Journal of Advanced Zoology

ISSN: 0253-7214

Volume 44 Issue 01 Year 2023 Page 34:41

Analysing the Chemical Composition of Sumac Gummy Candy from *Rhus Coriaria* (Sumac)

Alemsenla Jamir[1]*, Mandeep Singh Sibian[2]

[1]*Master of Science Student, Department of Nutrition and Dietetics, UIAHS, Chandigarh University,Mohali- 140413, Punjab, India. Email: alrmsenlajamir4@gmail.com*

[2]*Assistant Professor, Department of Nutrition and Dietetics, UIAHS, Chandigarh University, Mohali-140413, Punjab, India. Email: mandeep.e11393@cumail.in*

**Corresponding author's E-mail: alrmsenlajamir4@gmail.com*

Article History

Received: 06 June 2023
Revised: 05 Sept 2023
Accepted:11Sept 2023

Abstract

Sumac is the popular name for the genus Rhus, which is a member of the family Anacardiaceae and has over 250 distinct species of flowering plants. Sumac, or Rhus coriaria, is increasingly used in pharmacology, food science, and veterinary medicine, in addition to being used in cooking and human sustenance.In this study, the manufacture of sumac powder and its physicochemical composition of sumac gummy candy were assessed. Additionally, two varieties of sumac gummy candies with different formulations were created.Sumac gummy candies made with 20% agar, 70% sugar, and 190% sumac water in varied ratios of 90% sumac powder with 10% pomegranate juice (for coloring) and 70% sumac powder. Differences in the chemical composition and sensory qualities of the two kinds of candies were analyzed. The Nine-Point Hedonic Scale and Score Card Method were used for sensory evaluation in order to determine the best acceptable product. Based on sensory examination and chemical analysis, the sumac gummy candies (Sample A) received the highest ratings from the panelists for appearance (8.6), color (7.75), texture (8.4), taste (8.1), flavor (8.9), and overall acceptance (8.35). Moisture (32.61), ash (0.26), fat (0.52), protein (0.52), and carbohydrates (66.05) constitute the sumac gummy candy's physicochemical composition.

Keywords: *Sumac gummy candy, Sensory evaluation, Physicochemicals, Rhus Coriaria*

1. Introduction

Sumac (*Rhus coriaria*), a culinary spice, has been utilised throughout the northern regions of Africa and the region of the Mediterranean for a number of centuries [3].The word sumac derives from "Sumaga," which in Syriac signifies red. They have little blooms with parts organised in groups of four or six, as well as simple or compound leaves and small dry fruits containing a single seed that are frequently hairy and occasionally brilliantly coloured. Typically, they grow in dense clusters. Their stems contain milk or resinous liquid [10]. The plant is widely recognised in Middle Eastern and Iranian medicinal practises to cure a variety of illnesses, including haemorrhoids, gout, haemorrhoids, dysentery, and diarrhoea.It is also widely employed to heal wounds and lower blood sugar, cholesterol, and uric acid levels [14]. Berries from *Rhus coriaria* are helpful in preventing colitis, diabetes, obesity, and paralysis. The Middle Eastern cuisine uses the tart, acidic fruits of R. coriaria as a condiment and sour drink. Its juice contains citric and malic acids, which give it a sour flavour [1]. Tea made from sumac is a good source of vitamin D, works well to treat colds and the flu, and is also said to be a cure-all for infections, coughing, sore throats, and other ailments like asthma and shortness of breath [8].

Sumac's phytochemical composition has been thoroughly investigated, and it was found to contain tannins, polyphenols, flavonoids and organic acids [9]. Additionally, it includes fatty acids including malic, palmitic, stearic, oleic, and linoleic acids. Tannins also play a significant role in the polar chemicals found in the Sumac essential oil and extract. Gram-positive and gram-negative harmful microorganisms are significantly reduced by the use of sumac. Previous research has demonstrated that the Sumac fruit and leaf extracts have effective antibacterial properties against bacilli, staphylococci, enterococci, and lactobacilli [13]. All non-poisonous species have red berries when they are ripe, and they are all incorrectly referred to as red sumac. *Rhus coriaria* is the sole species in the genus [8]. Numerous investigations have been conducted to determine the main elements of Rhus coriaria, its bioactive chemicals, and the makeup of its fatty acids [19].

The use of plant extracts as organic preservatives is gaining interest in the food industry. Food can be treated with plant extracts to prevent lipid oxidation and microbial development. The excellent antioxidant and antibacterial activity of *Rhus coriaria* water extracts against pathogenic bacteria common in food supports their usage as efficient and all-natural preservatives in the food industry [18]. The oil business may regard the plant seeds as a source of linoleic and oleic acids despite the fact that they are a by-product of the industrial production of the spice [3].

Gummy candies made with sumac as a flavor provide consumers with a unique sensory experience that blends the comfort of gummy candies with the unexpected twist of a sour and lemony essence, breaking away from standard candy flavors [5]. Even though there hasn't been much research specifically on sumac gummy candies, sumac's possible health advantages have been extensively studied. Sumac, with its rich historical and culinary significance, introduces a unique flavor profile that can pique the curiosity of adventurous consumers seeking new taste sensations. This study aims to assess the acceptability of sumac gummy candies among customers and their chemical composition.

2. Materials And Methods

After The study, " Analysing the chemical composition of sumac gummy candy from Rhus Coriaria," was carried out in the department of Nutrition and dietetics, UIAHS, Chandigarh university, Gharuan, Punjab, in the academic year 2022–2023.The details of materials used and techniques adopted during the course of investigation are mentioned below:

Raw materials: Fresh sumac (Rhus *Coriaria*) berries were collected from the tress from Dimapur, Nagaland. The fully matured berries were harvested and transported to the lab for further examination. Sugar, agar powder, and pomegranates were purchased from Kharar's neighbourhood market in Punjab.

Preparation of sumac powder: Dry the berries in the sun for 7–10 days after being gathered. After drying out, they are roughly crushed using a pestle and mortar (the older, more traditional equipment for this is a wooden pestle and mortar known as a Jurun). The trash and any lingering branches are filtered using a wide-hole sieve [4].

Between the three phases of crushing, sifting, and drying, maca is dried in the sun for two days. When done, they are stored in an airtight container in a cool, dry, and dark environment as shown in figure 1.

Harvested berries

↓

Sun drying (7-10 days)

↓

Rough mash

↓

Sorting with sieve

↓

Removal of thrash

↓

Removal of branches

↓

Sun drying (2days)

↓

Crushing with pestle

↓

Sorting with sieve

↓

Sun drying (2days)

↓

Transfer to air tight container

↓

Storage in cool, dry , dark location

Figure 1: Flowchart for preparation of sumac powder

Production of sumac gummy candy:The modified approach was used to create two different formulations of sumac gummy candies using suagr and agar respectively(Table1).

Table 1: Formulation of sumac gummy candy

SAMPLE	Sumac powder(g)	Pomegranate juice(ml)	Agar(g)	Sugar(g)	Sumac Water(ml)
A	90	10	20	70	190
B	70	---	20	70	190

* 10ml of pomegranate juices was added for colouring.

Sumac water extract: The crushed berries were then put into a sizable vessel, like a jar or bowl. Then, using a ratio of around 4 cups of cold water to every 1 cup of crushed sumac berries, cold water was added to the container and gently swirled. To improve the flavour, the crushed berries were steeped in water for at least 18 to 20 hours while being occasionally swirled to help the flavours come through. An additional container was covered with a fine-mesh sieve after it had been kept for more than 20 hours. poured the sumac mixture through the sieve slowly, letting the liquid pass through while capturing any particles, and then did the same. The purified, airtight bottles were then filled with the filtered sumac water and kept it in a refrigerator to keep it fresh [9].

Preparation of sumac gummy candy: 2 tablespoons of sumac water were combined with 20 grams of agar. On medium heat, 70g of sugar and 190 ml of sumac water were heated. After continuing to boil, it reached a thick consistency. When dipped into water, it reached the soft-ball stage of cooking. After waiting for a while, the agar was added to the boiling sugar and sumac water along with 2 teaspoons of pomegranate juice for coloring. The food was removed from the stove after two minutes. It was then poured into the molds. It was kept for two hours in the refrigerator (figure 2).

Combine : 2 tbsp sumac water + 20gm of agar

↓

Heat : 70g of sugar + 190ml sumac water

↓

Boil until thick consistency

↓

Check soft boil stage

↓

Wait for a while

↓

Add : Agar mixture with 2 tsp of pomegranate juice

↓

Boil for 2 kin

↓

Remove from heat

↓

Pour into mould

↓

Refrigerate for 2 hours

↓

Serve and enjoy

Figure 2: Flowchart for peparartion of sumac gummy candy

Chemical Composition

Moisture

The moisture content of the samples was ascertained using the hot air oven method at 70°c for 5 hours. The technique of [2] was used to determine the moisture content.

Calculation

$$\text{Moisture (\%)} = \frac{(w_2-w_1)-(w_2-w_3)}{(w_2-w_1)} \times 100$$

Where, W1=Weight in gm of the dish with the material before drying
W2=Weight in gm of the dish with the material after drying
W=Weight in gm of the empty dish.

Ash

5 gms of the material was weighed in a dried and tared crucible. Then a hob was used to light the sample in a dish until it is totally blackened. Once grey ash is obtained, the dish was moved to a muffle furnace set at 550 °C. The food was weighed after cooling in a desiccator. The [2] procedure was used for estimating the amount of ash.

Calculation

$$\text{Total ash (\% by weight)} = \frac{(w_2-w)}{(w_1-w)} \times 100$$

Where, w_2 =Weight in gm of the dish with the ash
w=Weight in gm of empty dish
w_1=Weight in gm of the dish with the sample material taken for real.

Fat

Utilizing [2] process, the fat content was assessed. 5.0 g of the dry material was transferred to a thimble after weighing, filter paper was used to plug the thimble from the top. Measurement of an empty, dry Soxhlet flask was determined and hexane/pet ether was used to remove the fat in the Soxhlet apparatus for 3 to 4 hours. The solvent in the flask was evaporated and remaining solvent was removed by placing the flask in a hot air oven set to 105°C for around 30 minutes. Finally, flask was left to cool before weighing it precisely.

Calculation

$$\text{Total fat (\% by weight)} = \frac{(w_2-w_1)}{w} \times 100$$

Where, w= sample weight in gm
w_1= Weight in gm of the empty Soxhlet flask
w_2= Weight in gm of the Soxhlet flask with the fat

Protein

The [2] process was used for estimating the protein content. The sample was weighed at roughly 1.0 g, and then it is transferred to a 200 mL Kjeldahl digestion flask. The flask was filled with 25 mL of concentrated sulfuric acid, 9.96 gm of potassium sulphate, and 0.04 gm of copper sulphate. The flask was then placed on a stand within the digesting chamber and heated for at least 2.5 hours to make the sample transparent.

$$\text{Protein (\%)} = \frac{(\text{Blank T.V- Spl T.V}) \times \text{Normality (NaOH)} \times 0.0014 \times 1000 \times \text{protein factor.}}{\text{Sample weight(g)}}$$

Carbohydrates

It is calculated as Carbohydrates (%) =100-[Moisture (%) +Ash(%)+Fat (%) +Protein

Statistical Analysis

Using a Statistical Software Programme IBM (SPSS) Version 29.0.1.0(SPSS, 2023) was used on the information collected from the sensory assessment and proximal composition. Mean ± SD were made for the chemical composition of sumac powder and sumac gummy candies and sensory assessment for the control samples, Sample A and Sample B

3. Results and Discussion

Physico- chemical composition of sumac powder:

Sumac powder's approximate composition is shown in the table 2, with moisture content at 7.26 percent, ash content at 4.22 percent, fat content at 19.48%, carbohydrate content at 65.58 percent, and protein at 4.86%. According to research done on the chemical composition of sumac fruit, its mature fruits comprise 2.6% protein, 7.4% fat, 14.6% fibre, and 1.8% ash. The sumac fruit has a calorimetric estimate of 147.8 kcal per 100g [17]. The different physicochemical values might be due to the variety of Rhus Coriaria and the region from which the fruits were obtained.

Table 2: Physico-chemical composition of sumac powder

CHEMICAL PARAMETERS	OBSERVATIONS
Moisture	7.23±0.02
Ash	4.10±0.17
Fats	19.45±0.02
Carbohydrates	65.54±0.03
Protein	4.84±0.01

*Values are mean of three replicate observations ± S.D.

Physicochemical composition of sumac gummy candy and control:

The physicochemical composition of the control and sumac gummy candy (sample A and sample B) was demonstrated on a table 3. The moisture content in the control was found to be 30.73 while in sample A the moisture content was 32.61. For fresh carrot candies, the moisture content measurements made by [12] were 16.2, 14.2, and 21.0%, respectively. Sumac gummy candies (sample A) had an ash content of 0.26 as opposed to 0.13 in the control group. In accordance with [7], the total ash concentration in guava candies differed from 0.39 to 0.57. The fat content in the sumac gummy candies (sample A) was 0.52 and 0.37 in the control group. There are guava sweets with fat contents that vary from 0.28 to 0.42%, according to [7]. Sumac gummy candy contained 66.05% of its weight in carbohydrates, compared to 68.30% in the control. [7] found that the guava candies included 87.23–85.09% carbs, while [6] found that the honey-based carrot candy consisted of 78% of the total sugars. Sumac gummy candies (Sample A) had a protein content of 0.53, whereas the control group had 0.40. Aonla candy's protein concentrations varied between 1.22 and 0.94, according to [11]. In a comparable investigation, the protein content of tigernuts (Cyperusesculentus) was found to be 2.78% [15, 16].

Table 3: Physicochemical Composition of Control and Sumac Gummy Candy (Sample A)

CHEMICAL PARAMETERS	(CONTROL)	SAMPLE A (SUMAC GUMMY CANDY)
Moisture	30.73 ± 0.01	32.61 ± 0.02
Ash	0.13 ± 0.02	0.26 ± 0.01
Fats	0.37 ± 0.02	0.52 ± 0.01
Carbohydrates	68.30 ± 0.02	66.05 ± 0.02
Protein	0.23 ± 0.5	0.52 ± 0.01

*Values are mean of three replicate observations ± S.D

Sensory Analysis:

The table 4below contains information about candy sensory assessment. In comparison to the other candies, sample A i.e sumac gummy candy received higher average ratings for appearance (8.6), colour(7.7), texture(8.4), taste(8.1), flavour(8.9)and overall acceptability(8.35)The control candy obtained mean score of 7.6, 7.5, 7.3, 7.6,7.2 and 7.5 for appearance, colour, texture, taste, flavour and overall acceptability. The acceptance rating for the sample A (sumac-gummy candies) (8.35) was 2.17

points greater compared to the rating for the sample B. Sample A were accordingly the most popular treat based on sensory investigation.

Table 4: Sensory Evaluation of Control Candies and Sumac Gummy Candies

SENSORY PARAMETERS	CONTROL	SAMPLE A	SAMPLE B
Appearance	7.6±0.68	8.6±0.50	6.35±0.48
Colour	7.57±0.71	7.75±0.71	6.8±0.69
Texture	7.35±0.74	8.4±0.59	6.3±0.47
Taste	7.6±0.59	8.1±0.71	5.59±0.82
Flavour	7.2±0.61	8.9±0.30	5.5±0.76
Overall acceptability	7.5±0.22	8.35±0.44	6.18±0.48

*Values are mean sensory scores ± S.D.
A=90%sumac powder+15%promegranate juice+sugar+agar+sumac water(190ml) B=70%sumac powder+suagar+agar+sumac water(190ml).

4. Conclusion

Due to its nutritional value, greater convenience, and ability to be used as a dietary supplement by all consumers, sumac gummy candy among ready-to-eat meals may become increasingly popular. The panellists rated the sumac gummy candies (Sample A) highest for appearance (8.6), colour (7.75), texture (8.4), taste (8.1), flavour (8.9), and overall acceptability (8.35). The product's physicochemical composition contains moisture (32.61), ash (0.26), fat (0.52), protein (0.52), and carbohydrate (66.05). In order to enhance the quality of sumac gummy candies, the present study therefore cleared the door for more research supported by various therapies.

Acknowledgement: The author would like to thank the supervisor Dr. Mandeep Singh Sibian and Head of Department of Nutrition and Dietetics, Chandigarh University and members of advisory committee for their support and resources that made this research possible.

Ethics approval and consent to participate: Human participants were involved in this study. All experimental protocols were approved by the ethics committee of Chandigarh University. All participants provided written informed consent before participating in the study.

Consent for publication: Not applicable

Data availability: All data generated or analysed during this study are included in this published article.

Competing interest: The authors declare no competing interest.

Funding: No funding was received for this study

Author's contribution: A. designed the study, collected and analysed the data and wrote the manuscript. M.S.S. provided critical feedback and helped shaped the research, analysis and approved the final manuscript. All the authors read and approved the final manuscript.

References:

1. Asgarpanah, J., & Saati, S. (2014). An overview of phytochemical and pharmacological properties of *Rhus coriaria* L.
2. AOAC. (2000). *AOAC official methods of analysis*. MD, USA: Association of Official Analytical Chemists, Inc.
3. Batiha, G. E. S., Ogunyemi, O. M., Shaheen, H. M., Kutu, F. R., Olaiya, C. O., Sabatier, J. M., ... & De Waard, M. (2022). *Rhus coriaria L. (Sumac), a versatile and resourceful food spice with a cornucopia of polyphenols*. *Molecules, 27*(16), 5179. https://doi.org/10.3390/molecules27165179
4. Caliskan, G., & Dirim, S. N. (2016). The effect of different drying processes and the amounts of maltodextrin addition on the powder properties of sumac extract powders. *Powder Technology, 287*, 308-314.
5. Dobhal, A., & Awasthi, P. (2019). Formulation of beetroot candy using simple processing techniques and quality evaluation. *Journal of Pharmacognosy and Phytochemistry, 8*(4), 913-916.
6. Durrani, A. M., Srivastava, P. K., & Verma, S. (2011). Development and quality evaluation of honey-based carrot candy. *Journal of Food Science and Technology, 48*, 502-505.

7. Joshi, H., Kochhar, A., & Boora, R. S. (2019). Organoleptic characteristics and nutritive value of candy developed from new varieties of guava. *IJCS, 7*(2), 2124-2127.
8. Khoshkharam, M., Shahrajabian, M. H., Singh, R. B., Sun, W., Magadlela, A., Khatibi, M., & Cheng, Q. (2022). *Sumac: a functional food and herbal remedy in traditional herbal medicine in Asia*. In *Functional Foods and Nutraceuticals in Metabolic and Non-Communicable Diseases* (pp. 261-266).
9. Korkmaz, H. (2021). Could sumac be effective in COVID-19 treatment?. *Journal of Medicinal Food, 24*(6), 563-568. Academic Press.
10. Kossah, R., Nsabimana, C., Zhao, J., Chen, H., Tian, F., Zhang, H., & Chen, W. (2009). Comparative study on the chemical composition of Syrian sumac (*Rhus coriaria* L.) and Chinese sumac (*Rhus typhina* L.) fruits. *Pakistan Journal of Nutrition, 8*(10), 1570-1574.
11. Kumbhalkar, H. S., Raut, V. U., Raut, P. R., & Sarode, B. P. (2022). Studies on preparation of aonla candy with different brix concentration and steeping time.
12. Madan, S., & Dhawan, S. S. (2005). Development of value-added product 'CANDY' from carrots. *Process Food Ind*, *8*(3), 26-29.
13. Moghadam, P., Dadelahi, S., Hajizadeh, Y. S., Matin, M. G., Amini, M., & Hajazimian, S. (2020). Chemical Composition and Antibacterial Activities of Sumac Fruit (*Rhus coriaria*) Essential Oil on Dental Caries Pathogens. *The Open Microbiology Journal*, *14*(1).
14. Morshedloo, M. R., Maggi, F., Neko, H. T., & Aghdam, M. S. (2018). Sumac (*Rhus coriaria* L.) fruit: Essential oil variability in Iranian populations. *Industrial Crops and Products, 111*, 1-7.
15. Okudu, H. O., & Ogubuike, L. A. (2016). Evaluation of chemical composition of candy developed from tigernut (*Cyperus esculentus*) milk. *African Journal of Food Science and Technology, 7*(1), 027-031.
16. Onyekwelu, C. N. (2018). Chemical composition and sensory evaluation of candies from tiger nut and coconut milk blends. *Annals: Food Science & Technology, 19*(4).
17. Özcan, M., & Haciseferogullari, H. (2004). A condiment [sumac (*Rhus coriaria* L.) fruits]: some physicochemical properties. *Bulgarian Journal of Plant Physiology*, *30*(3-4), 74-84.
18. Rayne, S., & Mazza, G. (2007). Biological activities of extracts from sumac (*Rhus* spp.): a review. *Nature Precedings*, 1-1.
19. Sakhr, K., & El Khatib, S. (2020). Physiochemical properties and medicinal, nutritional, and industrial applications of Lebanese Sumac (*Syrian Sumac-Rhus coriaria*): A review. *Heliyon, 6*(1).