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Phenotypic association of textural, sensory, physicochemical, and untargeted aroma of boiled yam

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1. INTRODUCTION

Boiled yam (BY) is a staple food commonly consumed in Nigeria produced by peeling and steaming/boiling until sufficiently softened. Consumers have preference for BY texture with good crumbliness/ease of breaking, moderate hardness and pleasant aroma. This study aimed to elucidate the relationships among the textural, sensory and physicochemical properties of boiled yam (BY) and to identify untargeted aroma features associated with BY quality.

Keywords: Boiled yam, fracturing, hardness, penetration, sensory, untargeted aroma

2. MATERIALS & METHODS

Raw tubers of twelve yam genotypes harvested in Nigeria were freeze-dried and milled into flour. Boiled yam (BY) cubes (20 mm) were produced by steaming for 20 min, freeze-dried and milled into flour.

- **Texture** of boiled yam was assessed through a penetration test under standard protocols [1]. Key texture parameters include Fpeak (representing hardness) and LD total/ Area total (representing crumbliness).
- The effect of **storage on texture** was analyzed at 0-6 MAH (months after harvest).
- Nineteen trained panelists evaluated five selected 'champion' genotypes for two key **sensory** attributes of boiled yam: *yammy* and *earthy/woody* aroma on a scale 0 (lowest) to 10 (highest) [2].
- **Dry matter & Color** (DM) content and color (L*, a*, b*) parameters were measured in both raw and cooked yam samples.
- **Aroma** profiles of boiled yam were obtained using dynamic headspace GC–MS.

3. RESULTS

3.1. Texture, sensory and physicochemical features of boiled yam

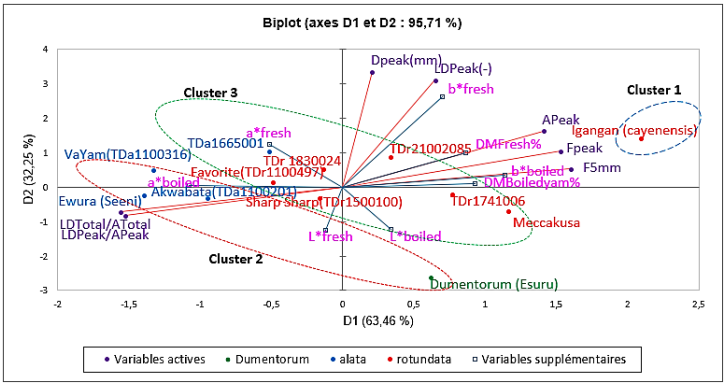

Fig 1. PCA with 3-class hierarchical clustering showing diversity of penetration texture, color and DM of boiled yam analyzed at 0 MAH

The PCA accounted for 95.7% of variation. The *D. cayenensis* genotype Igangan in cluster 1 was associated with harder texture, higher DM, and yellow color (b*fresh, b*boiled) for fresh and boiled yam, but poor crumbliness, and thus may be less likely preferred for boiling.

The crumbliest genotypes in cluster 2 linked to texture parameter LD total/ Area total were *D. alata* genotypes such as Akuabata, Ewura and Va Yam, with lower DM. These are likely preferred by consumers.

Favorite and Sharp Sharp in cluster 3 were moderately hard and crumblier than other *D. rotundata* genotypes, and are also likely preferred for boiling. TDr1741006 and Meccakusa also have moderate hardness, low crumbliness and higher lightness of boiled yam (L*boiled) could be less preferred.

Among the 'champion' genotypes, *D. rotundata* genotypes Meccakusa and Sharp Sharp appeared to be associated with yammy odour, while earthy/woody odour was seemingly linked to crumbly *D. alata* varieties like Akuabata and Va yam (not shown).

Significant positive correlations were found between Fpeak (hardness) and DM of fresh yam ($r = 0.70$, $p < 0.05$) and boiled yam ($r = 0.67$, $p < 0.05$). Therefore, drier yams may be more resistant to deformation by penetration.

3.2. Effect of storage on boiled yam hardness and crumbliness

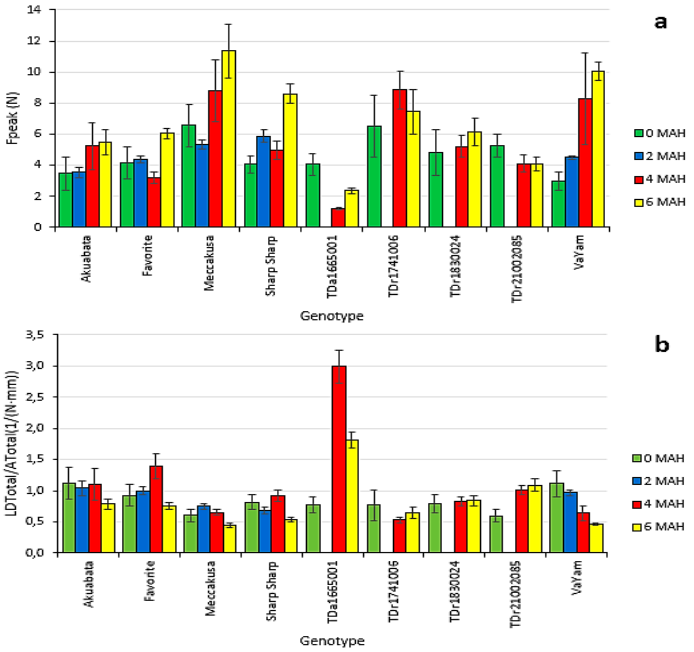

Fig 2. Effect of storage months after harvest (MAH) on penetration texture parameters (a) Fpeak and (b) LDTotal/Atotal of boiled yam.

Fpeak of boiled yam generally increased with storage except for TDa1665001 and TDr21002085. On the contrary, LD total/A total decreased significantly with storage, particularly for *D. alata* genotypes Akuabata and Va yam, but Favourite, TDa1665001 and TDr21002085 increased in crumbliness until 4 MAH. TDr1830024 and TDr1741006 largely remained unchanged in crumbliness with storage.

These changes may have resulted from hardening cell wall components with longer storage reducing susceptibility of starch granules to complete gelatinization.

3.3. Aroma features of boiled yam

More than 162 aroma compounds were detected, of which 43 were tentatively identified using the NIST20 spectral library and considered relevant to boiled yam quality. Some of these include furfural, ethyl acetate, pentanal, 2-pentylfuran, cyclohexanone, benzaldehyde, trans-2-nonenal, acetophenone, acetamide, phenol, and toluene.

4. CONCLUSION

The findings highlighted the relationships among textural, physicochemical, and sensory characteristics of BY and associated aroma features. The sensory appeal of BY depends on the eating quality which varied among genotypes. These outcomes may provide information to yam breeders in selecting varieties with desirable sensory and cooking quality, while taking into account changes in quality and preferences during storage.

5. ACKNOWLEDGEMENT

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6. REFERENCES

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