Original Research Article

**Sensory analysis of various dishes (pounded yam, fried yam, boiled yam) made from yellow-fleshed yam varieties "Kounougbé" and "Kangba" and three yam cultivars ("Bètè-bètè", "Krenglè", and "Kponan")**

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ABSTRACT

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| This study evaluated the sensory qualities of dishes made from boiled, fried, and pounded yam, derived from two yellow-fleshed yam varieties ("Kounougbé" and "Kangba") and three cultivars ("Bètè-bètè", "Krenglè", and "Kponan"). The analysis revealed significant differences in the sensory characteristics of boiled yams. On the one hand, the "Kounougbé" variety received the highest scores for color (6.85 ± 0.81), firmness (7.15 ± 0.81 in mouthfeel), and fibrosity (7.15 ± 0.93), indicating its overall quality in these attributes. On the other hand, "Kangba" exhibited the best taste acceptability (9.7 ± 0.47), suggesting a strong preference among consumers for its flavor. However, "Kponan" was the least favored variety, receiving the lowest ratings for fibrosity (5.00 ± 0.92) and fork firmness (5.80 ± 0.77), which may indicate a less desirable texture. For hedonic values, "Kangba" emerged as the most appreciated, with an overall acceptability of 8.57 ± 0.10, and obtained the highest scores for appearance (8.52 ± 0.30), aroma (8.73 ± 0.15), and overall texture (8.53 ± 0.30), emphasizing its attractiveness to consumers. "Kounougbé" followed closely with an overall acceptability of 8.15 ± 0.21. Compared to that, the cultivars "Bètè-bètè," "Krenglè," and "Kponan" performed moderately, with acceptability scores below 8. The sensory analyses revealed marked varietal effects, with "Kangba" and "Kounougbé" being the most preferred by consumers, particularly for boiling, frying, and preparing pounded yam. These results highlight the importance of these varieties in promoting local yam valorization in Côte d'Ivoire, suggesting their potential for broader market adoption and use in culinary applications. |

*Keywords: Sensorial analysis, boiled yam, fried yam, pounded yam, hedonic, descriptive*

1. **INTRODUCTION**

Yam is an essential food crop that nourishes approximately 300 million people worldwide (Price et al., 2017). Beyond its nutritional importance, it plays a key role in food security and poverty reduction, particularly in developing countries (Ita et al., 2020). In West Africa, yam serves as an economic and dietary pillar for at least 60 million farmers and their families (Owusu et al., 2022). In this region, Côte d'Ivoire ranks as the third-largest yam producer globally, after Nigeria and Ghana (FAOSTAT, 2025). In 2023, the country recorded a production of 7,967,113.65 tons, surpassing cassava, the second most important non-cereal staple food, which reached 7,201,944.02 tons (FAOSTAT, 2025). Among the cultivated yam species, *Dioscorea cayenensis-rotundata* and *Dioscorea alata* are the most widely used for human consumption (Cornet, 2005). More specifically, *D. cayenensis* Lam. and *D. rotundata* Poir., which originated and were domesticated in West Africa, are the most widespread (Scarcelli et al., 2019). Some traditional varieties, such as "Kounougbé" and "Kangba," are distinguished by their yellow flesh and high nutritional value, including essential carbohydrates, vitamins, and minerals. They are rich in nutrients such as carbohydrates, vitamins, and minerals (ANSES, 2020) and are distinguished by their high beta-carotene content, a precursor of vitamin A (CIRAD, 1998). However, despite these nutritional benefits, these varieties are increasingly being abandoned in favor of modern white-fleshed varieties, such as "Bètè-Bètè," "Krenglè," and "Kponan," which are now the most cultivated and widely available on the market. This preference is mainly driven by agronomic and commercial factors, including high yield, shorter production cycles, and strong consumer and market demand (Kouakou, 2010). Yam is consumed in various forms, with pounded yam, fried yam, and boiled yam being the most common preparations. Pounded yam, a staple dish in West Africa, is particularly appreciated for its specific sensory attributes, such as friability, elasticity, adhesiveness, and cohesion, which strongly influence consumer preferences (Adifon et al., 2019; Egesi et al., 2003; Hounhouigan et al., 2003; Olagunju-Yusuf et al., 2019; Orkwor, 1998; Otegbayo et al., 2006; Otegbayo et al., 2021). However, the organoleptic quality of yam varieties directly impacts on their acceptability and market value. While yellow-fleshed varieties have high nutritional potential, their limited presence on the market raises questions about consumer perception and their suitability for local culinary uses. In this context, it is essential to evaluate and compare the sensory properties of traditional yellow-fleshed and modern white-fleshed yam varieties to better understand consumer preferences and identify key factors for their market promotion. Therefore, the objective of this study is to compare the organoleptic quality of the yellow-fleshed yam varieties "Kounougbé" and "Kangba" with the modern varieties "Bètè-Bètè," "Krenglè," and "Kponan" through different culinary preparations (pounded yam, fried yam, boiled yam). This comparison aims to identify consumer preferences and guide strategies for the promotion and valorization of local yam varieties.

**2. MATERIAL AND METHODS**

## **2.1 Plant material**

The plant material consists of tubers from the *Dioscorea cayenensis-rotundata* varieties "Krènglè" and "Kponan," as well as the *Dioscorea alata* variety "Bètè-Bètè." These tubers were obtained from seed yams that had not undergone chemical treatments, and their plants were staked. They were freshly harvested without injuries from plots that had not been chemically treated and were subsequently carefully selected (Fig 1). The harvested tubers were used to prepare various dishes (boiled, fried, and pounded yam) and were compared to those from the "Kounougbé" and "Kangba" varieties under identical conditions, ensuring a sensory evaluation based on their inherent characteristics.

  

 

**Fig. 1.** Whole tubers of *D. cayenensis-rotundata* var\* "Kponan" (a), "Krenglè" (b), *D. alata* var\* "Bètè-Bètè" (c), and *D. cayenensis-rotundata* var\* "Kounougbé" (d) and "Kangba" (e).

\*Variety

## **2.2 Methods**

### **2.2.1** **Method for the preparation of boiled, fried, and pounded yam dishes**

#### 2.2.1.1 Technique for obtaining fresh yam slices

The yam slices used for the preparation of the different dishes were obtained following the method described by Coulibaly et al. (2021). Tubers from each sample were carefully washed with tap water, peeled, and then cut into 50 g slices using a stainless-steel knife. These slices were used for the preparation of boiled yam and pounded yam. Those intended for frying were cut into 30 g slices.

#### 2.2.1.2 Technique of boiled yam preparation

Boiled yam was prepared following the method described by Osagie (1992) (Fig 5). Pre-cut yam slices from each sample were placed in a pot and covered with water. The pot was then brought to a boil over the fire for 20 minutes to ensure proper cooking. Once the cooking time elapsed, the boiled yam slices were removed using a ladle and placed in a strainer to drain. After 5 minutes, the boiled yam was ready for consumption (Fig 2).

  

 

**Fig. 2.** Boiled yam from tubers of *Dioscorea cayenensis-rotundata*, var\* "Kponan" (a), "Krenglè" (b), "Kangba" (c), and "Kounougbé" (d), and from tubers of *D. alata*, var\* "Bètè-Bètè" (e).

\*Variety

#### 2.2.1.3 Technique of Fried Yam preparation

Fried yam was prepared following the method described by Osagie (1992) (Fig 5). Yam slices from each sample were dipped in heated refined palm oil and then fried for 10 minutes until golden brown. Once frying was complete, the slices were removed from the oil and placed in a strainer to drain. After 5 minutes, the fried yam was ready for consumption (Fig 3).

  

 

**Fig. 3.** Fried yam from tubers of *Dioscorea cayenensis-rotundata*, var\* "Kponan" (a), "Krenglè" (b), "Kangba" (c) and "Kounougbé" (d), and from tubers of *D. alata*, var\* "Bètè-Bètè" (e).

\*Variety

#### 2.2.1.4 Technique of Pounded Yam preparation

Pounded yam was prepared following the method described by Mosso et al. (1996) (Fig 5). Yam slices from each sample were boiled for 20 minutes until softened, then pounded hot in a mortar. During pounding, hot water was gradually added, and the process lasted 15 minutes to form a smooth paste. Finally, small balls were manually shaped from this paste, resulting in a thick and homogeneous preparation known as pounded yam (Fig 4).

  

 

**Fig. 4.** Pounded yam from tubers of *Dioscorea cayenensis-rotundata*, var\* "Kponan" (a), "Krenglè" (b), "Kangba" (c), and "Kounougbé" (d), and from tubers of *D. alata*, var\* "Bètè-Bètè" (e).

\*Variety

Washing

Peeling

Washing

Cutting

Looting for 15 minutes

Cook in oil for 10 minutes

Boil for 20 minutes

Boil for 20 minutes

Spin for 5 minutes

Spin for 5 minutes

Manual mixing

**Fig. 5.** Process for preparing pounded yam (Mosso et al. (1996), fried yam, and boiled yam (Osagie (1992)).

### **2.2.2** **Sensory Analysis Methods**

#### 2.2.2.1 Descriptive Test

##### **2.2.2.1.1 Panel Constitution**

The sensory analysis was conducted using the quantitative descriptive analysis method outlined by Watts et al. (1991). A panel of 20 individuals, regular consumers of the prepared dishes, was assembled to perform descriptive evaluation of the sensory attributes of the prepared samples. The panelists assessed dishes made from five yam varieties: "Kangba," "Kounougbé," "Krènglè," "Kponan," and "Bètè Bètè**".** Each panelist assigned a score using an intensity scale of 0 to 10. The scores obtained were used to generate sensory profiles of the different dishes. The samples, identified by a three-digit code, were presented in a random order to the tasters (Table 1). The evaluation consisted of assessing and quantifying relevant descriptors such as color, adhesiveness, appearance, taste, crunchiness, smell, firmness, fibrousness, and texture on an intensity scale. For pounded yam, the characteristics evaluated included color, appearance, elasticity (with fork, fingers, and in the mouth), adhesiveness, taste, and smell. Boiled yam was characterized by color, fibrousness, firmness (with fork, fingers, and in the mouth), taste, and smell. Finally, for fried yam, color, firmness (with fork, fingers, and in the mouth), crunchiness (with fingers and in the mouth), taste, and smell were selected for evaluation.

##### **2.2.2.1.2 Scoring Sheet**

A scoring sheet, including a questionnaire with a rating scale, was designed and handed out to each taster. This sheet was developed taking into account the specific characteristics of boiled, pounded, and fried yam. A session was held to explain how participants should evaluate the samples and fill out the pre-established questionnaire. The language used during this session was French.

##### **2.2.2.1.3 Session Procedure**

The evaluation tests were conducted in a well-ventilated classroom at Nangui Abrogoua University, free from odors and other potential distractions that could interfere with the panelists’ perception. The samples were presented in a randomized order, in three forms: boiled, pounded, and friedyam**.** Each sample was served on disposable plates and coded using a three-digit system to ensure anonymity and minimize bias. The test is conducted in the morning between 10:00 AM and 11:30 AM, to ensure the panelists' sensitivity was at its peak. To maintain a consistent level of perception, participants were instructed to rinse their mouths or drink the provided water after each tasting. Additionally, they were prohibited from communicating with one another during the evaluation process. Finally, participants were asked to rate their preference based on predefined sensory attributes for each sample using the provided evaluation scale 2.2.2.2 Hedonic Test

**Table 1.** Codes for the different formulated dishes.

|  |  |  |
| --- | --- | --- |
| **Varieties** | **Samples** | **Dishes** |
|  | KOF | Fried Yam |
| **"Kounougbé"** | KOB | Boiled yam |
|  | KOP | Pounded yam |
|  | KAF | Fried Yam |
| **"Kangba"** | KAB | Boiled yam |
|  | KAP | Pounded yam |
|  | KPF | Fried Yam |
| **"Kponan"** | KPB | Boiled yam |
|  | KPP | Pounded yam |
|  | KRF | Fried Yam |
| **"Krenglè"** | KRB | Boiled yam |
|  | KRP | Pounded yam |
|  | BEF | Fried Yam |
| **"Bètè Bètè"** | BEB | Boiled yam |
|  | BEP | Pounded yam |

#### 2.2.2.2 Hedonic Test

##### **2.2.2.2.1 Panel Constitution**

This study was conducted according to the method described by Stone and Sidel (2004). A panel of 80 tasters was formed, recruited from consumers in the city of Abidjan (Côte d'Ivoire). The panel voluntarily participated over a period of seven days, with 20 participants per day, assessing the acceptability of the different yam samples: boiled, fried, and pounded yam. The objective was to enable panelists to effectivelydistinguish the different samples while minimizing sensory fatigueand saturation effects. To achieve this, the evaluation was structured so that 20 participants were tested on days 1, 3, 5, and 7.

##### **2.2.2.2.2 Scoring Sheet**

Each taster was given a simple questionnaire-based scoring sheet (Watts et al., 1989) to assess their level of acceptance. A session was held to explain how participants should evaluate the samples and respond to the pre-established questionnaire. The French language was used for this study. The evaluation of yam dishes took into account various attributes. For boiled yam, the attributes included appearance, aroma, overall texture, and taste. Fried yam was evaluated in terms of appearance, aroma, crunchiness, overall texture, and taste. Finally, for pounded yam, the evaluated attributes included appearance, aroma, overall texture, adhesiveness, and taste. A hedonic test using a nine-point linear scale, ranging from "extremely unpleasant" (point 1) to "extremely pleasant" (point 9), was used to assess the degree of acceptability of the organoleptic characteristics.

##### **2.2.2.2.3 Session Procedure**

The evaluation tests took place in a well-ventilated room at Nangui Abrogoua University, free from any odors and disruptions that could influence the panelists' sensory perceptions. The yam dishes were served simultaneously to each taster, separated into disposable white plates, with anonymity assured by a three-digit coding system (Table 1).The test was organized during midday, between 12:00 PM and 1:30 PM, to ensure optimal sensitivity. No time limit was imposed on tasters who were not experienced. To maintain a constant level of sensitivity, tasters were asked to rinse their mouths or drink water provided after each tasting. Participants then rated their pleasure based on the selected organoleptic characteristics (appearance, aroma, crunchiness, overall texture, taste, and adhesiveness) for each sample using the nine-point hedonic scale.

##### **2.2.2.2.4 Determining General Acceptability**

General acceptability was assessed by calculating the average score given by the panelists for the different sensory criteria (color, smell, texture, taste, etc.). General acceptability was calculated using the formula provided by Meilgaard et al. (2006):

(1)

With: AG: Global Acceptability, Ni: Rating given by the i-th panelist, n: Total number of panelists

### **2.2.3** **Statistical Analyses**

Data entry and processing were performed using STATISTICA version 7.1 software. A one-way ANOVA (variety) followed by the Tukey test was used for the organoleptic characteristics. The significance level for all statistical tests was set at p ≤ 0.05.

# 3. RESULTS AND DISCUSSION

## **3.1 RESULTS**

### **3.1.1** **Sensory Characteristics of Boiled Yam from Five (05) Varieties**

#### 3.1.1.1 Descriptive Values of Boiled Yam

The analysis of the descriptive values of boiled yam revealed that variety has a significant effect (p<0.05) on certain sensory descriptors (Table 2). Regarding color, the boiled yam of the "Kounougbé" variety stands out with the highest score (6.85 ± 0.81), indicating a very satisfactory perception. In contrast, the "Kangba" variety has the lowest score (4.6 ± 0.50), reflecting a less appreciated color. Significant differences (p<0.05) were observed between the color appreciation scores of the boiled yam from the "Bètè-Bètè," "Krenglè," and "Kponan" varieties compared to those of "Kounougbé" and "Kangba." For odor, the study showed that the boiled yam received high scores. The "Kangba" variety stands out with the highest score (9.6 ± 0.60). However, statistical analysis did not reveal significant differences (p<0.05) between the odor appreciation scores of the boiled yam from the different varieties. Concerning firmness, evaluated in three contexts (in the mouth, with a fork, and with fingers), significant differences (p<0.05) were observed. In the mouth, the boiled yam of the "Kounougbé" variety has the highest score (7.15 ± 0.81), while the "Bètè-Bètè" variety has the lowest (5.45 ± 1.23). With a fork, "Kounougbé" also stands out with a score of 7.3 ± 0.73, while "Krenglè" has the lowest score (5.55 ± 0.60). Finally, when touched with fingers, "Kounougbé" maintains its advantage with a score of 7.65 ± 0.88, whereas "Kponan" has the lowest score (6.15 ± 0.93). In all three contexts, significant differences (p<0.05) were observed between the appreciation scores of boiled yam from the "Bètè-Bètè," "Krenglè," and "Kponan" varieties compared to "Kounougbé" and "Kangba." Regarding fibrousness, the boiled yam of the "Kounougbé" variety received the highest score (7.15 ± 0.93), while the "Kponan" variety had the lowest score (5.00 ± 0.92). Statistical analysis shows significant differences (p<0.05) between the fibrousness appreciation scores of the boiled yam from the "Bètè-Bètè," "Krenglè," and "Kponan" varieties compared to "Kounougbé" and "Kangba." As for taste, the boiled yam of all varieties was generally well-rated. The "Kangba" variety stands out with the highest score (9.7 ± 0.47), reflecting excellent taste acceptability. No significant differences (p<0.05) were observed between the taste appreciation scores of the boiled yam from the different varieties.

**Table 2.** Descriptive Values of Boiled Yam

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Sensory descriptors** | | | | | | |
| **Varieties** | **Color** | **Smell** | **Firmness in the mouth** | **Firmness with the fork** | **Firmness with the finger** | **Fiber content** | **Taste** |
| **"Kangba"** | 4,6 ± 0,50b | 9,6 ± 0,60a | 6,95 ± 0,94b | 6,30 ± 0,73b | 6,65 ± 0,88a | 6,95 ± 0,60b | 9,70 ± 0,47a |
| **"Kounougbé"** | 6,85 ± 0,81c | 9,45 ± 0,69a | 7,15 ± 0,81b | 7,30 ± 0,73c | 7,65 ± 0,88b | 7,15 ± 0,93b | 9,3 ± 0,73a |
| **"Kponan"** | 5,8 ± 0,77a | 9,35 ± 0,75a | 6,00 ± 0,86a | 5,80 ± 0,77ab | 6,15 ± 0,93a | 5,00 ± 0,92a | 9,45 ± 0,76a |
| **"Krenglè"** | 5,65 ± 0,49a | 9,25a ± 0,64 | 6,35 ± 1,27ab | 5,55 ± 0,60a | 6,85± 0,81a | 5,10 ± 1,17a | 9,5 ± 0,69a |
| **"Bètè Bètè"** | 5,25 ± 0,72a | 9,45a ± 0,60 | 5,45 ± 1,23a | 5,70 ± 0,80ab | 6,90 ± 0,79ab | 5,45 ± 1,28a | 9,35 ± 0,81a |
| ***P-value*** | 0,00 | 0,53 | 0,00 | 0,00 | 0,00 | 0,00 | 0,42 |

*Mean ± standard deviation; n = 20. For each variety, within columns, means that do not share a common letter differ significantly (p ≤ 0.05) according to Tukey's test.*

#### 3.1.1.2 Hedonic Values of Boiled Yam

The analysis of the hedonic values of boiled yam highlights significant differences (p<0.05) between the varieties for the sensory descriptors appearance and overall acceptability (Table 3). The "Kangba" variety shows the highest average scores for appearance (8.52 ± 0.30), aroma (8.73 ± 0.15), overall texture (8.53 ± 0.30), taste (8.5 ± 0.43), and overall acceptability (8.57 ± 0.10). It is the most appreciated variety for this preparation. "Kounougbé," with high average scores for appearance (8.26 ± 0.25) and overall acceptability (8.15 ± 0.21), ranks second. The "Kponan" and "Krenglè" varieties show moderate performances, with lower average scores for appearance (7 ± 0.43 and 6.7 ± 0.26, respectively) and overall acceptability (7.85 ± 0.59 and 7.71 ± 0.68, respectively). Finally, the "Bètè Bètè" variety received the lowest ratings, particularly for appearance (6.4 ± 0.75), taste (7.61 ± 0.37), and overall acceptability (7.55 ± 0.81). Furthermore, statistical analyses showed that the appreciation scores for appearance and overall acceptability of boiled yam from the "Kangba" and "Kounougbé" varieties differ significantly (p<0.05) from those of the other yam varieties. In summary, the "Kangba" variety stands out positively across all sensory descriptors, particularly for appearance, aroma, texture, and overall acceptability, making it the most appreciated variety. The "Kounougbé" variety also achieves satisfactory results, while "Kponan" and "Krenglè" offer moderate performances. These results confirm the influence of variety on the sensory perception of boiled yam.

**Table 3.** Hedonic Values of Boiled Yam

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Varieties** | **Hedonic values** | | | | |
| **Appearance** | **Aroma** | **Overall texture** | **Taste** | **Overall acceptability** |
| **"Kangba"** | 8,52 ± 0,30b | 8,73 ± 0,15a | 8,53 ± 0,30a | 8,50 ± 0,43a | 8,57 ± 0,10b |
| **"Kounougbé"** | 8,26 ± 0,25b | 8,20 ± 0,70a | 7,83 ± 0,83a | 8,30 ± 0,30a | 8,15 ± 0,21ab |
| **"Kponan"** | 7,00 ± 0,43a | 8,00 ± 0,30a | 8,03 ± 0,40a | 8,36 ± 0,50a | 7,85 ± 0,59a |
| **"Krenglè"** | 6,70 ± 0,26a | 8,00 ± 0,10a | 8,00 ± 0,20a | 8,16 ± 0,35a | 7,71 ± 0,68a |
| **"Bètè Bètè"** | 6,40 ± 0,75a | 8,24 ± 0,19a | 7,96 ± 0,20a | 7,61 ± 0,37a | 7,55 ± 0,81a |
| ***P-value*** | 0,00 | 0,16 | 0,43 | 0,14 | 0,00 |

*Mean ± standard deviation; n = 80. For each variety, within columns, means that do not share a common letter differ significantly (p ≤ 0.05) from each other according to the Tukey test.*

### **3.1.2** **Sensory Characteristics of Fried Yam from Five (05) Varieties**

#### 3.1.2.1 Descriptive Values of Fried Yam

The sensory analysis of fried yam showed that the variety variable has a significant effect (p<0.05) on the sensory descriptors (Table 4). Regarding color, fried yam from the "Kangba" and "Krenglè" varieties stands out with the highest scores, 6.35 ± 0.93 and 6.25 ± 0.72, respectively, indicating favorable appreciation. Conversely, the "Bètè-Bètè" (4.9 ± 0.72) and "Kponan" (5 ± 0.65) varieties show lower scores, reflecting a less satisfactory perception. Statistical analysis revealed significant differences (p<0.05) between the color appreciation scores of fried yam from the "Kounougbé," "Kangba," and "Krenglè" varieties compared to the "Bètè-Bètè" and "Kponan" varieties. For odor, fried yam from all varieties received high scores. The "Bètè-Bètè" variety stands out with the highest score (9.7 ± 0.57), followed closely by "Krenglè" (9.6 ± 0.50), confirming a highly appreciated aroma. However, statistical analysis did not show significant differences (p>0.05) between the odor appreciation scores of fried yam from different varieties. The analysis of crispiness, evaluated both in the mouth and by touch, reveals significant variations (p<0.05) among the varieties. For crispiness evaluated in the mouth, fried yam from the "Kponan" and "Bètè-Bètè" varieties ranks highest with scores of 6.8 ± 0.77 and 7.05 ± 0.83, respectively. In contrast, the "Krenglè" variety has a lower score (5.5 ± 1.15). Regarding crispiness evaluated by touch, fried yam from the "Kponan" variety achieves the highest score (7 ± 0.65), while "Krenglè" ranks lower (5.65 ± 0.49). Significant differences (p<0.05) were observed between the crispiness appreciation scores of fried yam from the "Krenglè" variety and those from other varieties. Regarding firmness, fried yam from the "Kangba" and "Kounougbé" varieties exhibits high scores. Firmness in the mouth is particularly high for the "Kangba" variety (7.2 ± 1.01), while firmness evaluated using a fork is notable for the "Kounougbé" variety (6.5 ± 1.54). Conversely, fried yam from the "Bètè-Bètè" variety shows lower scores, with 4.65 ± 0.88 for firmness in the mouth and 5.25 ± 0.79 for firmness assessed by fork. Statistical analysis showed that the firmness appreciation scores of fried yam from the "Kangba" and "Kounougbé" varieties differ significantly (p<0.05) from those of other varieties. As for taste, it is generally well-rated for fried yam from all varieties. The "Kangba" variety stands out slightly with the highest score (9.8 ± 0.41), followed closely by the "Kounougbé" (9.75 ± 0.44) and "Bètè-Bètè" (9.55 ± 0.51) varieties. In contrast, the "Kponan" (9.3 ± 0.47) and "Krenglè" (9.4 ± 0.68) varieties obtain slightly lower scores. Significant differences (p<0.05) were observed between the taste appreciation scores of fried yam from the "Kangba" and "Kponan" varieties.

**Table 4.** Descriptive Values of Fried Yam

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Sensory descriptors** | | | | | | | |
| **Varieties** | **Color** | **Smell** | **Crispness in the mouth** | **Crispness with the fingers** | **Firmness in the mouth** | **Firmness with the fork** | **Firmness with the finger** | **Taste** |
| **"Kangba"** | 6,35a ± 0,93 | 9,35a ± 0,67 | 6,35a ± 0,99 | 6,6ab ± 1,14 | 7,2c ± 1,01 | 6,05ab ± 1,19 | 8,35b ± 1,04 | 9,8b ± 0,41 |
| **"Kounougbé"** | 5,75a ± 0,79 | 9,25a ± 0,72 | 6,25ab ± 1,02 | 6,15abc ± 0,75 | 6,65c ± 0,75 | 6,5b ± 1,54 | 8,3b ± 0,92 | 9,75ab ± 0,44 |
| **"Kponan"** | 5,00b ± 0,65 | 9,2a ± 0,83 | 6,8a ± 0,77 | 7b ± 0,65 | 5,8b ± 0,77 | 6,2ab ± 0,77 | 5,8a ± 0,77 | 9,3a ± 0,47 |
| **"Krenglè"** | 6,25a ± 0,72 | 9,6a ± 0,50 | 5,5b ± 1,15 | 5,65c ± 0,49 | 5,25ab ± 0,72 | 5,4a ± 0,94 | 5,55a ± 0,69 | 9,4ab ± 0,68 |
| **"Bètè-bètè"** | 4,90b ± 0,72 | 9,7a ± 0,57 | 7,05a ± 0,83 | 6,75ab ± 1,12 | 4,65a ± 0,88 | 5,25a ± 0,79 | 5,15a ± 0,81 | 9,55ab ± 0,51 |
| ***P-value*** | **0,00** | **0,08** | **0,00** | **0,00** | **0,00** | **0,00** | **0,00** | **0,00** |

*Mean ± standard deviation; n = 20. For each variety, within columns, means that do not share a common letter differ significantly (p ≤ 0.05) according to Tukey's test.*

#### 3.1.2.2 Hedonic Values of Fried Yam

The analysis of hedonic scores for fried yam reveals that the varieties "Kounougbé," "Bètè Bètè," and "Kangba" are the most appreciated (Table 5). "Kounougbé" stands out with the highest scores for appearance (8.4 ± 0.4) and overall acceptability (8.26 ± 0.28), while "Bètè Bètè" excels in crispiness (8.63 ± 0.15) and performs well in texture and taste. "Kangba" shows consistent performance with high scores for crispiness (7.93 ± 0.40), overall texture (7.83 ± 0.32), and overall acceptability (8.01 ± 0.35), indicating strong appreciation. In contrast, the variety "Krenglè" received the lowest ratings, with low scores for appearance (6.1 ± 0.1), crispiness (6.96 ± 0.15), overall texture (6.46 ± 0.25), and overall acceptability (7.15 ± 0.93). Aroma and taste scores were generally high and homogeneous among the varieties, with no significant differences (p>0.05). These results show that variety strongly influences the sensory perception of fried yam, with a clear preference for "Kounougbé," "Bètè Bètè," and "Kangba," and lower acceptability for "Krenglè."

**Table 5.** Hedonic Values of Fried Yam

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Hedonic values** | | | | | |
| **Varieties** | **Appearance** | **Aroma** | **Crispiness** | **Overall texture** | **Taste** | **Overall acceptability** |
| **"Kangba"** | 7,56 ± 0,5bc | 8,33 ± 0,35a | 7,93 ± 0,40bc | 7,83 ± 0,32b | 8,4 ± 0,52a | 8,01 ± 0,35b |
| **"Kounougbé "** | 8,4 ± 0,4c | 8,6 ± 0,3a | 7,96 ± 0,15bc | 7,96 ± 0,20b | 8,36 ± 0,11a | 8,26 ± 0,28b |
| **"Kponan"** | 6,6 ± 0,1a | 8,63 ± 0,15a | 7,6 ± 0,45ab | 7,03 ± 0,25a | 8,46 ± 0,25a | 7,66 ± 0,88ab |
| **"Krenglè"** | 6,1 ± 0,1a | 8,13 ± 0,15a | 6,96 ± 0,15a | 6,46 ± 0,25a | 8,10 ± 0,26a | 7,15 ± 0,93a |
| **"Bètè Bètè"** | 6,9 ± 0,4ab | 8,66 ± 0,15a | 8,63 ± 0,15c | 7,83 ± 0,35b | 8,46 ± 0,25a | 8,1 ± 0,75b |
| ***P-value*** | 0,00 | 0,08 | 0,00 | 0,00 | 0,61 | 0,00 |

*Mean ± standard deviation; n = 80. For each variety, within columns, means that do not share a common letter differ significantly (p ≤ 0.05) from each other according to the Tukey test.*

### **3.1.3** **Sensory Characteristics of Fried Yam from Five (05) Varieties**

#### 3.1.3.1 Descriptive Values of Pounded Yam

The sensory analysis of pounded yam highlights the significant effect (p<0.05) of variety on sensory criteria (Table 6). Regarding color, the pounded yam from the "Kangba" variety stands out with a high average score (7.9 ± 0.85), closely followed by the "Kponan" (5.95 ± 0.83) and "Kounougbé" (5.8 ± 0.77) varieties. In contrast, the "Bètè-Bètè" variety has a significantly lower score (4.35 ± 0.67). Statistical analysis revealed that the color scores of the pounded yam from the "Kangba" variety differ significantly (p<0.05) from those of "Kounougbé," "Kponan," "Bètè-Bètè," and "Krenglè." Regarding appearance, the pounded yam from the "Kangba" variety also leads with a score of 9.10 ± 0.85, followed by the "Kounougbé" variety (8.3 ± 0.80). Conversely, the "Bètè-Bètè" variety scores very low (2.45 ± 0.69), indicating an unsatisfactory appearance. Statistical tests confirm that the sensory scores of the different varieties vary significantly (p<0.05). Concerning odor, the study showed that the pounded yam from different varieties received high scores, except for the "Bètè-Bètè" variety, which has a significantly lower score (7.10 ± 0.79, p<0.05). Significant differences (p<0.05) were observed between the odor appreciation scores of the "Bètè-Bètè" variety and those of the other varieties. The analysis of elasticity reveals that the pounded yam from the "Kangba" (7.15 ± 0.93) and "Kounougbé" (7.05 ± 0.83) varieties has a pleasant texture in the mouth. In contrast, the "Bètè-Bètè" variety has an extremely low score (2.1 ± 0.64), reflecting an undesirable texture. Statistical tests indicate significant differences (p<0.05) between the elasticity scores of the "Bètè-Bètè" variety and those of the "Krenglè," "Kponan," "Kangba," and "Kounougbé" varieties. These differences were also observed for elasticity evaluated by finger and fork tests. Regarding adhesiveness, the pounded yam from the "Kangba" (6.75 ± 0.85) and "Kounougbé" (6.9 ± 0.85) varieties received good ratings, whereas the "Bètè-Bètè" variety had a very low score (0.9 ± 0.64), indicating a significant defect. Significant differences (p<0.05) were observed between the adhesiveness scores of the "Bètè-Bètè" variety and those of the other varieties. As for taste, a crucial criterion, the pounded yam from the "Kponan" (9.75 ± 0.44) and "Krenglè" (9.8 ± 0.41) varieties achieved the highest scores, slightly surpassing the "Kangba" (9.4 ± 0.50) and "Kounougbé" (9.6 ± 0.50) varieties, which were still highly appreciated. In contrast, the "Bètè-Bètè" variety had the lowest score (5.45 ± 0.83), reflecting lower acceptability. Statistical tests confirm significant differences (p<0.05) between the taste appreciation scores of the "Bètè-Bètè" variety and those of the other varieties.

**Table 6.** Descriptive Values of Pounded Yam

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Sensory descriptors** | | | | | | | |
| **Varieties** | **Color** | **Appearance** | **Smell** | **Mouth elasticity** | **Fork elasticity** | **Finger elasticity** | **Adhesiveness** | **Taste** |
| **"Kangba"** | 7,90± 0,85c | 9,10 ± 0,85d | 9,60 ± 0,60a | 7,15 ± 0,93b | 6,80 ± 0,77 a | 7,10 ± 0,79a | 6,75 ± 0,85a | 9,40 ± 0,50a |
| **"Kounougbé"** | 5,80± 0,77b | 8,30 ± 0,80c | 9,60 ± 0,50a | 7,05 ± 0,83b | 7,15 ± 0,93a | 6,70 ± 1,22a | 6,90 ± 0,85ab | 9,60 ± 0,50a |
| **"Kponan"** | 5,95 ± 0,83b | 6,40± 0,99a | 9,35 ± 0,67a | 6,10 ± 0,91a | 6,55 ± 0,69a | 6,30 ± 0,92a | 7,00 ± 0,79ab | 9,75 ± 0,44a |
| **"Krenglè"** | 4,75 ± 0,64a | 6,20± 1,01a | 9,40± 0,75a | 6,25 ± 0,79a | 6,85 ± 0,88a | 6,50 ± 1,28a | 7,45 ± 0,60b | 9,80 ± 0,41a |
| **"Bètè Bètè"** | 4,35 ± 0,67a | 2,45± 0,69b | 7,10 ± 0,79b | 2,10 ± 0,64c | 1,15 ± 0,59b | 1,60 ± 0,50b | 0,90 ± 0,64c | 5,45 ± 0,83b |
| ***P-value*** | **0,00** | **0,00** | **0,00** | **0,00** | **0,00** | **0,00** | **0,00** | **0,00** |

*Mean ± standard deviation; n = 20. For each variety, within columns, means that do not share a common letter differ significantly (p ≤ 0.05) according to Tukey's test.*

#### 3.1.3.2 Hedonic Values of Pounded Yam

The analysis of the average hedonic scores of pounded yam is evaluated based on six sensory descriptors: appearance, aroma, overall texture, adhesiveness, taste, and overall acceptability (Table 7). It highlights significant differences (p<0.05) among the sensory attributes of pounded yam from different varieties. The analysis reveals that the pounded yam from the "Kangba" and "Kounougbé" varieties stands out with excellent scores for appearance, texture, adhesiveness, and taste, with high overall acceptability ratings of 8.44 ± 0.07 and 8.21 ± 0.68, respectively. "Kponan" performs well in terms of texture (8.7 ± 0.1) and taste (8.55 ± 0.13), but its moderate adhesiveness slightly reduces its overall acceptability (7.82 ± 0.87). Conversely, "Bètè Bètè" is by far the least appreciated variety, with very low scores for appearance (5.1 ± 0.1), texture (2.63 ± 0.15), adhesiveness (1.53 ± 0.05), and taste (4.53 ± 0.05), resulting in a very low overall acceptability score (3.84 ± 1.67). Aroma scores are generally high across all varieties except for "Bètè Bètè," which remains below the others (5.4 ± 0.1). These results confirm the significant influence (p<0.05) of variety on the sensory perception of pounded yam, with a clear preference for "Kangba" and "Kounougbé."

**Table 7.** Hedonic Values of Pounded Yam

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Varieties** | **Hedonic values** | | | | | |
| **Appearance** | **Aroma** | **Overall texture** | **Adhesiveness** | **Taste** | **Overall acceptability** |
| **"Kangba"** | 8,50 ± 0,30d | 8,40 ± 0,45b | 8,50 ± 0,30c | 8,48 ± 0,23c | 8,33 ± 0,15b | 8,44 ± 0,07b |
| **"Kounougbé "** | 8,26 ± 0,25cd | 8,71 ± 0,20b | 8,36 ± 0,32c | 7,03 ± 0,15b | 8,68 ± 0,16b | 8,21 ± 0,68b |
| **"Kponan"** | 6,80 ± 0,26b | 8,06 ± 0,15b | 8,70 ± 0,10c | 7,00 ± 0,10b | 8,55 ± 0,13b | 7,82 ± 0,87b |
| **"Krenglè"** | 7,76 ± 0,15c | 8,60 ± 0,20b | 7,20 ± 0,43b | 8,18 ± 0,23c | 8,46 ± 0,15b | 8,04 ± 0,56b |
| **"Bètè Bètè"** | 5,10 ± 0,10a | 5,40 ± 0,10a | 2,63 ± 0,15a | 1,53 ± 0,05a | 4,53 ± 0,05a | 3,84 ± 1,67a |
| ***P-value*** | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |

*Mean ± standard deviation; n = 80. For each variety, within columns, means that do not share a common letter differ significantly (p ≤ 0.05) from each other according to the Tukey test.*

## **3.2 DISCUSSION**

The evaluation of sensory and hedonic descriptors of boiled yam from the varieties "Kangba," "Kounougbé," "Krenglè," "Kponan," and "Bètè-Bètè" highlighted the importance of varietal characteristics in the perception of organoleptic qualities. The results obtained show that criteria such as color, firmness, fibrousness, and taste significantly influence (p<0.05) the overall acceptability of boiled yam. These observations align with the findings of Trèche (1997), who emphasized that the general appearance of tubers, flesh color, taste, and texture are essential characteristics for yam acceptability. Among these criteria, color stands out as the primary factor conditioning sample acceptance even before consumption, as confirmed by Ratsimbazafy et al. (2021). In this regard, the "Kounougbé" variety stands out with the highest color score, characterized by a yellowish hue, which is likely due to the presence of pigments, mainly carotenoids (Trèche, 1997). Beyond shape and color, the chemical composition of tubers significantly affects the perceived sensory characteristics during consumption. Thus, yam quality is defined by a combination of physical, chemical, and biochemical parameters that vary depending on genotypes, environmental conditions, storage, and processing methods (Trèche, 1997). The study revealed that boiled yam from the "Kangba" and "Kounougbé" varieties stands out for its exceptional sensory qualities and high overall acceptability. These performances reflect great consumer satisfaction, primarily attributed to a homogeneous texture and balanced firmness. The analysis of hedonic values confirmed these advantages, with high scores for key criteria such as appearance, aroma, and taste. These two varieties, due to their balanced texture and pleasant taste, appear to be the most suitable for meeting consumer expectations. In particular, the evaluation of firmness—conducted in the mouth, with a fork, and by hand—revealed significant differences (p<0.05) between the "Kangba" and "Kounougbé" varieties and the other varieties, reinforcing their privileged position in terms of sensory attributes. This observed difference could be attributed to dry matter content, as stated by Digbeu et al. (2009). According to these authors, dry matter is a determining factor in firmness appreciation, with a high content generally resulting in a firmer texture. This hypothesis is confirmed by Dje et al. (2010a, 2010b), who demonstrated that the "Kangba" variety has a higher dry matter content (42.31 ± 0.77) than the "Krenglè" (41.86 ± 0.28) and "Bètè-Bètè" (34.19 ± 0.67) varieties. Furthermore, statistical analysis revealed significant differences (p<0.05) in fibrousness ratings between the "Bètè-Bètè," "Krenglè," and "Kponan" varieties and the "Kounougbé" and "Kangba" varieties. These differences are likely related to the fiber content of the boiled yams. The results obtained for the "Kounougbé" and "Kangba" varieties indicate a homogeneous texture and moderate fibrousness, characteristics that enhance their overall acceptability. A moderate perception of fibers, particularly in the "Kounougbé" variety, contributes to its higher consumer appreciation. However, a high fiber content can alter texture homogeneity, which may be perceived as a sensory defect by some consumers. Thus, managing fibrousness appears to be a key factor in improving the sensory quality and acceptability of yam varieties. Overall, these results confirm that variety selection is a determining factor in the sensory perception of boiled yam. They further highlight the importance of promoting local varieties such as "Kangba" and "Kounougbé." Descriptive and hedonic analyses of fried yam also revealed a strong preference for the "Kounougbé," "Bètè-Bètè," and "Kangba" varieties. The results show that the observations from the hedonic analysis align with those from the descriptive analysis. These varieties achieved high scores for sensory criteria such as appearance, aroma, and taste. They also stood out for their consistent performance in key aspects such as color, crispness, firmness, and taste, further strengthening their overall acceptability. These observations corroborate the findings of Ratsimbazafy et al. (2021), who noted that taste varies according to the species used during processing and plays a central role in the general appreciation of the product. Our results surpass those obtained on fried Dioscorea alata by Kirmaci et al. (2015), who reported scores ranging from 5.29 to 6.39. These high values reflect the importance of yam-based dishes in Ivorian dietary habits. Among the studied varieties, "Kounougbé" particularly excels in appearance and overall sensory balance, while "Bètè-Bètè" is noted for its crispness and intense aroma. Significant differences (p<0.05) were observed in the crispness ratings of fried yam from the "Krenglè" variety compared to the other varieties. This disparity could be explained by a correlation between crispness and dry matter content, which directly influences the texture of fried products (Gaëtan, 2001). Indeed, texture is a fundamental quality criterion for food products. It plays a central role in defining a food product’s identity and in consumer perception (Wilkinson et al., 2001). Any perceived alteration in texture can negatively impact the consumer’s perception of the product. For fried products, golden color and texture are essential criteria. The ideal texture must combine a crispy crust with a soft center, characteristics influenced by several factors, including the amount of oil absorbed during frying (Oluwole et al., 2017; Kirmaci et al., 2015). Texture development during frying occurs in two stages: the first involves tissue softening and core cooking, while the second corresponds to crust formation and hardening (Pedreschi et al., 2001). These processes are crucial for achieving the crispy texture appreciated by consumers. The "Kangba" variety, with its high firmness and overall acceptability scores, illustrates remarkable sensory versatility. Conversely, the "Krenglè" variety is less well-received, likely due to its insufficient crispness, which limits its overall appreciation. Significant differences (p<0.05) were observed between the crispness ratings of fried yam from the "Krenglè" variety and those of the other varieties. These observations corroborate the findings of Oluwole et al. (2017), who also emphasized the importance of crispness as a key criterion for fried products. According to these authors, crispness, an essential quality criterion for all fried products, is a particularly appreciated attribute among consumers. Our observations align with those reported by Oluwole et al. (2017) on the frying of white yam and winged yam, which received appreciation scores of 7.14 and 6.39, respectively. The more intense golden color observed for the "Kangba," "Kounougbé," and "Bètè-Bètè" varieties is likely attributed to their high content of reducing sugars (Coulibaly et al., 2021). This coloration results from the Maillard reaction, a process in which sugars react with amino acids under the effect of heat, contributing to the appearance and flavor of fried products (Kirmaci et al., 2015). However, some yam-based processed products may exhibit a darker color. This hue is due to the production of brown molecules during enzymatic reactions, catalyzed by enzymes such as polyphenol oxidase and peroxidase (Akissoe et al., 2003). The sensory analysis of the hedonic scores of pounded yam highlights significant differences (p<0.05) between the varieties, demonstrating the major influence of variety on sensory perceptions. Evaluations based on six sensory descriptors appearance, aroma, overall texture, adhesiveness, taste, and overall acceptability, reveal that the "Kangba" and "Kounougbé" varieties stand out with excellent performance. These characteristics align with the food quality profile described by Otegbayo et al. (2023), who demonstrated that the main quality criteria for pounded yam are color and textural quality. Furthermore, the study recorded high scores for appearance, overall texture, adhesiveness, and taste, indicating remarkable overall acceptability for the "Kangba" and "Kounougbé" varieties. Our results on the sensory attributes of pounded yam from different varieties show minor variations in panelists' decisions, suggesting homogeneity in their assessments. This indicates that all samples were generally accepted by the panelists. These observations are consistent with previous studies, notably that of Abulude et al. (2018). Regarding elasticity, statistical analyses reveal significant differences (p<0.05) between the scores assigned to the pounded yam from the "Bètè-Bètè" variety and those of the "Krenglè," "Kponan," "Kangba," and "Kounougbé" varieties. These differences could be explained by variations in the botanical origin of the yam varieties used. Additionally, the observed difference in swelling capacity could be attributed to their starch content and the presence of lipids, which form a complex with amylose and inhibit swelling, as suggested by the work of Zheng et al. (1997). Thus, varieties with high swelling capacity would be those with high starch content and strong elasticity, as reported by Fakorede et al. (2020). Our findings align with those of Nindjin et al. (2007), who observed that pounded yam made from *Dioscorea alata* was less appreciated for its elasticity than that obtained from *Dioscorea cayenensis-rotundata*. According to these authors, moldability and elasticity were identified as essential criteria for the general preference for pounded yam. Regarding appearance, significant differences (p<0.05) were observed between the pounded yam of the "Kangba" and "Kounougbé" varieties and that of the "Krenglè," "Kponan," and "Bètè-Bètè" varieties. This observation could be explained by the starch structure, which gives these varieties specific properties resulting in a considerable swelling rate, as described by Elenga et al. (2016). Moreover, our results confirm those of Nindjin et al. (2007), who showed that Ivorian consumers preferred pounded yam made from *D. cayenensis-rotundata* over that obtained from *D. alata*.

# 4. CONCLUSION

The study on the sensory analysis of yam preparations (pounded, boiled, and fried) highlighted the significant effect of variety on sensory criteria. The "Kangba" and "Kounougbé" varieties stand out particularly for their high overall performance, reflecting a strong appreciation for descriptors such as appearance, texture, elasticity, adhesiveness, taste, and overall acceptability. They are particularly favored in all forms of preparation, with higher sensory scores in most of the studied descriptors.

# COMPETING INTERESTS

Authors have declared that no competing interests exist.

# DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

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