

# UTILIZATION OF FRUITS AND FLOWERS OF CAPPARIS DECIDUA FOR THE DEVELOPMENT OF VALUE-ADDED JAM

*Original Research*

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**Acknowledgement:** The authors acknowledge the support and resources provided for conducting this study.

Conflict of Interest: None

Grant Support & Financial Support: None

## ABSTRACT

**Background:** There are many neglected fruits available in Pakistan which elucidated health benefits. These fruits wasted every year without any use. The utilization of these fruits for value-added products can contribute in generating enough resources for country while providing health benefits to consumers.

**Objective:** This study focused on the development and characterization of jam from fruits and flowers of Capparis decidua.

**Methods:** The fruits and flowers were washed with water and then boiled at 100 °C until become soft. Then, softened fruits and flowers were blended until a smooth puree were obtained. 200 g pulp with equal amount of sugar and few drops of citric acid was added in a saucepan and heated until the jam reached to its desired consistency.

**Results:** The result demonstrated that the fruits jam has higher carbohydrate, protein, fiber and ash 58, 37, 14.8 and 3.72 as compared to flower jam, respectively. Sensory ratings indicated that both jams have good acceptable quality and sensory attributes. In consumer effective test, fruit jam was found to be better in texture and flavor while the flower jam was found to be better in color, aroma and overall acceptability as compared to each other. In QDA, fruit jam was found to be better in flavor, texture, aroma and overall acceptance while flowers jam showed better color as compared to each other.

**Conclusion:** Both fruits and flowers of Capparis decidua can be used as a functional ingredient in manufacturing of commercial jams. Further, researches required to explore its potential in other functional food products.

**Keywords:** Jam, Capparis decidua, Functional Food Products, Development and Innovation

## INTRODUCTION

*Capparis decidua* belongs to family Capparidaceae and genus *Capparis* consisted of 250 species. It is found in the tropical and subtropical or other arid regions of south Asia. It is a small tree of 4-5 m high with leafless branches (1). It is also known as with many local names such as karu, karil, karer, karel etc. It is a dessert tree and also known as a medicinal plant (2). (3) reported that methanolic extract of *Capparis decidua* contains anti-cancer, anti-proliferative and cytotoxic effects. *Capparis decidua* consists of fatty acids, glycosides, terpenoids and alkaloids. The flowers of this plant contain phthalic acid, oxalic acid, phytic acid, ascorbic acid and some hydrocarbon fractions such as triacontane and nonacosane. It contains various therapeutic properties such as antidiabetic, antioxidant, anthelmintic, antigout, antirheumatic, anaesthetics and antihemolytic. It is also used to treat many diseases such as cough, asthma, toothache, dysentery, cardiac troubles, analgesic, and liver infections (4).

Malnutrition is a basic problem in under developed countries. It is reported that 38% children (six month to 5 years) are underweight because of malnutrition. Women and children are mostly affected by the issue of malnutrition (5). *Capparis decidua* is enriched with neutral fiber, crude protein and minerals and can play an important role in improving physiological and metabiological functions of human and animals (6). Whole plant is a rich source of nutrients. It is reported that fruit of *Capparis decidua* has better nutritional profile as compared to many other vegetables (7, 8). It contains high quantity of carbohydrate, fibers and protein. Flowers of *Capparis decidua* are also enriched with high amount of protein while roots of this plant are enriched with fibers. All parts of plant are enriched with micronutrients such as calcium, sodium, potassium, iron, manganese. While some heavy metals are also present such as cadmium, nickel and cobalt (5).

Jam is a modern and traditional product which is consumed on daily basis. It is one of best preservation technique for increasing the shelf life of fruits. It is prepared by the boiling of pulp with sugar. Some other ingredients such as coloring agent, flavoring agent and preservative can also be used to improve its functions. Due to increase in demand of flavor products, it is necessary to develop new innovative products with good nutritional profile (9). *Capparis decidua* is the neglected plant and has good nutritional profile. It has good potential to be utilized in development of functional food products. There is no such article available in the literature about its use in development of functional food products. This study focused on the development and characterization of jam from the fruits and flowers of *Capparis decidua*. The development of jam from fruits and flowers of *Capparis decidua* increase it shelf life and also increase its economic value. This study introducing the *Capparis decidua* for the formulation of commercial jam. Both fruits and flower jams were compared in this study and results indicated after statistical analysis.

## METHODS

*Capparis decidua* fruits and flowers were procured from the rural areas of Multan. All the raw material were directly taken to Bahauddin Zakariya University, Multan. Mature fruits were washed with the clean water and then deseeded to ensure the quality and cleanliness. Cleaned fruits were boiled in water at 100 °C until become soft. Then these softened fruits were blended in a blender until a smooth pulp obtained. Then 200 g pulp was taken in a saucepan and added an equal amount of sugar in the mixture and few drops of citric acid to enhance the taste and preservation. The mixture was heated at the low flame with continuously stirring to prevent it from burning or sticking. A small drop of lemon juice was also added to improve the flavor of product. The jam mixture was boiled until it reached to its desired consistency. The setting point of jam mixture can be checked by placing a drop on cold plate and checked its movement. Removed the jam mixture from stove after desired consistency and allow it to cool. Then poured it into the sterilized glass jar and sealed it properly and then stored at cool place for further analysis. For the preparation of flower jam, flowers were cleaned with clean water. Then blended the flowers in a blender to obtained a homogenous mixture. 200 g flowers pulp or mixture were poured into a saucepan and added an equal amount of sugar. Further procedure was performed same as discussed above for the fruit jam.

The moisture was determined by using the method as described by. Two grams of sample were taken and heated in oven at 105 °C until constant weight. The loss in weight during drying was measured as a moisture content (10). Protein, Carbohydrate, Ash and fiber were investigated by (11, 12). In consumer effective test, Untrained panelists were recruited and asked about their judgement related to product. 50 students from Bahauddin Zakariya University, Multan were recruited. All the students were given a training about the

sensory evaluation by sensory experts. Samples were coded with random numbers and presented in a plate towards the panelists. Panelists were asked to show their judgement by rating the product from 9-point hedonic scale. This scale was consisted of nine points which includes dislike extremely (1), dislike very much (2), dislike moderately (3), dislike slightly (4), neither like nor dislike (5), like slightly (6), like moderately (7), like very much (8) and like extremely (i.e., 9) (13).

In this test, a group of trained and expert panelists were recruited and asked to judge the product by using their expertise. Ten trained persons were recruited from the Bahauddin Zakariya University and different food industries of Multan. Before tasting each sample, the judges were advised to clean their palate by drinking water to prevent the taste effects of previous sample (14). Total plate counts of both jam for a storage study of 0 to 60 days were determined by following the procedure as mentioned by (15). For determination of total fungal count, potato dextrose agar (PDA) was used as medium for fungal growth. Plates were incubated for 5 days at 37C. Colonies of yeast and molds were counted by using the standard plate count method (SPC) (16). All the experiments were performed triplicate and the results were analyzed by using software such as SPSS 2019 and Microsoft Excel 2016. All the results are presented in the form of Mean  $\pm$  Standard Deviation (17).

## RESULTS

The proximate analysis of fruits and flower jams were determined and result demonstrated in terms of percentage as mentioned in Table 1. Sample T1 showed moisture ( $84.6 \pm 2.5$ ), carbohydrate ( $58 \pm 2.6$ ), protein ( $37.33 \pm 2.51$ ), fiber ( $14.83 \pm 1.61$ ), ash ( $3.72 \pm 0.50$ ). While the sample T2 demonstrated moisture content ( $72.83 \pm 1.25$ ), carbohydrate ( $15.33 \pm 1.52$ ), protein ( $25.33 \pm 4.50$ ), fiber ( $14.76 \pm 0.66$ ) and ash ( $4.47 \pm 0.46$ ). The result presented that T1 has high moisture percentage as compared to T2 while T2 has less percentage as compared to T1. Carbohydrate content determined high in T1 while T2 has very less percentage of carbohydrate. T1 has high protein content as compared to T2. There was no significant difference in the fiber content of both samples T1 and T2. Ash content was slightly higher in T2 as compared to T1.

**Table 1: Nutritional composition of Capparis decidua jam from fruits and flowers.**

Proximate Analysis	T <sub>1</sub>	T <sub>2</sub>
Moisture	$84.6 \pm 2.5$	$72.83 \pm 1.25$
Carbohydrate	$58 \pm 2.6$	$15.33 \pm 1.52$
Protein	$37.33 \pm 2.51$	$25.33 \pm 4.50$
Fiber	$14.83 \pm 1.61$	$14.76 \pm 0.66$
Ash	$3.72 \pm 0.50$	$4.47 \pm 0.46$

T<sub>1</sub>: Capparis decidua fruit jam; T<sub>2</sub>: Capparis decidua flower jam

In consumer effective test, results were determined and presented in terms of Mean  $\pm$  Standard Deviation as mentioned in Table 2. Sample T1 showed the ratings for color ( $7.5 \pm 0.90$ ), flavor ( $8.60 \pm 0.5$ ), texture ( $7.00 \pm 0.85$ ), aroma ( $7.60 \pm 0.50$ ) and overall acceptance ( $7.67 \pm 0.68$ ). While T2 showed ratings of color ( $7.9 \pm 1.10$ ), flavor ( $8.50 \pm 0.50$ ), texture ( $6.50 \pm 0.50$ ), aroma ( $8 \pm 0.50$ ) and overall acceptance ( $7.72 \pm 0.65$ ). Sample T1 received higher ratings for flavor and texture while the sample T2 was found to be higher for color, aroma and overall acceptance. T1 received lower sensory ratings for color, aroma and overall acceptance as compared to T2. While T2 showed lower sensory ratings for flavor and texture. In QDA test, T1 sample showed the ratings  $7.50 \pm 0.85$  for color,  $8 \pm 0.5$  for flavor,  $7 \pm 0.50$  for texture,  $8.50 \pm 0.50$  for aroma and  $7.75 \pm 0.58$  for overall acceptance. While the sample T2 was found to be  $7.60 \pm 0.50$  for color,  $7.85 \pm 0.12$  for flavor,  $6.95 \pm 0.50$  for texture,  $8.10 \pm 0.40$  for aroma and  $7.62 \pm 0.38$  for overall acceptance as mentioned in Table 2. Sample T1 received higher ratings for the flavor, texture, aroma and overall acceptance. While the sample T2 received higher ratings of color by the judges. T1 has lower ratings for color as compared to T2 while the T2 has lower ratings of flavor, texture, aroma and overall acceptance as compared to T1.

**Table 2: Sensory Testing results of Capparis decidua fruit and flower jam.**

Sensory Testing	T <sub>1</sub>	T <sub>2</sub>
<b>Consumer Effective Test</b>		
Color	7.5 ± 0.90	7.9 ± 1.10
Flavor	8.60 ± 0.5	8.50 ± 0.50
Texture	7.00 ± 0.85	6.50 ± 0.50
Aroma	7.60 ± 0.50	8 ± 0.50
Overall Acceptance	7.67 ± 0.68	7.72 ± 0.65
<b>Quantitative Descriptive Test</b>		
Color	7.50 ± 0.85	7.60 ± 0.50
Flavor	8 ± 0.5	7.85 ± 0.12
Texture	7 ± 0.50	6.95 ± 0.50
Aroma	8.50 ± 0.50	8.10 ± 0.40
Overall Acceptance	7.75 ± 0.58	7.62 ± 0.38

T<sub>1</sub>: Capparis decidua fruit jam; T<sub>2</sub>: Capparis decidua flower jam

The results elucidated that the total plate counts of fruit jam showed significant ( $p < 0.05$ ) increase from 0 to 2, at storage days of 0-60, respectively. Similarly, the flower jam delineated a significant increase ( $p < 0.05$ ) from 0-1.5 at storage days of 0-60, respectively as mentioned in (Table 3).

**Table 3: Total plate counts (TPC) of Capparis decidua fruit and flower jam at storage days of 0 to 16.**

Storage Days	T <sub>1</sub>	T <sub>2</sub>
0	N.D	N.D
30	1±0.5	1±0.4
60	2±0.5	1.5±0.5

T<sub>1</sub>: Capparis decidua fruit jam; T<sub>2</sub>: Capparis decidua flower jam; N.D: Not Detected

The results delineated total fungal counts of flower jam showed significant ( $p < 0.05$ ) increase at storage days of 0-60, respectively as compared to fruit jam. The results are mentioned in (Table 4).

**Table 4: Molds and Yeast count (CFU/g) of Capparis decidua fruit and flower jam at storage days of 0 to 16.**

Storage Days	T <sub>1</sub>	T <sub>2</sub>
0	N.D	N.D
30	1.5×10 <sup>3</sup>	1.7×10 <sup>3</sup>
60	2.1 × 10 <sup>3</sup>	3.8 × 10 <sup>3</sup>

T<sub>1</sub>: Capparis decidua fruit jam; T<sub>2</sub>: Capparis decidua flower jam; N.D: Not Detected

## DISCUSSION

It is demonstrated that *Capparis decidua* fruit jam was found to be higher in moisture, protein, carbohydrate content but lower ash content. While the flowers jam has lower moisture, carbohydrate, protein but higher ash content. There was no significant difference observed in the fiber content of both jams. It was observed that the jam developed from *Capparis decidua* fruit has higher moisture, protein, carbohydrate and lower ash content as compared to the jam developed from flowers as mentioned in (Table 1). These results were found to be comparable with (18-21). Sensory ratings reported that our results were found to be comparable with another study of (9, 13, 22). Both jams have good and acceptable ratings. Fruit jam received higher ratings for flavor, texture and lower ratings for color, aroma and overall acceptance as compared to flower jam. While the flower jam has higher ratings for color, aroma, overall acceptance and lower ratings for texture and flavor. Flower jam was found to be more prominent in color, aroma and has more ratings for overall acceptance as compared to fruit jam. While the texture and flavor were found to be better in fruit jam as compared to flower jam. Table 2 reported that both the jams obtained good and acceptable ratings by the judges. fruit jam obtained higher rating for flavor, texture, aroma and overall acceptance while the flower jam obtained higher ratings for color. It was reported that the fruit jam has higher aroma, flavor and texture as compared to the flower jam. While the jam developed from flower was found to be more prominent in color as compared to fruit jam. The TPC results demonstrated that both jam was found to be in acceptable limit and jam were found to be safe for consumers. There was no significant difference in the results of both treatments but T<sub>1</sub> showed a slightly higher counts as compared to T<sub>2</sub>. Our results were found to be comparable with (23). The results of total fungal count were reported in such a way that at zero days T<sub>1</sub> and T<sub>2</sub> both samples showed no fungal growth. After 30 days fungal count of  $1.5 \times 10^3$  and  $1.7 \times 10^3$  was observed for T<sub>1</sub> and T<sub>2</sub> respectively. This shows that as storage time increase microbial growth starts. After 60 days CFU increases with the increase in time up to  $2.1 \times 10^3$  for T<sub>1</sub> and  $3.8 \times 10^3$  for T<sub>2</sub>. Fruit of *Capparis decidua* is more acidic as compared to its fruit. Therefore, T<sub>1</sub> has less microbial count as compared to the T<sub>2</sub>. (24, 25) also observed that there is an opposite relation with samples acidity and growth of Mold and yeast colonies.

## CONCLUSION

*Capparis decidua* fruits and flowers has good nutritional profile. Both fruits and flowers are enriched with macronutrients such as carbohydrate, protein, fiber and micronutrients such as calcium, magnesium, sodium. *Capparis decidua* is a neglected plant and their exposure for the development of functional products is still unknown. In this study Jam was prepared from the fruits and flowers of *Capparis decidua* and jams were checked for its proximate composition and sensory evaluation. The results indicated that fruit jam had higher proximate composition as compared to flower jam. While there was no significant difference in the fiber content of both jams. Fruit jam obtained higher ratings for flavor and texture while flower jam received higher ratings for aroma, color and overall acceptance in consumer effective test. While in QDA fruit jam had higher rating for aroma, texture, flavor and overall acceptance. While flower jam had higher ratings for color. Both jams have more than good sensory ratings and overall acceptance. These results demonstrated the use of *Capparis decidua* as a functional ingredient in commercial jam production. Further studies are required to explore its use in other functional products.

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