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Akpan

Identification of quality attributes by survey

Part of

D 1.1.2.1: Survey results: quality attributes for Group 1

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Abstract

Information on the quality attributes of marketable akpan was collected through a survey performed in different districts of Bénin by means of a questionnaire used on akpan producers, sellers, and consumers. Four types of akpan are marketed in Bénin, with quality attributes depending on raw materials and processing techniques: (1) akpan from maize ogi, a wet sieved fermented maize mash, which is the most commonly produced; (2) akpan from sorghum ogi, a wet sieved fermented mash similar to maize ogi; (3) akpan obtained by kneading and fermentation of whole sorghum flour and finally akpan from wet sieved fermented mash of “mixed sorghum and maize grains”. Regarding quality attributes, akpan should have no lumps; it should be flavoured, smooth, sweet or acidic. Particularly, akpan from sorghum is of red colour, sour taste, mushy and smooth texture whereas akpan from exclusively maize is of white colour, slightly acidic, partially/slightly cooked with an aroma of fermented ogi.

Background

Cereal-based fermented foods are widely consumed worldwide. Besides improved organoleptic quality, fermented foods are also superior in digestibility and nutritive value, compared to their unfermented counterparts (Muhammet and Orhan, 2002). Ogi is one of the fermented cereal intermediate products from maize/sorghum/millet. It serves to prepare many dishes among which a thirst-quenching beverage known as akpan, (ready-to-serve or ready-to-eat foods). Akpan is of great economic significance and will take increasing importance in the future due to the many variants currently available. Indeed, the consumer demand for non-dairy products such as akpan, commonly known as “vegetal milk”, is a challenge to the future food industry. Bénin will have a competitive advantage over other countries if it improves these products with specific sensory attributes. Accordingly, it is necessary to know the basic characteristics of akpan produced in Bénin, with emphasis on the sensory perception. Different types of akpan, based on processing method and raw material used, were observed in Cotonou and Porto-Novo. Information on processing techniques of akpan was gathered in an earlier survey performed at Cotonou (Madode, 2003). However, information on quality attributes of akpan is limited. A survey was carried out in Cotonou and Porto-Novo to

supplement the current lack of information about this beverage. The quality attributes of akpan as perceived by actors are discussed in this document.

1. Study areas and samples size

The study was carried out in Littoral and Ouémé, two localities south of Benin where akpan is commonly produced, sold and consumed. The study areas covered five municipalities at Cotonou and thirteen municipalities at Porto-Novo. The survey was performed from 11 March to 10 April 2011. In total 145 producers/sellers and 607 consumers were interviewed representing a response rate of 95.4% and 98.2% respectively.

2. Data Collection and analysis tools

A questionnaire was designed to collect data on akpan production, commercialization and consumption. The survey was carried out by individual interviews or in focus group (2-3 persons) discussions.

Information on the sensory attributes were collected from producers/sellers and consumers and analyzed through descriptive statistics using Sphinx plus² v.4.5.

3. Results

3.1 Descriptive sensory attributes of akpan

An inventory of sensory attributes of akpan as perceived by actors concerned the taste, the colour, the texture and the aroma. The sensory attributes listed as most important (Table 1) were similar, irrespective of actors. However the percentage of respondents varied according to the actors.

3.2 Taste attributes

Sour taste

About 54.5% of akpan producers/sellers from maize ogi and 75% of those from sorghum ogi consider the product to be slightly acidic. In contrast, akpan from mixed maize and sorghum and akpan from whole kneaded and fermented sorghum flour are regarded as very acidic by 100% and 60% of producers/sellers respectively. About 36.8% of consumers of akpan from sorghum and 11.1% of consumers of akpan from the mix cereals recognized the slightly acidic taste or medium acidic taste. On the other hand, for 82.2% of consumers of akpan from

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maize ogi, it must be slightly acidic. This is consistent with a previous investigation on maize-based akpan (Madode, 2003).

Sweet taste

Milk or sugar addition is very important before consumption therefore akpan should be sweet, as confirmed by 75.4% of consumers of akpan from maize ogi, 54.4% from sorghum ogi and 72.2% from the mix of both cereals ogi. Particularly, for 22.5% of consumers of akpan from maize ogi, and 14.4% from sorghum ogi and 27.8% from the mix ogi, akpan should be very/highly sweet. According to the consumers, the degree of sweet taste depends on the quantity of the concentrated milk added by the sellers.

Iced drink

Irrespective of the type of akpan, consumers (54.2% of akpan consumers from maize ogi, 33.3% from the mix and 49.5% from sorghum) preferred the product very iced. Indeed the majority of those interviewed consume the product after lunch as thirst-quenching beverage.

3.3 Texture attributes

Viscosity

The interviewed producers/sellers (100% of akpan from maize ogi, 53.3% of akpan from kneaded sorghum flour, and 50% of akpan from sorghum ogi recognized the product to be very viscous. A similar result was obtained in a previous study on maize-based akpan (Madode, 2003). Only 44.7% of the consumers of akpan from maize consider this criterion as an important quality attribute. Furthermore, for 36.1% of consumers of akpan from sorghum and 22.3% of those of akpan from mix, the product should be slightly viscous.

Lumpiless

The presence of lumps in akpan is regarded as a disqualifying factor for consumption. This attribute denotes the unsuccessful cooking of ogi into akpan. Irrespective of the types of akpan, this attribute is cited by the majority of consumers as an important sensory attribute: 70.1% of consumers of akpan from maize ogi, 50% of those of akpan from the mix and 28.9% from sorghum. Regarding the producers/sellers, 50% of producers/sellers of akpan from sorghum ogi and 35.1% of those of akpan from maize expect akpan to be without any lumps.

3.4 Colour

As for gowé, the colour of akpan derives from that of the raw materials used. Accordingly, three types of colour (red, white and slightly red) were cited depending on whether sorghum, maize and the mixed sorghum and maize was used. Of the producers/sellers of akpan from maize 54.5% estimated that akpan must be of white colour. The majority of the consumers (87.7% of respondents) preferred this white colour. Indeed, this colour is recognised as the most well-known colour as originally akpan was derived from white maize. On the other hand, akpan from sorghum or the mix of maize and sorghum are innovative and only recently developed by producers who increasingly cater for consumers' consumption habits. For these types of akpan, consumers prefer a red (87.6%) or slightly red (100%) colour for akpan from sorghum and the mix respectively. In addition, 50% of producers/sellers of akpan from sorghum estimate that it should be of red colour and 60% of those of akpan from mix think it should be slightly red.

3.5 Degree of cooking of ogi mash

Akpan is a starchy product. It should be slightly cooked, with a low degree of gelatinisation of the starch. About 33.3% of consumers consider this criterion to be an important quality attribute. The medium degree of cooking of ogi mash into akpan is preferred. According to the actors of akpan from sorghum, insufficient cooking of the product could lead to consumers developing stomach ache. In addition, 49% of producers of akpan from maize estimate that the cooking operation should last 5 to 20 min.

3.6 Aroma

For all the producers/sellers, akpan from maize is considered to have an aroma of fermented ogi. Besides the odour of fermented ogi, producer could add commercial aroma such as vanilla, citronella etc. during processing. Therefore, akpan must be flavoured naturally (fermented aroma) and/or artificially (e.g. citronella or vanilla-flavoured). The flavour attribute is cited by the majority of producers/sellers as important: 86.7% and 100% of respondents of akpan from sorghum (wet sieving and kneading), 94.3% from maize, and 100% for akpan from the mix. Indeed, nowadays, almost all producers add citronella or some other aroma during cooking to give a specific flavour to the final product. In addition, commercial aroma can be added after cooking, just before selling, as practiced by some producers/sellers (13.3% from sorghum and 17.9% from maize).

3.7 Safety

Akpan can be stored for about a week. However, after 7 to 10 days of storage, some contaminants can develop on it. The majority of producers/sellers recount that they could observe larvae and a layer of dirt on akpan: 52.8% of respondents said that they note the presence of the larvae and 10.4% the formation of a layer of dirt (Table 2). In addition, the products are sometimes contaminated by ants and flies. The ants were observed in concentrated sweet milk and in sugar used as additives.

Conclusion

Akpan is made of various kinds of cereals (maize, sorghum and the mix). The quality attributes of akpan as perceived by producers/sellers and consumers are similar for akpan from sorghum or mixed cereal grains), but akpan from maize is different in colour, the sour taste and the aroma of fermented ogi. In addition, akpan of the best quality and taste is made of ogi mash. This sensory perception will be instrumentally characterized in further work.

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Sensory attributes	PRODUCERS /SELLERS				CONSUMERS		
	Akpan from sorghum (wet sieving) (N=15)	Akpan from sorghum (kneading) (N=31)	Akpan from maize (N=145)	Akpan from “maize and sorghum” (N=2)	Akpan from sorghum (N=112)	Akpan from maize (N=541)	Akpan from “maize and sorghum” (N=15)
Very sweet	-	-	-	-	14.4	22.5	27.8
Moderately Sweet /to taste milky	-	-	-	-	54.6	75.4	72.2
Iced taste	75	3.3	54.5	-	49.5	54.2	33.3
Slightly acid	25	60	-	100	-	82.2	-
Very acid	-	-	17.9	-	23.7	-	-
moderate acid	50	53.3	100	-	36.8	-	11.1
Very mushy/viscous	-	10	-	-	9.3	44.7	5.5
Slightly viscous	50	26.7	35.1	-	36.1	1.5	22.3
No lumps/Lumpiless	-	-	48.5	-	28.9	70.1	50
White colour	50	60	-	50	-	87.7	-
Red colour	-	-	-	-	87.6	-	-
Slightly red colour	-	-	100	-	-	-	100
Slightly cooked	50	33.3	-	-	-	33.3	-
Very cooked	-	13.3	17.9	100	34.2	-	-
Commercial aroma	86.7	100	94.3	100	8.2	5.3	-
Citronella aroma					-	-	-

Table 1: Sensory attributes and their importance (% respondents) per types of akpan as perceived by actors

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Table 2: Safety problems as perceived by producers /sellers of akpan

Contaminants observed	Percentages
Larvae (after prolonged storage)	52.8
Dirt	10.4
Ants and flies	14.

Kenkey

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INTRODUCTION

African Food Tradition Revisited by Research (AFTER) aims to revisit traditional African products, knowledge and know-how in the light of new technologies for the benefit of consumers, producers and processors in Africa and Europe. By applying European science and technology to African traditional food products, AFTER seeks to turn research into quantifiable and innovative technologies and products that are commercially viable in both European and African markets. Kenkey is a fermented cereal-based product which will be characterised according to existing knowledge on technologies and processes. Through this survey, comprehensive scientific knowledge of the existing know-how on technologies on, processes of kenkey will be established. . The different groups of stakeholders (producers, consumers and sellers of kenkey) were interviewed along the Kenkey chain . The needed information from each group was specified.

This survey was carried out to gather information on the production, consumption and vending of kenkey in Ghana and to identify the major problems and bottlenecks related to kenkey production in order to investigate some of these and propose adequate solutions. The survey was conducted in the Greater Accra, Central and Eastern Regions of Ghana. In all nine (9) districts were considered for the three regions. The districts surveyed in Greater Accra region were the Ga, Tema Municipality, Accra Metropolis. The survey districts for the Central region were Cape- Coast , Abura-Asebu Kwamankese, Mfantseman and the Awutu-Efutu Senya districts. In the Eastern Region, the survey covered the Asuogyaman and Manya Krobo districts.

In the Greater Accra Region, the areas in the district surveyed were Achimota, Sowutuom, Adenta, Madina, Darkuman, Tema, Ashiaman, Nungua, La, Osu, Chorkor and Jamestown. The survey areas in the Central region were Kakumdo, Nkanfoa, Abura, Asebu, Akroma and Yamoransa . The survey areas in the Eastern Region were Anum, Kpong, Atimpoku, South Senchi and Somanya.

1. Districts surveyed in the Greater Accra Region

The *Ga District* is part of the Accra Metropolis, Accra being the capital city of Ghana. The Ga District has grown from 170,000 people in 1994 to over 500,000 in 2009. As a result of this tremendous population growth, the region has now been divided into three municipal areas -- Ga East and Ga West maintains a sister city relationship with Grand Rapids in the US.

The Accra Metropolitan District is considered Accra's city proper. The Accra Metropolis District has a total land size of 200 square kilometres and is made up of six sub metros namely Okaikoi, Ashiedu Keteke, Ayawaso, Kpeshie, Osu Klotey and Ablekuma. The Metropolis is bordered on the South by the Gulf of Guinea from Gbegbegese to the Mukwe Lagoon and continues along the Accra-Tema road .

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The Tema Municipal District is a district of Ghana in the Greater Accra Region. This district is grouped into twenty-six communities. Tema municipality serves as the administrative capital. The Greenwich Meridian (Longitude) passes through the city of Tema. The municipality shares common boundaries with the Accra Metropolis on the west, the Ga District Assembly on the North West and the Dangme West District on the northern and eastern borders. It is bordered to the south by the Gulf of Guinea.(Plate 1).

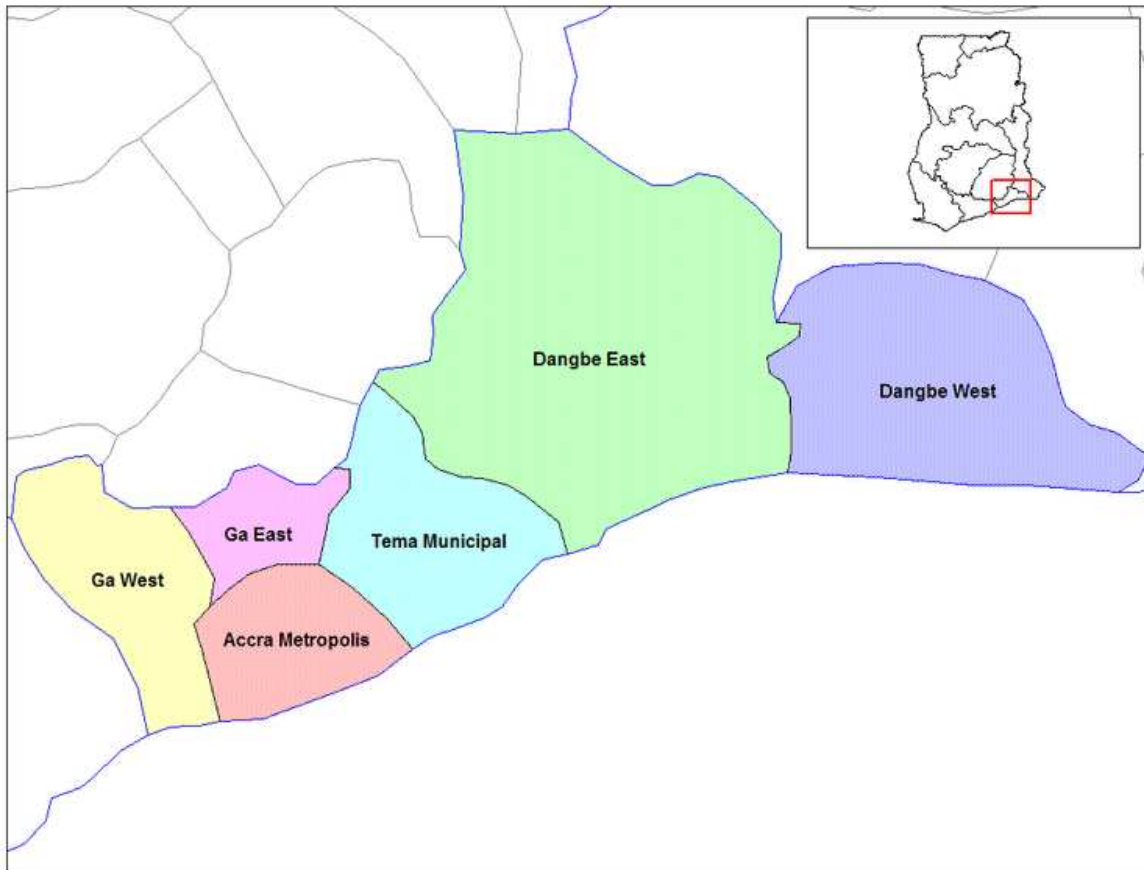


Plate 1: Surveyed districts: Ga, Tema municipality, Accra Metropolis- Greater Accra

Asuogyaman District Assembly is one of the twenty-one (21) districts in the Eastern Region of Ghana. The District covers a total estimated surface area of 1,507 square kilometers and constitutes 5.7% of total area of Eastern Region. The district is the 10th largest district in the Region. Atimpoku is the capital of the district. The Asuogyaman District Assembly is located approximately between latitudes 6° 34° N and 6° 10° N and longitudes 0° 1° W and 0°14E. It is about 120m above Mean Sea Level (MSL).

The population of Asuogyaman District is approximately 80,529 people. It has a total land area of 1,507 square kilometers. The district is divided into two by the Volta Lake (the largest man-made lake in the world). Numerous chains of mountains covered with thick and green vegetation create a serene environment along the banks of the Volta River. Resort centres are located along the banks of the river.

Lower Manya Krobo is one of the twenty-one [21] districts in the Eastern Region located in the eastern part of the Region along the south-western corner of the Volta River. It is

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bordered to the north-east by Kwahu West Municipal, to the North-west by Fanteakwa, to the South-West by Dangme West, to the East and West by Asuogyaman and Yilo Krobo Districts respectively and to the south-east by North Tongu District. The District covers an area of 1,476 km, constituting about 8.1% of the total land area within the Region (18,310 km). The major towns in the district include Odumase township (which incorporates Atua, Agormanya and Nuaso), Akuse and Kpong in the Lower Manya area. Major towns in Upper Manya area are Asesewa, Sekesua, Akateng and Otokper (Plate 2) .

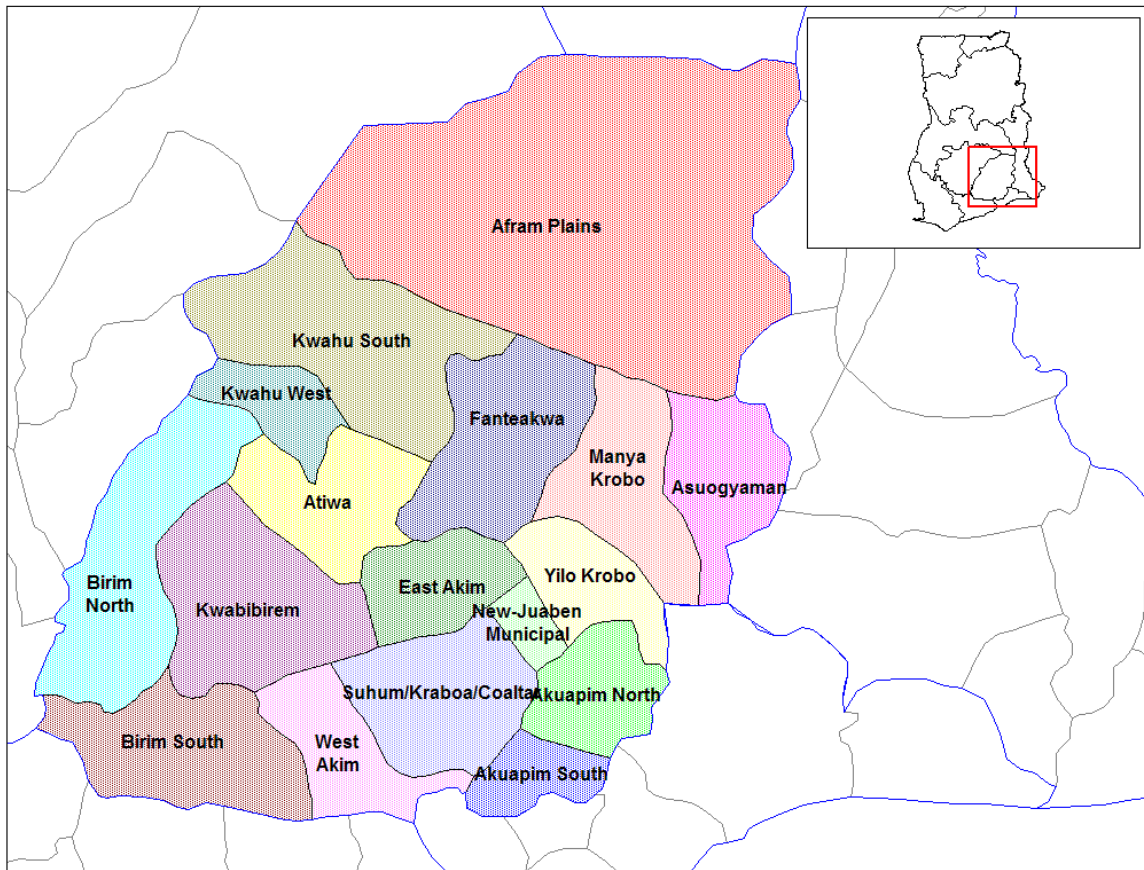


Plate 2 :Surveyed districts: Asuogyaman, Manya Krobo- Eastern Region

The Cape Coast Metropolitan is bounded on the south by the Gulf of Guinea, west by the Komenda / Edina / Eguafo /Abrem Municipal, east by the Abura/Asebu/Kwamankese District and north by the Twifu/Hemang/Lower Denkyira District. The Metropolis covers an area of 122 square kilometers and is the smallest metropolis in the country. Cape Coast is the capital of the Central Region.

The Abura-Asebu Kwamankese District is a district of Ghana in the Central Region. Some of its notable towns include Asebu and Abakrampa. .

The district capital of the Mfantseman Municipal District is Saltpond. Mfantseman Municipal is located along the Atlantic coastline of the Central Region of Ghana, stretching from about 21 kilometers along the coastline and for about 13 kilometers inland. The Municipal is

bounded to the West and Northwest by Abura-Asebu-Kwamankese District, to the East by Gomoa District and to the South by the Atlantic Ocean. The district covers about 612 sq km and the proportion of land area to region is in the ratio 1:16.(Plate 3).

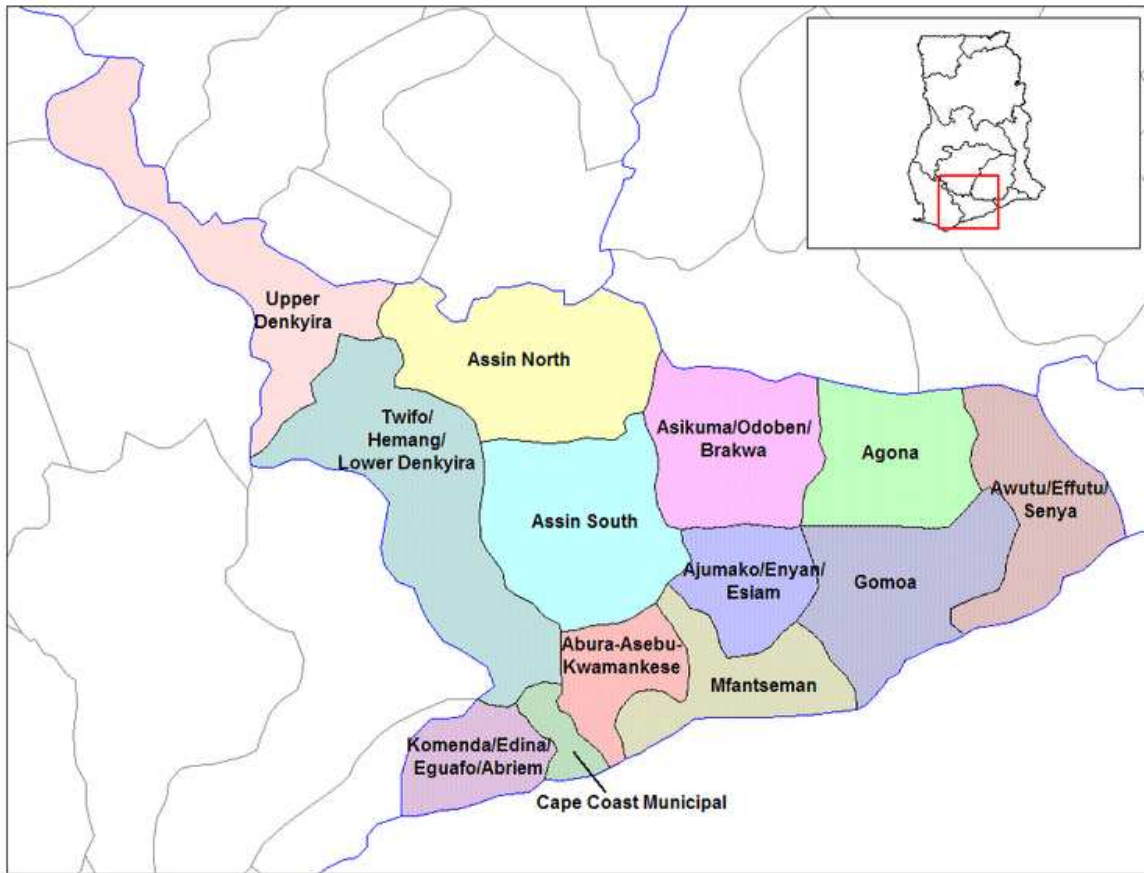


Plate 3: Surveyed districts: Cape Coast district, Abura-Asebu Kankese, Mfantseman and Awutu-Effutu-Senya- Central Region

2. Survey methodologie

A semi-structured questionnaire was administered to producers, sellers and consumers of kenkey. The questionnaire was administered to gather information about the production, vending and consumption of kenkey in Ghana and also to identify the major problems which could be investigated and solutions proposed.

The total sample size of the respondents to be interviewed for the whole geographical region was calculated using

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

N_i being the total number of respondents to be surveyed for the study (Chadare *et al*, 2008).

$$p_i = n_p / N_t$$

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$P_i = n_p/N_t$; the proportion n_p of the product producer, seller and consumer among the N_t randomly interviewed and d the expected error margin fixed at 0.05 (Dagnelli, 1998). Based on the formula, the total number of consumers to be interviewed was three hundred and fifty four (354), producers two hundred and thirty two (232) and sellers two hundred and nine (209).

2.1 Respondents Interviewed

For Greater Accra, a total of one hundred and sixty three consumers (163), one hundred and five (105) producers and one hundred and six (106) kenkey vendors were interviewed. For Central region, one hundred and forty -one (141) consumers ,eighty five(85) producers and eighty- four (84) sellers were interviewed. For Eastern Region, one hundred and nineteen (119) consumers , sixty-seven (67) producers and fifty-five(55) sellers were interviewed.

Consumers and sellers were selected randomly on the streets and market places whilst, producers were interviewed at their production sites. Each respondent was given information and consent form to sign to seek his/her approval before the questionnaire was administered .

2.2 Language used

The interviews were conducted in English, Twi, Ewe, Ga, Guan and Fanti, depending on respondent’s preference. Enumerators translated and wrote the answers in English language.

2.3 Enumerators used

Fifteen enumerators were used in the Greater Accra Region and ten enumerators each for the Central and Eastern Regions.

2.4 Statistical analyses of survey data

All data from the survey were analysed using the Statistical Package for Social

Scientists (SPSS) for Windows, version 16.0. Frequencies and percentages of both the demographics and the actual questions were analysed and charts developed .

Table 1: Survey logistics

Area surveyed	Total number of actors surveyed	Numbers of actors surveyed		
		Number of producers	Number of traders	Number of consumers
Greater Accra				
Achimota	25	<u>105</u> 8	<u>106</u> 8	<u>163</u> 9
Sowutuom	51	21	19	11
Adenta	27	6	11	10

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Madina	66	16	13	37
Darkuman	23	8	8	7
Tema	55	11	13	31
Ashiaman	18	7	10	1
Nungua	6	5	1	0
La	26	9	8	9
Osu	40	3	4	33
Chorkor	9	4	4	1
Jamestown	31	8	7	16
Central Region		85	84	141
Kakumdo	50	10	13	27
Nkanfoa	46	26	7	13
Abura	73	7	13	53
Asebu	41	11	7	23
Akroma	15	7	6	2
Yamoransa	45	14	25	6
Kasoa	38	10	13	15
Eastern Region		67	55	119
South Senchi	57	26	14	17
Somanya	6	3	1	2
Atimpoku	51	8	10	33
Kpong	34	9	11	14
Anum	93	21	19	53

3. Results

3.1 Production

Producer profile (socio-cultural characteristics)

The producers of kenkey interviewed consisted of 98.4% females and 1.6% males. This is expected since traditional food processing in Ghana is mainly carried out by women.

Table 2: Age groups of kenkey producers

Age Range	Frequency	Percentage(%)
<20	1	0.4
20-29	41	15.9
30-39	42	16.3
40-49	84	32.6

>50

90

34.9

About 35% of the kenkey producers interviewed were more than 50years old . This showed that elderly women are more into the production of kenkey whilst their daughters sell the kenkey produced. Producers between the 40 and 49years made up 32.6%(Table 2).

Ethnic group of Kenkey Producers

Majority of kenkey producers interviewed were from the Fanti ethnic group and constituted (31.4%). In decreasing order 24% were from the Ga, 17.8% were from the Ewe, 9.3% were Twi, 4.7%were from Krobo ethnic group and other ethnic groups apart from those mentioned constituted 33%.

Educational level of Kenkey Producers

Most of the respondents(38.4%) interviewed did not have any formal education. In decreasing order 23.3% had JHS level of education, 17.8% had primary education, 7.8% had secondary level 5.4% had non-formal education, 4.7% had middle school education and 0.4% had tertiary level education .

Marital status of Kenkey producers

A greater percentage of kenkey producers (65.1%) were married, 16.7% divorced. 14.3% were single and 3.5% widowed.

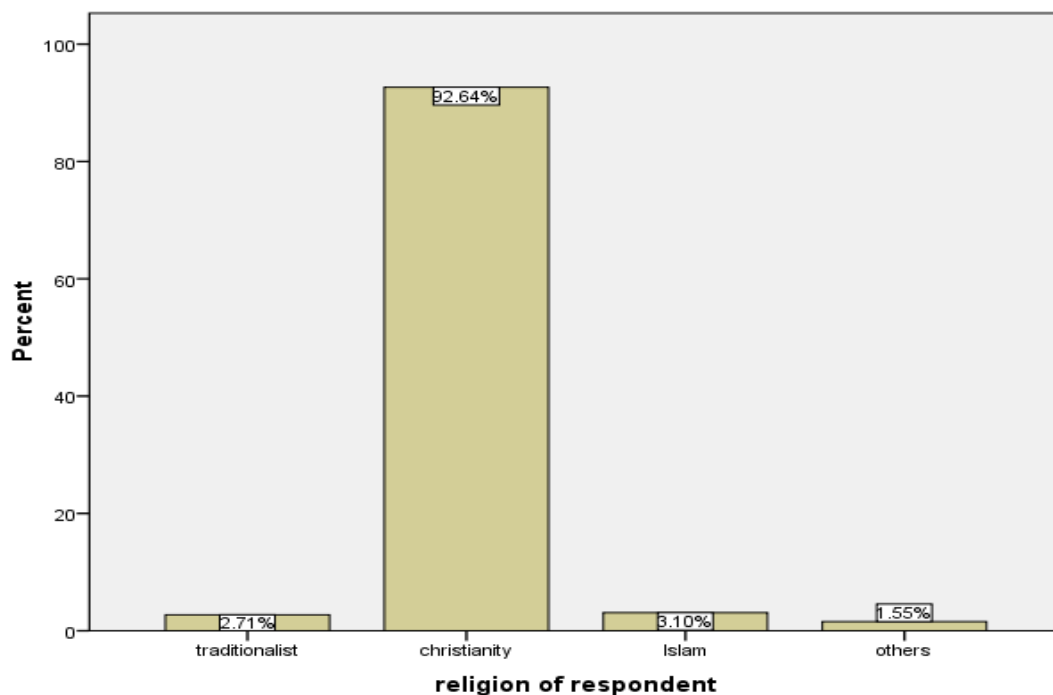


Figure 1: Religion of Kenkey Producers

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Majority of the kenkey producers(92.64%) were Christians(Figure 1), 3.10% Islam, 2.71% traditionalist and 1.55% were from other religion apart from those mentioned above.

Background on types of kenkey

Kenkey is consumed all over Ghana but especially in the southern coastal areas where it originated from. There are two main types of kenkey produced from whole maize, these are Ga Kenkey and Fanti Kenkey. Both are cooked sour tasting stiff porridges with a pH of about 3.7, moisture level of between 52-55% and usually eaten with sauce and fish. During the production of kenkey, the dough is divided into two parts: one part, the *aflata* is cooked into a thick porridge, while the other uncooked part is later mixed with the *aflata*. The resulting mixture is moulded into balls and wrapped in dried maize husk or plantain leaves, after which it is boiled. It is interesting to note that kenkey varieties vary widely throughout Ghana. Ga kenkey is fermented for 2-3 days, salted, cooked, wrapped in maize husks and has a shelf-life of about 3 to 4 days. Fanti kenkey which has a shelf-life of about one week is fermented for 3 -4 days, not salted and cooked wrapped in plantain leaves. In addition to Ga and Fanti kenkey. There are also a few other types of kenkey produced but these are mainly produced from dehulled rather than whole maize grains, one of such product is are *Nsiho* or *Akporhie*. The dehulled grains are steeped for 3days, milled and a dough is prepared from it. The dough is fermented for a day, *aflata* is prepared and moulded and packaged in maize husk and steam cooked for 2-3 hours.

Maize is the main raw material used for the production of the types of kenkey.. In the case of Ga and dehulled (*Akporhie* or *nsiho*) kenkey, the packaging material used is maize husk., Dried plantain leaves are used as the packaging material for Fanti Kenkey production. Salt is added to the Ga and dehulled (*Akporhie*) kenkey during preparation. The maize used for the production is clean, free from dirt, free from molds and other foreign materials. Firewood is used for the cooking of the kenkey.

Price variation of raw materials used in Kenkey Production

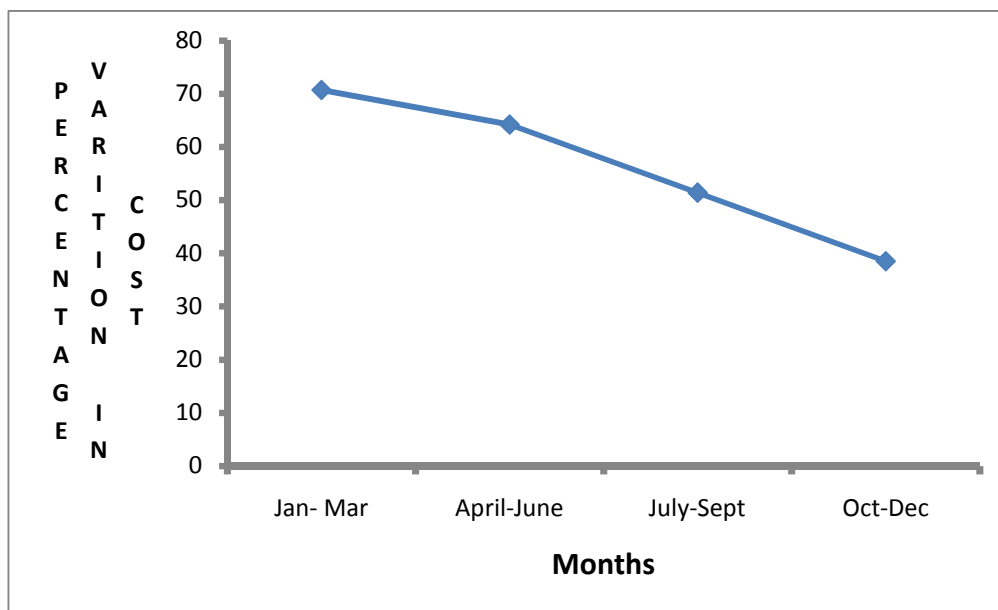


Figure 2: Price variation of maize and corn husk through the year

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Maize and corn husk prices are constant from January to March, the price increases from April to June. The price generally lowers from July to September and becomes constant from October to December (Figure2).

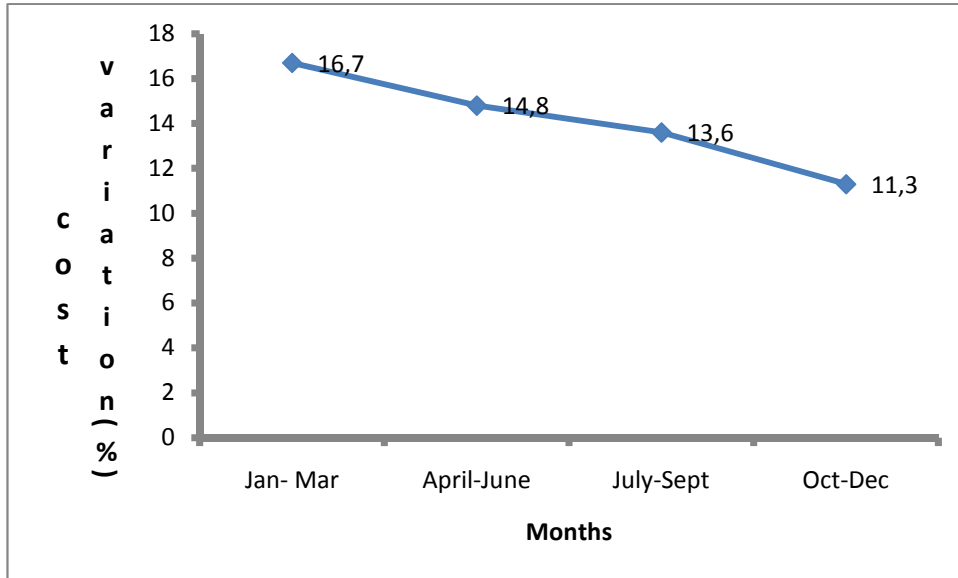
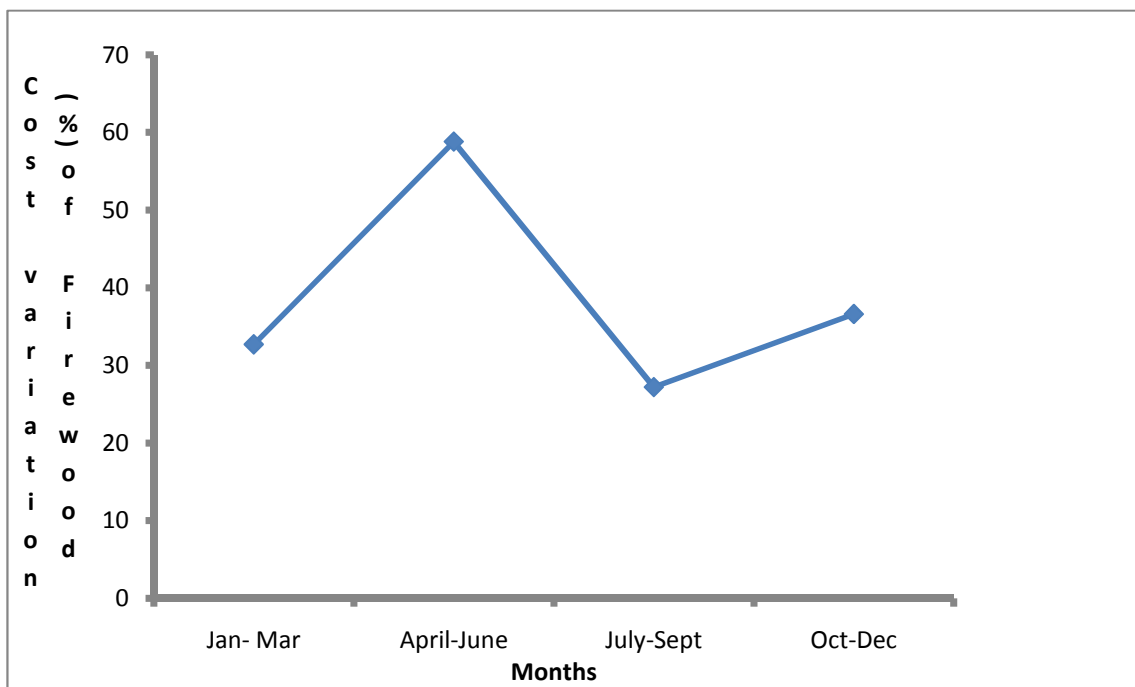


Figure 3: Price variation of plantain leaves through the year

The cost of plantain leaves is constant from January to March ,but increases from April to June and lowers from July to September and October to December(Figure3).



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Figure 4: Price variation of firewood through the year

Firewood price is constant from January to March , the cost however increases from April to June and July to September. It is constant from October to December.

Profitability of Kenkey Business

Of the producers interviewed, (242) agreed that kenkey making is profitable whilst sixteen (16) producers think that it is not profitable.

Quantity, frequency of maize processed weekly, price range and storage facility

Table 3:Percentage of quantity of maize processed

Quantity of maize processed	Percentage(%)
<10kg	1.6
10-50kg	47.3
50-100kg	34.9
Above 100kg	16.3

Table 4 Weekly production of kenkey

Number of times kenkey is produced weekly	Frequency
1-3 times	117
4-6 times	66
7-10 times	68
More than 10times	7

Table 5 Price range of 1 maxi bag(50kg) of maize

Price range	Percentage(%)
GH□50-100	53.9
GH □110-150	45
Less than GH□50	1.2

Table 6 Storage facilities used by producer to store maize

Price range	Percentage(%)
Storeroom	70.9
Commercial mill	13.2
Container	4.7
Market place	0.8
Others	10.5

Table 7 Period of storage of maize by kenkey producer

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Weeks	Percentage(%)
1-4weeks	70.9
5-8weeks	17.1
9-14weeks	6.2
More than 16weeks	5.8

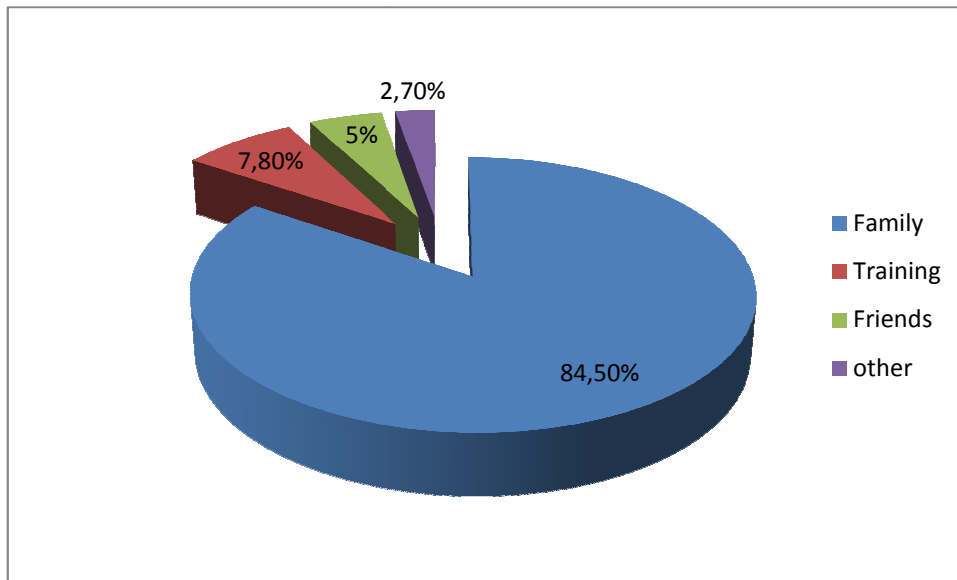


Figure 5: Percentage(%) showing how producers learnt kenkey trade

Majority of producers (96.1%) produced kenkey at their homes, (3.9%) produced at a site outside their home.

Production activities which affect quality of Kenkey

For all the different types of kenkey, the producers responded that the following practices affect the quality of kenkey negatively.

Table 8: Activities that affect quality of Kenkey

Activity	How quality is affect
<ul style="list-style-type: none"> • Use of contaminated maize • Improper washing of utensils for steeping maize, cooking of pre-cooked dough (<i>aflata</i>), mixing of pre-cooked dough (<i>aflata</i>) with uncooked dough and cooking pot. 	Smelly Kenkey
<ul style="list-style-type: none"> • Putting hands into maize during steeping • Use of over- fermented dough 	Kenkey becomes discoloured

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<ul style="list-style-type: none"> • Use of contaminated water, use of dirty corn husk and plantain leaves for wrapping kenkey. • Use of unfermented dough 	Kenkey is uncharacteristically sweet
<ul style="list-style-type: none"> • Improper Pre-cooked dough (<i>Aflata</i>) preparation • Mixing more pre-cooked dough with uncooked dough • Improper mixing of pre-cooked dough with dough • Too much water during steam cooking(dehulled kenkey) • Use of too much water during pre-cooked dough preparation. • Unmonitored cooking time • Improper milling(less steeping time) • Maize not steeped for 3 days in the case of dehulled kenkey 	Poor texture (inelastic)of kenkey Lumps in kenkey Kenkey which is too soft Hard kenkey Kenkey texture not smooth Kenkey flavour not adequately developed
<ul style="list-style-type: none"> • Insufficient firewood • Too much water • Inadequate cooking time 	Kenkey not properly cooked Kenkey too soft Watery Kenkey

Labour intensive activities during Kenkey production

Table 9 Operations which producers consider to be labour intensive

Operations	Percentage(%)
Making of slurry for cooking into <i>aflata</i>	5.1
Aflata preparation	27.9
Mixing of <i>Aflata</i> with fresh dough	21.0
Molding of Kenkey	25.6
Mixing of <i>Aflata</i> with fresh dough + Molding of Kenkey	8.9
<i>Aflata</i> preparation + molding of kenkey	11.5

From Table 9 , *Aflata* preparation is the operation which producers consider to be labour intensive. Molding of the kenkey is the second most labour intensive unit operation.

Description of process and product variability - describe how diversity in processes leads to diversity of products

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Table 10a, : Process description and variability-for Ga kenkey

Process Ga kenkey Operations	Function/objective of the operation	Variation of Materials/equipment	Duration per material/equipment used	Workforce (specify number and sex per material/equipment used)	Product resulting from the operation	Quality attributes of intermediate and end-product
Sorting of maize	Remove unwanted materials like chaff, stones	Traditional rectangular sieve	1hour per maxi bag of 100kg	2 females	Sorted clean maize	White and clean maize flour
Steeping maize in water for 2 days	To soften the maize grains and make milling easier	Large Basins	20 minutes for 100kg maxi bag	1female	Soft maize grains	Soft and unscented maize grains
Milling of maize	To obtain smooth maizeflour	Corn mill	45 minutes for 100kg maxi bag	2 persons-1 male, 1 female	Smooth maize flour	Very smooth and unscented maize flour
Doughing of maize flour (Moistening with water)	To swell the dough, aid in fermentation and prevent smell in maize flour	Basins, water	45 minutes for 80kg maxi bag	1 female	Smooth corn dough	Unscented and white dough
Fermentation (2 days)	To achieve the desired odour, texture and taste of fermented dough	Basins	2-3 days for 90kg	1 female	Fermented maize dough	Odourless and sour maize dough
Partially cooking of 2/3 portion of	To obtain the desired elastic texture of kenkey	Aluminium cooking pot, water,Wooden stirrer, firwood and	1 hour for 30kg of fermented	1 female	Partially cooked	Partially cooked dough

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dough +Salt (Aflata preparation)		fire			(Aflatalized) dough	
Mixing of Aflata with 2/3 portion of fermented maize dough	To obtain soft and desired texture of kenkey and make molding easier	Rectangular wooden container, Wooden stirrer, Basins	1 hour for mixing Partially cooked dough with fermented dough	1 female	Mixture of partially cooked dough with fermented dough	unscented partially cooked dough and uncooked dough
Molding of kenkey and wrapping with clean maize husk	To make kenkey into units that can be easily cooked	Aluminium cooking pot, firewood, fire	2 hours	3 females	Molded kenkey	Molded and properly wrapped kenkey balls
Cooking of kenkey	To make kenkey edible and soft	Aluminium cooking pot, firewood, fire,	3- 4 hours	1 female	Cooked kenkey	Soft and cooked kenkey

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Table 10b: Process description and variability-for Fanti kenkey

Process	Function/objective of the operation	Variation of Materials/equipment	Duration per material/equipment used	Workforce (specify number and sex per material/equipment used)	Product resulting from the operation	Quality attributes of intermediate and end-product
Fanti kenkey Operations						
Sorting of maize	Remove unwanted materials like chaff, dirt, stones	Traditional rectangular sieve	1hour per maxi bag of 100kg	2 females	Sorted clean maize	White and clean maize flour
Washing of maize 2X	To make maize grains clean	Basins, water	1hour per maxi bag of 100kg	2 females	Clean maize grains	Sorted clean maize grains
Steeping maize grits in water for 3 days	To soften the maize grains and make milling easier	Basins	45 minutes per 100kg	1female	Soft maize grains	unscented soft maize grains
Milling of maize grains	To obtain smooth maize flour	Corn mill	2 hours per 100kg	2 persons- 1 male and 1 female	maize flour	Smooth and unscented maize flour
Doughing of maize flour (Moistening with water)	To swell the dough, aid in fermentation and prevent smell in maize flour	Basins, water	1hour for 80kg of corn flour	1 female	Maize dough	Smooth and unscented, white maize dough
Fermentation of dough for 3	To achieve the desired odour,	Basins	2-3 days for 90kg	1 female	Fermented	Odourless and

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days	texture and taste of fermented dough				maize dough	sour maize dough
Partially cooking of 1/3 portion of dough (Aflata preparation)	To obtain the desired elastic texture of kenkey	Aluminium cooking pot, water, Wooden stirrer, firewood and fire	1 hour for 30kg of fermented	1 female	Partially cooked (Aflatalized) dough	Partially cooked dough
Mixing of pre-cooked dough with remaining fresh dough	To obtain the desired elastic texture of kenkey	Aluminium cooking pot, water, Wooden stirrer, firewood and fire	1 hour for 30kg of fermented	1 female	Partially cooked (Aflatalized) dough	Partially cooked dough
Molding of kenkey in clean polythene and plantain leaves	To make kenkey into units that can be easily cooked	Basin	3 hours	4 females	Molded kenkey	Molded and properly wrapped kenkey balls
Cooking of kenkey	To make kenkey edible and soft	Barrel cooking pot, firewood, fire,	7 hours	1 female	Cooked kenkey	Soft and cooked kenkey

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Table 10c Process description and variability-for *Akporhie/Nsiho* kenkey

Process Akporhie/ Nsiho kenkey Operations	Function/objective of the operation	Variation of Materials/equipment	Duration per material/equipment used	Workforce (specify number and sex per material/equipment used)	Product resulting from the operation	Quality attributes of intermediate and end-product
Sorting of maize	Remove unwanted materials like chaff, stones	Traditional rectangular sieve	1hour per maxi bag of 100kg	2 females	Sorted clean maize	White and clean maize flour
Dehulling of maize	To remove the husk and make kenkey very white	Dehuller machine	45minutes per maxi bag of 100kg	2 persons- 1 male and 1 female	Dehulled maize grits	Sorted dehulled maize grits
Washing of maize grits with portable water	To clean the maize grains from dirt	Basins	30 minutes for 50kg	1 female	Clean maize grits	Washed maize grits
Steeping maize grits in water for 3 days	To soften the maize grains and make milling easier	Basins	20 minutes for 50kg	1 female	Soft maize grits	Soft and clean maize grits
Milling of maize grits	To obtain smooth corn flour	Corn mill	1 hour for 50kg of maize grits	2 persons- 1 male and 1 female	Dehulled corn flour	White dehulled and smooth corn flour
Doughing of dehulled maize flour for 1 day (Moistening with water)	To swell the dough, aid in fermentation and prevent smell in maize flour	Basins, water	30 minutes for 45kg of corn flour	1 female	Dehulled Maize dough	Smooth and unscented, very white dehulled maize dough

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Partially cooking of whole portion of dehulled dough (Aflata preparation) + salt Optionally, If Aflata is too soft small amount of raw dehulled maize dough is added to harden it	To obtain the desired elastic texture of kenkey	Aluminium cooking pot, water, Wooden stirrer, firewood and fire	45 minutes for 45kg of dehulled maize dough	1 female	Partially cooked (Aflatalized) dough	Partially cooked dehulled maize dough
Molding of kenkey and put in maize husk	To make kenkey into units that can be easily cooked	Basin	2 hours	3 females	Molded dehulled kenkey	Molded and properly wrapped white kenkey balls
Steaming cooking of molded kenkey	To make kenkey edible and soft	Aluminium cooking pot, firewood, fire,	4hours	1 female	Cooked kenkey	Soft and cooked dehulled kenkey

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Table 11: Problems experienced during Kenkey production and suggested improvements or solutions

Intermediate and final products	Criteria used to appreciate the quality of the intermediate or end-product	Problems experienced in the management of the quality of the product and determining factors	Proposed solution for this problem
Steeped maize	Softness and swelling of grains	Foul smell of maize and maize flour is not smooth	Using sorted grains , clean water and not putting hand in steeped maize
Fermented Corn dough	Colour, smell and textural changes and swelling of dough	Bad smell and over sourness in dough	Prepare the dough after 2- 3 days for Ga and Fanti kenkey and 1 day for <i>Akporhie</i> (Nsiho) kenkey
Partially cooked dough (<i>Aflata</i>)	Aroma, colour and textural changes	Poor consistency, too soft and Lumps in <i>aflata</i> .	Good consistency and lump-free <i>aflata</i> . Well-cooked <i>Aflata</i> .
Kenkey	Aroma, softness and elastic kenkey	Bad aroma of kenkey, hardness of kenkey, rough and lumps in kenkey	Prevent using contaminated maize, over fermented dough. Use well cooked <i>Aflata</i> . Proper mixing of partially cooked dough(<i>Aflata</i>) with fermented dough well.

3.2 Commercialisation

Retailer profile

The percentage of sellers interviewed from the Eastern was 22.5%, 44.7% from the Greater Accra region and 32.8% from Central region.

Table 12: Age bracket of Kenkey sellers from Eastern, Greater and Central Region

Age range	Eastern	Greater Accra	Central
<20	0	11	3
20-29	13	41	26
30-39	13	25	21
40-49	15	18	18
>50	14	14	12

Ethnic group of Kenkey Sellers interviewed in Regions

Table 13: Breakdown of sellers interviewed in Regions

Ethnic group	Eastern	Greater Accra	Central	Total
Ewe	24	15	5	41
Twi	8	14	19	41
Krobo	6	2	0	8
Ga	4	45	0	49
Fanti	1	16	57	74
Others	12	17	2	31
Total	55	109	80	244

Marital status of kenkey sellers

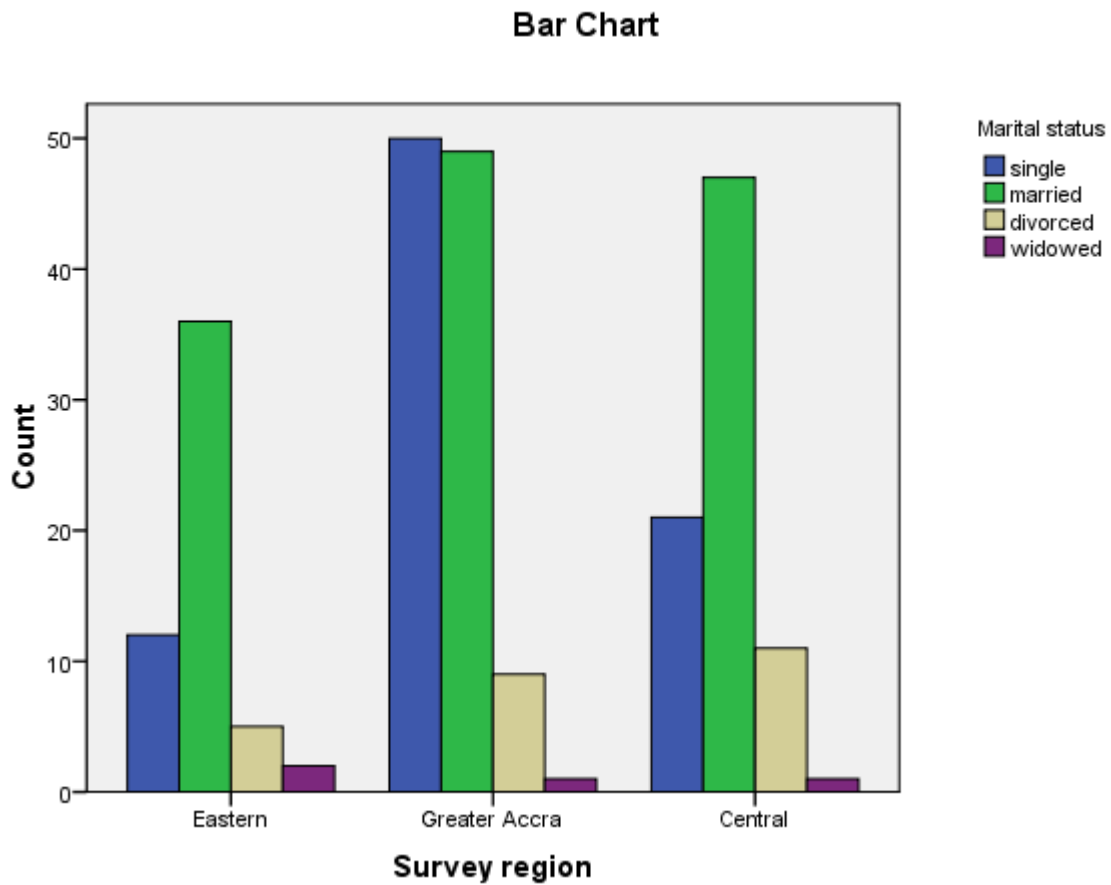


Figure 6: Marital status of Kenkey sellers interviewed in Regions

3.3 Religion of Kenkey sellers interviewed in Regions

Two hundred and twenty-five (225) sellers from all regions were Christians. Thirteen (13) were from the Islam religion, three each were from traditionalist and other religion.

Table 13 gives the breakdown of kenkey sellers in the regions. Ga kenkey sellers were predominant in the Greater Accra region, Fanti kenkey sellers were the highest in the Central Region and dehulled (*Akporhie*) kenkey sellers were predominant in the Eastern Region. One(1) Ga kenkey seller was interviewed in the Eastern region and ten(10) in the Central region. Three Fanti kenkey sellers were interviewed in the Eastern region and fourteen (14) in the Greater Accra region. Four(4) dehulled (*Akporhie*) kenkey sellers were interviewed in Greater Accra region and two(2) in the Central region.

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Table 13: Number of Sellers of types of kenkey sold in regions

Type of kenkey	Eastern	Greater Accra	Central	Total
Ga	1	91	10	102
Fanti	3	14	68	85
<i>Akporhie/Nsiho</i>	45	4	2	51
others	6	0	0	6

Types of Customer who buy kenkey

From the survey, it was observed that 47.1% middle group buy kenkey, 28.3% were from the lower group, 13.9% were office workers and 10.7% were from the high income group.

Texture, softness taste, aroma and appearance of kenkey were the quality criteria sellers and consumers look out for in kenkey. Table 8 below gives the details on the quality criteria desired in kenkey.

Table 14: Quality criteria sellers and customers look out for in kenkey

Quality Criteria	Percentage(%)- Sellers	Percentage(%)-customers
Aroma	10.7	6.1
Softness	30.7	29.5
Texture	38.9	50
Taste	12.7	
Appearance	-	13.1
others	7.0	1.2

Price range of Kenkey balls

The breakdown for the price range of kenkey balls was (4.1%) for 20 pesewas, (28.3%) for 30 pesewas, (33.6%) for 40 pesewas, (31.6%) for 50 pesewas and (2.5%) was in the more than 50 pesewas price range.

Cost involved in transporting kenkey to Vending site

The percentage price for transporting kenkey for selling was as follows, 46.7% of the kenkey sellers incurred a cost of GH¢2-4 for transporting Kenkey to vending site, 34.8% walked to

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the vending site, 9.4% pay GH¢ 4-5 and 9% pay GH¢ >5 for transporting kenkey to the vending site.

Table 15: Shelf-life of types of kenkey

Days	Ga	Fanti	<i>Nsiho/ Akporhie</i>
1-2 days	43	13	12
3-5days	50	42	32
5-10days	7	18	4
Above 10	2	12	3

Table 15: Problems experienced during commercialisation, suggested improvements or solutions

Intermediate and final products	Problems experienced in commercialisation	Detailed description of the problem	Proposed solution for this problem
Ga kenkey	Complaints from Customers	Size of kenkey, texture , small amount of sauce, price of fish	Need patience and Good human relationship
Fanti kenkey	Poor patronage during rainy season, Struggle for purchase, risk of crossing roads, problem, Customers complain about hardness of kenkey	No shade for shelter during rainy season. The sellers are many as a result there is high competition. Crossing of roads to get the customers to buy product.	A permanent location for selling of product is needed. Shift system for selling should be introduced
Dehulled kenkey(<i>Akporhie/Nsiho</i>)	Customers complains Customers run away with money. Bodily pains on sellers	Size of kenkey Customers buy from moving vehicle Sellers run up and down to catch the passengers in moving vehicle. The product is very heavy.	Size improves when maize cost goes down Permanent location is needed. Shift system for selling should be

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Intermediate and final products	Problems experienced in commercialisation	Detailed description of the problem	Proposed solution for this problem
	Competition among other sellers. Credit from customers	Refusal to pay debts	introduced. Refuse to credit

3.3 Consumption

Consumer profile

One hundred and seventy seven (177) males and one hundred and ninety- one (191) female consumers were interviewed. Majority of the respondents (110) were from the Twi ethnic group and one hundred and four (104) from the Fanti ethnic group. Seventy-one(71) were from the Ewe ethnic group and forty-five(45) were from the Ga ethnic group.

Ninety-three (93%) percent of consumers were Christians, five (5%) were from the Islam religion, 1.9% were traditionalist and the 0.2% were from other religion .

Most of the respondents were dependent and not head of household.

Types of Sauces

Kenkey consumers preferred eating kenkey with fresh pepper than the other available sauces. The second preferred sauce was the tomato sauce , then black pepper. The least preferred was the others apart from the ones listed.

Table 16: Percentages of type of sauces used for eating kenkey

Sauces	Frequency	Percentage(%)
Fresh pepper	297	71.2
Black pepper	54	11.1
Tomato sauce	47	11.4
Okro	15	3.8
Soup	6	1.4
others	4	1.1

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Reasons why Consumers eat Kenkey

The reasons consumers gave for eating kenkey is shown in Figure 7. The primary reason was ready –to-eat and secondly because it is a heavy meal. Other consumers said they ate kenkey because they were tired of other foods.

Table 17: Places where consumers buy kenkey

Sauces	Percentage(%)
Street Vendor	56
Hawker	33
Vendors	7.6
Restaurant	3.3

Majority of consumers buy from the street vendors and 3.3% buy from the restaurants. Most of the respondents (36.2%) ate kenkey 2-3 days in a week, 18.4% eat kenkey once a week, 17.3% eat kenkey 4-5 times in a week, 10.9% eat kenkey more than 7 times in a week, 9% eat kenkey 6-7 times and 8.3% of the respondents rarely eat kenkey.

Table 18: Period of the day when Kenkey is eaten

Period	Percentage (%)
Lunch	52.2
Breakfast	31
Dinner	16.3
Between Meals	0.2
Special Ocassion	0.2

Most of the consumers eat kenkey at lunch, the minority ate kenkey between meals and on special occasion. 78.7% of consumers eat kenkey at home , (12.5%) eat kenkey at the street vendors place, 7.8% eat in their offices and shops and 4% eat kenkey at the restaurant.

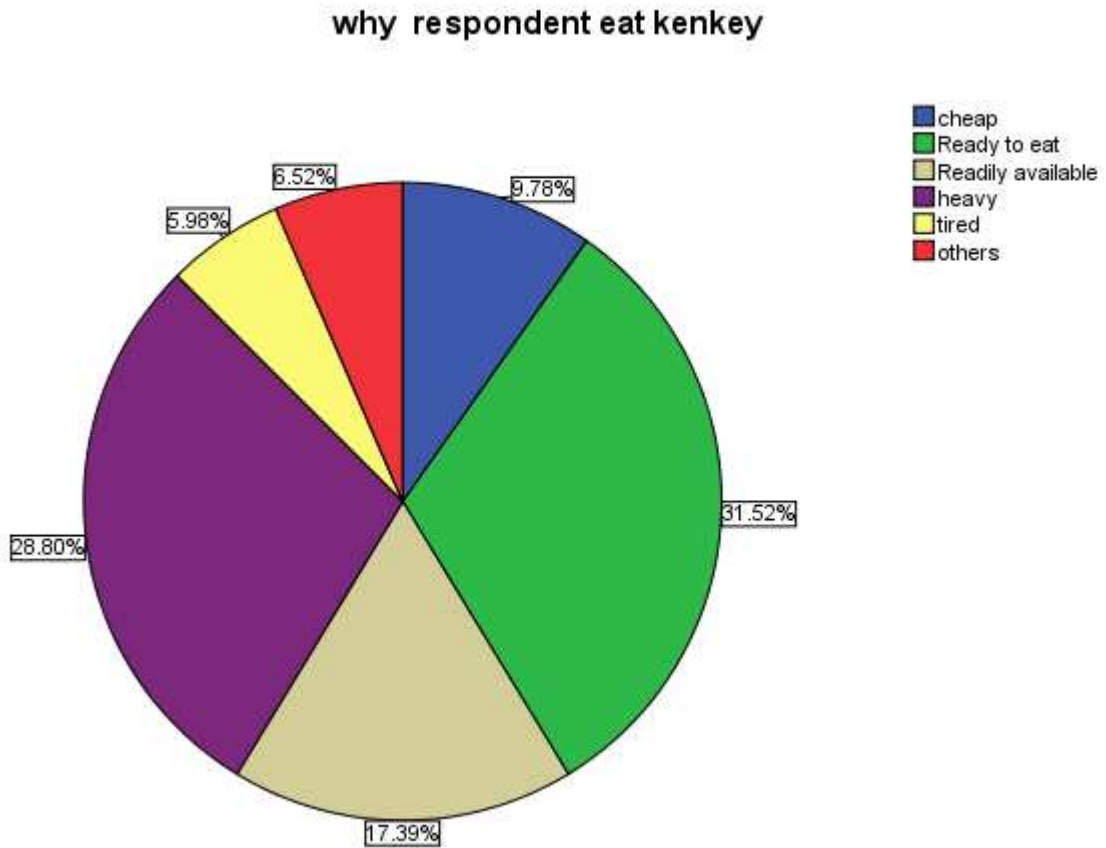


Figure 7: Pie chart showing why consumers eat kenkey

Quality attributes consumers look out for in Kenkey

The Table 19 gives quality attributes of importance to consumers of kenkey. The most preferred quality attribute is the texture, followed by the softness, taste and appearance.

Table 19 Quality attributes of importance to consumers

Quality attributes	Frequency	Percentage (%)
Softness	144	34.0
Texture	146	34.5
Taste	109	25.8
Appearance	20	4.7
others	4	0.9

Table 20 shows quality attributes consumers look out for in specific types of kenkey. For Ga kenkey, consumers look out for the softness of the kenkey before the texture. In the case of the Fanti kenkey, consumers prefer the texture first then taste of kenkey before the softness. For the dehulled (*Akporhie*) kenkey, consumers prefer the softness then the taste before the

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texture of the kenkey. Most of the consumers do not consider the appearance in buying kenkey.

Table 20: Quality attributes preferred by consumers for specific type of kenkey

Type of kenkey	Softness	texture	Taste	Appearance	others
Ga	77	76	47	10	0
Fanti	31	44	33	3	1
<i>Akporhie/Nsiho</i>	36	26	29	7	3

Possible therapeutic effect(s) perceived by Consumers

Consumers responded that kenkey gave energy because it contains carbohydrate. Others believed that when kenkey is mashed and drunk cured fever. Others responded that fermented foods are healthy. Some consumers believed that kenkey especially the Ga and Fanti kenkey aids digestion, because it contains roughage. Other responded that kenkey helps increase intestinal microflora. Some of the consumers responded that the stock from cooking of Ga kenkey cured malaria. Consumers also responded that kenkey was whole grain food and promotes good health.

4. Discussion

Females are involved in kenkey production and selling. The diversity in the types of kenkey is in the fermentation methods, soaking time, precooked dough (*Aflata*) preparation, addition of salt and cooking method. Whole maize is used in the preparation of the Ga and Fanti kenkey and dehulled maize is used in the preparation of dehulled kenkey. In the case of Ga and Fanti kenkey, the dough is fermented for 2-3 days, but for the dehulled kenkey(*Akporhie*) the dough is fermented for a day. Salt is added to the Ga and dehulled kenkey during the pre-cooking of the dough (*Aflata*). However in the case of the dehulled kenkey, the addition of uncooked dough to the pre-cooked dough is optional and most producers do not add uncooked dough to the pre-cooked one except where the precooked dough is too soft. Polythene is used to wrap the Fanti kenkey before the plantain leaves are used. This helps in preserving the kenkey. Ga kenkey and Fanti kenkey are cooked in large amount of water but the dehulled kenkey is steam. There is a need to critically analyze the process of kenkey preparation and take note of the time, quantity and yield for each unit operation and the work force involved .

Ga and Fanti kenkey sellers pay for transporting their wares to the vending site, while the dehulled kenkey sellers mostly walk to the location for selling. Ga kenkey sellers are stationary at specific location , but the Fanti and dehulled kenkey sellers usually have to struggle for customers from moving vehicles. The unsold kenkey for the Ga kenkey is added

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to the *aflata* and used for another production batch, but for the Fanti and dehulled kenkey, can be resold after it is not bought a day after preparation. Ga kenkey sellers sell sauce and fried fish also but the sellers of Fanti kenkey and dehulled kenkey sell only the kenkey. However, dehulled kenkey sellers give customers some sauce.

Ga and dehulled kenkey are kept in polythene before selling to keep it warm, but other sellers arrange Ga kenkey in ice-chest. Fanti kenkey is arranged in basins before selling. Consumers look out for softness in good quality Ga and dehulled kenkey and texture in Fanti kenkey. Consumers (87.5%) agreed that they will be ready to pay more for good quality kenkey, twelve (12%) said No to this accession.

The literature search on the Fanti Kenkey producers showed that cooking time was 3 hours but from the survey conducted Fanti kenkey is cooked for 6 hours and more. The literature search and the survey confirmed that producers of kenkey are able to keep the dough for a longer time by adding less amount of water during the doughing process. The producers of kenkey never mentioned backsloping of their dough but the literature talked about backsloping of old dough with fresh dough. Both literature search and survey established that aflatalization was important to produce kenkey of desired texture. Also it was established by both literature search and survey that the portion of pre-cooked dough (*Aflata*) added to dough depends on the type of kenkey being produced. The literature search showed that indigenous Ga producers used 1:1 portion of precooked dough with uncooked dough but the survey did not show this fact. Some activities according to literature and survey that could affect the quality of kenkey were the use of contaminated maize, unclean corn husk and plantain leaves which make the kenkey smell. Also the survey established that the use of improperly cleaned utensils, putting hands in steeped maize and using of over fermented dough made the kenkey smell. The literature search and survey established that women with little or no formal education carry out commercial production as a family acquired art. They carry out their activities either as individuals or as a family, depending on family labor to produce and retail kenkey. A new innovation that has been added was the wrapping of Fanti kenkey in polythene before the plantain leaves which improves the shelf-stability of the kenkey.

The literature search and sellers survey established that kenkey sellers were from diverse background and that females formed the majority. Also it was established by both literature search and survey that kenkey provided food for large part of the urban population. The literature and survey on kenkey consumers confirmed that consumers liked kenkey because it was convenient, accessible and affordable. They mostly ate with fried fish. Kenkey water is believed to have curative properties against malaria, diarrhoea and jaundice, this fact was confirmed from the literature search and survey by consumers of kenkey.

CONCLUSION

The kenkey business is traditional and a family trade, mostly learnt from the producers' mothers. The production and selling of kenkey is a female trade. Producers of kenkey were very aware of the activities that could give the quality of kenkey consumers' desire. Most of the producers of kenkey were sellers as well. Most sellers earn daily income of GH¢ 20-40.

Most of the producers and seller of Ga kenkey were from the Ga ethnic group. Fanti kenkey producers and sellers were all from Fanti ethnic group. The dehulled kenkey (*Akporhie/Nsiho*) producers and sellers were from Ewe ethnic group. The trend shows that Ga and Fanti kenkey originated from the Greater Accra and Central regions of Ghana respectively. Although the dehulled kenkey is predominant in the Eastern region of Ghana, that district borders the Volta region of Ghana this explains why the producers and sellers were from that descent. Kenkey producers responded that the business was profitable. Kenkey producers interviewed processed 10-50kg of maize in a week and produced kenkey 1-3times a week.

Consumers like kenkey because it is ready –to eat firstly and secondly because it is heavy. They preferred fresh pepper sauce with fried fish when eating kenkey . Consumers responded that kenkey gave energy and the stock of kenkey relieved fever. Consumers look out for the texture and softness in good quality kenkey. Most kenkey consumers eat kenkey at home and buy the kenkey from street vendors. Kenkey is consumed by all classes of the society- lower class, middle class and high class.

The unit operation for kenkey production has to be monitored critically, the time involved, people involved, the amounts used and the yield. This can be done for the dehulled kenkey because less work has been done on it and for the re-engineering purposes it will be more acceptable.



Kishk Sa'eedi
Identification of quality attributes by survey

Part of

D 1.1.2.1: Survey results: quality attributes for Group 1

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1. INTRODUCTION

This document contributes to deliverable 1.1.2.1" Survey results: quality attributes for group 1" of the AFTER project. This deliverable aims at identifying the products namely Kishk Sa'eedi (KS) and assessing the quality attributes. These were achieved by conducting field survey in the main production zones and in the trade centers of the KS.

To-date, KS has not been fully investigated and standards for its operating procedures have never been established. This survey responds to the need to understand the quality characteristics of KS and provide the first piece of evidence needed to explore the quality characteristics of KS. This survey aims to obtain comprehensive scientific knowledge of the existing know-how on technologies, processes and products as well as of the sensory quality criteria as perceived by the traditional processors and consumers.

This document presents the results of the first survey in Egypt of traditional KS producers conducted during the period from May- August 2011. The report provides the sector's views on the main quality attributes as perceived by the processors, the consumers and the traders in the main production zones and in the trade centres of KS. The report completed by , the survey coordinator Zahra S. AHMED.

2. SURVEY METHODOLOGY

2.1. Obtaining the permission from the CAPMAS and NRC Ethical review committee

It is a prerequisite to get formal permission from the Central Agency of Public Mobilization and Statistics (CAPMAS) prior to undertake field activity for scientific or educational purposes. Accordingly, the request was submitted and the permit number 638/2011 was issued. It is a condition of all permissions to submit a report of the work carried out under the permission, including any results, to CAPMAS within two months of the expiry of the permission.

In addition the survey was introduced to the NRC Ethical review committee and subjected to discussion. Throughout three successive sessions the committee discussed AFTER project with the NRC technical responsible person and report writer. Queries relevant to the aim and procedure of the survey were answered and the survey was approved by the NRC ethical review committee.

2.2. Survey instruments

The study instrument was developed by Université Abomey Calavi / Faculté des Sciences Agronomiques with additional input from NRC team. The method employed included three questionnaires direct to different actors i.e. producers, traders and consumers (annex 1, 2, and 3). All of them were semi structured questionnaire and were administered in the form of individual interviews with villagers.

These individual interviews were focused on issues related to the nature of the product, its socio-economic conditions of production, trading and consumption pattern, and the sociology of the populations. First questionnaire focused on the households producing KS, the second direct to commercial KS traders and the third was administered to KS consumers of the sampled villages. The three questionnaires were used to achieve various goals and to reach various actors.

The interviews generally lasted about from 60 to 75 minutes. Participants sometimes asked to stop and continue later; this was permitted. We had the consent form and the questionnaire translated into Arabic and was back translated into English by native speaker to ensure that meaning was preserved.

2.3. Sampling

When designing the field survey, the study area was firstly stratified (i.e. divide the area into relatively homogenous units. Stratified sampling provides a logical, objective and efficient method of undertaking surveys and ensures that the full range of potential KS types will be systematically sampled. Preliminary site visit to refine the initial stratification units was undertaken.

The sample solicited participants from accessible house in the sampled villages with the goal of having a broad presentation. Participants were a convenience sample of villagers who were willing to participate in the interview. Relevant personnel are liaised with by NRC team, to gain support for survey activities.

2.4. Survey team

For each sampling cluster, team of two interviewers i.e. ladies and one local field facilitator were designated. The rural social workers data collectors were trained on how to conduct the effective interview. In addition field supervisor with good grounding was appointed to act as a focal point. NRC team covered aspects such as training of data collectors, quality control, access, daily itineraries, data entry and subsequent analysis and reporting.

2.5. Quality assurance measures

A simple guideline dealing with the best practice survey methods for conducting effective interview was developed by NRC team and handed to data collectors. Field supervisor was also assigned to provide necessary guidance and to assure the application of the best practices during the interviews.

The completed questionnaires were returned to the survey coordinator who reviewed each questionnaire for completeness and consistency. The survey coordinators spent time in the field and attended/participated significant number of interviews. Also a regular phone consultation with interviewers was done and any ambiguities were resolved.

After this preliminary quality control step data were entered and outputs were reviewed and edited. Any ambiguous responses were flagged for further review. Data were entered and reviewed by cross checking with hard copy of the filled questionnaire. Then SPSS 17.0 software for windows was used to perform statistical analysis.

Table 1 summarized the number of actors surveyed stratified by districts and villages. Three districts out of nine districts representing geographically El-Minia Governorates were sampled. Within each district three villages were selected where 902 producers, consumers, and traders were interviewed.

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Table 1: Survey logistics

Area surveyed		Total number of actors surveyed	Numbers of actors surveyed		
District	Village		Number of producers	Number of traders	Number of consumers
Maghagha	Mallatia village	89	44	--	45
	Elabasia village	104	50	3	51
	Gezeeret Sharona	130	50	30	50
	Total	323	144	33	146
El-Minia	Talla village	110	49	14	47
	Towa village	53	49	3	1
	Nazlet Hussain village	106	51	5	50
	Total	269	149	22	98
Mallawi	Sangerge village	100	50	--	50
	El-Roda village	101	50	2	49
	Deer El-Barsha village	100	50	0	50
	Total	310	150	2	149
Grand total		902	443	57	393

3. RESULTS

The field survey period extends from July to mid August. Over this period, a number of 902 of KS producers, consumers and traders were interviewed. The participation rate was 97% and most respondents who declined said that they were not interested or were too busy. Few interviewees did not give specific reason for declining.

3.1. PRODUCTION/CONSUMPTION ZONES

3.1.1. Production

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KS production is a family business and is essentially a feminine occupation where, almost all interviewees (97.3%) were female KS producers. In some households, the kneading of the product of the second fermentation of the wheat-milk mixture may be too heavy a task for a woman, and a male hired help are employed for that specific task.

The percent of households hiring male for assistance is 2.7% of the total participants. For the stage of shaping into balls and arranging in rows to dry on the reed mats, the women of the family and/or the neighbors join in, and the favor is returned when it is their turn to produce KS.

3.1.3. Raw materials: types and quality, other ingredients and sources

The KS consists of two main ingredients namely: whole parboiled locally grown freshly harvested wheat and unpasteurized fermented buttermilk (*Laban Zeer*).

The fermented buttermilk or *Laban Zeer* is a by-product of butter production prepared by collecting the buttermilk after churning raw unpasteurized buffalo or cow milk. The collected buttermilk is transferred into an earthenware jar called *zeer*, or to the skin of small goat called *Jelda* and freshly separated butter milk is added to it and stirred in, followed by a sprinkle of coarse table salt on the surface. The cover is then well secured with a clean cloth and the *zeer/jelda* is left in a well aired dark place. The whey formed by the process of fermentation and souring of the buttermilk progressively seeps through the pores of the *zeer/jelda* and is collected and disposed of. Over time, the fermented buttermilk in the *zeer/jelda* thickens to produce the sour milk referred to as *Laban Zeer* which is in the form of a heavy paste. This process of *Laban Zeer* production is seasonal and starts usually during December and January and can extend to April-May. During this period, the animals feed on fresh green clover which influences the composition and characteristics of the milk that is used in *kishk Sa'eedi* production.

The **whole wheat grains** are manually sorted to discard stalks, dirt and weeds. Clean mature grains are boiled on an open fire in a metal barrel or large aluminium cooking pot in plenty of water till they soften. The end point is just before rupture of the bran layer. They are drained and spread on clean mats to dry in the sun. They are then coarse milled and the resulting wheat meal is sieved using a metal or silk mesh sieve.

Whole cumin seeds are added just before cutting and shaping the fermented *hama*. In some households, a small quantity of finely ground hot chilli pepper is added as well.

The main **source of ingredients** varies where; more than 67.5% of the respondents cultivate their own wheat or they get it from relatives/neighbours. More than half of the respondents buy *laban zeer* from the weekly village market or from relatives/neighbours. For the condiments i.e. cumin and hot chilli the main source is the small shops, street vendors or small groceries.

3.1.4. Description of process and product variability

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The data gathered during the survey confirmed the previously reported method of processing *KS* and added fine technical details. *Kishk sa'eedi* is made from a combination of parboiled whole locally fresh grown wheat with fermented buttermilk from water buffalos and/or cows.

The *Laban Zeer* is fermented alone, then mixed and fermented again with the coarsely ground mature whole wheat that had been previously parboiled and sun dried. The mixing is traditionally done in a large unglazed earthenware pot, the *magour*, in which the fermented milk and parboiled whole wheat are mixed together. Aluminum large shallow jars are increasingly used for the second fermentation instead of the *magour*. Wheat-*laban zeer* mixture i.e. *hama* is left to ferment again then kneaded and the cumin added. The mixture is shaped into balls or nuggets then spread out on reed mats to dry in direct sunlight. Final *KS* is stored in earthenware pot or in small silo made of mud and dried under the heat of sun.

The methods employed for the production of Egyptian *Kishk Sa'eedi (KS)* differed from one region to another because these processes are based on traditional local knowledge systems. Data generated from the survey revealed considerable product variations between *KS*. These existing variations between *KS* products are based on the following technical criterion: type of fermenting agent; quality; and purpose of production. According to these consideration *KS* can be categorized as follows:

- Based on quality:
 - *KS* produced for home consumption *BEITY*
 - *KS* produced for commercialization *SOOKY*
- Based on type of Fermenting agent
 - *KS* fermented with *skimmed laban zeer*
 - *KS* fermented with *full fat laban zeer*

Table 2 detailed the technical information on the technology, variation in the materials and equipments used, the duration of each processing step, workforce involved, and the quality attributes of the intermediate and end product are tabulated hereunder.

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Table 2: Process description and variability

Process Operations	Function/objective of the operation	Variation of Materials/equipment	Duration per material/equipment used	Workforce (specify number and sex per material/equipment used)	Product resulting from the operation	Quality attributes of intermediate and end-product
I. Preparation of parboiled grinded whole wheat						
Cleaning and sorting	Removal of dirt, stones, small grains, exotic grains and any unwanted materials.	<i>Ghorbal</i> i.e. Screen with metal mesh or silk mesh	It depend on the amount to be sieved and ranges from 30 - 90 minutes	One woman and young girl	Clean grains	Free of any unwanted materials
Parboiling	To soften wheat grains	Metal barrel, aluminum large cooking pot	It depend on the amount of wheat grain and ranges from 45-90 minutes	Two experienced women	Parboiled grains	Light yellow grains with transparent core
Draying	To remove water	Wet grains are usually placed on mat in sunny place on the roof top.	3-5 days	Two young girls	Dried whole parboiled grains	Can be broken by teeth
Grinding	To convert parboiled wheat into coarse flour	Small electric grinding machine Or Manual operating traditional stone grinding device	It depend on the amount of wheat grain and ranges from 90-180 minutes	One woman and one man Or One woman and young girl	Coarse flour and fine unwanted part remains after sieving	Uniform particle seize usually judged by experienced old women
II. Preparation of <i>Laban Zeer</i>						
Collecting the buttermilk after churning raw unpasteurized buffalo or cow milk	To collect butter milk then transferring it into <i>zeer</i>	<i>Zeer</i> i.e. earthenware lager conical jar Or <i>Geldah</i> an animal skin bag usually that of a goat or sheep	3-5 months	One experienced woman	Whey like liquid	Pleasant odor and pleasant sour taste
Salting by sprinkle of coarse table salt on the surface.	To prevent it from spoilage	Kitchen utensils	5-10 minutes when adding new batch	One experienced woman	Heavy paste	Pleasant odor and pleasant sour taste
Maintaining <i>laban zeer</i>	To maintain and prevent it from spoilage by stirring regularly	Clean wooden stick	5-10 minutes	One experienced woman	Heavy paste	Pleasant odor and pleasant sour taste

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Process Operations	Function/objective of the operation	Variation of Materials/equipment	Duration per material/equipment used	Workforce (specify number and sex per material/equipment used)	Product resulting from the operation	Quality attributes of intermediate and end-product
III. Preparation of <i>laban zeer</i> parboiled wheat mixture (<i>hama</i>)						
Adding warm salted water to dry parboiled wheat mixture	To soften coarse wheat flour and to initiate the first fermentation	<i>Magour</i> i.e. earthenware lager shallow jar Or <i>Bastella</i> i.e. Aluminum lager shallow jar	2-4 hours	Two experienced women	Paste	Pleasant odor and fresh taste
Adding <i>laban zeer</i> and kneading	To initiate the second fermentation	<i>Magour</i> i.e. earthenware lager shallow jar Or <i>Bastella</i> i.e. Aluminum lager shallow jar	60-90 minutes	Two young energetic girls Or Hired man	Paste	Pleasant odor and fresh taste
Left to ferment	To complete fermentation	<i>Magour</i> i.e. earthenware lager shallow jar Or <i>Bastella</i> i.e. Aluminum lager shallow jar	1-3 hours	One experienced woman	Paste	Pleasant odor and fresh taste
Second kneading and adding cumin	To reach the proper texture	<i>Magour</i> i.e. earthenware lager shallow jar Or <i>Bastella</i> i.e. Aluminum lager shallow jar	45-90 minutes	One-two experienced women	Fluffy dough	Pleasant odor and sour taste
Shaping	to shape <i>hama</i> into the desired form	<i>Magour</i> i.e. earthenware lager shallow jar Or <i>Bastella</i> i.e. Aluminum lager shallow jar And Clean dry mat	1-2 hours	Up to five young and old women	Small balls or irregular nuggets	Pleasant odor and sour taste

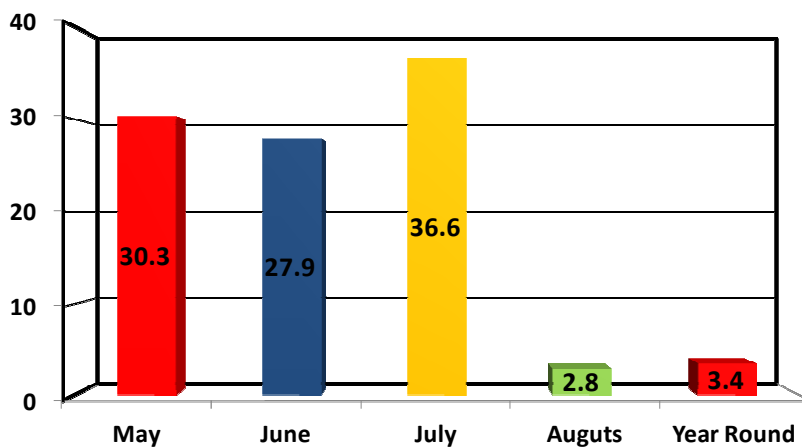
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Process Operations	Function/objective of the operation	Variation of Materials/equipment	Duration per material/equipment used	Workforce (specify number and sex per material/equipment used)	Product resulting from the operation	Quality attributes of intermediate and end-product
IV. Drying of final KS balls or nugget						
Drying	To remove water and tune it shelf stable	reed mats to dry in placed in direct sunlight or the hot shade	7-10 days	Two-three young girls	Dry small balls or irregular nuggets	<ul style="list-style-type: none"> - Can be broken by teeth - The core of the balls /nuggets are dry
V. Storing of final KS balls or nugget						
Storage	To keep it intact for consumption year round	elongated mud-sealed unglazed earthenware jars or earthenware jar or plastic bags	One year	One experienced woman	Dry small balls or irregular nuggets	<ul style="list-style-type: none"> - Can be broken by teeth - The core of the balls /nuggets still dry - Free of infestation - Light color - pleasant taste - Pleasant odor

3.1.5. Final product: average quantity produced weekly, monthly and storage period

More than one third of the respondents (36.6%) reported that the peak of *KS* home production is during July. Same trend was reported during summer months May and June. In other words more that 90% of *KS* home production occurred during the three months May, June, and July above mentioned. These trends in the production are coincided with the harvest of wheat. The percentage of households produces *KS* all the year round reported to be 3.4% figure (2).

Figure (2): Variation Percentage of *KS* production throughout the year



3.1.6. Problems experienced in production and suggested improvements or solutions

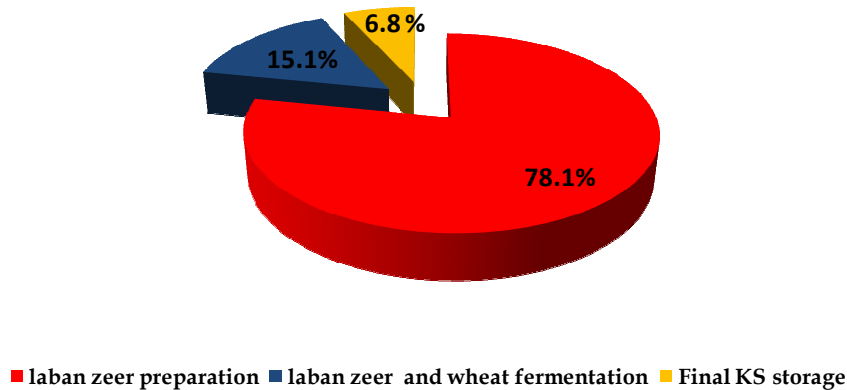
In general participants reported that most difficult operations in the processing of *KS* are the preparation and maintenance of *laban zeer*. Care should be taken during this process to avoid possible unwanted contaminations. Second difficult step in the production is the fermentation of *hama* i.e. the mixing of parboiled dried grinded whole wheat with *laban zeer*. Problem experienced and solution proposed for these problem are tabulated hereunder table 3.

Table 3: Problems experienced during production

Intermediate and final products	Criteria used to appreciate the quality of the intermediate or end-product	Problems experienced in the management of the quality of the product and determining factors	Proposed solution for this problem
<i>Laban Zeer</i>			
	<ul style="list-style-type: none"> - Color: White to off white - Texture: Thick i.e. semi solid - Taste: pleasant sour and mild salty 	<ul style="list-style-type: none"> - Worm infestation - Discoloration - unpleasant odor 	<ul style="list-style-type: none"> - Adhere to the proper cleaning protocol
<i>Parboiled wheat</i>			
	<ul style="list-style-type: none"> - Grain color: light yellow and the core is transparent - Grain size: large and puffy i.e. size increase by boiling - Grain texture: easy to chew - Taste: pleasant taste 	<ul style="list-style-type: none"> - Over or under cooked grains 	<ul style="list-style-type: none"> - Adjust and control cooking time
<i>Zeer milk + Parboiled wheat mixture (hama)</i>			
	<ul style="list-style-type: none"> - The surface of the <i>hama</i> is cracked - The <i>hama</i> is worm - the <i>hama</i> taste and smell good 	<ul style="list-style-type: none"> - the <i>hama</i> texture is doughy and sticky 	<ul style="list-style-type: none"> - Adjust kneading time - Adjust the amount of added liquid - control temperature of the added liquid
<i>Kisk Sa'eedi balls or nuggets</i>			
	<ul style="list-style-type: none"> - Color: light and ranged from off-white to yellow - Tast and odor: pleasant and mild - Texture not doughy when chewing - When soaked in water turn the color of soaking water into milky color 	<ul style="list-style-type: none"> - Worm infestation - Insect infestation - Discoloration - Unpleasant odor 	<ul style="list-style-type: none"> - Store <i>KS</i> in sunny And dry place - subject utensils used for storage to strict cleaning and drying protocol - utensils used for storage dedicated for this purpose only - Herbal fumigation of storage area and storage utensils

Respondents stated that many technical adjustments are need to end up with quality *KS*. Example of precautionary measures reported by *KS* procurers are, the exact adjustment of kneading time, amount of added liquid, and the fine adjustment of fermentation temperatures, figure (3) and table 3. The final storage of *KS* balls or nuggets was reported difficult by 6.8% of respondents. They stated that final storage of *KS* in sunny and well aerated place is essential to keep *KS* intact during the consumption period which is for one year

Figure (3): The most difficult operations in the processing of *KS* as perceived by producers



4. COMMERCIALISATION

The *KS* is a home production business and is essentially a feminine occupation. The production is for family and extended family consumption and for distribution as a gift to family, friends and relatives living outside the *KS* producing governorates. Thus there is limited market distribution for *KS*. When encountered in markets, *KS* presents itself in the form of unpackaged dried balls or nuggets. It is not served in eating places or restaurants.

The product rarely reaches the markets in cities of the northern Delta region. It may be found in popular markets on Greater Cairo and the Giza neighbourhoods and is sold in the form of dried small balls or nuggets.

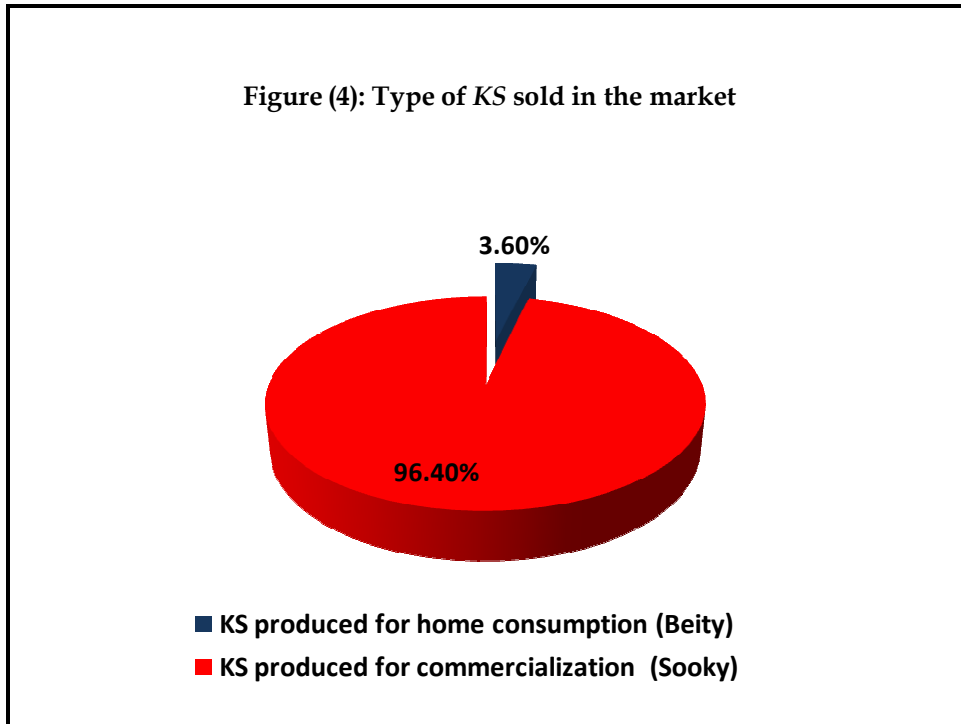


Figure (4) represent the type of commercialized KS, where almost all traded KS (96.4%) are produced for this purpose i.e. produced at home and directed to be sold. Whereas, only (3.6%) of the KS in the market are either from the remaining of the family production and/or sold to generate income for the family.

The KS destined for commercialization i.e. *SOOKY* is usually perceived inferior compared to KS produced for home consumption i.e. *BEITY*. Shortcuts in preparation time and cost containment modifications in the raw materials may be adopted when producing for the market.

In addition, KS fermented with full fat *laban zeer* is usually perceived superior compared to KS fermented with full fat *laban zeer*. Reasons for appreciating the quality as perceived by trader and consumer are given hereunder.

Criteria used to appreciate the quality as perceived by consumer and trader
<ul style="list-style-type: none"> ➤ High quality KS: <ul style="list-style-type: none"> - Color: off white to golden color - Mouth feeling: Granular, cohesive, gritty, contain less bran particles - Taste: pleasant acidic and sour taste - When soaked in water turn the color of soaking water into milky color. ➤ Low quality KS: <ul style="list-style-type: none"> - Color: dark yellowish - Mouth feeling: less gritty, less cohesive and contained more bran particles - Taste: unpleasant sour taste (acidic bit on the tongue) - When soaked in water the color of soaking water remain as is

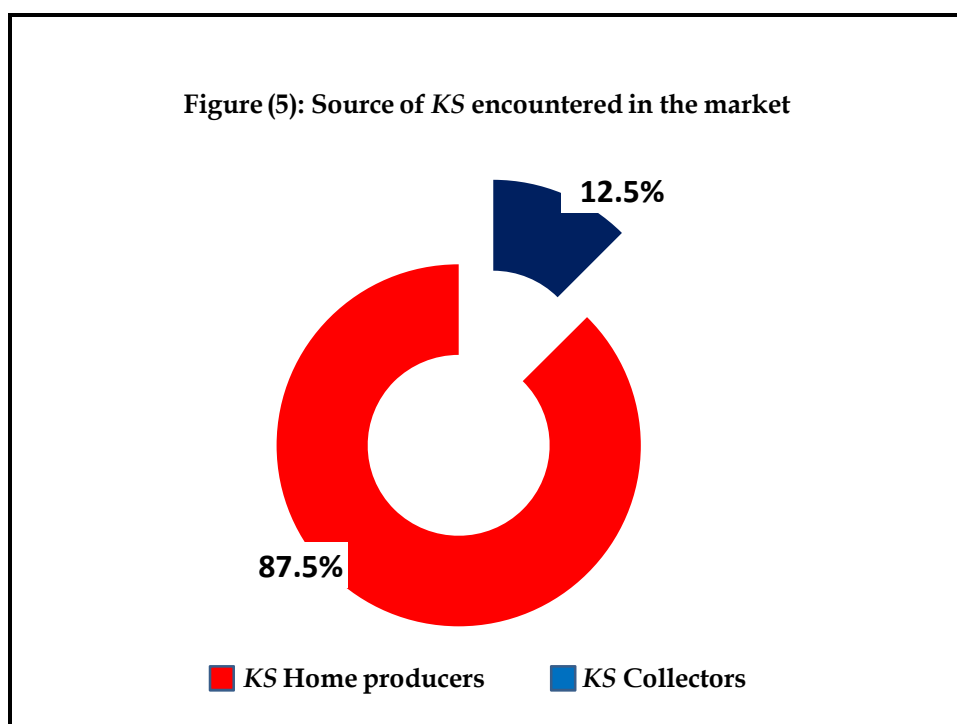
4.1. Trader profile

Trading of *KS* is a feminine business where 91.1% of respondent traders were female. They sell their products individually as street vendors or in the weekly village market in shops selling grains and dried legumes or small groceries. The *KS* Sooky clients are usually those who are living outside the *KS* producing area, those how cannot afford to produce *KS* at home or those who exhausted the *KS* received from their families, relatives or friends.

In response to a question about to what *KS* consumers are willing to pay more, 77% reported that they are willing to pay more for:

- *KS* light in color
- and exhibit pleasant odor.

More than four fifth of the *KS* traders reported that they receive the *KS* direct from the producers. The rest i.e. (12.5%) reported that they received through *KS* collector's figure (5).



4.2. Sales of product: types of product, target market, quantity, quality criteria vs selling price (variation during year)

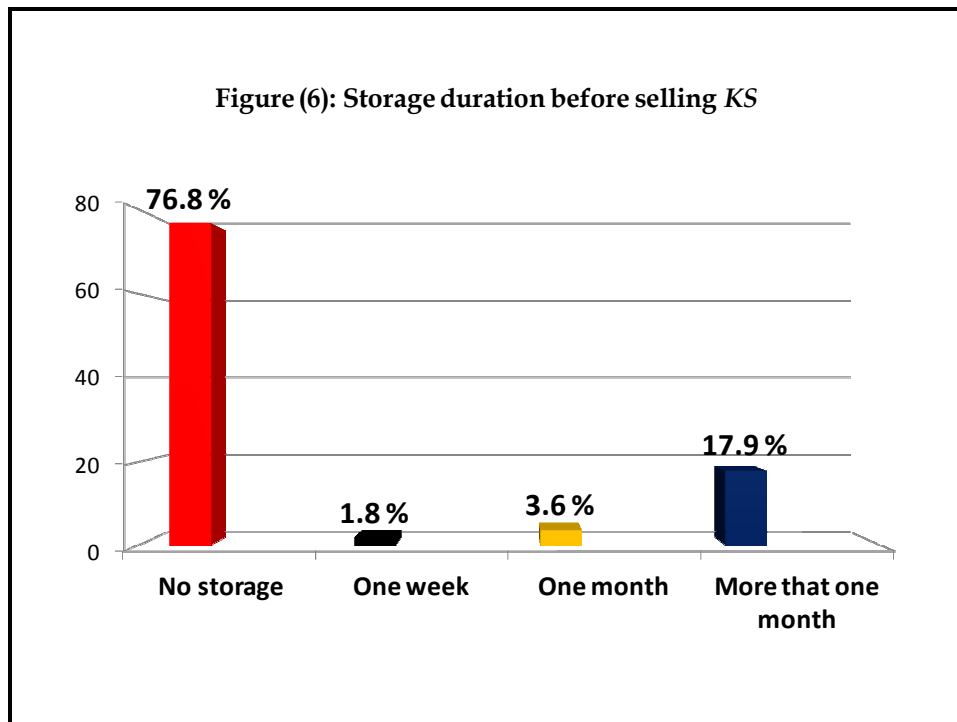
The commercial *KS* i.e. *Sooky* is sold in the form of unpackaged dried small balls or irregular nuggets. It is sold by weight (kg), by volume using empty cans and/or by number i.e. *Toura* which is 4 *KS* balls/nuggets. The price of *Soky* *KS* is ranging from 5-10 LE/Kg (equivalent to 0.9 to 1.8 USD). The *KS* price increase during winter.

In response to a question asking about the quantity of *KS* commercialized annually, the respondents replied with a wide range of quantities extended from 25kg per season up to 2000 kg. This reflects the wide range of quantities offered for sale rather than the demand. It is also an indication of the informal marketing and distribution channels (e.g. street vending, village weekly markets, or shop offering *KS* all year round).

4.3. Transport and storage logistics: period and conditions

The data generated by this survey revealed that more than three fourth (76.8%) of the *KS* commercialized is sold direct after processing i.e. without further storage. About one fifth of the respondents reported that they store *KS* for more than one month till selling it figure (6).

With respect to the transportation of *KS* from production places to the market more than 50% of the traders i.e. mostly women share the transportation cost as they apply the co-marketing model.



4.4. Problems experienced, suggested improvements or solutions

Table 4: Problems experienced during commercialisation

Intermediate and final products	Problems experienced in commercialisation	Detailed description of the problem	Proposed solution for this problem
<i>Laban zeer</i>			
	<ul style="list-style-type: none"> - Irregular supply - Continues rise in the price 	The shortage in the feed and the high demand for milk are the main reason for irregular milk supply. In turn continues increase in the price is adding a burden on the <i>KS</i> producers.	<ul style="list-style-type: none"> - Getting either raw milk or <i>laban zeer</i> from the neighborhood
<i>Kishk Sa'eedi balls or nuggets</i>			
	<ul style="list-style-type: none"> - Irregular supply - Continues rise in the price - Continues rise in the transportation cost 	The shortage in the feed and the high demand for milk are the main reason for irregular milk supply. In turn continues increase in the price is adding a burden on the <i>KS</i> producers.	<ul style="list-style-type: none"> - Getting <i>KS</i> from the neighborhood - Providing women with ingredient to produce <i>KS</i> under the name of that supplier

5. CONSUMPTION:

KS is a basic traditional food for Upper Egyptians and is popular among all social strata. 87% of respondents said that eating *KS* is very important to them. Reasons given for eating *KS* are listed hereunder. However the most common reason given for not eating *KS* is the limited resources to produce *KS* and/or leaving away from their villages. In the village it is common to share food with relatives in other households or with relatives in other governorate. Thus, those who are working outside the village did not eat *KS* regularly and they have it occasionally. 50% of the sampled respondents consume *KS* 3-4 times a week. One fourth of the participants reported that they eat 5-6 times a week.

Reason given for eating <i>KS</i>
Liking and preferring the taste They can afford producing it at home The know how to produce it They feel food secure by having it It is the custom and habit The belief that <i>KS</i> are healthier and nutritious

5.1. Consumer profile

The survey profiled the *KS* consumption where the data generated showed that 87% of the respondents identified *KS* is the core of their diet. Upper-Egyptian drive a large portion of their diet and many drive their income from *KS*, where it shares the importance of bread as a basic component of the diet. It is considered essential for an Upper Egyptian home to always be well stocked in bread (dried) and *kishk Sa'eedi*.

5.2. Dishes consumed: types, frequency (e.g. per week), place, quality attributes of importance to consumers

One of the unique features of *KS* is that it can be eaten at all stage of production. Diluted *Laban Zeer* is consumed in summer on its own as a refreshing drink. The *hama* (mixture of *Laban Zeer* and parboiled ground wheat) is consumed as a sour paste for breakfast or as a semisolid mash as an accompaniment to vegetables and eggs. The final dried balls/nuggets can be eaten as a snack and are a common school snack for Upper Egyptian children.

In general participants reported that dried *KS* balls/nuggets are reconstituted by soaking in water and consumed as a hot gruel, often with the incorporation of vegetables, eggs, spices, garlic, or dates. It can form the core ingredient in savory and sweet dishes. Two *KS* balls soaked in a glass of water is the first drink on waking up in the morning for many Upper Egyptian women.

The preparation way varied by districts however, the dominant preparation methods were used in soups and stews in Upper Egypt. It can be cooked with meat or poultry as a *kishk Sa'eedi* stew. For households with limited incomes, a few *KS* balls thrown in the cooking pot replace meat in the preparation of the daily vegetable stew. *KS* balls/nuggets are also munched in the dry state. Typical breakfast for millions of Egyptian is dipping few *KS* balls/nugget in the cub of tea with milk.

Egyptians consume *KS* at all meals under different forms of preparation and it serves as the food of choice for the sick. Prepared in a number of different ways, it can be served at any of the three main meals and between meals as well.

5.3. Possible therapeutic effect(s) as perceived by consumers

The questionnaire contained also open ended questions pertaining to the attitude and concern about *KS* and its possible therapeutic effect (s). The most common concerns expressed about *KS* were inconsistency of the sensory quality, and interrupted supply. Only 2.7% of the respondents reported concern about safety of *KS* i.e. cleanliness of the utensils, and quality of water, although there were many comments about reduced quality of *KS*.

About two third (63.9) % of interviewed *KS* consumers did not believe of possible therapeutic effect. However, they do believe that *KS* achieve satiety. They do also

believe that *KS* is a good source of quality proteins that allows the consumption of milk proteins throughout the year.

Meanwhile, more than one third of the respondents believe of the therapeutic effect. It serves as the food of choice for patients with gut problem. Some traditional healers are using *KS* to treat diarrhea episodes in infants and elderly people. Water remaining after soaking of *KS* balls/nuggets is used for the treatment of high body temperature. Common advice from experienced women to lactating mother is to eat more dishes containing *KS*.

6. DISCUSSION

This report provides necessary information on the considerations of *KS* quality attribute by surveying *KS* producers, traders and consumers in the main area of production. The survey was carried out by rural social workers from the sampling villages. Upon completing the interviews, the filled questionnaires were sent to the capital of the Governorates. Then the gathered data were subjected to several validation processes as follows; (i) checking for any odds on the paper survey forms upon receipt, (ii) reviewing the different section of the questionnaire, (iii) cross checking each questionnaire for completeness and consistency, and (iv) reviewing entered data by cross checking with hard copy of the filled questionnaire.

The data gathered during the survey confirmed the previously reported methods employed for the production of Egyptian *Kishk Sa'eedi* (*KS*) and added fine technical details (See literature review and background information). Considerable product variations between *KS* are reported as these processes are based on traditional local knowledge systems. The inconsistency in the sensory profiling as well as the hygienic quality of *KS* reflects the variability of its technological processes

These existing variations between *KS* products are based on the following technical criterion: type of fermenting agent; quality; and purpose of production. According to these consideration *KS* can be categorized as follows:

- Based on quality:
 - *KS* produced for home consumption *BEITY*
 - *KS* produced for commercialization *SOOKY*
- Based on type of Fermenting agent
 - *KS* fermented with *skimmed laban zeer*
 - *KS* fermented with *full fat laban zeer*

The generated information by surveying 902 respondents was in accordance with *KS* literature review and confirmed the fact that *KS* production and trading is a feminine occupation. The know-how of *KS* production is transmitted from mother to daughter across generations. The traditional production method has been preserved with little change in the utensils and other equipment used.

The geographic region for *KS* production extended from El-Fayoum Oasis to Assiut Governorate. The *KS* consumption region however, extended the production region and includes places where upper Egyptian lives and works. The *KS* reach some urban markets through informal marketing channels.

7. CONCLUSION

Traditional *KS* products have been produced for centuries in Egypt and are very popular and appreciated by millions of Egyptians. Based on the available information reviewed here above, a number of conclusions can be drawn:

- Under current conditions, the *KS* (the dried balls/nuggets) produced for home consumption, are based on traditional lactic fermentation processes. This would be greatly improved with the development and application of quality and safety systems such as GHP, GMP and HACCP.
- From a nutrition point of view, new methods for increasing nutrient and energy density and for removal of phytic acid, offer opportunities for future improvement in nutrient uptake by consumers.
- The popularity of ready-to-eat food items among both the food processing companies and the consumers offers excellent opportunities for improved reengineered *KS* e.g. school snack, energy bar and cereal flakes.
- A variety of reengineered intermediate *KS* products like fresh or frozen *KS* sourdough packed in modified atmosphere packs and used as a thickening ingredient in stews and gravies.
- Dehydrated sourdough prepared from different cereal mixes and extraction rates can be used in the production of baby foods and for thickening of soups. These could open novel culinary and technological applications, commercially and at home. Innovative research is needed to produce second generation *KS* products that are adapted to the preferences of the modern consumer and to the demands of modernity.

This could lead to commercial exploitation of the advantages of *KS* such as the affordable price, the relatively high nutritional quality, the low energy input required for its production and the low environmental impact of its production method.

To conclude in order to enhance further the potential improvement in the application of the *KS* processing technology, there is need for more research, technology transfer with due consideration to the socio-economic implications.

8. SURVEY LIMITATIONS

- Difficulty in contacting women in the targeted households and obtaining access permission especially that the time of the survey followed the implication of Avian Influenza (AI) outbreaks and coincides with the unfinished Egyptian revolution.
- Weather during the survey period (e.g. surveys undertaken during the hottest months in the year).

9. OBSERVATION MADE BY THE REPORT WRITER

Observation made by the report writer after frequent field visits during the data collections revealed that the problems associated with *KS* can be considered in FOUR categories i.e. production environment, microbiology in processing, process control, and nutritional and toxicological status.

9.1. Production environment

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In our traditional setting where the production level is that of subsistence housekeeping, the processing environment is very diverse: the equipment used is (earthenware, leaves, baskets, aluminium kitchen utensils, and clothes), the hygiene of handlers, equipment and facilities is not checked, the water used is said to be potable. All these factors affect the quality of final product and the acceptance of ultimate consumers.

9.2. Microbiology of process

There was many way to assure a consistently uncontaminated environment for the fermentation: the processor i.e women wear clothes dedicated for KS processing only, earthenware used for fermenting *laban zeer* is subjected to firm cleaning protocol, restricted access to fermentation room. In addition there is also accurate maintenance protocol for the fermenting agent i.e. *laban zeer*. The age and purity of each batch of the fermenting agent is assured thorough visual observation and sensorial testing by the most experienced person in the household which is usually elder women e.g. grandmother, mother in law, etc.

9.3. Process control

In view of the gathered information, the practice of process control was maintained as follows: a) fermentation periods were chosen according to human Judgment; b) quantity of water and ingredients to be used was based on the inherited experience through generations. On the contrary, it was virtually impossible to standardize the process between seasons and/or between households. All the above-mentioned factors resulted in inconsistent quality.

9.4. Nutritional and toxicological status

The lack of knowledge or information on the effect of fermentation on the nutritional quality of the final products stood as a problem in that consumers were unaware of the actual nutritional worth of the KS except the organoleptic attributes. Also the type and degree of danger posed by the consumption of fermented products which are unfit for human consumption due to the handling process or post-fermentation contamination were not known. Any possible problem resulting from these above-named sources could not be established conclusively.

Gowé

Identification of quality attributes by survey

Part of

D 1.1.2.1: Survey results: quality attributes for Group 1

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Abstract

A survey on gowé production, commercialization and consumption was carried out in the central part of Bénin (Zou and Collines). Some of the collected information concerned actor's status, raw materials, processing technique, equipment, quality attributes, storage, consumption rate and price. It was seen that the production was essentially carry out by females aged between 26 and 50 years (88%). The socio-cultural groups involved were mainly the Fon and Datcha, representing respectively 54.1% and 28.4% of the respondents. Maize and sorghum were used singly in Zou but were combined in the Collines. So three types of gowé were identified according to the raw material used: gowé from sorghum only, gowé from maize only and gowé from 'mixed sorghum and maize'. Maize/sorghum combination in a ratio 1:1, 2:1, 3:1 were used, according to locality. In Zou, the majority of the producers/sellers (79.6%) achieved the malting of the grains. Some producers used only malted grains whereas some others used a combination of malted (25%) and non-malted grains (75%). About 20.4% of the producers/sellers in Zou and 85% of the producers/sellers from Collines used only non-malted grains for the production. But producers/sellers from Zou added commercial sugar to give a sweet taste to the final product. Also the fermentation and cooking durations are longer when mixture of 'maize and sorghum' is used. According to the producers/sellers, the most important sensory attributes for the commercialization of gowé from single maize or sorghum were the sweet and sour taste (slightly acid), a smooth texture (fine particle size) while the colour might dependent on the raw material used (red for sorghum and white for maize). Reversely, gowé from 'mixed maize and sorghum' must be non-sweet with coarse particles. The majority of producers/sellers (60% to 68.6%) achieve the production two to three times per week. The storage duration varied with the processing method used. The name of the product varied from one locality to another and according to the technology used. The majority of producers/sellers (34.3% to 75%) have an income of 200 to 500 FCFA per kg of raw material used. Depending on the cities, gowé purchasers belong to different groups. Gowé is consumed one to five times per week and is supposed to possess some therapeutic effects. It is consumed mainly at home during lunch or dinner.

Background

Cereal grains constitute the main sources of nutrients for human food consumption in Bénin. Various food products are obtained from different processing techniques and type of cereal used. Some traditional cereals based products encountered in Benin include *Tchoukoutou Tchakpalo*, *Akpan* and *Gowé*. *Gowé* is a non-alcoholic cereal beverage traditionally produced from malted sorghum or maize. It is a fermented and sweet paste with specific aroma consumed after dilution in water. Sugar, ice or milk is added if wanted. Different types of *gowé* are usually produced based on the processing technique and the raw material used. Several types of *gowé* identified in Cotonou and Parakou were reported by Michodjéhoun-Mestres *et al.* (2005), Glidja *et al.*, (2006), Vieira-Dalodé *et al.*, (2007). *Gowé* is a product originated from the center part of Benin (Zou and Collines). Although the beverage has a widespread level of consumption, and high demand, up to now there is not any study carried out on the product in that area. The present study was carried out to gather information on the processing, the commercialization and the consumption of *gowé* in its area of origin.

1. Survey methodology

1.1. Study areas and sample size

The study was carried out in Zou and Collines: two localities of the Center of Benin. The municipalities areas covered in Zou were: Abomey, Bohicon and Covè. Those in Collines were: Dassa-Zoumè, Glazoué and Savalou (figure 1). The preliminary and prompted survey was conducted from 31 January to 2 February 2001 to gather information on the production areas and to test the questionnaire. The actual survey was performed from 11th March to 10th April. A total of 109 producers/sellers were interviewed representing a response rate of 90.8%. Concerning the consumers 300 persons (100% interviewed) were interviewed (table 1). Eligible interviewed actors were selected by ranking of producers/sellers of *gowé*.

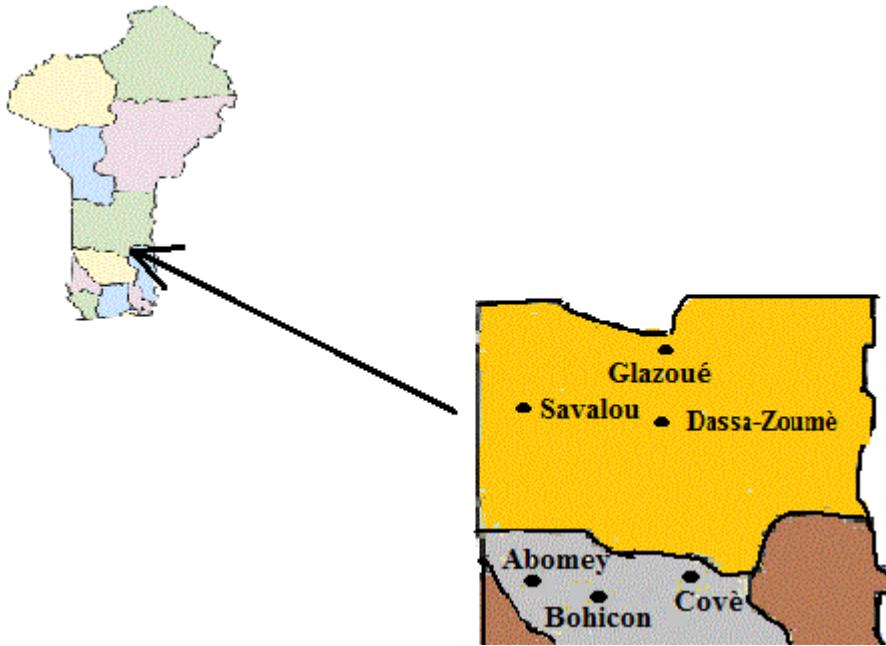


Figure 1: Map of Benin showing the municipalities of the study

1.2. Data Collection and analysis tools

A questionnaire was designed to collect data on gowé production, commercialization and consumption. The survey was carried out by individual interviews or focus group (2-3) discussions.

Demographic data related to gender, age, religion, marital status and academic qualifications were collected from both producers/sellers and consumers. Other information collected included: cereal grains used, production processes, equipment, quality attributes, quantity produced, storage period, frequency and place of gowé consumption, etc. The information were analyzed through descriptive statistics using Sphinx plus² v.4.5.

Table 1: Survey logistics

Area surveyed	Total number of actors surveyed	Numbers of actors surveyed	
		Number of producers/sellers	Number of consumers
Abomey	73	18	55
Bohicon	56	11	45
Covè	69	20	49
Dassa-Zoumè	70	20	50
Glazoué	71	20	51
Savalou	70	20	50

2. Production and commercialization of gowé

2.1. Socio-cultural characteristics of producers/sellers

The production and the commercialization of gowé are traditional activities performed only by women among which 96.3% were married (table 2). The number of the respondents aged from 36 to 50 years was the highest representing 55% of the interviewed producers/sellers. The second age group was 26-35 years representing 33%. These age groups seemed to be the most important ones more interested in the locality by the production and sale of gowé than younger or older groups. Fon and Datcha socio-cultural groups represented respectively 54.1% and 28.4% of the respondents. The high percentage of Fon group was expected because the main language spoken in three of the interviewed areas is Fon. Christians accounted for 59.2% of the respondents and animists 37.9%. About 86.2% of the respondents did not have any academic qualification.

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Table 2: Socio-cultural characteristics of producers/sellers

Socio-cultural characteristics	Percentage
Age (years)	
15-25	6.4
26-35	33.0
36 -50	55.0
<50	5.5
Gender	
Female	100
Ethnic groups	
Fon	54.1
Mahi	12.8
Nago	4.6
Datcha	28.4
Academic qualifications	
No school	86.2
School	13.8
Marital status	
Married	96.3
Unmarried	1.3
Divorcee	1.3
Religious	
Animism	37.9
Christian	59.2
Islam	2.7
Housekeeping status	
Housekeeping chief	1.8
Dependent	98.2

2.2. Raw material

2.2.1. Cereal grains used in gowé production

The cereal grains used in gowé production are maize and sorghum. Some respondents use a mixture of the grains for the production. The level of preference in the use of these grains was as follows: sorghum 32.1%, maize 32.1% and ‘sorghum and maize’ 55%. The production from single raw material is achieved only in Zou whereas in Collines all the producers/sellers use the mixture of cereal grains. The majority of producers/sellers from Abomey and Bohicon

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(94.4% and 100% respectively) use sorghum whereas 50% and 54.5% respectively use maize. In Covè all the respondents use maize; only 35% use sorghum. In Collines, the mixing ratio for the mixture of cereal grains differed from one locality to the other and between individuals at the same place. The reasons for proportional mixing of the grains included color development, increase in certain nutrients from sorghum and income improvement.

2.2.2. Types

The majority of the producers/sellers of gowé from sorghum (84.4%) use the red variety because it gives to the final product a red colour very appreciated by the consumers. Similar results were revealed by the previous studies (Michodjéhou-Mestres *et al.*, 2005, Glidja *et al.*, 2006). Some producers/sellers (9.1%) combine this variety with the red variety with white. Indeed according to them, when the final product is too red, the consumers consider that the raw material used is maize mixed with an additive (abohankan) used just to confer the red colour to the product. Concerning the maize grains, 50.5% of the respondents preferred the white variety. For the others producers/sellers using maize, the variety can be white or yellow.

2.2.3. Quality of raw material

The first quality of raw material for gowé production is that it should not be damaged and should be without weevil (figure 2). This quality criterion is necessary for a good germination and a good yield of production. The final product can also have bad smell when the grains are damaged by weevil. This criterion was cited by 77.9% of the 95 respondents using sorghum and 81% of the 95 respondents using the maize. Similar trends were obtained by previous investigations on gowé from sorghum (Glidja *et al.*, 2006). For 45.4% of the producers/sellers using sorghum and 52.6% of those of maize, the grains not contain pesticides residue because the final product may kept the smell. About 81% of the producers/sellers using sorghum mentioned the red colour of the grains as a quality attribute of final product. Whereas only 28.4% of the producers/sellers using maize consider the white colour as a quality criteria. Also the floury character (18.9% and 17.9% for sorghum and maize respectively) and the small grains (11.6% and 24.2% for sorghum and maize respectively) are the others criteria for the choice of the raw material.

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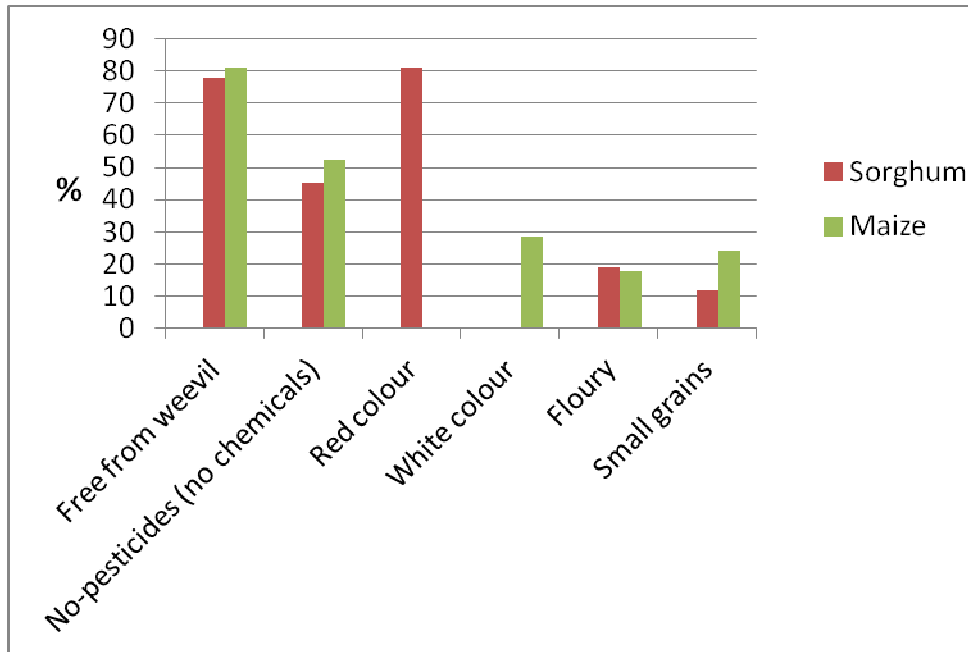


Figure 2: Quality criteria of raw material

2.2.4. Price and availability of raw materials

Sorghum used is mainly cultivated in the North part of Benin, whereas maize is mainly cultivated as well as in the north part (Nikki, Parakou), and in the East-south (Adja). The reasons for the choice of these raw materials are mainly the colour, the floury character and the water absorption capacity.

According to the interviewed producers/sellers, the sorghum is available from December to April. The price varies from 25.000CFA (39 Euro) to 50.000 CFA (77 Euro) for 100kg. Concerning maize, it is available from June to January and the price varies from 18.000 CFA to 30.000CFA (46 Euros) for 100kg. The mean storage duration is about eight months. According to the interviewed producers/sellers, the grains stored for a long period don't germinate and are damaged.

2.2.5. Quantity of raw material used weekly and frequency of production

Gowé is produced throughout the year with a peak production during the dry season (95.4% of respondents). The present survey was carried out during the dry season. The majority of the producers/sellers from single raw material (48.6% from sorghum or maize) use 16 to 25 kg of raw material for the weekly production (figure 3). About 34.3% of producers/sellers from sorghum and 25.7% of those from maize use 5 to 15 kg. Irrespective of raw material the other

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ranges represent 2.8 to 14.3%. During the wet season, the majority of producers/sellers (51.4% from sorghum and 48.6% from maize) use only 5 to 15 kg (figure 4). During the dry season, the majority of producers/sellers of gowé from mixture (63.3%) use 5 to 15 kg per week. Only 25% use 15 to 25 kg. For the maize/sorghum combination, 80% of the 20 respondents from Savalou favored the ratio of 1:1, while 40% and 35% from Glazoué and Dassa-Zoumè respectively preferred the ratio of 3:1. The ratio of 2:1 is preferred by 45% and 20% of producers/sellers from Glazoué and Dassa-Zoumè respectively.

The majority of producers/sellers (60% from sorghum, 68.6% from maize, 66.7% from mixture) produce gowé two to three times per week. Whereas 11.4% of producers/sellers of gowé from sorghum and 25.7% of those from maize and 26.7% from the mixture produced once a week. Only 28.6%, 5.7%, 6.7% of producers/sellers from sorghum, maize and mixture respectively produce more than three times per week. Gowé is produced by the majority of the respondents more than once a week because of the short shelf-life of the product.

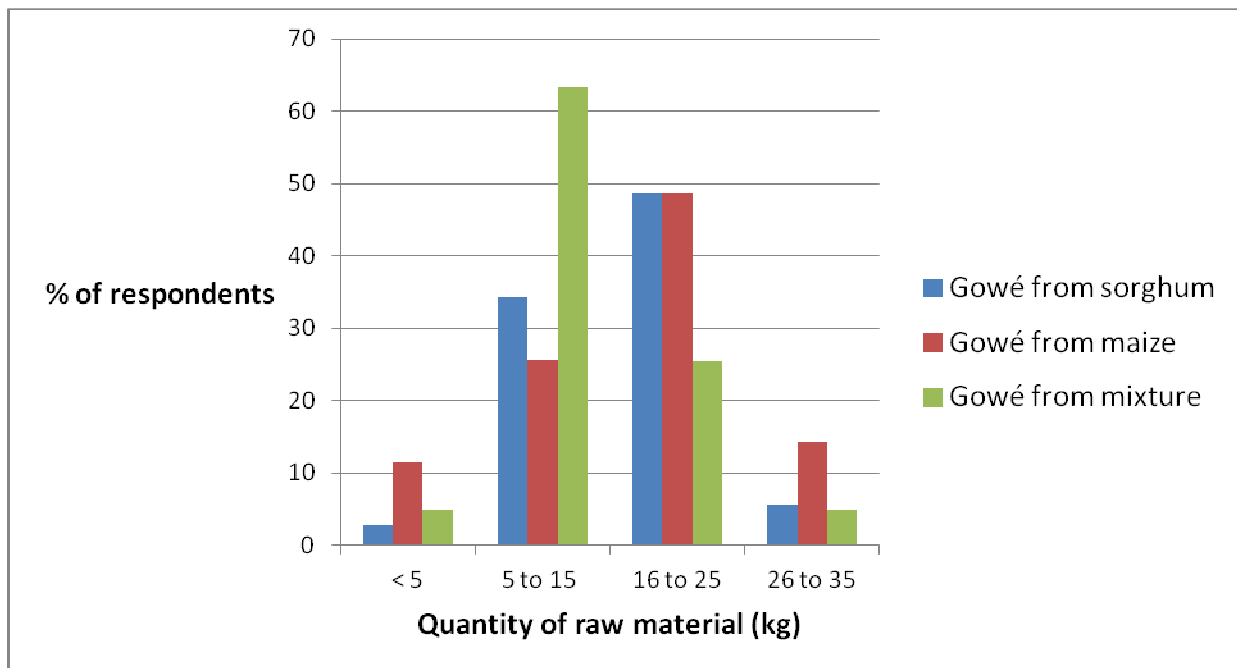


Figure 3: Quantity (kg) used per week during the hot period

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Survey results: quality attributes for Group 1

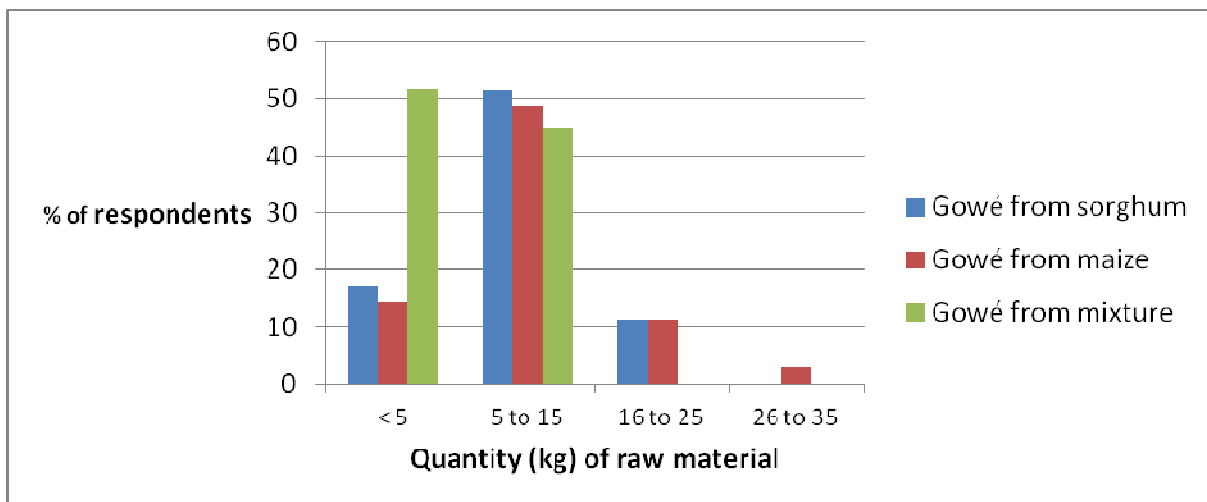


Figure 4: Quantity (kg) used per week during the wet period

2.3. Intermediate and Final product

2.3.1. Intermediate product and their quality criteria

According to all the producers/sellers achieving the malting, the radicles must be well developed before giving the sweet taste to the final product. Some respondents appreciated also the germination by the thickness of the germination layer (53.1%). According to 97.9%, these grains can be contaminated by moulds and are not used for the production. For the production of gowé from single raw material, the majority of respondents (65.7% of producers/sellers from maize and 71.4% of those from maize) consider that the product should have smooth texture whereas the product from mixture (71.7%) must be of coarse particle. The majority of producers/sellers reported that after 20 to 30 days they observe larvas and bugs in the malted flour. The respondents reported the presence of the larvas (54.2%) and bugs (31.2%) if the product is stored opened. Some respondents (64.6%) note that an unpleasant smell can develop if the drying is not well achieved before milling. About 94.5% of respondents recognized the supernatant with a sour and sweet taste. All the producers/sellers performing the malting noted the sweet taste. According to respondents, after two to three days of storage, they observe the presence of the larvas (69.7%), the increase of the sour taste (28.4%) and occurrence of unpleasant odour (50.5%).

2.3.2. Relation between the price of raw materials and gowé and place sale of final product

The price of final product varied throughout the year (99.1%). According to the respondents using sorghum, the price increases from April to December. For those using maize, it increases from June to January because of unavailability of the raw material. The price of

gowé varied with the price of raw material (100%). It varied also with the price of the fuel (wood) (17.4%) and the material for packaging (leaves) (18.3%). Gowé is sold at street food (66.0%) followed by home (49.5%) and in market (44.9%)

2.3.3. Processing technique

The technology of production varied with the type of gowé, the locality and between people in the same place. The main production processes are shown in table 3, 4, 5, 6.

In Zou for 57.1% of producers/sellers of gowé from sorghum and 28.6% of those from maize the grains were usually cleaned (15 to 120 min), washed (10 to 30 min) and soaked (10 to 20h) at local room temperature (28-30°C) (annex, table 5). The soaked grains are drained and left for germination for 48 to 72h. The germinated grains are sun dried (5 to 20h) and milled (3 to 4 times) to obtain the malted flour. This flour is kneaded and mixed with tap or hot water or supernatant of a previous production and left for fermentation during 6 to 20h at room temperature (28-30°C). Some producers/sellers (11.4% from sorghum and 2.8% from maize) left the kneaded flour for a first fermentation/saccharification of 5 to 10h before a second fermentation (10 to 13h). The fermented product obtained is cooked during 15 to 80 min and packed in leaves.

In Zou, some producers/sellers (25.7% from sorghum and 60% from maize) cleaned and divided the grains into two parts (annex, table 6). One part (25%) is soaked, germinated and sun dried. This malted grains are mixed with the second part (75%) and the mixture is milled (3 to 4 times). Some producers/sellers achieve the mixture after the milling operation. A part of this flour obtained is kneaded with water for a first fermentation/saccharification for 4 to 10h. The other part is used to make a hot slurry which is then mixed with the fermented product with water and left for a second fermentation for 10 to 13h. Irrespective of raw material the fermented product is cooked (15 to 80 min) and packed in leaves. A particularity was noticed for the gowé produced from maize at Covè. In this locality, all the producers/sellers (57.1%) achieve a steam cooking of the packed product during 3 to 5h. The steam cooking is a cultural habit to increase the consistency and the storage duration of the final product. Similar processing technique not including steam cooking was described in a previous study on gowé from sorghum in Cotonou by Michodjéhoun-Mestres *et al.*, (2005).

In Zou, mainly Abomey and Bohicon, a third technology was identified (annex, table 4). About 17.1% and 11.4% of producers/sellers respectively from sorghum and from maize do not apply malting. The product is obtained by fermentation of non-malted grains flour for 6

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to 15h and commercial sugar is added to obtain the sweet taste. Sometimes the hot water or supernatant of a previous fermentation is used to reduce the fermentation time. The fermented product is cooked during 15 to 80 min. A similar process was found during previous investigations in Cotonou (Michodjéhoun-Mestres *et al.*, 2005).

In Collines, 85% of producers/sellers use the mixture of non-malted maize and sorghum for gowé production. (annex table 3). The mixing ratio differed from a locality to another and between individuals at the same place. The sorghum grains were cleaned, washed (10 to 30 min) and sun dried for 1 to 15h. The dried sorghum grains are mixed with the cleaned maize grains. The mixture is milled (1 to 2 times) and the flour obtained is sieved. This flour is then mixed with tap or hot water or supernatant of a previous fermentation for a fermentation of 15 to 60h. Some producers/sellers (36.7%) achieve a first fermentation of 5 to 13h before a second fermentation to 20 to 48h. The fermented product is cooked during 1h30 to 2h30. Only 15% of producers/sellers from Collines achieve the malting of sorghum before mixing with the cleaned maize grains.

2.3.4. Quality criteria of the final product according to producers/sellers

According to the producers/sellers, the most important sensory attributes for the commercialization of gowé from single raw material was the sweet taste (97.1% for sorghum gowé and 100% for maize gowé) and slightly acid: 68.6% of sorghum gowé and 74.3% of maize gowé. (table 7). Those types of gowé are considered having a smooth texture (fine particle size): 65.7% and 71.4% for gowé from sorghum and maize respectively. The colour might depend on raw material (red for sorghum and white for maize). The product made from the mixture of sorghum and maize must not have a sweet taste (81.7%), but must be sour (40% and 46.7% for very and slightly acid respectively), and should have a coarse particles (71.7%). Irrespective of the type of gowé, about 68.6 to 82.9% of producers/sellers thought that gowé should be a paste. All interviewed actors recognized that the final product have the aroma of a fermented product. But it was difficult for them to specify the exact type of aroma. For 97.2% of the interviewed producers/sellers, gowé must not be contaminated by the moulds. According to 18.3% of them, the mould appears when gowé is wrapped in vegetable leaves without any heating treatment. For 29.4% of producers/sellers, the plastic material used as packaging allow to avoid contamination but leads to the increase of the sour taste and decreases the storage duration and the consistency of final product.

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Table 7: Sensory attributes and their importance (%) per type of gowé as perceived by actors

Sensory attributes	PRODUCERS/SELLERS			CONSUMERS		
	Gowé from sorghum (N=35)	Gowé from maize (N=35)	Gowé from 'mixed maize and sorghum' (N=60)	Gowé from sorghum (N=87)	Gowé from maize (N=73)	Gowé from 'mixed maize and sorghum' (N=151)
Sweet taste	97.1	100.0	18.3	96.6	93.1	13.2
No-sweet taste	-	-	81.7	-	-	74.2
slightly acid	68.6	74.3	40.0	67.8	72.6	39.7
Very acid	31.4	17.1	46.7	25.3	23.3	52.3
No-burnt taste	11.4	11.4	-	-	-	-
Pasty	68.6	82.9	80.0	37.9	42.5	72.2
No-lumps/lumpiless	17.1	5.7	11.7	9.2	9.6	6.6
Smooth (fine particle)	65.7	71.4	16.7	32.2	42.5	17.9
Coarse (Bigger) particle	-	-	71.7	-	-	51.0
White colour	-	54.3	-	-	43.8	-
Red colour	82.9	-	-	93.1	-	-
Slightly red	-	-	56.7	-	-	31.1
Aroma of fermented product	100.0	100.0	100.0	100.0	100.0	100.0

2.3.5. Storage duration

According to the majority of producers/sellers of gowé from sorghum (94.3%), the product can be stored three to four days (figure 5). Only 25.7% of producers/sellers from maize revealed the same duration. For 60% of respondents gowé from maize can be stored five to six days. The same duration was revealed by 66.6% of producers/sellers from mixture. Indeed, some producers/sellers (57.1% of producers/sellers from maize) cook gowé by steaming and the majority (73.3%) of producers/sellers of gowé from 'maize and sorghum' achieves a long cooking operation (1h30-2h30). According to the producers/sellers, the storage duration increase with the consistency of gowé.

According to the producers/sellers, during the storage, gowé can be contaminated by the moulds (97.2%). The acidity increases (25.7%) and an unpleasant odour appears (18.3%)

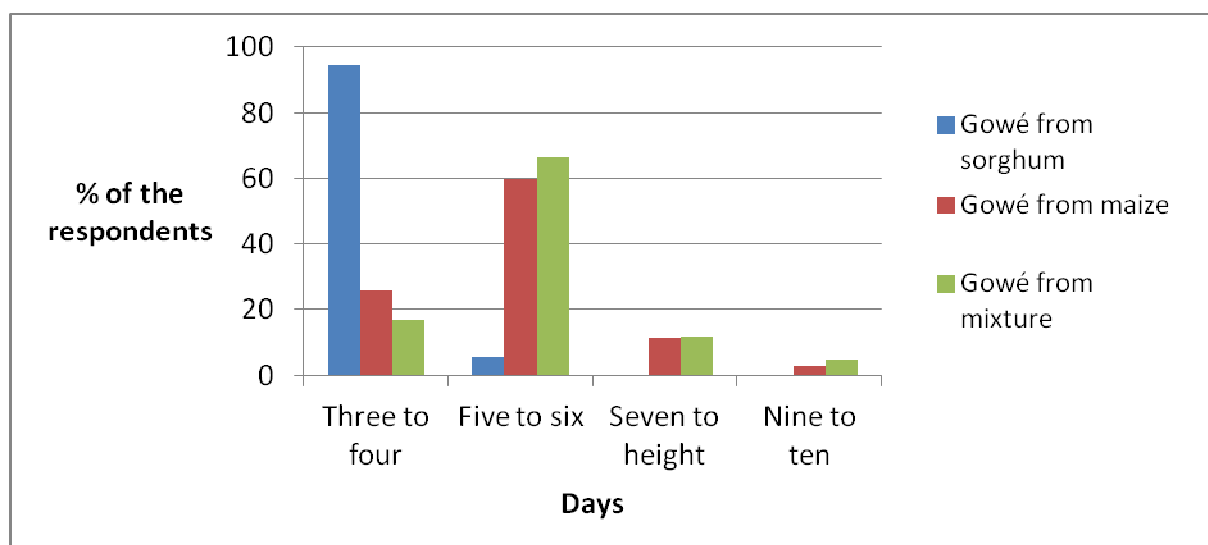


Figure 5: Storage duration of gowe (days)

2.3.6. Name of final product

The name of final product varied from locality to locality and with the type of raw material. The final product from sorghum is named abotin by 94.1% and 81.8% of producers/sellers in Abomey and Bohicon respectively whereas it is named gowé in Covè (71.4%). Concerning the product from maize, the producers/sellers in Abomey (100%) and Bohicon (100%) recognized the name gowé whereas in Covè, only 40% cited this name; in this area, the name

use is gblin (100%). The product from mixture is named abogo in Dassa-Zoumè (95%), egblinbaba in Glazoué (95%) and abogblin in Savalou by 90% of respondents.

2.3.7. Origin of technology

The processing of gowé from sorghum is originated from Abomey (71.4% of respondents) and Bohicon (17.1%). Concerning gowé from maize, according to 48.5% of respondents the technology is originated from Covè, and specifically the technology using the steam cooking. But for 37.1% this technology is rather originated from Abomey, only 8.6% cited Bohicon as the origin. Gowé from mixture is originated from Dassa-Zoumè and Savalou for 40% and 28.3% of the respondents respectively. Only 13.3% of them cited Glazoué.

2.3.8. Income

The majority of producers/sellers (75% from mixture, 40% from sorghum and 34.3% from maize) have an income around 200 to 500 FCFA per kg of raw material used. 17.1%, 25.7% and 6.7% of producers/sellers from sorghum, maize and mixture respectively revealed an income of 500 to 800 FCFA. For 5.7% of producers/sellers from sorghum and 2.8% of those from maize, the income can be more than 800 FCFA.

2.3.9. Target market

Gowé purchasers belong to different groups depending on the town: Civil servants (75.2%), workers (96.3%), pupils or students (78%), traders (96.3%). According to the producers/sellers 59.6% of purchasers have high income; middle or low income (95.4%).

2.3.10. Management of problems experienced during production

The germination step of kernels, milling, and fermentation are some of the critical points during the production of gowé. These problems are experienced during the production of gowé (table 8) but solutions are developed in relation with producers' skill. The most important is the germination. If the germination is not well achieved, the sweet taste of the final product is low. To solve this problem some respondents increase the soaking and germination duration. A second problem is the development of the moulds if the drying is not achieved well.

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Concerning the milling, the grains must be ground 2 to 3 times to get product of fine particle size. Respondents reported that they note the presence of the larvas if the flour is stored opened.

Concerning the supernatant, during the storage, the acidity increase, the respondents note the presence of the larvas and occurrence of unpleasant odour.

Regarding gowé, during storage, the acidity increase and the moulds appears. According to some respondents the plastic material used as packaging avoids contamination but it leads to increasing sour taste and decreases the storage duration and the consistency of the final product. To solve these problems some respondents produce small quantity and use leaves for packaging.

Table 8 : Problems experienced during production

Intermediate and final products	Criteria used to appreciate the quality of the intermediate or end-product	Problems experienced in the management of the quality of the product and determining factors	Proposed solution for this problem
Malted grains	Good development of radicles,	When the germination is not well achieved, the sweet taste of the final product is low	Increase the soaking and germination duration.
	No development of moulds	Failure in good drying leads to the development of moulds	Concerning appear of the moulds, ensure a good drying of the grain
Malted flour	Small particle size,	If the flour is bigger particle size, the final product is not appreciated	Grinding 2 to 3 times
	No-larvas	Respondents reported that they note the presence of the larvas and if the product is stored opened	Use the flour after one to two week of production
Fermented dough	Sweet and/or sour taste,		
Supernatant	Sweet and/or sour taste,	The acidity of product increase during the storage.	Use or thrown after three to five days of storage
	No larvas, no unpleasant odour	Apparition of larvas and bad odour after two to three days of storage	
Gowé	Sweet and sour taste, no-lump, desirable particle size, consistency, colour, aroma	Apparition of moulds, increase of acidity. The plastic material used as packaging avoids contamination but it leads to increasing sour taste and decreases the storage duration and the	Production in small quantity and packaging in leaves

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consistence of final prod

3. Gowé consumption

3.1. Socio-cultural characteristics of consumers

Three hundred respondents completed the questionnaire and socio-cultural characteristics of the consumers are given in table 9. The consumers varied in age group (90.7% between 16 and 50 years). The gowé is mostly consumed by the Fon socio-cultural group (58%), but also by the Datcha (19%) and the Mahi representing 14.7%. Other ethnic groups are noticed as consumers (Goun, Adja, Yoruba and Nago) representing 0.3 to 5.3%. About 57% of those contacted don't have any academic qualification. Some have the primary school (30.7%), secondary school (11.3%) and university (0.7%). The majority of consumers (75.3%) were married. Christians accounted for 60% of the respondents; Animism 28.7% and Islam 4%.

Table 9: Socio-cultural characteristics of respondent

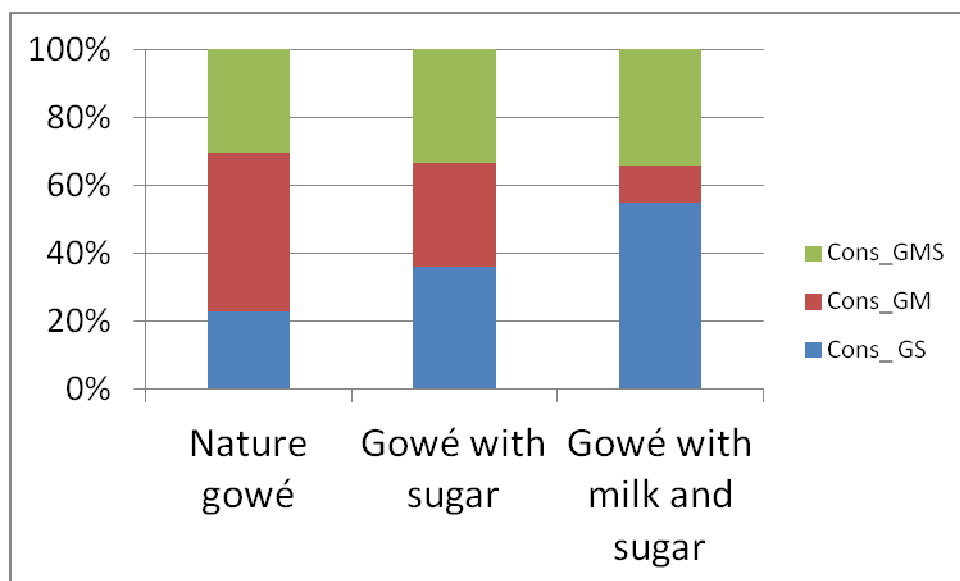
Socio-cultural characteristics	Percentage
Age (years)	
Below 15	3.0
15-25	29.0
26-35	38.0
36 -50	23.7
Above 50	6.0
Gender	
Female	50.0
Male	50.0
Ethnic groups	
Fon	58.0
Mahi	14.7
Nago	5.3
Datcha	19.0
Adja	1.7
Yoruba	1.0
Goun	0.3
Academic qualifications	
No school	57.0
Primary school	30.7
Secondary school	11.3
University	0.7
Marital status	

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Married	75.3
Unmarried	23.0
Divorcee	1.7
Religious	
Animism	28.7
Christianity	60.0
Islam	4.0
Housekeeping status	
Housekeeping chief	36.3
Dependent	63.3

3.2. Types and forms of gowe consumed

The majority of respondents in Abomey (83.6%) and Bohicon (95.5%) consume gowé from sorghum. Only 21.8% and 26.7% consume gowé from maize in Abomey and Bohicon respectively. Reversely in Covè gowé from maize is most consumed (100%). In this area gowé from sorghum is consumed only by 4.08%. In Collines, all the respondents consume only the product from mixture. In total 29%, 24.3% and 50.3% of respondents consume gowé from sorghum, gowé from maize and gowé from mixture respectively. The majority of consumers (64.4% to 74.7%) consume gowé with sugar (figure 6). Whereas for 2.7% to 13.8%, gowé is consumed with milk and sugar. Only 17.2% to 31.5% of respondents consume gowe without any additives. The majority of the consumers add only sugar because they cannot effort to buy milk.



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Cons_GMS : consumers of gowe from maize and sorghum

Cons_GS : consumers of gowe from sorghum

Cons_GM : consumers of gowe from maize

Figure 6: Importance of additives used during consumption

3.3. Frequency of consumption

Irrespective of the type, 28.7% to 31.4% of the respondents consume gowé two to three times per week (table 10). 17.2% to 27.4% of consumers drink it four to five times per week, whereas 24.1% to 32.9% consume once a week. The figures indicate a very high level of consumption of this beverage because of the following mentioned effects.

3.4. Possible beneficial effects of gowe

The results of survey (table 10) showed that according to the consumers gowe is consumed because it is an energetic beverage (24.6% to 40.2% of respondents), it may contain some vitamins (32.9% to 50.1% of respondents). Gowe may also helps to struggle againts malaria (23.3% to 27.6%) and may help to avoid anemia (20.7% from sorghum and 11.9% from mixture). It is also just considered as a thirst quenching, refreshing drink (29.1% to 39.1%).

3.5. Moment and place of consumption

Gowé is consumed at dinner (64.4%), followed by lunch (51.2%) and between meal (19.1%). The others moment of consumption are breakfast, supper, ceremonies representing 2.3% to 4.4% (figure 7). Gowe is consumed at home (90.3%) followed by work place (16.7%), street sides (5.7%) and at ceremonies like burial (0.7%).

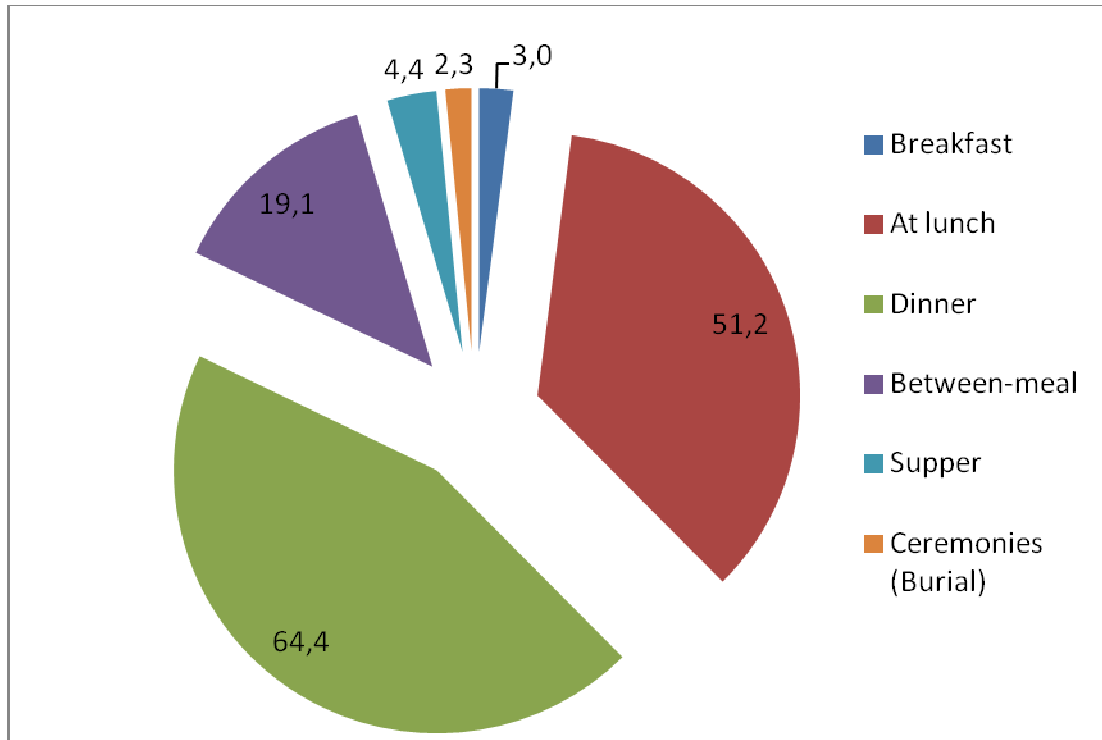


Figure 7: Importance of gowe consumed in reference to eating periods

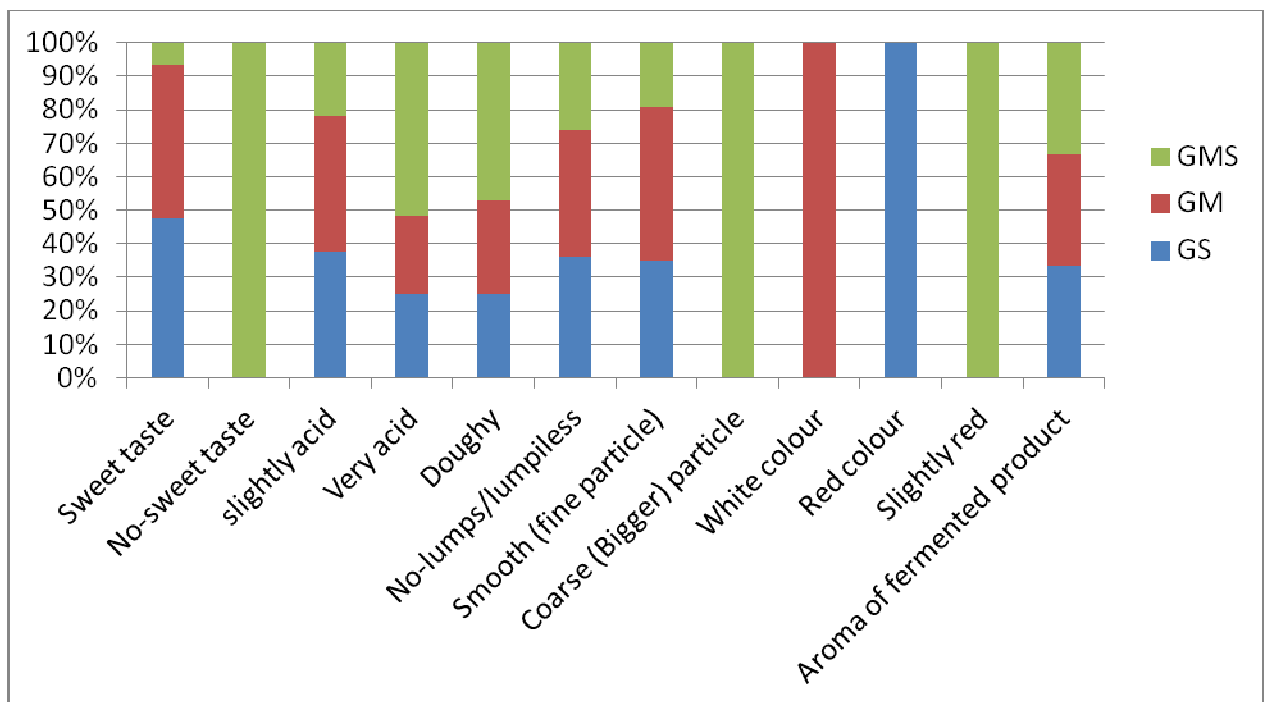
3.6. Quality criteria of final product according to consumers

Sensory qualities of gowe cited by consumers are presented in table 7 and figure 8. According to consumers gowé from sorghum exclusively (96.6% of respondents) or maize exclusively (93.1%) is sweet (table 7). In contrast, 74.2% of consumers revealed that the gowé from “maize and sorghum” is non-sweet. Indeed gowé from the mixture of ‘maize and sorghum’ is recognized to be very sour by 52.3% of consumers. The majority of the interviewed consumers (67.8% of consumers of gowé from sorghum; 72.6% from maize and 39.7% from the mixture) preferred this type of gowé, eg sweet with slight acid taste. Irrespective of the type of gowé, about 37.9% to 72.2% of consumers thought that the gowé should be pasty. For 51% of the consumers, gowé from ‘maize and sorghum’, possess the coarse particles whereas gowé from maize and gowé from sorghum only are considered having smooth texture for 42.5% and 32.2% of respondents respectively. Gowe might be without lump (6.6% to 9.2% of respondents). The majority of the consumers (93.1% of respondents) preferred the red colour for gowé from sorghum. Concerning gowé from maize it should have a white colour for 43.8% of consumers whereas 31.1% of respondents revealed the slightly red colour for gowé from mixture. All interviewed actors recognized the final product to have aroma of fermented product.

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According to 14% of respondents the plastic material used as packaging avoids the contamination by moulds but it leads to a faster increasing of the sour taste and decreases the shelf-life and the consistency of final product. For 16.3% the leaves used as packaging give a specific aroma to the final product.

According to the consumers of gowé from mixture (30.5%), the quantity of sorghum used for the production could lead to the higher price. For 11% of respondents gowé can be sold at higher price if it is sold as ready-to-eat product (mixing with sugar and/or milk).



Cons_GMS : consumers of gowe from Maize and sorghum

Cons_GS : consumers of gowe from sorghum

Cons_GM : consumers of gowe from Maize

Figure 8 : Sensory attributes of gowé as perceived by consumers

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Table 10: Consumption of gowé

Consumption	Gowé from sorghum (N=87)	Gowé from maize (N=73)	Gowé from mixture (N=151)
Consumption forms			
Nature gowé	17.2	35.1	23.1
Gowé with sugar	74.7	64.4	69.5
Gowé with milk and sugar	13.8	2.7	8.6
Consumption frequency (times per week)			
6 to 7	19.5	1.4	5.3
4 to 5	24.1	27.4	17.2
2 to 3	28.7	30.1	38.4
Once	24.1	32.9	24.5
Rarely	3.4	5.5	13.2
Possible effects			
Give the energy	40.2	24.6	27.1
Contains the vitamins	36.8	32.9	50.1
Thirst quenching	39.1	34.2	29.1
Prevent malaria	27.6	23.3	27.1
Avoid anemia	20.7	-	11.9
Facilitate the nursing	8.0	21.9	12.6
Facilitate the digestion	14.9	13.7	13.9
Consumers' classes			
Children	80.5	84.9	85.4
Teenager	100	91.8	98.0
Adults	100	94.5	99.3
Aged people	100	94.5	98.0
Sick people	96.5	90.4	95.4
Pregnant women	96.5	87.7	95.4
Nursing women	96.5	68.3	94.7

4. Discussion

The use of sorghum as raw material for gowe is well known in contrast to maize or the mixture of maize and sorghum. The main traditional process of gowe production can be divided into three main steps: the malting, the fermentation and the cooking. The processing technique from single non-malted raw material was described by Michodjèhoun-Mestres *et al.*, (2005). According to Michodjèhoun-Mestres *et al.*, (2005), the general traditional processing of gowe includes the mixture of malted and non-malted before the fermentation. Similar process operations are reported in this survey from in Zou.

In collines two news processing techniques using the mixture of raw materials were identified. Gowe produced from mixture of malted sorghum and non-malted maize and gowe produce from only malted grains. Generally the fermentation duration is longer.

According to interviewed actors, gowe from single raw material must be slightly acid, with sweet taste and smooth texture (fine particle). But the new types of gowe identified are different by taste. According to respondents gowé from mixture of ‘maize and sorghum’ must be of non-sweet taste, very sour and coarse (bigger particle).

Irrespective of the processing, the product is preferred with an aroma of fermented product.

Conclusion

Eight types of gowé were identified during the survey according to the raw materials or/and processing technique. Gowé is made of various kinds of cereals (sorghum and maize and the mix). The main unit operations for production of gowé from single raw material are the malting, fermentation and cooking whereas gowé from mixture “maize and sorghum” is produced without malting; only the fermentation and cooking are achieved. The quality attributes of gowé as perceived by producers/sellers and consumers are similar for gowé from single raw material even if some discrepancy exists in the importance of each attribute. Gowé from ‘maize and sorghum’ has coarse particle size, sour taste in contrast with those from sorghum or maize. The majority of producers/sellers achieve the production two to three times per week and the storage duration of final product varied with the processing technique used. Depending on the cities, gowé purchasers belong to different groups. Gowé is consumed one to five times per week mainly at home during lunch or dinner.

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Survey results: quality attributes for Group 1

ANNEXE

Table 3: Processing techniques of gowé from mixture of 'non malted maize and sorghum' (Collines)

Survey results: quality attributes for Group 1

Process Operations	Function/objective of the operation	Variation of Materials/equipment	Duration per material/equipment used	Workforce (specify number and sex per material/equipment used)	Product resulting from the operation	Quality attributes of intermediate and end-product
Cleaning of maize and sorghum grains	To remove the dust, sand, stones, damaged grains,	Tray, bowl	15 to 120 min	1 to 3 females	Cleaned grains	
Washing of sorghum (duration)	To remove the dust, sand, damaged grains	Plastic bucket, bowl	10 to 30 min	1 to 3 females	Washed sorghum	
Sun drying of sorghum(temperature, duration)	To reduce the water content	Plastic material, cloth, jute, bag	1 to 15h	1 female	Dried sorghum	
Mixture of sorghum and maize grains		Plastic bucket, bowl		1 female		
Milling (Number of replication)	Determine the particle size of final product	Millstone	1 to 2 times	1 male	'Sorghum and maize' flour	Coarse particle of flour
Sieving	To eliminate the bran and others	Sift		1 to 3 females	Sieved flour	No-waste
Adding of tap or hot water water or supernatant/ fermentation (temperature, duration)	Storage of gowé by the formation of lactic and acetic acids. Development of flavour and aroma	Plastic bucket, bowl, spatula	15-60h	1 female	Fermented dough, supernatant	Sour taste, Aroma
Cooking (temperature,	Stop of	Pot, spatula	1h30-2h30	1 to 3 females	Cooked	Sour taste,

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 Survey results: quality attributes for Group 1

duration)	fermentation Microbial destruction, pathogens destruction and development of flavour				gowé	Coarse particle, No-lumps, coloured, consistency aroma
Packing	Avoid contamination, humidity, air	Leaves, spatula	1 to 3h	1 to 3 females	Cooked and wrapped gowé	

Table 4: Processing techniques of gowé from non-malted maize or sorghum (Abomey-Bohicon)

Survey results: quality attributes for Group 1

Process Operations	Function/objective of the operation	Variation of Materials/equipment	Duration per material/equipment used	Workforce (specify number and sex per material/equipment used)	Product resulting from the operation	Quality attributes of intermediate and end-product
Cleaning of maize or sorghum grains	To remove the dust, sand, damaged grains, others waste	Tray, bowl	15 to 120 min	1 to 3 females	Cleaned maize or sorghum	
Washing (duration)	To remove the dust, sand, the damaged grains, others waste	Plastic bucket, bowl	10 to 30 min	1 to 3 females	Washed grains	
Sun drying (temperature, duration)	To reduce the water content	Plastic material, cloth, braid, bag	1 to 15h	1 female	Dried grains	
Milling (Number of replication)	Determine the particle size of final product	Millstone	3 to 4 times	1 male	Sorghum or maize flour	Fine particle size
Kneading (temperature, duration)	To homogenize the dough, enhance fermentation	Plastic bucket, bowl		1 female	Dough	
Adding of tap or hot water of supernatant/fermentation (temperature, duration)	Storage of gowé by the formation of lactic and acetic acids. Development of flavour and aroma	Plastic bucket, bowl, spatula	6 to 20h	1 female	Fermented sediment and supernatant	Sour taste, development of aroma
Cooking (temperature, duration)	Stop fermentation, destruction and	Pot, spatula	15 to 80 min	1 to 3 females	Cooked gowé	Sour taste, smooth texture, no-lumps,

AFTER (G.A n°245025) - Deliverable 1.1.2.1
Survey results: quality attributes for Group 1

duration)	development of flavour					colour, consistency, aroma
Packing	Avoid contamination humidity, air	Leaves, spatula	1 to 3h	1 to 3 females	Cooked and wrapped gowé	

Table 5 : Processing techniques of gowé from only malted grains (Abomey-Bohicon)

Process Operations	Function/objective of the operation	Variation of Materials/equipment	Duration per material/equipment used	Workforce (specify number and sex per material/equipment used)	Product resulting from the operation	Quality attributes of intermediate and end-product
Cleaning of maize or sorghum grains	To remove the dust, sand, damaged grains, others waste	Tray, bowl	15 to 120 min	1 to 3 females	Cleaned grains	Cleaned grains
Washing (duration)	To remove the dust, sand, the damaged grains, others waste	Plastic bucket, bowl	10 to 30 min	1 to 3 females	Washed grains	
Soaking (temperature, duration)	To increase the water content	Plastic bucket, bowl	10 to 20h	1 female	Soaked grains	
Germination (temperature, duration)	Activation of enzymes for hydrolysis of starch	Plastic bucket, bowl, basket, jute bag	48-72h	1 female	Germinated grains	Good development of radicle; No-moulds
Sun drying of germinated grains (Temperature and duration)	To stop the enzymatic activity and to dry the malted grains	Plastic material, cloth, braid, bag	5 to 24h	1 female	Malted grains	
Milling (Number of replication)	Determine the particle size of final product	Millstone	3 to 4 times	1 male	Malted flour	Fine particle size
Kneading		Plastic bucket, bowl		1 female	Dough	

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Survey results: quality attributes for Group 1

Adding of water or hot water or supernatant/fermentation (temperature, duration)	Storage of gowé by the formation of lactic and acetic acids. Development of flavour and aroma	Plastic bucket, bowl, spatula	6 to 20h	1 female	Fermented dough, supernatant	Sour taste, Smooth texture, No-lumps, Aroma
Cooking (temperature, duration)	Microbial destruction and development of flavour	Pot, spatula	15 to 80 min	1 to 3 females	Cooked gowé	Sour taste, smooth texture, no-lumps, colour, consistency, aroma
Packing	No-contamination, humidity, air	Leaves, spatula	1 to 3h	1 to 3 females	Cooked and wrapped gowé	

AFTER (G.A n°245025) – Deliverable 1.1.2.1
Survey results: quality attributes for Group 1

Table 6 : Processing techniques of gowé from mixture of malted and non-malted grains (Abomey-Bohicon-Covè)

Process Operations	Function/objective of the operation	Variation of Materials/equipment	Duration per material/equipm ent used	Workforce (specify number and sex per material/equipment used)	Product resulting from the operation	Quality attributes of intermediate and end-product
Cleaning of maize or sorghum grains	To remove the dust, sand, damaged grains, others waste	Tray, bowl	15 to 120 min	1 to 3 females	Cleaned grains	
Washing of sorghum or maize (duration)	To remove the dust, sand, the damaged grains, others waste	Plastic bucket, bowl	10 to 30 min	1 to 3 females	Washed sorghum	
Soaking of maize or sorghum (temperature, duration)	To increase the water content	Plastic bucket, bowl	10 to 20h	1 female	Soaked grains	
Germination of maize or sorghum (temperature, duration)	Activation of enzymes for hydrolysis of starch	Plastic bucket, bowl, basket, jute bag	48-72h	1 female	Germinated grains	Good development of radicle; No- moulds
Sun drying of germinated maize or sorghum (Temperature and duration)	To stop the enzymatic activity and to dry the malted grains	Plastic material, cloth, braid, bag	5 to 24h	1 female	Malted grains	
Mixture of malted and non- malted grains				1 female		

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Survey results: quality attributes for Group 1

Milling (Number of replication)	Determine/obtained the desired particle size of final product	Millstone	1 to 2 times	1 male	Flour	
Kneading/Saccharification	Enhance and performe saccharification Hydrolysis of starch by the enzymes	Plastic bucket, bowl, spatula	4 to 10h	1 female	Fermented dough	Sweet taste, slightly acid
Making of hot slurry from mixture of malted and non-malted flour		Pot, spatula	30 min to 1h	1 female	Slurry	Slightly viscous, Slightly hot
Adding of slurry/cooling and fermentation	Storage of gowé by the formation of lactic and acetic acids. Development of flavour and aroma	Plastic bucket, bowl, spatula	10 to 13h	1 female	Fermented sediment, supernatant	Sweet and sour taste, aroma
Cooking of gowé from maize or sorghum	Stop fermentation, destruction of pathogens and development of flavour	Pot, spatula	15 to 80 min	1 to 3 females	Cooked gowé from maize or sorghum	Sweet and sour taste, smooth texture, no-lumps, colour, consistency aroma
Packaging	Avoid contamination, humidity, air	Leaves, spatula	1 to 3h	1 to 3 females	Cooked and wrapped gowé from maize or sorghum	

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Survey results: quality attributes for Group 1

Steam cooking of gowé
from maize

Increase the
consistency and
the shelf life

Pot

3 to 5h

1 to 3 females

Cooked and
wrapped
gowé from
maize

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Survey results: quality attributes for Group 1

Table 11: Problems experienced during commercialization

Intermediate and final products	Problems experienced in commercialisation	Detailed description of problems	Proposed solution for this problem
Supernatant	Low demand, increase of acidity		Use for gowé production or thrown
Gowé	The purchasers don't appreciate a product stored more than 24h Decrease of the shelf life if the product is exposed to sun	When the product is stored more than 24h, the purchasers estimates that the product doesn't have the same quality attributes The sun may have to increase the sour taste and decreased the shelf life and the consistency of final product	Production must be achieved two to three times per week. Sale at a fixed place but this it may reduce the income.

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