

Scope of incorporating fruits for the development of pasta

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■ **ABSTRACT :** The present study focused on the incorporation of fruits, jackfruit (Koozha) papaya, banana along with other ingredients such as green gram flour, wheat flour and tapioca starch for the production of pasta. The ultimate aim of the study was to utilize locally available low cost fruits for the development of pasta. In the present study, different proportion of various ingredients such as wheat flour, green gram flour, tapioca starch and selected fruit pulps were worked out for the development of pasta. Five proportions of each, banana incorporated pasta, papaya incorporated pasta and jackfruit incorporated pasta was worked out as well as four proportions of mixed fruit pasta were developed. From each group best proportion was taken for further analysis. The proportions of fruit pulp and wheat flour were constantly changed in each proportion. The quantity of green gram flour and tapioca starch maintained constant in each proportion. Replication of each proportion was done. The extrusion behaviour of pasta was assessed. Mass flow rate (MFR) was the commonly used criterion for analyzing the extrusion behaviour. Based on the mass flow rate, best four proportions were selected from each fruit such as banana pasta, papaya pasta, jackfruit pasta and mixed fruit pasta. The MFR values ranged from 0.52 to 2.72. The least MFR value was shown by jackfruit incorporated pasta (0.52). Papaya pasta shown greater MFR value (2.72), followed by mixed fruit pasta (2.11) and banana pasta (1.79). These selected proportions were again subjected to further analysis of physical characteristics. The statistical interpretation showed that each proportion was significantly different from each other. Among the four proportions, papaya incorporated pasta showed best in MFR and also in physical characteristics. The well accepted pasta products that were developed in the study can be scaled up for potential commercialization and marketing. The underutilized fruits also can be utilized for development of products which will improve the nutritional value and reduce the cost.

■ **KEY WORDS:** Jackfruit, Papaya, Banana, Pasta

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Foods are perishable commodities and are, therefore, processed to preserve them from deterioration while providing the consumer with palatable, wholesome, nutritious and tasty foods in a convenient form throughout the year (Anand, 2000). Food processing add value, enhances shelf-life of the perishable agro - food products and encourages crop diversification. Food processing industry is of enormous significance for India's development because of the vital linkages and synergies that it promotes between the two pillars of the economy, namely, industry and agriculture (Mahesh Kumar, 2009). Pasta is consumed in large quantities throughout the world (Gallegos-Infante *et al.*, 2010). As it is a popular food because of its ease of

preparation, sensory appeal, low cost and storage stability. Nevertheless, it is not recognized as a balanced product due to the poor biological value of its proteins and the low content of dietary fibre (Martinez *et al.*, 2007). A number of researchers have used fruits and vegetable by-products such as apple, pear, orange, peach, blackcurrant, cherry, artichoke, asparagus, onion, carrot pomace (Grigelmo-Miguel and Martin-Belloso, 1999; Ng *et al.*, 1999; Nawirska and Kwasniewska, 2005) as sources of dietary fibre supplements in refined food. Research findings make clear that not only is the pasta itself a healthful and nutritious food, but that when it is incorporated with other healthy ingredients like olive oil, fruits, vegetables, beans, fish, or meat and egg-

pasta is a perfect meal (Dewettinck *et al.*, 2008). India with its diverse agro - climatic conditions produces a wide range of tropical and temperate fruits and vegetables. Hendringson (2011) reported that papaya fruit is an excellent source of nutrients and is antioxidant, flavonoids and carotenes and low in calories and sodium that help in blood clotting. Indra and Kowsalya (2011) developed nutritious mix and extruded products from semi ripened papaya in dried form which could be successfully incorporated in the daily menus. Umsakulk (2006) stated that year round availability, affordability, varietal range, tastes, nutritive and medicinal value makes banana as the favourite fruit among all classes of people. Campbell *et al.* (2003) reported that banana is also helpful in treating stomach ulcer (banana has a natural antacid), colitis, digestive disorder, diarrhoea, constipation and hemorrhoids. Jackfruit is a nutritious fruit which is widely grown as an important crop in Kerala's homesteads and it is popularly known as poor man's fruit (Ukkuru and Pandey, 2004). Sambamurthy (2005) reported that jackfruit is rich in phytonutrients and vitamin C that can fight cancer and slow down degeneration of cells that can lead degenerative diseases. Durum wheat is used in pasta manufacturing because of its high content of protein and the carotenoid pigment lutein, which gives the yellow colour to the pasta (Belitz and Grosch, 1999; Pomeranz, 1988). Cereal grains are generally used as major raw material for development of extruded snack foods due to their good expansion characteristics because

of high starch content. Cereal grains tend to have a poor biological value protein due to their limited essential amino acid content and these are usually fortified with lysine or pulse protein to produce nutritious foods. Thus, the present study focused on the incorporation of locally available and less utilized fruits for the development of nutritious extruded pasta product.

■ RESEARCH METHODS

Selection and preparation of ingredients:

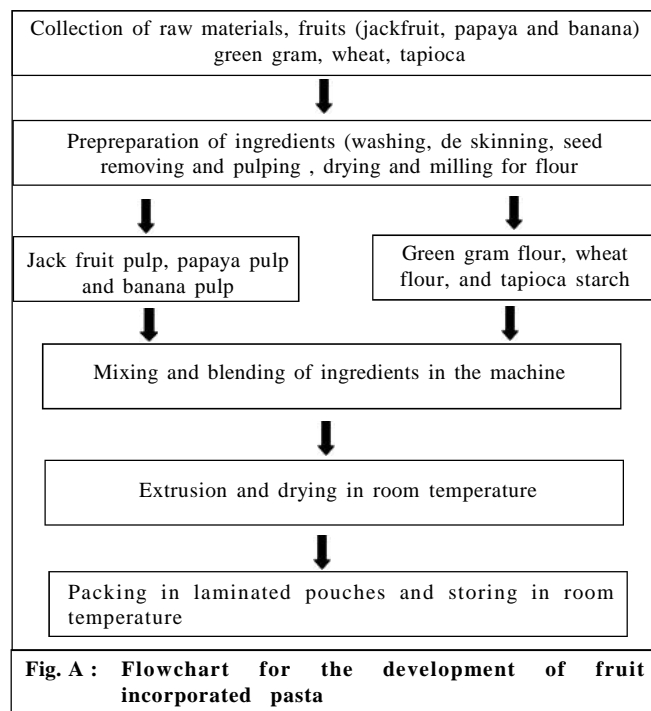
Locally available and low cost fruits were chosen for the study. Fully ripened and matured jackfruit papaya, and banana were selected for the pasta development. Wheat flour, green gram flour and tapioca flour, were the other ingredients, selected for the development of pasta. Wheat flour is the basic component for the development of pasta. Tapioca is an important ingredient for the development of extruded snack foods because of its excellent binding property. For the improvement of biological value of protein of the developed pasta, green gram flour was also added in the pasta development.

Processing and development of pasta:

The fruits were cleaned and separated into pulp and seed and then pulped using a fruit pulper. All the ingredients along with the fruit pulp were taken to pasta making machine. The extruded pasta was dried at room temperature. The ideal proportion of the ingredients for

Proportions	Jackfruit pulp	Papaya pulp	Banana pulp	Whole wheat flour	Green gram flour	Tapioca starch
1	-	-	200	600	100	100
2	-	-	300	500	100	100
3	-	-	400	400	100	100
4	-	-	500	300	100	100
5	-	-	600	200	100	100
6	-	200	-	600	100	100
7	-	300	-	500	100	100
8	-	400	-	400	100	100
9	-	500	-	300	100	100
10	-	600	-	200	100	100
11	200	-	-	600	100	100
12	300	-	-	500	100	100
13	400	-	-	400	100	100
14	500	-	-	300	100	100
15	600	-	-	200	100	100
16	200	200	200	200	100	100
17	100	100	100	500	100	100
18	150	150	100	400	100	100
19	100	150	150	400	100	100

the pasta product was analyzed by working out different combinations. Each proportion was replicated twice for the standardization of pasta. The different proportions worked out with the various ingredients are given in Table A. Fig. A shows the flowchart for the development of fruit incorporated pasta.



Selection of best proportion:

The extrusion behaviour of pasta was assessed based on the time required for blending all the ingredients, extrusion time in seconds and drying time. Mass flow rate (MFR) was the commonly used criterion for analyzing the extrusion behaviour (Sigh *et al.*, 1996). So, MFR was used for selecting the best pasta. Five proportions of each banana incorporated pasta, papaya incorporated pasta and jack fruit incorporated pasta were worked out as well as four proportions of mixed fruit pasta were developed. From each group, best proportion was taken for further analysis.

Physical characteristics assessment of developed pasta product:

Physical characteristics such as optimum cooking time (AACC, 2000), cooking loss (AACC, 2000), swelling index (AACC, 2000) and water absorption index (AACC, 2000), of the best extruded pasta were analyzed.

Sensory evaluation of developed pasta:

Sensory characteristics such as appearance, colour, flavour, texture, taste and overall acceptability of the developed pasta were recorded using a score card by selected

trained panel of 10 members.

Statistical analysis

In order to obtain meaningful interpretation, the generated data were subjected to suitable statistical analysis such as ANOVA.

■ RESEARCH FINDINGS AND DISCUSSION

The experimental findings obtained from the present study have been discussed in following heads:

Selection and preparation of ingredients:

The fruits pulps individually as well as in combination were added to the flours. Five proportions of individual fruit pulp and four proportions of the three fruit pulps in combination were worked out. In each proportion, the quantity of fruit pulp and wheat flour was varied and the quantity of the green gram flour and tapioca starch was constant. Each proportion was replicated twice for the standardization of fruit pasta (Table 1).

Selection of best proportion:

Based on the MFR study (Singh *et al.*, 1996), proportion number 2 from banana pulp, proportion number 7 from papaya pulp, proportion number 12 from jackfruit pulp and proportion number 17 from mixed fruit pulps were selected as the best proportion. These proportions were further called as proportion 1, proportion 2, proportion 3, and proportion 4, respectively. The time taken for drying was constant. Drying at room temperature for 24 hours was done for the developed pasta. This four selected proportions were taken for further analysis of physical characteristics. Table 1 shows that as the quantity of fruit pulp increases or decreases from 300 g per kg, the mass flow rate is affected. The mass flow rate was maximum when the fruit pulp quantity was at 300 g. Among the fruits selected, papaya fruit pulp incorporated pasta had maximum mass flow rate (2.72 ± 0.04) followed by mixed fruits pasta, banana fruit pasta and jackfruit pasta. The blending time ranged from 10-13 minutes. Due to the presence of 3 different fruits, the blending time exceeded for mixed fruit pasta.

Physical characteristics of developed pasta product:

The statistical analysis of Table 3 showed that there was significant difference between the swelling indexes of different fruit pasta. The study showed that the cooking loss for jackfruit pasta was more followed by mixed pasta compared to banana and papaya pasta. The cooking loss for papaya pasta was very less. The average cooking time for normal wheat pasta is 11 minutes. The statistical analysis showed that there was significant difference in the cooking time among the banana, papaya, jackfruit and

mixed fruit pasta. Papaya pasta has got maximum water absorption index. The least water absorption index was for jackfruit pasta. There was a significant difference between the water absorption index of papaya pasta and other three pastas.

Sensory evaluation of developed pasta:

The sensory evaluation of the pasta (Table 3) showed that there was significant difference for the appearance, colour, flavour and taste. The texture for the four proportions had no significant difference. The overall score was high for the proportion 1 pasta.

Table 1 : MFR of developed fruit pasta

Proportions	Wt. of sample (g)	Extrusion time (secs)	MFR	Blending time (min)
1	850	480	1.74±0.04	10
2	950	420	2.27±0.01	10
3	720	600	1.20±0.00	10
4	600	660	0.90±0.01	11
5	530	840	0.63±0.01	10
6	870	420	2.07±0.00	11
7	980	360	2.72±0.04	10
8	740	660	1.12±0.02	11
9	650	720	0.90±0.00	10
10	620	780	0.79±0.00	10
11	840	510	1.60±0.00	10
12	860	480	1.79±0.00	10
13	700	600	1.16±0.01	12
14	660	630	1.04±0.10	12
15	540	720	0.75±0.02	11
16	440	840	0.52±0.00	12
17	890	420	2.11±0.00	10
18	880	510	1.72±0.02	12
19	860	480	1.79±0.00	13

Table 2 : Physical characteristics

Criteria	Proportion 1	Proportion 2	Proportion 3	Proportion 4	CD Value	F value	SEM
Selling index	1.322	1.387	1.267	1.2	0.009	6.13**	0.0322
Cooking loss	2.175	1.1	4.1	4	0.332	132.78**	0.010
Cooking time	11.5	11	12.5	10.75	0.969	6.052 **	0.31
Water absorption index	12.5	17	8.5	11.25	3.041	12.89 **	0.986

** indicate significance of value at P=0.01

Table 3 : Sensory characteristics

Criteria	Proportion 1	Proportion 2	Proportion 3	Proportion 4	CD value	F value	SEM
Appearance	5.2	4.4	4.1	3.9	0.867	3.47*	0.30
Colour	5.1	4.5	3.9	3.6	0.827	5.188**	0.29
Texture	4.6	4.3	4.3	4	0.845	1.378	0.29
Flavor	5	4.1	3.6	3.1	0.820	7.82**	0.289
Taste	5.3	4.3	3.9	3.4	0.914	6.231**	0.322

** indicate significance of value at P=0.01

Conclusion:

Extruded products like pasta products are popularly used as snack products. Usually, pasta products are prepared using cereals like wheat, which are limiting in some essential amino acids. In order to increase the nutritive value of such products, the supplementation with protein rich green gram is an alternative. Development of pasta products using cereals, pulses and fruits without compromising on the quality of the final product would help to improve the nutritional quality apart from adding a distinct flavour and taste. The well accepted pasta products that were developed in the study can be scaled up for potential commercialization and marketing. The underutilized fruits also can be utilized for development of products which will improve the nutritional value and reduce the cost.

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