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Processing and utilization of jackfruit seeds, pearl millet and soybean flour for value addition

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Abstract

Study was conducted to develop Jackfruit Seed, soy flour and pearl millet noodles. Different levels of refined wheat flour: jackfruit seed flour, soy flour and pearl millet flour were added in the ratio of 85:15, 75:25 and 65:35 for the development of noodles and its quality were analysed. The product was analyzed for ash, moisture, protein, fat and calcium contents by using AOAC (2000) procedures. Data obtained during investigation was statistically analyzed by using analysis of variance (ANOVA) and critical difference test (C.D). The noodles developed with addition of jackfruit seeds, soybean and pearl millet flour had desirable organoleptic properties as indicated by the taste panel studies. However, based on sensory analysis noodles with (T3) 65:35 of refined wheat flour: jackfruit seed flour, soy flour, pearl millet flour were found more acceptable than other levels. On the basis of objectives it is concluded that the best treatment of noodles (T3) containing 7.33 percent moisture, 2.33g/100g Ash, 20.63g/100g Protein, 3g/100g Fat, 5.43g/100g Fibre, 5.3mg/100g Iron and 50.26mg/100g Calcium, 118.6g/100g Carbohydrate. The results of study indicated that samples of jackfruit seeds, soybean and pearl millet flour had added noodles, for all addition levels contained more protein, fat, calcium, iron, fibre and energy as compared to control sample.

Keywords: Nutrients, jackfruit seed flour, soy flour, pearl millet flour, noodles, refined wheat flour, sensory analysis.

Introduction

Noodles are one of the staple foods consumed in many Asian countries. Instant noodles have become internationally recognized food, and worldwide consumption is on the rise. Many researchers are exploring the potential of noodle fortification as an effective public health intervention and improve its nutritional properties. The properties of instant noodles like taste, nutrition, convenience, safety, longer shelf life, and reasonable price have made them popular. Quality factors important for instant noodles are colour, flavour and texture, cooking quality, rehydration rates during final preparation, and the presence or absence of rancid taste after extended storage [1]. Nowadays Consumers all around the world, all are more at the risk of many diseases such as diabetes due to obesity, high cholesterol, cardiovascular diseases, high blood pressure and irregular blood sugar levels. These risk factors are because of the unfit diet which is low in essential nutrients like dietary fiber, phytochemical and antioxidants. Functional foods provide health benefits and help in the avoidance of diseases by incorporating nutraceutical ingredients and other essential nutrients. In the world now days the market of instant noodles gaining popularity. Usually, wheat flour is preferred to prepare instant *Noodles* with low protein and dietary fiber content [2]. Traditional noodles are claimed to lack other essential nutritional components such as dietary fiber, vitamins and minerals, which are lost during wheat flour refinement [3].

Jackfruit (*Artocarpus heterophyllus Lam.*) a member of the family Moraceae is the largest tree-borne fruit in the world. India is the second biggest producer of the fruit in the world and is considered as the motherland of jackfruit. The jackfruit is native to parts of South and Southeast Asia and is believed to have originated in the rain forests of Western Ghats of India and is cultivated throughout the low lands in South and Southeast Asia. Major jackfruit producing countries are Bangladesh, India, Myanmar, Nepal, Thailand, Vietnam, China, the Philippines, Indonesia, Malaysia and Sri Lanka. There are 100-500 seeds in a single fruit [4]. In fact, the seeds contain an antimicrobial effect and antibacterial properties to prevent the access of bacteria. The jackfruit seeds contain potential nutrients such as protein, fiber, Vitamin B, Potassium and carbohydrates. Jackfruit seeds are packed with insoluble fiber. Insoluble fiber bulks up the stool for easy elimination. It also detoxifies the colon and maintain healthy digestion. Fiber also regulates digestive processes, keeps the heart healthy and prevents cardiovascular diseases. When the colon is clean and the digestion is healthy.

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Jackfruit seeds contain high-quality protein. The protein derived from jackfruit seeds are free from cholesterol. Jackfruit seeds are a great source of iron [5].

The soybean belongs to the family Leguminosae and the genus name is Glycine L. [6]. Soybean is classified more as an oil seed crop than as a pulse. It contains 40-42% of proteins and 18-20% of oil [7]. Owing to its amino acids composition, the protein of soybean is called a complete protein. Its nutrition value in heart disease and diabetes is well known. It is significant that Chinese infants using soybean milk in place of cow's milk are practically free from rickets [8].

Soybeanis one of the richest and cheapest sources of plant protein that can be used to improve the diet of millions of people, especially the poor and low income earners in developing countries. The main ingredients of noodles are wheat, which is having deficiency of essential amino acid lysine, whereas soybean is richer in lysine and can be complement to wheat in noodles. Soybean protein is more economical than high priced meat protein and so they are considered as best source of protein especially in vegetarian diet. It increases nutritional status of vulnerable groups like pregnant woman, nursing mother, school going and young children. High protein soya product reduces incidence of malnutrition and encourage the farmers to grow more soybeans due to increasing demand in the market [9].

The consumption of pearl millet is very poor inspite of being nutritional superior to other crops. The majority of people in India are economically poor and thus, food choices for a balanced diet are further restricted by poverty and insufficient supply of nutritious foods. Therefore, it becomes important to focus on promoting maximal use of locally available inexpensive foods rich in protein, calcium, iron, fibre etc [10]. The percentage of crude protein, fat, crude fibre and ash content of pearl millet as reported in various analytical studies ranges from 7.02 to 13.67, 4.02 to 7.80, 0.54 to 3.00 and 0.25 to 2.54 per cent, respectively. Besides, the total quantity of protein, their amino acid composition is important for better nutritional quantity. The amino acids profile of pearl millet is better than that of sorghum and maize and is comparable to wheat, barley and rice [11]. Substitution with bajra flour is a cost-effective way to increase protein, fibre, iron and other nutrient [12].

Though, the study was carried to produce a nutritious noodles by incorporating jackfruit seed. Pearl millet and soy flour in noodles with its quality analysis.

Materials and methods
The ingredient of noodles were purchased from local market of Allahabad UP. The experimental studies were carried out in Food Processing laboratories at Sam Higginbottom Institute of Agriculture Technology and Sciences, Allahabad. Preparation of Jackfruit Seed Flour by soaking, sun drying then milling. Pearl millet flour was obtained through roasting for 5-10min and then grinded into powder. Soybean grains were soaked in water for 4-6 hours and then autoclaved for 5 minutes in a pressure cooker then dry it in sun light then grinded into powder. The prepared noodles with the incorporation of jackfruit seeds, pearl millet and soybean flour. For each basic (control also) has three variations T_1, T_2, T_3 respectively, where the amount of one or more ingredients was varied. Organoleptic evaluation of the food product for their acceptability was done by a panel of five judges. The score card based on the 9 point hedonic scale was used for Organoleptic/sensory evaluation on the basis of evaluation of attributes like Colour and Appearance, Body and Texture, Taste and Flavour and Overall Acceptability [13]. Methods described by AOAC [14]. were used for determination of nutritional composition of the developed extruded product. This included estimation of moisture, ash, fat, crude fiber, iron and calcium of the products. Protein estimation is an extension of the Biuret Method. Hence, it is largely followed to determine the protein content of enzyme extracts [15]. The carbohydrates [nitrogen free extract (NFE)] were calculated by difference. Carbohydrate (NFE) = 100- (% moisture+% fat +% protein+% ash+% crude fibre).Cost of the prepared products was calculated taking into account the cost of individual raw ingredients used in the preparation of food products as the prevailing market price. The data obtained from sensory evaluation were statistically analyzed by using Analysis of variance technique, ANOVA (2 way classification), Critical Difference (CD) and t-test (paired t-test) for chemical analysis [16].

Preparation of Noodles
Noodles were prepared in the laboratory. The jackfruit seed and soy flour noodles were prepared by mixing the ingredients were dry mixed and kneaded with water into dough. The dough was covered with wet muslin cloth and kept at 28 to 30°C for 30 minutes for seasoning. Then dough was passed through extruder and product was kept in tray dryer at 60°c for 2-3 hr. then Cooled to room temperature, packaged in LDPE bag and product is for further study [17].

The following treatment combination was prepared in this study

Ingredient	T_0	T_1	T_2	T_3
Refined wheat flour (g)	100	85	75	65
Jackfruit seed flour(g)	0	5	10	15
Soya flour(g)	0	5	10	15
Pearl millet flour(g)	0	5	5	5

Results and discussion
The data collected on different aspects as per the methodology have been tabulated and analyzed statistically. The mean score values for colour, texture, consistency flavor and overall acceptability were more in T_3as compared to other treatments. Overall acceptability of products indicates was highly comparable to treatment as also evident from significant difference between the scores [18].

1. Sensory Analysis

Table 1: Average sensory scores of control and treated sample of *Noodles*

Control and Treatments	Colour and Appearance Mean ± SE	Body and Texture Mean ± SE	Taste and Flavour Mean ± SE	Overall Acceptability Mean ± SE
T_0	9±0.00	8.8±0.04	8.63±0.07	8.80±0.03
T_1	6.96±0.02	6.9±0.33	7.13±0.09	6.99±0.06
T_2	7.13±0.3	7.33±0.14	7.13±0.05	7.26±0.17
T_3	8.73±0.21	8.9±0.08	8.8±0.09	8.89±0.01
Ftable	4.76	4.76	4.76	4.76
Fcalculated	19.54	15.32	67.22	57.13
CD	0.38	1.41	0.08	0.11

SE-Standard Error

Sensory evaluation of *Noodles* with or without the incorporation of prepared mix powder showed that the overall acceptability was highest in T_3 (8.89) followed by T_1 (6.99), T_2 (7.26) and T_0 (8.8) respectively and there was a significant difference, ($p < 0.05$) between the control and the treatment. The overall acceptability of T_3 was significantly better than control (T_0).

The results is supported by the findings of Vinod D. Nandkule [19]. Reported the data shows the average sensory scores for different parameters in control and treated sample of jackfruit seed and soy flour *Noodles*, clearly indicates that treatments T1 (7.54) had the highest score followed by T0 (7.52), T2 (7.2), T3 (7.06), T4 (6.86), (T5) 6.74, (T6) 6.6. The calculated value of F is greater than the tabulated value of F at 5% probability level. Therefore, it can be concluded that there was significant difference between treatments regarding the overall acceptability of jackfruit seed and soy flour *Noodles*. Thus, the flavour, appearance and overall acceptability increased as the amount of 5 percent of jackfruit seed flour and 5 percent of soy flour increased.
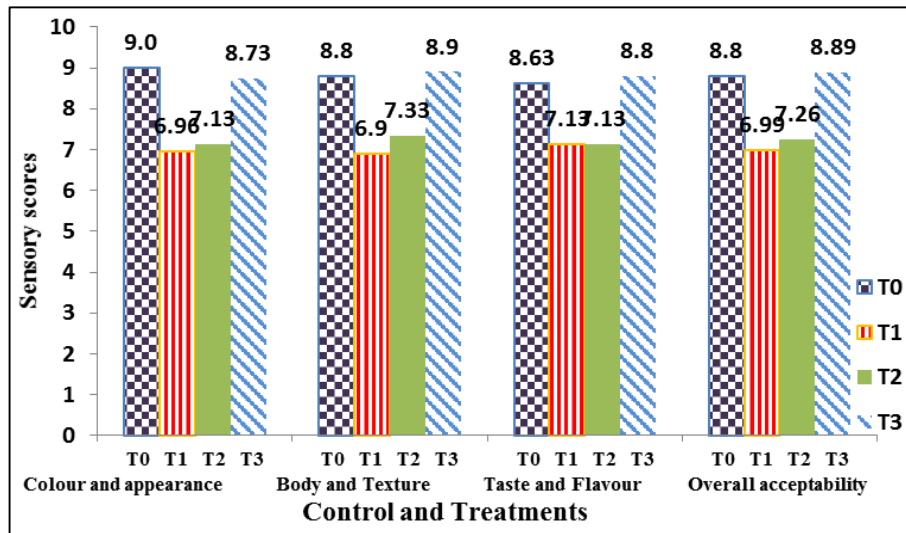

Fig 1: Average sensory scores for different attributes of '*Noodles*'

2.) Chemical Analysis

Table 2: The average nutritional composition of control and the best treatment samples of '*Noodles*' (per 100 g)

Nutrients	(T_0)	(T_3)	Difference ($T_1-T_0=D$)	t (calculated)	T (tabulated value at 5%)	Results
Moisture (%)	5.5	7.33	1.83	11	4.303	S
Ash (g)	1.5	2.33	0.83	2.167	4.303	NS
Protein (g)	11	20.63	9.63	12.78	4.303	S
Fat (g)	0.9	3	2.1	7.937	4.303	S
Crude fibre (g)	0.73	5.43	4.7	15.66	4.303	S
Iron (mg)	2.9	5.3	2.4	11.52	4.303	S
Calcium (mg)	24	50.26	26.26	49.25	4.303	S
Energy(Kcal)	483.7	583.92	100.22	789.02	4.303	S
Carbohydrates (g)	107.9	118.6	10.7	14.25	4.303	S

S = Significant; NS = Non- Significant

The chemical composition of the best product (T_3) increased in the incorporation of prepared mix powder the moisture content in *Noodles* was found in 7.33 percent, Ash content was found to be 2.33g/100g, Protein content is 20.63g/100g, Fat content is 3g/100g, Fibre in the product found to be 5.43g/100g, Iron and Calcium were found 5.3mg/100g and 50.26mg/100g, Carbohydrate content in product is 118.6g/100g. On applying the 't' test it was found that moisture, protein, fat, fibre, calcium and iron content significantly increased.

The result is supported by the findings of Himabindu *et al.,* [20]. Reported the among all the formulations tried, noodle sample prepared from 70% wheat flour and 30% malted kodo millet flour. Proximate composition of *Noodles* Parameter Amount (%) Moisture (%) 5.13 Protein (%) 13.24 Fat (%) 15.52 Total carbohydrate (%) 47 Crude fibre (%) 1.56 Calcium(ppm) 180 Iron(ppm) 2.78 Ash (%) 1.8.

3. Cost of the prepared food products

Table 3: Cost of the prepared product namely *Noodles*

Ingredients	Actual rate/kg (Rs)	T0		T1		T2		T3	
		Amt. (g)	Cost (Rs)	Amt. (g)	Cost (Rs)	Amt. (g)	Cost (Rs)	Amt. (g)	Cost(Rs)
Refined flour	30	100	3.00	85	2.5	75	2.25	65	1.95
Soybean flour	60	-	-	5	0.3	10	0.60	15	0.9
Jackfruit seeds flour	50			5	0.25	10	0.50	15	0.75
Pearl millet flour	50			5	0.25	5	0.50	5	0.50
Salt	10	0.5	0.02	0.5	0.02	0.5	0.02	0.5	0.02
Total amount (Rs.)			3.02		3.32		3.87		4.12

Table 3 shows that the total cost of *Noodles* per 100g of dry ingredients at the prevailing cost of the raw materials was T_0 is Rs. 3.02 for treatment, T_1 is Rs. 3.32, T_2 is Rs. 3.87 and T_3 is Rs. 4.12. It is therefore concluded that the control T_3 has the highest cost and T_0, T_2 and T_3 has the lowest cost because the incorporation level of Multigrain flour did Increase the cost of the prepared products marginally.

Conclusion
On the basis of findings, it is concluded that jackfruit seeds flour, soybean flour and pearl millet flour mix products was found to be rich in protein, iron, calcium and carbohydrate and it can be successfully incorporated in the preparation of the products like *Noodles*. Sensory evaluation showed that the treatment T_3 (refined flour: jackfruit seeds flour, soybean flour and pearl millet flour in the ratio of 65:35) was the most acceptable in *Noodles*. The content of iron, calcium, carbohydrate, increased significantly in *Noodles*. It has higher values of protein, fiber and minerals (calcium and iron) than the control sample. As the incorporation levels of jackfruit seeds flour, soybean flour and pearl millet flour increased the cost but it is very nutritious than control.

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