Proximate Composition and Pasting Behavior of Starch from Indian Bananas (Musa Spp)

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Abstract: Four varieties Poovan (AAB), Monthan (ABB), Karpuravalli (ABB) and dwarf Cavendish (AAA) of mature banana green fruit growing in Tamil Nadu were used for flour production. The proximate compositions and pasting profiles were studied in these flours. The Poovan variety presented more Carbohydrate and dietary fibre. In general all the chemical composition in all the varieties was similar except ash content. The fat, ash, protein and fibre content were more in karpuravalli. KB has the highest peak viscosity (429.83 RVA), PB has the highest resistant to heating, shear- thinning as revealed by its breakdown viscosity (117.08 RVA) And Karpuralli has more Set back viscosity-(178.33RVA). The simple method of processing and application reported in this study will enhance the extension of shelf life and utilization mature green banana fruits.

Key words: Mature green • Banana flour • Pasting properties • Carbohydrate

INTRODUCTION

India is the largest producer of banana in the world with an annual production of 16.81 million MT from an area of 0.49 million ha [1-4]. Since then, development of high yield, short time growth, disease resistant banana varieties by institutions of agriculture have increased the volume of banana at harvest. ‘Poovan’ is the popular variety grown commercially in different regions due to its wider adaptability and high degree of tolerance to drought in a perennial cropping system and is the leading commercial cultivar of Tamilnadu. These bananas are mainly transported to urban areas, where they would be eaten as fruit vegetables. However unavoidable delay in transport, poor post- harvest technology and fluctuating market demand results in over ripe and senescence of fruits prior to market delivery. Hence large amount of banana post-harvest losses are usually recorded [3]. These unbearable post harvest losses serve as impetus to study on the processing and application of mature green bananas with view to diversity utilization of the crop. Carbohydrate is the principal component of green bananas, which undergoes important changes during ripening [5-7]. Consequently the objective of the study is the production, characterization of banana flour and to determine their pasting properties of these Carbohydrates isolated from this alternative source. Materials and methods:

Raw Materials: Four varieties of freshly harvested matured green banana (Musa spp) fruits such as Poovan (AAB), Monthan (ABB), Karpuravalli(ABB) and dwarf Cavendish (AAA), Bananas harvested from field were used for study.

Production of Unripe Plantain Flours: Banana flour was produced according to the procedure of Perezaira [8] with little modification for prevention of enzymatic browning. The procedure is as follows fresh mature green bananas were peeled under water treated with 0.05% sodium metabisulphite and the sliced at average thickness of 1cm using sharp knife. The slices were then dried at 50°C for 48h in air oven. The dried chips were milled in UDY Cyclone mill to obtain flour from mature green banana fruits. The flour was sieved and packaged for subsequent use.

Proximate Composition Determination: Proximate compositions of samples were determined according to the method of AOAC [9] with analytical procedures. Moisture content is estimated at 105°C by hot air oven method (AOAC official method 945.15): oil content is analysed by soxlet apparatus (AOAC official method 945.16): crude protein (Nx6.25) is estimated by kjeldhal method (AOAC official method 920.87): Dietary fibre is estimated by fiber extractor method (AOAC official method 460.01): total ash is estimated with muffle furnace
at a temperature of 550°C ((AOAC official method 923.03): The Carbohydrate is obtained by difference. All tests were average of triplicate analysis.

**Determination of Pasting Properties:** The Pasting Profile of Flours and Flour blends were characterized by Rapid Visco Analyser (New Port Scientific Australia). 5g of accurately weighed starch was added into water to obtain a ratio 1:2(w/w). the treated starch was heated from 28 to 150°C at 4°C/min and all experiments were carried out triplicate. The RVA 3d was operated with 250g of 9.9%treated starch in water suspension. The temperature profile included a 2 min isothermal step at 50°C, linear temperature increases to 95°C in 7 min, a holding step (8 min inat 95°C) a cooling step (7 min) with a linear temperature decreases to 50°C and a final isothermal step at 50°C. Duplicate measurements always agreed within 5 rapid visco units (RVU) over the whole profile.

**RESULTS AND DISCUSSION**

Table 1 and 2 summarises the Proximate composition of banana flours The lowest moisture content were recorded 7.7% in Poovan The low (7.7~9.9) moisture content of the flour signifies good storability of the product. [10-12] Fibre content high in Poovan (2.0%) followed by Monthan (1.7%) and least in Rasthali and Nendran (0.55% and 0.60%). In spite of low protein content the high dietary fiber content makes them of interest from a nutritional point of view. Milled products with low moisture content of less than 13 % are stable from moisture dependent deterioration [3, 10, 11, 13, 14]. Generally all the samples are high (83.79-86.00%) in Carbohydrate [4, 15].

**Mature green banana fruit**

**Flow diagram for production of flour from mature green banana fruit**

Pasting properties of the mature green flours are shown in Figure and Table. 2. Variance in pasting spectral (Figure 4) of the samples signified heterogeneous Carbohydrate granules in the samples. PB has the highest peak viscosity (429.83 RVU) which implied the sample with highest water – binding potential. This flour is suitable ingredient for quick preparations or instant food [7, 16]. KB has the highest resistant to heating, shear- thinning as revealed by its breakdown viscosity (117.08 RVU). Added to this, KB had the lowest set – back viscosity (88.3RVU) form the peak. This reflects the stability of the cooked paste against retro gradation [18, 19]. The shortest cooking time observed was 4.87min for PB [20]. Cooking time has cost implication. KB has the lowest pasting temperature (81.55°C). Pasting temperature provides an indication of the minimum temperature required to cook a given sample. This can have implication on stability of other components in a formulation and also influence energy cost.

**Table 1: Proximate composition of (%) banana flours**

<table>
<thead>
<tr>
<th>S.NO</th>
<th>Variety</th>
<th>Moisture content</th>
<th>Ash</th>
<th>Fat</th>
<th>Protein</th>
<th>Dietary Fibre</th>
<th>Carbohydrate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Monthan</td>
<td>8.4</td>
<td>2.54</td>
<td>0.75</td>
<td>1.45</td>
<td>1.7</td>
<td>85.76</td>
</tr>
<tr>
<td>2.</td>
<td>Poovan</td>
<td>7.7</td>
<td>2.40</td>
<td>0.75</td>
<td>1.05</td>
<td>2.0</td>
<td>86.00</td>
</tr>
<tr>
<td>3.</td>
<td>Karpuravalli</td>
<td>8.3</td>
<td>1.20</td>
<td>2.06</td>
<td>3.25</td>
<td>1.8</td>
<td>83.79</td>
</tr>
<tr>
<td>4.</td>
<td>Pachai</td>
<td>7.9</td>
<td>2.80</td>
<td>1.82</td>
<td>1.73</td>
<td>1.0</td>
<td>83.75</td>
</tr>
</tbody>
</table>

**Table 2: Pasting Properties of Banana Flours**

<table>
<thead>
<tr>
<th>S.NO</th>
<th>Variety</th>
<th>(PV)</th>
<th>(BV)</th>
<th>(FV)</th>
<th>(SV)</th>
<th>(PT)</th>
<th>(Pt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>MB</td>
<td>596.58</td>
<td>406.92</td>
<td>189.67</td>
<td>105.67</td>
<td>5.27</td>
<td>87.25</td>
</tr>
<tr>
<td>2.</td>
<td>KB</td>
<td>385.17</td>
<td>117.08</td>
<td>474.00</td>
<td>88.83</td>
<td>4.87</td>
<td>81.55</td>
</tr>
<tr>
<td>3.</td>
<td>PB</td>
<td>571.00</td>
<td>429.83</td>
<td>141.17</td>
<td>178.33</td>
<td>5.27</td>
<td>87.30</td>
</tr>
<tr>
<td>4.</td>
<td>PaB</td>
<td>599.50</td>
<td>410.17</td>
<td>189.33</td>
<td>140.08</td>
<td>5.27</td>
<td>88.8</td>
</tr>
</tbody>
</table>

Fig. 2: Moisture, Ash and Fat content of banana flours (%)
1-Moisture content: 2-Ash: 3-Fibre

Fig. 3: Protein, dietary fibre and starch content banana flours (%)

Fig. 4: Pasting properties of banana flours
In the result revealed that high carbohydrate content can be obtained from banana fruits without sophisticated purification procedure. Among the fruits Poovan had more carbohydrate and dietary fibre. The method yielded flour products with low moisture contents that signaled high storability potentials. The pasting properties evaluated can give insight to applicabilities of the flours in food such as baby weaning foods, puddings, soups and gravies [21] and non-food products like thickener, water binder, emulsion stabiliser and gellir. The simple method of processing and application reported in this study will enhance the extension of shelf life and utilization of mature green poovan banana fruits.

REFERENCES

8. Missing