

Hygiene Practices of Carney Products in the City of Abeche, Chad

Abdelsalam Adoum Doutoum^{1,*}, Abdelsalam Tidjani², Attahir Attamar¹,
Djamalladine Mahamat Doungous³, Ali Ahamat Hamid², Abdel-Mahamoud Adam Yaya³,
Roumane Moukhtar², Alhadj Nazal Markhous⁴

¹Département des Sciences et Techniques d'Élevage, Institut National Supérieur des Sciences et Techniques d'Abéché, Abéché, Tchad

²Département de Santé Publique, Faculté des Sciences de la Santé Humaine, Université de N'Djaména, N'Djaména, Tchad

³Département des Sciences Biomédicales et Pharmaceutiques, Institut National Supérieur des Sciences et Techniques d'Abéché, Abéché, Tchad

⁴Département de l'environnement, Faculté d'Agronomie, Université de Sarh, Sarh, Tchad

*Corresponding author: doutoum3000@yahoo.fr

Received June 22, 2019; Revised August 06, 2019; Accepted August 15, 2019

Abstract To meet the growing needs, to ensure the safety of meat products for consumers, it is essential to know the hygiene practices in slaughterhouses and establishments of their transformations. The purpose of the study is to evaluate the knowledge on the hygiene practice of meat products in the city of Abéché and to study the relationship between the associated risk factors. A survey was conducted to collect information from 264 subjects. The cross-tabulation test was used to know the relationship between the variables and the practice of hygiene. The results showed that 43.6% of the study population is over 30 years old and 50% at a primary level. The 68.6% of people have unacceptable knowledge, 22.3% have acceptable knowledge and 9.1% have satisfactory knowledge of hygiene practices. At the slaughterhouse 56.1% of those surveyed have no knowledge of hygiene, including 75% of women. In restaurants and grilling places, 55.9% have no knowledge of food hygiene, including 77% of women. The 75.14% of the respondents have no knowledge of hygiene at the market level. The cross-tabulation test showed that the relationship between the age of the study population and the practice of food hygiene is significant ($P < 0.05$). As well as the relationship between the level of education on hygiene practice is significant ($P < 0.05$). Men have better hygiene knowledge than women. The infrastructures of all the surveyed sites (slaughterhouse, markets, restaurants) do not meet hygiene standards.

Keywords: *hygiene, Meat products, Slaughterhouses, Abeche, Chad*

Cite This Article: Abdelsalam Adoum Doutoum, Abdelsalam Tidjani, Attahir Attamar, Djamalladine Mahamat Doungous, Ali Ahamat Hamid, Abdel-Mahamoud Adam Yaya, Roumane Moukhtar, and Alhadj Nazal Markhous, "Hygiene Practices of Carney Products in the City of Abeche, Chad." *Journal of Food Security*, vol. 7, no. 4 (2019): 115-121. doi: 10.12691/jfs-7-4-3.

1. Introduction

The quality of meat products is a major challenge for all meat sectors. It is considered a must for manufacturers and distributors and a must for consumers. The different food crises have called into question not only the intrinsic and extrinsic quality approach, but also the product / market strategies of the various stakeholders in the meat sector. From livestock farming to product processing, from marketing to consumption, consumers are expressing new expectations in terms of perceived and sought-after quality [1-2]. The consumption of grilled meat is booming in the city of Abéché. Processing, transforming and packaging of meat products are still underdeveloped in Abéché, given the low volume of livestock production, especially meat and fish, but also high equipment and energy costs. and lastly, the lack of credit facilities [3].

Dried meat is traditionally made in Abeche and is the only form of traditional meat preservation. It comes in the form of dried meat "charmout", and is an essentially female activity. Another form of meat preservation is Kilichi, 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 where smoked meat is prepared especially for the Abéché's market. Dried meats provide people with valuable protein and provide them with valuable incomes [4]. The town of Abéché produces an abundance of meat but its population eats only the poor hygienic quality [5]. Meat and fish for household consumption are sold almost at the market. Meat is the staple food of the Abéché's after the fish. Few households spend the week without eating. In these times of crisis, it is easier to buy a piece of meat than a small fish, not very accessible to average purses. But what about the quality of the meat and fish we eat? According to Tidjani et al. [4] Laboratory analyzes have highlighted fecal germs in

grilled and dried meat sold in N'Djamena. Mold has also been found in both grilled and dried meats and fish. These fungi expose consumers, butchers and vendors who do not realize the danger to which they expose themselves. The latter do not respect the minimum hygiene rule [6,7].

The basic hygiene rules are far from being satisfied because of the low level of education of producers and the lack of training on good hygiene practices and good manufacturing practices. Several studies have shown that sanitary precautions for the handling of street foods vary and have been identified as a major factor of contamination [8-9]. Meat is the main source of high quality protein and essential nutrients. Its composition of water and proteins of high biological value makes it a very favorable niche for the development of microorganisms [10]. Meat was traditionally thought to be responsible for a significant number of food-borne illnesses occurring in humans. The continuation of the problem has been amply demonstrated in recent years by monitoring human studies for contaminants in meat, such as *Escherichia coli* [5,11]. Apart from the hygiene of the slaughter process, the hygienic quality of the meat must be taken into account to ensure food safety.

The general objective is to better understand the practice of hygiene of meat products in the city of Abéché. The specific objectives were therefore to assess the hygiene knowledge of producers and processors of meat products, to assess the risks of contamination of meat products and finally to identify the infrastructures of production and processing at the point of sale.

2. Material and Methods

As part of our study, we used the following equipment: investigation cards, computer equipment, means of transport (motorcycles); GPS; the biological material consisted of meat, chicken and fish.

2.1. Type of Study

This is a cross-sectional study aimed at studying the risk factors for the production and processing of meat products (meat, "Charmout" chickens and fresh and dried fish) of the city of Abéché. Our research began with a first phase during which much of the literature was screened and combed. Then the data was collected on the survey sheets. Finally the ISHIKAWA rule using the five M's (Material, Materials, Methods, Environment and Workforce) and the organoleptic characteristics completed our method.

2.2. Study Population

The study focuses on the men and women of the city of Abéché who produce, process and sell meat products.

2.3. Study Area

The study took place in the urban and peri-urban area of the city of Abéché over a period of 6 months. Located in eastern Chad (Figure 1), the city of Abéché is the capital of the Ouaddaï region. It extends between latitude 13° 48'584 " North and longitude 20° 50'139 " East. 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 masses of humid maritime air of the Southwest (the monsoon). The average annual rainfall is about 300 mm. The temperature of the region is variable according to the periods. The average annual temperature in Abéché 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 (Municipality of Abéché, 2016).

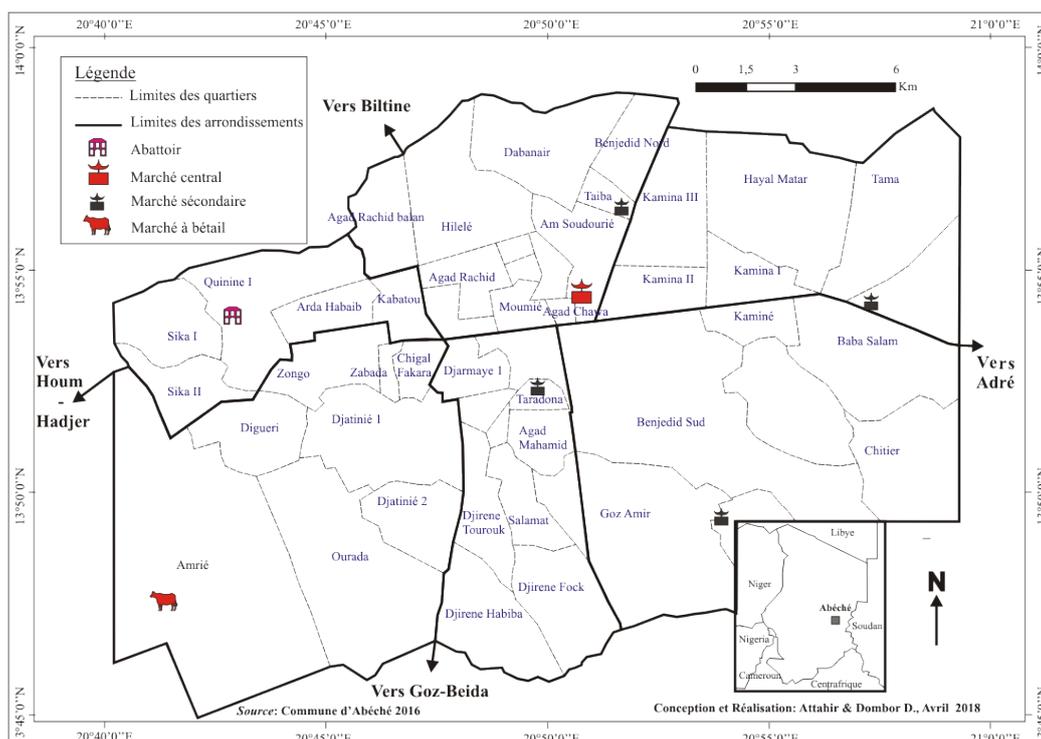


Figure 1. Presentation of the study area

2.4. Duration of the Study

The study began on July 1, 2016 and ended on December 31, 2016.

2.5. Size of the Sample

Sampling was done using a non-probability method. In other words, the selection was consecutive for all men and women, meeting the inclusion criteria. The size of the sample is determined according to the Lorentz formula:

$$n = P(1 - P) \frac{(z\alpha)^2}{\alpha^2}$$

With: n = sample size; α = risk of error ($\alpha = 0.05$); p = estimated prevalence of 50%; α : confidence level (95% confidence standard value is 1.96).

The estimated sample size is 264 people (vendors, butchers and restaurateurs). Thus, 264 people were surveyed.

2.6. Progress of the Study

The study was conducted in two (2) stages, namely, the survey stage with processors to assess their knowledge of the hygienic practice of meat products and the observation of hygienic practices, places of transformation of these products.

2.6.1. The Survey Stage

After explaining to the men and women, the purpose of the study and obtaining their consent, the persons meeting the inclusion criteria were interviewed according to the pre-established questionnaire, the data processors, sellers and butchers answer the questions we ask them and the sheets are as and when completed. Field surveys involved 264 subjects, which enabled us to obtain information on the hygienic practice of meat products in five (5) markets, eleven (11) restaurants and at the slaughterhouse.

2.6.2. The Observation Stage

The observations of the hygienic practice in the actors of the meat products were done as follows: workplace visit of the processors; presentation of the purpose of work; request for access to the workplace; observation of their hygiene practices during the various manipulations.

2.6.3. Abéché Slaughterhouse

In general, slaughterhouses are establishments where the animals intended for human consumption are slaughtered and prepared. Their purpose is to enable quality control of meat, to prevent the dangers of slaughtering animals and to ensure public safety by concentrating surveillance and cleanliness measures in one place. Slaughterhouses are public or private. The abattoir Abéché is located northwest of the city, in the Kinine district. This is the place where animal species (camels, cattle, sheep and goats) are slaughtered for consumption by the population of Abéché. The operation of the slaughter is daily from 5h to 10 hours approximately. The staff is composed of four (4) technicians (responsible for

inspecting the meat) and eleven (11) maneuvers (responsible for the health of the slaughterhouse).

2.6.3.1. Reception of Animals

The reception of animals for slaughter is the preliminary stage of inspection or inspection, as animals may show signs of illness, tiredness or injury, especially during transport, or be soiled with faeces with risk. microbial contamination of meat, hence the importance of ante-mortem inspection upon receipt of the animals.

2.6.3.2. Stabulation

Stabling is an important step in the process of slaughtering animals. It constitutes a period of observation and rest of the animal during which the hydric diet is carried out. The lack of a water diet at the slaughterhouse we visited can lead to postprandial bacteremia, which is detrimental to the hygienic quality of the meat. The risk of contamination of the meat is therefore very high.

2.6.3.3. Ante-mortem Inspection

The term "ante-mortem inspection" refers to the inspection that takes place before slaughter to determine whether the animal is healthy and whether it can be consumed by humans or not. The animal with a legally contagious disease is removed from the slaughter circuit.

2.6.3.4. The Supply

The transfer of animals from the stabling places to the bleeding room is a rather delicate step with the animals. It can be the cause of many damages if the professionals are not sufficiently applied. Mistreatment of animals (beaten and force-fed) by abattoir personnel causes excitement, fatigue and trauma with the risk of injury or bacteraemia of slaughter. The risk of decontamination of meat in this situation is quite high.

2.6.3.5. Bloodletting

It is a decisive step in the slaughter process on meat hygiene because it is very often a source of depreciation of the health quality of a part of the carcass. The risks incurred with poor bleeding practice are then very high. There is a possibility of bacterial contamination if it is done on the ground, or by a knife not disinfected and / or washed after each bleeding which is the case in the slaughterhouse.

2.6.3.6. Draft, Evisceration

This operation requires special attention because of the handling of the meat and its exposure to environmental conditions. Current dressing practices at the slaughterhouse visited expose the meat to very high contamination risks. These risks are mainly: microbial contaminations crossed through the hands, knives, aprons; the risk of contamination of the meat due to the practice of evisceration on the ground, blowing with the mouth and draft with the forearm.

2.6.3.7. Post-mortem Inspection

Post-mortem inspection refers to post-mortem inspection. It aims to ensure the safety of meat produced at the

slaughterhouse. When not done, the risks to consumers are very high. In fact, this inspection is carried out at the slaughterhouse, which means that the risk of microbial contamination is low.

2.6.4. Markets and Restaurants in the City of Abéché

Our study took place in five markets and eleven restaurants surveyed where meat products are of paramount importance in terms of food and economy. The meat products sold are fresh meat, dried meat, fresh fish, dry fish, and grilled meat.

2.6.4.1. Fresh Meat

This is the meat resulting from the slaughter of camel sheep and goats. The places of sale are sheds built by the state or unsanitary butchers and do not meet any hygienic standards.

2.6.4.2. Dried Meats

Dried meat is traditionally made in the city of Abéché and is the only form of traditional meat preservation. It is called "charmout", and is an essentially female activity. The processing of this meat takes place at the homes of the processors. Cutting operations are done on old mats on the ground and drying on old ropes. Once the product is dried, it will be put in bags and stored in a room. The sale of the product is made by bag to wholesalers who come from Faya and N'Djamena, by "coro" or in piles for the customers on the different markets of Abéché. Although dried meat provides people with valuable protein and provides them with a significant income, the risk of contamination during processing and storage is very high.

2.6.4.3. Broilers

These are chickens sold in great restaurants (Shadow of Africa and Daralsalam etc). These chickens are slaughtered in restaurants. The plucking is done with boiled water and the chickens are eviscerated and washed with the same water before being put in refrigerators. Part of the

chickens are grilled and sold to customers according to their orders.

2.6.4.4. Fish

Fresh and dry fish come from Fitri and N'Djamena. They are sold in piles in the various markets of the city of Abéché.

2.6.5. Questionnaire

A questionnaire structured in 24 parts allowing the collection of data, was developed using the Sphinx software. The questionnaire contains 24 questions. These questions were used to assess knowledge of food hygiene, to highlight sociodemographic characteristics, parameters such as, level of education, age, occupational assets and knowledge on food hygiene. The knowledge on food hygiene of meat products concerned: hand washing and handling of food products on personal hygiene in households the preservation hygiene of meat products; mastery of HACCP system.

2.6.6. Data Entry and Statistical Analysis

The data were entered using the SPSS software and exported to Excel 2007. The Excel spreadsheet allowed us to do the descriptive statistics (mean and frequency) and the comparison of averages using the ANOVA comparison test. The effects of significance are described as significant ($p < 0.05$) and not significant ($p > 0.05$). The map of the study area was designed using GPS coordinates and Map-info software

3. Results and Discussion

3.1. Sociodemographic Characteristics and the Practice of Food Hygiene

Sociodemographic characteristics concerning age, educational level, population type and food hygiene practice are summarized in [Table 1](#).

Table 1. Relationship between socio-demographic characteristics and the practice of food hygiene

Variables	Effective total	Satisfactory		Acceptable		Not acceptable	
		n	%	n	%	n	%
Age (year)							
14-20	52			3	5,8	49	94,2
20-30	97	7	7,2	30	30,9	60	61,8
> 30	115	19	16,5	27	23,5	69	60
Education							
None	60					60	100
Primary	132			12	9,1	120	90,9
Secondary	63	11	17,5	36	57,1	21	33,3
Superior	9	4	44,4	4	44,4	1	11,2
Genre							
Woman	146	9	6,2	25	17,1	112	76,7
Man	118	15	12,7	34	28,8	69	58,5

Table 1 shows that the majority of the study population is older than 30 years with a population of 115. Follow-up of those who are between 20 and 30 years old (97 subjects) and in the end those of 14 to 20 years old (52 subjects). In terms of educational attainment, most of the population studied has a primary level of education with a population of 132 subjects. Follow-up of the 63 subjects who have a secondary level, the 60 subjects have no level of education and 19 of those subjects have a higher level. In the end, there are more women than men with 146 and 118 respectively. The age of the population seems to have an effect on the practice of hygiene. Yet theoretically when the person is very young, she has no concept on product hygiene. This result is in agreement with those of [12] in Burkina Faso who showed that the practice of hygiene is linked to age. Other studies have also shown that people under 20 years old practice poor hygiene compared to older or older people [13-14]. The level of education and the age of the population therefore have a negative impact on the hygiene practice of meat products. This result is consistent with those of Ahmed et al., [15] in Australia. In addition, they are close to those of Malley [16] and De Jong [17] who found a population range between 16 and 50 years. On the other hand, our results are contrary to those of Gueye [18] in Senegal and Cortese et al., [19] in Brazil because they worked on a rather old population between 25 and 60 years old.

3.2. Knowledge of the Hygiene Practice of Meat Products at the Slaughterhouse

Data reporting knowledge on the hygiene practice of meat products concerning 57 subjects (41 males and 16 females) surveyed at the slaughterhouse are recorded in Table 2.

Table 2. Assessment of food hygiene knowledge at the slaughterhouse

Variables	Men		Women		Total (%)
	Effective	Frequency	Effectif	Frequency	
Satisfactory	8	19,5	1	6,2	15,8
Acceptable	13	31,7	3	18,8	28,1
Not acceptable	20	48,8	12	75	56,1
Total	41	100	16	100	100

This table shows that 56.1% of those surveyed have no knowledge of hygiene at the slaughterhouse, among whom 48.8% of men and 75% of women. The 28.1% of the subjects surveyed have an acceptable knowledge of food hygiene and the 15.8% have a satisfactory knowledge of food hygiene. Our results are similar to those of Tidjani et al. [3]. The same observation was reported by Mbawala et al. [20] in Cameroon; Abdelrahim et al., [21]; Tidjani et al., [4] who worked in Chad. These results can be explained by the fact that most of the subjects surveyed at the slaughterhouse are young, the level of education is low and women neglect hygiene practices.

3.3. Knowledge of Population on the Hygiene Practice of Meat Products in Markets

The subjects (47 males and 126 females) surveyed in the market are shown in Table 3.

Table 3. Assessment of food hygiene knowledge at the market level

Variables	Men		Women		Total (%)
	Effective	Frequency	Effective	Frequency	
Satisfactory	3	6,5	8	6,3	6,36
Acceptable	11	23,9	21	16,7	18,50
Not acceptable	33	69,6	97	77	75,14
Total	47	100	126	100	100

It can be seen from this table that in the markets of the city of Abéché, 6.36% of the subjects surveyed have satisfactory knowledge of the hygiene of meat products (meat and fish), including 6.5% of men and women. 6.3% of women. 18.5% of those surveyed have an acceptable knowledge of market hygiene. 75.14% of respondents have no knowledge of market hygiene; 69.6% of men and 77% of women. Our results are similar to those obtained by Kebede [22] in Cameroon. Langtar [23] and Hadjer [24] in Chad reported that foods sold by men are often safer than those sold by women (72 p100 vs. 30 p100). On the other hand Musengarurema [25] in Rwanda found that hygiene is quite satisfactory whatever the type. These observations were also made by Diarrassouba [26] in Cameroon.

3.4. Knowledge of the Population on the Hygiene Practice of Meat Products in Grilled Restaurants

The population knowledge data on the hygiene practice of meat products for 34 subjects (30 men and 4 women) surveyed in restaurants and grills are shown in Table 4.

It can be seen from this table that 11.43% of restaurants and steakhouses practice good hygiene. 31.43% have an acceptable level of hygiene knowledge. 55.9% have no knowledge of food hygiene, including 77% of women and 53.3% of men. Men are more aware of hygiene than women. This could be explained by the low level of education of women and that women are not very receptive to awareness. Our results are consistent with those of Redmond and Griffith [27] in Chad as well as those of Tidjani et al. [3] reported that food is unsafe for women than for men.

Table 4. Evaluation of knowledge of food hygiene in grilled restaurants

Variables	Men		Women		Total (%)
	Effective	Frequency	Effective	Frequency	
Satisfactory	4	12,9	0	6,3	11,43
Acceptable	10	32,3	1	16,7	31,43
Not acceptable	16	53,3	3	77	55,9
Total	30	100	4	100	100

3.5. Microbial Contamination of Meat at Slaughterhouse

Our observations have shown that the enclosure that houses Abéché slaughterhouse is poorly designed with a single door that serves as an exit and entrance. The cleaning system does not work. Its state of health is very deplorable and is a favorable mechanism for the

multiplication of infectious germs that can contaminate foodstuffs, equipment and personnel. In addition there is a release of a putrid odor that invades the slaughterhouse and outlying areas. Water equipment is not available and without electricity. In night, it serves a place where wandering animals (dogs, cats, jackals etc.) come to lick the debris of blood and pieces of meat. During the hours of slaughter an uncontrolled movement of people reigns at the level of this establishment from which there is a risk of very high contamination). We have found that the Abéché slaughterhouse does not meet hygiene standards and constitutes a very significant risk for the contamination of meat and personnel. With regard to the reception of animals for slaughter, the study showed that this stage presents a high risk of microbial contamination of the meat. Animals destined for slaughter show signs of illness, including injuries during transport, and are soiled by feces. [Figure 2](#) shows the risk of contamination observed in different operations during slaughter.

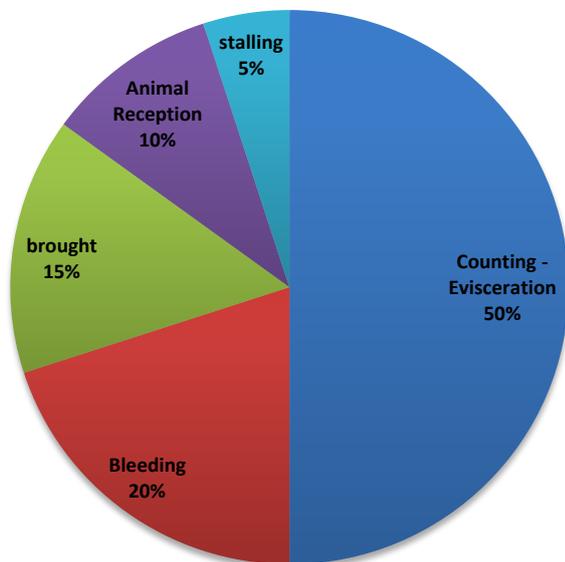


Figure 2. Risk of microbial contamination of meat at slaughterhouse

[Figure 2](#) shows a very high contamination rate at the level of skinning and evisceration in the order of 40%, followed by bleeding (20%), feeding (15%), receiving (10%) and stalling (5%). Our results are similar to those obtained by Hadjer [24] in Chad; on the other hand Langtar [23] found quite acceptable results. According to Ababouch [8], non-compliance with the rules of good practice and hygiene by food processors and sellers leads to their contamination by coliforms and total flora.

3.6. Contamination by Transport

The transport of meat from the slaughterhouse to the markets and the various sales outlets is ensured by motorcycles, tricycles and pushers. These means are not suitable for transporting meat. Because the meat is exposed to the wind, the heat and the carcasses are heaped together. This practice without special hygiene measures increases the risk of direct and cross microbial contamination.

Our surveys reveal that 60% of sellers of fresh or grilled meat transport meat using motorcycles, 20% using tricycles and 20% using non-refrigerated sprouts; the carcasses are piled up behind these machines, which are

most often dirty. The same results are obtained by Ababouch [8] in Morocco and Hadjer [24] in Chad.

3.7. Conservation

Our observations have shown that most meat products are stored in bags or suspended at the point of sale at room temperature. This practice encourages the multiplication of germs.

Our surveys have shown that 80% of meat products are not stored in refrigerators. By cons, 20% are kept in the freezer before the sale at night and in case of power failure or failure of the refrigerator, they buy water ice to keep the meat. Our results are different from those of Langtar (20% and 80%) in 2009 in Senegal [23] and Al-Shabib et al. [28] in Saudi Arabia. The poor preservation of the meat by some sellers would favor the bacterial multiplication, because the conservation in the freezer makes it possible to inhibit the microbial growth. The use of water ice in the event of a cut could be a source of contamination [24].

3.8. Exhibition of Meat Products

Our observations show that meat is spread by retailers on tables and sold in heaps or kilograms according to customer demand. With one hand the salesman invites the customers and on the other hand he flies the flies. In addition to this, there are also mobile vendors of meat (minors) holding meat in hand or on plates that pass on the different axes of the markets. While poisons (dry and cool) are exposed to the open air under dust and heat.

It shows that 90% of meat products are exposed to the open air and 10% are exposed in safe places. The risk of microbial contamination is therefore very high. When exposed to the open air, the meat products could be contaminated by the customer who handles them often with bare hands and the environment (air, flies, insects, etc.). Our results are consistent with those of Mensah et al. In Ghana [29]. Several bacteria responsible for Food Collective Toxi-Infections (TIAC) may belong to the flora of the digestive tract and may be carried by the wearer's hands (eg *E. coli*) in Chad [4].

3.9. Conditioning

This is the last step before the meat arrives to the consumer; usually the butcher delivers the meat and handles the money at the same time. Fresh fish are packaged in old freezers that fill the ice with water. On the other hand dry fish are packed in mats, bags and cartons.

The study showed that the sellers deliver the products and handle the money at the same time. With regard to the packaging, the following results are obtained: 65% use the plastic bag; 15% use the paper and sachet; 10% of sellers use paper and plates; 5% use cement wrapping paper; 5% of vendors use plates; The risk of microbial contamination and heavy metals during packaging is high. The results obtained are similar to those of Barro et al., [30].

4. Conclusion

In Chad, as in many other countries of the sub-region, establishments for the sale of raw or prepared meat

products have proliferated in order to satisfy consumers. However, this lucrative business risks endangering the health of consumers when hygiene measures are not respected. This study was conducted in the city of Abéché to assess the knowledge of the hygienic practices of processors and the situation of the place of their transformation. This study first revealed that the majority of the study population is older than 30 years, 43.6% and 50% at primary level. At the slaughterhouse 56.1% of those surveyed have no knowledge of hygiene, including 75% of women. In restaurants and grills, 55.9% have no knowledge of food hygiene, including 77% of women. This work has also shown that the age, education and gender of the study population have an influence on the practice of hygiene. In addition, men have better knowledge of hygiene than women. In addition, the infrastructures of all the surveyed sites (slaughterhouse, markets, restaurants) do not respect hygiene standards.

Statement of competing interests

The authors have no competing interests.

References

- [1] Ackah, M., Gyamfi, E. T., Anim, A. K., Osei, J., Hansen, J. K., & Agyemang, O. (2011). Socio-economic profile, knowledge of hygiene and food safety practices among street-food vendors in some parts of Accra-Ghana. *Internet journal of food safety*, 13, 191-197.
- [2] Dumont B.L. (2015). Quelques aspects de la qualité des viandes de boucherie. *Bull. Soc. Sci. Hyg. Aliment*, 48, 137-146.
- [3] Tidjani, A., Doutoum, A. A., Otchom, B. B., Bechir, M., Chemi, H. D., Toukourou, F., & de Souza, C. A. (2013). Assessment of Hygiene Practices and Identification of Critical Control Points Relating to the Production of Skewered Meat Sold in N'Djamena-Chad. *Journal of Food Research*, 2(5), 190.
- [4] Tidjani A., Doutoum A.A., Brahim B.O., Bechir M., Tidjani S. M .T., Toukourou F et de Souza C. A. (2013). Démarche assurance qualité dans le plan de maîtrise des diagrammes de production des viandes séchées « Kilichi » commercialisées » au Tchad. *Microbiol.Hyg.Alim.* (25), 72.
- [5] Doutoum, A. A., Tidjani, A., Sylla, K. S. B., Tidjani, S. M. T., Alambédji, R. B., Balde, M., ... & Toguebaye, B. S. (2013). Identification of lactic acid bacteria in traditional curd in the Sudanian zone of Chad. *Int. Res. J. of Microbiol*, 4(5), 119-124.
- [6] Joffin C., Joffin J.N., *Microbiologie Alimentaire*, CRDP Aquitaine (Centre Régional de Documentation Pédagogique), Bordeaux, 1999, 45.
- [7] Boeckel, T. P. V., Hounhouigan, J. D., & Nout, R., *Les aliments: transformation, conservation et qualité*. Backhuys Publishers & CTA, Wageningen, 2003, 1-13.
- [8] Ababouch L.H., *Assurance de la qualité en industrie halieutique*, ACTES, Rabah, 1995, 214.
- [9] Barro, N., Outtara, C. A. T., Nikiema, A. P., Outtara, A. S., & Traore, S. A. (2002). Evaluation of the microbiological quality of some street food in the city of Ouagadougou in Burkina Faso. *Cah. Health*, 12, 369-374.
- [10] Benaissa A., *Etude de la qualité microbiologique des viandes camelines et ovines conservées selon différents modes*. Mémoire de Magister en Biologie, Option Microbiologie Appliquée, Université Kasdi Merbah Ouargla, Ouargla, 2011.
- [11] King, L. K., Awumbila, B., Canaco, E. A., & Ofosu-Amaah, S. (2000). An assessment of the safety of street foods in the Ga district, of Ghana; implications for the spread of zoonoses. *Acta tropica*, 76(1), 39-43.
- [12] Meda N. (1999). Anaemia during pregnancy. *Bulletin of the World Health Organization*, 77(11), 916-922.
- [13] Scholl, T. O., Chen, X., Khoo, C. S., & Lenders, C. (2004). The dietary glycemic index during pregnancy: influence on infant birth weight, fetal growth, and biomarkers of carbohydrate metabolism. *American journal of epidemiology*, 159(5), 467-474.
- [14] Chen, F. C., Godwin, S. L., & Kilonzo-Nthenge, A. (2011). Relationship between cleaning practices and microbiological contamination in domestic kitchens. *Food Protection Trends*, 31(11), 672-679.
- [15] Ahmed, F., Coyne, T., Dobson, A., & McClintock, C. (2008). Iron status among Australian adults: findings of a population based study in Queensland, Australia. *Asia Pacific journal of clinical nutrition*, 17(1), 40-47.
- [16] Malley A., *Les motifs de saisie des viandes dans les abattoirs en côte d'ivoire chez les bovins: Prévalence et Incidence socioéconomique*. Th. Med. Vet. 5, EISMV, Dakar, 2001.
- [17] De Jong, A. E. I., Verhoeff - Bakkenes, L., Nauta, M. J., & De Jonge, R. (2008). Cross - contamination in the kitchen: effect of hygiene measures. *Journal of Applied microbiology*, 105(2), 615-624.
- [18] Gueye M., *Les motifs de saisie des viandes les plus fréquemment rencontrés au niveau des abattoirs de la région du cap-vert: conséquences économiques et sociales*. Th. Med. Vet. 17, EISMV, Dakar, 1981.
- [19] Cortese, RDM, Veiros, MB, C. Feldman et SB Cavalli (2016). Sécurité alimentaire et pratiques d'hygiène des fournisseurs au cours de la chaîne de production d'aliments de rue à Florianopolis, au Brésil: une étude transversale. *Le contrôle des aliments*, 62 , 178-186.
- [20] M'bawala, A., Daoudou, B., & Ngassoum, M. B. (2010). Qualité microbiologique du kilishi (produit carné séché) produit dans la ville de N'Gaoundéré (Cameroun). *Tropicicultura*, 28(3), 153-160.
- [21] Abdelrahim, A. M., Tidjani, A., Doutoum, A. A., Barro, N., & Traore, A. S. (2012). Evaluation of the microbiological quality of braised fish and their seasonings sold in the streets of Ouagadougou (Burkina Faso). *Microbiol. Hyg. Alim*, 24(69), 47-54.
- [22] Kebede G., *Contribution à l'étude de la contamination superficielle des carcasses de bovins aux abattoirs de Dakar*. Th. Med. Vet., EISMV, Dakar, 1986.
- [23] Langtar N.J., *Contribution à l'alimentation de la législation et la réglementation de l'inspection des viandes de boucherie au Tchad*. Th. Med. Vet., EISMV, Dakar, 2009.
- [24] Hadjer M., *Etat des lieux des abattoirs et aires d'abattages situés dans trois régions du Tchad*. Th. Med. Vet., 22, EISMV, Dakar, 2014.
- [25] Musengarurema, *Les dominant pathologiques observées à l'abattoir de Kigali (Rwanda): incidences économiques et sociales*. Th. Med. Vet. 14, EISMV, Dakar, 1983.
- [26] Diarassouba K .A., *Etude diagnostique des conditions de préparation et inspection des viandes de boucheries aux abattoirs de district d'Abidjan*. Th. Med. Vet. 14, EISMV, Dakar, 2011.
- [27] Redmond, E. C., & Griffith, C. J. (2003). Consumer food handling in the home: a review of food safety studies. *Journal of food protection*, 66(1), 130-161.
- [28] Al-Shabib, N. A., Mosilhey, S. H., & Husain, F. M. (2016). Cross-sectional study on food safety knowledge, attitude and practices of male food handlers employed in restaurants of King Saud University, Saudi Arabia. *Food Control*, 59, 212-217.
- [29] Mensah, P., Yeboah-Manu, D., Owusu-Darko, K., & Ablordey, A. (2002). Street foods in Accra, Ghana: how safe are they?. *Bulletin of the World Health Organization*, 80, 546-554.
- [30] Baro, N., Bello, A. R., Itsiembou, Y., Savadogo, A., & Ouattara, C. A. T. (2007). Street-vended foods improvement: Contamination mechanisms and application of food safety objective strategy. *Crit. Rev*, 6, 01-10.

