

Socio-Economic Evaluation and Technological Production of Kom Fermented Corn Dough

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Abstract: *Kom* is a fermented, slightly salty dough produced from steamed corn. Its origin is from Ghana. This paste is produced and sold near streets, in markets and on the highway in rural and urban areas of central and southern Benin. Facing increasingly strong competition, this sector of activity appears as employment sources. Knowledge of this activity sector is necessary, because the production conditions are traditional and not studied. The objective of this study is to highlight the interest of the development of Benin *Kom* production. To achieve this objective, a survey is carried out in Abomey-Calavi and Comè in Atlantic and Littoral departments. The result of these surveys is important. Both women and men are involved in the production of *Kom*, and this in the municipality of Abomey-Calavi, which is not the case in Comè, where only women are involved (100%). These respondents, N = 80, have an age that varies from 18 to 55 years. The majority age group carrying out this activity is 25 to 30 years (40.30%). Only 27.40% exercise only this activity. These producers/sellers are 62.50% educated. Some are beneficiaries of transmission by initial follow-up of this activity (37.50%), while others from personal experience (30.60%) and the rest either by nonpaying apprenticeships (20.8%) or by paying (11.10%). In Abomey-Calavi, more of the respondents who produced *Kom* exercise it through personal experience unlike Comè where transmission is more by initial follow-up. The greatest number (40.30%) of female producers/sellers have a low level of experience ([0-5] years). The ethnic origins of the producers—sellers are diverse in Abomey-Calavi, Adja (17%), Aïzo (3%), Fon (53%), Mina (17%), while in Comè, we can cite Sahoué (13%) and Watchi (67%) and these producers—sellers are 81.60% married. Thus, maize varieties such as *parakou ébli*, *gbado*, *yoyo*, *carder*, *bli*, and *yellow forget-me* are important in the production of *Kom*. The latter varies from 150 to 200 FCFA. This investigation also identified two different technologies for preparing *kom* in these municipalities.

Keywords: *Kom*, Socio-Economic and Technological, Fermented Corn Dough

1. Introduction

The activities of the agricultural sector are dominated by crop production marked by a varied range of food crops. They form the basis of food security and nutritional security in most countries in West Africa. Among these food crops, corn occupies a prominent place because of its nutritional and economic assets [1]. It is involved in many traditional culinary preparations such as pasta, drinks, porridge, pancakes, donuts, and appetizers [2]. The fermentation of

cereals is one of the traditional processes used by producers to improve the point of view of the product quality from textural, organoleptic, and nutritional and to maintain the food ration in good condition [3]. The result of this technique is a diversity of fermented foods, including fermented pasta. Studies have been conducted on several of them, including: *Ogi*, *Mawé*, *Ablo* and *Gowé* in Benin [4, 5], *Banku* and *kenkey* and *Nisho* in Ghana, etc. [6, 7].

Food of great socio-economic and nutritional importance, “*kom*” or “*dokunu*” (dokounou) is a slightly salted cereal-based (corn) dough obtained through pregrinding (cleaning, soaking) and postgrinding (fermentation, precooking, packaging steam cooking) which is a type of traditional and family technology [8]. It is highly valued in rural and urban areas in central and southern Benin, given its texture in terms of hardness and elasticity during consumption [9]. It is similar to some consumed pasta such as *kenkey* and *banku* which vary in name and technology.

Faced with the increasing demand from consumers, *kom* production actors remain unable to satisfy consumer demand because of the embryonic state of the sector (traditional, arduous and lengthy process).

In Benin, few studies have been conducted on this consumer product. It is important to undertake in-depth studies on this sector of activity in order to improve the conditions of *kom* production, to set up a data directory of the sector of activity and to propel this sector to an industrial scale. This could bring a better knowledge of the techniques of production, marketing and consumption of *kom* in Benin.

2. Materials and Methods

The geographical setting of our study is south of Benin, precisely in the departments of Atlantic and Mono. The study was carried out in the communes of Abomey-Calavi and Comè due to the fact that they are considered communes with high production, sale, and consumption of *Kom* of the Republic of Benin. We find in these areas, populations from all corners of the country and important changes related to urbanization could be observed. Comè is located in one of the main areas of origin of *kom*. Urbanization is more recent there and the traditional method still persists.

2.1. Equipment

The study is carried out on the basis of a survey for the identification and characterization of the main *kom* manufacturing processes.

2.2. Plant Material

The raw materials used consist of local white maize (*Zea Mays* L.) and *abéli man* bought in the market by the producers.

Other materials

White sachets were used for packaging. Salt and water from Benin National Water Society (SONEB) are also used.

Kom production equipment

The material used in the production of *kom* consists of basins, baskets, plastic buckets, pots, pallets, hearth, and a mill.

2.3. Investigation

On the basis of the data collected from the preliminary surveys, a socio-cultural as well as a technological survey

phase with producer-sellers and consumers in the communes of Abomey-Calavi and Comè was possible. The methodological approach adopted for carrying out the survey work was the direct interview on the basis of a questionnaire to better understand the evolution and other changes in the production of *kom*, followed by direct observation in the field. Thus, 80 producer-sellers and 20 *kom* consumers.

From these municipalities are questioned. Of this number of producer sellers, two are selected by the technique based on the monitoring input offered by the production technology. In addition, the relevance of the technology reveals three selection criteria which are:

- 1) the producers must be over fifteen years old at the date of the survey,
- 2) they must be produced at least once a week and
- 3) They must be involved in all stages of production.

2.4. Determination of the Sample Size

The size of the sample of respondents is determined according to the formula of [10]:

$$N_i = 4P_i(1-P_i)/d^2$$

N_i : Total number of yam chip producers to be surveyed in locality.

P_i : Producer rates obtained during the prospective study in department I.

d : Margin of error fixed at 0.05.

By applying the above formula, 100 actors were selected, i.e., 80 processors and 20 consumers.

2.5. Statistical Analyze of Data

MINITAB software is used to analyze survey data (age group, social status level, of education, source of technology acquisition). The level of significance retained is at the 5% threshold ($p < 0.05$).

3. Results and Discussion

3.1. Socio-Economic, Cultural, and Demographic Characteristics of Kom Producers/Sellers

The study of the socio-economic and demographic characteristics of the surveyed producers—sellers allowed us to classify the population according to several criteria including: age, sex, social status, level, of education.

3.1.1. Distribution of Producers/Sellers by Sex and Old

Figures 1 and 2, respectively, show the results of the distribution of female producers/sellers of respondents according to sex and age. Thus, 95% and 5% is the percentage respective ment of men and women in Abomey-calavi producers/sellers of *kom*. In Comè, only women (100%) are doing this activity. The age of these producers/sellers varies from 15 to 50 years and over. 37% of these producers are in the age group [30; 35] while the elderly (50 years and over) exercising the profession is 30% in these municipalities.

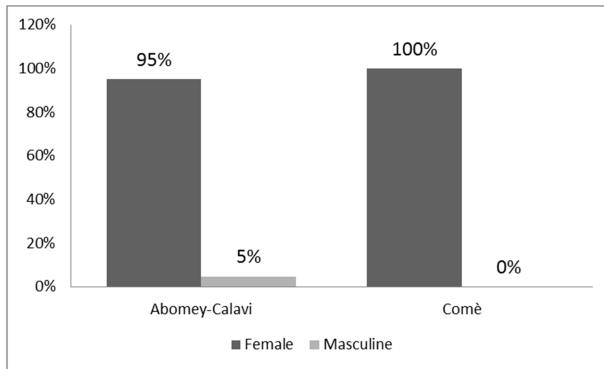


Figure 1. Distribution diagram of producers / sellers according to sex.

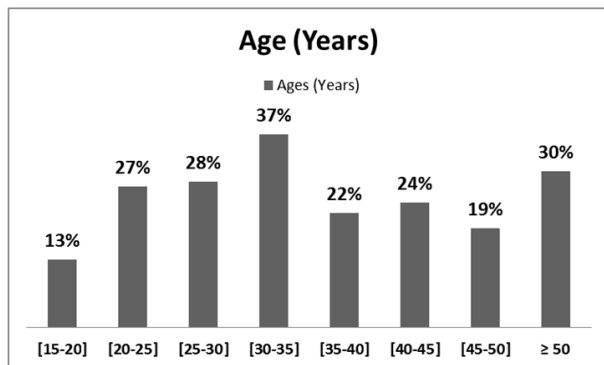


Figure 2. Distribution diagram of producers / sellers according to old.

3.1.2. Distribution of Producers/Sellers According to Social Status and Level of Education

Figures 3 and 4 show the distribution diagrams of producer-sellers according to the level of education and whether they exercise other activities.

The players in this sector of activity in the communes of Abomey-Calavi and Comè are, respectively, 76% and 47% educated and 24% and 53% uneducated. We note that there are more educated (76%) in Abomey—Calavi exercising this activity unlike Comè where the percentage of uneducated is high (53%).

We note on the diagram of Figure 4, a high percentage (86%, 62%) of producers sellers carrying out other activities and (14%, 38%) carrying out only this activity, respectively in the communes of Abomey-Calavi and Comè. Thus, the vast majority of producer vendors associate other activities with the production of kom.

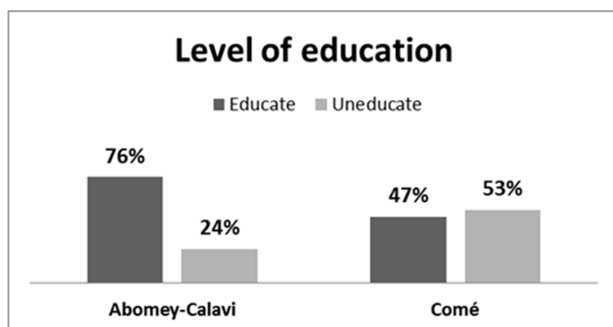


Figure 3. Distribution diagram of producers/sellers according to the level of education.

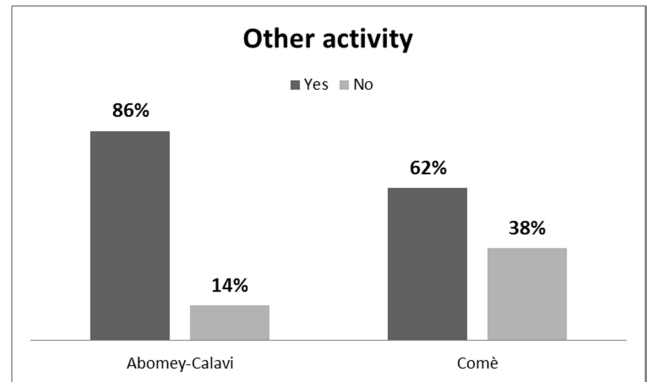


Figure 4. Distribution diagram of producers/sellers according to the activities carried out.

3.1.3. Distribution of Female Producers/Sellers According to the Sources of Technology Acquisition and the Year Experience

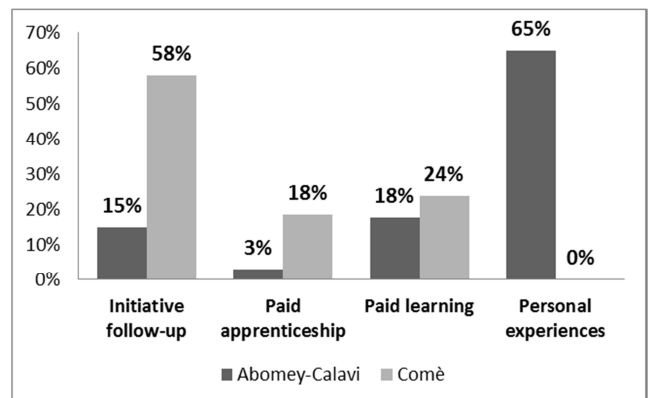


Figure 5. Producer-seller distribution diagram according to the learning mode.

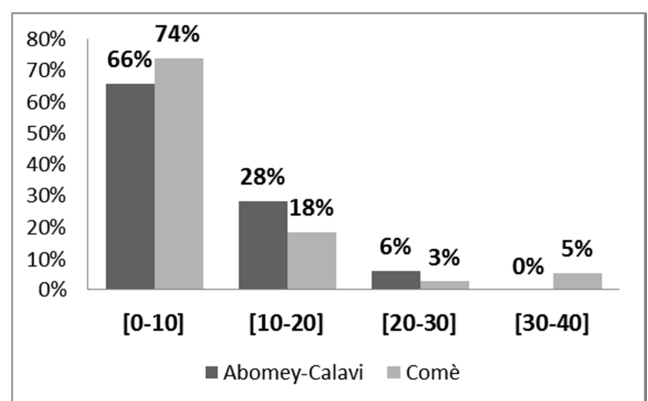


Figure 6. Distribution diagram of producer-sellers based on years of experience.

Figures 5 and 6 show the distribution diagram of producers sellers according to the mode of learning and years of experience, The beneficiaries at initial follow-up are a high percentage (58%) in the commune of Comè and with personal experience (65%) in the commune of Abomey-Calavi. In Comè, it turns out that producers sellers prioritize learning in this field of activity (58%, 18%, 24%), while in Abomey-Calavi, personal

experience is more relevant. These producers/sellers in the two municipalities are in high proportion (66%, 74%) in [0; 10] of experience but in low proportion (0%, 5%) in the group [30, 40] of experience. We deduce that this sector is promising for jobs and the hardship of this sector is explained by the low percentage of experimenters.

3.1.4. Matrimonial

Figures 7 and 8 show, respectively, the ethnic origin of the producer/seller and the marital status of the producer/seller. In Abomey-Calavi, Adja (6%), Fon (17%), Mina (6%), and Comé Sahoué (5%), Watchi (23%), Pédah (3%), Adja (4%) are the producers/sellers surveyed in Comé, we have Fon (3%), Mina (3%), Pédah (3%), Sahoué (13%) and watchi (67%) married at 81.60% and unmarried at 18.4% (figure 7).

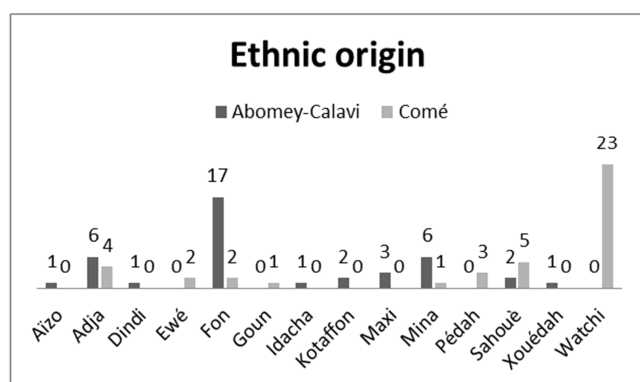


Figure 7. Distribution diagram of producers/sellers according to their ethnic groups.

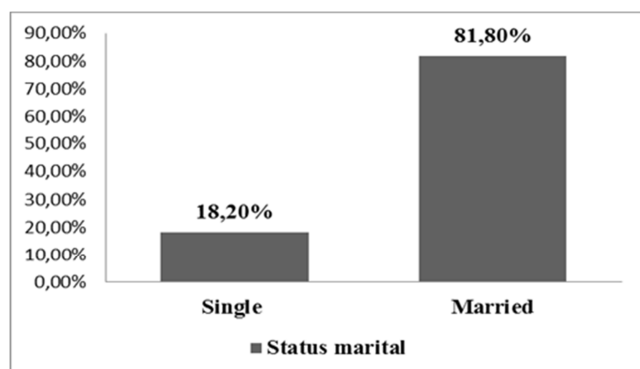


Figure 8. Distribution diagram of producers/sellers according to marital status.

3.2. Characterization of Kom Production Technology

Figures 9 and 10 illustrate the different varieties of maize used by the surveyed producers/sellers of Abomey-Calavi and Comé. They used *Parakou ébli* (1.4%), *Gbado yoyo* (2.7%), *Carder bli* (1.4%), *Yellow ebli* (12.3%). Some who use all varieties of corn are 82.19%. Regarding the price of the raw material, it varies from 150 to 200f CFA and the producers/sellers prefer the cheapest (75%).

The production of *kom* is based on the processing of corn.

This cereal is the staple in the manufacturing process of many foods in Benin [11, 12]. The characteristics of these corn kernels used determine the quality of the derived products. As a result, some producers/sellers prefer local varieties since they have tender and floury grains than improved varieties (hard and glassy grains) [13]. Others prefer the mixture of the two varieties (local and improved) to compensate each other for the shortcomings that one or the other of the varieties may present a good qualitative and quantitative profitability of the final product (Figure 9). The choice of variety also depends on the cost of this raw material which varies from 150 FCFA to 200 FCFA. According to some, the local variety costs more than the improved variety.

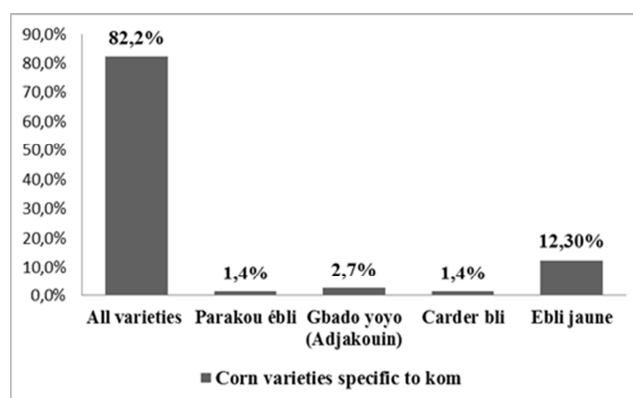


Figure 9. Different varieties of maize used by producers/sellers.

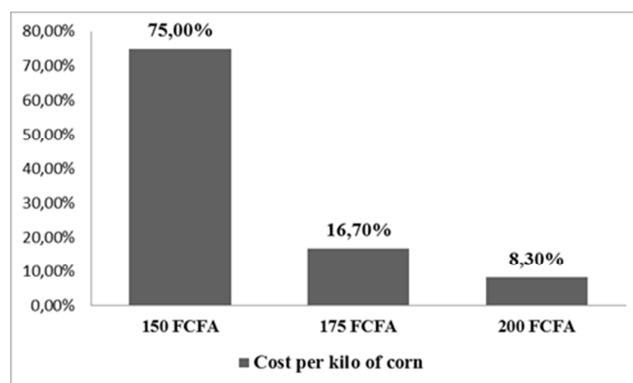


Figure 10. Diagram of the cost of purchasing a kilo of corn.

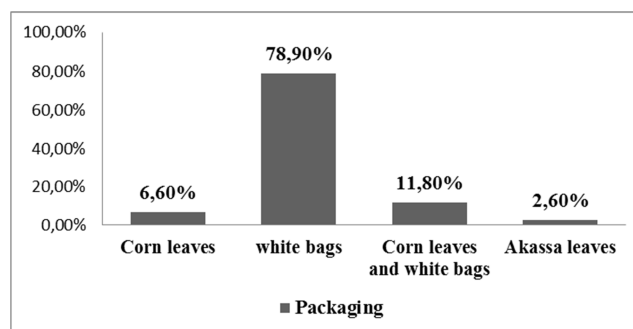


Figure 11. Distribution of producers/sellers according to the choice of packaging used.

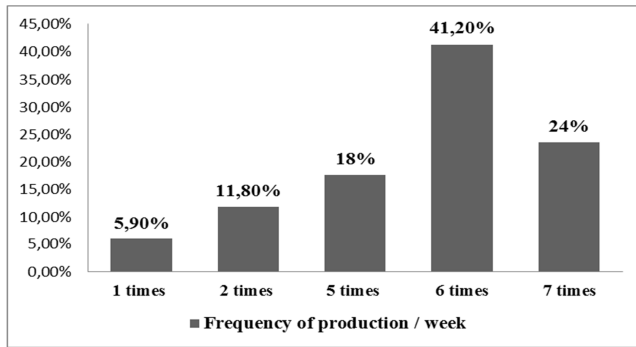


Figure 12. Distribution of producers/sellers according to production frequency.

Figures 11 and 12 show, respectively, the different packaging used by the producers/sellers and their *kom* frequency production per week. We observe that the producers/sellers use sachets (78.90%), maize leaves (corn husk at 6.6%), and the *akassa* leaves (*afléman* at 2.6%).

Others use corn bags and husks at 11.8%. These producers/sellers make either 63% once, 12.5% twice, 19% in 5 times, 43.8% in 6 times, and 19% in 7 times.

3.3. Consumer Appreciation

The consumers surveyed estimate 100% that the cleanliness of the producer/seller influences the consumption of *kom*. According to them, this paste is whitish (47%), tender (66%), not very acidic, fermented, and not very salty (48%). They recognize 95% of the use of the bag, but they would like at least 86% to use the corn leaf. This is not the case at 14%. Some consumers (at 48%) like *kom* just like that and others because of its nutritional value (38%) and hot (95%). 76% of consumers affirm finding it accessible full time and at a low price of 50f CFA per unit (91%).

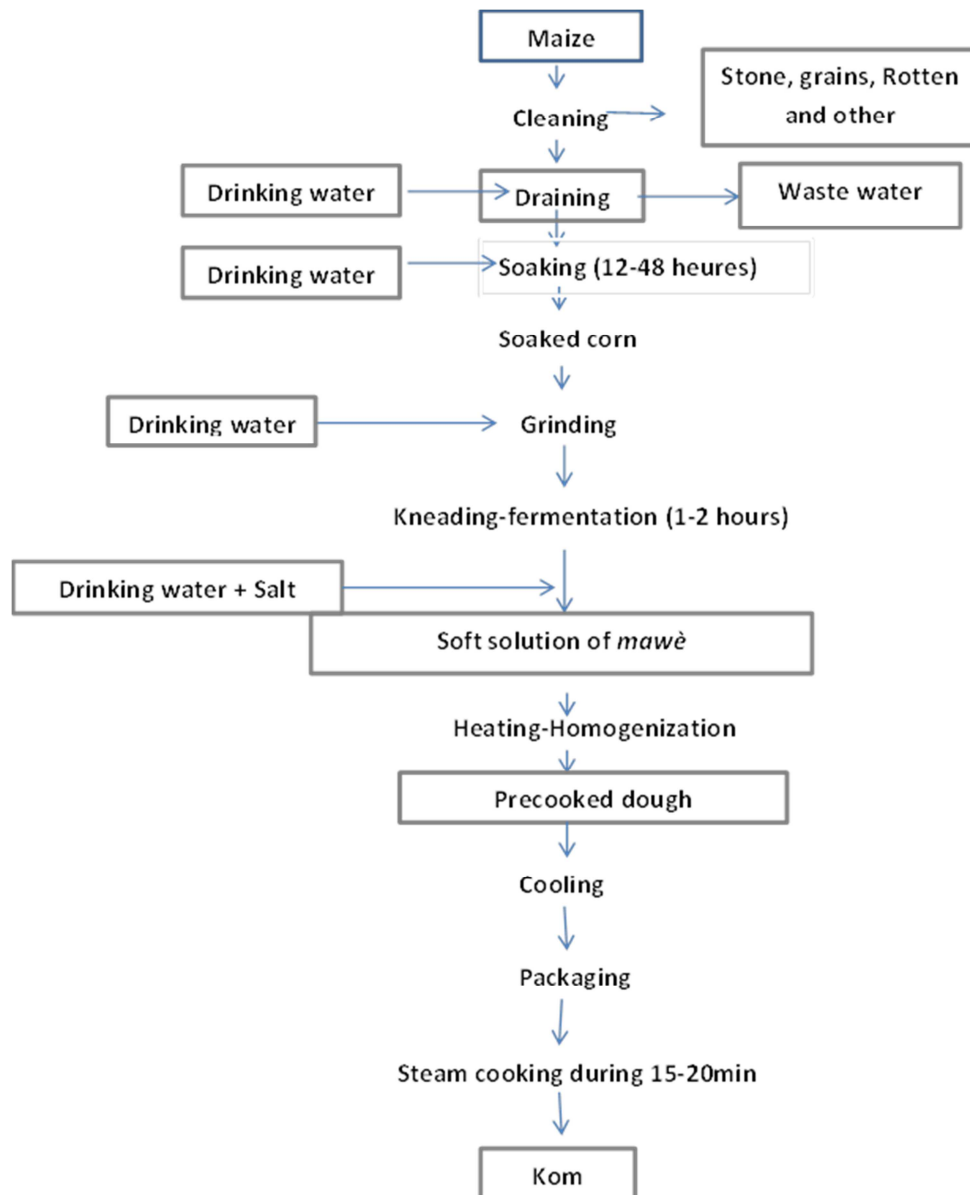


Figure 13. Technological diagram of production by steeping—with fermentation of corn (*mawé*).

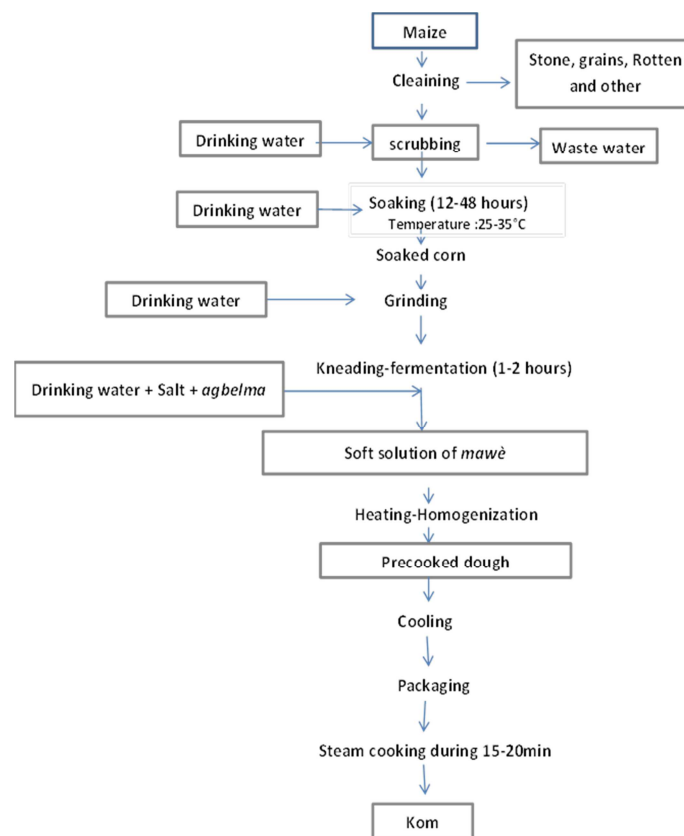


Figure 14. Technological diagram of production by steeping—with fermentation of corn (mawè) and addition of ferments.

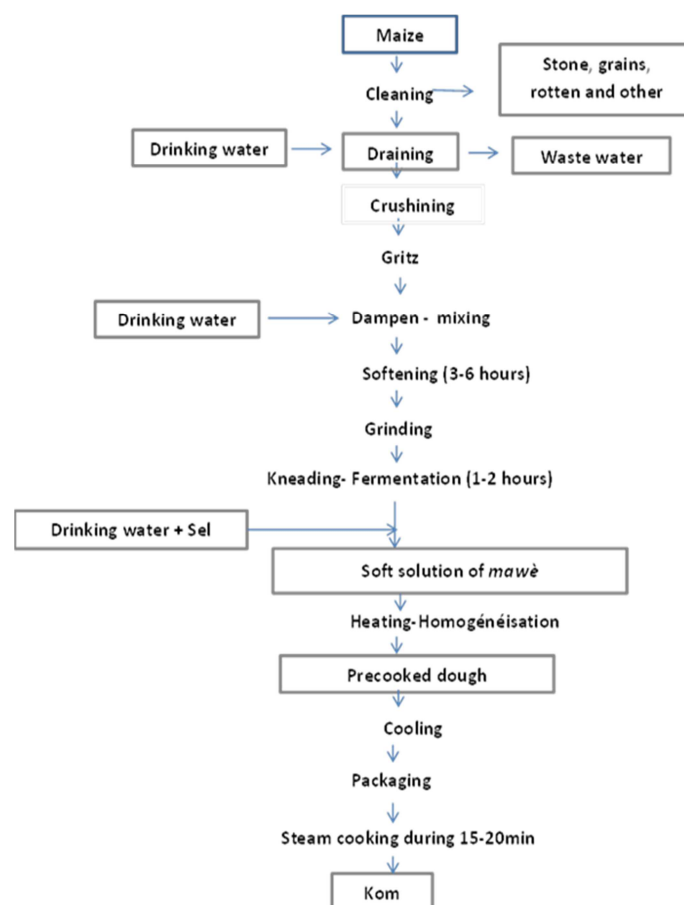


Figure 15. Technological diagram of production by crushing—with fermentation of corn (mawè).

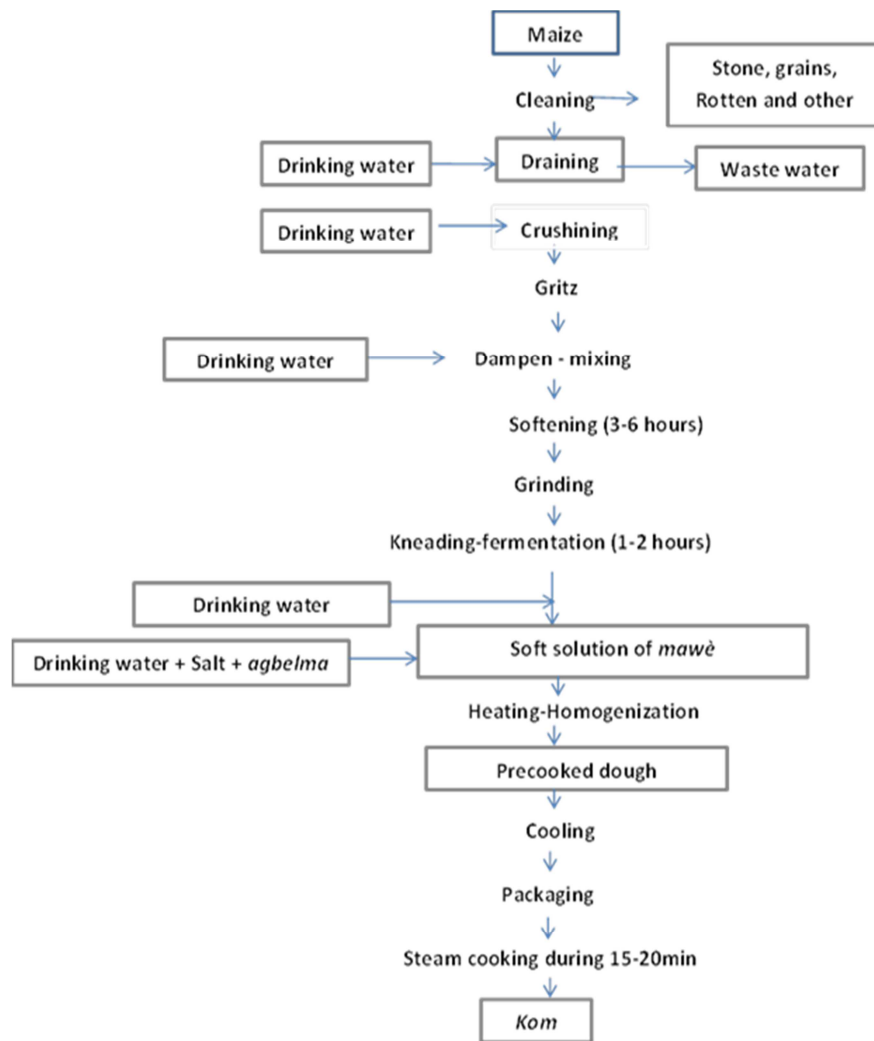


Figure 16. Technological diagram of crushing with fermentation of corn (*mawé*) and addition of ferments.

3.4. Different Kom Production Technologies Were Identified and Characterized from Survey Data

In these municipalities, four *kom* production technologies are evaluated: the traditional transformation process which takes into account the production technology by steeping—with fermentation of corn (*mawé*) only and the technology of production by crushing—with fermentation of corn (*mawé*) only (Figures 13 and 14) and the improved processing which includes the technology by steeping—with fermentation of corn (*mawé*) and addition of ferments (other products derived from cassava) and the technology of production by crushing—with fermentation of corn (*mawé*) and addition of ferments (other products derived from cassava) (Figures 15 and 16). For the technologies in Figures 13 and 15, the production time covers three to four days (3–4 days) of production taking into account the unitary operations “soaking” and “fermentation” which each vary between 24 and 48 hours depending on the producer. The fermentation of *mawé* can be extrapolated to the detriment of the fermentation of the ferments used (cassava derivatives: *lafu*, *agbeliman*)

according to some producers sellers (Figure 15) unlike others who keep *mawé* at the storage stage during fermentation where they are used for the preparation all week. According to the testimonies of producers—sellers surveyed, *kom* obtained from corn (*mawé*) + ferments are more tender. This could be explained by the low content of starch in the ferments (derived from cassava) in amylose, which makes it resistant to retrogradation, giving the fermented dough a long, supple and creamy texture after cooking [14]. The technology taking into account the “crushing” unit operation appears to be very fast. According to respondents, the last one to two (1–2 days), so the product is also available to consumers more quickly. The other unit operations such as washing the raw material before soaking vary from one producer to another, the soaking time varies from 1 to 3 days at most depending on the water temperature (cold water and hot water). Grinding, precooking and cooking is done everywhere. Pre-cooking and cooking are fundamental steps that allow consumers to gain or lose in nutritional quality. According to some authors, heat treatments eliminate a large part of the lactic acid microorganisms and the rest of the pathogens escaped during fermentation [15].

4. Conclusion

As a result of this work, we were able to understand the reasons for the choice of the *kom* activity sector and the evaluation of the different *kom* processing technologies in the municipalities of Abomey-Calavi and Comè. In these communes, four *kom* production technologies were evaluated: the soaking production technology—with corn fermentation (mawé) only and the crushing production technology—with corn fermentation (mawé) only and soaking technology.—with fermentation of corn (mawé) and addition of ferments and production technology by crushing—with fermentation of corn (mawé) and addition of ferments. These different techniques are based on several unit operations including cleaning, washing, soaking and/or crushing, grinding, fermentation, precooking, packaging, and cooking. The substitution or addition of a unitary operation or the addition of ferments varying from one producer-seller to another depend on the diversity of production techniques and the finished product.

Authors Contributions

This work was conceptualized and supervised by Nicodème CHABI and carried out by Aziana Reine ZINSOU. The conceptualization of this subject was made by Aziana Reine ZINSOU and Mouaïmine MAZOU. Mouaïmine MAZOU then set up the methodology. A methodology validated by Nicodème CHABI and Fidèle Paul TCHOBO. The data analysis was however carried out by Mouaïmine MAZOU.

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