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Standardization and quality evaluation of banana flour from "Grand Naine" (cv. Musa (AAA group)

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Abstract

Grand Naine banana is popular high yielding cultivar in India. During peak season, large volume of fruits available and due to perishable nature of the commodity, the producers are faced with low income returns. The present study was conducted to develop *payasam Ada* by using selected Grand Naine banana flour. The fresh mature banana was peeled under water and was dipped in a solution of citric acid and ascorbic acid for two time periods (5 minutes and 10 minutes).The banana flour was evaluated by preparing a standard porridge. Based on organoleptic evaluation the organoleptic attributes was found to high in T_5 (banana slices dipped in one per cent ascorbic acid and 0.5 per cent citric acid, dried at 50^{o}c for 48 hours). The physio functional properties of grand banana flour is pH (4), moisture (3.17 g 100g^{-1}), Water holding capacity (3 g water/g flour), oil absorption capacity (0.8 g oil/ g flour) and bulk density (1.87g/ml) and it was reduced during storage except bulk density. The nutrional properties of grand Naine banana flour contain TSS (4.03 Brix), reducing sugar (1.26 %), total sugar (1.75 %), starch (70 g 100g^{-1}), protein (3.6 g 100g^{-1}). Fibre (2.62 g^{-1}), *in vitro* digestability of starch (76.1 %) calcium (60.34 mg 100 g^{-1}), phosphorus (72.5 mg 100 g^{-1}), iron (6.75 mg 100 g^{-1}), potassium (410 mg 100 g^{-1}), and the availability of minerals is calcium (30.22%), iron (65.25 %), zinc (61.98%) and phosphorus (56.5 %) respectively. *Ada* was prepared by incorporating Grand Naine banana flour at different levels with rice flour and was dried at three different temperatures (60^{0}C, 65^{0}C and 70^{0}C). *Ada* (T_{17}). Blending rice flour and banana flour at a proportion of 50:50 and dried at 70^{0}c for 2 hours attained a maximum score for all organoleptic attributes. The treatment T_{17} was adjudged as the best for the preparation of *ada.* Hence, the study reveals an immense scope for the development of value added products from Grand Naine banana and diffrent value added products will help to prevent the post-harvest loss and fetch an additional income.

Key words: Grand Naine banana flour- Moisture content-water holding capacity- bulk density-oil absorption capacity- pH- nutritional properties- *Payasam Ada.*

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Introduction

Grand Naine banana is popular high yielding cultivar and is one among the most popular banana varieties commonly grown in India. During peak season, due to large volume of fruits available and due to perishable nature of the commodity, the producers are faced with low returns. Development of shelf stable value added products is essential to prevent the losses. New economical strategy to increase utilization of banana includes the production of banana flour when the fruit is unripe, and to incorporate the flour into various innovative products. Green

banana is very rich in starch and its flour contains 61.3-76.5 g/100g of starch and also has a fibre content of 6.3-15.5 g/100g. Moreover of great part of the starch found in green banana flour (*Musa cavendishii)* is resistant starch. (Tribess *et al*., 2009). The substitution of brown rice flour with pregelatinised banana flour by 80 per cent produced an acceptable functional instant porridge with improved level of resistant starch, dietary fibre, antioxidant activity and total phenolic contents (Loypimai and Moongngram, 2015).

Banana starch has potential, both from digestive and functional properties. Unripe banana flour is excellent source of resistant starch and antioxidants. Banana flour has commercial importance by itself or as a base with other foods such as weaning foods and snacks. It is a low cost ingredient for food industry and an alternative to minimize banana wastage. Hence, the production of banana flour from Grand Naine and to incorporate the flour into various products will have immense potential in the present scenario.

Materials and Methods

Collection of raw ingredients

Fully mature unripe Grand Naine banana where collected from the Banana Research Station, Kannara of Kerala Agricultural University. All other ingredients required for the study were purchased from the local market.

Standardization of Grand Naine banana flour

The fresh mature green banana was peeled under water and was dipped in a solution of citric acid and ascorbic acid for two time periods. The treatments are detailed below (Table 1)

Table 1: Composition and immersion time of various pretreatment media

Sl. No	Treatments	Particulars	Time (min)
	T_0	Without pre treatment	-
1	T_1	0.5 % AA + 0.1 % CA	5
2	T_2	0.5 % AA + 0.1 % CA	10
3	T_3	0.5 % AA+ 0.2 % CA	5
4	T_4	0.5 % AA + 0.2 % CA	10
5	T_5	1.0 % AA + 0.1 % CA	5
6	T_6	1.0 % AA + 0.1 % CA	10
7	T_7	1.0 % AA + 0.2 % CA	5
8	T_8	1.0 % AA + 0.2 % CA	10
9	T_9	1.5 % AA + 0.1 % CA	5
10	T_{10}	1.5 % AA + 0.1 % CA	10
11	T_{11}	1.5 % AA + 0.2 % CA	5
12	T_{12}	1.5 % AA + 0.2 % CA	10

(AA – Ascorbic acid, CA – Citric acid)

The banana was sliced to an average thickness of 1 cm. The slices were dried at 50˚c for 48 hrs in a hot air oven. The dried chips was ground and sieved to get uniform flour (Plate 1)

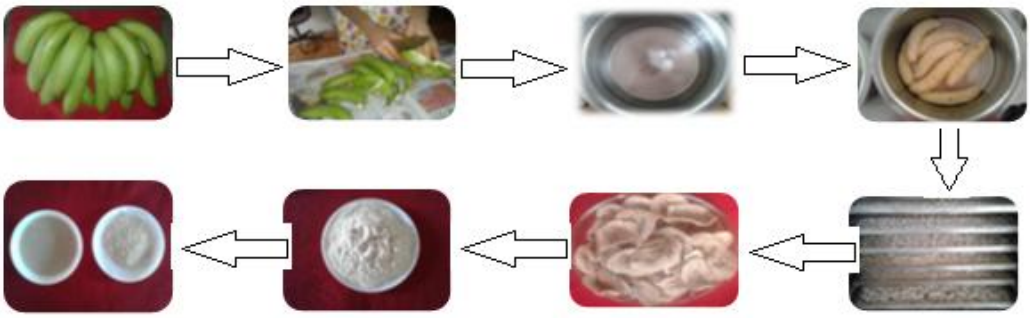

Plate 1- Preparation of "Grand Naine" banana flour

Organoleptic evaluation of banana flour

The banana flour was evaluated by preparing a standard porridge (Thajudeen, 2000). Organoleptic qualities were evaluated by the selected panel of judges using the score card.

Physico – functional properties of flour

The physico- functional properties like moisture (AOAC, 1980), pH, Water holding capacity oil absorption capacity (Ranganna, 1995) and Bulk density (Okaka and potter, 1977) of best selected Grand Naine banana flour was determined evaluated initially and at monthly interval for three months of storage.

Nutritional properties of flour

The nutritional properties like TSS, Total sugar, reducing sugar (Ranganna, 1995), starch, protein, fibre (Sadasivam and Manickam, 1972), phosphorus (Jackson, 1973), Calcium, potassium, *in vitro* digestability of Starch and *in vitro* availability of mineral (Perkin – Elmer, 1982) of best selected Grand Naine banana flour was determined evaluated initially and at the end of storage.

Standardization of secondary product – *Payasam Ada*

Ada preparation was standardized by incorporating the selected banana flour at different levels with rice flour. The treatments adopted for standardization are given below (Table 2)

Table 2: Proportions of rice flour and banana flour for preparing *ada*

S. No.	Treatments	Combinations
1	T_0	100% Rice flour (Control)
2	T_1	100% Banana flour
3	T_2	80% Banana flour+ 20% Rice flour
4	T_3	70% Banana flour+ 30% Rice flour
5	T_4	60% Banana flour+ 40% Rice flour
6	T_5	50% Banana flour+ 50% Rice flour

The batter prepared with the flour was used to make *payasam ada* by traditional method. The drying temperature and time for the above treatments were standardised by varying the temperature to 60˚C, 65˚C and 70˚C until it attains a moisture content of 10 per cent.

Statistical analysis

The data was analysed using suitable statistical techniques. The best treatments were selected by applying Kendall's coefficient of concordance.

Result and Discussion

Standardization of Grand Naine banana flour

The mature Grand Naine banana was peeled under water and dipped in a solution of ascorbic acid and citric acid for two time periods. Then it was sliced to average thickness of 1 cm. The slices was dried at 50˚c for 48 hrs in a hot air oven after that the dried chips was ground and sieved to get uniform flour.

Organoleptic evaluation of banana flour

Porridge was prepared using selected banana flour, adopting the standard procedure by Thajudeen (2000). Organoleptic evaluation of banana flour was carried out using score card by a panel of fifteen judges.

Plate 2: Grand Naine banana flour

Plate 3: Preparation of Grand Naine porridge

The treatment T_4 scored the highest for appearance followed by T_5 and in case of colour and flavour the highest score was observed for T_{11} followed by T_5. The organoleptic attributes such as texture, taste and overall acceptability was found to be higher in T_5. For any porridge the base material is the flour of the corresponding ingredient. The cohesion and visocity of the porridge is totally dependent on the physical properties of the flour of which texture is of utmost importance followed by taste and flavour. Based on this T_5 was adjudged as best with regarding to banana flour (Plate 2). Based on kendall's value (w) significant agreement among judges was noticed in the evaluation of different quality attributes of banana flour. The flour for all the 12 treatments was however carried over for making porridge for a second stage comparison of the treatments. The porridge was prepared using the standard procedure and the results of organoleptic evaluation are furnished in Table 4

On the preparation of banana porridgeT_5 and T_{11} secured highest score for appearance with a score of 8.2. The treatment T_{11} obtained slightly higher score for colour (8.4), flavour (8.2), texture (8.33) taste (8.31) and overall acceptability (8.37) followed by T_5 with8.15, 8.13, 8.15, 8.02 and 8.06 respectively. The analysis of concordance resulted in a slightly higher scores for T_{11} but the porridge from T_5 also has similar characteristics. One the judgment that the base material is of utmost important for maintaining the quality of porridge T_5 was adjudged as best treatment (plate 3).

Physico – functional properties of banana flour

pH is a numeric scale used to specify the acidity or basicity of aqueous solution. The treatments were replicated thrice and the mean values are represented in Table -5. The pH value of freshly prepared Grand Naine banana flour was 4, which increased during storage and reached 5.03 within a period of three months of storage. Abbas *et al.,* (2009) reported that the average pH of Cavendish banana flour (4.77) was slightly lower than that of Dream banana (4.63).

Table 3: Organoleptic evaluation of prepared Grand Naine banana flour

Parameters	**T_0**	**T_1**	**T_2**	**T_3**	**T_4**	**T_5**	**T_6**	**T_7**	**T_8**	**T_9**	**T_{10}**	**T_{11}**	**T_{12}**	**W**
Appearance	7.68 (5.37)	7.68 (5.33)	7.82 (6.17)	7.55 (5.7)	9.6 (5.67)	8.52 (10.53)	8.00 (7.67)	7.95 (7.6)	7.82 (6.53)	7.7 (6.57)	7.75 (6.0)	8.17 (10.07)	7.93 (7.8)	0.210
Colour	7.71 (5.20)	7.64 (3.90)	7.93 (7.63)	7.77 (5.03)	7.88 (5.63)	8.3 (10.83)	7.93 (6.90)	7.91 (6.53)	7.91 (6.50)	7.91 (6.70)	8.06 (8.23)	8.4 (10.70)	7.93 (7.20)	0.293
Flavour	7.64 (8.20)	7.24 (4.57)	7.35 (5.97)	7.55 (7.37)	7.53 (6.70)	8.04 (10.97)	7.47 (7.57)	7.51 (6.20)	7.51 (7.27)	7.42 (6.87)	7.24 (4.83)	8.2 (7.33)	7.51 (7.27)	0.176
Texture	7.8 (6.87)	7.8 (7.3)	7.82 (6.8)	8.04 (6.73)	7.9 (6.90)	8.17 (9.13)	7.8 (6.63)	7.86 (5.57)	7.86 (7.07)	7.8 (6.00)	7.68 (6.4)	7.86 (9.43)	7.75 (9.17)	0.095
Taste	7.53 (7.4)	7.17 (5.2)	7.31 (6.57)	7.44 (6.47)	7.57 (6.20)	8.02 (11.47)	7.53 (8.00)	7.17 (7.27)	7.17 (5.13)	7.31 (6.93)	7.04 (4.33)	7.6 (9.00)	7.4 (7.03)	0.233
Overall acceptability	7.83 (8.67)	7.49 (5.20)	7.56 (5.97)	7.62 (6.97)	7.68 (5.40)	8.6 (10.97)	7.65 (6.93)	7.58 (6.97)	7.58 (6.77)	7.72 (8.33)	7.3 (4.13)	7.9 (9.07)	7.53 (5.63)	0.238

Table 4: Organoleptic evaluation of prepared Grand Naine banana flour porridge

Parameters	T_0	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	T_{10}	T_{11}	T_{12}	W
Appearance	7.88 (6.23)	7.93 (7.27)	7.86 (6.73)	7.75 (5.27)	7.82 (6.9)	8.2 (10.10)	7.91 (6.87)	7.8 (6.43)	7.84 (6.37)	7.6 (4.67)	7.8 (5.63)	8.2 (10.83)	7.9 (7.70)	0.244
Colour	7.71 (6.20)	7.68 (5.67)	7.55 (5.57)	7.46 (4.30)	7.62 (5.67)	8.15 (9.53)	7.7 (6.63)	7.7 (6.70)	7.8 (7.20)	7.75 (7.00)	7.8 (7.50)	8.4 (11.50)	7.8 (7.53)	0.249
Flavour	7.86 (7.00)	7.6(5.32)	7.73 (6.71)	7.46 (5.04)	7.6 (6.18)	8.13 (10.25)	7.68 (6.82)	7.66 (6.68)	7.66 (6.25)	7.6 (5.93)	7.57 (6.61)	8.2 (11.61)	7.6 (6.20)	0.249
Texture	7.88 (7.53)	7.7 (6.90)	7.57 (5.50)	7.71 (7.07)	7.6 (5.77)	8.15 (10.63)	7.71 (7.33)	7.53 (5.43)	7.66 (6.57)	7.51 (5.40)	7.82 (5.43)	8.33 (11.23)	7.6 (6.20)	0.295
Taste	7.8 (8.73)	7.48 (6.70)	7.46 (6.23)	7.11 (4.47)	7.26 (5.83)	8.02 (10.53)	7.04 (5.87)	7.13 (4.10)	7.31 (5.30)	7.68 (8.43)	7.26 (6.00)	8.31 (12.23)	7.35 (6.57)	0.394
Overall acceptability	7.9 (8.8)	7.52 (5.87)	7.56 (6.30)	7.43 (5.03)	7.54 (6.17)	8.06 (10.20)	7.51 (5.80)	7.34 (3.93)	7.58 (6.23)	7.7 (7.77)	7.3 (5.97)	8.37 (12.13)	7.56 (6.80)	0.346

Table 5: Physico – functional properties of Grand Naine banana flour

Parameters	Initial	1st month	2nd month	3rd month	C.D.
pH	4.00	4.36	4.48	5.03	NS
Moisture (g 100 g^{-1})	3.17	4.19	4.5	5.13	NS
Water holding capacity (g water/g flour)	3.00	3.54	4.07	4.29	NS
Oil absorption capacity (g oil/ g flour)	0.86	0.97	1.03	1.16	NS
Bulk density (g/ml)	1.87	1.56	1.47	1.40	NS

The water holding capacity of freshly prepared Grand Naine banana flour was 3g water/g flour. The water holding capacity of flour gradually increased after the third month of storage to 4.29g water/g flour. Abbas *et al.,* (2009) reported a similar result for water holding capacity of fibre rich unripe banana flour (2.5 g water/g flour) Water activity of the unripe banana flour increased with time due to hygroscopic nature of flours. Hygroscopicity is due to the attainment of equilibrium between product and surrounding environment at particular relative humidity and temperature conditions. Water holding capacity is related to physical state of starch, fibre and protein of the flour during storage. It was the release of amylase which has the capacity to effectively bind water molecules yielded higher water holding capacity (Ambriz, 2008).

Oil absorption capacity is an important functional property of banana flour and an increase during storage was also observed in Grand Naine banana flour ranging from 0.86 – 1.15g oil/g flour. These values are slightly similar to that reported for Cavendish banana flour (0.93 – 0.99 g oil/g flour) and Dream banana flour (0.84 – 1.05 g oil/g flour) by Abbas *et al*, (2009). These values are slightly lower than that reported in fibre rich banana powder that could hold 2.2 g oil/g flour (Ambriz, 2008). Oil absorption capacity is related to the hydrophilic character of starch which is abundant in banana flour and fibre rich powder of banana flour (Ambriz, 2008). Good oil absorption capacity of the flour makes it useful in food preparations that involve oil mixing, such as in bakery products (Abbas *et al.*, 2009).

Gradual increase in moisture content of unripe banana flour was observed during storage period. This was due to hygroscopic nature of the flour to absorb moisture from the surrounding environment though the packaging material. Minimum moisture obtained by unripe banana flour was 3.17 and 5.13 g $100g^{-1}$respectively. Pragathi *et al.,* (2014) reported that maximum moisture obtained by unripe banana flour was 8.9 – 11.2 respectively which is below recommended value of fruit powders (13%) (Potter and Hotchkiss, 1995). Moisture content of Grand Naine banana flour was observed as 5.1 per cent. Slightly similar result with moisture content of 6 % was reported by Sahoo *et al*., (2015).

Bulk density relates with the flowability of the flour therefore it can affect the conveying and storage properties. During storage the bulk density was found to be reduced progressively. The observed values for bulk density of grand naine banana flour in the initial, first, second and third month of storage were 1.87, 1.56, 1.47 and 1.40 respectively. Pragathi *et al.,* (2014) reported that the bulk density of unripe banana flour decline during storage.

Nutritional properties of banana flour

Soluble solids concentration (SSC%, ^{o}Brix) can be determined in a small sample of sample using a hand held refractometer. The TSS of Grand Naine banana flour contains 4.03 during the initial stage and it was increase after three months. The reducing sugar found that minimum (1.73%). It was supported (1 %) by Sahoo *et al*., (2015).

Reducing sugar of banana powder increased with the advancement of storage period at the 1st day of storage, maximum (1.26%) reducing sugar was found. On 90th day of storage, maximum (1.43%) reducing sugar

was found. The reducing sugar content of banana flour also follows an increasing trend with days of storage which may be due to hydrolysis of non reducing sugars due to the presence of organic acid, which might have resulted in degradation of disaccharides to monosaccharides as described by Mulla, (2007)

Table 6: Nutritional properties of flour

Constituents	Initial	Final	t value
TSS (^{0} brix)	4.03	5.10	21.00^{NS}
Total sugar (%)	1.73	2.02	29.00^{NS}
Reducing sugar (%)	1.26	1.43	5.66^{NS}
Starch (g 100 g^{-1})	70.00	66.8	5.667^{NS}
Protein (g 100 g^{-1})	3.6	3.4	2.00^{NS}
Fibre (g 100 g^{-1})	2.62	2.55	3.00^{NS}
In vitro digestibility of starch (%)	76.1	73	63.00^{NS}

Total sugar is a total amount of all sugar present in the different samples. The Grand Naine banana flour contain 1.73 during first day of storage and it was increased during storage period (2.02) There was significant increase in total sugar content of banana powder at ambient storage. On the 1st day of storage, maximum (1.86%) quantity of total sugar was recorded in cabinet dried whereas solar dried showed minimum (1.60%) total sugar. On the 120th day of storage, solar dried recorded maximum (2.80%) total sugar while cabinet dried recorded minimum (2.39%) total sugar (Sahoo *et al.* 2015). Ullah and Elahi (1977) also reported similar results of increase in total sugar with advancement of storage of dried banana slices.

The mean starch content of the Grand Naine banana varied from 70 - 66.8 g 100 g^{-1}. The highest starch content was seen during initial stage and lowest in third month of storage. According to Lakshmy (2003) the nendran banana flour varied from 61.90 to 64.60 g 100g-1. A gradual decrease in starch content of banana flour of all nendran types was noticed during storage.

The crude fibre content of the Grand Naine banana flour was varied from 2 - 2.6 g. The highest fibre content was found in the initial period and it is gradually decrease during storage. According to Lakshmy (2003) nendran banana flour was low fibre content. The fibre content varied from 0.08 – 0.14 g /100g.

The mean protein content of the Grand Naine banana flour found to be 3.6 g (initial stage) and 3.4 g (third month of storage) per 100 g. During storage period protein found to be reduced. These values were lower than those reported in Nendran banana varieties (4.20 to 4.48 g/100g) (Lakshmy, 2003).

The calcium content of grand naine banana flour was found to be 60.34 mg (initial stage) and 58.92 mg (third month of storage). Whereas the calcium content of nendran banana flour varied from 33.90 – 78.98 mg/100g. The highest calcium content was in banana flour of nendran type (78.98 mg/100g) and lowest in Myndoli (33.90 mg/100g) (Lakshmy, 2003). The initial stage of phosphorus content of grand naine banana flour was found to be72.5 mg /100 g and it was declined during storage (70.5 mg /100 g). Lakshmy (2003) revealed that the nendran type banana flour phosphorus content was varied from 56.5 – 81.8 mg /100g. The highest phosphorus content was found to be in chengalikodan nendran banana. The iron and potassium content of the grand naine banana flour was found to be 6.75 and 410.5 respectively in initial stage and it was declined during storage. (Iron – 6.54 mg /100g, 396 mg /100g). Lakshmy (2003) reported that the iron content of nendran banana flour was 6.10, 5.70, and 4.90 mg /100g and the potassium content varied from 553 – 591 mg /100g.

Table 7: Total mineral content of banana flour

Minerals (mg 100 g^{-1})	Initial	Final	t value
Calcium	60.34	58.92	142.00^{NS}
Phosphorus	72.5	70.5	2.00^{NS}
Iron	6.75	6.54	2.158^{NS}
Potassium	410.5	396.0	29.00^{NS}

Table 8. *In vitro* availability of minerals

Minerals (%)	Initial	Final	t value
Calcium	30.22	28.63	159.00^{NS}
Phosphorus	56.5	54.24	226^{NS}
Iron	65.25	62.00	13.245^{NS}
Zinc	61.98	59.03	102.19^{NS}

The grand naine banana flour contain minerals are calcium (60.34 mg), Iron (6.74 mg), Potassium (410.5 g) and phosphorus (72.5 mg) during initial stage and after three month of storage it was reduced. The bioavailability of a mineral or trace element is defined as the fraction of the ingested nutrient that is absorbed and subsequently utilised for normal physiological functions (Susan and Hurrell, 1996). As shown in Table 8 the in vitro availability of minerals. The banana flour contain bioavailability of minerals are Ca (30.22 %), Iron (65.25 %), Zinc (61.98%) and phosphorus (56.5 %) and slight variation occur after three months. After three months the availability of mineral was reduced. Akinsanmi *et al.,* (2015) reported that the plantain banana flours availability of minerals are Na (162 mg/g), K (235 mg/g), Ca (100 mg/g), Mg (76 mg/g), P (360 mg/g) and Fe (5.6 mg/g).

Standardization of secondary product – *Payasam ada*

Ada was standardised by incorporating the selected Grand Naine banana flour (T_5) at different levels with rice flour. The drying temperature and the time for the above treatments was standardized by varying temperature of 60^0C, 65^0C and 70^0C until it attained a moisture content of 10 per cent.

Table 9: Time taken for drying of *payasam ada*

Treatments	Time (h)		
	60^0C	**65^0C**	**70^0C**
T_0 (100%RF)	6	4	2
T_1 (100%BF)	6.5	4.5	2.5
T_2 (80% BF+ 20%RF)	6.15	4.15	2.15
T_3(70%BF+30%RF)	6	4	2
T_4 (60% BF+40%RF)	6	4	2
T_5 (50%BF+50%RF)	6	4	2

(**RF** – Rice flour, **BF** – Banana flour)

The time taken for drying of *ada* at 60^0C and 65^0C varied from 6 to 6.5 hrs and 4 to 4.5 hrs respectively for various treatments. At a temperature of 70^0C, *ada* was dried within a time of 2 to 2.5 hrs. When ada was dried at 70^0c a drastic reduction in time was observed. Khandker *et al.,* (1986) also reported that cooking time and cooking loss of rice vermicelli extruded at 35 per cent moisture content at 55^0c temperature were 3 minutes.

Organoleptic evaluation of *payasam ada*

Ada was prepared in five different proportions with rice flour and banana flour at three different temperatures and the results of organoleptic evaluation are furnished in table 10.

The highest mean score for appearance of 8.22 was recorded for T_0 and T_{17}. The Among different treatments tried for the preparation of *payasam ada*, the highest mean score for colour (8.11) was recorded for T_{17} and the lowest mean score of 7.37for colour was noticed in T_1.The mean score for flavour for *payasam ada* ranged from 6.95 -7.42. Among different treatments tried for the preparation of *payasam ada* the highest mean score for texture (7.95) was recorded for T_{17}. The lowest mean score of 7.28 for texture was noticed in T_{13}.The mean scores for taste of *payasam ada* ranged from 7.15 - 8.15 with highest score for T_{17}. Among the different treatments tried for *payasam ada* the highest rank score for overall acceptability (7.5) was noticed in T_{17}. The mean rank scores for treatments, T_0 to T_{17} varied from 6.27 to 15.83 for appearance, 6.43 to 15.17 for colour, 6.67 to 14.9 for flavour, 6.6 to 14.03 for texture, 6.83 to 15.8 for taste and 6.8 to 15.07 for overall acceptability.

Payasam ada prepared by blending rice flour and banana flour at a proportion of 50:50 and dried at 70^0C for 2 hours attained a maximum score for all organoleptic attributes. The treatment, T_{17} obtained a slightly higher total score of 47.35 compared to other treatments. Hence the treatment T_{17} was adjudged as the best for the preparation of *ada* (Plate 4).

A slight discolouration was noticed in all treatments. The brown colour of the *ada* may be due to maillard reaction. Blending 50 per cent rice flour and banana flour attained highest score for colour and good texture compared to other treatments. Sarah (2017) reported 50:50 blend of vermicelli with wheat flour and banana flour attained the maximum score for overall acceptability.

Plate 4: Payasam Ada

Table 10: Mean score for organoleptic evaluation of *payasam ada*

Treatments		Appearance	Colour	Flavour	Texture	Taste	Overall acceptability	Total score
T_0(100%RF)	60˚C	8.22 (14.8)	8.02 (14.4)	7.73 (14.9)	7.91 (12.9)	7.84 (12.9)	7.31 (12.43)	47.03
T_1(100%BF)		7.48 (8.47)	7.37 (6.9)	6.95 (7.1)	7.37 (6.6)	7.33 (7)	7.04 (9.13)	43.54
T_2(80% BF+20%RF)		7.35 (6.27)	7.46 (7.8)	6.95 (8.03)	7.51 (9.3)	7.46 (8.7)	7 (8.23)	43.73
T_3(70%BF+30%RF)		7.48 (8.27)	7.42 (7.23)	7.17 (11.13)	7.62 (10.23)	7.33 (6.83)	7.15 (10.9)	44.17
T_4(60%BF+40%RF)		7.48 (8.6)	7.42 (7.43)	7.24 (11.33)	7.55 8.93	7.6 (11.63)	7.04 (9.1)	44.33
T_5(50%BF+50%RF)		7.53 (8.83)	7.6 (9.37)	6.91 (6.67)	7.53 (9.43)	7.62 (11)	6.95 (8.37)	44.14
T_6(100%RF)	65˚C	7.62 (9.63)	7.6 (9.97)	7.06 (8.4)	7.44 8.43	7.57 10.13	6.93 (8.33)	44.22
T_7(100%BF)		7.46 (7.77)	7.57 (9.03)	7 (7.73)	7..57 (10.03)	7.48 (9.4)	6.95 (8.23)	44.03
T_8(80%BF+20%RF)		7.73 (10.9)	7.6 (9.93)	7.11 (10.13)	7.55 (9.83)	7.51 (8.97)	6.97 (9.13)	44.47
T_9(70%BF+30%RF)		7.73 (11.17	7.62 (10.07)	7.13 (9.73)	7.44 (8.43)	7.4 (7.7)	6.84 (6.8)	44.16
T_{10}(60%BF+40%RF)		7.37 (7.77)	7.37 (6.43)	7.08 (9.8)	7.44 (8.2)	7.53 (9.37)	6.95 (7.6)	43.74
T_{11}(50%BF+50%RF)		7.4 (7.27)	7.62 (10.07)	7.06 (9.2)	7.48 (9.17)	7.46 (8.27)	7.06 (9.67)	44.08
T_{12}(100%BF)	70˚C	7.48 (8.67)	7.68 (10.43)	7.08 9.87	7.51 (8.4)	7.48 9.13	7.11 (10.87)	44.34
T_{13}(100%RF)		7.68 (10.27)	7.55 (8.9)	7.02 (8.17)	7.28 (6.8)	7.15 (5)	7.06 (9.83)	43.74
T_{14}(80%BF+20%RF)		7.48 (8.3)	7.6 (9.63)	6.95 (7.13)	7.48 (9.1)	7.48 (9.3)	7.02 (9.17)	44.01
T_{15}(70%BF+30%RF)		7.46 (8.13)	7.4 (6.97)	6.95 (7.83)	7.6 (10.13)	7.35 (7.57)	6.95 (8.77)	43.17
T_{16}(60%BF+40%RF)		7.6 (10.07)	7.71 (11.27)	7.1 (9.83)	7.62 (11.03)	7.73 (12.3)	6.97 (9.37)	44.73
T_{17}(50%BF+50%RF)		8.22 (15.83)	8.11 (15.17)	7.42 *14)	7.95 (14.03)	8.15 (15.8)	7.5 (15.07)	47.35
W		.230**	.217**	.197**	.129**	.244**	.138**	

Value in parentheses are mean rank scores based on Kendall's W which was significant
(** Significant at 1% level, * Significant at 5% level) (RF – Rice flour, BF – Banana flour)

Conclusion

Hence, from the study it can be concluded that Grand Naine banana flour is a good source of starch and can be used for preparing porridge and as composite flour. Banana flour prepared by dipping banana slices in 1 per cent ascorbic acid and 0.1 per cent citric acid for 5 minutes and drying at 50^0C for 48 hours attained a highest total score for organoleptic attributes. Among the different combinations the treatment T_5 was selected as the best for preparation of banana flour and porridge. *Ada* was prepared in different proportion with rice flour and banana flour at three different temperatures. Among the different combinations of *ada* T_{17} (50 per cent rice flour incorporated with 50 per cent banana flour dried at 70^0C for 2 hrs) was the best. Grand Naine banana was highly suitable for preparation of different value added products which is contributes to minimize post harvest losses of banana. Hence there is a great scope for exploring the possibility of value added products in the field of processing. Future works has to be carried out for the production of new innovative products and to assessing the shelf life of the product.

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