

## Assessment of the quality and safety of food products in Libreville

Solange Kiki-Mvouaka <sup>1,\*</sup>, Florence Gheloube <sup>2</sup> and Kowir Pambo Bellow <sup>3</sup>

<sup>1</sup> Department of Life and Earth Sciences, Superior Normal School, Libreville, Gabon.

<sup>2</sup> Department of Educational Sciences, Superior Normal School, Libreville, Gabon.

<sup>3</sup> Department of Science and Mathematics, Superior Normal School, Libreville, Gabon.

International Journal of Science and Technology Research Archive, 2022, 03(02), 172–178

Publication history: Received on 17 October 2022; revised on 05 December 2022; accepted on 08 December 2022

Article DOI: <https://doi.org/10.53771/ijstra.2022.3.2.0152>

### Abstract

In Africa and Gabon particularly, rampant urbanization, the increase in female professional activity, the break-up of the classic family model have induced new eating behaviors and consumption patterns. The development of the cold chain promotes the reduction of food losses, the conformity of products to quality requirements, market safety and the improvement of production. The cold chain is therefore an essential factor in food safety. In Gabon, national consumption needs are more or less covered by local production with regard to plantain, cassava, taro, yam and fish products. The coverage rate is zero for rice, wheat, fruit ballast, quite low for vegetables, meat and poultry. So much so that it is common to hear people say in Libreville: "I am going to buy the embalmed, how are we going to do it again?". FAO 2008 defines food security as a state where "all human beings have, at all times, physical and economic access to sufficient, safe and nutritious food, enabling them to satisfy their energy needs and food preferences to carry out a healthy and active life »

Our non-stratified sample includes teachers and ATOS staff from the ENS Libreville campus. A total of 100 questionnaires are distributed, only 88 are collected for the study. The survey conducted within the premises of the Superior Normal School of Libreville is not statistically representative of the whole country. The limitations of the study are related to its geographical coverage. The approach is based on the place of purchase and the type of purchase.

This study shows that respondents determine the quality of what they buy by the eyes, the color, the smell and the place of purchase. As places of purchase they prefer supermarkets (Mbolo, CKDO). Many of them believe that the authorities do not pay enough attention to the quality of food. The objective of this work is to understand the processes that populations bring into play in the development of food quality.

**Keywords:** Appreciation, Sanitary quality; Food products; Embalmed; Cold chain

### 1 Introduction

Gabon, located in the Gulf of Guinea and straddling the equator, is still dependent on foreign countries for its food supplies and spends nearly 300 billion CFA francs each year on imports. In 2013, the estimated population of 1,811,079 inhabitants grew at an annual rate of 2.9%. Mostly urban, it is made up of 87% young people, more than half are under 22 and the average age is 26 (Lefort L, 2015). This 70% population is concentrated on 1.1% of the national territory and 40% in Libreville in particular (PNSAN, 2017).

The level of income and the evolution of food habits linked to this urbanization have resulted in a considerable increase in imports of cereals, fruits, vegetables, meat, dairy products to the detriment of locally produced tubers. Relegated for

\* Corresponding author: Solange Kiki-Mvouaka  
Department of Life and Earth Sciences, Superior Normal School, Libreville, Gabon.

a long time behind sectors such as oil (31.6% of GDP in 2015), mining (10.4% of GDP in 2014) for manganese and (9.2% of GDP in 2014) for wood, Gabonese agriculture contributed 5.6% to GDP in 2013, PSAN, 2017p. Today it is a question of making agriculture a lever of the economy which would lead to the development of the territories or provinces. Indeed, with reference to the Operational Plan of Green Gabon, the Ministry in charge of Agriculture has developed the strategy for the revival of the agricultural economy 2016-2023 which aims, with the development of agriculture, to improve food security, food self-sufficiency and to drastically reduce food imports by 75% (PSAN, 2017). Gabonese subsistence agriculture, essentially geared towards self-sufficiency, cannot feed all of its inhabitants. To meet growing food demand in urban centres, the country must rely heavily on food imports (60% of food consumption is imported, World Trade Organization, 2013b). It can be considered that national consumption needs are mainly covered by local production with regard to plantain, cassava, taro, yam and fish products. The coverage rate is quite low for fruits, meats, vegetables or zero for rice and wheat. (2017 Economic Recovery Plan).

According to FAO 2008, food security is a situation that guarantees a population at all times access to sufficient food, both qualitatively and quantitatively. This food must be sufficient to ensure a healthy and active life, taking into account dietary habits. Food and nutritional security is analyzed on four axes: availability, stability, accessibility and use of food resources. Availability is linked to demography, arable land, domestic production, productivity; capacity, import, storage, and food aid. Public policies, climate forecasts, purchasing power, price fluctuations, available infrastructure, condition access. Processing processes, transportation, food hygiene and access to water determine food safety and quality. In sub-Saharan Africa and Gabon in particular, the vast majority of food and local products are sold in informal markets or wet markets. These markets escape health and safety controls (Roesel and Grace 2016). The formal sector is supposed to provide controlled healthy foods that can be consumed without concern. In the formal sector products are properly canned in large refrigerators or bottled, labeled with a best before date, stored in a clean and shiny environment. However in Libreville, it is common to hear consumers say: "I am going to buy the embalmed ones, we are still going to do how". Food should be a source of health, yet throughout the world food can injure, cripple and kill. Indeed the 2011 seed report indicates the cases of UK with *Campylobacter* bacter, USA with Norovirus, China in 2008 with and Germany melamine scandal in 2011 where food products posed a serious risk to public health. Quality assessment is the assessment of whether a product is good or bad. The quality assessment determines the risk assessment. In animal health, there are two ways of using and approaching risk assessment. The risk assessment can, on the one hand, be used in the context of each import of animals or products of animal origin, to enable a country to assess the risk relating to these imports. On the other hand, it can be used as a tool for understanding the mechanisms leading to the appearance of an adverse event (Toma B, 2000, Olive M-M, 2007). The quality of a product is defined by the approach of representations of the principles of consumer choice. These representations are evaluated according to their utility/demand and their production/supply costs (Stanziani, 2008). This risk assessment is based on scientific knowledge and involves several steps.

What are the strategies put in place by the populations to circumvent the situation of these so-called "embalmed" products? By using field surveys as an investigative tool, we try to identify the indicators put in place by the populations to assess the quality of food. Being in the context of African agrarian systems, the question of food risk is part of the broader issue of sustainable development and the fight against poverty (Mathieu, 1998) but also of public health. The results of our work fall within the framework of the strengthening of education programs for sustainable development.

---

## 2 Material and methods

### 2.1 Materials

A pre-survey carried out with teachers and ATOS staff made it possible to construct a questionnaire based on the information collected. A total of 100 questionnaires were distributed to randomly selected individuals. Only 88 individuals were collected for the study. The investigation was conducted within the premises of the Ecole Normale de Libreville. This study is therefore not statistically representative of the whole country. The limitations of the study are related to its geographical coverage. The approach is based on the place of purchase and the type of purchase.

### 2.2 Methodology

The counting was done according to the items of the questionnaires and the results analyzed by the software sphinx (plus). Even if the  $X^2$  was calculated with numbers below 5 in certain groups, it gives us interesting results. The comparisons do not take into account the different age groups.

### 3 Results and discussion

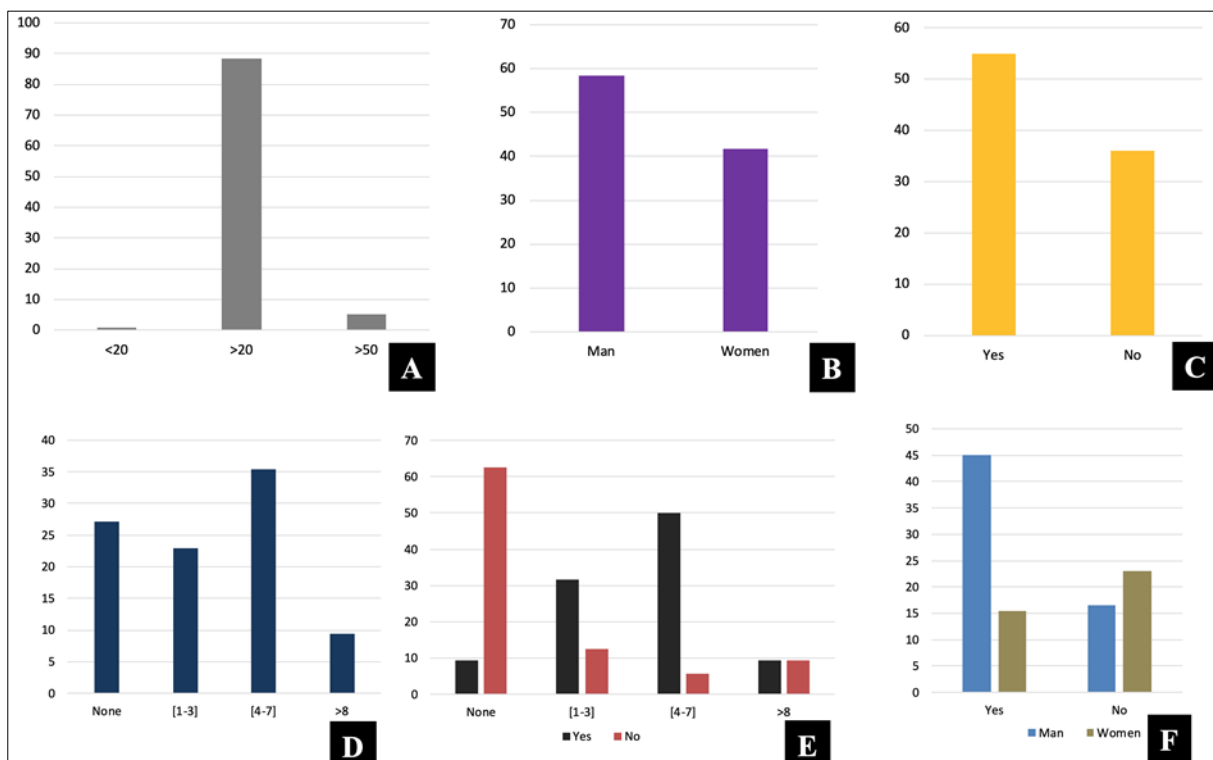
#### 3.1 Presentation of the study area

This study was conducted in Libreville. The food consumption of the Gabonese concerning his daily ration consists of more than 66% of calories and more than 73% of imported proteins. Cameroon is the main supplier for food, Brazil for poultry offal, Asia for rice (Monteillet, 2017). The lack of investment in the improvement of varieties or cropping systems, the aging of the agricultural population have had adverse consequences on rural productivity. The urban populations of Libreville and major cities of Gabon are very vulnerable to the international market. Due to the country's heavy dependence on food imports, the risks of supply disruption and food and nutrition insecurity in Gabon are high. In this city the street food sector thrives flexibly in areas of high economic activity and high population concentration.

#### 3.2 Socio-economic characteristics of respondents

##### 3.2.1 Consumer characteristics

The surveyed population is made up of 1% under 20, 85.5% over 20 and 5.2% over 50 (Figure 1A). Men are more numerous in this sample, i.e. 58.3% against 41.7% for women (Figure 1B). Family responsibility is ensured by 57.3% of respondents against 37.5% (Figure 1C). The difference with the reference distribution is significant.  $\chi^2=3.97$ ,  $dof=1$ ,  $1-p=95.36\%$ . The  $\chi^2$  is calculated with equal theoretical numbers for each modality. The sum of the percentages is less than 100% due to deletions. We note that 57.3% people say they are heads of families, against 37.5%. This difference is significant.  $X^2=3.97$ ,  $dof=1$ ,  $1-p=95.36\%$ .



A)- Age (in years); B)- Sex; C)- Family responsibility; D)-Number of people housed; E)-Link between family responsibility and the number of people housed; F)-Link between family responsibility and gender

**Figure 1** Socio-economic characteristics of respondents

The analysis of the results indicates that 30 or 31.3% of respondents have lived in Libreville since birth, 21 or 21.9% for five (5) years and 35 or 36.5% for more than ten (10) years. The number of individuals in the three groups does not differ significantly  $X^2 = 3.51$ ,  $ddl = 2$ ,  $1-p = 82.72\%$ . The difference with the reference distribution is very significant.  $\chi^2=7.86$ ,  $dof=1$ ,  $1-p=99.49\%$ . The  $\chi^2$  is calculated with equal theoretical numbers for each modality. The sum of the percentages is less than 4100% due to non-responses. Only 17% of this population owns a personal vehicle while 74% use public transport. The difference with the reference distribution is very significant.  $\chi^2 = 35.70$ ,  $dof = 1$ ,  $1-p =$

>99.99%. The chi2 is calculated with equal theoretical numbers for each modality. The sum of the percentages is less than 100% due to deletions.

### 3.2.2 Characteristics of consumers and dependents

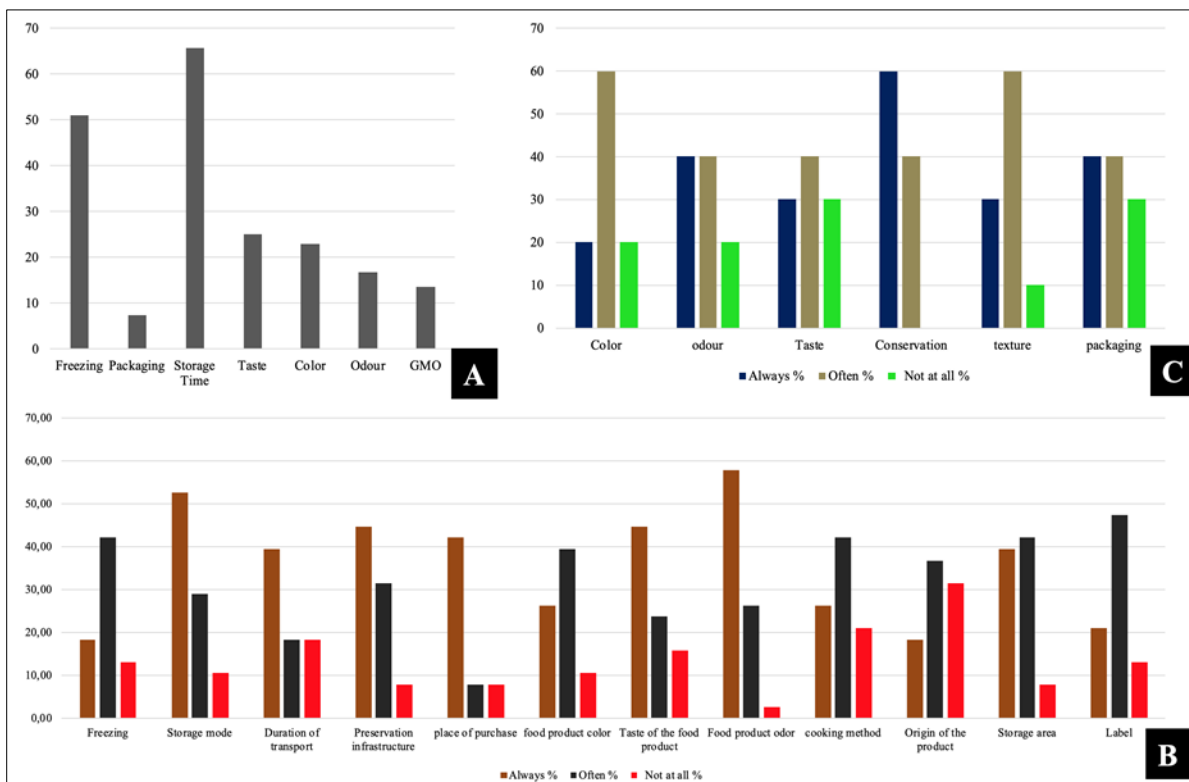
We note that 9.4% say they house more than 8 people, 35.4% of respondents house 4 to 7 people, 22.9% house 1 to 3 people while 27.1% say they do not house any person (Figure 1D). However, the majority of people, 62.8%, say they are heads of household, compared to 37.2% (Figure 1E). In this majority 31.4% say they have 4 to 7 dependents. The chi2 indicates a significant difference  $X^2 = 28.94$ ,  $dof = 3$ ,  $1-p = >99.99\%$ . With regard to the intersection of the sex and head of household variables, the result indicates that 45.1% of men claim to be head of household, 15.4% of women. Men are mostly heads of households, with a significant  $X^2$ ,  $X^2 = 9.94$   $dof = 1$ ,  $1-p = 99.84\%$ .

The population studied is mainly composed of people aged over 20 years. There are almost as many men (58.3%) as women (41.7%) (Figure 1F). The difference is significant between people who say they have a load (57.3%) and those who say they do not have one 37.5%,  $X^2 = 3.97$ ,  $ddl = 1$ ,  $1-p = 95.36\%$ , Significantly, men are heads of households. The fact of having grouped the men and the women makes it possible to obtain significant results. Although men are significantly heads of households, women are too. Whatever the duration, they are in the majority head of the family. Although in Libreville there is more than half of the population, these results cannot be transposed to the scale of the Gabonese population.

### 3.3 Criterion for determining a healthy food

#### 3.3.1 Different types of operators

The difference with the reference distribution is very significant.  $chi^2 = 91.20$ ,  $dof = 7$ ,  $1-p = >99.99\%$ . The chi2 is calculated with equal theoretical frequencies for each modality.



A)- Elements representing the quality of a food; B)- Scale representing the quality of a food; C)- Scale of the mode of designation of an embalmed food

**Figure 2** Different types of operators

According to the respondents, the food loses its healthy character in order of importance, because of the freezing time, the freezing and the taste, etc. Freezing would imply the loss of sought-after qualities such as freshness and taste quality (Grace et al., 2016). Freezing can indeed create damage in the cells of foods such as meats. With freezing, the flesh is

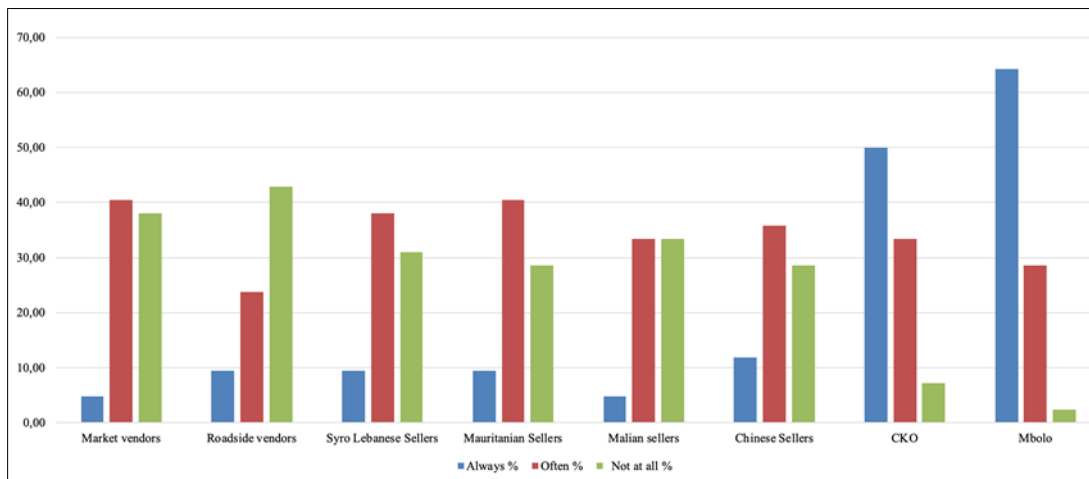
destructured and the natural emulsifying properties of food are reduced. On thawing, this results in a flabby or soft type appearance. At the biochemical level, freezing causes oxidation of fats in high-fat foods; oxidation all the more marked as the storage period is long. Freezing also has an effect on the color of food due to the oxidation of pigments and in particular myoglobin in meat (Figure 2A). Protein denaturation, which leads to the appearance of a bitter taste and grayer meats (Cluzelle *et al.*, 2013).

The scale of representations of a healthy food makes it possible to confirm the representations of the respondents. Representations are the result of processing information received or captured during registration (Churchland, 1989); by making a synthesis (Edelman, 1999; Foster, 2001) for the elaboration of an internal response to a stimulus, in the cognitive process. The representations thus make it possible to organize the information accumulated during the registration and coming from various sources. This accumulation, which sometimes occurs unconsciously, becomes "knowledge" once this information is classified and reaches "consciousness" (Meunier, 2002) (Figure 2B).

Respondents or consumers say they determine the quality of what they buy with the help of their senses. Among the senses the eyes, smell and touch are the most solicited senses for this sensory analysis. This analysis shows that food products are no longer just considered uncertain, they are also the subject of controversy in increasingly open public spaces. Here the term "embalmed" refers to the duration and mode of conservation. It clearly alludes to the cold chain. Keeping refrigerated foods at a low temperature makes it possible on the one hand to slow down the growth of micro-organisms and thus limit the occurrence of food poisoning, and on the other hand to preserve the nutritional and organoleptic qualities of foods. The effectiveness of this cold chain will depend on the level of the refrigeration temperature but also on the maintenance of this refrigeration. However, the electricity supply in Libreville causes some problems (Figure 2C).

### 3.3.2 Food safety in grocery stores, informal markets and hypermarkets in Libreville

In these places, there are large stocks of food products of dubious traceability. Here the major concern is food preservation. As a general rule, certain conditions are required so that the products marketed are delivered to customers in the best possible conditions. However, the observation is that hygiene conditions are not always appropriate in certain places of commerce (the authorities use visual clues to attract the attention of consumers).



**Figure 3** Scale of the mode of designation of operators who guarantee quality

If in some way the cold chain seems to be respected in the supermarkets visited. It is not the same in grocery stores where you can still see dirt, dust or rust on some displays. In the neighborhood commercial surfaces and in the markets the situation is worse, we are witnessing a deplorable spectacle. Flies, cockroaches and filth rub shoulders with fish, meat and vegetables. It is not uncommon to observe a freezer that is dripping, not far away, these are torn packaging that expose products such as chicken, cotis or kidneys. At first glance, we see that the texture of the food is far from normal. Other violations of food storage regulations can add to this dark picture. In Gabon, the last link in the distribution chain are stalls and shops in small markets and neighborhoods. The situation there is dramatic. Some shopkeepers don't understand why they would go to such trouble to regularly clean the freezer where they store chicken, or even why they shouldn't unplug his freezer whenever he wants.

### 3.3.3 *Role of government in food control*

The Gabonese Food Security Agency (AGASA) is trying to take action to bring distribution players to comply with standards. This is how it launched a health control campaign at the end of which smileys were displayed on the signs and entrances to supermarkets which respect the conditions of hygiene and food preservation. Commendable actions, but which are far from sufficient. The same is true of the General Directorate for Competition and Consumption (DGCC) which, thanks to Order No. 426/MEFBP/DGCC, sets the conditions for the transport and storage of products and foodstuffs. Following these field visits, the DGCC “finds that” there are cold rooms where the temperatures are not respected. Which is problematic. For other products, the use-by dates have been modified to extend them” (Gabonew, 2019). In the case of meat, we can note the significant influence of temperature on the percentage of frozen water and water activity (Agoulon, 2012). Despite these actions by the public authorities, the consumer remains skeptical about the action of the authority and develops his own control mechanisms.

---

## 4 Conclusion

In conclusion, this study on the assessment of the quality and safety of food products in Libreville shows the importance of the quality of the cold chain and storage operations on their organoleptic properties of foodstuffs. For freezing to continue to serve the interests of consumers who are increasingly demanding in terms of product quality, it is necessary to better educate and control operators on the basics of this process. The impact of freezing on sensitive foods such as meat, fruits and vegetables or even seafood is enormous. Frozen food is not stable from all points of view. It is not "fragrant" either, because if its microbiological stability is acquired, it always remains the site of physical and biochemical reactions likely to compromise its organoleptic qualities in the long term.

---

## Compliance with ethical standards

### *Acknowledgments*

We would like to thank the Service Edition Publication for correcting and proofreading this document.

### *Disclosure of conflict of interest*

The authors have no conflicts of interest to declare.

### *Statement of informed consent*

Informed consent was obtained from all individual participants included in the study.

### *Funding*

This work has not received any specific subsidy from the public, commercial or non-profit funding organizations.

---

## References

- [1] Agoulon A, 2012 Impact of freezing parameters on the characteristics of foodstuffs, Air Products and Chemicals, Inc.
- [2] Blecker C, 2003; sensory analysis <https://orbi.uliege.be/bitstream/2268/63541/1/Cours%202003.do> consulted on February 3, 2017
- [3] Bonert G. 1996: Importance of psychrotrophic bacteria in food hygiene *Revue Méd. Vet.*, 2000, 151, 11, 1003-1010
- [4] Churchland.;PM, 1989. On the Nature of Theories: A Neurocomputational Perspective. *Minnesota Studies in the Philosophy of Science* 14:59-101.
- [5] Divard R, Urien B, 2001: The consumer lives in a world in color *Research and Applications in Marketing*, Vol. 16, No. 1., 3-24
- [6] Duesne A. 1996: Bacterial stress; consequences on the effectiveness of heat treatments. 1st part: adaptation system of microorganisms. *Bull. CTSCCV binding* 6, 1, 3-6.
- [7] Esoh Elamé Local Agenda 21 and political representation of immigrant populations in Italy: issues and perspectives <https://www.unil.ch/files/live/sites/ouvdd/>

- [8] Esoh Elame, 2011 Tools to decolonize sustainable development <http://www.duralpes.com/quels-outils-pour-decoloniser-le-developpement-durable>
- [9] Etiévant PVE, Gros V., Feillet P, 2010. Food: the different facets of quality in Chemistry and food <https://doi.org/10.1051/978-2-7598-0917-2-005>
- [10] FAO, 2008. An introduction to the basic concepts of food security
- [11] Foster D, 2001. Representation and recognition in vision Brain, Volume 124, Issue 5, Pages 1055–1056,
- [12] FAO (2008): Introduction to food security concepts: <http://www.fao.org/docrep/013/al936f/al936f00.pdf>
- [13] FAOSTAT, 2004: Food safety system, Ministry of Agriculture and Fisheries France
- [14] Gabonews 2019, <http://www.gabonews.com/fr/actus/economie/article/gabon-la-dgcc-en-guerre-contre-les-commerçants> Accessed July 24, 2019
- [15] Imazakii P., tahirii A, Taminiau B., Nezer C., Daube G., Clinquart A. 2012: Bacterial diversity and its evolution during the preservation of fresh beef from different origins vacuum-packed Renc. Search Ruminants, 19 p 254
- [16] MacLeod, Sauvageot. F. 1986. Neurophysiological bases of the sensory evaluation of food products. Notebooks ENS.BANA, 5, 3-165.
- [17] Miller, JG, 2002. Three types of cognitive representations <https://www.lanci.uqam.ca/wp-content/uploads/2013/10/2002-02.pdf> consulted on 07/24/2019
- [18] Monteillet, N 2017. Out-of-Home Food and Health in the Context of Supply Transformation: The Case of Fang Adolescents and Adults from Libreville Health Sci. Say: Flight 18
- [19] WHO Regional Office for Africa-Brazzaville (2012): Guide for the development and implementation of a national policy and strategic plan for food safety / 2012.
- [20] Report of the Ministry of Agriculture and Livestock of Gabon, responsible for the implementation of the MAEPG seed program (2017): Food and nutritional security policy.
- [21] Report from the French Ministry of Agriculture and Fisheries: food safety: a priority public health issue [www.securitesanitairesaliments.com](http://www.securitesanitairesaliments.com)
- [22] Grain Report 2011: Who benefits from food safety? Corporate profits versus people's health <https://www.who.int/en/news-room/fact-sheets/detail/food-safety>
- [23] AFSSA report, 1999. Animal feed and food safety » [Www.ladocumentationfrancaise.fr/var/storage/rapports-publics/004001815.pdf](http://www.ladocumentationfrancaise.fr/var/storage/rapports-publics/004001815.pdf), consulted on May 12, 2018
- [24] Revel A. 1997, World Food Summit 1996, Rural Economy 238pp. 44-46.
- [25] Roesel, K. & Grace, D. 2016. Food safety and informal markets: animal products in sub-Saharan Africa. Nairobi, Kenya: International Livestock Research Institute.