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Effect of drying different temperature in preparation and quality evaluation of raw banana powder and shelf life

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Abstract
The present study deals with preparation and quality evaluation of raw banana powder. The tray drying method was adopted for drying purpose. Banana was sliced and was given a pre- treatment of 0.5% citric acid. The raw banana slices were tray dried and grounded to fine powder. Sensory evaluation of raw banana powder was done by using 9-point hedonic scale. The proximate analysis result of raw banana powder shows that moisture 3.73, ash 4.08, fat 1.56, Protein content 3.44, crude fibre 8.62, carbohydrates 78.57. Microbial analysis of raw banana powder was also examined. Among all the temperature used for drying purpose of banana powder, 80 ℃ for 6hr had shown better acceptability. From the present study it can be concluded that tray drying method best suitable for drying of banana slices to get quality of raw banana powder. The results of study shows that the protein content decreased with increase in storage period for both samples. The number of microorganisms increased over time (days). All these temperatures used for dehydration of banana powder, the performance of 80 ℃ temperature packed in HDPE was found better in respect of average rate of drying. After sensory evaluation it was found that the color, texture, flavour and overall acceptability were found satisfactory in HDPE sample dried at 80 ℃.

Keywords: Raw banana, tray drying, steam blanching, banana powder

Introduction
Banana (Musa. Spp.) are considered as a major produced fruit of tropical and subtropical countries. Bananas are considered a staple food in many countries (FAO, 2019). Banana is also called Apple of paradise Adam's fig Kela and botanically Musa spp. which belongs to a family Musaceae [1]. The varieties usually grown in India are Grand Naine, Robusta, Dwarf Cavendish, Red Banana, Nendean. Beside India other banana producing countries are china, Ecuador, Brazil & Indonesia. [2]. According to nutritional of view, banana container several macros such as vit A B complex & Asciacia.

It is a seasonal and highly peristable crop; therefore, stable and storable products usually in the form of dried composite flour and chips are made from the plantain fruit immediately after harvest to reduce postharvest loss [3, 4]. Various processed products can be prepared by using drying of banana include banana chips, banana flaker & banana powder and can be used to prepare weaning food for children. Banana powder is prepared by different drying methods (tray drying, oven and multi-purpose tray dryer) [5]. They are produced abundantly in Africa with more than twelve million metric tonnes annually in which Nigeria is the lead producer [6]. Banana plantain and cooking banana (Musa spp.) could also be processed into many products such as biscuits or as an infant formula supplement at different stages of physiological maturity, unripe, ripe overripe or during a number of ways such as frying, grilling, boiling and Drying [7]. The largest producer of banana and plantains only few of it undergo industrial processing mostly for improved preservation and value addition. Plantains and unripe banana are consumed cooked, whereas, mature dessert banana is eaten raw [8]. Pretreatment of plantain by moist infusion has also been identified as improving the reconstitution characteristics of oven-dried plantain [9] Plantain fruit (Musa AAB), is one of most important sources of carbohydrates for people living in the humid regions of Latin America, Africa and South Asia [10]. Banana can also be processed in various ways so that they may be stored for longer periods and utilized for other purpose. New economic strategies are now considered for banana use, such as the production of banana flour to increase utilization if banana, green banana flour is a low-cost ingredient for food industry, as well as an alternative to reducing banana waste [11].

Plantains are the unripe green bananas (UGB) that are consumed after cooking. The presence of high amount of resistant starch, dietary fibres, polyphenolic compounds, flavonoids, and non-digestible carbohydrates in unripe green bananas (plantains) makes its suitable raw materials for producing banana flour that can be used as alternate for wheat flour [12].

In present study, Varing time and temperature combinations were adopted to produce banana powder using tray drying method.

Materials and Methods

Procurement

Raw banana were purchased from local market of Prayagraj.

Preparation of banana powder

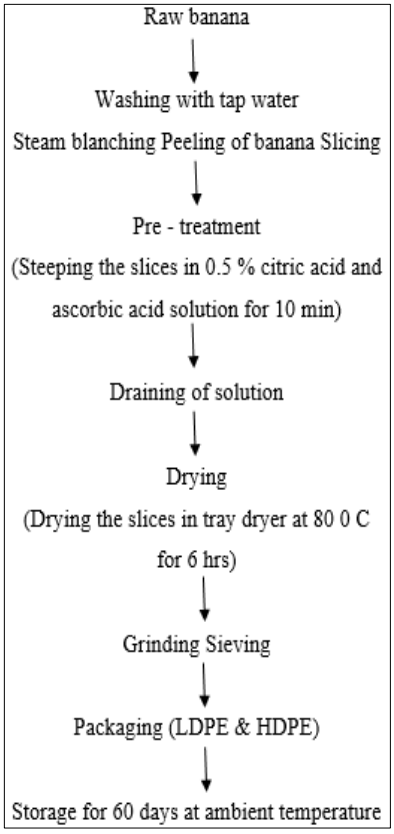

Fig 1: Preparation of banana powder

Raw material i.e., bananas were procured from local market of Prayagraj. The variety of Cavendish banana, Dwarf caven dish banana, Grand Nain and red banana. The raw bananas were washed using tap water. Steam blanching of banana was carried out at temp of 100 ℃ after that peeling was done to remove outer peel. Slicing was done for size reduction to 3 mm. The pretreatment of citric acid having 0.5% & Ascorbic acid solution given for 10 min given to cut banana slices by dipping in it & draining was done to remove excess dipping solution after that banana were dried at 80 ℃ in tray drier for 6hr. dried slicer of banana were grinded using grinder & passed through sieve having mesh no.72 to get desired partical size of banana powder after sieving raw banana powder packed in HDPE & LDPE packaging materials. Store raw banana powder at ambient temperature.

Traditionally, fruit is first peeled, sliced, sundried and ground into fine powder (called in Yoruba Eluba Ogade, Tiv-mwem ma ayaba). The present mode for sun drying in the open air expose the product to dirt, damage from insects, bacteria infestation and the deposition of fungal spores, and a varying degree of the environmental toxicants, depending on the site/location of drying. Therefore, it is clear that a sanitary, efficient drying technique is required. This study was therefore carried out to the try drying method.

Physico-chemical parameter

Proximate analysis for moisture, crude fat, crude protein, crude fibre, and ash were carried out in accordance with the official methods of the Association of Official Analytical Chemists [14].

Test Parameter	Test Result	Unit (per 100 gm)
Energy	342.08	Kcal
Carbohydrates	78.57	Gm
Protein	3.44	Gm
Fat	1.56	Gm
Ash	4.08	Gm
Moisture	3.73	Gm
Crude Fibre	8.62	Gm
Total plate count	5.10×10^3	Cfu/ml

Sensory scores

Sensory scores for colour, texture, flavour and overall acceptability of banana powder were recorded over a 9- point Hedonic scale by semi-tranied panel.

Shelf-life studies

Shelf-life tests were performed on the products, which were packaged in HDPE and LDPE and stored at room temperature for periodic analysis. The ability of the packaging material to prevent moisture and oxygen permeability, with stand impact and protect product from insects and pests' attacks were exploited. The shelf life of raw banana powder was studied at the interval of 15 days till 60 days.

The heat of the drying process does reduce total microbial count, but the survival of food spoilage organisms may give rise to problems in the rehydrated product. The type of microflora present in dried products depends on the characteristics of the products, such as pH, composition, pre-treatments, method of drying. The dried products should be stored under appropriate conditions to protect them from infection by dust, insects and rodents. The bacterial TPC counts during storage of tray dried banana powder in both packaging material pouches remained within the prescribed limits by ICMSF (1986) [13] even after 60 days storage of the product under ambient condition indicating the microbial safety of the product. However, the sample packed in the LDPE pouches showed the TPC counts more than HDPE pouches at the end of 60 days storage, so it indicates that the LDPE packaging was not ideal for long term storage period of banana powder. Among the packaging material HDPE packed pouched recorded lowest TPC counts. This was due to the low moisture and absence of humid air in pouches which inhibit the growth of microorganisms.

Results and Discussion

Table 1: Physico-chemical changes during storage of tray dried banana powder in HDPE pouches Storage period, days

Temperature	Storage Period Days				
Moisture	0	15	30	45	60
60	2.69	2.60	2.56	2.45	2.38
70	3.27	3.17	3.03	3.29	2.87
80	3.62	3.54	3.40	3.29	3.15
Protein					
60 ℃	3.18	3.12	3.04	3.0	2.92
70 ℃	3.07	3.02	3.0	2.95	2.85
80 ℃	3.23	3.18	3.08	3.07	3.03
Fat					
60 ℃	1.19	1.15	1.09	1.04	0.95
70 ℃	1.28	1.21	1.15	1.06	1.0
80 ℃	1.50	1.43	1.41	1.34	1.26
Ash					
60 ℃	2.92	2.85	2.75	2.60	2.25
70 ℃	2.82	3.05	2.60	2.45	2.34
80 ℃	3.34	3.30	3.23	3.15	3.07
Crude fibre					
60 ℃	1.76	1.73	1.72	1.65	1.59
70 ℃	2.26	2.20	2.12	2.05	1.93
80 ℃	4.06	3.76	3.70	3.28	3.01
Carbohydrates					
60 ℃	88.23	88.52	88.82	89.44	89.76
70 ℃	87.29	8.46	88.12	88.49	88.98
80 ℃	84.22	87.36	85.16	85.85	86.45

Table 2: Changes in sensory characteristics during storage of tray dried banana powder in HDPE.

Drying temperatures ℃	Storage periods days				
Colour	0	15	30	45	60
60	7.0	6.8	6.4	6.2	6.1
70	7.0	6.9	6.4	6.2	5.7
80	7.1	7.0	6.7	6.5	6.2
Texture	0	15	30	45	60
60	6.1	6.0	6.0	5.7	5.5
70	6.4	6.4	6.1	6.0	5.8
80	6.4	6.3	6.1	5.9	5.6
Flavour	0 Days	15 Days	30 Days	45 Days	60 Days
60 ℃	7.0	6.8	6.4	6.2	5.9
70 ℃	7.1	7.0	6.8	6.5	6.0
80 ℃	7.3	7.2	7.1	6.8	6.7
Overall Acceptability	0	15	30	45	60
60 ℃	6.7	6.5	6.2	6.0	5.8
70 ℃	6.8	6.7	6.4	6.2	5.8
80 ℃	6.9	6.8	6.6	6.4	6.1

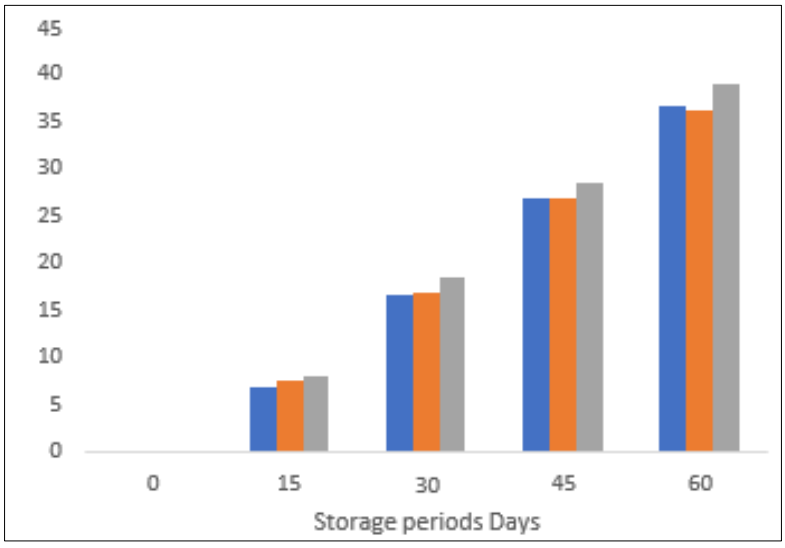

Fig 2: Total plate count during storage of tray dried banana powder in HDPE pouches

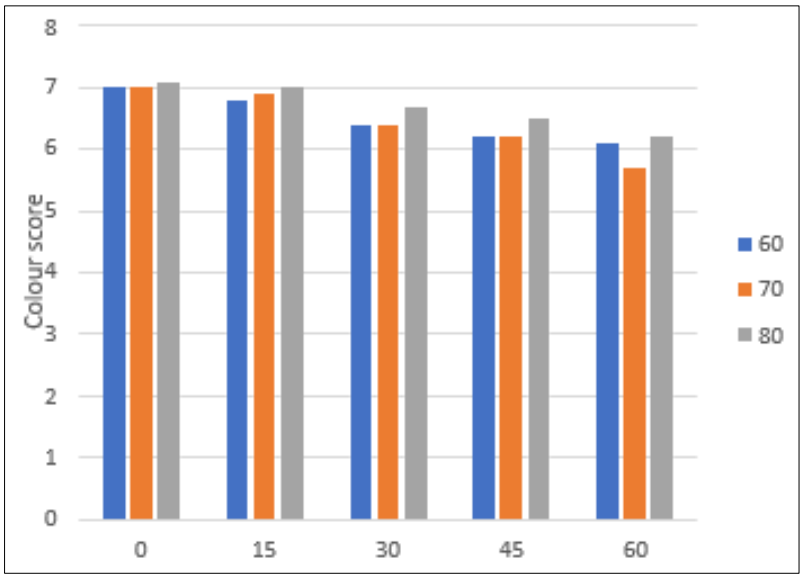

Fig 3: colour scores during storage of tray dried banana powder in HDPE pouches

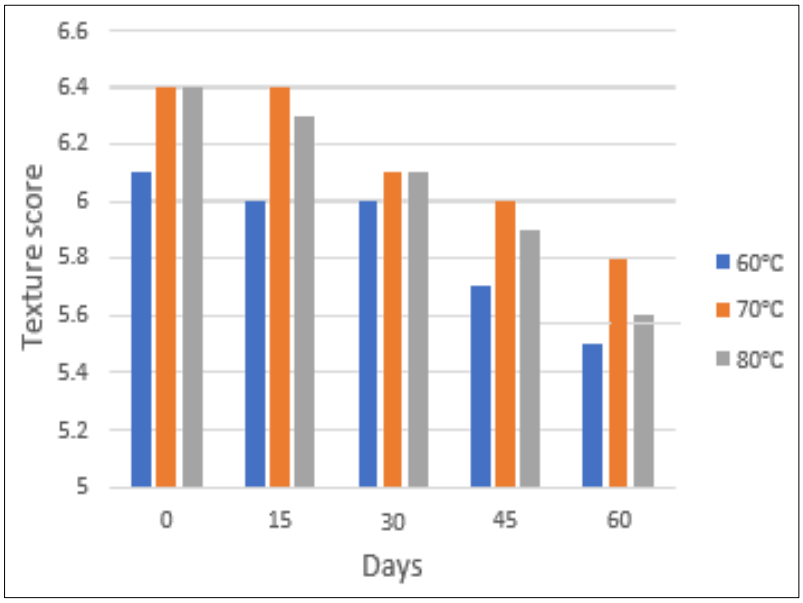

Fig 4: Texture scores during storage of tray dried banana powder in HDPE pouches

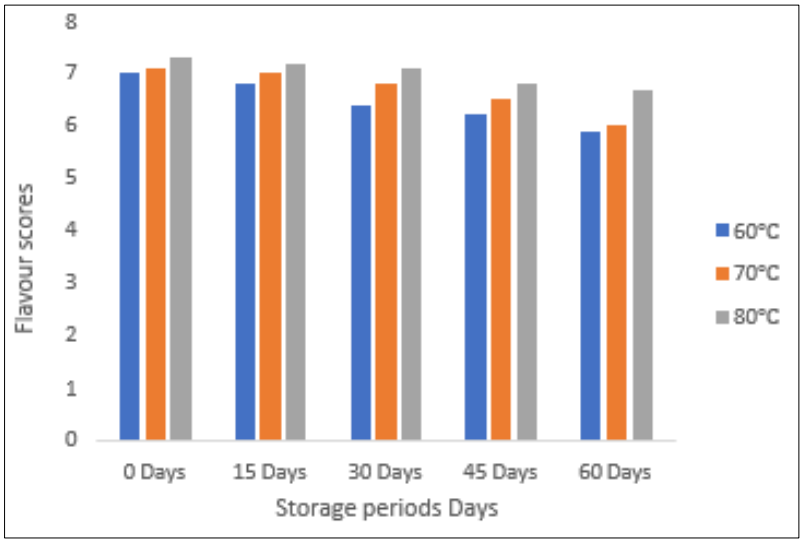

Fig 5: Flavour scores during of tray dried raw banana powder in HDPE pouches

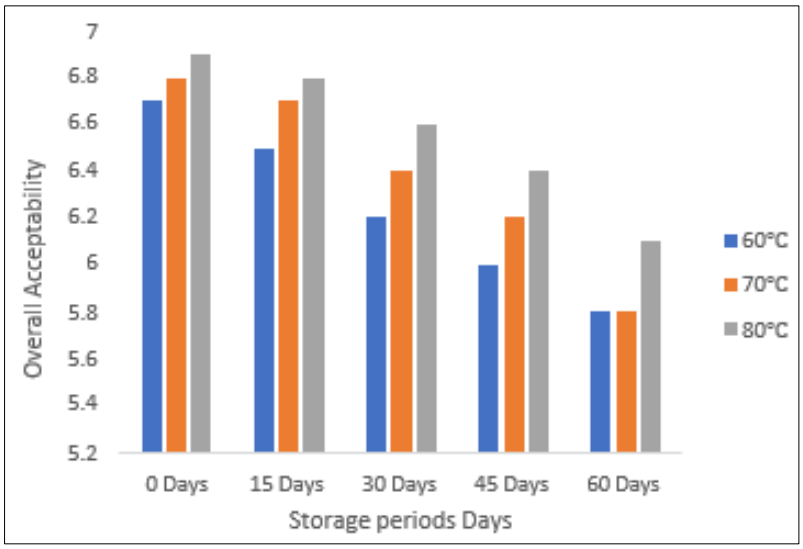

Fig 6: Overall Acceptability scores during of tray dried raw banana powder in HDPE pouches

Conclusions

The study was carried out to evaluate the effect of Pre-treatment and different Tray drying temperature on quality of raw banana powder The Proximate analysis consisted of moisture, ash, fat, fibre, protein content Based on the results of the study, the water content, protein, ash, crude fibre, carbohydrates and fat of banana powder are affected by the drying temperature, and the LDPE package and changes in color, taste, texture, microbial load, and sensory properties. Is a minimal HDPE material, protein, fat, crude fibre, and ash content decreased with increasing shelf life of samples. Bacterial count increased with increasing number of days
at all these temperatures used for dehydration of banana powder, the performance of 80 ℃ filled in HDPE in terms of average drying rate after sensory evaluation it turned out to be excellent. HDPE sample dried at 80 ℃ ℃ were found to have good color, texture, taste, and overall tolerance.

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