CHARACTERIZATION OF THE FINGERS, FLOUR AND STARCH PROPERTIES OF TWO VARIETIES OF PLANTAINS, APEM AND APENTU, FROM GHANA

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Abstract

Studies were carried out on the morphology of the fingers and the differential scanning calorimetry (DSC), the pasting properties as well as the scanning electron micrograph of flour and starches of two plantain varieties, *Apem* (French Horn) and *Apentu* (False Horn) from Ghana, at the unripe and ripe stages. The weights, length, circumference and diameter of the *Apentu* varieties were higher than that of the *Apem* for both the unripe and ripe samples. The DSC established the % amylose content in the unripe plantain ranged from 22.49 to 23.44, but these values decreased as the fruit ripens. Peak viscosities and set back values of the flours of both varieties decreased significantly as the fruit ripens. Ripe plantains of both varieties had significant differences in the scanning electron micrographs from the unripe types.

Introduction

Plantains (Musa AAB) are important food crops in much of Africa (Anon, 1992).

Little is however known about the physicochemical properties of plantain starch and flour.

The physicochemical properties are important determinants of the food uses of plantains

OBJECTIVE: To characterize the morphology of the fingers and the differential scanning calorimetry (DSC), pasting as well as the scanning electron micrograph properties of flour and starches of two plantain varieties, Apem (French Horn) and Apentu (False Horn) from Ghana, at the unripe and ripe stages.

Materials and Methods

Raw materials: French Horn (*Apem)* and False Horn (*Apentu*) plantains

Physical characterization:

- Fruit weights, length circumference and diameter of peel and pulp (Dadzie and Orchard, 1993).
- Amylose content of flour and starch (Mestres et al 1996)
- Pasting characteristics (Walker et al., 1988).
- Scanning Electron Microscopy (SEM) (Huang et al., 1990).

Results and Discussion

Table 1: Morphological characterization of Unripe and ripe plantains

Sample name	Weight (g)	Length (cm)	Circumference (cm)	Diameter (mm)	Pulp to peel* ratio
Unriped *Apentu*	286.00 ± 28.52	26.20 ± 1.13	14.59± 0.64	46.53± 3.08	1.92±0.06
Unriped *Apem*	165.97 ± 24.13	24.52 ± 1.69	12.28 ± 0.82	38.39± 6.15	1.09±0.03
Riped *Apentu*	250.89 ± 77.59	27.29 ± 1.48	13.48 ± 1.72	29.53 ± 5.20	2.37± 0.01
Riped *Apem*	155.79 ± 21.88	22.74 ± 1.72	11.47 ± 0.59	20.84 ± 4.21	2.64± 0.02

including pulp to peel ratio for moisture content for unripe plantains
mean ± standard deviation

- The weights, lengths, circumference and diameter of the Apentu cutivars were higher than the Apem for both ripe and unripe samples (Table 1). Generally the Apentu cultivars are larger than the Apem cultivars.
- Unripe samples had higher weights which could be attributed to high starch content compared to that of the ripe cultivars where most of the starch had been converted to sugars through hydrolysis of starch.
- The heterogeneity of the samples contributed to the high standard deviation value for the ripe Apentu.

Table 2: Differential scanning calorimetry (DSC) characteristics of unripe and ripe plantains flours and starches

Plantain flours	Onset	Peak	End	ΔH	Amylose (%)
Riped Apem flour	75.687	77.065	79.04	3.754	5.54
Riped Apentu flour	75.71	78.733	79.99	7.28	11.28
fam3	78.32	80.82	81.95	12.28	19.16
fam5a	78.36	80.89	82.32	12.62	19.77
fau1	77.80	80.73	82.33	12.30	19.66
fau2	77.91	80.82	82.36	11.86	20.49
Plantain starches	Onset	Peak	End	ΔH	Amylose (%)
am3	68.84	75.75	82.82	14.34	23.28
am5a	77.89	80.32	81.32	14.23	22.49
au1	87.43	85.30	81.24	13.71	23.44
au2	77.49	80.23	81.64	13.69	22.50

am3 indicates Apem plantain from third hand of the bunch, am5a indicates Apem plantain from the fifth hand with fingers(2,6,9,12,16), au1 indicates Apentu plantain from the first hand and au2 for Apentu plantain from second hand. Code f is for the flours from the plantain

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- The ΔH values were higher in the starches from both cultivars compared to the flours. This was because the starches were native starch but the flour contained fiber and other constituents.
- The % amylose for the starches from both cultivars was high which explains the high peak temperature observed.
- The ripe Apentu flour recorded higher amylose value compared to flour from the ripe Apem, this was because the Apem cultivar was very ripe and more hydrolysis of starch to sugar had taken place.

Table 3: Pasting properties of flour and starches from ripe and unripe plantains

Pasting properties	AM	AU	FAM	FAU	RAM	RAU
Pasting temp.(°C)	79.79	81.31	80.59	81.69	*	81.20
Peak viscosity (cP)	1584	1421	2160	2147	43*	440
Peak time (min)	9.94	9.72	8.95	8.84	11.23*	10.10
Setback (cP)	732	585	362	255	30*	104

AM-Apem starch, AU- Apentu starch, FAM- unriped Apem flour, FAU- unriped Apentu flour,RAM- Riped Apem flour, RAU- Riped Apentu flour.

- The *Apem* starch and flour recorded higher peak viscosity than the flour and starch from the *Apentu* cultivar. The peak viscosities of all the flours from the two cultivars were higher than their starches.
- Peak viscosity for the ripe samples was lower as a result of hydrolysis of starch
- The *Apem* starch and flour recorded higher setback values than the Apentu which indicated that the *Apem* cultivar has a better consistency than the *Apentu* cultivar since it will form a stronger gel which is a requirement in industrial application.
- The ripe flours from both cultivars exhibited lower pasting parameters because there had been hydrolysis of greater percentage of the starch when ripe.

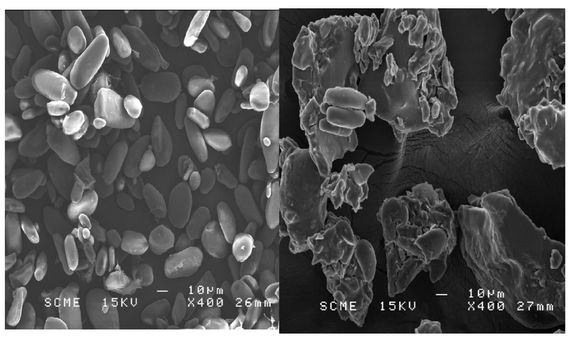

Fig 1-Scanning electron micrograph of unripe and riped plantain (var. Apem) (X400)

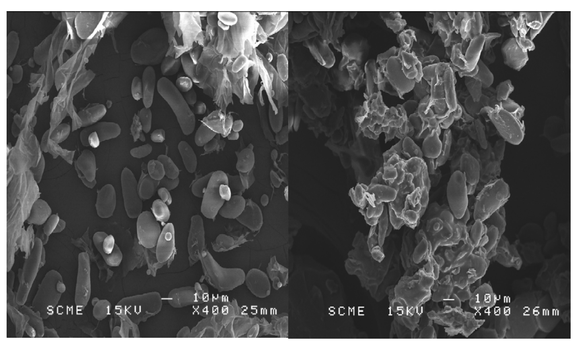

Fig 2- Scanning electron micrograph of unripe and riped plantain (var. Apentu) flour (X400)

Fig. 1 and 2 show the differences in the sizes and shapes of the starch granules of both ripe and unripe Apem and Apentu flours. The disrupted cell walls are indications that starch hydrolysis has taken place (Walker et al., 1988)

Conclusion

There are morphological, physical and rheological differences between the fingers, flours and starches of French Horn (Apem) and False Horn (Apentu) plantains. These could affect the processing of plantain into specific food products.

References

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