainly by women (82.02%) but also by men (17.98%) and all with an average age of 31 years and standard deviation  $\pm 1$ . These results confirm the results of Tidjani [36]; Attamar, [5]; Doutoum [13]. These men transform meat into kilichi which is the Nigerian method. The results also showed that these men and women also do other activities. They reveal that among these processors there are 33.71% of shopkeepers, 31.46% of women housewives and 16.82% of pupils and students.

As far as the processing zone is concerned, production is concentrated or distributed in different districts of the city. Thus, the district where this activity is more practiced is therefore the Kabartou district (22%) followed by Zongo (14%). On the other hand, it is less practiced in the Goz-amir district (2%).

As the most processed type of meat in the city, beef is in the majority with 40% followed by that of camels with 20%. But the results of the survey also show that there are also

producers of mixed dried meat, i.e. those who process beef and camel meat (5%), beef and ov / cap (1%) and all kinds of meat (2%). The majority of dried meat from meat from small ruminants and fish is for family consumption (44.94%) and large ruminants are commercial in nature (55.06%). Most of this fresh meat comes from the slaughterhouse (67.42%) and from personal slaughter (20.22%) or at home. The origin of Oum-adjer and N'Djamena is specific to fish.

The producers of dried meat have a motivation which pushes them to choose a particular meat to be processed. The meat of large ruminants gives a good yield (52.81%) especially for marketing. These results corroborate with the results of Yacoub [40]. For family consumption, the personal slaughter of small ruminants, the purchase of fish and carcasses on the market for processing are essential for storage and for their quality (37.08%). But also to reduce the risk of contamination (1.12%). There is also the processing of meats whose objective is to sell fresh but after a slump they are dried (8.99%).

The drying time indicates that during the dry season, to dry camel meat it takes 5 days while that of cattle and fish 3 days, sheep / goat 2 days. This same duration is insignificant depending on the method used. It is 3 days on the mat and 2 days on the rope. However, it is significant through the use of additives for processing. The meat takes too long to dry 6 days if the oil is used as additives or ingredients whereas it is 2 days if nothing is used as an additive.

Unlike the dry season, the drying time during the rainy season is 9 days for camel meat, 7 days for fish and 5 days for small ruminants. With regard to the drying method, the duration is substantially the same on the mat (6d) as on the rope (5d). The influence of additives can also be observed during the rainy season. The use of the oil extends the duration (11 days) on the other hand, it is reduced in the case of reduced salt (5 days) or nothing is used as an additive.

From all of the above, this duration is on average 2 days for the dry season and 5 days for the rainy season. These results are similar to those obtained by Djambo, [10] and Ahmat, [3]. It should be noted that Mbofung [29]; Jones [23] have also conducted studies to monitor the product during its manufacture and to identify, more broadly, the critical points and risk factors for the quality of Kilichi. It emerges from these studies that drying is a sensitive and essential step in the success of the product [24]. In the majority of processing places, the hygiene rule is not respected. From production (slaughterhouse) to processing, the ISCHIKAWA rule is neglected with 59% unacceptable, i.e. poor processing and 41% acceptable. This can be explained by the old transformation method, the minimum age is less than 20 years and the level of education is low. Our results are similar to those of Tidjani [37]. The same observation was reported by Tidjani [36] who worked on KILICHI in Chad; as well as those obtained by Attamar [5] who worked on braised fish in Chad. These results are also similar to those obtained by Attamar, [5]

Regarding the marketing of dried meat, part is exported to other cities and countries and the other part is sold locally in the city's markets. At these markets, the sale is by bag, coro

and also in detail. The average selling price per coro is 5,834.15 FCFA and that of the bag is 282,763.16 FCFA. This activity provides income for these men and women. Because, on the request to know their benefit the majority admit having found profit. These results corroborate those obtained by Igene [22] and lower than that of Yacoub [40]

As regards consumption, the majority of the Abechois population is a consumer of this meat. Of the survey population, 85.44% consume Charmoute and 14.55% rarely consume especially dried red meat. The appreciation of this meat is also observed by Musonge [32]. The question of religion does not pose problems for these consumers because, both religious denominations are amateurs. The latter much prefer dried beef from cattle (31.30%) followed by all kinds of meat (27.30%). Dried camel meat is consumed less by its high cost (10.10%).

The frequency of consumption is generally per week (70%) on the other hand those who consume per year (9%), do not like this meat too much because of its poor preparation. These results are lower than those of Yacoub [40] who obtained 24.28% of the population who affirm the manufacturing quality. The supply markets are much more the market of Kabartou, Grand Marché, Taradona, and Hilékinine with 28.85%; 19.23%; 14.41% and 12.50% respectively. There are also producer-consumers (25.03%), that is to say those who prefer to process their own meat. The average purchase price on these markets is CFAF 6,035.71 / Coro, CFAF 273,750.00 / bag with standard deviations of  $\pm 102.80$ ;  $\pm 23140.68$  respectively. Some consumers claim that Charmoute is cheaper. This statement is different from that obtained by Yacoub [40] on the kilichi.

The reasons for consumption are various. 49.19% consume for good taste, 33.65% consume the Abeche Charmoute because it is of good quality and others refuse by its poor preparation (5.83%). The majority does not buy or consume directly. During the dry season the meat becomes a little expensive, so some prefer storage (64.42%) to overcome this moment other buy just for a single meal (35.58%). The duration of this storage can range from 'a week to a year. These meats are sometimes contaminated during their preparation by different means of preparation by microorganisms. Indeed, desiccation prevents the proliferation of these microorganisms which prevents putrefaction therefore its conservation but does not completely destroy them. Therefore, to destroy these microorganisms or prevent them from harming the health of consumers, good cooking is required. Thus, the average preparation time for cooking is 40 min with a standard deviation of  $\pm 1.28$ .

## 5. Conclusion

This study allowed us on the one hand to familiarize ourselves with survey techniques: field trips and collection of samples, computerized data processing and on the other hand to acquire and master the techniques of analysis of food processing processes.



In the longer term objective of improving the traditional Charmoute manufacturing process, the survey conducted in the town of Abéché allowed us: identify different types of Charmoute which is distinguished by their raw material (dromedary beef, sheep or goat) but also by their processing techniques. Thus, while the literature only reports on Charmoute, our investigation reveals the existence of salted / dried Charmoute produced at the family level only. It was thus possible to draw up a complete diagram of the Charmoute manufacturing processes carried out on several levels (craft, family); identify the ingredients used during its preparation and the types of smoker used; obtain information on consumption patterns and frequencies; Identify the quality attributes of Charmoute and consumer preferences.

Thus, this meat is obtained by thong and its production is not only in household but also on a large scale of production (grouping). In fact, drying often represents the only possibility of preserving meats from hot countries. However, Chad has certain advantages for the production of dried meats thanks to a large animal potential and special climatic conditions. Also in order to provide our populations with healthy products at a time when the world is starving, son means should be overlooked. Unfortunately, very few studies have been carried out to improve this process. The methods accepted in Chad, show that the preparation is in the realm of the empirical. However, the meat is generally prepared and eaten under defective hygienic conditions. Thus, the study of the production and consumption of dried meats reveals technical and nutritional particularities of indisputable interest: the materials are reduced and simple in their effectiveness and the meat is of excellent quality but is expensive. It is nonetheless true that the value of this dried meat on the city's markets should make its manufacturing profitable. Another study will identify the microbiological and nutritional characteristics of this meat and also its marketing.

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