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FOOD TECHNOLOGY

PHYSICO-CHEMICAL CHARACTERISTICS OF VALUE ADDED BANANA PRODUCTS

Muhammad Farooq [1], Saghir Ahmed Sheikh[2], Tanveer Fatima Miano [*3] and Noor-un-Nisa Memon [4]

ABSTRACT

The present research was conducted at the Institute of Food Science and Technology, Faculty of Crop Production, Sindh Agriculture University, Tandojam, Sindh, Pakistan during the year 2015 to study physico-chemical and sensorial qualities of value added banana products. In this regard unripe fruits of Cavendish variety of banana were collected from local banana orchard of Tandojam and processed for making banana flour. Banana flour was used to make different products viz. dough, chapati and banana kheer. Chappati was also explored by adding rice and basin flour. Unripe banana fruit, banana flour and their products were analysed for pH, titratable acidity, moisture (%), TSS (Brix) and vitamin C. The results showed that physico-chemical and sensorial qualities of banana flour and their products were significantly affected by value added banana products. Maximum pH (7.68) and TSS (26.30 brix) were recorded from banana kheer. However, ash (0.8260) and vitamin C (18.35) remained highest in chapatti that was made by adding banana and rice flours. However, results of vitamin C (18.3) in chapatti were non-significant with those obtained from unripe banana fruit (17.54) and banana kheer (15.79). Unripe banana fruits had maximum moisture (72.08%) in comparison to banana products. Minimum pH (6.79) and titratable acidity (0.02) were observed in unripe banana fruit, while banana flour had minimum moisture (7.47%) and ash (0.2363%). Minimum vitamin C (12.83) and TSS (5.30) were observed in chapati and banana and basin flour, respectively. It is clear from the results that processing of banana for value added products altered the physico-chemical qualities of banana flour.

KEYWORDS: *Muss paradisca*; banana flour; chapatti; rice flour; kheer; milk; chemico-physical properties; Pakistan.

[1] M.Sc. Student, [2] Professor, Institute of Food Science and Technology, [3] Associate Professor, [4]Professor, Department of Horticulture, Sindh Agriculture University, Tandojam, Sindh, Pakistan.
*Corresponding author e-mail: drtanveerfmiano@yahoo.in

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INTRODUCTION

Banana (*Muss paradisca* L.) is one of the most popular fruits and leads not only in production but also consumed on a large scale in the world (Akhtar *et al.,* 2012). The banana is very delicious in taste and ranks first with production rate of 25 percent (Ricardo *et al.,* 2003; Sothornvit and Pitak, 2007). Ripen banana has 5 to 10 days of shelf life after harvesting. It is a soft and delicate fruit which makes it susceptible to diseases and injury when transported to the markets for utilization (Abbas *et al.,* 2009). Human consumption of banana fruit has been increasing day by day, by cultivating it on large scale and potential of converting banana into cash crop is being explored by developing products of commercial interest (Emaga *et al.,* 2008).

In developed countries 40 – 50 % of annual agricultural produce is converted into value added commodities (Surendranathan *et al.,* 2001). So in such situation it's more important to convert banana into valuable products having high nutritional value for fulfilling the consumer demand and avoiding its spoilage (Suntharalingam and Ravindran, 2003).

Commercially the banana flour production is not well known. Therefore, the banana producing industries are gaining popularity (Chong and Aziah, 2008). The banana pulp may also be processed to make banana flour, but high quality control measures, budgets and manpower is required, Physical must be studied for analyzing chemical and nutritional qualities of flour (Ricardo *et al.,* 2003). It has been considered that when banana does not mature fully, its conversion into flour is major source of fibre, starch, total starch and minerals (P, Mg, K, and Ca) (Zhang *et al.,* 2005). Gradual increase in titratable acidity (0.08 to 0.18%), moisture (0.23 to 0.48%), protein (0.09 to 0.40%) and fibre (0.12 to 1.03%) was largely due to the addition of *Aelo vera* powder (Farhat *et al.,* 2014).When banana is converted to flour it has the potential to use in bakery products (Aparicio-Sagnilan *et al.,* 2007 and Asif *et al.,* 2014). Addition of citrus peels oil in the preparation of cakes and rusks about 3 ml and 4 ml per 500g of flour enhanced the physico-chemical properties of the value added products (Muhammad and Rehman, 2006).

The present experiment was designed to study the physico-chemical qualities of value added banana products.

MATERIALS AND METHODS

This study was conducted at the Institute of Food Science and Technology, Faculty of Crop Production, Sindh Agriculture University, Tandojam, Sindh, Pakistan during the year 2015. Fruits of Cavendish banana variety were collected from near local orchard of Tandojam and brought to the laboratory. Unripe fresh and good quality banana fruit was randomly selected, washed and cut into separate finger pieces. After that banana was peeled off manually and cut into 3 mm even portions. These sliced bananas were then dipped into 5% ascorbic acid solution for ten minutes to increase colour of final product. The pieces were dehydrated in a drier for about 8-9 hours at 60^0C. Then, these dried pieces were taken into the juicer-blender for making flour. Then flour was filled in the white polyethylene bags for preparing value added products. The dough (250g) was made by mixing individual samples (treatments) with unripe banana flour (T_1), banana flour (T_2), chapati basin flour and banana flour (T_3), chapati banana flour and rice flour (T_4) and kheer with banana flour and cow milk (T_5). Banana flour was mixed with pre-arranged amount of water for three minutes in mixer and was allowed to rest for 20 minutes before making dough balls. Dough pieces were curved and rolled to make a uniform thickness. Chapaties were prepared by mixing 50.0 g banana flour, 3 g oil, 50.0 g rice flour, 50.0 g gram (chickpea) flour and kneaded with water with pinch of salt. Kheer was prepared by taking 15g of banana flour and was boiled in one litter cow milk with 30 g of sugar. The value added products were observed for TSS (^{0}Brix), pH, titratable acidity (%), vitamin C content, ash content (%) and moisture content (%) with the following formulae:

$$\text{Titratable acidity (\%)} = \frac{1/10 \times \text{Eq.Wt.of acid} \times \text{Normality of NaOH} \times \text{titer}}{10}$$

$$\text{Vitamin C (mg/100g)} = \frac{\text{Titre} \times \text{Dye factors} \times \text{Volume made up}}{\text{Volume of filtrate taken} \times \text{volume of sample}} \times 100$$

$$\text{Ash content (\%)} = \frac{\text{Weight of ashed sample}}{\text{Weight of fresh sample}} \times 100$$

$$\text{Moisture content (\%)} = \frac{\text{Weight of fresh sample} - \text{weight of dried sample}}{\text{Weight of fresh sample}} \times 100$$

RESULTS AND DISCUSSION

Titratable acidity (%)

The results regarding titrable acidity were significant at 0.05 level of significance. Maximum titratable acidity (0.04%) was recorded in chapati (banana flour mixed with basin flour) (Fig.1), against minimum unripe banana flour (0.02%) which significantly differed with one another. Remaining results were statistically non-significant (*P<0.05*); banana flour and rice flour (0.02), banana flour (0.03) and milk + banana (kheer) (0.034).

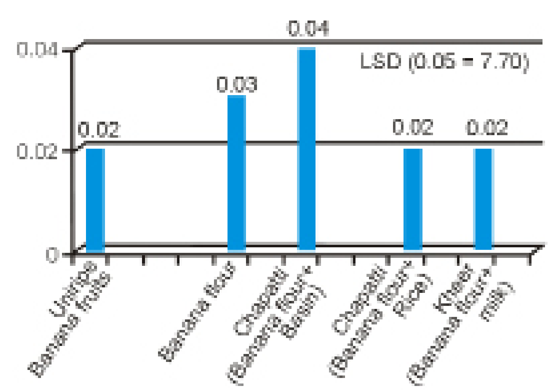

Fig. 1. Titratable acidity of unripe banana and its products.

pH

The results (Fig. 2) showed maximum pH (7.68) in kheer. However, minimum pH (6.79%) was found in unripe banana fruit. There were statistically significant (P> 0.05) differences in pH of unripe banana flour and its products.

Moisture(%)

Differences for moisture content were significant among the products. Maximum moisture (72.08%) (Fig. 3) was observed in unripe banana fruit followed by chapati prepared by banana flour mixing with rice flour (59.16%) and kheer (banana flour and milk) (36.3%). Minimum moisture was recorded in banana flour (7.47%) followed by chapati prepared by banana flour + basin flour (25.27%).

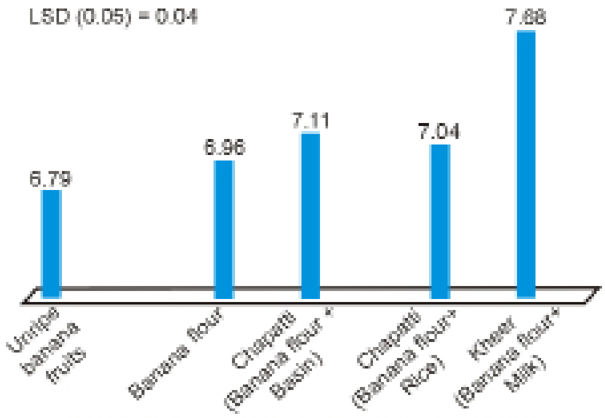

Fig. 2. PH of unripe banana and its products.

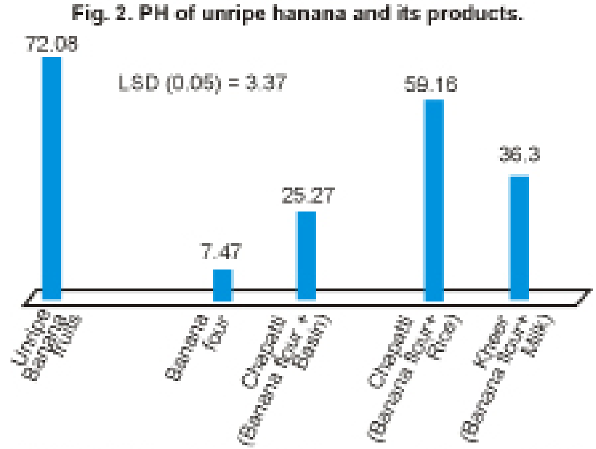

Fig. 3. Moisture (%) of unripe banana and its aproducts.

Ash(%)

Significant differences for ash content were also observed among the treatments. Maximum value (0.82%) for ash was recorded in chapati (banana flour and rice flour) followed by kheer (0.71%). Differences among other treatments remained non-significant (Fig. 4). Minimum ash content was observed in banana flour (0.023) followed by unripe banana fruits (o.46). Zainun (2008) observed more ash (1.77%) in breaded bananas (fried) as compared to fresh bananas (1.16%). However, he observed increased moisture content in fresh bananas (67.55%) as compared to fried breaded bananas (66.33%).

TSS (°Brix)

Banana kheer had significantly maximum TSS (26.32) (Fig. 5) followed by unripe banana fruits (19.10) against minimum (5.30) TSS in chapati prepared by adding rice flour with banana flour which was not significant with other treatments ($P<0.05$). The incorporation of 30% unripe banana flour in the noodle ingredients significantly increased their total dietary fibre and resistant starch content (Ritthiruangedj *et al.,* 2011).

Vitamin-C

The results pertaining to Vitamin-C had non- significant ($P<0.05$) difference for treatments of banana flour (12.54 mg/100g) and chapatti (banana flour and basin flour) (12.83). Maximum Vitamin-C was obtained under treatment of chapati prepared with banana flour and rice flour (18.35) followed by unripe banana fruit (17.54). So chapatti prepared with rice flour had significant ($P> 0.05$) results with other treatments (Fig. 6). These results are in accordance with those of Asif *et al*. (2014) who reported maximum content of vitamin C in unripe banana and its products.

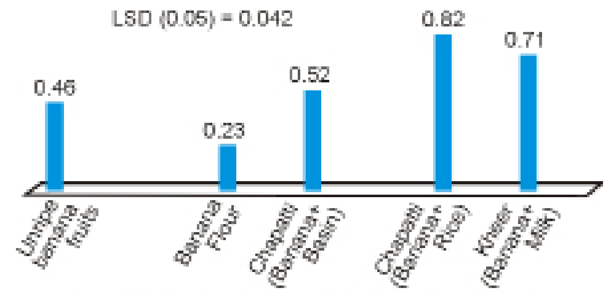

Fig. 4. Ash (%) of unripe banana and its products

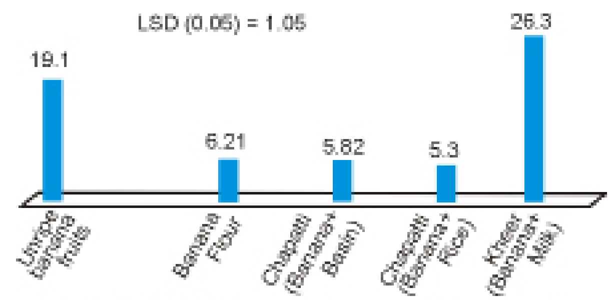

Fig. 5. TSS (°Brix) of unripe banana and its products.

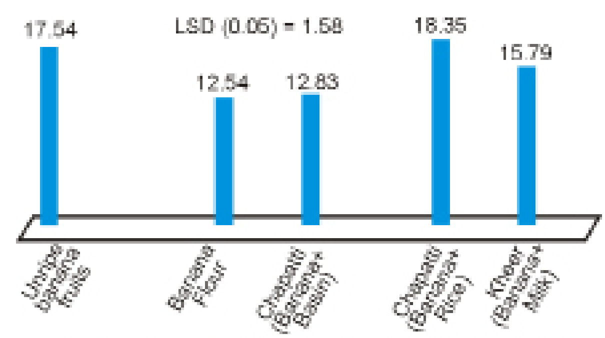

Fig. 6. Vitamin C (mg/100g) of unripe banana and its products.

The study showed that physico-chemical characteristics of banana flour with its different products were significant. The low value of different characters was mainly due to low carbohydrates present in unripe banana flour, while addition of rice and milk might increased the carbohydrates and protein content of the products due to which ash content increased. Moisture was maximum in fresh unripe bananas sample which decreased after processing into flour as freshly harvested bananas might had accumulated more moisture, and during flour development most of the moisture evaporated so, it contained low moisture. When banana flour was mixed with rice flour moisture increased but when milk was added it reduced due to more evaporation during processing. Swami *et al*. (2012) observed maximum moisture (9.73%) from banana flour of variety Grand naine. Zowariah and Aziah (2009) observed lower moisture and ash content from modified banana flour as compared to banana flour. This was due to heat, moisture, and autoclave treatment of modified banana flour that had an impact on the physico-chemical properties of flour. Zebib *et al*. (2015) used banana flour with sesame and found significant increase in ash and moisture. Swami *et al*. (2009) obtained maximum total soluble solids from banana flour of Grand naine variety. Present results confirm these previous findings but the differences may be due to variety, processing methods and the picking stage of banana. However, vitamin C was observed maximum from banana flour as compared to the results of Swami *et al*. (2009), who obtained 7.69 mg per 100g vitamin C (ascorbic acid) from banana flour of Udhyam variety.

CONCLUSION

Mixing of unripe banana flour with rice flour and basin flour significantly influenced the chemical composition of unripe banana flour, chapati quality as well as water absorption percentage. The chapati prepared from unripe banana flour with basin flour and with rice flour and banana kheer contained highest moisture ash, vitamin C, total soluble solids, pH and titratable acidity. However, more research needs to be done regarding preparation of different banana products for value addition. Further research should also be done for preparation of ripe banana flour for value addition. Different varieties of banana should be evaluated for preparing banana flour.

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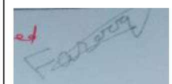
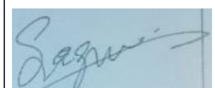
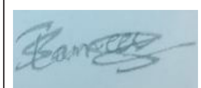
CONTRIBUTION OF AUTHORS

S. No.	Author name	Contribution	Signature
1.	Muhammad Farooq	Conducted research work and collected data	
2.	Saghir Ahmed Sheikh	Prepared experimental design and supervised the research	
3.	Tanveer Fatima Miano	Analyzed the data and helped in methodology write-up	
4.	Noor-un-Nisa Memon	Critical analyzed the data, helped in discussion of results, prepared write-up of manuscript