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Process Optimization For Making Unripe Banana Flour And Its Utilization In Vermicelli

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***Abstract*— Banana fruit has a very short post harvest shelf life because of its highly perishable nature. Short shelf life and increased production necessitates development of non-conventional products from banana. To prevent the losses of riped banana drying method was applied to convert raw banana into banana flour by drying the raw banana flakes in tray dryer at 55°C for 6hrs. To make proper use and avoid wastage of banana we have introduced vermicelli with banana flour which is rich in nutrients. This study was carried out to determine the effect of substituting wheat flour with different levels of unripe banana flour in order to make vermicelli blends. The wheat flour was supplemented with UBF at different substitution levels. The study demonstrated that the nutritional quality and functional properties of vermicelli can be improved through supplementation with UBF.**

Keywords— **Wheat Flour, Unripe banana Flour, banana.**

I. INTRODUCTION

We Recent data of Fruits and Vegetables claimed that India's diverse climate ensures the availability of all varieties of fresh fruits & vegetables. It ranks second in fruits and vegetables production in the world, after China. As per National Horticulture Database published by National Horticulture Board, during 2014-15 India produced 86.602 million metric tonnes of fruits and 169.478 million metric tonnes of vegetables. The area under cultivation of fruits stood at 6.110 million hectares while vegetables were cultivated at 9.542 million hectares. India is the largest producer of Ginger and Okra amongst vegetables and ranks second in production of potatoes, onions, cauliflowers, brinjal, Cabbages, etc. Amongst fruits, the country ranks first in production of Bananas (22.94%), Papayas (44.03%) and Mangoes (including mangos teens, and guavas) (37.57%). The vast production base offers India tremendous opportunities for export. During 2015-16, India exported fruits and vegetables worth Rs. 8,391.41 crores which comprised of fruits worth Rs. 3,524.50 crores and vegetables worth Rs. 4,866.91 crores. Mangoes, Walnuts, Grapes, Bananas, Pomegranates account for larger portion of fruits exported from the country while Onions, Okra, Bitter Gourd, Green Chilles, Mushrooms and Potatoes contribute largely to the vegetable export basket. The major destinations for Indian fruits and vegetables are UAE, Bangladesh, Malaysia, Netherland, Sri Lanka, Nepal, UK, Saudi Arabia, Pakistan and Qatar [1].

Now-a-days consumers demand convenience, quality, and innovative food products. Consumers expect the food producers to deliver high quality products for a reasonable price. In addition, consumer's tastes and preferences are also changing. Health is considered important, but not at the expense of quality. Consumers want to experience novel and interesting foods, which are fresh, convenient and tasty. Increased attention to health along with the unavailability of unique foods plus a strong consumer demands for convenience creates the need for convenience foods. Technology is also a challenge to the food industry.

Banana is usually eaten either as supplementary food or as a whole meal. Bananas that are usually consumed fresh at full ripe stage are the most popular cultivars. The cooking types are usually referred to as plantain. In Nigeria, the unripe banana pulp is usually grated and used for the preparation of popular traditional complimentary food called “oto mboro” for infants by the Efik and Ibibio ethnic groups. The green bananas are also boiled, fried or toasted and eaten with palm oil, stew or vegetable soup. Processing of green bananas into flour is one of the means of post harvest preservation of the crop. Nutritionally, banana pulp is rich in carbohydrate, vitamin A, B_6, and C, mineral elements such as potassium, magnesium, iron and phosphorus, but low in sodium and protein content. [2]

Banana is the common name of herbaceous plants of the genus Musa and for the fruit they produce. Banana plants are monocotyledons, perennial and important crops in the tropical and subtropical world region. They include desert banana, plantain and cooking banana. Cooking banana is a major staple food; it is starchy, rich in carbohydrate, calcium, phosphorous, iron and other food nutrients. [3]

Banana is traditionally used in diarrhoea (unripe), dysentery, intestinal lesions in ulcerative colitis, diabetes (unripe), in sprue, uremia, nephritis, gout, hypertension, cardiac disease. M.spaientum is also used in the treatment of excess menstruation with Canna indica L. var. speciosa. Banana leaves (ashes) are used in eczema , as cool dressings for blister and burns . Flowers are used in dysentery and menorrhagia. Stem juice of fruited plant is used for treating diarrhoea, dysentery, cholera, otalgia, haemoptysis and flower is used in dysentery, diabetes and menorrhagia. The root is used as anthelmintic , blood disorders, venereal diseases . The plant is also used in inflammation, pain and snakebite. [4]

Vermicelli is a popular instant food product. It falls under the category of extruded product and is made from wheat flour. It is basically a snack food item and at times it is also used as a table enricher. Vermicelli is prepared in household level by extruding the dough (wheat semolina with suitable quantity of water contents) with a cylindrical hand extruder. The extruded product is dried by different means. Open sun drying is the most primitive methods of vermicelli drying.

Objectives of this study are as follows.

- Process optimization of unripe banana flour.
- Chemical and nutritional studies of flour.
- Development of innovative value added product.
- Chemical and nutritional studies of the developed product.

II. RELATED WORK

Egbebi and Bademosi reported Ripe and unripe plantains were obtained from Ado Ekiti markets and were made into flour. The chemical compositions of ripe and unripe flour were investigated. The following results were obtained for ripe plantain flour; moisture contents 61.3%, protein contents 3.15%, ash contents 6%, fat contents1.2%, crude fibre 1.11%, sugar contents 12.8%, carbohydrate 27.24%, and total solid 38.7g / 100g. while the following results were obtained for unripe plantain flour; moisture contents 38.5%, protein contents 2.8%, ash contents 3.8%, fat contents 0.2%, crude fibre 0.7%, sugar contents 5.53%, carbohydrate 54% , and total solid 61.5g/100g. The results of the chemical analysis indicate that the chemical composition for plantain vary in proportion to their maturity. Hence. Unripe plantain flour can be used as a composite flour in baking industry and can be better stored because of its low moisture contents (38.5%) compared to that rip[e plantain flour which had high moisture contents (61.3%) thereby limiting its usage in food industry. Ripe plantain had high sugar contents (12.8%) as a result of the conversion of starch to sugar thus making it susceptible to high deterioration by biochemical and microbial actions; however it is suitable for human consumption. [5]

Egbebi, Bademosi studied that Culinary banana (Musa ABB) is an important ingredient of several dishes and is yet to be scientifically studied its nutritional and other biochemical compositions at different stages of development. It is one of the important nutritionally riches *Musa* sp and is a part of a balanced diet in Northeast India. Variations in nutritional and biochemical compositions associated with growth were studied at 20 (stage I), 35 (stage II), 50 (stage III), 65 (stage IV) and 80 (stage V) days after emergence (DAE) of banana inflorescence. Ash (7.03 g/100 g), protein (10.56 g/100 g), fat (1.50 g/100 g), phenol content (307.99 mg/100 g), radical scavenging activity (59.12% SA), linoleic acid (2.081 mg/100 g) and linolenic acid (1.210 mg/100 g) gradually declined with maturity. A rise in starch content from 12.36 to 22.66 g/100 g was observed with the maturity of banana. Maximum total carbohydrate was observed at stage III (32.15 g/100 g) and declined gradually. Out of 8 minerals tested, magnesium (Mg) was recorded the highest followed by potassium (K) and zinc (Zn) irrespective of the developmental stages of banana. Essential amino acids were found to be present at all the stages of development. The carotenoids (0.130 - 0.159 mg/100 g), vitamin A (0.028 - 0.038 mg/100 g) and thiamine (0.002 – 0.032 mg/100 g) were recorded at various stages of development of culinary banana. Pulp to peel ratio and total soluble sugars suggest that 50 DAE is the optimum stage of harvesting for culinary banana. However, young stages are rich in antioxidants, amino acids and fatty acids. [5]

Musa paradisiaca L. and Musa sapientum L. (Musaceae) are mainly grown in the tropical and subtropical countries and are widely used for its nutritional values all over the world. The fruits as well as the other parts of the plant are used to treat different diseases in human in traditional medicine. This review presents the scientific information on the traditional uses, phytochemistry and pharmacology of these two species. Both M. paradisiaca and M. sapientum are traditionally used in diarrhoea, dysentery, intestinal lesions in ulcerative colitis, diabetes, sprue, uremia, nephritis, gout, hypertension and cardiac disease. This review reports the phytochemicals isolated and identified from fruit pulp, peel,

seeds and flowers. A comprehensive assessment of the biological activities of different extracts is included and possible mechanisms and phytochemicals involved have been correlated. [4]

Banana is one of the most consumed fruits in tropical and subtropical regions of Southeast Asia, belongs to family Musaceae and class Liliopsida. Banana is the fourth largest fruit crop of the world. Banana is cultivated in nearly 120 countries in the world. India is the largest producer of banana and ranks first in the banana production in the world during the year 2012-13. The total world production of banana is 10.53 million tons in the year 2012-13, and having market value equivalent to 55,000 crores. The Gujarat account for 17.10 % of banana fruits produced in India and ranks second in the production of banana fruit after Tamil Nadu in 2012-13. The weight of selected banana fruits ranged between 98 to 120 gm. The maximum and minimum diameter of banana fruits ranged from 35.00 to 41.00 mm and 31.00 to 35.00 mm. The pulp to peel ratio for banana fruits was ranges from 1.27 to 1.43. Carbohydrate content of dehydrate the banana powder after dehydration in Tray dryer with perforated plates possessed significantly higher amount (78%) at 80˚C temperature for 7mm slices. The fat content was highest in the Tray dryer with solid plates at 80˚C temp. for 7mm Slices. Ash content of the eighteen samples was in the range of 4.1 to 5.12 % .The ash content was highest in the oven at 80˚C for 7mm slices and tray dried at 75˚C for 7mm slices samples. The 7-mm slices dried at 75˚C75˚C in multipurpose tray dryer have obtained the highest sensory score within the experimental range of different dryers. It can be concluded from the study that multipurpose tray dryer best suitable for drying of banana slices to get good quality powder. [6]

Production of alcohol from banana juice which use as complete replacement of malt in alcohol production by utilizing pure culture of Sacharomyces cerevisiae as fermenting organism. Banana juice was made from banana pulp by using pectinase enzyme. Optimization of amount of pectinase enzyme for juice production and optimization of pH of the final product were also aim of this study. Pectinase enzyme used for liquefying the pulp production was 0.0003% (w/v). The sugar percentage found in the banana juice was 18%. A sequential study has been done by consecutive pH levels of 4.5, 5.0, 5.5, 6.0, 6.5, and 7.0 in the final product. The best product was obtained at pH 6.0 with respect to taste; pH was regulated only after the complete fermentation of the banana juice but just before the filtration process. Alcohol percentage of the product was 8% (v/v) at 28°C. Total number of colonies detected was 21 in freshly prepared alcohol and total number of colonies detected was 20 in the beer after 5 months from production. Another aim of the work was utilization of the banana residue for the production of fiber enriched cookies. High fiber enriched cookies were prepared using 5%-20% level of fiber obtained from banana residue. 7%-10% fiber content was obtained as best parameter for cookie production and final moisture content of cookie was 3%. [7]

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Physical properties of ripe banana flour were studied in Cavendish and Dream banana, in order to distinguish the two varieties. Flour was analyzed for pH, total soluble solids (TSS), water holding capacity (WHC) and oil holding capacity (OHC) at 40, 60 and 80 °C, color values L*, a* and b*, back extrusion force and viscosity. Physical properties data were analyzed by cluster analysis (CA) and discriminant analysis (DA). CA showed that the two types of flour were different in terms of selected physical properties. DA indicated that WHC at 60 °C was the main contributor in discriminating the two types of flour. [8]

Utilization of green Banana flour as a functional ingredient in yellow noodle, Banana Pulp(BP) noodles prepared by partial substitution of wheat flour with green

Cavendish banana pulp flour were assessed pH, color, tensile strength and elasticity, and in-vitro hydrolysis index (HI) and estimated glycemic index (GI). BP noodles had lower L* (darker) and b* values (less yellow) but higher tensile strength and elasticity modulus than control noodles. Following an in-vitro starch hydrolysis studies, it was found that GI of BP noodles was lower than control noodles. Partial substitution of green banana pulp into noodles may be useful for controlling starch hydrolysis of yellow noodles. [9]

Pasting properties of flour from six varieties of matured green banana (Musa spp) fruits identified as Gross michel (GM), Dwarf Cavendish (DC), Cavendish (CA), Lacatan (LA), Poyo (PO) and Red skin (RS) were determined. Flour of CA, used in formulation of banana-whole maize meal was assessed organoleptically for binding and mouth feels qualities. Peak viscosity ranged from 434.75 - 837.17 RVU; break down viscosity, 115.42 - 487.92 RVU; final viscosity, 355.00 -504.92 RVU; set back viscosity, 70.17 - 426.25 RVU; gelatinization time, 3.94 - 4.56 min; and gelatinization temperature, 64.35 - 67.55°C. Statistical analysis (P = 0.05) of sensory scores of different formulations of flour-whole maize meal showed an improvement of binding property and mouth feel of the composite food product. This simple method of processing banana, its pasting profile and application in food product reported in this study will serve as a means of utilization and extension of shelf life of mature banana fruits .[10]

Unripe banana flour is a starchy food that contains a high proportion of indigestible compounds such as resistant starch, and non-starch polysaccharides, which are included in the dietary fiber content. The objective of this study was to use unripe banana flour as an ingredient to make dried noodle products of high nutritional quality with low carbohydrate digestibility and rich in resistant starch. The effect of wheat flour substitution with unripe banana flour was investigated in terms of the physicochemical, textural, cooking and sensory qualities of dried noodles. Five additional dried noodles were prepared by substituting wheat with 10, 20, 30, 40, and 50% banana flour. The optimal ratio of noodle from banana flour was investigated using sensory qualities in comparison with the control (100% wheat flour). The results of noodle formula development indicated that as the amount of banana flour increased, the stickiness of the noodles decreased and the appearance became darker. The optimum formula consisted of 20.45% banana flour, 47.72% wheat flour, 20.45% water, 2.04% salt, 1.02% sodium carbonate, 6.82% egg powder, 0.14% polyphosphate and 1.36% propylene glycol. Banana flour was used to replace 30% of the total wheat flour in the formula. Uncooked dried noodles were composed of 13.7% protein, 0.12% fat and 4.8% dietary fiber (including 2.8% resistant starch). The optimal cooking time and cooking loss were 14.5 min and 11.15%, respectively. The tensile strength and breaking length of cooked noodles were 16.4 g and 67.2 mm, respectively. The results of consumer evaluation showed that the overall liking of uncooked and cooked dried noodles were at the moderate level. The present study indicated that unripe banana flour is a potential source of fiber when substituted for wheat flour in dried noodle products. The incorporation of 30% unripe banana flour in the noodle ingredients significantly increased their total dietary fiber and resistant starch content. [11].

The effects of process factors (screw speed, feeder screw speed, and barrel temperature, drying temperature) on extruded rice vermicelli properties by using a single screw extruder were examined. The results of the optimum conditions for the extrusion process were: screw speed 30 rounds per minute; feeder speed, 50 rounds per minute; the temperature of first zone: second zone: third zone as 90 O C: 100 O C: 100 O C. Drying time and temperature significantly affected the product quality. The product dried at room temperature for 24 hours before packing gave good appearance with final moisture content less than 12%. When cross-linked modified starch type, MYK-500T 4%, and emulsifier, monoglyceride Monomul 90-35P 1.00%, were added to the rice flour, the product showed cooking weight at 315.68%, cooking loss 11.10% and final moisture content 8.72%. The hardness of the product was 1,230.25 g and tensile strength 9.50 g. The acceptance of the extruded rice vermicelli was not significantly different from commercial rice vermicelli obtained by traditional processes. [12]

III. MATERIALS & METHODS

The Raw Materials used for this study are as follows: Unripe Banana, Wheat Flour, Oil, Citric Acid. Many Equipments, instruments and chemicals have been used to carry out this study.

Preparation of Unripe Banana Flour

Three types of banana flour were prepared using unripe banana

1. Banana flour from unripe unpeeled blanched banana
2. Banana flour from unripe peeled blanched banana
3. Banana flour from unripe unpeeled unblanched banana

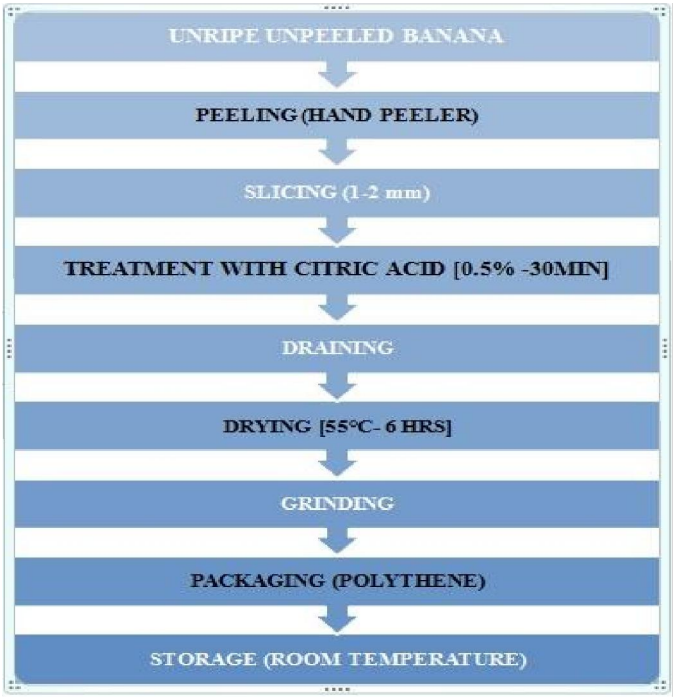

Figure 1: Unripe Unpeeled Banana without peel without blanching.

Unripe green bananas (UGBs) were peeled using hand peeler and sliced into 1-2 mm thickness slices, the uniform thickness was maintained to get accurate and uniform drying results. Citric acid was used as anti-browning agent. The slices were immediately dipped into citric acid solution (0.5%) for 30 minutes to avoid enzymatic browning. These slices were removed and dried in tray drier at 55°C for 6 hours and powdered in grinder. Packaging of the powder was done in polyethylene pouches and stored at room temperature for subsequent

Preparation of Blends

Blend of various types of Banana flour and Wheat flour was prepared by mixing. The ratio of wheat flour and banana flour was taken with different proportion, whereas wheat flour [100:00] was taken as control sample [T], [75:25] as [T], 50:50 as [T], and 25:75 as [T].

Treatment	Wheat flour (%)	Unripe banana flour (%)
T_0	100	00
T_1	75	25
T_2	50	50
T_3	25	75

Table No. 1: Formulation of unripe banana flour and wheat flour blend.

Preparation of Vermicelli

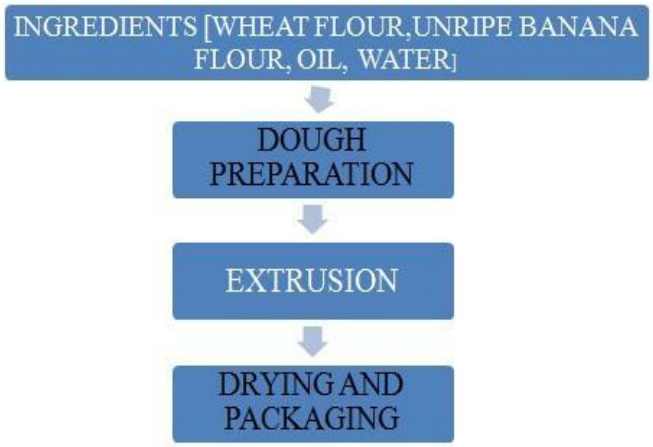

Figure 2 : Preparation of Vermicelli

Wheat and banana flours in different proportions as mentioned above were mixed with around 100ml of water was used, kneading has been done for 30 mins to prepare uniform and consistent dough. This dough was passed through extruder and long rods of vermicelli came out from the extruder which were cut into the desired length and diameter of 2.08 mm then placed in the tray drier for drying. Drying temperature was around 65°C for 8 hrs. Further the product has been packed in polythene bags.

The vermicelli samples were evaluated using 9 point hedonic scale for their sensory characteristics namely appearance, color, texture, taste and overall acceptability by a trained panels comprising of 10 panelists drawn from faculty members and under graduate students of the department. The panelists were asked to record their observations on the sensory sheet based on 9 point hedonic scale.

SR. NO.	REMARKS	SCORE
1	Like extremely	**9**
2	Like very much	**8**
3	Like moderately	**7**
4	Like slightly	**6**
5	Neither like nor dislike	**5**
6	Dislike Slightly	**4**
7	Dislike moderately	**3**
8	Dislike very much	**2**
9	Dislike Extremely	**1**

Table No. 2: Hedonic Scale

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Proximate Composition of Unripe Banana Flour and Vermicelli was calculated considering the moisture content, Ash content, Carbohydrate, Protein, Crude fibre, fat and Calorific Value.

Contents	Calories kcal/g
Protein	4
Fat	9
Carbohydrate	3.75

Table No. 3: Calorific Value

Functional Properties of Unripe banana flour and vermicelli were calculated considering the Bulk Density, Water Absorption capacity, Oil absorption capacity, Swelling index, and cooking time of Vermicelli.

IV.RESULTS

The optimal process conditions for unripe banana flour formation have been determined. Hence the second batch was selected and used for further study as optimized unripe banana flour due to proper prevention of enzymatic browning without any wastage.

Sensory analysis of vermicelli incorporated with unripe banana flour was carried out for Colour, Appearance, thickness, flavour taste, smell and overall acceptability and the results are shown in the following table below.

Sample	Colour	Appearance	Texture	Flavour	Taste	Smell	OAA
T_0	8.7± 0.46	8.4±0.49	8.8± 0.40	7.1± 0.54	7.1± 0.54	8.5 ±0.50	8.8 ±0.40
T_1	8.2 ±0.87	8.4±0.66	8.7± 0.46	7.0± 0.89	7.2± 0.60	8.3 ±0.64	8.5 ±0.50
T_2	7.8 ±0.98	8.0±0.63	8.8± 0.40	7.0± 0.45	7.1± 0.54	8.4 ±0.49	8.7 ±0.46
T_3	6.6 ±1.69	6.9±1.94	8.7± 0.64	7.1± 0.70	7.2± 0.60	8.4 ±0.49	8.3 ±0.78

Table No. 4.1: Sensory evaluation of Vermicelli incorporated with unripe banana flour

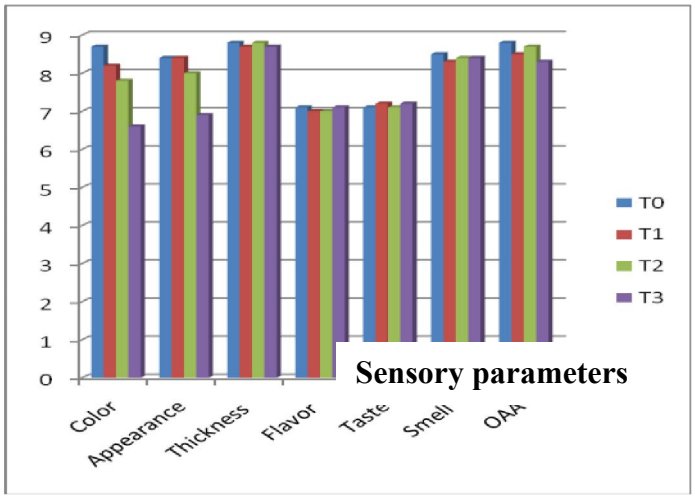
Values are shown as mean ± SD, n=3

T_0 = Control -100% wheat flour Vermicilli

T_1 = 75% wheat flour: 25% unripe banana flour Vermicilli

T_2 = 50% wheat flour: 50% unripe banana flour Vermicilli

T_3 = 25 % wheat flour: 75% unripe banana flour Vermicilli



Graph No. 1: Sensory evaluations of Vermicelli

Parameter %	Values
Moisture	10.76± 0.25
Ash	2.79± 0.13
Carbohydrate	90.69 ± 0.17
Protein	4.27 ± 0.06
Crude fibre	1.38 ± 0.02
Fat	0.51 ± 0.04
Calorific value	361.77±0.65

Table No. 5: Chemical analysis of unripe banana flour

Parameter (%)	T_0	T_1	T_2	T_3
Moisture	11.25±0.10	9.74±0.09	8.62±0.23	8.06±0.21
Ash	4.97±0.13	5.26±0.09	5.36±0.07	5.52±0.04
Carbohydrate	63.54 ±0.41	66.26 ±0.27	67.53 ±0.47	68.78 ±0.44
Protein	16.51±0.18	13.94±0.12	12.42±0.07	10.84±0.09
Crude fiber	3.67±0.09	4.65±0.09	5.92±0.14	6.63±0.16
Fat	0.05±0.01	0.16±0.04	0.16±0.01	0.18±0.01
Calories (k.cal)	304.80 ±0.84	305.66 ±0.89	304.31 ±1.51	302.87 ±1.31

Table No. 6: Chemical composition of Vermicilli

Each value represents the average value of three determinations
T_0 = Control -100% wheat flour Vermicilli
T_1 = 75% wheat flour: 25% unripe banana flour Vermicilli
T_2 = 50% wheat flour: 50% unripe banana flour Vermicilli
T_3 = 25 % wheat flour: 75% unripe banana flour Vermicilli

Bulk Density g/ml	WAC g/g	OAC g/g	Swelling index ml/g
0.78±0.16	5.75±0.39	7.07±0.15	0.93±0.09

Table No. 7 : Functional properties of unripe banana flour

Parameter	T_0	T_1	T_2	T_3
Bulk density (g/ml)	0.424±0.015	0.433±0.010	0.447±0.010	0.472±0.011
WAC (g/g)	1.198±0.010	1.202±0.001	1.202±0.001	1.203±0.001
Cooking time (Min)	12.66±0.47	14.33±0.47	13.33±0.47	13.66±0.47
Swelling index (ml/g)	1.246±0.013	1.193±0.008	1.125±0.010	1.080±0.050

Table No. 8: Functional analysis of Vermicelli

*Each value represents the average value of three determinations
T_0 = Control -100% wheat flour Vermicilli
T_1 = 75% wheat flour: 25% unripe banana flour Vermicilli
T_2 = 50% wheat flour: 50% unripe banana flour Vermicilli
T_3 = 25 % wheat flour: 75% unripe banana flour Vermicilli

Image 1: Control Sample

Image 2: Vermicelli with 75% wheat flour and 25% UBF

Image 3: Vermicelli with 50% wheat flour and 50% UBF

Image 4: Vermicelli with 25% wheat flour and 75% UBF

V.CONCLUSIONS

From the results of present study process of optimization for making unripe banana flour and its utilization in vermicelli, following conclusions were drawn.The physiochemical characteristics of raw material i.e. unripe banana flour used in the study for the preparation of vermicelli shows that the flour was found to have higher carbohydrate and protein.

The unripe banana flour was low in moisture content and fat which is favourable. The average fat content was 0.51% so banana flour can be used as a diet food because of low fat content. It's good to be consumed as food diet.

The goal was to obtain a product with low moisture content, because levels more than 13 % can provide a microbial growth and deterioration in short time. The maximum moisture content of UBF was 11.04 % which is significant

Four blends of vermicelli had been prepared by taking the different proportions of wheat flour and unripe banana flour i.e. T_0 [100:0] T_1 [75:25] T_2 [50:50] T_3 [25:75]. On the basis of 9 point hedonic scale the best selected was T_2 [50:50] with improved sensorial quality profile.

Followed by sensory analysis, Raw material [unripe Banana flour] and vermicelli products viz. T_0 [Control], T_1, T_2, T_3 are evaluated for its functional properties and proximate compositions. Functional properties which includes Bulk density, Water absorption capacity, Oil absorption capacity, swelling properties results of unripe banana flour [0.78±0.16; 5.75±0.39; 7.07±0.15; 0.93±0.09] and Bulk density, Water absorption capacity, cooking time, swelling properties of product T_0 [0.424±0.015; 1.198±0.010; 12.66±0.47; 1.246±0.013] T_1 [0.433±0.010; 1.202±0.001; 14.33±0.47; 1.193±0.008] T_2 [0.447±0.010; 1.202±0.001; 13.33±0.47; 1.125±0.010] T_3 [0.472±0.011; 1.203±0.001; 13.66±0.47; 1.080±0.050].

Proximate compositions includes Moisture, ash , carbohydrate, protein, crude fibre, fat, calorific value of unripe banana flour results as [10.76± 0.25; 2.79± 0.13; 90.69 ± 0.17; 4.27 ± 0.06; 1.38 ± 0.02; 0.51 ± 0.04; 361.77±0.65] and of vermicelli products T_0 [11.25±0.10; 4.97±0.13; 16.51±0.18; 0.05±0.01; 3.67±0.09; 63.54 ±0.41; 304.80 ±0.84] T_1 [9.74±0.09; 5.26±0.09; 13.94±0.12; 0.16±0.04; 4.65±0.09; 66.26 ±0.27; 305.66 ±0.89] T_2 [8.62±0.23; 5.36±0.07; 12.42±0.07; 0.16±0.01; 5.92±0.14; 67.53 ±0.47; 304.31 ±1.51] T_3 [8.06±0.21; 5.52±0.04; 10.84±0.09; 0.18±0.01; 6.63±0.16; 68.78 ±0.44; 302.87 ±1.31]

Increased level of fortification of unripe banana flour with wheat flour shows the increase in carbohydrate, ash, crude fiber and decrease in fat, moisture content, protein which is valuable.

Sensory valuation of vermicelli prepared from different blends shows the decrease in colour score. Fading of colour was observed as the level of supplementation of the unripe banana flour was increased in the wheat flour.

The results obtained in the project claimed that the Nutritive value of Vermicelli incorporated with unripe banana flour was higher as compare to control sample of Vermicelli. Based on the sensory results it can be concluded that T_2 i.e. 50:50 (Wheat flour : unripe banana flour) blend of vermicelli was acceptable overall.

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