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**Deepa Verma**  
Assistant Professor, GPS  
Government Girls P.G. College,  
Azamgarh, Uttar Pradesh, India

**Aruna Palta**  
Principal, R.B. Government  
Naveen Kanya Mahavidyala,  
Raipur, Chhattisgarh, India

**Santosh**  
Soil Conservation Inspector,  
Dept. of Agriculture, Uttar  
Pradesh, India

**Correspondence**  
**Deepa Verma**  
Assistant Professor, GPS  
Government Girls P.G. College,  
Azamgarh, Uttar Pradesh, India

## Development of papaya powder fortified weaning food

Deepa Verma, Aruna Palta and Santosh

### Abstract

The efforts were made to incorporate the nutritional value of papaya in Fortified semolina kheer and in besan halwa prepared as value added product. Mature green papaya powder (MGPP) as developed with a special process by the late researcher Dr. Kurt Koesel of Hawalli Contains an excellent source of vitamins, minerals and enzymes. MGPP contains more vitamin A and vitamin C compare to carrots and oranges respectively along with excellent source of papain which is helpful in digestive disorder and extremely useful for any disturbances of the GIT. Also useful in preparation of geratic nutritional diet as well as for weaning food because of its easy digestibility.

Dried fruit powders are frequently used in nutritional supplements. Papaya fruit powder may be used as a high-density vitamin supplement for fortification of household recipes to overcome vitamin A deficiency diseases in infants and pre-school children. Best way of papaya powder fortification appears to be in fat-rich foods like ladoos, semolina pudding, porridge, muesli etc. A fortified weaning food semolina kheer was prepared by 10%, 20% and 30% replacement of papaya powder 20% incorporation of oven dried papaya powder obtained maximum score showed quality acceptability for fortified semolina kheer. Due to availability of proteolytic enzyme in papaya powder is helpful for better digestibility.

In this study two weaning food recipes were developed by fortification of papaya powder. In the first preparation fortified besan halwa was taken in which chick flour was replaced by papaya powder @ 10, 20 and 30% respectively. In another preparation fortified semolina *kheer* prepared by replacing semolina by papaya powder @ 10, 20 and 30%, respectively. Both recipes were analyzed by organoleptic evaluation using 9 point hedonic rating scale (Amerine *et al.*, 1965).

The final outcome of the research emphasis the best combination of papaya powder with semolina kheer and besan halwa strongly supported on the basis of the scores of appearance, taste, flavor, colour, texture and overall acceptability of fortified papaya for semolina kheer of treatment-2 (20% papaya powder) were 7.0, 6.8, 7.0, 7.0, 7.2 and 7.0 respectively for semolina kheer and for besan halwa treatment-3 (30% papaya powder) were 7.2, 7.8, 7.2, 7.2, 7.2 and 7.3. At the same time, this will not only result in providing nutritious products at reasonable price to the consumers but also add an efficient utilization of papaya powder.

**Keywords:** Papaya powder, weaning food, fortification, nutritional value, sensory characteristics

### Introduction

Papaya (*Carica papaya* L.), an herbaceous fruit crop belonging to the family Caricaceae, is one of the tropical plants that is claimed to have several medicinal properties, is rich in anti-oxidants and phytonutrients that work against free radicals and therefore is said to protect the body from possible heart diseases and cancer. In terms of nutritional value, it is not only known for its nutritional benefits but also considered to possess medicinal properties, i.e., low in calories and rich in natural vitamins and minerals, like vitamin C, vitamin A, thiamine, iron and dietary fiber, all of which are essential for better health. Nutrition experts advocate the intake of two servings of fruits in the daily diet. It is the fifth most important crop in India, which is cultivated to 106 thousand ha of land and production of 4196 thousand MT with average productivity of 39.6 MT/ha in 2014-15 (Indian Horticulture Database, 2015).

The nutritional highlight of papaya is a proteolytic enzyme called papain, which is an excellent aid to digestion. This enzyme is so powerful that it can digest up to 200 times its own weight of protein. (Becker, 2008). Papaya contains an enzyme called arginine which is good to treat erectile dysfunction.

Dried fruit powders are frequently used in nutritional supplements. Papaya fruit powder may be used as a high-density vitamin supplement for fortification of household recipes to overcome vitamin A deficiency diseases in infants and pre-school children.

Best way of papaya powder fortification appears to be in fat-rich foods like ladoos, semolina pudding, porridge, muesli etc. Study has been carried out to study the effects of % replacement of buffalo milk by papaya pulp at different levels (5, 10, 15 and 20%) in the manufacture of kalakand (Kartik M Patel, S K Roy, 2015) [8].

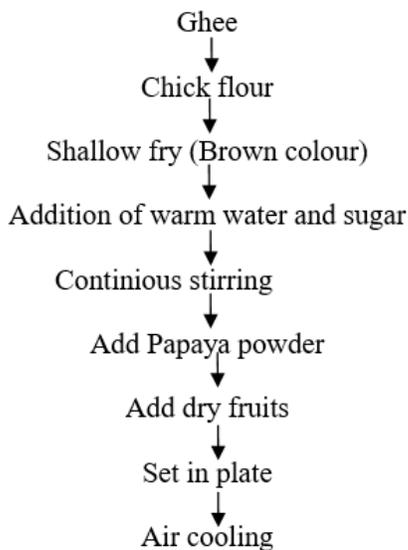
**Materials and methods**

Fortified *besan halwa* was prepared, in which chick flour was replaced by papaya powder @ 10%, 20% and 30%, respectively (Table-1). Fortified semolina kheer prepared by replacing semolina by papaya powder @ 10, 20 and 30% respectively (Table-2). The organoleptic evaluations for assessing the colour, flavour and texture of develop recipes were conducted by a panel of 7 judges, who scored on a 9 point Hedonic rating scale (Amerine *et al.*, 1965).

**Besan Halwa**



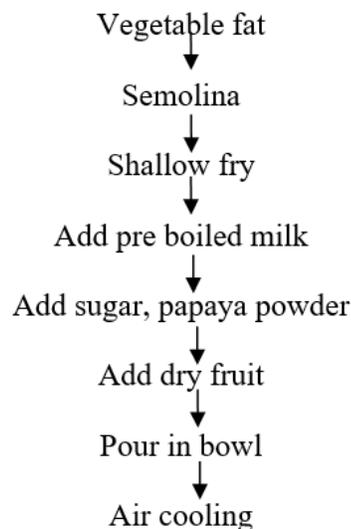
**Flow diagram of Besan Halwa**



**Semolina Kheer**



**Flow diagram of Semolina Kheer**



**Table 1:** Recipe for papaya powder fortified halwa

Ingredient	Control (gm)	Treatment-1 (gm)	Treatment-2 (gm)	Treatment-3 (gm)
Chick pea flour	100	90	80	70
Papaya powder	-	10	20	30
Sugar ground	30	30	30	30
Hydrogenated fat	20	20	20	20
Chopped dry fruit	10	10	10	10

**Table 2:** Recipe for powder fortified semolina kheer

Ingredient	Control (gm)	Treatment-1 (gm)	Treatment-2 (gm)	Treatment-3 (gm)
Semolina (g)	100	90	80	70
Papaya powder (g)	-	10	20	30
Milk (ml)	100	100	100	100
Sugar (tbsp)	1	1	1	1
Vegetable fat (g)	5	5	5	5

**Table 3:** Sensory characteristics of semolina kheer (number of replicates=5)

S. No.	Treatment	Sensory characteristics					
		Appearance	Taste	Flavor	Colour	Texture	Overall acceptability
1	T-1 (10%)	6.6	5.6	4.8	6.2	5.6	5.8
2	T-2 (20%)	7.0	6.8	7.0	7.0	7.2	7.0
3	T-3 (30%)	5.0	5.8	5.2	5.8	6.2	5.6
4	Mean value	6.2	6.06	5.6	6.3	6.3	6.35
5	Control	5.2	5.2	5.4	5.0	4.8	5.12
6	SEM ±	0.316	0.265	0.292	0.308	0.381	0.197
7	CD	0.948	0.793	0.874	0.924	0.142	0.592

**Table 4:** Sensory characteristics of besan halwa (number of replicates=5)

S. No.	Treatment	Sensory characteristics					
		Appearance	Taste	Flavor	Colour	Texture	Overall acceptability
1	T-1 (10%)	5.4	5.6	5.4	5.4	6.4	5.6
2	T-2 (20%)	6.4	5.8	6.4	6.2	7.2	6.4
3	T-3 (30%)	7.2	7.8	7.2	7.2	7.2	7.3
4	Mean value	6.3	6.4	6.3	6.3	7.0	6.3
5	Control	6.0	6.0	6.0	6.0	8.0	6.0
6	SEM ±	0.374	0.332	0.374	0.332	0.400	0.155
7	CD	1.22	0.994	1.122	0.994	1.199	0.464

**Table 5:** Active ingredients of different parts of the papaya tree (Nadkarni and Nadkarni 1954; Rehman *et al.*, 2003; Krishna *et al.*, 2008) <sup>[13, 17, 9]</sup>.

Parts	Active ingredients
Fruits	Amino acids, carotene, citric acid, protein, fat, carbohydrates, fiber, mineral, calcium, phosphorous, iron, vitamin C, thiamine, riboflavin, niacin and malic acid (green fruit).
Juice	N-butyric acids, n-hexanoic and n-octanoic acids, lipids, Myristic, planets, stars, linolec, linolenic and <i>cis</i> -vaccenic and oleic acid.
Seeds	Fatty acids, crude protein, crude fiber, papaya oil, carpaine, benzyl isothiocyanate, benzylglucosinolate, glucotropaeolin, benzoylthiourea, hentricontane, sitosterol, caressing and enzyme myrosin.
Roots	Carposide and enzyme myrosin.
Leaves	Alkaloids carpain, pseudoscorpion and dehydrocarpaine and, choline, carposide vitamin C and E.
Bark	Beta-sitosterol, glucose, fructose, sucrose and xylitol
Latex	Proteolytic enzymes, papain and chemopapain, glutamine, cyclotransferase, chymopapain A, B and C, peptidase A and B and lysozymes.

## Results and discussion

In India, halwa is prepared in different forms. The recipes were prepared by using flour, melted butter or ghee, sugar and optionally goondh. Different forms of palatable halwa are produced and served in India, Afghanistan, Nepal, Bangladesh, Pakistan, and surrounding countries. Fortified weaning food semolina kheer and besan halwa were trailed by 10%, 20% and 30% replacement of papaya powder. Table 3 showed that 20% incorporation of oven dried papaya powder obtained maximum score showed quality acceptability for fortified semolina kheer, while table 4 depicts the relative proportion of major component of besan halwa depends upon % replacement by papaya powder. 30% replacement showed quality acceptability by obtaining maximum score in besan halwa. Integration of papaya extracts or powder in semolina kheer or besan halwa increases the nutrient value of final products and increases the demands due to presence of several nutrients. Presence of papaya powder in final product (kheer or halwa) indicates the products are also very rich in antioxidant flavonoids and carotenes, very high in vitamin C and vitamin A, and low in calories and sodium, can be benefited to people suffering from colon cancer and other forms of cancers and ailments of cardiovascular and gastrointestinal systems (Table-5). It is totally natural product so it can be approved by several quality control agencies for health benefits. Due to low cost of papaya

in India (in several states) it can be used as nutritional supplements.

Sensory evaluation score of papaya fortified halwa are presented in table 3 & 4. It depicted that flavour, colour and appearance, body and texture and overall acceptability score were varied significantly. It is evident from the table that the significantly higher score was given to treatment with 20% and 30% papaya powder with respect to semolina kheer and besan halwa respectively.

The findings of the present study as well as relevant discussion have been presented under following heads

### Flavour

It was revealed from table 3 and 4, that the variation in the score of flavour was observed statistically significant due to effect of various treatments. The score of flavour of semolina kheer blended with papaya powder for treatment T1, T2 and T3 were 4.8, 7.0 and 5.2 respectively. The treatment T2 was significantly superior over T1, and T3 treatments, the treatment T3 was at par with treatment T2. These result were supported by the results reported by Narayanan and Lingam (2013) who observed highest score 8.66 (9 point hedonic scale) for 20% ripe banana shrikhand improves the flavour over control. The score of flavour of besan halwa blended with papaya powder for treatment T1, T2 and T3 were 5.4, 6.4 and

7.2 respectively. The treatment T3 was significantly superior over T1, and T2 treatments, the treatment T2 was at par with treatment T3. These results were not fully supported by the result reported by Narayanan and Lingam (2013).

### Texture

The variation in the score of texture was observed statistically significant due to effect of various treatments. It was observed that score of texture of fortified papaya with semolina kheer for treatment T1, T2 and T3 were 5.6, 7.2 and 6.2 respectively. The treatment T2 was significantly superior over T1 and T3 treatments. While texture of papaya in fortified besan halwa for treatment T1, T2 and T3 were 6.4, 7.2 and 7.2 respectively. The treatment T2 and T3 were significantly superior over T1 treatment. Gavane *et al.* (2010) reported that, blending of a maximum of 2% of custard apple pulp had a positive appeal on the body and texture of shrikhand.

### Colour and appearance

The variation in colour and appearance score was observed (table 3 and 4) to be statistically significant due to effect of various treatments. It was observed that score of colour of fortified papaya with semolina kheer for treatment T1, T2 and T3 were 6.2, 7.0 and 5.8 respectively. The treatment T2 was significantly superior over T1 and T3 treatments and for appearance of fortified papaya with semolina kheer for treatment T1, T2 and T3 were 6.6, 7.0 and 5.0 respectively. The treatment T2 was significantly superior over T1 and T3 treatments. It was recorded that score of appearance of fortified papaya with besan halwa for treatment T1, T2 and T3 were 5.4, 6.2 and 7.2 respectively. The treatment T3 was significantly superior over T1 and T2 treatments and for appearance of fortified papaya with besan halwa for treatment T1, T2 and T3 were 5.4, 6.4 and 7.2 respectively. The treatment T3 was significantly superior over T1 and T2 treatments. Chavan *et al.* (2009) reported that the shrikhand samples prepared with addition of 15% strawberry pulp and 30 or 40% sugar were showed the better colour and appearance score than the other samples. Kumar *et al.* (2011) observed that, there was a decline in the trend in appearance score with increase in apple pulp, though the decline was not significant.

### Taste

The variation in the score of taste was observed statistically significant due to effect of various treatments. It was observed that score of taste of fortified papaya with semolina kheer for treatment T1, T2 and T3 were 5.6, 6.8 and 5.8 respectively. The treatment T2 was significantly superior over T1 and T3 treatments. While texture of papaya in fortified besan halwa for treatment T1, T2 and T3 were 5.8, 7.2 and 7.8 respectively. The treatment T3 was significantly superior over T1 and T2 treatment.

### Overall acceptability

The data of overall acceptability score was observed to be statistically significant (table-3 and 4) due to effect of various treatments. It was observed that score of overall acceptability of fortified papaya with semolina kheer for treatment T1, T2 and T3 were 5.8, 7.0 and 5.6 respectively. The treatment T2 was significantly superior over T1 and T3 treatments. The score of overall acceptability of fortified papaya with besan halwa for treatment T1, T2 and T3 were 5.6, 6.4 and 7.3 respectively. The treatment T3 was significantly superior over T1 and T2 treatments. Mali *et al.* (2010) reported that the significantly highest score for overall acceptability was

obtained in shrikhand prepared with 20% papaya pulp, while the lowest score was obtained in shrikhand prepared without papaya pulp. Narayanan and Lingam (2013) reported that highest score 8.66 for 20% ripe banana shrikhand improves the overall acceptability over control.

### Conclusion

Dried papaya powder is rich in vitamin A and proteolytic enzyme. Vitamin A deficiency is a major health problem in India especially for preschoolers. Although very little information is available on account of the supplementation of papaya powder in cereal based and fat rich recipes. The final outcome of all the treatments emphasis the best combination of papaya powder with semolina kheer and besan halwa strongly supported on the basis of score of appearance, taste, flavor, colour, texture and overall acceptability of fortified papaya for semolina kheer of treatment-2 (20% papaya powder) were 7.0, 6.8, 7.0, 7.0, 7.2 and 7.0 respectively for semolina kheer and for besan halwa treatment-3 (30% papaya powder) were 7.2, 7.8, 7.2, 7.2, 7.2 and 7.3.

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