

QUALITY EVALUATION AND VALUE ADDITION PROSPECTS OF LOCAL APRICOT (*PRUNUS ARMENIACA*) CULTIVARS GROWN IN DISTRICT SHIGAR, GILGIT-BALTISTAN, PAKISTAN

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Abstract

This study presents a comprehensive evaluation of the fruit quality of local apricot cultivars (*Prunus armeniaca*) grown in District Shigar, Skardu–Baltistan, Pakistan. The primary objective was to assess the physicochemical characteristics of seven widely cultivated apricot varieties from the region. Data were recorded for physical parameters including fresh weight, dry weight, length, and width, as well as proximate and chemical attributes such as moisture content, ash content, total soluble solids (TSS), pH, titratable acidity, total sugars, crude fat, crude fiber, and protein content. The results (mean of three replicates) revealed significant variation among the cultivars. Halman exhibited the highest TSS (19°Brix), whereas Zochaq recorded the lowest (11°Brix). The highest moisture content (95.5%) was observed in Kho Chuli, while Zochaq showed the lowest moisture level (75.5%). Although apricot fruits generally contained low fat levels, Yaqkar had the highest crude fat content (0.24%), and Zochaq had the lowest (0.09%). Crude fiber was highest in Halman (12.86%) and lowest in Zochaq (7.26%). Interestingly, despite lower values for several attributes, Zochaq exhibited the highest ash content (1.35%), while the minimum ash content (0.97%) was recorded in Marghulam. Further variability was observed in other quality traits. Yaqkar showed the highest protein content (0.89%), whereas Halman had the lowest (0.45%). Hawalapa recorded the highest total sugar content (7.88%), while Kho Chuli had the lowest (4.47%). Total acidity was highest in Karfo (0.83%) and lowest in Hawalapa (0.31%). Due to its favorable sugar-to-acid ratio (25.42), Hawalapa was selected for candy preparation. Organoleptic evaluation of the developed apricot candy indicated high consumer acceptability and overall preference.

Introduction

Apricot (*Prunus armeniaca*) belongs to the genus *Prunus*, which is widely distributed throughout the world. It is a member of the Rosaceae family, which includes economically important fruit crops such as apricots, cherries, peaches, nectarines, and plums. These fruits are cultivated primarily for their attractive and fleshy mesocarp. The genus *Prunus* comprises approximately 200 species (Potter et al., 2007), including nearly 35 species native to the Old World and about 25 species from the New World (Potter, 2012). Apricot flowers are typically rosaceous, white in color, and borne in clusters. The plants generally bloom during April–May, and the fruits ripen in July–August (Yigit et al., 2009). Stone fruits are predominantly cultivated in Asia and Europe; however, except for Antarctica, they are grown across all continents, each with its own major producing countries (Janick, 2005). Nutritionally, stone fruits are rich sources of vitamins and minerals.

Historically, *Prunus armeniaca* originated in China and subsequently spread throughout Asia. During the seventeenth century, apricots were introduced into Britain and later into the United States (Virginia) through trade and exchange. In the eighteenth century, Spanish explorers introduced apricots to California (Faust et al., 1998; Janick, 2005; Zhebentyayeva et al., 2012). Apricot belongs to the subfamily Prunoideae within the Rosaceae family, which also includes cherry, almond, and plum (Durmaz and Alpaslan, 2007; Pastorello et al., 1999). Globally, Turkey is one of the leading producers of apricots, with an annual production of approximately 476,132 tons (Ercisli, 2009). The global apricot production is estimated at around 2.6 million tons (FAO, 2005). Pakistan ranks among the major apricot-producing countries, with an annual production of about 0.5 million tons (FAO, 2008; DAO, 2008). Fruit quality was first systematically described by Kramer and Twig in 1966, who defined it based on physical and chemical characteristics (Moreau-Rio and Roty, 1998).

In Northern region apricot is safeguard fundamentally by traditional strategy like sun drying with next to no substance treatment. As per UN-PK/FAO/2003 review report, Northern region created each year around 17068 tons natural products. Apricot is having a place with the group of Rosaceae. Apricot (*Prunus armeniaca* and *Prunus domestica*) is one of the main delicious and significant product of northern area of Pakistan. These species are diploid with eight sets of chromosomes ($2n=16$) (Kryukova 1989). Natural product is accessible whenever while the new organic product is accessible from May to September (Faqir et al., 2004). Apricot tree is around 5cm length and it remembers one enormous seed for it (Rich, 2000). This tree developed height around 3000 meters (Annon., 1998). In calm local apricot is generally significant making juice and jams is utilized. For their natural worth cell reinforcement, carotenoids, phenolics and phytochemical are generally significant (Lichou et al., 2003).

In Pakistan, apricot is filled in Balochistan, Parachinar, Hangu, Chitral, Hazara Abbottabad, Murree, Northern Kashmir and Diamer, Gilgit, Ghanche, Ghizer, and Skardu areas of Gilgit-Baltistan. In Pakistan GB is the top producer, and in GB district Shigar on top. As of late the creation worth of pollinated crops in Pakistan was specified as 1.59 billion US\$ with significant portion of organic products with 0.98 billion US\$ (Irshad et al., 2014).

The apricot tree, are utilized restoratively to treat many sicknesses, including respiratory, gynecological, and stomach related diseases and for their antipyretic, mitigating, hepatoprotective, vulnerary, anthelmintic, and anticancer properties since they have high satisfied of protein, nutrient, starch, carotenoid, phenolic, sugar, unsaturated fat and fiber (Alajil et al., 2021). Most pharmacological examinations did to date have zeroed in on apricot foods grown from the ground (Deng P et al., 2021). The natural impacts announced have remembered defensive action for the heart, antioxidative/revolutionary searching, neuroprotective, antihyperlipidemic, hepatoprotective, antimicrobial, antiparasitic,

antiviral, calming, pain relieving, immunomodulatory, and anticancer action. All apricot parts show different pharmacological impacts. The vast majority of the examinations that have been completed so far have announced the pharmacological examination of apricot leafy foods. Different pieces of the apricot plant are utilized overall as a correlative and elective medication (CAM) to treat disease, and a few starter clinical examinations have previously demonstrated a promising potential for apricot-based items in this field (Sagbo et al., 2021).

Dry apricot and apricot parts help in anticipation of cold, hack, fever, and influenza and are rich wellspring of dietary fiber and iron. Apricot is additionally utilized in treating acid reflux, bits are remembered to bring down circulatory strain. Oil extricated from the pieces of the unpleasant apricots is generally utilized for restoring cancers and is likewise used to treat joint agony and joint pain. Apricot oil is exorbitant it is utilized in informing body parts particularly foot, knees, legs, and so forth. It is utilized in cooking and is likewise applied to hair; it is a decent wellspring of cell reinforcements moreover, it is viable in treating minor eye contaminations. After the oil is removed the waste is utilized to make a cup like construction around 200 to 250 g in weight. Practically all pieces of the tree are utilized for one of several things. The wood of apricot is utilized to make articles like dishes and handles of many kinds of gear like sledge, blade and spade and so forth. Wood is likewise utilized in making spoons, seats and represents cutting and mincing meat. The pruned branches as well as the roots are utilized as kindling in conventional "chulhas" and "bukharies" in the colder time of year season. Endocarps are blended in with cow excrement to work with its consuming. Leaves are taken care of

to the home-grown creatures like cow, goat, sheep and so forth particularly throughout the colder time of year and pre-winter seasons (Raj v et al., 2012).

2. Materials and Methods

2.1 Sample collection

For this scientific research apricot sample were collected from District Shigar, during 17 July to 29 July at their fully mature stage. These apricots were taken from agriculture department of Shigar churka and Hachupi bagh through composite sampling using cutter. After harvesting the apricot samples were placed into polyethene bags and stored at 4C⁰ until the analysis process performed. Each cultivar was collected from at least three different 7 tree and branches for homogenous sampling. This is conducted at Pakistan council of research and scientific and industrial research (PCSIR) lab, Skardu Gilgit-Baltistan.

2.2 Qualitative Experiment

For subjective trial, polls were ready and flow among the people groups and taken from uninformed people groups of Shigar area. Questions which are the piece of subjective exploration are connected with taste, variety, size and weight of the cultivar. The information was likewise be broke down measurably.

2.3 Quantitative experiment

In quantitative experiment juice of every variety of apricot fruit were prepared for the biochemical tests and the results will be analysed statistically. Biochemical test is the determination of concentration of different major molecules including fibre, protein, fat, ash sugar and acidity etc which was present in the fruit.

Table 1: Apricot samples collection, sources and location

S.NO	Variety	Location	Source	Age of tree	Yield	Farmer name
1	Halman	Chorka	Agriculture Department Shigar	23	80Kg	Muhammad Ali
2	Yaqkar	Hashupi	Garden	22	70Kg	Fatima
3	Karfo	Chorka	Garden	22	70Kg	Gulzar Hussain
4	Hawalapa	Khobanistan	Fruit nursery	20	110Kg	Raza
5	Kho chuli	Hashupi	Agriculture Department Shigar	25	120Kg	Gulzar
6	Zochaq	Chorka	Fruit nursery	15	60Kg	Anwar
7	marghulam	Khubanistan	Garden	24	90Kg	Askari

2.4 Physical characterization of apricot fruits

The collected fruit sample were used to get other physical data's like Length, width and weight of each variety fruit measured instantly, 40 samples of each variety were washed and make pulp using juicer machine. Fruit weights are taken by using analytical balance and size were taken by using digital vernier caliper. Fresh weight of 50 samples of each varieties of apricot sample is as follows. "Hawalapa chuli , Halman chuli, zochaq chuli ,karfo chuli , Marghulam chuli ,Kho chuli and Yaqkar chuli".

2.4.1 Fresh weight of fruits

From every 7 cultivar of apricot 50 samples which were collected from hashupi and churka shigar, weighted taken by using analytical balance and result were noted.

2.4.2 Dry weight of fruit

Every 7 different cultivars of apricots were dried. Through sun drying the apricots after that measured by using analytical balance.

2.4.3 Size of fruits

Every 7 cultivars of apricot were measured by using digital vernier caliper from PCSIR laboratory Skardu. Sizes include each fruit length and width.

2.5 Chemical characterization

2.5.1 Treatable Acidity

i. Titratable Acidity (% in terms of malic acid)

Titratable acidity (% in terms of malic acid) of fruit samples was determined by following AOAC (1990), method No. 981-12.

$$\frac{0.1 \times 67 \times 0.1 \times \text{ml used}}{\text{Weight of sample}}$$

2.5.2 Total soluble solute (TSS)

Total Soluble Solids (°Brix) were determined by using refractometer (PAL-3 ATAGIO made in Japan), as described by AOAC (1990), method No. 920-151.

2.5.3 pH

Every 7 cultivars of apricot were find out their pH using pH meter in lab according to AOAC (1990), method No. 981-12.

2.5.4 Moisture content

Moisture content of 7 cultivars of apricot was determined through the recommended process of AOAC (2012). The percent moisture of the cherry sample was find out by using the following formula:

$$\text{Moisture (\%)} = \frac{\text{Initial weight} - \text{Wt of the dried sample}}{\text{Wt. of the original sample}} \times 100$$

2.5.5 Protein content

Protein content of apricot sample was determined by using Method no. (46-10), following the procedure recommended by AACC (2000).

2.5.6 Fat Content

Fat content of apricot sample were determined by using Method no. (30-10), following the procedure recommended by AACC (2000).

2.5.7 Fiber content

Fiber content of apricot sample was determined by using Method no. (32-10.01), following the procedure recommended by AACC (2000).

Fiber(%)=

$$\frac{\text{Weight after drying} - \text{weight after ashing}}{\text{Weight of sample}} \times 100$$

2.5.8 Ash content

The ash content was determined by incinerating the dried sample in muffle furnace at 500-600°C for 5 to 6 hours as described in AOAC method No.940-26

$$\text{Ash(}\% \text{)} = \frac{\text{Ash weight} \times 100}{\text{Sample weight}}$$

2.7.9 Sugar test

The reducing and non-reducing sugar of the apricot samples was determined with help of A.O.A.C (2012).

2.8 Preparation of Apricot candy

For the preparation of apricot candy, the selected fruits were first thoroughly washed to remove dirt and surface contaminants. The apricots were then cut into halves and the pits were removed. The fruit halves were blended in a food processor to obtain a smooth apricot pulp. The pulp was measured, and sugar was added in a 1:1 ratio (one cup of sugar for each cup of apricot puree). Additionally, one tablespoon of lemon juice per cup of puree was incorporated to enhance acidity and help preserve the natural color of the

product. The mixture was cooked over medium heat with continuous stirring to prevent sticking and scorching. Heating was continued until the mixture thickened and reached approximately 220°F (104°C). The thickened mass was then poured onto a prepared baking sheet and evenly spread using a spatula. The mixture was allowed to cool and set at room temperature for several hours or overnight. Once properly set, the apricot sheet was cut into desired shapes with a knife. The pieces were rolled in granulated sugar to prevent sticking and to improve texture and appearance. The coated candies were placed on a cooling rack and allowed to dry for an additional 24 hours to achieve a firmer consistency. After complete drying, the candies were packed in polythene zipper bags for storage.

3. Results and Discussion

3.1 Physicochemical properties of different apricot varieties

In the present study seven varieties of apricot fruit were collected from district Shigar and studied for their physical, chemical and sensory analysis.

3.1.1 Fresh and dry weight of apricot fruit

The result regarding fresh and dry weight of apricot cultivars was illustrated in Figure 1. The results revealed that the each apricot variety exhibits different weights. The Zochaq variety shows the highest fresh weight as well as the highest dry weight (49.3 g) indicating it retains the most mass both in its natural state and after drying. Conversely, the Yaqkar variety has the lowest fresh weight (8.9 g) and dry weight, making it the lightest variety among those studied. This variation in weight highlights the differences in the physical properties of apricot fruits across different varieties.

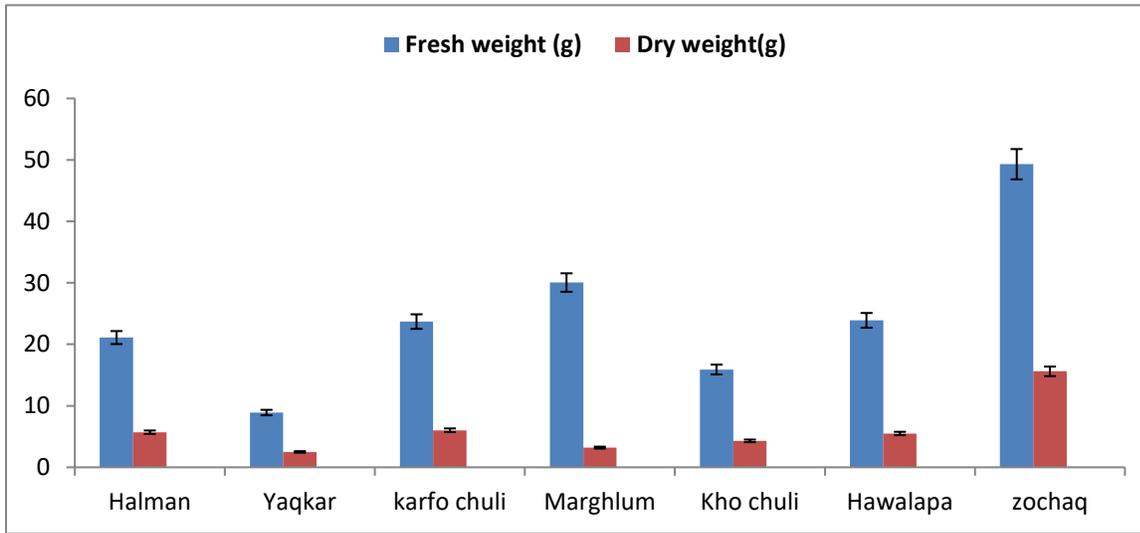


Figure1: Measurement of Fresh and dry weight of apricot fruits

3.1.2 Length and width of apricot fruits

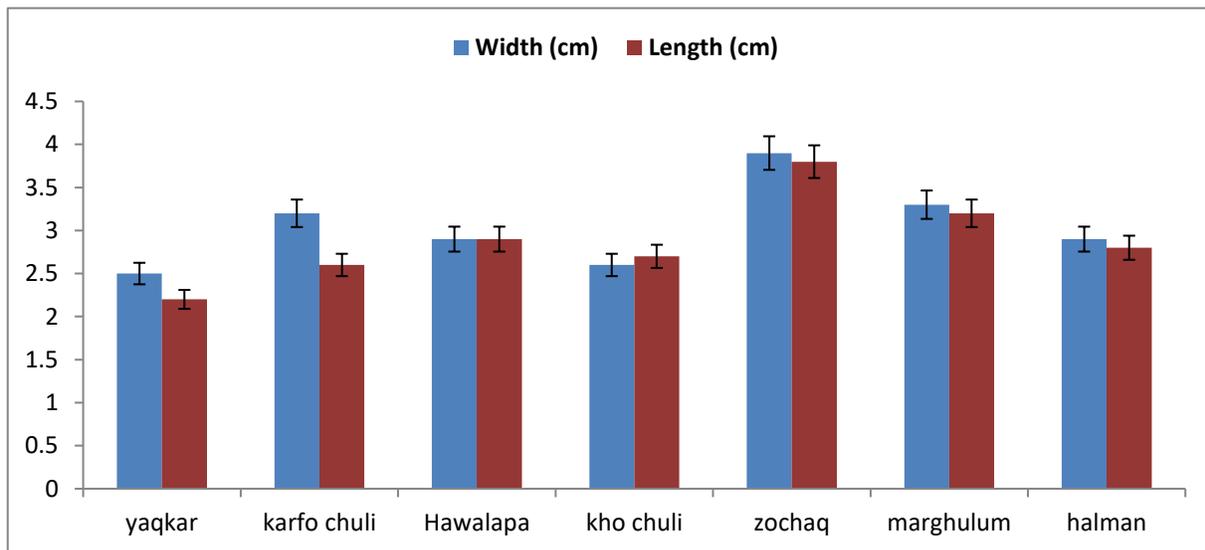


Figure 2: Mean values for Length and width of fruit of Apricot

The result regarding fresh and dry weight of apricot cultivars was illustrated in Figure 2. The results indicated that the height and width of apricot fruits vary across different varieties. The Zochaq variety shows the highest percentages of both width (3.9cm) and length (3.8cm), making it the largest among the varieties studied. In contrast, the Yaqkar variety has the lowest

percentages of width(2.5 cm) and length(2.2 cm), making it the smallest. This variability highlights the distinct physical characteristics of apricot fruits among different varieties

3.2 Visual attributes and taste of different varieties of apricot

The organoleptic evaluation of seven varieties revealed noticeable variation in taste and color attributes (Table 2). Taste ranged from very sweet to sour and tasteless, while color varied from red to different shades of yellow and orange. Among the studied varieties, Halman was characterized as very sweet with a distinct red color, making it unique compared to the other varieties. The intense sweetness and attractive red coloration may indicate a higher accumulation of soluble sugars and possibly anthocyanin pigments. Yaqkar and Karfo were described as slightly sweet, with slight yellow and light yellow coloration, respectively. While Hawalapa and Marghulam were categorized as sweet, though their color differed slightly. Hawalapa exhibited a light orange color, while Marghulam showed light yellow.. In contrast, Kho chuli was reported as sour with an orange color. The sour taste may be

attributed to higher organic acid content and comparatively lower sugar concentration. Similarly, Zochaq was identified as tasteless with a light orange color, suggesting lower accumulation of both sugars and acids. Overall, sweetness was the dominant taste profile among the studied varieties, with five out of seven varieties exhibiting sweet to slightly sweet characteristics. Color distribution showed predominance of yellow and orange shades, while only one variety (Halman) displayed red coloration. These variations in sensory attributes may be influenced by genetic factors, environmental conditions, and maturity stage at harvest. The findings indicate that Halman, Hawalapa, and Marghulam may possess better consumer acceptability due to their favorable sweetness and appealing color, whereas Kho chuli and Zochaq may require processing or blending to improve palatability

Table 2: Visual attributes and taste of different varieties of apricot

S.NO	Varieties	Taste	Colour
1	Halman	Very sweet	Red
2	Yaqkar	Slightly sweet	Slight yellow
3	Karfo	Slightly sweet	Light yellow
4	Hawalapa	Sweet	Light orange
5	Kho chuli	Sour	Orange
6	Zochaq	Taste less	Light orange
7	Marghulam	Sweet	Light yellow

3.3 Proximate analysis of different varieties of apricot

Proximate analysis is a fundamental set of procedures used to determine the basic nutritional composition of food, providing essential information for quality control, nutritional labelling, and research in food science. This analysis includes the determination moisture content, ash content, total soluble solid (TSS), pH, along with chemical analysis including acidity, total sugar, crude fat and crude fiber

content. The results regarding moisture content of apricot varieties were presented in Table-3. The findings revealed that the Kho Chuli variety of apricot has the highest moisture content at 95%, making it the juiciest among the varieties studied. In contrast, the Hawalapa variety has the lowest moisture content at 77%, indicating it is less juicy. This significant variation in moisture content highlights the differences in water retention and potential texture between the different apricot varieties. The results about

crude oil content of apricot varieties were showed that the yaqkar has highest crude oil content (0.24%) and zochaq has lowest (0.9) quantity of crude oil (Table-3). Apricot fruits typically have very low fat content in their pulp, usually less than 1%. The results also revealed that the Halman variety has highest percentage of fiber (13%) and Zochaq has lowest percentage (7%) of fibre found in it. Dietary fiber in fruits like apricots contributes to digestive health and can affect satiety. The results regarding ash content of apricot varieties were presented in Table-3, indicated that the Zochaq variety of apricots exhibits the highest ash content percentage at 1.3%, indicating a relatively higher mineral content compared to other varieties. In contrast, the Marghulam variety has the lowest ash content percentage at 0.9%, suggesting it contains fewer minerals in comparison. Ash content is an important indicator of the mineral composition of fruits, influencing their nutritional profile and potential uses in food processing and nutrition. According to the results presented in Table-3, the Yaqkar variety of apricots has the highest protein content percentage at 0.9%, indicating it has a relatively higher protein concentration compared to other varieties studied. On the other hand, the Halman variety shows the lowest protein content percentage at 0.4%, suggesting it has a lower protein concentration. Higher protein content can be desirable for nutritional value, especially in fruits where it might not be the predominant nutrient. The findings also revealed that the Hawalapa variety of apricots has the highest content of total sugar at 8%, indicating it is relatively sweeter compared to other varieties

studied. In contrast, the Kho Chuli variety has the lowest content of total sugar at 4.2%, suggesting it is less sweet compared to the other varieties. Sugar content in fruits like apricots contributes to their flavor profile and sweetness, influencing consumer preference and suitability for various culinary uses. Variability in sugar content among different apricot varieties can result from factors such as genetics, climate, and maturity at harvest. The Karfo Chuli variety of apricots has the highest content of total acidity at 0.9%, indicating it has a relatively higher acidity level compared to other varieties studied. On the other hand, the Hawalapa variety has the lowest content of total acidity at 0.3%, suggesting it is less acidic. Total acidity in fruits like apricots contributes to their tartness and overall flavor profile. It can vary depending on factors such as fruit maturity, growing conditions, and post-harvest handling. Understanding acidity levels is important for determining the culinary use of apricots, such as in fresh consumption, cooking, or processing into products like jams and preserves. The results regarding sugar acid ratio showed significant variation in sugar acid ratio (SAR) among different apricot varieties. The Hawalapa Chuli variety shows the highest SAR at 25.42, suggesting a sweeter taste profile with a higher ratio of sugar to acidity. In contrast, the Zochaq variety exhibits the lowest SAR at 7.45, indicating a relatively higher acidity compared to sweetness. SAR is a crucial measure in fruit evaluation, as it reflects the balance between sugar content and total acidity, influencing the overall flavor and consumer preference for fresh consumption or processing purposes.

Table 3: Proximate analysis of different varieties of apricot

Variety	TSS(°B)	Moisture (%)	Crude fat(%)	Crude fiber(%)	Ash (%)	Protein (%)	Total sugar (%)	Total acidity (%)	Sugar Acid Ratio (%)
Halman	(19 ^o)	79.36d	0.16d	12.86a	1.03e	0.45e	6.12b	0.58c	10.55c
Yaqkar	(15 ^o)	85.72b	0.24a	8.97c	1.09d	0.89a	6.86b	0.56c	12.25b
Karfo	(16 ^o)	87.3b	0.13e	9.40b	1.21b	0.57c	7.63a	0.83a	9.19
Marghulam	(14 ^o)	80.07c	0.18c	8.73c	0.97f	0.79b	5.06c	0.56c	9.04d
Kho	(15 ^o)	95.5a	0.18c	9.79b	1.14c	0.57c	4.47d	0.48d	9.31d
Hawalapa	(16 ^o)	77.67d	0.19b	9.22b	1.20b	0.78b	7.88a	0.31e	25.42a
Zochaq	(11 ^o)	75.01e	0.09f	7.26d	1.35a	0.54d	4.84d	0.65b	7.45e

Preparation and sensory evaluation of Apricot Candy:

As from the above mentioned data, it can be depicted that HAWALAPA variety of apricot displayed excellent sugar to acid ratio and can be used for preparation of apricot candy. The preparation steps of apricot candy which revealed promising appeal to market a natural and nutritional product.

Sensory evaluation of apricot candy

The results regarding sensory evaluation of apricot candy by five groups of judges. The mean value of five judges showed, except flavour and mouth feel, all other sensory parameters showed high likability by the judges. Although both flavour and showed slightly lower scores but still they were acceptable.

The Figure-3 illustrates the sensory evaluation results of apricot candy based on five attributes: taste, flavour, mouth feel, colour, texture, and overall acceptability. The scores (on a 9-point hedonic scale) indicate a high level of consumer preference across all evaluated parameters. Among the attributes, colour received one of the highest scores (approximately 8), suggesting that the candy possessed an attractive and appealing appearance. This may be attributed to the natural

pigmentation of apricot along with the addition of lemon juice, which helped preserve the bright color during processing. Taste also scored highly (around 7.5-8), indicating a desirable balance between sweetness and acidity. The favourable sugar-to-acid ratio likely contributed to this positive perception. Texture and mouth feel achieved similarly strong ratings (approximately 7.5), reflecting a smooth, firm, and pleasant consistency of the final product. The controlled cooking temperature (104°C) and adequate drying time likely played a key role in achieving the desirable gel-like structure and chewiness of the candy. Flavour scored slightly lower than taste but still remained within the highly acceptable range (around 7), indicating that the characteristic apricot aroma was well retained during processing. The minor variation among attributes suggests uniform quality without any major sensory defects. Overall acceptability was rated highly (approximately 7.5-8), confirming that the developed apricot candy was well accepted by the sensory panel. The consistently high scores across all parameters demonstrate the successful formulation and processing of the product, indicating good potential for value addition and commercialization of local apricot cultivars.

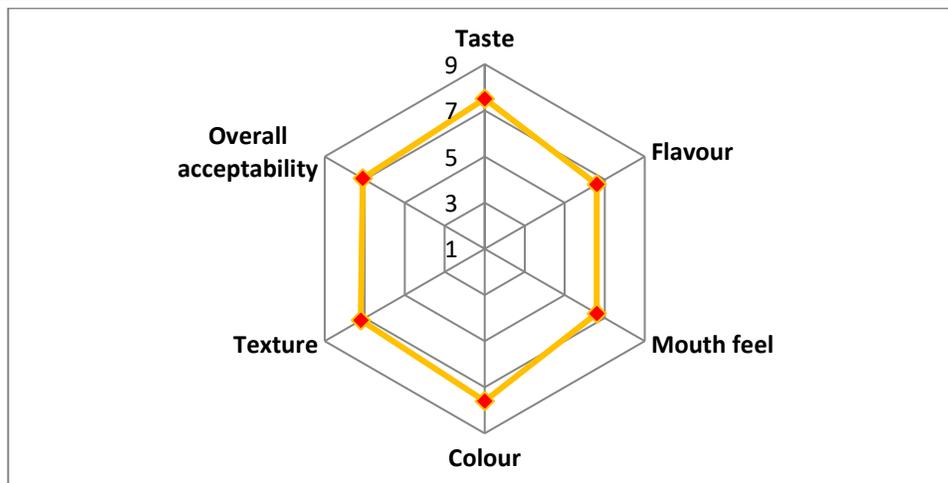


Figure 3: Sensory evaluation of apricot candy

Conclusion

The results indicate considerable variation among the apricot varieties in both physical and nutritional attributes. Zochaq exhibited the greatest fruit width and height, whereas Yaqkar had the smallest dimensions. Kho Chuli recorded the highest tree age and yield percentage, while Zochaq showed the lowest. In terms of composition, Kho Chuli had the highest moisture content, and Hawalapa the lowest. Yaqkar contained the highest crude oil and protein contents, whereas Zochaq had the lowest crude oil and Halman the lowest protein content. Halman showed the highest crude fiber content, while Zochaq had the lowest. Ash content was highest in Zochaq and lowest in Marghulam. Hawalapa recorded the highest total sugar content and the lowest acidity, whereas Karfo Chuli had the highest acidity and Kho Chuli the lowest sugar content. Due to its favorable sugar-to-acid ratio, Hawalapa was identified as the most suitable variety for apricot candy preparation. Overall, these findings highlight significant variability among apricot cultivars, emphasizing the importance of varietal selection for nutritional quality and value-added product development.

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