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Babita Sharma
Department of Food Science and Technology, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, India

Devina Vaidya
Department of Food Science and Technology, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, India

Corresponding Author:
Babita Sharma
Department of Food Science and Technology, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, India

Standardization of dipping time for apple pops and apple rings (Sugar, honey)

Babita Sharma and Devina Vaidya

Abstract
New products were prepared from apples by osmotic dehydration. In the present study, osmotic dried apple rings and apple pop were developed from "Golden Delicious" apples. The technology was optimized for osmosis dried apple pops with a diameter of 28 mm and apple rings with a thickness of 0.5 cm, followed by dipping in sugar and honey syrup for four hours at 50 ° C. Osmo dried apple pops and rings with honey performed better in quality and sensory characteristics and with less water activity. Therefore, the developed technology can be explored commercially at an industrial level for the production of quality osmo dried apple pops, apple rings.

Keywords: Apple, apple pops, apple rings, honey

Introduction
The apple (*Malus domestica*) is one of the most important temperate fruits of Himachal Pradesh, which makes up about 49% of the total area of this fruit. It is cultivated in an area of 1, 10, 679 ha with a production of 7, 77.126 MT and a productivity of 7.02 MT / ha [1]. With great nutritional value, apple occupies an important place in state food products and plays a vital role in people's economy. The apple contains many nutrients including vitamin C, potassium and fiber [2]. Apples are processed into a variety of products, but by far the largest volume of processed apple products is in the form of juice. Apple juice, pulp and concentrate are the main processed products on the market. However, there is a lack of new products from apples.

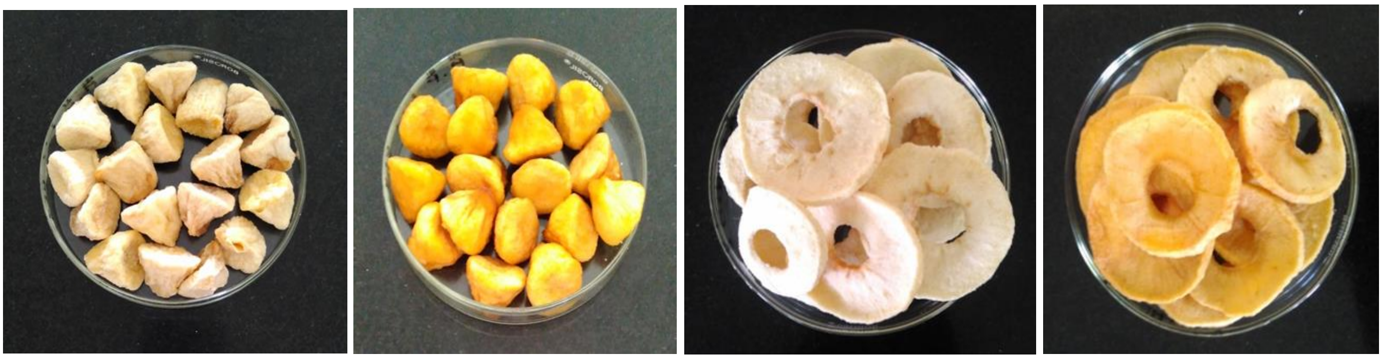
Apples are subject to qualitative and quantitative losses after harvest and losses of up to 17% can occur during post-harvest and storage operations [3]. Drying may be the best option to avoid losses and increase the shelf life of apples [4]. Sun drying is a common method among followed growers to produce sun dried apple rings commonly known as Sakori, but the quality of sun dried apples is very poor. Nuts are beneficial to human health because they are rich sources of vitamins, minerals, antioxidants and especially fiber (including soluble fiber) due to their concentration during processing [5]. Additionally, osmotic dehydration (sugar syrup) is a better drying method and is considered a preservation method that provides a high quality product by removing water without phase change [6]. However, taking into account the health concerns of consumers, honey can be used as a sugar substitute in a hypertonic solution which can give a better osmosis dried product with good nutritional value.

Apple rings made with traditional technology are not getting better prices due to their look and taste. Therefore, developing new dried apple products using them in baked goods and confectionery can be a profitable enterprise. Therefore, taking into account the demand for innovative products in the market and the enormous extent of the use of apples, the present study was conducted to develop consumer-friendly apple popsicles and apple rings (sugar, honey).

Materials and methods
Raw Materials
The apple fruits (*Golden delicious*) harvested at optimum maturity was procured from the local market. The raw material was purchased from the local market and the multifloral honey was purchased from the local farm, Dr. YS Parmar University of Horticulture and Forestry, Nauni, Solan, H.P used to conduct this study

Methods and Procedure
The dipping time for apple pops and apple rings was optimized initially by selecting firm ripe

fruits followed by washing, peeling and preparation of different sizes apple pops and rings. Apple pops (28.08mm diameter) and apple rings (0.5 cm thickness) were prepared and blanched for 30 seconds (Figure 1). The blanched apple pops and apple rings were osmotically dehydrated in hypertonic solution (sugar and honey) at 70° Brix. A known weight fruits were treated with different treatments. The osmosis was carried to optimize the osmotic time at different time interval (1, 2, 3, 4, 5, 6, 7, 8, and 9 h) at 1:3 ratio. The sizes having optimum osmosis were standardized on the basis of drying time. Further from osmo-dried apple pops and apple rings were prepared respectively.



Apple pops (Sugar) | Apple pops (Honey) | Apple rings (Sugar) | Apple rings (Honey)

Fig 1: Osmo-dried apple pops and apple rings (Sugar and Honey)

Physico-chemical analysis

Physico-chemical analysis of fresh apple and osmo-dried apple pops, apple rings was conducted by using standard analytical procedures [7-9]. Total soluble solids (TSS) content of fresh and processed products was determined by using hand refractometer and sugars were estimated by Lane and Eynon method as detailed by [9]. Acidity was determined by titrating the aliquots against 0.1 N NaOH to a pink end point using phenolphthalein as an indicator [9]. Total phenols were extracted in 80% ethanol and were estimated using Folin-Ciocalteau reagent [8]. The antioxidant activity was analyzed by free radical scavenging activity [10]. Energy value of the developed products was measured in bomb calorimeter (Model Toshiwal DT-100), which is based on the principle that the amount of heat produced by burning the sample must be equal to the amount of heat absorbed by calorimeter assembly [11]. Furthermore, non-enzymatic browning (NEB) was determined at 440 nm using 60% aqueous alcohol as a blank in the spectrometer (Spectronic-20).

Water loss (WL) or (Mass transfer) [12]

Water loss was the net loss at time T on an initial mass basis and expressed as in percentage. Water loss in fruits was calculated by using the following formula:

$$\%WL = \frac{IW - WL\ (T)}{IM} \times 100$$

Where,
IW = Initial water content
WL (T) = Water loss at time (T)
IM = Initial mass of the sample

Solid gain (SG) or (Mass transfer) [12]

The solid gain was the net sugar transported into the fruits on an initial mass basis and expressed in percentage.

$$\%SG = \%WL - \%MR$$

Where, WL = Water loss
MR = Mass reduction

Statistical analysis

The data on chemical characteristics of fresh and processed products were analyzed statistically by following Completely Randomized Design (CRD) detailed by [13]. Triplicate determinations were made for each attributes.

Result and discussion

(a) Physico- chemical characteristics of apple

Data of physico-chemical characteristics of fresh apple is presented in Table 1. The length, breath, weight, specific gravity and firmness were observed 65.80 ± 0.10mm, 68.66 ± 0.02mm, 124.07 ± 0.02g, 10.60 ± 0.20 and 10.26 ± 0.02 lbs/inch^2 respectively. [14] reported the similar results in variety Golden delicious' whereas [15] in apple variety 'Parlin's'. The moisture content, ash content, titratable acidity, total soluble solids, reducing sugars, total sugars and non-reducing sugars were found 83.90 ± 0.10 per cent, 2.42 ± 0.02 per cent, 0.40 ± 0.01 per cent, 15.00 ± 1.53 °B, 5.00 ± 0.50 per cent, 8.33 ± 0.02 per cent and 3.33 ± 0.01per cent respectively. The results were comparable to the finding of [12]. The ascorbic acid, total phenols, antioxidants were observed 8.90 ± 0.10mg/100g, 32.50 ± 0.20mg/100g, 35.50 ± 0.20 per cent respectively. Similar results were reported by [12]. The antioxidant activity and phenols content 31.2mg/100g and 34.3mg/100g respectively in 'Granny smith' [16]. Crude fibre was found 3.00±0.50%. [17] reported the similar results 1.64±0.01% crude fibre in apple fruit whereas water activity was observed 1.00±0.50. [18] reported water activity of 0.99 in apple fruits.

Table 1: Physico-chemical characteristics of apple

S. No.	Parameter	Observations (Mean±SE)*
1.	Length (mm)	65.80 ± 0.10
2.	Breath (mm)	68.66 ± 0.02
3.	Weight (g)	124.07 ± 0.02
4.	Specific gravity	0.98 ± 0.01
5.	Firmness (lbs)/inch^2)	10.26 ± 0.02
6.	Moisture content (%)	83.90 ± 0.10
7.	Ash content (%)	2.42 ± 0.02
8.	Titratable acidity (%)	0.40 ± 0.01
9.	Total soluble solids (°B)	15.00 ± 1.53
10.	Reducing sugars (%)	5.00 ± 0.50
11.	Non reducing sugar (%)	3.16± 0.02
12.	Total sugars (%)	8.33 ± 0.02
13.	Crude fiber (%)	3.00 ± 0.50
14.	Ascorbic acid (mg/100g)	8.90 ± 0.10
15.	Phenols (mg/100g)	32.50 ± 0.20
16.	Water activity (a_w)	1.00 ± 0.50
17.	Flavonoids (%)	10.00 ± 0.50
18.	Antioxidants (%)	35.50 ± 0.20
19.	Non enzymatic Browning (440nm)	0.02 ± 0.02

(b) Physico-chemical characteristics of honey (Multifloral)
Data of physico-chemical characteristics of fresh honey is presented in table 2. The total soluble solids of fresh honey were 70.00 ^{0}B which was more than the values observed by [[19]] and was less than the observations of [20]. The free acid, lactose, total acid content in meq per 100 g was 3.60, 0.98 and 4.47 respectively which were slightly higher as recorded by [[21, 22]]. The total and non-reducing sugar recorded were 65.34 per cent and 5.74 per cent respectively. [19, 21, 22] recorded the total sugar and non-reducing sugar of different types of honey, which were near to the values recorded in the investigation. The fresh honey had a moisture content of 16.50 per cent with the ash content of 0.19 per cent. The fructose, glucose and their ratio observed were 35.85 per cent, 30.24 per cent and 1.18 respectively. The fructose and glucose content of honey observed were 35.85 per cent and 30.24 per cent which was in the same range as observed by [23, 24, 21].
The HMF content observed was 9.35 mg/kg lower than values recorded by [19, 25]. However, the diastase number recorded was higher than the values observed by [26-28]. has reported 24.8 diastase number though [29] and [30] found the diastase number to vary between 0 - 2.5 and 0 - 12.5, respectively.

Table 2: Physico- chemical characteristics of multifloral honey

Parameters	Honey
Total soluble solids(°B)	70.00±1
Free acid (meq/100 g)	3.60±0.2
Lactone (meq/100 g)	0.98±0.01
Total acid (meq/100g)	4.47±0.01
pH	3.86±0.02
Reducing sugars (%)	59.30±0.1
Non-reducing sugars (%)	5.74±0.01
Total sugars (%)	65.34±0.01
Moisture (%)	16.5±0.2
Total solids (%)	83.5±0.1
Ash (%)	0.19±0.01
Fructose (%)	35.85±0.01
Glucose (%)	30.24±0.01
Glucose: Fructose ratio	1.18±0.01
Diastase Number (DN)	20.50±0.1
Total phenols (mg/100g)	65.45±0.02
HMF (mg/kg)	9.35±0.01

Table 3: Standardization of osmo dipping time for apple pops and rings (Sugar and Optimization of osmo dipping time for apple pops (Sugar 70°B)

Parameters/Hours	(%) Weight loss in pops	(%) Volume gain in syrup	(%) Increases in TSS of pops	(%) Decrease in TSS of syrup
1	23.5	2.22	28.5	8.57
2	29.8	4.44	38.0	11.4
3	30.6	6.66	47.6	14.2
4	30.6	6.66	47.6	14.2

Table 4: Optimization of osmo dipping time of apple rings (Sugar 70°B)

Parameters/Hours	(%) Weight loss in rings	(%) Volume gain in syrup	(%) Increases in TSS of rings	(%) Decrease in TSS of syrup
1	35.1	2.77	7.69	11.4
2	36.3	5.71	15.3	14.2
3	37.6	8.57	23.0	17.1
4	37.6	8.57	23.0	17.1

Table 3 and 4 represents the optimization of osmosis dipping time for apple pops and apple rings. The data for per cent weight loss, per cent volume gain, per cent increase in TSS of fruits and per cent decrease in TSS of syrup was recorded after each hour and found 23.5 per cent weight loss in pops and 35.1 per cent in rings after one hour of dipping at 50°C while after three hours there was 30.6 per cent weight loss in pops and 37.6 per cent weight loss in rings with 6.66 per cent volume gain in syrup in pops and 8.57 per cent in rings. The weight loss, volume gain, TSS of fruits and TSS of syrup were observed and found constant after three hours.

Table 5: Optimization of osmo dipping time of apple pops (Honey 70ºB)

Parameters/Hours	(%) Weight loss in pops	(%) Volume gain in syrup	(%) Increases in TSS of pops	(%) Decrease in TSS of syrup
1	21.1	1.42	21.0	8.57
2	25.6	2.85	31.5	11.4
3	27.8	4.28	42.1	14.2
4	32.8	5.71	57.8	17.1
5	32.8	5.71	57.8	17.1

Table 6: Optimization of osmo dipping time for rings (Honey 70ºB)

Parameters/Hours	(%) Weight loss in rings	(%) Volume gain in syrup	(%) Increases in TSS of rings	(%) Decrease in TSS of syrup
1	28.0	4.00	8.57	10.0
2	37.5	8.00	14.2	11.4
3	49.2	12.0	20.0	12.8
4	52.7	14.0	24.8	14.2
5	52.7	14.0	24.8	14.2

Similarly dipping time for apple pops/rings in honey syrup was observed as shown in Table 5and 6. Per cent weight loss, per cent volume gain, per cent increase in TSS of fruits and per cent decrease in TSS of syrup was recorded after each hour and found 21.1 per cent weight loss in pops and 28.0 per cent in rings after one hour of dipping at 50ºC while after four hours there was 32.8 per cent weight loss in pops and 52.7 per cent weight loss in rings with 5.71 per cent volume gain in syrup in pops and 14.0 per cent in rings. The weight loss, volume gain, TSS of fruits and TSS of syrup were observed and found constant after four hours. Henceforth three hours dipping time for apple pops and apple rings (sugar) and four hours dipping time for apple pops and apple rings (honey) was found optimum. Similarly [31] showed the maximum weight loss after 6 hours in 70ºB sugar concentration at 70ºC in mango slices. [32] observed that rate of weight reduction and water removal reduced after 1.5 hours of osmotic treatment in banana slices. [33] concludes that higher water loss and solids gain were observed at 40 ºC in pears. Water loss and solid gain were higher at the beginning of the osmosis, reaching maximum at 3.5 hours at 65ºB sugar syrup in guava [34, 31] reported that the concentration of sugar syrup increases with increase in time of dipping and maximum solid gain was recorded after 6 hours in 70ºB sugar concentration. Maximum sugar penetration during first 2 hours in apple slices was observed by [34].

Conclusion
On the basis of results presented, it can be concluded that the apple fruits can be utilized for the preparation of osmo-dried apple pops and apple rings. These osmo-dried products can further be utilized for the development of bakery products which are the new products in the market. Further, the use of honey for osmotic dehydration improves the nutritional quality of the developed products. Henceforth, the developed technology will be boon to apple processing industry and can be commercially explored at industry level for the production of quality value added products like osmo-dried apple pops and apple rings and bakery products as novel products.

References

1. Anonymous. Horticulture at a glance (State Department of Horticulture). http://www.hpagrisnet.gov.in/hpagris/Horticulture. 2016.
2. Boyer J, Liu RH. Apple phytochemical and their health benefits. Nutr. J. 2004; 3:5.
3. Shah N, Khan M, Kasi A, Khair M. Post-harvest and cold storage losses in apple of Balochistan. Asian Journal of Plant Science. 2002; 1:65-66.
4. Famurewa JAV, Oluwamukomi MO, Adenuga AL..Dehydration of osmosised red bell pepper (*Capsicum annum*). Research Journal and Biological Science. 2006; 1:36-39.
5. Farzaneh P, Fatemian H, Hosseini E, Asadi GH, Darvish F. A comparative study on drying and coating of osmotic treated apple rings. International Journal of Agricultural Sciences and Research. 2011; 2:57-66.
6. Lenart A. Osmo-convective frying of fruits and vegetables-technology and application. Drying Technology. 1996; 14:391-341.
7. Ting SV, Rouseff RL. Citrus fruits and their products-analysis and technology. Marcel Dekker, Inc., New Delhi. 1986, 293.
8. AOAC. Official Methods of Analysis of the Association of official Analytical chemist, Hortwits W (ed). Assoc Official Anal. Chemists, Washington, D. C. US, 1996.
9. Ranganna S. Hand book of Analysis and Quality Control of Fruit and Vegetable Products. 4th edn.Tata McGraw Hill, New Delhi. 2009, 1112.
10. Brand-Williams W, Cuvelier ME, Berset C. Use of a free radical method to evaluate antioxidant activity. Lebensmittel-Wissenschaft und Technologie. 1995; 28:25-30.
11. Kays SE, Barton FE. Rapid predication of gross energy and utilizable energy in cereal food products using Near-Infrared reflectance spectroscopy. Journal of Agricultural and Food Chemistry. 2002; 50:284-289.
12. Sharma KD, Sethi V, Maini SB. Changes in quality of osmo-vac dried apple slices on storage. Journal of Scietific and Industrial Research. 1998; 57:393-398.
13. Cochran WG, Cox GM. Experimental designs (2nd edn.). New York: Wiley. *ISBN* 1992; 978-0-471-54567-5.
14. Sharma KD, Sethi V, Maini SB. Effect of pre-treatment and package on chemical and sensory characteristics of dried apple. Indian Food Packers. 2000, 52-59.
15. Sharma KD, Alkesh, Kaushal BBL. Evaluation of apple cultivars for dehydration. Journal of Food Technology. 2006; 43:177-181.
16. Drogoudi PD, Pantelidis G. Effect of position on canopy and harvest time on fruit physico-chemical and antioxidant properties in different apple cultivars. Scientia Horticulturae, 2011; 129:752-760.
17. Abdualrahman MAY. Comparative study between local and imported apple (*Malus domestica*) fruits and their uses in juice production. Science International. 2015; 3:69-72.

18. Bulut L, Kilic M. Kinetics of hydroxymethyfurfural accumulation and colour change in honey during storage in relation to moisture content. Journal of Food Processing and Preservation. 2009; 33:22-32.
19. Lakhanpal P, Vaidya D. Development and evaluation of honey based mango nectar. Journal of Food Science and Technology. 2015; 52: 1730-1735.
20. Kaushik R, Joshi VK, Gupta JK. Total soluble solids, acidity, pH and standard plate count in the Indian honey as affected by different treatments and storage conditions. Journal of Food Science and Technology. 1993; 30:442-443.
21. Mishra RC. Honeybees and their management in India. ICAR, New Delhi. 1995, 168.
22. Phadke RP, Nair KS, Nandedkar U. Studies on Indian honeys. IV. Minor constituents. Indian Bee Journal. 1970; 32:29-35.
23. Poncini L, Wimmmer FL. The composition of some fiji honeys. Apiculture Abstract 1987; 32:281.
24. Singh B. Studies on the physico-chemical characteristics of honey from important floral sources in Punjab. M.Sc. Thesis. PAU, Ludhiana, 1994.
25. Hebbar HU, Nandini KE, Lakshmi MC, Subramanian R. Microwave and infrared heat processing of honey and its quality. Food Science and Technol Research. 2003; 9:49-53.
26. Simpson J, Riedel IB, Wilding N. Invertase in the hypopharyngeal glands of the honeybee. Journal of Apiculture. Research 1968; 7:29-36.
27. Sagar VR, Kumar PS. Improvement of some process variables in mass transfer kinetics of osmotic dehydration of mango slices and storage stability. Journal of Scientific and Industrial Research. 2009, 1043-1048.
28. Nowakunda K, Andres A, Fito P. Osmotic dehydration of banana slices as a pretreatment for drying processes. Proceedings of the 14th International Drying Symposium. 2004, 2077-2083.
29. Nadia DM, Nourhene BM, Nabil K, Francis C, Catherine B. Effect of osmo-dehydration conditions on the quality attributes of pears. Journal of Food Processing and Technology. 2013; 256:2157-7110.
30. Noroes ERV, Brasil IM, Lima JR, Bianchi M, Tau TG. Kinetics of the osmotic dehydration of guava. Acta Horticulturae. 2010, 367-370.
31. Morrera R, Sereno AM. Volumetric shrinkage of apple cylinders during osmotic dehydration. *Proceedings* International congress on Engineering and Food. ICFS 2001; 8:1351-1355.