Consumer Testing of Attieke in Rural and Urban Areas in Côte d'Ivoire

Understanding the Drivers of Trait Preferences and the Development of Multi-user RTB Product Profiles, WP1, Step 4

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Ethics: The activities, which led to the production of this manual, were assessed and approved by the CIRAD Ethics Committee (H2020 ethics self-assessment procedure). When relevant, samples were prepared according to good hygiene and manufacturing practices. When external participants were involved in an activity, they were priorly informed about the objective of the activity and explained that their participation was entirely voluntary, that they could stop the interview at any point and that their responses would be anonymous and securely stored by the research team for research purposes. Written consent (signature) was systematically sought from sensory panellists and from consumers participating in activities.

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ABSTRACT

This report is part of the RTBfoods project WP1 outputs, essentially devoted to consumer testing (Activity 5) of Attieke. This activity aims to provide information on the relationships between sensory properties and consumer overall liking of attieke. For this purpose, information related to sensory quality characteristics and processing of Attieke was collected from previous activities (Activity 3 "Surveys" and Activity 4 "Processing diagnosis") and used for consumer testing (Activity 5) as presented here.

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Content:

Attieke has become one of the most consumed side dish in Côte d'Ivoire, and even beyond. Although it is processed in different forms (Agbodjama, attieke adjoukrou, garba, etc), the sensory quality of attieke is linked to the variety of cassava used and is an important factor in the acceptance of this variety by farmers, processors and consumers. In order to understand consumer requirements for Attieke, and to obtain relevant information for WP2, a consumer test was carried out in the Bouake region, in the center of Côte d'Ivoire..Six (6) varieties of cassava, traditional and improved (Yace, Yavo, Bocou 2, I083774, Agbable and Bocou4), harvested at 15 months of age at the CNRA experimental plot in Bouake, were used for the preparation of attieke and tested by a total of 164 consumers. Consumer testing was performed using hedonic, JAR and CATA tests. The overall liking of attieke varied between a score of 5.5 (neither like nor dislike) to 7.4 (like moderately to like very much) for Bocou4 and Yace, respectively. Attieke from the Yacé variety was liked by the majority of consumers, regardless of location. The Yacé variety scored more than 75% JAR for the four attributes tested.

High quality attieke has rounded and slightly cohesive grains, is bright in color and moldable, not too sour, with a fresh attieke odor. On the other hand, low quality characteristics include: over-fermented, hard grains, sour taste, non-cohesive and heterogeneous grains, and fibrous.

Keywords: Attieke, sensory quality characteristics, JAR (Just About Right) analysis, CATA (Check All That Apply) analysis, consumers' liking

Key Words: cassava, attieke, hedonic testing, check-all-that-applies, just-about-right test, consumer acceptability, Ivory Coast

1 STUDY CONTEXT AND GENERAL OBJECTIVES

Attieke is a cassava couscous produced by steaming fermented cassava pulp semolina. It is an Ivorian traditional calorie-dense side dish, with a slight sour taste. It originated from the South area of Côte d'Ivoire, and has become one of the most consumed side-dish in the whole country. Its fame has exceeded the Ivorian borders. This product is now consumed, and even manufactured in West Africa and even in China and other parts of Asia. It is eaten with fish, meat and vegetables.

Although it is processed in different forms, the sensory quality of attieke that varies from one cassava variety to another, and the suitability of cassava variety for making high quality attieke of cassava are important factors in the acceptance of this variety by processors and farmers.

Some sensory characteristics of Attieke were collected during previous Activity 3 "Surveys". Moreover, during Activity 4 "Processing diagnosis", the suitability of different cassava varieties for processing into Attieke and their associated quality characteristics were determined. The main aim of this Activity 5 "Consumer testing" is to understand the consumers' demand for the quality characteristics of Attieke.

Another aim is to provide WP2 with a clear and visual mapping of the most liked products associated with high quality characteristics and high Overall liking scores, and of the least liked products associated with low quality characteristics and low Overall liking scores. The specific objectives are to relate sensory characteristics of Attieke to consumer overall liking and to identify factors that could affect consumer overall liking.

The activity consisted in inviting a large number of consumers (164) to test the 6 Attieke samples made in the previous processing step from varieties with different quality characteristics. The objectives.

2 METHODOLOGY

2.1 Location

Consumers testing of Attieke was held in the Center region of Côte d'Ivoire one of the two processing hubs where the activity 3, gendered food mapping, took place. The consumer testing was conducted on September 13th 2021 in two villages and 3 neighbourhoods in the city of Bouaké. Each location had approximatively 30 participants. (Table 1)

2.2 Samples

Attieke from 6 cassava varieties harvested from the CNRA's experimental plot were processed by 6 skilled processors using steam cooking conditions described in the previous processing diagnosis. Briefly, cassava roots were peeled, washed and ground with the ferment and some oil. Grounded tubers were left to ferment overnight. The next day, fermented paste was pressed, sieved and rolled into small grains. Grains were dried for about 15 min-30 min and steam cooked. Attieke were conditioned hot in big plastic bags. The samples were consumed at room temperature for consumer testing the following day. Tubers used in this study were 15 months old at harvested. Two varieties are known as very good varieties for Attieke (Yacé and Yavo), two as good (Bocou 2 and Agbablé) and the other two as less good varieties (Bocou 4 and I083774).

Table 1: Number of consumers interviewed in rural and urban areas of the Center region

	Total	Urban Area (Bouaké)			Rural Area (Villages)	
		Tchelekro	**Ahougnansou**	**Nimbo**	**Bendekouassikro**	**Molonouble**
Number of Consumers	164	35	31	34	31	33
Women	77	20	10	16	14	17
Men	87	15	21	18	17	16

2.3 Consumer testing

Consumer testing was carried out with 164 consumers (Table 1 previously). A method including a hedonic test, a just-about-right (JAR) test, and a check-all-that-apply (CATA) test. Consumers (n = 164), were randomly selected in each locality. People of those locations who are regular consumers and processors of Attieke were invited to participate in the tasting session. About 20g of each sample were served to consumers in white rounded plastic plate, with a 3-digit label. Mineral water was available for cleaning palate between sample testing. Consumers were asked individually to look/touch/smell/taste each Attieke sample, one after the other, in a random order, and score the overall liking using a nine-point hedonic scale (from 1. "dislike extremely, to 9. "like extremely").

The most important quality characteristics identified during Activities 3 & 4, including fermented smell, texture in the hand (soft and mouldable) and in the mouth, and sour taste were evaluated using the 3-point "just about right" (JAR) test (1 = "TW: too weak" 'not enough, 2 = "JAR: just about right", and 3 ="Too high, too strong, too much"). JAR test was used to identify the intensity of these characteristics that could affect the overall liking of the Attieke. These characteristics were chosen because they were mentioned during the activity 3 and 4 as the main characteristics that guide consumer acceptance.

In addition, consumers were then asked to select the quality characteristics that better describe each Attieke sample, among a list of 16 sensory characteristics -the most liked and the least liked-, using a "Check-All-That-Apply" (CATA) approach. All the 16 sensory terms were selected from the previous activities 3 and 4 of WP1 (Table 2). The order of presentation of CATA terms to the consumer was randomised to limit bias.

Finally, consumers were invited to add comments at the end of the questionnaire to give their opinion and preferences on the Attieke samples.

2.4 Data analysis

A one-way analysis of variance (ANOVA) with a Tukey's test (p-value) was carried out to identify significant differences in Overall liking scores between the six (6) varieties as tested by 164 consumers. An Agglomerative Hierarchical Clustering (AHC) analysis was used to organize consumers into similar groups of overall liking. Multiple pairwise comparisons were applied using the Tukey test, with a confidence interval of 95% at $p < 0.05$ (n=164 consumers). For each Attieke sample, the number of consumers who judged each specific characteristic either Just All Right (JAR), 'too weak' or 'too strong' was counted, and the percentage of consumers (out of 164) was determined. A Principal Component Analysis (PCA) was used to describe the relationships between frequencies of citation of CATA sensory characteristics and the mean overall liking scores for each Product sample. All statistical analyses were performed using XLSTAT 2019 software (Addinsoft).

Table 2: Quality characteristics identified during the previous activities 3 & 4 and selected for building the CATA table

	List of **the most liked** characteristics	List of **the least liked** characteristics
Quality characteristics of the ready to eat product	**Appearance** - White colour - Whitish colour - Bright colour - Round grains **Odour** - Fresh attieke odour **Texture when touching** - Mouldable - Non-cohesive grains (grains détachés) **Taste** - Sweet taste	**Appearance** - Yellow color - Fibrous - Heterogeneous grains **Odour** - Over-fermented odour **Texture when Touching** - Hard grains - Sticky grains **Taste** - Sour taste - Red Palm oil taste and odour

In red colour: characteristics identified during Activity 3; In blue colour: characteristics identified during Activity 4; In green colour: characteristics identified during Activity 3 and 4.

3 RESULTS

3.1 Overall liking of the product samples

The overall liking of the product significantly differed between the six (6) samples at a significant level of p<0.05 (one-way ANOVA) (Table 3).

Table 3: Mean overall liking scores for the six (6) product samples tested

Product Samples	Mean Overall liking scores* (164 consumers)	Groups**			
Yacé	7.4	A			
Yavo	6.5		B		
I083774	6.2			B	
Bocou2	6.2				B
Agbable	5.6					C
Bocou4	5.5					C

*Overall liking was rated on a nine-point scale from 1 = dislike extremely, to 9 = like extremely.

**Different letters correspond to the products, which are significantly different. Tukey test (p<0.05).

The most liked product samples were the Yace samples with a mean overall liking score between 7 (like moderately) and 8 (like very much).

The least liked were the Bocou4 and Agbable samples with a mean overall liking score between 5 (neither like nor dislike) and 6 (like slightly). The Yavo, I083774 and Bocou2 samples are statistically the same with with 6.5, 6.2 and 6.2, respectively, comprised between 6 (like slightly) and 7 (like moderately). Yace is the variety mostly used in south part of the country and mostly liked by Attieke processors. Bocou 4 is an improved variety, not really accepted by processors because of its fibrous characteristics as explained by cassava breeders from the research station.

Results show clearly that even the varieties that are usually not liked by processors for various reasons, can still be processed into an acceptable product for the consumers. This may result of the skilfulness of the processors that we have used.

3.2 Segmentation of consumers into groups of similar overall liking

The aim of an Agglomerative Hierarchical Clustering (AHC) analysis is to create homogeneous clusters of consumers who have similar overall liking scores. It is useful to classify consumers who have been interviewed randomly, into similar groups.

By an Agglomerative Hierarchical Clustering analysis of the mean overall liking scores, we identified three groups of consumers, with almost the same trend, despite some differences. The largest group is that of "Bocou4 less likers" with 43%, followed by the group of "all likers" representing 33% of consumers interviewed. The third group "Bocou 2 & Agbable dislikers" represents 24% of all the consumers in this study. There were significant differences (P < 0.001) in the overall liking of the three clusters (Figures 1 and 2).

It clearly appears that the Yace variety is the most preferred one. It scored the highest overall liking mean within the 3 clusters. Results also show that a significant number of consumers are unable to discriminate the quality attributes differences between samples within the cluster 3 ("all likers") because they like all the products alike.
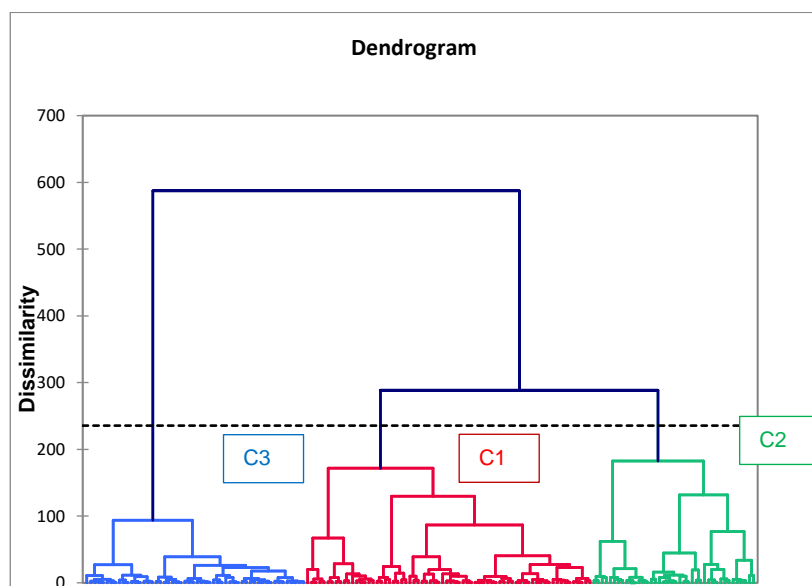

Figure 1 Clustering of the consumers based on their overall liking scores of the product
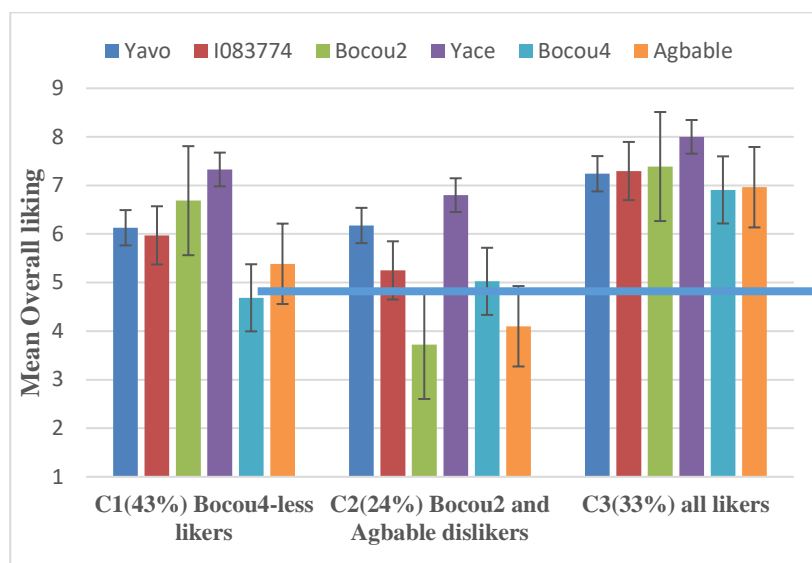

Figure 2: Mean overall liking of the product samples by consumer cluster type (%)

(Error bars represent the standard error.)

3.1.1. Demographic data of the consumers interviewed

The socio-demographic characteristics of consumers interviewed and their dietary habits related to Attieke are summarized in Table 4.

Among the 164 consumers interviewed, 46.3% were women and 53% were men. The majority of these consumers were young adults, between 18 and 25 years (32.9%) and 26 to 35 years (25%). The most represented ethnic group was Baoule with 72% of the consumers. This is understandable because the city of Bouake is one of the largest city belonging to the tribe Baoule. 27.8% of consumers attended college or university, 25.6% went to secondary schools; however 27.4% are illiterates. Concerning their occupation, 22.6% of consumers are students, 18.3% working in the private sector and 15.9% are farmers.

No significant differences between these clusters were observed with respect to any socio-demographic characteristics at 5% threshold, except the marital status.

Table 4: Demographic differences of the consumers with respect to cluster division

Categories	Variables	Total (n)	%Cluster 1 (Bocou 4 less-likers)	%Cluster 2 (Bocou 2 and Agbable dislikers)	%Cluster 3 (All likers)	Chi-square (p)*
Gender	Men (%)	53.0	21.3	14.6	17,1	0.597
	Women (%)	46.3	21.3	9.8	15.2	
Place	Ahougnansou	18,9	6,1	5,5	7,3	
	Bedekouassikro	18,9	9,1	3,7	6,1	
	Molonouble	20,1	7,3	6,1	6,7	0.594
	Nimbo	20,7	11,0	5,5	4,3	
	Tchelekro	21,3	9,1	3,7	8,5	
Age	18-25 years old (%)	32.9	15.2	7.9	9.8	
	26-35 years old (%)	25.0	12.8	3.0	9.1	
	36-45 years old (%)	17.1	4.9	6.7	5.5	0.492
	46-55 years old (%)	8.5	3.0	3.0	2.4	
	> 56 years old (%)	8.5	3.0	2.4	0.6	
	Non specified	7.9	3.7	1.2	0.6	
Ethnicity	Baoulé (%)	72	28.7	17.7	25.6	
	Senoufo (%)	4.3	1.8	1.2	1.2	
	Agni (%)	3	1.8	0.6	0.6	
	Attié (%)	1.8	0.6	0.0	1.2	
	Bété (%)	1.8	0.6	1.2	0.0	0.396
	Abidji (%)	1.2	0.0	1.2	0.0	
	Wobe (%)	1.2	1.2	0.0	0.0	
	Yacouba (%)	1.2	0.0	0.6	0.6	
	Others (%)	11.2	6.2	1.9	3.1	
Education	No education	27.4	11.0	7.3	9.1	
	Primary education	17.7	6.7	2.4	8.5	0.476
	Secondary education	25.6	12.2	6.7	6.7	
	Higher Education	27.4	12.2	7.9	7.3	
Marital status	Single (%)	52.4	25.6	13.4	13.4	
	Married (%)	40.2	15.9	10.4	14.0	*0.02
	Widower (%)	3.0	1.2	0	1.8	
	Divorced (%)	3.0	0	0	3.0	
	Non-specified	1.2	0	0.6	0.6	
Occupation	Student (%)	22.6	12.2	5.5	4.9	
	Artisanship (%)	2.4	1.8	0.6	0	
	Civil servant (%)	1.8	0.6	0.6	0.6	
	Farmers (%)	15.9	6.1	5.5	4.3	

Categories	Variables	Total (n)	%Cluster 1 (Bocou 4 less-likers)	%Cluster 2 (Bocou 2 and Agbable dislikers)	%Cluster 3 (All likers)	Chi-square (p)*
	Food processors (%)	14	4.3	3	6.7	0.055
	Traders (%)	9.8	4.9	3	1.8	
	Employed in private sector (%)	18.3	7.3	5.5	5.5	
	Retired (%)	4.3	1.2	0.6	2.4	
	Non Specified (%)	10.9	4.2	0	6.7	
Frequency of consumption	Everyday (%)	34.1	17.7	5.5	11.0	0.340
	Many times a week (%)	43.3	18.9	11.0	13.4	
	Once a week (%)	5.5	1.2	2.4	1.8	
	Many times a month (%)	7.3	3.0	1.8	2.4	
	Rarely (%)	9.8	1.8	3.7	4.3	
Occasion of consumption	At breakfast (%)	39.0	16.5	11.6	11.0	
	At lunch (%)	70.7	29.3	17.7	23.8	
	Between meals (%)	7.9	3.7	1.8	2.4	
	At dinner (%)	33.5	16.5	4.9	12.2	
Consumption patterns	Alone with oil (%)	11.6	5.5	3.0	3.0	0.962
	With fried fish or meat (%)	55.5	22.6	14.6	18.3	
	With braised eat or fish (%)	53	21.3	11.6	20.1	
	With sauce (%)	25	9.1	7.9	7.9	

*Chi-square test performed using IBM SPSS Statistics Version 20

3.1.2. Consumption attitudes

Chi-square analysis showed that Attieke is more consumed by men and young people as compared with women and old adults. They consume Attieke daily or many times a week (their estimated rate is lower than the actual rate) (Table 4 previously).

Attieke is consumed plain, just with some oil, or with fish and meat, fried, roasted or cook with some stew.

The product is mainly consumed at lunch time for more than 70% of consumers interviewed. It is also consumed at breakfast and for dinner (about 30% for both). It is not often eaten between meals. Figure 3 shows the split of consumers based on their marital status because this was shown as significant in Table 4.
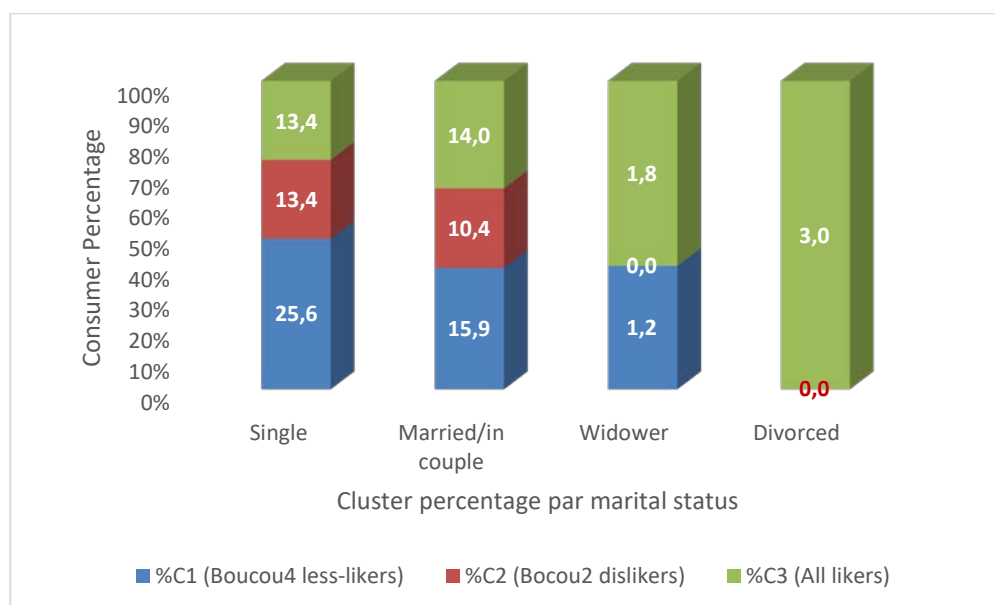

Figure 3: Percentage of consumer cluster type by marital status

3.3   A Just About Right test (JAR)

Just about right (JAR) scale was used to determine the optimum level of intensity as perceived by the consumers for the fermented odor, texture in the hand, texture in the mouth, and taste of the Attieke samples. Such "descriptor diagnostic" may help understand why consumers like or dislike a specific attieke sample.

Consumers were asked to give their perception of the fermented odor, texture in the hand, texture in the mouth, and taste of each Attieke sample, by using a 3-point JAR scale (1 = "Too low, not enough", 2= "Just About Right" and 3 = "Too high, too strong, too much") (Figure 4).

For the fermented odor, texture in mouth and sourness, more than 50% of consumers were globally satisfied with samples, even though Yace attieke samples always scored higher than others and Bocou 4 scored the lowest. For the texture in the hand, samples from Bocou 4, Agbable and Bocou2 scored JAR for less than 50% of consumers. A great number of consumers found the grains too separated. Consequently, this quality attribute was used by the consumers to range these samples as last in overall liking.

3.4   Check All That Apply (CATA) test

The objective of the CATA test is to show the relationships between hedonic overall liking scores for each product sample and the frequencies of citation of each CATA sensory characteristic by all the consumers.

After scoring the overall liking and the perception of some specific sensory characteristics, consumers were invited to choose the most appropriate terms among 16 sensory characteristics that better describe each Product sample.

The frequency of citations given by consumers to describe each Attieke sample were calculated (Table 5).
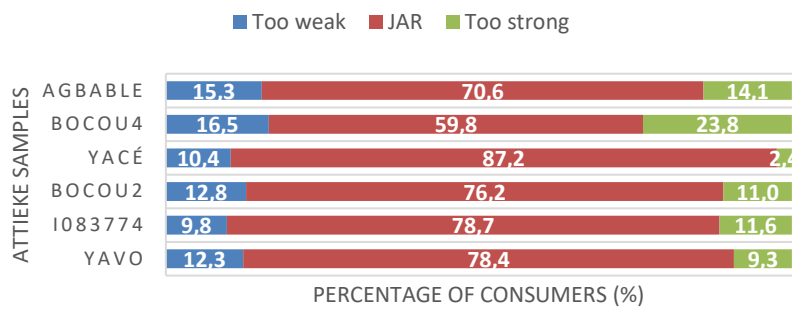
The sensory characteristics most frequently cited by the consumers were considered the best for describing Attieke. They were the following: "Round Grains" and "Good taste" with a frequency of citation of 696 and 650 respectively, followed by "Mouldable" and "Separated grains" and "Fresh Attieke Odor" with a frequency of citation between 500 and 588. The least used terms were "overfermented" and "Red palm oil odor and taste". Those last sensory descriptors were mostly mentioned for the yellow flesh varieties, Bocou 2 and I083774.

The Yace variety attieke was described by consumers as "White" (113 citations), "Mouldable", and "Shiny" (127 and 97 citations respectively), with ''round grains'', a "Good Taste" and a "fresh attieke odor" (132, 133 and 94 citations respectively). This variety has the highest overall liking mean (7.4)

Bocou4 variety attieke, which had the lowest overall liking mean (5.5), despite some similar points with the Yace sample, had the highest score of the sensory descriptors ''fibrous'' (58 citations), with 'separated grains'' (120 citations), ''overfermented'' (32 citations) and the lowest score with "Good taste" and "mouldable" (86 and 70 citations respectively).

With regard to the results of the CATA test, we can observe that the important sensory attributes for the appreciation of Attieke are the good taste, the fresh attieke odor and the mouldability.

FERMENTED ODOR

Legend: ■ Too weak ■ JAR ■ Too strong

ATTIEKE SAMPLES	Too weak	JAR	Too strong
AGBABLE	15,3	70,6	14,1
BOCOU4	16,5	59,8	23,8
YACÉ	10,4	87,2	2,4
BOCOU2	12,8	76,2	11,0
I083774	9,8	78,7	11,6
YAVO	12,3	78,4	9,3

PERCENTAGE OF CONSUMERS (%)

TEXTURE IN THE HAND

Legend: ■ Not enough separated ■ JAR ■ Too separated

ATTIEKE SAMPLES	Not enough separated	JAR	Too separated
AGBABLE	14,6	43,3	42,1
BOCOU4	17,2	37,4	45,4
YACÉ	16,5	78,7	4,9
BOCOU2	18,3	47,6	34,1
I083774	32,5	62,0	5,5
YAVO	25,0	57,9	17,1

PERCENTAGE OF CONSUMERS (%)

TEXTURE IN THE MOUTH

Legend: ■ Too soft ■ JAR ■ Too hard

ATTIEKE SAMPLES	Too soft	JAR	Too hard
AGBABLE	31,9	55,2	12,9
BOCOU4	19,6	51,5	28,8
YACÉ	9,8	77,3	12,9
BOCOU2	11,7	58,9	29,4
I083774	28,2	67,5	4,3
YAVO	14,0	62,8	23,2

PERCENTAGE OF CONSUMERS (%)

SOURNESS

Legend: ■ Not enough sour ■ JAR ■ Too sour

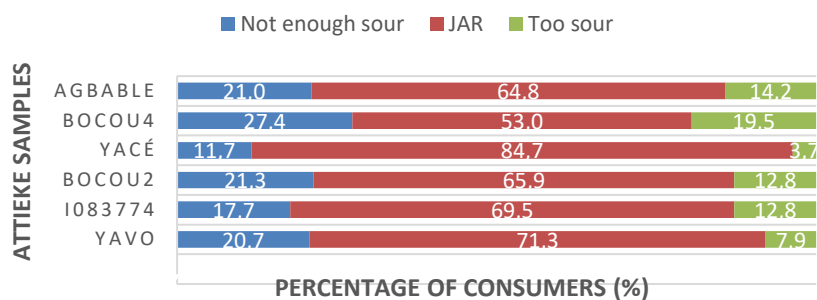| ATTIEKE SAMPLES	Not enough sour	JAR	Too sour
AGBABLE	21,0	64,8	14,2
BOCOU4	27,4	53,0	19,5
YACÉ	11,7	84,7	3,7
BOCOU2	21,3	65,9	12,8
I083774	17,7	69,5	12,8
YAVO	20,7	71,3	7,9

PERCENTAGE OF CONSUMERS (%)

Figure 4: Percentage of consumers who scored the three specific quality characteristics.

Table 5: Frequency of citations of each quality characteristic by all the consumers

Quality Characteristics	Yavo	I083774	Bocou2	Yace	Bocou4	Agbable	Total
Shiny	85	74	86	97	73	69	484
Fresh attieke odor	90	85	83	94	73	75	500
Overfermented odor	19	20	18	7	32	20	116
Mouldable	101	128	85	127	70	77	588
Hard grains	49	18	57	43	48	27	242
Red palm oil odor/taste	2	30	21	1	5	5	64
Sticky grains	45	95	29	67	24	30	290
Good taste	125	113	102	135	86	89	650
Fibrous	19	25	21	31	58	23	177
Yellow color	5	163	155	3		8	334
Creamy color	79	2	8	48	19	109	265
Sour taste	39	40	41	10	62	48	240
Separated grains	101	46	112	69	120	115	563
White color	80			113	146	49	388
Round grains	117	106	130	132	106	105	696
Heterogeneous grains	79	72	69	57	82	87	446
Mean Overall Liking	6.5	6.2	6.2	7.4	5.5	5.6	

3.5   Sensory mapping of the sensory characteristics

Figure 5 depicts a Principal component analysis (PCA), used to summarize the relationships between CATA sensory characteristics, Attieke samples, and mean overall liking of each product scored by all the consumers.

The PCA plot explained 82.2% of the variance of the sensory characteristics, the first and second axes accounting for 66.4% and 15.8% respectively. Most of the variance was explained by the first axis.

The loading of sensory characteristics on PCA plan (Figure 5) shows that the variability between samples is greatly impacted by the color and the presence of fibers in the attieke. Axis 1 was mainly explained positively by the terms such as "yellow color", "Red palm oil taste and odor", which are related to the Yellow flesh cassava varieties Attieke samples, and negatively by the terms such as "white color", "cream color" and "fibrous".

Axis 2 is mostly correlated to attributes linked to the overall liking of the attieke products. That axis is mainly explained positively by the terms such as "Sour taste" and "non-cohesive grains", "heterogeneous grains'' and ''over-fermented odor''; terms related to the Agbable sample, and depicting a lower quality product sample. Axis 2 was, however, negatively explained by the terms such as "Fresh Attieke Odor", "Shiny" and "Mouldable", "sweet (good) taste, "sticky grains", and "rounded grains''. These terms are positively correlated to the overall liking scored by consumers and associated to the Yace variety to some extent. Thus, there are high quality product characteristics.

Some attributes are mainly correlated to the axis 3 or 4. ("shiny", "hard grains" and "rounded grains").

Variables (axes F1 et F2 : 82,25 %)

Grains détachés

Grains hétérogènes

Goût aigre

Odeur trop fermentée

Couleur jaune

Odeur/Goût d'huile rouge

Grains durs

Couleur crème

Fibreux

Couleur Blanche

Grains arrondis

Eclatant

Odeur d'attiéké frais

Appreciation globale

Goût doux

Grains collants

Modelable

F2 (15,80 %)

F1 (66,45 %)

● variables actives   ■ Variables supplémentaires

Observations (axes F1 et F2 : 82,25 %)

Agbable

Bocou2

Bocou4

Yavo

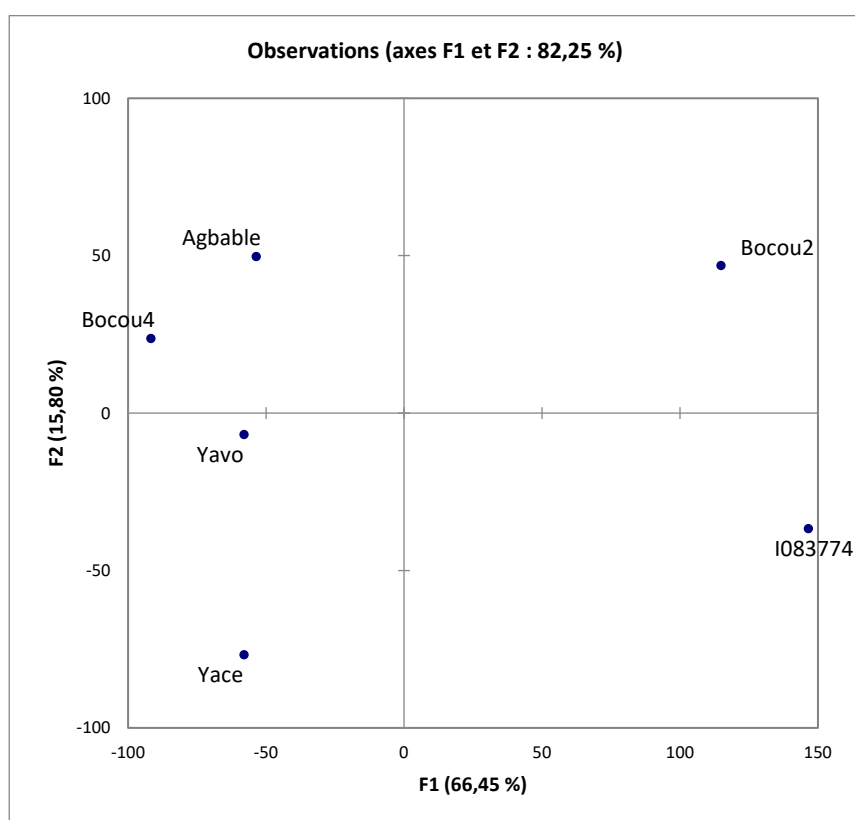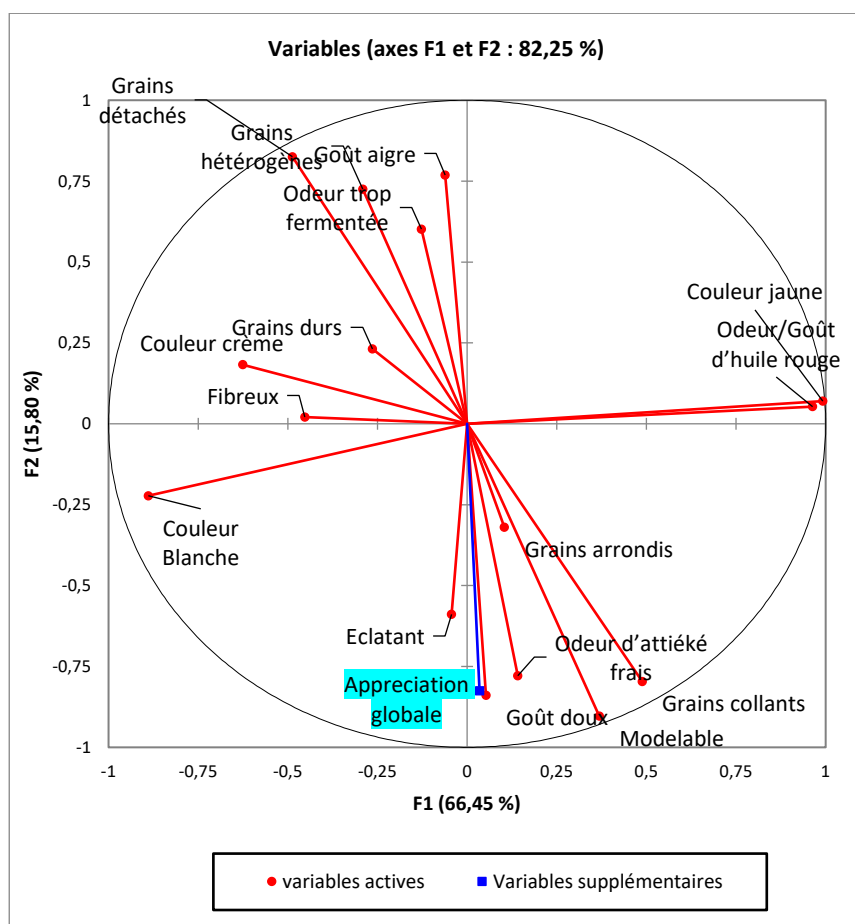I083774

Yace

F2 (15,80 %)

F1 (66,45 %)

Figure 5: Mapping of the sensory characteristics and the overall liking of the product samples

4 DISCUSSION AND CONCLUSION

The six (6) Attieke samples were accepted by the consumers. The samples were classified into 3 groups: the liked sample from the Yace variety, the moderately liked samples from Bocou 2, I083774 and Yavo varieties; and finally, the least liked, the *Agbable* and *Bocou* 4 samples.

Yace variety is a traditional variety mostly used for the production of attieke, especially in the Southern part of the country. Bocou 4 is an improved variety, but was really not adopted by processors, because it was reported very fibrous. Agbable is a much used variety in the Center of the Country; however, it is reported that its Attieke loses its brightness the following day of its preparation; it gets darker. This statement is verified on the ACP. "Agbable" and "brightness" are opposite, so negatively correlated.

Consumers overall liking was based on differences that affect less than 50% the variability of samples. **The high quality characteristics are 'sweet taste', 'mouldable', 'rounded grains', 'fresh attieke odor', 'bright'**, '**not sour', 'cohesive grains'**, which are completely opposite *to the* low quality sample attributes, such as over-fermented, sour taste, non-cohesive and heterogeneous grains.

The red palm oil odor and taste are highly correlated to the yellow color. This is because that the yellow fleshed varieties are perceived as containing red palm oil by the consumers.

Color attributes (yellow, white, cream) are not significantly linked to the overall liking. This means that Color is not a quality attribute. Hence, Attieke with any of these three colors would be acceptable to consumers, if the sample has the main sensory quality attributes. The main issue of Attieke's appearance is not the color because the 'glow' of the product. It should not be dull, but bright.

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