

Assessment of the production and risks of consumption of artisanal refreshing drinks (Bissap, Gnamankoudji) in Haut Sassandra (Daloa department)

ABSTRACT

*Introduction:*The production and consumption of artisanal refreshing drinks (Bissap, Gnamankoudji) in the Haut Sassandra region are anchored in local culture. These artisanal drinks are experiencing considerable growth despite their artisanal and unstable production.

*Objective :*The objective of this study is to diagnose the production of these artisanal drinks and to assess the potential risks associated with their consumption in the Haut Sassandra region.

*Methodology :*A cross-sectional and retrospective survey was carried out with producers to make the diagnosis and with consumers to identify some main conditions linked to the consumption of these drinks. 52 producers were investigated, and 780 consumers were submitted to a questionnaire, for a total of 832 people audited.

*Results :*Bissap and Gnamankoudji have many similar unit operations. In addition, Bissap undergoes heat treatment. The drinks are mostly packaged in used pots. The main conditions encountered were diarrhea (8.3% and 8.7%),belly bloating (2.4% and 2.8%), fever (1.80% and 2.30%), nausea (1.80% and 1.90%), vomiting (0.90% and 1%) respectively after consumption of Gnamankoudji and Bissap.

*Conclusion :*The study collected data on the production of artisanal drinks and the risks incurred by consumers. The consumption of these drinks represents a major risk for public health.

Keywords: artisanal drinks, consumption, Haut Sassandra, risks

1. Introduction

In sub-Saharan Africa, the consumption of artisanal refreshing drinks is growing, due to their affordable cost and the many nutrients they contain. These refreshing drinks have now become an integral part of people's eating habits [1] [2]. They are obtained from local products including fruits, vegetables and certain roots [3]. In Ivory Coast, *Bissap* and *Gnamankoudji* are among the most common artisanal refreshing drinks [4]. *Bissap* is an artisanal drink obtained from Hibiscus flowers (*Hibiscus sabdariffa*). *Gnamankoudji* is an artisanal drink obtained from the rhizomes of ginger (*Zingiber officinale Roscoe*) [5].

These drinks are sold along roadsides, in markets and densely populated areas such as schools and bus stations [6]. Their production is based on rudimentary traditional methods. The processes implemented are simple and require little equipment and technical expertise [5] [7]. However, these manufacturing processes are not always mastered, they are not standardized and therefore vary from one producer to another [8].

In addition, drinks are packaged in already used or reusable containers or packaging materials whereas this makeshift packaging is strongly discouraged [9]. It was also noted that these drinks are kept for a long time during sale in uncontrolled hygienic conditions [10]. From production to marketing, these drinks can be subject to contamination by various microorganisms including pathogens. Additionally, several disease outbreaks have been attributed to the beverages in various parts of the world and some infections have been reported [11] [12].

The large population of the Daloa department estimated today at 709,810 inhabitants also know this attraction to the consumption of artisanal refreshing drinks [2]. However, little data exists on the production method and the illnesses linked to the consumption of these drinks.

This study aims to diagnose the production of artisanal drinks in the Daloa department, and to identify the main conditions linked to their consumption.

2. Material and methods

2.1. Survey for the diagnosis of production of artisanal drinks

A survey was carried out in several neighborhoods and villages in the Daloa department. In total, 26 production sites were investigated. To this end, a questionnaire was developed in order to diagnose the production of these drinks. The main information sought was: the manufacturing process of these artisanal drinks, the hygienic state of the production sites, the added ingredients, the packaging, as well as the marketing conditions.

2.2. Survey to identify the main conditions linked to consumption

A survey was carried out in 26 neighborhoods and villages in the Daloa department. To carry out the survey, a questionnaire was developed and 780 volunteers were interviewed randomly. The investigation lasted 3 months (June to August 2023). The essential information sought focused on the main conditions encountered by consumers. The respondents were of two genders, of all levels of study and of all social strata. The only exclusion criterion was children under 15 years of age as well as the very elderly. The map below presents the Daloa department with the different districts, villages or survey sites (Figure 1).

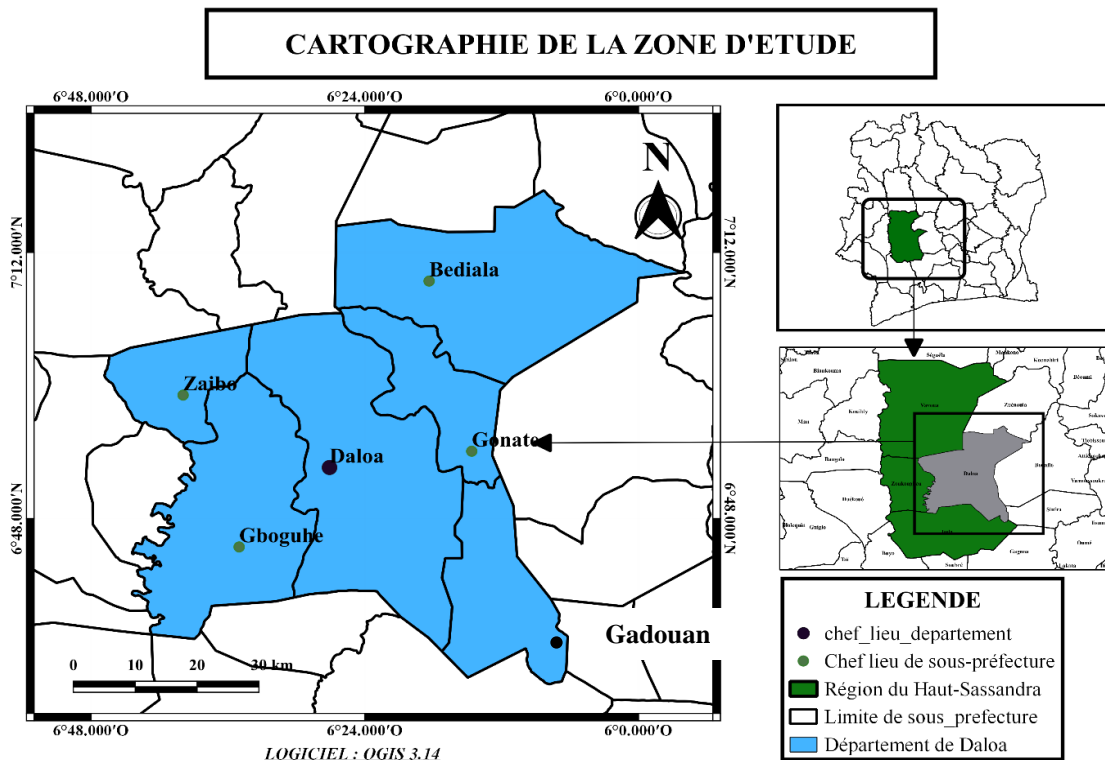


Figure 1: Map of the study area

2.3.Data analysis

The data collected during the survey were processed by the Sphinx Lexica software and entered using the Excel 2013 spreadsheet.

3. Results

3.1.Diagnosis of the production process

The main unit operations of Gnamankoudji and Bissap are: washing, soaking, filtration and adding ingredients (brown sugar, vanilla sugar). However, to obtain Gnamankoudji(Figure2),the ginger rhizome (Figure 3) goes through the grinding stage while the *Hibiscus sabdariffa* flowers (Figure 4) undergo heat treatment (infusion) to obtain *Bissap* (Figure 5) and add ingredients. The essential operations are illustrated by the production diagram below (Figure 6)

- Beverage packaging and storage

At the end of production operations, the drinks are packaged in used plastic(PET) packaging. These plastics were not often sterilized, only detergents were used for their disinfection. Once packaged, conservation was done in refrigerators or freezers.



Figure 2 :Gnamankoudji**Figure 3 :Ginger rhizome**



Figure 4 : *Hibiscus sabdariffa* flowers

Figure 5 : *Bissap*

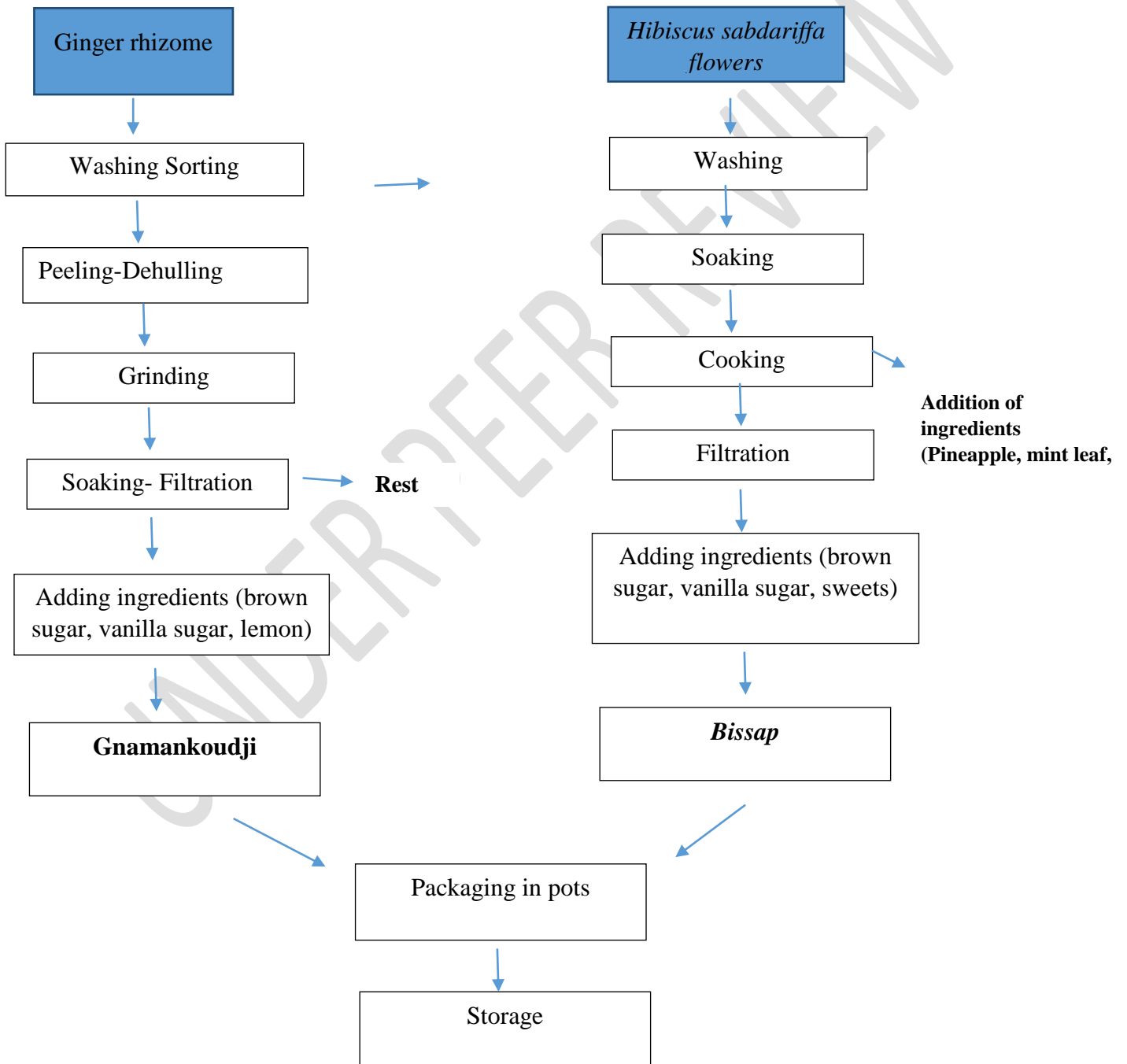


Figure 6 : *Bissap* and *Gnamankoudji* manufacturing diagram

Obtaining the drinks required a succession of the following steps :

- Triage : This is the operation in which all foreign bodies are removed from the flowers and rhizomes destined for processing. This operation is done by hand
- Washing : It consists of washing the selected ginger rhizomes
- Dissections : This is the operation that consists of removing the pulp from the ginger rhizomes and are finally cut and then crushed
- Grinding : The rhizomes of ginger are reduced to a paste-like substance using a machine (grinder)
- Baking : This operation consists of bringing the water to a boil, then stir in dried flowers of *Hibiscus sabdariffa* and let it infuse
- Ginger filtration : It is an operation that consists of making the drink obtained clear and its decanting to obtain a clearer drink without starch, the filtration is done with the help of a strainer
- Bissap filtration : It is made to separate the drink from its debris. This operation is done from a strainer
- Adding ingredients to drinks
- Homogeneous mixture of *Bissap* and *Gnamankoudji*

3.2.Characteristics of the consumption of artisanal drinks

- Consumer profile

The survey revealed that the consumption of *Gnamankoudji* and *Bissap* drinks was dominated by men (55.6% and 55.4%) compared to (44.6% and 44.4%) for women (Figure 7). Consumers aged 20 to 30 represent the most consuming age group (55%) (Figure 8). Regarding the level of education, the vast majority of consumers were illiterate (59%), a proportion of (31%) had higher education and secondary education (10%) (Figure 9). The majority of consumers were made up of traders (51%), pupils (17%), civil servants (15%), students (11%) (Figure 10). Additionally, the data revealed that consumers were single (68%; 67%), married (5%), and others in relationships (27%; 28%) (Figure 11). The ethnic group of the region (Krou) represented the ethnicity of the majority of consumers (29.1%; 29%) followed by the Akan (27.1%; 27.2%), the Gour (21.8%; 21.7%), the Mandé (20.6%; 20.8%) and 1.4% for the others (Guinean, Burkinabe) (Figure 12).

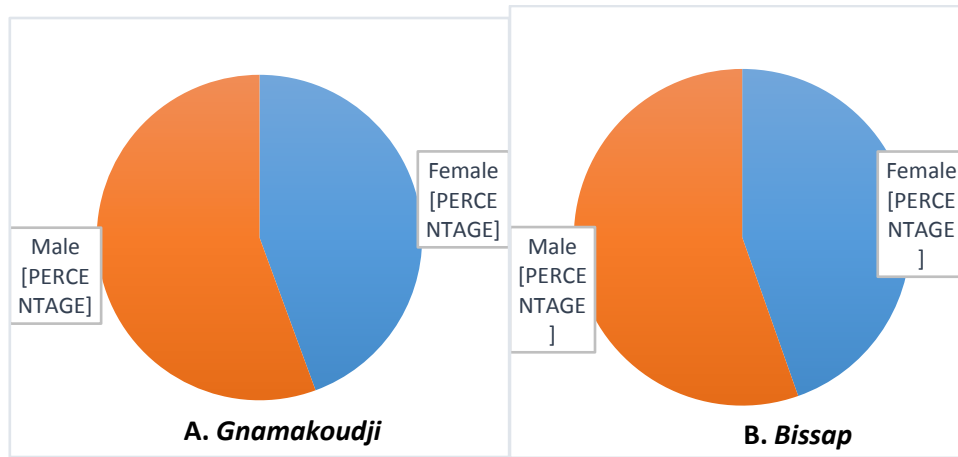


Figure 7: Distribution of consumers according to gender

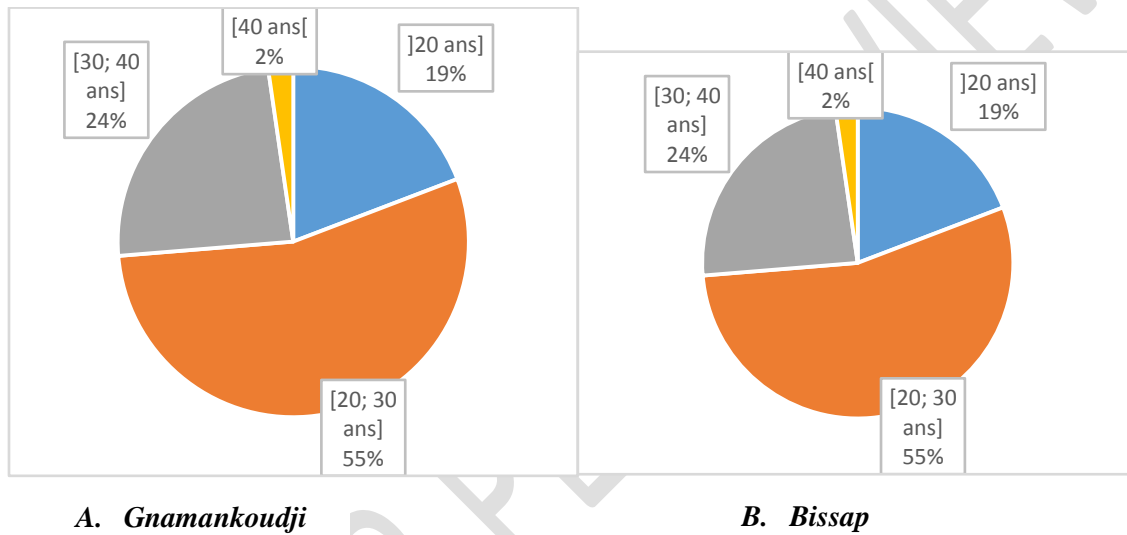


Figure 8: Distribution of consumers according to age

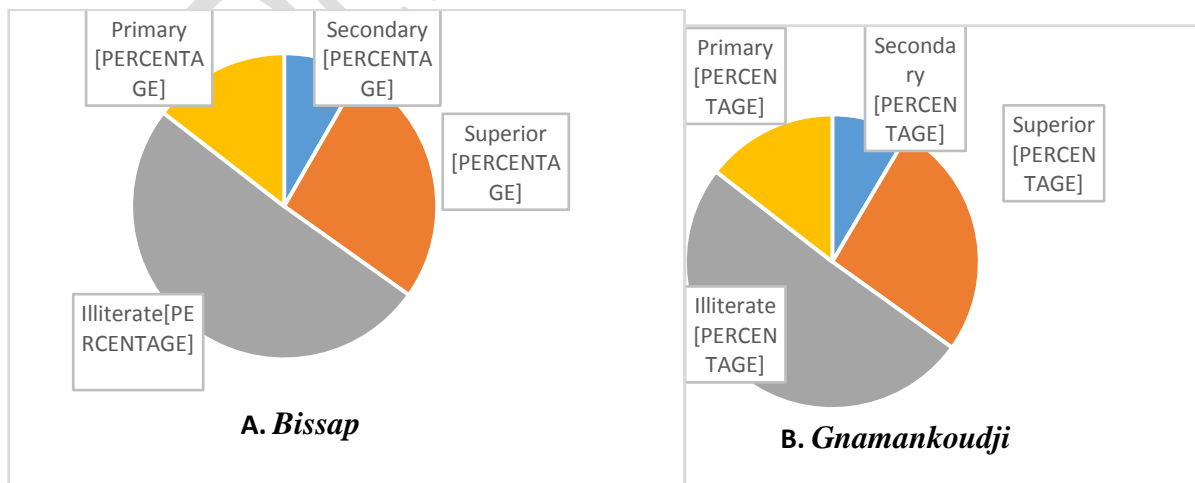


Figure 9: Distribution of consumers according to level of study

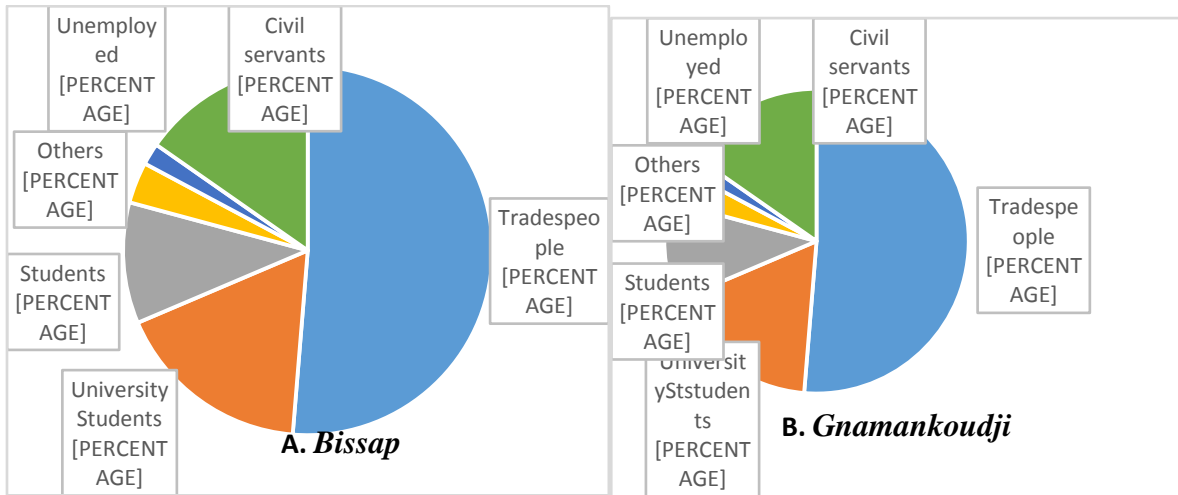


Figure 10: Distribution of consumers according to profession

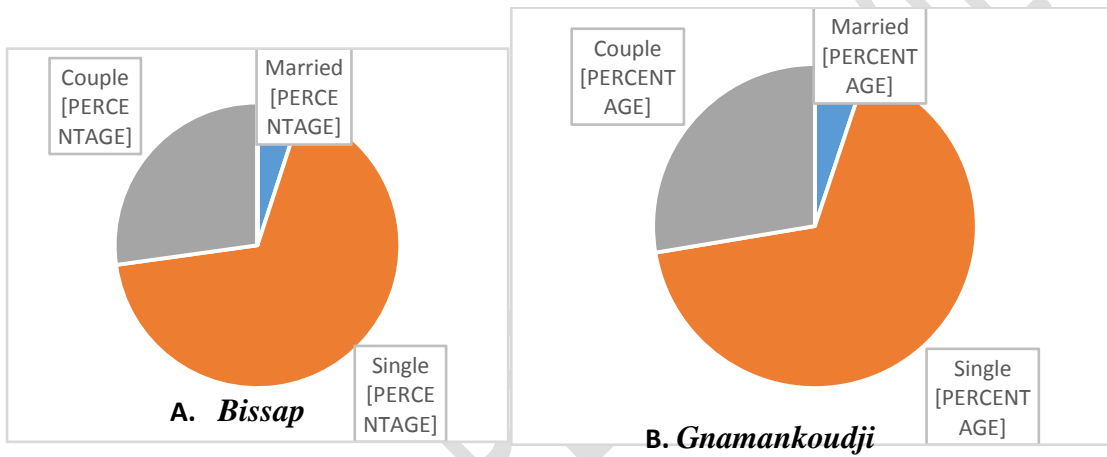


Figure 11: Distribution of consumers according to marital status

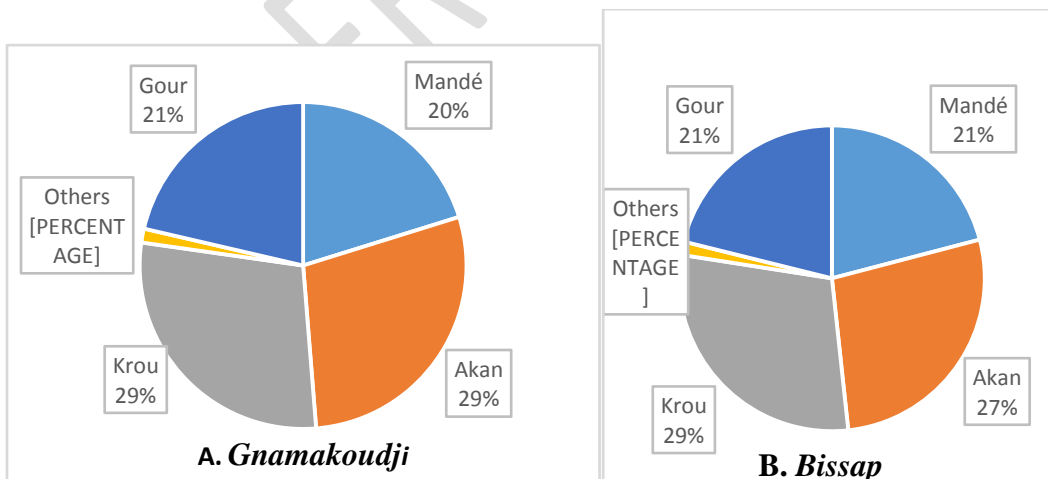
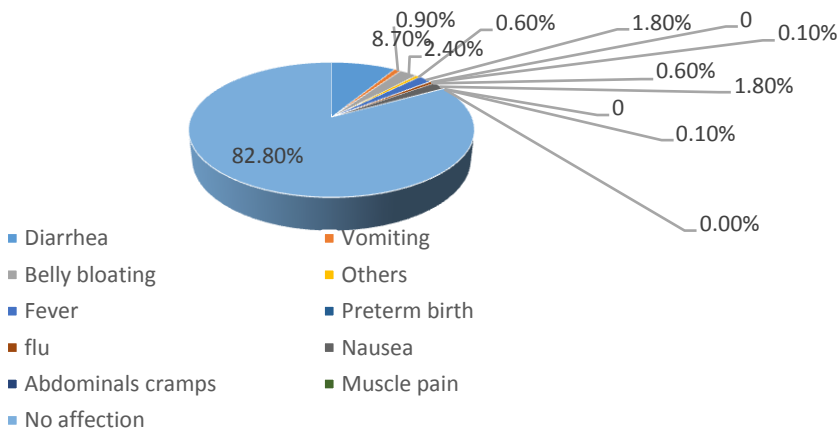


Figure 12: Distribution of consumers according to ethnic group

- **Main conditions encountered after consumption**

According to consumers, the main ailments encountered following the consumption of artisanal drinks were diarrhea (8.3%; 8.7%), stomach bloating (2.8%; 2.4%), fever (2.30% ; 1.8%), nausea (1.9%; 1.8%), vomiting (1%; 0.9%), flu (0.9%; 0.6%) (Figure 13). However, the consumption of Bissap caused slightly more illnesses (18.3%; 17.3%) (Figure 14). The conditions were more common among women (17.90%; 20.10%) compared to (16.90%; 16.60%) (Figure 15). Younger consumers (under 20 years old) presented more conditions than older people (40 years old) (Figure 16). The conditions were more common among uneducated people than among those with a high level of education (Figure 17).



A. Gnamankoudji

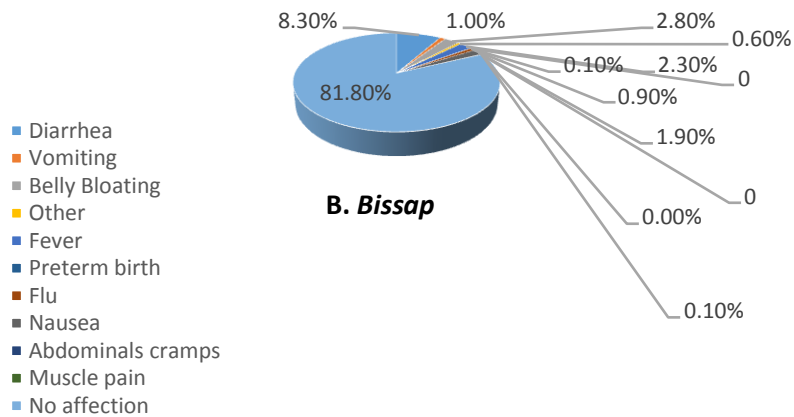


Figure 13 : Conditions observed after consumption

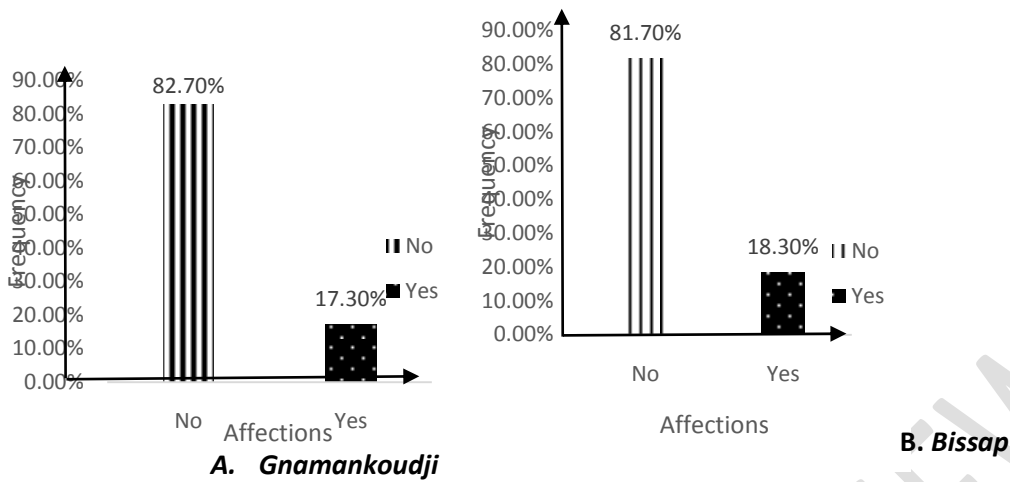


Figure 14: Frequency of consumers having experienced discomfort after consumption

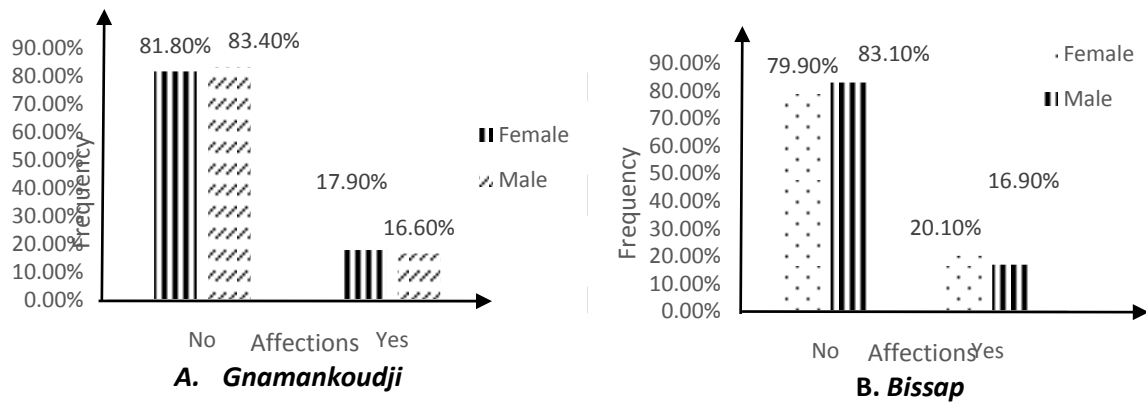
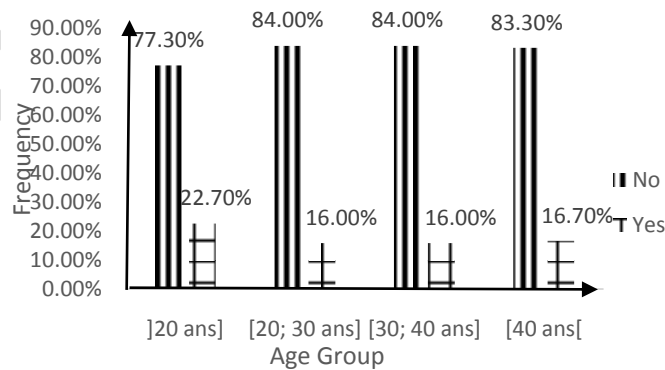


Figure 15: Appearance or not of discomfort depending on sex



A. Gnamankoudji

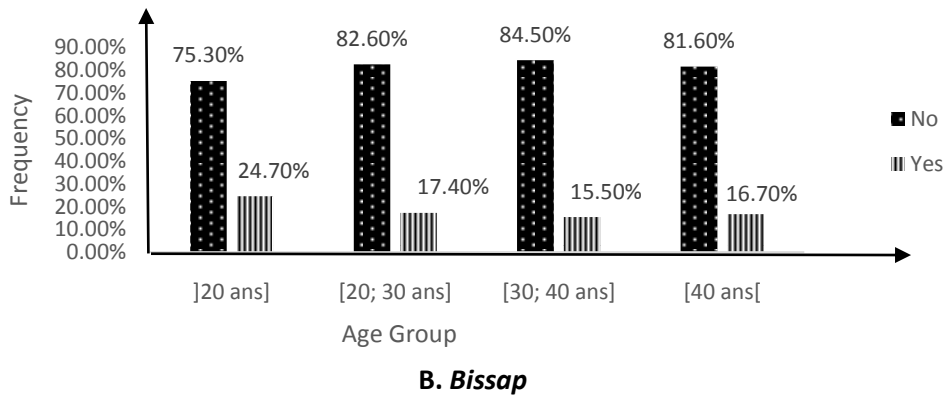


Figure 16: Appearance or not of conditions depending on the age group

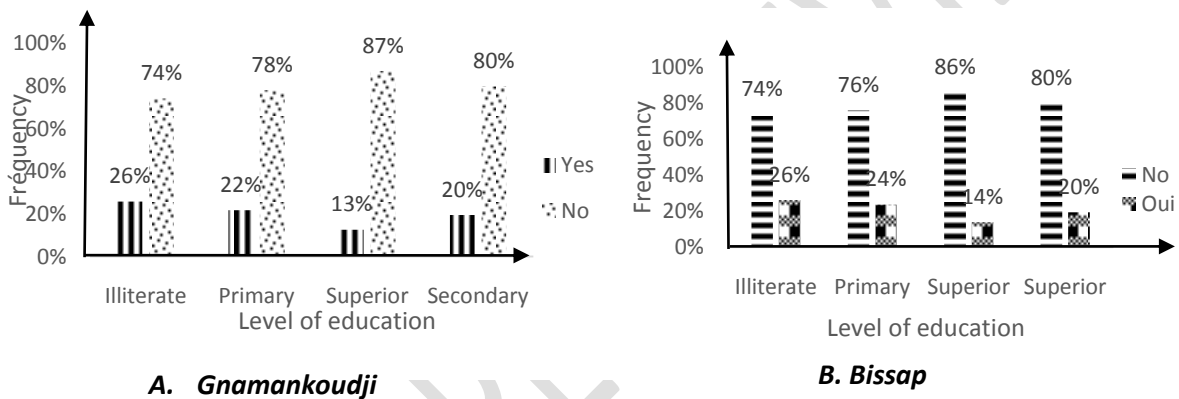


Figure 17: Appearance or not according to the level of study

4. Discussion

Artisanal drinks (*Bissap* and *Gnamankoudji*) sold in the Daloa department are increasingly consumed by the population. All the people interviewed (780) know *Bissap* and *Gnamankoudji* and consume them regularly. They consume them at least once a day. Furthermore, 18.3% and 17.3% of people consuming *Bissap* and *Gnamankoudji* respectively had illnesses following the consumption of these drinks. These conditions, generally characterized by diarrhea, stomach bloating, fevers and nausea, are attributed to the ingestion of uncooked or poorly preserved food or that has been subject to defective handling, as is the case with the artisanal drinks studied. . These results are in agreement with those of Farthing who established a link between the appearance of discomfort and the ingestion of drinks [13]. Artisanal drinks are more consumed by students and traders in the Daloa department. These results corroborate those of Daniel who highlighted a strong link between food consumption and occupation of the populations of Ouagadougou (Burkina Faso) [14].

The majority of producers were not in a satisfactory hygienic state. In fact, more than half of the beverage production sites were in an unsanitary state. Also, the producers carried out a simple washing of the raw materials, no disinfection operation was undertaken. This could increase the risk of contamination by microorganisms, particularly pathogens in these drinks. Some work has indicated that poor hygiene would add contaminants to drinks [15]. The hygienic conditions of the points of sale have also been described [16]. The prolonged storage of drinks, the lack of use of appropriate disinfectants, the lack of sterilization of containers and the unhygienic environment all contribute to these discomforts encountered among consumers [10]. The majority of producers were illiterate. According to studies by Somda and his colleagues, the ignorance of actors in the informal food sector represents a risk factor; source of foodborne illnesses [17].

In addition, the hygienic condition of mechanical grinders in community markets used for grinding ginger was not under control. In addition, the multiplicity of products crushed by these machines could be considered as a major risk factor for consumers. Also, the beverage extraction operation is commonly carried out with bare hands by producers. As hands are not always clean, this could increase health risks. It should be noted, however, that the drinks obtained were always packaged in already used or recycled pots; which does not guarantee their hygienic quality. In addition, the processing techniques currently used are traditional and do not make it possible to present a quality product on the market. Manufacturing processes greatly influence the quality of craft drinks [3]. Furthermore, in a study on food packaging, recycled packaging is strongly discouraged because it constitutes a source of food contamination.

5. Conclusion

This study made it possible to diagnose the production of artisanal drinks in the Daloa department, and to identify the main conditions linked to their consumption. The main unit operations of *Gnamankoudji* are washing of ginger rhizomes, grinding, soaking, filtration and addition of ingredients. *Bissap* are washing of *Hibiscus sabdariffa* flowers, decoction, filtration and addition of ingredients. The production process for these drinks is traditionally rudimentary and production conditions do not respect hygiene rules. The main conditions encountered after their consumption are diarrhea, stomach bloating, fever, nausea and vomiting. The consumption of these drinks therefore represents a danger for the health of consumers. It is therefore imperative to initiate corrective actions to remedy the problems

identified, promote responsible production practices that respect quality and safety standards, in order to preserve public health.

6. References

1. Chauliac M, Bricas N, Ategbro E, Amoussa HW, Zohoun I. Food outside the home of schools in Cotonou (Benin). *Health Notebook*. 1998; 8:101-108.2.
2. Kouassi KC, Voko BI Don-Rodrigue R, Koffi A. Microbial contamination of the non-alcoholic beverage Gnamakoudji made from *Zingiber officinale* in Daloa, Ivory Coast.2018b;p. 857-865 *African Journal of Microbiology Research*.
3. Bayoï JR, Darman R, Justine M, Daoudou B, Josiane S, Barak N, Guy T, Rodrigue TS, Jean JE, Francois-Xavier E. Influence of the manufacturing process on the microbiological quality of “folere” juice (*hibiscus sabdariffa*) sold in three cities in Cameroon: Maroua, Mokolo and Mora. 2014. *International Journal of Innovation and Applied Studies*.
4. Koffi CA, Kouassi KC, Nimaga D, Koffi-Nevry R. Evaluation of microbiological and physico-chemical parameters of juices sold in the streets of the city of Man (Ivory Coast): Case of *Zingiber officinale* and *Hibiscus sabdariffa*. 2022; 22(11): 77-80. *Journal of Advances in Microbiology*
5. Mpondo EM, Vandi D, Ngouondjou T, Foze Patrice BM, Enyegue EM, Dibong SD. Contribution of the populations of the villages of central Cameroon to traditional treatments of respiratory tract conditions. 2017; 32(3):5223-5242. *Journal of Animal and Plant Sciences*.
6. Kouassi KC, Coulibaly IB, Konaté I. Diagnosis and characteristics of street food consumption in a city with a high population Growth: Case of Daloa (Côte d'Ivoire).2018a; 2319-7064. *International journal of science and research*.
7. Gagara M. Evaluation of the quality of local drinks sold on the public roads of Cotonou and Abomey-Calavi. Master's Thesis in Standards and Quality Control of Agro-food Products, Ecole Polytechnique d'Abomey-Calavi; 2010.
8. Folefack DP, Njomaha C, Djoulde DR. “Diagnosis of the production and marketing system for Guinea sorrel juice in the town of Maroua, *Tropicultura*”.2008; 26(4), pp. 211-215.

9. FAO. Food packaging solutions adapted to developing countries. Rome; 2014. www.fao.org/3/a-i3684e.pdf
10. Lewis JE, Thompson P, Rao BV, Kalavati C, Rajanna B. Human bacteria in street vended fruit juices: A case study of Visakhapatnam City, India. 2006; 8:35-38. Internet Journal of Food Safety.
11. WHO. Basic measures to improve the safety of food sold on public roads; 2010. Information note INFOS AN No. 3/2010, 6 p.
13. Farthing MJG. Diarrhea: a significant worldwide problem. 2000;14:65-69 International Journal of antimicrobial agents.
16. Barro N, Evaluation of the microbiological quality of some street foods in the city of Ouagadougou in Burkina Faso. 2002; 12(4): 369-374. French-speaking/Health Study and Research Notebook.
17. Somda NS, Bonkougou OJ, Zongo C, Kagambèga A, Bassolé IH, Traoré Y, Savadogo A. Safety of ready- to- eat chicken in Burkina Faso: Microbiological quality, antibiotic resistance, and virulence genes in Escherichia coli isolated from chicken samples of Ouagadougou. 2018; 1077- 1084. Food Science and Nutrition.

CONSUMPTIONSURVEY

I- DRINK CONSUMER PROFILE

Neighborhood.....

Site.....

Sex : Female Male

Age group

[10- 20 ans] [20- 30 ans] [30- 40 ans] [40 ans ; [

Level of education

Illiterate Primary Secondary Superior

Profession : Student University students Official Commerçant Unemployed Others
If other, specify.....

Marital status : Married Single couple Others

If other, specify

Ethnic Group : Mandé Krou Gour Akan Other

If other, specify

II- CONSUMPTION OF DRINKS

Do you regularly consume the drink ? Yes No

Si yes, what is your frequency of consumption?

Once/week Twice/ Week Three times/week each day

Other If other, specify

Where do you source this drink?

Itself Supermarket To an individual Street vendors

Do you find hygienic the place of sale ?

YesNo

III- RISKS ASSOCIATED WITH THE CONSUMPTION OF DRINKS

Have you ever had a condition after consumption?

Yes No

If yes, what were the symptoms ? Fever Vomiting Diarrhea Belly bloating
Preterm birth If other, specify

How long the condition lasted ?

1 day A few days Weeks Other

If other, specify

The condition required hospitalization? Yes No

If so, how many days did the hospital stay last ?

1 day A few days Week Weeks

Other If other, specify

PRODUCTION SURVEY

Neighborhood.....

Site.....

Sex : Female Male

Age group : [10- 15 ans] [15- 25 ans] [25- 35 ans] [35 ans ; [

Level of education : Illiterate Primary Secondary Superior

Which containers do you use? Plastic containers Other

If other, specify.....

If you use the plastic, is that there is a sterilization? Yes No

If not, what other treatments do you use?

.....

How do you get the drink from the *Hibiscus sabdariffa* flowers or ginger flowers?

.....
.....
.....

Add other ingredients to obtain the drink?

Yes No

If yes, specify.....

Do you use preservatives ?

Specify.....
.....

How do you homogenize the drink?

Hands Others

If others, specify.....

How do you proceed with the sale?

It self Delivery Wholesale Other

Specify.....

If you yourself, how do you store the drink?.....

States of marketing.....