

**TRADITIONAL FRUIT PRODUCTS: FRUIT LEATHERS WITH
A NEW POTENTIAL MEMBER, GOLDENBERRY LEATHER**

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Abstract

The fruit leathers are common traditional fruit products in Turkey. This popular product group is commonly produced from grape, mulberry, apple, apricot, plum etc. These traditional products are produced by fruit pulp mixed with wheat starch. The cooking procedure is a general heating process and mixture of fruit and starch forms a paste when the temperature of mixture exceeds 55-60°C at which starch gelatinization occurs. The fruit-starch paste is spread in a tray for drying. As a drying method, drying under sunlight and drying in a conventional hot air dryer are common used methods. After drying the fruit leathers become microbiologically safe products and can be easily stored without extreme storage conditions. In this study it is aimed to provide general information about fruit leathers popular in Turkey, and to introduce a new leather produced from goldenberry interest of researchers on which has been increased in recent times due especially to its high biological potential including antioxidant activity, high fiber and carotenoid contents.

Key words: Fruit leathers, process, goldenberry, nutritional properties

1. INTRODUCTION

Fruit leathers (Pestil) are traditional food stuffs. Leathers are traditionally produced in summer and fall seasons depending on originated fruit type for winter period due in part to their high energy contents. Fruit leathers also possess high nutritional values due in part to vitamins and mineral contents. In Turkey particularly apple, grape, apricot, plum, mulberry etc. have been processed to leather and frequently consumed. Addition to the homemade production, small sized enterprises have fruit leathers in their product group. Turkey has a high production potential of fruits, particularly summer fruits, so in this extent processed fruit products, one of which is the fruit leathers production, are also significant to utilize these excess amount of fruit productions which could not be consumed fresh and not to be easy to store (Eksi & Artik 1984).

This group product has been taking increasing interest of researchers and consumers nowadays due to coming out of importance of healthy diet. Comparing to the junk foods just having high energy without nutritional content, fruit originated leathers are rich in minerals and vitamins besides of sugars being main contributors of their energy contents (Batu et al. 2007). In the fact of this statement it could be said that the leathers have high potential for being preferable towards to the junk foods.

In terms of the production amount, grape leather is coming first in order. The grape related researches have figured out its nutritional value and particularly mineral potential has been mentioned. Iron, calcium, phosphor, potassium, magnesium are main mineral members of grape leathers. Additionally it was reported to be rich in tiamin and B6 (Eksi & Artik 1984). Similarly other fruit leathers keep nutritional properties of their originated fruits. This presents the significance of fruit leathers in terms of diet.

Part of the functional and nutritional properties of fruit leathers are arisen from main ingredient of this product group which is starch. Starch has significant properties affecting textural of leathers due in part to its interaction with water molecules under heat influence (Maskan et al. 2002). This interaction in between starch and water molecules is identifier in drying properties of leather production and final product structure. Additionally starches originated from different sources take in place in the group of carbohydrates which is significant for nutritional potential of leathers (Eksi & Artik 1984).

Fruit leathers are produced from different fruits and labeled depending on these fruits like grape leather, plum leather, mulberry leather etc. Although depending on fruit type used leathers are named, the production steps of process are similar for all leather types, as can been seen in Figure 1.

The well-known products, fruit leathers are evaluated according to quality parameters. Visual appearance of product is used for the first quality judgment, thus color of final product gain high importance. The remaining quality parameters are taste, odor and texture (Avila & Silva 1999; Lopez et al. 1997; Rhim et al. 1989). All these parameters are dependent on primarily fruit type from which leather is produced. For example, color of frequently produced fruit sheet, grape leather is related to the anthocyanin content of grape fruit (Rhim et al. 1989). On the other hand sugar content and their types of fruits are other factors directly affecting leather taste and texture. The compounds related to the odor of leather are also originated from fruits used. Thus the quality and ripeness of fruits are significant due to their determinative effects on final product quality. To consolidate the information given above, it is worth to present views about this group product, before mentioning about production step (Figure 1-6).



Figure 1. A view from fruit leather production.



Figure 2. A view from fruit leather production; spreading of fruit paste on cloths for drying.



Figure 3. A view from fruit leather production; drying of leathers under sun light.



Figure 4. A view from fruit leather production; drying of leathers under sun light for industry production.



Figure 5. A view from fruit leather production; folding of leathers before slicing.



Figure 6. A view from fruit leather production; folded leathers.

2. FRUIT LEATHER PRODUCTION

General fruit leather production was given in Figure 7. As mentioned before high quality fruits are selected due to direct influences on final product. Cleaning procedure includes washing and removing of stems from fruits to avoid passing undesirable compounds from stems and impurities. The following step is crushing and pressing of fruits. In this step fruits are mechanically damaged and pressure is applied to extract fruit juice from fruits. This fruit juice and pomace mixture is introduced to the filtration unit in next step to separate the fruit pomace from juice. Depending on product

clarification process is applied to raw fruit juice to remove substances causing turbidity. The next step is concentration of mixture. Fruit juice and starch are both introduced and boiled to aimed concentration level depending on fruit leather. After desired concentration level is achieved, the product is spread on a cloth before drying. Drying could be performed under sun light and/or hot air stream. Drying should be achieved from both sides, so fruit leather sheet is attached to wire for both side drying after upper side of fruit sheet is dried. At the end of drying process, fruit leather is removed easily by wetting back side of cloth with little amount of cold water. The dried fruit leather has such a suitable structure that it can be easily shaped and fold. At this point the significant issue is to spread the wheat flour, starch and/or sweet sugar flour (icing sugar) to avoid sticking of sheet layer to each other's after folding. The shaped and fold leathers are packed in humid resistant packing material and stored in a place having dry atmosphere.

The properties of fruit leathers and process steps are depended on fruit type used. One of the significant properties of fruit leathers, thickness ranges from 0.5 mm to 2 mm depending on fruits (Parlak & Bilisli 2004). Mixing of starch with fruit juice is the most significant step in the leather production, since starch interacts with water molecules under high temperature levels ($>55^{\circ}\text{C}$) which is called as gelatinization of starch. In some cases wheat flour can be also used instead of starch (Batu, et al. 2007). For fruits like apricot and plum stones should be removed before further processing. Crushing and pressing are required processes for grape and mulberry fruits and similar ones (Anonymous 2003; Cemeroğlu, & Karadeniz 2001). Clarification is another process applied in grape leather production (Cemeroğlu & Karadeniz 2001). Preheating is applied for plump and apricot like fruits to increase the juice yield.

3. NUTRITIONAL SIGNIFICANCE OF FRUIT LEATHERS

A demand for healthy diet and nutritional foods has been taken increasing attraction of consumers and researchers with awareness of significance of diet on human health. As a result reactions against consumption of junk foods just including content having high energy but without nutrients have risen. Traditional food stuff, fruit leather has high potential to substitute the junk foods in markets, since having high nutrients content and being good energy source. Another advantage of fruit leathers is being natural products. Table 1 and Table 2 indicated nutritional contents and mineral constituents of different leathers produced in Turkey (Eksi & Artik 1984). As can be seen from Table 1 that total solid content of all reported leathers are higher than 80% total sugar is the main constituent of which. The percentage of total sugar in total solid content is around 80%, although its amount for grape leather is calculated as more than 88% (Table 1). Remaining constituents of solid content are protein, fat, total acid and ash which vary depending on fruit used for leather production (Table 1).

Fruit leathers are also considered as a good source of minerals mainly including iron, phosphor, calcium, potassium, sodium, magnesium and copper (Table 2). Calcium and potassium varying in the large extend depending on fruit types are main mineral constituents which amounts of phosphor and sodium follow, whereas remaining are in miserable compared to others (Eksi & Artik 1984). In another study comparing different fruit leathers the coincidence results are reported by Cagindi and Otles (2005). In that study leathers produced from mulberry, apricot, and grape were examined and the analyzed properties, moisture, total solid, total sugar, protein, fat, ash contents were found to similar the results belonging to those reported by Eksi and Artik (1984) like that the highest ash content was found for apricot leather. Additionally the energy value of each leather was examined by Cagindi and Otles (2005). Energy values were found to be between 321.5 and 356.4 kcal/100g of which carbohydrates are main contributors, on the other hand no difference was reported for energy levels of studied leather samples (Cagindi & Otles 2005). This could be due in part to similar total sugar percentages of fruit leathers.

Appearance of fruit leather was crucial, since its direct impact on consumers' perceptions and decisions. Color is one of main appearance properties indicating stuff quality. In general extend fruit leathers carry characteristic color of fruits from which they are produced. Some process parameters and conditions could affect the color of final product. In this extend Cagindi and Otles (2005) reported possible influences of sun drying and thickness of leather.

As can be understood that the fruit leathers are nutritious food stuffs with high energy contents, so they should be preferred as substitutes of junk foods providing just excess energy without any nutritional constituents. Another advantage is to be stored for a long time without any deterioration for fruit leathers, so they would be used as nutritive products for winters.

Table 1. Nutritional constituents of different fruit leathers (Eksi & Artik 1984).

Constituent (%)	Mulberry	Plump	Apricot	Grape
Moisture content	14.3	19.5	17.3	11.3
Total dry material	85.7	80.5	82.7	88.7
Total sugar	83.4	79.0	80.1	87.6
Total acid	0.2	2.3	6.2	0.7
Protein	2.0	2.0	1.9	4.1
Ash	1.4	1.6	3.5	1.6
Fat	0.4	0.1	2.6	0.6

Table 2. Mineral constituents of fruit leathers (Eksi & Artik 1984)

Minerals (mg/kg)	Mulberry	Plump	Apricot	Grape
Iron	14	11	46	13
Copper	10	6	9	10
Phosphor	401	821	865	1099
Potassium	3881	8061	15206	5173
Sodium	215	245	207	203
Calcium	2507	3828	2318	2563
Magnesium	47	68	72	65

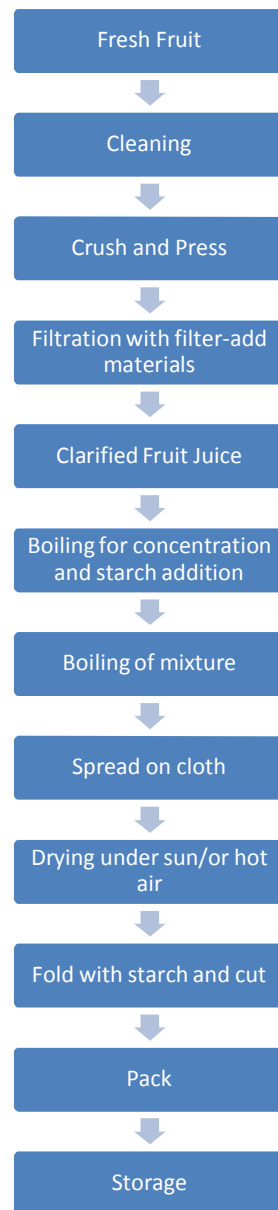


Figure 7. Flow chart of fruit leather production (Eksi & Artik 1984; Maskan, et al. 2002; Nas & Nas 1987)

4. GOLDENBERRY LEATHER

As mentioned above, it could be easy to find fruit leathers particularly including grape, apricot, plum, mulberry, however, the consumers continuously look for new food products. This attitude of consumers is common through the world, so actors in food industry continually try to develop new products in all fields of food products to meet demands of consumers.

In this extend it was thought to develop another leather and for which goldenberry being popular fruit of the recent times was used. The most distinct properties of golden berry attracting attentions are considered to be high fiber content, intense phenolic compound and carotenoid amount and related antioxidant activity value. Furthermore goldenberry being rich in unsaturated fatty acid composition includes high content of vitamin C, vitamin B complex, carotenoid (provitamin A) and minerals mainly phosphor, calcium and iron (Puente et al., 2011). Goldenberry is prominent with its high ascorbic acid content. In literature, it is reported to include high ascorbic acid (46mg AA/100g) compared to different fruits like apple (6mg AA/100g), peach (7mg AA/100g) and pear (4mg AA/100g) (Belitz & Grosch 1999). Goldenberry is also good source of carotenoids contributing the high antioxidant activity of this berry fruit (Ramadan & Mörsel 2003; Castro et al. 2008).

Goldenberry leather was produced in accordance with common method, but with few modifications. The first difference is the usage of fruit pulp produced by homogenization of fruit instead of fruit juice used in common process flow. Another difference no filtration was applied to pulp to remove fiber and other cellulosic substances from juice, on the contrary, whole fruit is processed due in part to include the beneficial effect of fibria substances in leather. Sugar was added besides to wheat starch owing to suppress sour taste of raw fruit including high amount of fruit acids. Except these differences, remaining process steps were carried out and the final product was produced with brilliant color and full flavor and textural properties.

5. CONCLUSION

As conclusion, it could be said that the fruit leathers are important food stuff, particularly in Turkey due to their high energy content with nutritional properties. Especially they are available in winter seasons for consumers providing similar properties and taste to fresh fruits which could not be stored for that long time periods. As mentioned above, goldenberry leather is seen to have high potential in this market group, since its high nutrients contents and fibers as a fresh fruit, if these properties could be successfully transferred to the leather.

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