

## A comprehensive study on *attiéké* vending and consumption in three main cities of Burkina Faso

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### Article history:

Received: 2 February 2023

Received in revised form: 6 May 2023

Accepted: 23 April 2024

Available Online: 12

December 2024

### Keywords:

*Attiéké*,

Seller,

Consumer,

Good hygienic practices,

Street food,

Burkina Faso

### DOI:

[https://doi.org/10.26656/fr.2017.8\(6\).059](https://doi.org/10.26656/fr.2017.8(6).059)

### Abstract

Street vended foods are developed in West African countries offering a variety of meals to populations. *Attiéké* is a local popular street vended food widely consumed in Burkina Faso. Street food vending is operated by actors without knowledge of good hygienic practices leading to foodborne infections. Therefore, this study was carried out to investigate on behaviors of vendors and consumers of *attiéké* in three main cities of Burkina Faso. Surveys were performed on vending sites with face-to-face interviews of 300 vendors and 500 consumers. The results revealed the major presence of women (88.67%) in *attiéké* vending in public areas. Most vendors (68%) do not respect good hygienic practices during food handling. In addition, consumers, mostly consisted of men (57.40%) are not aware of vending conditions and even less of their own hygienic behavior. Regarding the socio-economic importance of *attiéké* and its role in foodborne illnesses, vendors should be regularly trained and retrained to prevent foodborne disease outbreaks. Similarly, this sector needs to be better organized, by using a holistic approach that involves all the actors.

## 1. Introduction

The economic situation of Burkina Faso is defined by the growth and expansion of population and great urbanization (Institut National de la Statistique et de la Démographie (INSD), 2022). This led to the development of street food vending in the following three main cities: Ouagadougou, Bobo-Dioulasso and Koudougou (Barro *et al.*, 2002). Street food consumption is a widespread phenomenon in these three cities (Barro *et al.*, 2006). *Attiéké* is one of the local street foods appreciated and consumed in most West African countries including Burkina Faso. Typically, food-based cassava product of southern coastal region populations of

Côte d'Ivoire (Egnankou, 2020), *attiéké* appears to be the most popular and consumed product in Burkina Faso (Flibert *et al.*, 2016). *Attiéké* is an agglomerated cassava semolina made from freshly peeled, powdered, washed, crushed, fermented, wrung out, granulated, sieved, pre-dried, validated, and steamed cassava tubers (Ebah Djedji *et al.*, 2019). It preserves well, adapts itself to street cookery, and is basically energetic (Sotomey *et al.*, 2001; Alexis and Jean, 2010). Several types or varieties of *attiéké* have been identified. The most common of which are coarse-grained *attiéké* or "*Agbodjama*", medium-grained *attiéké* or "*attiéké adioukrou*", and *garba attiéké* called "*attiéké vitess*", which is generally

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made up of almost indistinct or invisible grains (Regina *et al.*, 2015). The *attiéké* is usually served with fish, tomato, cucumber, onion, chili and oil. Few studies on informal commerce in Burkina Faso have addressed the issue of actors' profile in the *attiéké* trade and sanitary environment in which it is sold (Dembélé *et al.*, 2018). However, it is important to highlight the characteristics of *attiéké* processing and vending and their role in foodborne disease transmission (Monney *et al.*, 2014).

However, as the consumption of street foods increases, related illnesses, particularly *Salmonella* infections (Vollaard *et al.*, 2004), as well as contamination with coliforms (Al Mamun *et al.*, 2013), bacterial contaminations and other infections as a result of transmission from vendors are frequently observed (Orlando *et al.*, 2012). Several previous studies have indicated that a large proportion of street foods are contaminated with microorganisms and can cause diseases such as diarrhea, cholera, typhoid fever and food poisoning (Al Mamun *et al.*, 2013). Millions of people globally develop illnesses every day as a result of consuming contaminated food and water (WHO, 1999; Havelaar *et al.*, 2015). Food safety has been declared a global and increasing public health concern by international agencies such as the Food and Agriculture Organization (FAO) of the United Nations and the World Health Organization (WHO, 1999). Poor personal and environmental hygiene contributes to food contamination and results in food-borne diseases (Mathee *et al.*, 1996; Gasem *et al.*, 2001).

Indeed, ignorance and/or disrespect of good hygienic practices have been pointed out as the most important factor of contamination in street foods and *attiéké* (Barro *et al.*, 2006; Bello *et al.*, 2014; Dembélé *et al.*, 2018). To date, the knowledge and attitudes of street food vendors have been reported in several studies (Barro *et al.*, 2006; Dembélé *et al.*, 2018; Ngoc *et al.*, 2020). The purpose of this study was to obtain a better understanding of the actors' profile in the *attiéké* trade and highlight the unhygienic conditions of the vending sites in the three main cities (Ouagadougou, Bobo-Dioulasso and Koudougou) of Burkina Faso.

## 2. Materials and methods

### 2.1 Site and period of study

This Cross-sectional study was carried out in Ouagadougou, Bobo-Dioulasso, and Koudougou through a questionnaire in order to document the Socio-demographic characteristics of *attiéké* consumers and vendors and the status of sales sites. These three cities were chosen because they are the main cities in Burkina Faso and are accessible by train from Côte d'Ivoire. The

survey was conducted from October 2021 to February 2022 in different places where *attiéké* was sold including public areas, local markets, streets, bus stations, restaurants and beneath retail trees, on any day of the week and at different times of the day (Figure 1).

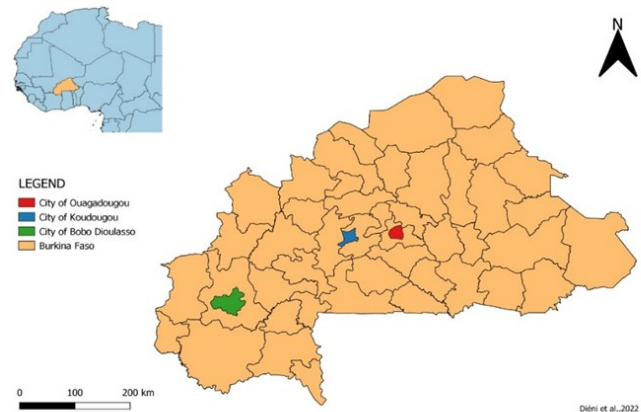


Figure 1. Study sites in different cities.

### 2.2 Population of study and data collection

A total of five hundred (500) consumers and three hundred (300) sellers were interviewed using structured questionnaires via face-to-face interviews. The sample size for the surveys was estimated by the simple random sampling method performed by Manly (1992) using  $\epsilon = 1.96$  for an accuracy  $\alpha = 5\%$ , the formula is as follows:

$$N = \frac{\epsilon^2 \times p \times q}{i^2}$$

$Q = 1 - p$ ,  $i$  being the precision. The prevalence ( $p$ ) is estimated to be 68% among sellers (Al Mamun *et al.*, 2013) and there is no estimate of  $p$  available among consumers, it is therefore assumed to be  $p = 0.5$ . With this method, 318 vendors and 384 consumers were obtained. The required sample sizes for all the 3 cities were 367 vendors and 422 consumers with 10% relative precision. The sample sizes were further adjusted as indicated above. Environmental data on hygienic aspects of the sites were collected by direct observations and documentary research. The respondents have been informed about the study's purpose and methodology. Those who agreed to participate in the study have provided their addresses and signed informed consent.

### 2.3 Hazard identification and critical control points

The determination of CCP was based on the method of applying hazard analysis to the production diagram used by Obadina *et al.* (2008) and Kouamé *et al.* (2019) based on the identification of hazards and critical control points during the process of *attiéké*.

### 2.4 Data analysis

Descriptive statistics were performed for all variables using the statistic software package (SPSS)

Table 1. Socio-demographic characteristics of *attiéké* consumers and their consumption patterns.

Parameters	Frequency	Percentage (%)
<b>Sex</b>		
Male	287	57.40
Female	213	42.60
<b>Marital status</b>		
Married	167	33.40
Single	333	66.60
<b>Age group</b>		
≥19	41	8.20
19 - 49	435	87.00
50 - 59	6	1.20
≥ 60	5	1.00
Not determined	13	2.60
<b>Socio-professional class</b>		
Pupils	82	16.40
Merchant	83	16.60
Student	156	31.20
Unemployed	3	0.60
Housekeeper	28	5.60
Other professions	148	29.60
<b>Conservation of the <i>attiéké</i> before consumption</b>		
Same day consumption	451	90.20
Delayed consumption	49	9.80
Storage in the refrigerator	17	34.69
<b>Storage time in the fridge</b>		
1 day	6	35.29
2 to 5 days	11	64.71
Storage at room temperature	32	65.31
<b>Storage time at room temperature</b>		
1 day	14	43.75
2 to 5 days	18	56.25
<b>Treatment of <i>attiéké</i> before consumption</b>		
Steam heating	236	47.2
If consumed the same day of purchase	188	79.66
If stored at room temperature	34	14.41
If stored in the refrigerator	14	5.93
No heat treatment	264	52.80
If consumed the same day of purchase	257	97.35
If stored at room temperature	4	1.52
If stored in the refrigerator	3	1.14
<b>Frequency of consumption of <i>attiéké</i> during the 3 main meals</b>		
Breakfast	90	18.00
Lunch	236	47.20
Dinner	174	34.80
<b>Places of consumption of <i>attiéké</i></b>		
Home	316	63.20
Outside the home	184	36.80
Street Restaurant	62	33.70
Bars	57	30.98
<i>Garbadrôme</i>	37	20.11
Other places	28	15.22
<b>Consumers' appreciation of the quality of <i>attiéké</i> sold on the street</b>		
Satisfying	311	62.20
Acceptable	133	26.60
Unsatisfactory	56	11.20

version 20.0 and Microsoft Excel version 2016. Analysis of variance (ANOVA, Fisher exact test: *t-test*) test was used to test if there was a statistically significant difference between means. The level of significance retained was 5% ( $p < 0.05$ ).

### 3. Results

#### 3.1 Characteristics of consumers

Table 1 presents the socio-demographic characteristics of consumers. *Attiéké* was purchased and consumed by any person without sex and age distinction. Young people of 19-49 years represent a high proportion of consumers and they prefer to eat this food outside. Consumers belong to all social classes, but are dominated by students (31.2%), shopkeepers (16.6%) and pupils (16.4%). The proportions of *attiéké* consumers were 5.6%, 0.6% and 29.6% respectively for housewives, the unemployed and other professions.

*Attiéké* was cooked, vended and consumed at any period of the day. The rest was sold the next day. However, it was not kept at an adequate temperature. The storage time before consumption ranged from 1 to 5 days (Table 1). A total of 35.29% and 64.71% of consumers kept *attiéké* in the refrigerator for one day and 2-5 days respectively, while 43.75% and 56.25% kept it at room temperature for one day and 2-5 days respectively. *Attiéké* was consumed without being reheated by 52.80% of consumers. It is consumed during the three main meals of the day with 18% consumed at breakfast, 47.20% at lunch and 34.80% at dinner.

*Attiéké* was consumed one (01) to four (4) times a day and one (1) to six (6) days a week. Thus, most people (81.1%) consumed it one time a day (Table 1). Consumers had difficulties in distinguishing the qualities and the different types of *attiéké* for their preference. Indeed, 11.20% of interviewers complained about the quality of *attiéké* sold in these surveyed sites ( $P \leq 0.05$ ).

#### 3.2 Characteristics of *attiéké* sellers

Characteristics of sellers are detailed in Table 2. More than 80% of vendors are located along the main streams and in public areas. They generally act in this street food trade without training and knowledge of good hygienic practices (42.67%). The vending process is dominated by manual operations. The vending conditions are typically similar to those of common street foods. Indeed, vending environments are characterized by the presence of different wastes, shelters are precarity, transportation systems by uncovered motorcycles exposing food to contamination, and unvended foods are briefly reheated the next day.

Table 2. Socio-demographic characteristics of sellers and the status of sales sites.

Parameters	Frequency	%
<b>Sex</b>		
Male	34	11.33
Female	266	88.67
<b>Hygiene Training</b>		
Yes	128	42.67
No	172	57.33
<b>Mode of transport of the <i>attiéké</i> to the points of sale</b>		
Motorcycle	150	50.00
Hand-cart	75	25.00
Foot	39	13.00
Bicycle	36	12.00
<b>Packaging during transport to the sales sites</b>		
Protected « <i>plastic packaging</i> »	292	97.33
Unprotected	8	2.67
<b>Healthiness of the sale premises</b>		
Clean	270	90.00
Dirty	30	10.00
<b>Clothes of the saleswomen</b>		
Clean	273	91.00
Dirty	27	9.00
<b>Service of the <i>attiéké</i> during the sale</b>		
With the bare hand	204	68.00
With a ladle (bole)	27	9.00
Wearing plastic gloves	69	23.00
<b>Sale of the whole <i>attiéké</i></b>		
Yes	161	53.67
No	139	46.33
<b>What happens to the remaining <i>attiéké</i> after sales</b>		
Transformation and Resale	58	41.73
Family consumption	81	58.27
<b>Location of sales sites</b>		
Bars	25	8.33
Road restaurant	103	34.33
Street side	156	52.00
Informal market	16	5.33

#### 3.3 Raw *attiéké* supply

Loading and unloading of imported foods were carried out by traders and/or importers themselves from the city of supply to arrival. There are no transport wagons reserved solely to *attiéké* and cassava starches. In general, there was a lack of compliance with basic hygiene rules at all levels (environment, unloading, conservation and selling). Moreover, the majority of the women operate in an unhygienic environment, where they are exposed to dust, near gutters or at crossroads with the presence of flies. Similarly, all the interviewed saleswomen handled the *attiéké* and spoke during the

sale and none of them had hand-washing items. The plastic bag used for *attiéké* packaging was damaged and didn't cover the whole food on sale. These shortcomings reported are based on the informal nature of the activities of the *attiéké* production chain.

3.4 Description of *attiéké* preparation (biological risk hazards and critical control points

The technological process of manufacturing *attiéké* was dominated by a sequence of manual operations. During the production and marketing of *attiéké*, flow diagrams reported in this study record miscellaneous operations (Figure 2). CCP has been also introduced at certain stages of production such as cassava roots (raw material), crushing, fermentation, pressing, drying, preparation, packaging, transport conditions, selling and consumption (Figure 3).

4. Discussion

Street food vending is an important socioeconomic activity in many cities in Africa (Rahman et al., 2012; Mwove et al., 2020). Indeed, the present study revealed

that this activity was carried out by both women and men. That could be due to the socioeconomic context especially characterized by unemployment and poverty (Dakouri et al., 2019). However, women are most represented in the *attiéké* vending in Burkina Faso. Similar studies were reported in Uganda (Namugumya and Muyanja, 2011). In Africa, where sociocultural practices still exist, the preparation and selling of street foods are dominated by women (Rahman et al., 2012). Vendors use their traditional knowledge and methods to offer the population different available meals that are well-appreciated by consumers at any time of the day (Barro et al., 2002). However, the presence of some men highlighted among the surveyed vendors could be explained by the very difficult national socio-economic situation (Barro et al., 2002). As it appears in this study, *attiéké* is an available important street vended food in different cities. Its lower cost and ease of cooking make it one of the most consumed street foods in Burkina Faso. In contrast, *attiéké* preparation and vending are operated in an unappropriated environment and by actors without good hygiene practice (GHP) principal application. Indeed, the development of *attiéké* vending

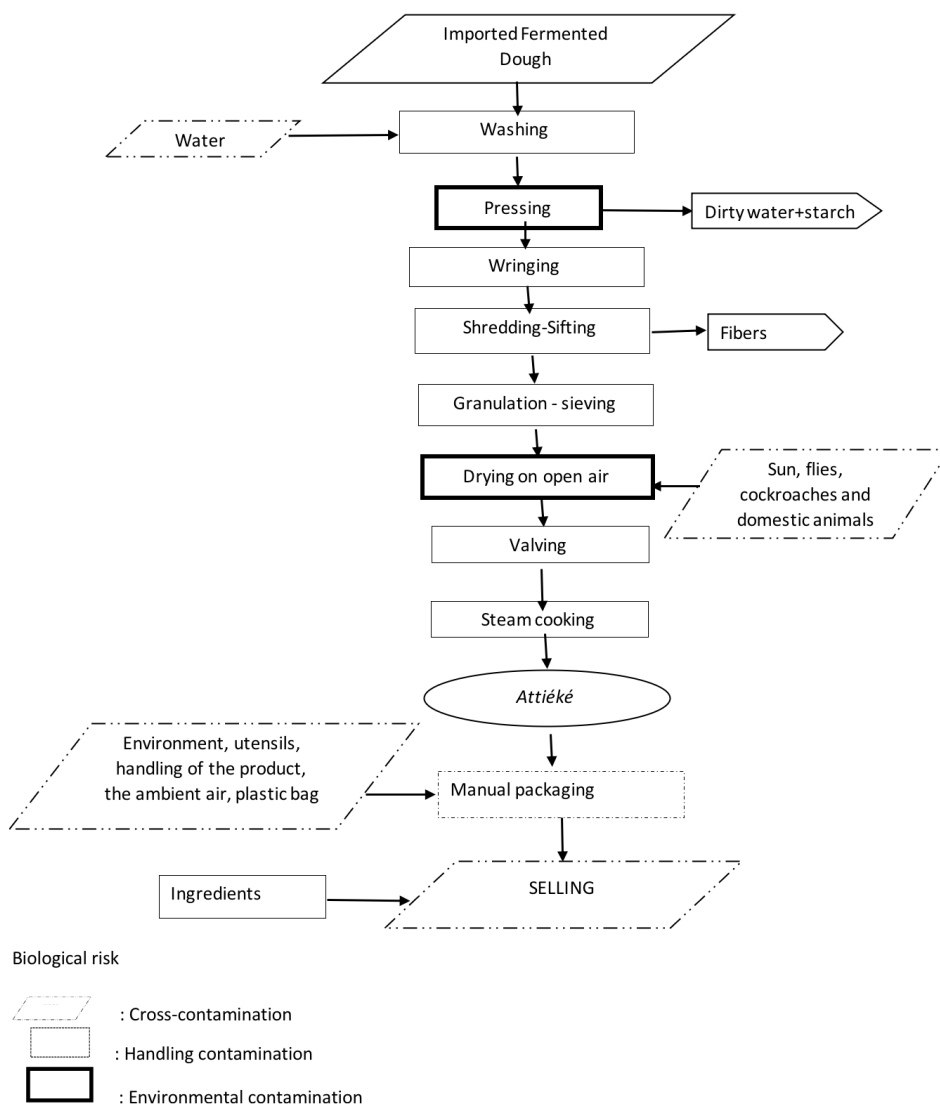


Figure 2. Flow diagram of the major risk factors leading to traditional processing of *attiéké* in Burkina Faso.

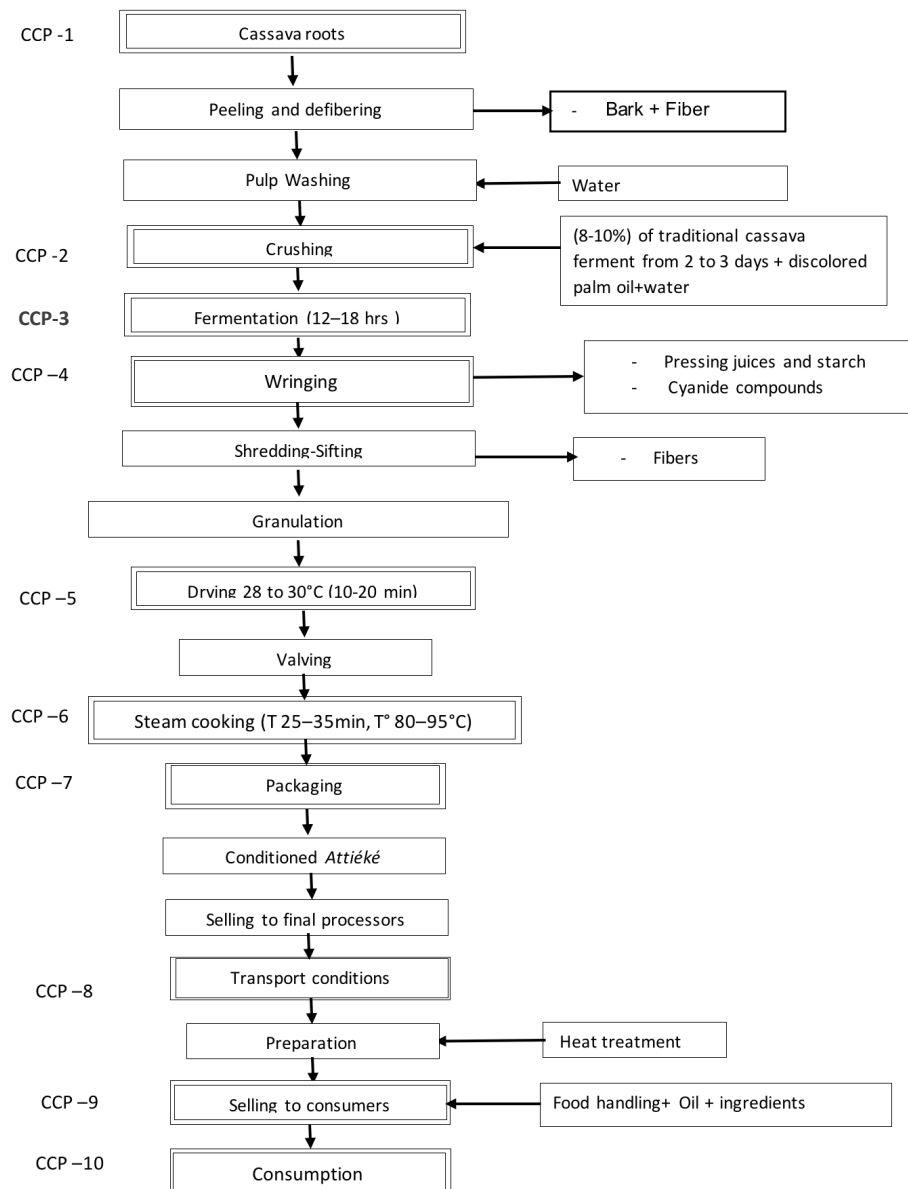


Figure 3. *Attiéké* production, distribution, and consumption flowchart with Critical Control Points (CCP). Adapted from Kouamé et al. (2019).

in Burkina Faso's cities may be due to the informal nature of this sector, the poverty and the high living cost (Barro et al., 2006). However, street vendors play an important role in economic losses and the spread of foodborne diseases (Monney et al., 2014). In this study, unhygienic precautions when handling *attiéké* appeared as contamination factors (Kouadio-Yapo et al., 2018). Poor techniques of preparing, packaging, preserving and selling *attiéké* in a precarious environment have been noticed and may also be the sources of contamination (Kruy et al., 2001; FAO, 2007). The study revealed the use of non-biodegradable plastic packaging for the sale of *attiéké* which may have negative health and environmental consequences (Bouafou et al., 2021).

In many urban settings in developing countries, street foods have become an indispensable component of food distribution systems (Leshi et al., 2017). In Burkina Faso, many students, schoolchildren, workers, housekeepers, employees and other professionals are

consumers of street vended *attiéké*. Similar findings were reported in the study of street food in Asia (Winarno and Allain, 2018). Among them, men are the most numerous and assiduous. That may be due to the socio-cultural context of Burkina Faso where women rarely eat outside (Barro et al., 2002). *Attiéké* consumption is influenced by people's income level and its availability as a ready-to-eat food. For example, *attiéké* can be obtained in the cities of Burkina Faso for as little as 200 FCFA (~\$0.30). Another important characteristic of street vended *attiéké* is that it provides a very accessible dietary source for many consumers living in urban areas of Burkina Faso (Steyn et al., 2014). More than half of the surveyed consumers consumed *attiéké* at least once a day. These results corroborate those reported by Amani and Kamenan (2003) in Côte d'Ivoire. In addition, rapid urbanization and economic hardship are believed to be the main drivers of the increase in consumers in African countries (Sotomey et al., 2001; Kouassi et al., 2008; Djéni et al., 2011). The consumption of ready-to-eat

foods in general and *attiéké* in particular outside the home could also be explained by the distance from the workplace and the continuous work-day system observed in Burkina Faso (Djéni et al., 2011). Furthermore, the majority of *attiéké* consumers in the three cities of Burkina Faso (Ouagadougou, Bobo-Dioulasso and Koudougou) were single. Similar data were reported in Abidjan (Côte d'Ivoire) (Yobouet, 2016).

Consumer acceptance and perception of *attiéké* quality is a complex human behavior influenced by many interrelating factors. The results showed that the majority of consumers were satisfied with the quality of *attiéké* but a significant proportion of respondents still complained about its quality. According to FAO (2016), if consumers had no immediate health problems or ailments after eating, then *attiéké* was safe. In such a context, the quality and safety of street foods must become a socio-economic issue of primary importance.

This study revealed that at the packaging and selling in retail stages, preventive control measures must be introduced because at these stages if a pathogenic micro-organism is introduced, the hazard will go directly to the consumer because there is no other stage for its elimination (Kouamé et al., 2019).

#### 4. Conclusion

From this study, it appeared that *attiéké* was a popular and commercially successful food consumed by both genders and all ages. *Attiéké* sellers play a vital role in improving food security for people in large cities in Burkina Faso. In addition, respecting good hygiene practices at the point of sale could guarantee the prevention of many infectious diseases. If food safety knowledge is lacking among *attiéké* sellers, the consequences could be serious and the possibility of foodborne disease outbreaks is evident. Indeed, it provides information on the degree of food safety awareness of *attiéké* sellers and customers. This study is valuable to food control authorities, food service managers, and food safety trainers. Indeed, consumer's awareness of reheating *attiéké* before consumption, coupled with messages on the freezing *attiéké*, if necessary, could help consumers avoid the risk of food poisoning. However, given the limited size of this sample, caution should be applied when extending the results to the wider population and more typical sampling is expected in future studies.

#### Conflict of interest

The authors declare no conflict of interest.

#### Acknowledgements

The authors would like to thank all the *attiéké* sellers and consumers who had freely accepted to participate to this study.

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