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Standardization of Bael /Blended Extruded Products

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Abstract:-The present investigation was undertaken to develop powder from bael fruit, to study the sensory, functional and nutritional qualities of bael fruit powder & to utilize fruit powder for value added products. The process for preparation of powder was standardized. The sensory evaluation of fruit powder indicated that the bael powder was liked moderately by the panelist. Bael powder was incorporated (10% & 20%) in extruded products extruded products (vermicelli, pasta, macaroni).Sensory characteristics indicated that all the products were organoleptically acceptable in terms of colour, appearance, flavor, texture, taste and overall acceptability. An attempt was also made to check the field acceptability of these bael powder based products, which proved successful and received a positive response from the respondents.

Keywords: Bael pulp, bael powder and extruded products, acceptability, nutritional evaluation.

I. INTRODUCTION

Bael fruit (*Aegle marmelos Correa*) is well known and respected all over the planet, east and west for its healing properties. The bael occupies an important place among the indigenous fruits of India. The history of this tree has been traced to Vedic period 200 BC-800 BC. The mention of bael fruit has been made in Yajur Veda. The tree has great mythological significance and it abounds in the vicinity of temples. It is a woody and smooth food, which is 5 to 15 cm in diameter and belongs to family Rutaceae. It is also known as "Bengal Quince". In addition to India, it is also grown in Sri Lanka, Pakistan, Bangladesh, Burma, Nepal and several South-East Asian countries [1] it has also been introduced into Florida and Hawaii regions of the USA. However, it can be grown on a wide range of soils and can tolerate temperatures as low as -7^0C and as high as 48^0C [2]. Fruits take 11 months to ripen.

The bael fruit is one of the most nutritious fruit and used for the preparation of number of products like candy, squash toffee, pulp-powder and nectar. The energy value of bael is found to be at least 1.5 times greater than either of orange or grapefruit. According to Gopalan *et al.* [3], edible portion of bael contains 61.59 per cent water, 0.3 per cent fat, 1.7 per cent minerals, 2.91 per cent fiber and 37.8 per cent carbohydrates. B-carotene content is 5.2mg/100g also higher than most of the reputed fruits like apple, guava and mango [4].Dehydration as drying is the most widely used methods of food preservation. During dehydration of bael fruit pulp, carbohydrate & crude fat content increased while protein content decreased. It might be due to the destruction of some of the proteins while reacting with the peroxides produced during lipid oxidation. On dehydration as nutrients becomes concentrated, the proximate composition as fiber, ash, total carbohydrates, protein & fat were 4.09%, 5.83%, 79.82%, 5.48%, 4.55%, respectively. Ascorbic acid content on drying increased i.e. from13.35 to 39.62mg/100g of bael powder. The shelf life of perishables could be extended by arresting the water activity through sun or mechanical means of dehydration. Therefore, the present investigation was planned to undertake with the following objectives: To assess the nutritional composition of bael fruit powder and to develop value-added extruded products incorporating bael fruit powder and study their nutrient composition and storage.

II. MATERIAL AND METHODS

Fully ripened bael fruit harvested in May were used for the preparation of value added extruded products. The bulk sample of bael fruit grown at the experimental orchard of CCS Haryana Agricultural University and Regional Research Station, Bawal (Rewari) was obtained in single lot for experimental work.

Preparation of Bael powder

Bael fruit powder was prepared by drying the pulp after adding 2000 ppm SO_2 in the form of a thin sheet to 10 per cent moisture. The sheets were then cut in to pieces and further dried to below 4 per cent moisture in a cabinet drier at 60 ± 5^0C. The pieces were ground in to powder in a grinding machine [5]. The flow sheet of bael fruit powder is given below.

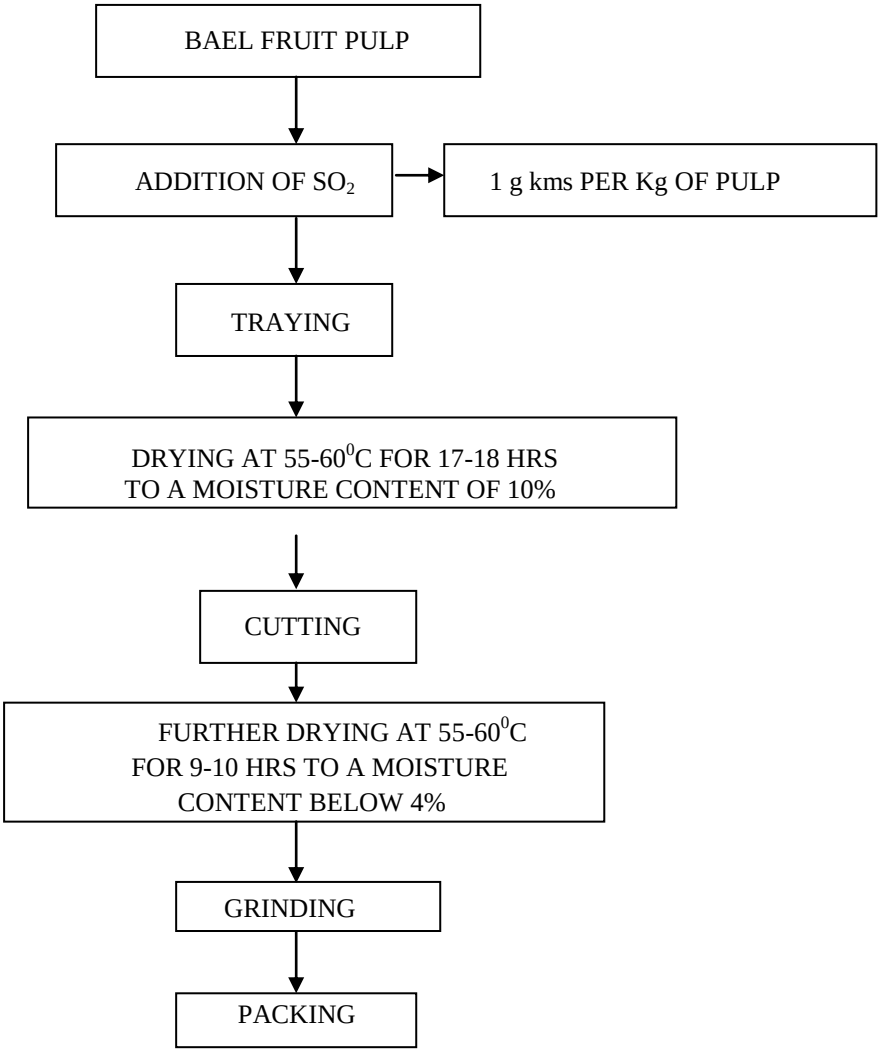

Fig:-2 Flow sheet for the preparation of bael fruit powder

Nutritional evaluation of bael fruit and products.

The powder and the best acceptable products were analyzed for proximate composition, carbohydrates, in-vitro digestibility, ant nutrient, total minerals and vitamin using standard methods for all the nutritional parameters in triplicate.

Proximate composition i.e.

Moisture, Crude protein, Crude fat, Ash, Crude fiber were analysed by AOAC, [6]

Total carbohydrates: -Total carbohydrates were assessed by difference method.

Total CHO=100-(moisture +protein +fat +fiber +ash content)

Carbohydrates: - Total soluble sugars were extracted by the method of Cerning and Guilhot [7]. **Total soluble sugars:** Total soluble sugars were estimated by the method of Yemm and Willis [8]. **Reducing sugars:** Reducing sugars were estimated by Somogyi's [9] modified method. N**on reducing sugars:** (by difference) :-The amount of non-reducing sugars was calculated by the differences between the amounts of total soluble sugar and reducing sugars.

In vitro digestibility: *In vitro* protein digestibility *In vitro* protein digestibility was determined by the modified method of Mertz *et al.* [10].

$$\text{Protein digestibility (\%)} = \frac{\text{Digested protein}}{\text{Total protein}} \times 100$$

***In vitro* starch digestibility**

In vitro starch digestibility was assessed as per the method of Singh *et al*. [11].

Antinutrient: - Tannin content was estimated by the method of Singh and Jambunathan, 1981. **Minerals: - Acid digestion** .**Ca, Iron, Mg and Zn Lindsey and Norwell, [12]**

Phosphorus:-Phosphorus was determined calorimetrically by the method of Chen *et al.* [13]. **Vitamins: -**vitamins such as β-carotene & vitamin C were analyzed by the same method as mentioned earlier in 3.3.5.1 & 3.3.5.2.

EXTRUDED PRODUCTS. The Bael powder was used for the preparation of traditional (sweet & salty), baked and extruded products by utilizing bael powder in two proportion i.e.10% and 20% in standardized recipes. Refined flour was replaced with bael powder for the preparation of extrudates (*pasta, vermicelli, & macaroni*).These all are prepared by standardized methods.

III. RESULT & DISCUSSION

Fruits have excellent nutritional quality. These are good sources of vitamins and minerals and are low in fat and high in fibre. This fruit is a very good source of protein that is 5.12 per cent of the edible portion. Edible portion of bael contains 2.90 per cent fibre, 1.71 per cent mineral and 37.80 per cent carbohydrates. It is also a rich source of vitamin A (186 IU/100g pulp) richer than most of the reputed fruits like apple, guava and mango Jauhari and Singh, [4]. Keeping all this in view, the present investigation was conducted to develop bael powder and its utilization for value addition of products. Nutritional composition, organoleptic quality, field acceptability and shelf life of these value added products were studied. The results of the study are presented. **Extruded products** as Vermicelli, Pasta &Macaroni. The bael powder was prepared as per procedure outlined by Rai and Misra [15]. The powder was then analyzed for all the nutritional parameters as: moisture, protein, fat, fibre, ash, carbohydrates, in vitro digestibility, antinutrient and vitamins (Table 1).

Moisture content of bael powder was 5.2 per cent. The crude protein content of bael powder was 5.4 per cent. Rai *et al.* [16] reported similar results as 5.48 per cent crude protein in bael powder. Whereas, Gopalan *et al.* [17] reported 1.8 g/100g protein in edible portion of bael fruit and bitter gourd fruit.

Table 1: Nutritional evaluation of bael powder (on dry matter basis.)

S.No.	Parameter	Fresh bael pulp	Bael powder
1.	Moisture (%)	66.00	5.20
2.	Protein (%)	4.70	5.40
3.	Fat (%)	0.10	0.62
4.	Ash (%)	0.03	5.83
5.	Fibre (%)	0.02	5.34
6.	Total carbohydrates (%)	22.3	79.82
7.	Total sugars (mg/100g)	35.70	89.60
8.	Reducing sugars (mg/100g)	7.90	18.64
9.	Non reducing sugars (mg/100g)	27.80	70.96
10.	In-vitro protein digestibility	-	70.84
11.	In-vitro starch digestibility	-	32.40
12.	Tannin (%)	6.60	8.60
13.	β-Carotene (mg/100g)	0.05	5.20
14.	Ascorbic acid (mg/100g)	13.30	39.62
15.	Calcium (mg/100g)	117.60	234.40
16.	Iron (mg/100g)	52.20	106.60
17.	Phosphorous (mg/100g)	78.80	151.40
18.	Zinc (mg/100g)	-	-
19.	Magnesium (mg/100g)	-	-

Extruded products

Pasta

Mean scores of sensory characteristics of pasta are given in Table 2. Mean scores of colour of pasta indicated that colour of control pasta and pasta prepared by using 10 per cent and 20 per cent bael powder were liked moderately by the panelist and there was non significant difference in colour of control pasta and type I and type II pasta. Mean scores of appearance of pasta indicated that the appearance of control and type I pasta prepared by using 10 per cent bael powder were liked very much by the panel of judges. However, type II pasta prepared by using 20 per cent bael powder were in liked moderately category. Mean scores of flavour of pasta indicated that control pasta were in liked very much category. However, type I and II pasta prepared by using 10 per cent and 20 per cent bael powder were liked moderately by the panelist and the difference was non significant.

Mean scores of texture of pasta indicated that the control pasta were in liked very much category. However, type I and type II pasta prepared by using 10 per cent and 20 per cent bael powder were in liked moderately category. There was non-significant difference in the taste of control pasta and bael powder incorporated pasta. Mean scores of overall acceptability of pasta indicated that there was no difference in overall acceptability of control and type I and type II pasta prepared by using 10 per cent and 20 per cent bael powder. The pasta prepared by incorporating 10% and 20% bael powder were acceptable and almost similar to control pasta in terms of colour, appearance, texture, taste and over all acceptability.

Macaroni

Mean scores of sensory characteristics of macaroni are given in Table 3. Mean scores of colour of macaroni indicated that control macaroni and type I macaroni prepared by using 10 per cent bael powder were in liked very much category. However, type II macaroni prepared by using 20 per cent bael powder were liked moderately by the panelist.

Table 2: Mean scores of various sensory characteristics of *pasta* prepared using bael powder

Product	Colour	Appearance	Flavour	Texture	Taste	Over all acceptability
Control	7.90±0.18	8.00±0.21	8.10±0.23	8.00±0.25	7.90±0.23	7.98±0.21
I	7.80±0.20	8.00±0.25	7.90±0.23	7.80±0.24	7.80±0.24	7.86±0.22
II	7.50±0.26	7.60±0.26	7.50±0.26	7.40±0.30	7.40±0.26	7.50±0.26
CD (P<0.05)	NS	NS	NS	NS	NS	NS

Control = 100% refined flour.

I = 90% refined flour + 10% Bael powder. II = 80% refined flour + 20% Bael powder.Values are mean ± S.E. of ten panelist NS= Non significant

Table 3: Mean scores of various sensory characteristics of *macaroni* prepared using bael powder

Product	Colour	Appearance	Flavour	Texture	Taste	Over all acceptability
Control	8.20±0.13	8.70±0.15	7.50±0.16	8.50±0.17	8.70±0.15	8.21±0.10
I	8.30±0.15	7.30±0.35	7.40±0.30	7.40±0.22	7.40±0.22	7.56±0.22
II	6.60±0.30	7.30±0.30	6.70±0.30	6.70±0.30	7.70±0.30	7.00±0.28
CD (P<0.05)	0.61	0.79	0.76	0.68	0.67	0.62

Control = 100% refined flour.I = 90% refined flour + 10% Bael powder.II = 80% refined flour + 20% Bael powder.
Values are mean ± S.E. of ten panelist NS= Non significant

Mean scores of appearance of macaroni indicated that the control macaroni were in liked very much category. However, type I and II macaroni prepared by using 10 per cent and 20 per cent bael powder were liked moderately by the panelists. Mean scores of flavour indicated that the flavour of control and type I macaroni prepared by using 10 per cent bael powder were liked moderately by the panelist. However, the type II macaroni prepared by using 20 per cent bael powder were significantly lower and were liked slightly by the panelists.

There was significant difference observed in texture of control macaroni and type I and type II bael powder incorporated macaroni. Mean scores of taste of macaroni indicated that taste of control macaroni were liked very much by the panelist. However, type I and type II macaroni prepared by using 10 per cent and 20 per cent bael powder were liked moderately by the panelist. There was significant difference in the mean scores of taste of macaroni.

Mean scores of overall acceptability of macaroni indicated that control macaroni were in liked very much category. However, type I and II macaroni prepared by using 10 per cent and 20 per cent bael powder were liked moderately by the panel of judges. The difference was non-significant in overall acceptability of macaroni. The macaroni prepared by incorporating 10% and

20% bael powder were acceptable and almost similar to control macaroni in terms of colour, appearance, texture, taste and over all acceptability except flavour, texture and colour of macaroni which was prepared by incorporating 20% bael powder.

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