International Journal of Food Science and Nutrition
ISSN: 2455-4898, Impact Factor: RJIF 5.14
www.foodsciencejournal.com
Volume 1; Issue 5; September 2016; Page No. 06-09

Preparation and nutritive value of Himalayan wild apricot fruit rolls

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Abstract
The study was conducted to standardize the protocol for the preparation of wild apricot fruit roll and to find its nutritive value. The standardization of the recipe was done by evaluating sensory properties. Hedonic rating for taste, flavor, color, texture and overall acceptability was highest for sample 3 and was significantly different from hedonic rating of all the properties as compared to all the other three samples indicating that the sample 3 of the Apricot product was the most liked product by the panel of 10 judges ($p<0.05$). The minimum rating for sample 3 was 7.8 for color, 7.5 for texture, 7.6 for taste, 7.5 for flavor and 8 for overall acceptability whereas the maximum rating was 9.0 for color, 9.0 for texture, 9.0 for taste, 9.0 for flavor and 9.0 for overall acceptability. The mean rating for sample 1 was highest for taste 8.6 and lowest for color 8.3. The mean rating for overall acceptability was 8.5 and that for texture and flavor was 8.4. The overall acceptability score of 8.5 indicates that the product was liked extremely by the panel. Physico chemical properties of the most accepted products that is sample 3 was done by the standard procedures.

Keywords: Himalayan wild apricot, minerals, vitamins & antioxidants

1. Introduction
Apricot (Prunus armeniaca L.) is one of the most tasty temperate fruits (Bhat *et al*. 2002) [3]. It is one of the most nutritionally rich fruit. Apricot is a good source of carbohydrates and minerals besides having attractive colour and flavour (Ghorpade *et al*. 1995) [9]. Glucose, fructose, sucrose, sorbitol and malic acid and citric acid are the major constituents of Apricot. It is also good source of minerals such as potassium, sodium and iron (Lal *et al*. 1989; Hui 1992) [11]. Uttarakhand, Himachal Pradesh, Jammu and Kashmir are the states in India where major production of the Apricot is done. 38, 31, 823 tonnes is the total production of apricot from an area of 5, 20, 455 ha (FAO 2010) [7].
Out of this, India produces is about 10,000 tonnes of cultivated apricot from an area of 2,400 ha. On an average the productivity of apricot is about 4.17 tonnes/ha. In Uttarakhand, apricot (including wild forms) is grown over an area of 9,156 ha, with annual fruit production of 30,948 tonnes (Anonymous 2008). It is an important temperate fruit used as fresh and also in preserved form.
Fruit leather or fruit bar also known as fruit roll up means is a sheet of dried pureed fruit prepared by blending from ripe fruit, fresh or previously preserved nutritive sweeteners, fat or milk solids & other ingredients required for the product which can be mould into desired shape or size (Food Safety & Standards Authority of India, Act 2006 & Rule 2011) [8].
Fruit bar is a dried fruit-based confectionery dietary product which is generally taken as snack or dessert (C.Raab 1976) [4]. Different methods for drying such as convective, far-infrared drying, hot air drying, solar drying, sun drying, and microwave drying, can be used to make fruit leathers. Most of them are dried at 30 to 80 °C for up to 24 hours until the target final moisture content (12–20%) has been reached. Fruit leather are generally low in calories, less than 100 Kcal per serving, then many other fried snack. Fruit leathers are dehydrated fruit made from fresh fruit pulp or a mixture of fruit juice and other ingredients. Puree based fruit leathers are nutritive & organoleptically acceptable. Fruit leather have ample quantities of dietary fibers, minerals, vitamins & antioxidants (Damodaran S., *et al*., 2010) [6].
Fruit leather is one product that can be made by using a drying process. Fruit leathers are dried sheets of fruit pulp that have a soft, rubbery texture and have tangy-sweet taste. Fruit leathers can be dried using various drying forces including sun drying, oven drying, cabinet drying & dehydrator drying. The pulp of fruit (one or more types) is pureed, mixed with other ingredients to improve its physico-chemical & sensory characteristics (Phimpharian *et al*., 2011) [13]. Wide variety of fruits such as guava, banana, papaya, mango, sapota, apple, jackfruit etc. can be used to prepare the fruit leather (Mathur *et al*. 1972) [12].
Ahmad *et al*. (2005) [1] developed a procedure by which fruit bar was made from mixture of ripe papaya and pulp of tomato in the ratio 75:25 on weight basis. Papaya leather from pasteurized pulp was prepared with addition of 15% sugar, 0.5% citric acid and drying at 70 °C for 4.5 hrs in thin layer (4–5 mm) in tray drier (Sandhu *et al*. 2008) [15]. 11.20g of defatted soy flour, 3.00g of stevia, and 1.57 g/100 g of pectin pulp were optimized for preparation of pineapple fruit bar (Kulshrestha *et al*. 2008) [10]. Apricot fruit bar prepared by dehydration of apricot puree with supplementation of with soy slurry, had high level of protein and fat (Chauhan *et al*. 1993) [5].
Ample of information is available on the preparation of fruit bars from different fruits including various varieties of apricot, but the acquataince on the utilization of the wild forms of apricot, which are otherwise unsuitable for table purposes and are treated as a waste for fresh consumption, for the preparation of wild apricot fruit bar is rare in literature. Hence, the present study was undertaken to standardize the protocol for the preparation of fruit roll from wild apricot

grown in Uttarakhand and to evaluate the physico chemical properties of developed product.

2. Objectives

- To prepare and standardize wild apricot fruit leather.
- To assess the sensory quality of prepared fruit leather.
- To assess the physico-chemical quality of the most accepted fruit leather.

3. Materials and Methods

The aim of the study was to prepare and standardize recipe of Himalayan wild apricot. The fruit roll was biochemically analyzed for the amount of carbohydrates, protein, fat, crude fiber, dietary fiber, sodium and potassium. Ripe fruits of wild apricot were procured from Uttarkashi located at an altitude of 1500–2000 m above mean sea level.

After sorting, washing, peeling fruits were dip slice in the solution containing 0.3% ascorbic acid, 0.2% citric acid and 0.1% KMS for 30 minutes and then steam blanched for 4-5 minutes in in a stainless steel pan by adding water (100 ml/kg of fruit) and passed through the pulper for extraction.

For, additives like sugar and pectin were added to the pulp in different proportions A1 (Pulp +40% sugar +0.20% pectin), A2 (Pulp +40% sugar +0.30% pectin), A3 (Pulp +40% sugar +0.40% pectin), A4 (Pulp +50% sugar +0.20% pectin), about 50 g of sugar was retained for mixing in pectin for its uniform distribution. Weighed quantities of pectin were added to the mixture of pulp and sugar by uniform sprinkling and continuous mixing. The mixture when ready in each treatment was poured into aluminum trays (smeared with butter) in layers. The trays were kept in solar cabinet dryer and product was dried at solar cabinet dryer. After drying, fruit bar sheets were cut into rectangular shapes and then rolled.

Apricot Fruit Bar	
Apricot	1 Kg
Sugar	40%A1, 40%A2, 40%A3, 50% A4
Liquid glucose	50 gm
Citric acid	2gm+2gm
Pectin	0.20%A1, 0.30%A2, 0.40%A3, 0.20%A4
KMS	1+1 gm
Ascorbic Acid	3 gm
Water	50 ml

Method

- Select Fully matured fruits
- Wash fruits using clean tap water
- Peel the fruits using peeler and slice
- Dip the slices in the solution containing
- 0.3% ascorbic acid,0.2% citric acid and 0.1% KMS for 30 minutes
- Steam blanch the slices for 4-5 minutes
- Pass the slices through the junior pulp extractor
- Collect the pulp in a vessel
- Blend the pulp with syrup
- Pour the mixture into stainless steel trays and dry in solar cabinet dryer
- After drying cut into slabs
- Pack in plastic boxes and shrink wrap the container

(b). Syrup preparation	
Sugar	100 gm
Citric acid	2 gm
Pectin	1gm
KMS	1gm
Water	50 ml

Method

- 100 gm and dissolve the content in 50 ml of water under low flame so that it dissolves properly
- Add 2 gm of citric acid (0.2%)which was pre dissolved in small quantity of water and 1gm of pectin to the above content
- Add the above mixture to 1 kg of apricot pulp
- Add 1 gm of potassium metabisulphite (0.1%) which was pre-dissolved in small quantity of water.

Homogenize the mixture using electric homogenizer

Fruit bars were evaluated for sensory quality on the basis of colour, texture, taste, flavour and overall acceptability by semi - trained panel of 10 judges consisting of males and females of age 20–50 years on 9 point Hedonic scale (Amerine *et al*. 1965) [2]. Where 1 = dislike extremely, 5 = neither like nor dislike and 9 = like extremely (Amerine *et al*. 1965) [2]. An average score was taken for each parameter for standardization of the recipe, and standard deviation was computed to assess deviation among the scores of panelists.

Standard procedures were followed for the estimation of physico-chemical quality parameters like moisture, acidity, reducing sugars, total sugars, ascorbic acid and sensory quality (Ranganna 1997; Sharma and Nautiyal 2009) [14, 16].

Statistical Methods

Data were analyzed using SPSS software for Windows (version 16.0, 2007, SPSS Inc, Chicago, IL). Data are presented as Mean ± SD. Descriptive Statistics were used to find the mean, standard deviation, minimum and maximum values for different properties of samples that were evaluated using Hedonic rating scale. One-way ANOVA with post-hoc Tukey's test was used to analyse the difference in the mean hedonic rating values for colour, texture, taste, flavour and overall acceptability of the 4 products.

4. Results

Apricot was used to develop Apricot Rolls. 4 variations of each sample were created with some variations in the composition of the food products. A panel of 10 judges used a 9 point Hedonic rating scale ranging from 1 as dislike extremely to 9 as like extremely to assess the acceptability of the developed food products.

Hedonic rating scale of apricot products

Table 1 gives Hedonic rating scale of Sample 1 made using Apricot. The minimum rating for sample 1 was 6 for color, 6 for texture, 6.8 for taste, 6 for flavor and 6 for overall acceptability whereas the maximum rating was 7.7 for color, 7.3 for texture, 7.5 for taste, 7.2 for flavor and 7.5 for overall acceptability (Table 1). The mean rating for sample 1 was highest for taste (7.1) and lowest for texture (6.5) (Table 1).

The mean rating was 6.6 for color and 6.7 for both flavor and overall acceptability (Table 1). The overall acceptability score of 6.7 indicates that the product was liked moderately by the panel (Table 1).

Table 1: Hedonic Rating Sample 1 Apricot Product

	Color	Texture	Taste	Flavor	Overall acceptability
Mean	6.6	6.5	7.1	6.7	6.7
Standard Deviation	0.5	0.5	0.3	0.4	0.4
Minimum	6.0	6.0	6.8	6.0	6.0
Maximum	7.7	7.3	7.5	7.2	7.5

Data presented as actual values

Table 2 gives Hedonic rating scale of Sample 2 made using Apricot. The minimum rating for sample 2 was 6 for color, 6 for texture, 6 for taste, 6.8 for flavor and 6.5 for overall acceptability whereas the maximum rating was 7.7 for color, 7.7 for texture, 7.5 for taste, 7.7 for flavor and 7.5 for overall acceptability (Table 2). The mean rating for sample 1 was highest for taste, flavor and overall acceptability (7.1) and lowest for texture (6.9) (Table 2). The mean rating for texture was 6.9 (Table 2). The overall acceptability score of 7.1 indicates that the product was liked moderately by the panel (Table 2).

Table 2: Hedonic Rating Sample 2 Apricot Product

	Color	Texture	Taste	Flavor	Overall acceptability
Mean	7.0	6.9	7.1	7.1	7.1
Standard Deviation	0.5	0.5	0.4	0.3	0.4
Minimum	6.0	6.0	6.0	6.8	6.5
Maximum	7.7	7.7	7.5	7.7	7.5

Data presented as actual values

Table 3 gives Hedonic rating scale of Sample 3 made using Apricot. The minimum rating for sample 3 was 7.8 for color, 7.5 for texture, 7.6 for taste, 7.5 for flavor and 8 for overall acceptability whereas the maximum rating was 9.0 for color, 9.0 for texture, 9.0 for taste, 9.0 for flavor and 9.0 for overall acceptability (Table 3). The mean rating for sample 1 was highest for taste (8.6) and lowest for color (8.3) (Table 3). The mean rating for overall acceptability was 8.5 and that for texture and flavor was 8.4 (Table 3). The overall acceptability score of 8.5 indicates that the product was liked extremely by the panel (Table 3).

Table 3: Hedonic Rating Sample 3 Apricot Product

	Color	Texture	Taste	Flavor	Overall acceptability
Mean	8.3	8.4	8.6	8.4	8.5
Standard Deviation	0.5	0.5	0.5	0.5	0.4
Minimum	7.8	7.5	7.6	7.5	8.0
Maximum	9.0	9.0	9.0	9.0	9.0

Data presented as actual values

Table 4 gives Hedonic rating scale of Sample 4 made using Apricot. The minimum rating for sample 4 was 7 for color, 7.1 for texture, 7 for taste, 7 for flavor and 7 for overall acceptability whereas the maximum rating was 8.2 for color, 8 for texture, 8.4 for taste, 8.8 for flavor and 8 for overall acceptability (Table 4). The mean rating for sample 1 was highest for texture and taste (7.5) and lowest for color, flavor and overall acceptability (7.4) (Table 4). The overall acceptability score of 7.4 indicates that the product was liked moderately by the panel (Table 4).

Table 4: Hedonic Rating Sample 4 Apricot Product

	Color	Texture	Taste	Flavor	Overall acceptability
Mean	7.4	7.5	7.5	7.4	7.4
Standard Deviation	0.3	0.4	0.4	0.6	0.5
Minimum	7.0	7.1	7.0	7.0	7.0
Maximum	8.2	8.0	8.4	8.8	8.0

Data presented as actual values

Table 5 compares the hedonic rating of all 4 samples of apricot against each other for all properties, i.e. color, texture, taste, flavor and overall acceptability. As seen in Table 5, hedonic rating for color, texture, taste, flavor and overall acceptability was highest for sample 3 and was significantly difference from hedonic rating for all properties as compared to all the other 3 samples indicating that "sample 3" of the Apricot product was the most liked product by the panel of 10 judges ($p<0.05$). After sample 3, sample 4 had the highest rating for all properties followed by sample 2 and lastly sample 1 (Table 5). Sample 4 had significantly higher ratings for color as compared to sample 1; significantly higher rating for texture as compared to sample 1 and sample 2 and significantly higher ratings for flavor and overall acceptability as compared to sample 1 indicating that even "sample 4" was more liked as compared to sample 1 and

sample 2 of apricot ($p<0.05$) (Table 5). Sample 1 and sample 2 had the lowest hedonic rating of all the 4 samples of apricot and there was no significant difference in any properties between sample 1 and sample 2 indicating that of the 4 samples, "sample 1" and "sample 2" were the least liked products of apricot ($p>0.05$) (Table 5).

Table 5: Hedonic rating of the Apricot products

	Sample 1	Sample 2	Sample 3	Sample 4
Color	6.6±0.5*#	7.0±0.5*	8.3±0.5	7.4±0.3*
Texture	6.5±0.4*#	6.9±0.5*#	8.4±0.5	7.5±0.4*
Taste	7.1±0.2*	7.1±0.4*	8.6±0.5	7.5±0.4*
Flavor	6.7±0.4*#	7.1±0.3*	8.4±0.5	7.4±0.6*
Overall Acceptability	6.7±0.4*#	7.1±0.4*	8.5±0.4	7.4±0.6*

Data presented as Mean±SD
*significant difference from Sample 3 ($p<0.05$)
#significant difference from Sample 4 ($p<0.05$)

Physical Properties

Standard procedures were followed for the estimation of physico-chemical quality parameters like moisture, acidity, reducing sugars, total sugars, ascorbic acid and sensory quality (Ranganna 1997; Sharma and Nautiyal 2009) [14, 16].

S. No.	Parameter	Result	Test Method
1.	Colour	Black	Physical
2.	Thickness, mm	2.02	Physical

Physico Chemical Analysis

The apricot fruit roll prepared was analyzed for their physico-chemical properties. Energy, protein, fat, carbohydrates, vitamin C, crude fiber, dietary fiber, total sugar, sodium, potassium of the most accepted samples were estimated by standard methods.

	Parameter	Results	Test Method
1	Energy, Kcal/100gm	329.31	By Calculation
2	Protein, gm/100gm	Not Detected	IS: 7219: 1973
3	Fat, gm/100gm	0.24	IS: 4684: 1975
4	Carbohydrates, gm/100gm	81.81	IS: 1656: 2007
5	Vitamin C, gm/100gm	27.44	IS: 5838: 1970
6	Crude Fiber, gm/100gm	2.16	IS: 10226: 1982(P-1)
7	Dietary Fiber, gm/100gm	4.21	AOAC 985.29
8	Total Sugar, gm/100gm	6.11	IS: 4979: 1970
9	Sodium,mg/100gm	48.00	FRAC/SOP/INST/242
10	Potassium, gm/100mg	307.32	FRAC/SOP/INST/242

5. Conclusion

The studies shows that the preparation of apricot roll can be scaled up to small scale level and can be used as nutritional and functional food adjunct. The product has considerable amount of carbohydrate, dietary fibers, vitamin C and other minerals. It can be easily prepared by using wild apricot pulp +60% sugar +0.30% pectin and drying the mixture in a mechanical dehydrator and thus the recipe was optimized.

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