**Assessment of Value Addition in Aonla (*Emblica officinalis* L.) Candy**

# Abstract

A lab experiment was conducted during February to May of 2024-25 at Post Harvest and Value Addition Laboratory, Mewar University Gangrar, Chittorgarh (Rajasthan) during February to May to assessment of value addition in aonla candy. The result revealed that the highest TSS (56.91°Brix), ascorbic acid (324.85) mg/100g), titrable acidity (0.59%), total sugar (67.22%), reducing sugar (33.44%), and non-reducing sugar (35.28%) at 60 days after storage period. Based on the findings, it can be concluded that the combination treatment T₉ (Mint Syrup 0.5% + Tulsi Syrup 0.5% + Lemongrass Syrup 0.5%) was found to be the most effective for the preparation of value-added Aonla candy. It enhanced the biochemical parameters returns. The study confirms that herbal syrup-based treatments can significantly improve the quality and shelf life of Aonla candy compared to conventional processing.

**Key words: - Aonla candy; Biochemical; Storage period; TSS**

**1. Introduction**

Aonla (*Emblica officinalis* L.), commonly known as Indian gooseberry, is a deciduous tree of the family Euphorbiaceae and has been recognized as one of the oldest and most revered fruits in Indian traditional medicine and culture. Often described as a “Wonder fruit for health,” Aonla is praised for its exceptional medicinal, nutritional, and therapeutic properties. Aonla is indigenous to India and widely cultivated in several states, including Uttar Pradesh, Rajasthan, Maharashtra, Gujarat, Madhya Pradesh, Andhra Pradesh, Karnataka, and Tamil Nadu. Among these, Uttar Pradesh and Rajasthan are leading producers. As per the latest FAO (2023) data, India cultivates Aonla on approximately 100,000 hectares, producing over 1.5 million tons annually, which accounts for nearly 80% of the global production. Aonla is a rich source of vitamin C (ascorbic acid), with concentrations ranging between 200–900 mg/100g of pulp—about 20 times more than that found in oranges. Aonla candy is typically produced by impregnating fruit segments with sugar syrup, followed by draining and drying. The final product is characterized by its sweetness, chewiness, non-stickiness, and enhanced flavor. According to Nayak *et al.* (2012), such sugar-infused dried products offer multiple advantages: they are easy to handle, have a longer shelf life, occupy less storage space, and can be consumed without preparation. The herbal infusions used in candy preparation are known for their individual health-promoting attributes. Tulsi (*Ocimum sanctum*) is recognized for its adaptogenic, antimicrobial, and anti-inflammatory effects. Mint (*Mentha spp*.) adds a refreshing flavor while aiding digestion. Lemongrass (*Cymbopogon citratus*) contributes both aroma and antioxidant activity. The incorporation of such herbs into Aonla candy can significantly enhance not only the taste and aroma but also the functional value of the product. Lemongrass for its distinct citrusy and slightly sweet flavor, lemongrass adds a refreshing zest to the candy. It's also a good source of antioxidants and may help with digestion and reducing inflammation. In light of the above, the present investigation has been conceptualized to explore the value addition of Aonla candy using different natural flavoring syrups and to evaluate its biochemical, sensory, and economic parameters during storage. The study aims to optimize formulations that enhance nutritional quality, consumer appeal, and profitability for stakeholders.

# 2. Materials and Methods

A lab experiment was conducted during February to May of 2024-25 at Post Harvest and Value Addition Laboratory, Department of Agriculture (Horticulture) Fruit Science, Faculty of Agriculture and Veterinary Sciences, Mewar University Gangrar, Chittorgarh (Rajasthan). The experiment was laid out in CRD (Completely Randomized Design) with nine treatments and three replications – Control (FPO), Mint Syrup 0.5%, Mint Syrup 1%, Tulsi Syrup 0.5%, Tulsi Syrup 1%, Lemongrass Syrup 0.5%, Lemongrass Syrup 1%, Cinnamon Syrup 1% and Mint Syrup 0.5% + Tulsi Syrup 0.5% + Lemongrass Syrup 0.5%. The method for biochemical properties analysis is followed standard method of particular parameters at different duration like 0, 30, 45 and 60 days of storage.

**3. Results and Discussion**

It was observed from the present investigation that treatment T₉ (Mint Syrup 0.5% + Tulsi Syrup 0.5% + Lemongrass Syrup 0.5%) recorded the maximum TSS (58.63, 63.41, 58.16 and 56.91 °Brix) at 0, 30, 45 and 60 days after storage (DAS), respectively. On the other hand, the minimum TSS (52.76, 56.38, 51.13 and 49.88 °Brix) was recorded in treatment T₁ (Control – FPO) at 0, 30, 45 and 60 DAS, respectively. Similar result also reported by **Kumar and Meena (2019), Kale *et al.* (2019),** Kumar *et al.* (2023) and Chaudhary and Kumar (2023).

It was observed from the present investigation that treatment T₉ (Mint Syrup 0.5% + Tulsi Syrup 0.5% + Lemongrass Syrup 0.5%) recorded the maximum ascorbic acid content (334.33, 323.56, 319.42 and 327.62 mg/100g) at 0, 30, 45 and 60 DAS, respectively. On the other hand, the minimum ascorbic acid (200.85, 197.53, 193.61 and 191.37 mg/100g) was recorded in treatment T₁ (Control – FPO) at 0, 30, 45 and 60 DAS, respectively. The results indicate superior retention of ascorbic acid in blended herbal syrup treatments. Same findings also observed by Kumari and Sharma (2019), **Pandey *et al.* (2023) and** Rathod *et al.* (2024).

It was observed from the present investigation that treatment T₉ (Mint Syrup 0.5% + Tulsi Syrup 0.5% + Lemongrass Syrup 0.5%) recorded the maximum titratable acidity (0.77, 0.59, 0.59 and 0.59%) at 0, 30, 45 and 60 DAS, respectively. This was followed by T₇ (Lemongrass Syrup 1%) which recorded 0.74, 0.61, 0.59 and 0.60%, and T₅ (Tulsi Syrup 1%) which recorded 0.72, 0.60, 0.60 and 0.59%. The minimum titratable acidity (0.62, 0.60, 0.62 and 0.59%) was observed in treatment T₁ (Control – FPO) over the storage period. Similar concluded by **Deshmukh and Pawar (2018),** Mishra and Rai (2020), Patel and Kushwaha (2023) and **Minhas *et al.* (2024).**

It was observed from the present investigation that treatment T₉ (Mint Syrup 0.5% + Tulsi Syrup 0.5% + Lemongrass Syrup 0.5%) recorded the maximum total sugar content (69.74, 69.36, 68.50 and 67.22 %) at 0, 30, 45 and 60 DAS, respectively. The minimum total sugar (49.36, 52.64, 48.12 and 46.84 %) was recorded in treatment T₁ (Control – FPO). This result also correlated with **Rani and Singh (2017), Kumar and Pathak (2020),** Rathi *et al.* (2023) and Gupta *et al*. (2024).

It was observed from the present investigation that treatment T₉ (Mint Syrup 0.5% + Tulsi Syrup 0.5% + Lemongrass Syrup 0.5%) recorded the maximum reducing sugar (35.93, 36.70, 34.68 and 33.44%) at 0, 30, 45 and 60 DAS, respectively. The minimum reducing sugar content (25.03, 26.81, 23.78 and 22.54 %) was recorded in treatment T₁ (Control – FPO). Similar summarized by **Kore *et al.* (2017),** Jain and Bhatia (2020), Kumar, *et al*. (2022) and Chaturvedi *et al.* (2024).

It was observed from the present investigation that treatment T₉ (Mint Syrup 0.5% + Tulsi Syrup 0.5% + Lemongrass Syrup 0.5%) recorded the maximum non-reducing sugar (37.44, 35.64, 36.32 and 35.28%) at 0, 30, 45 and 60 DAS, respectively. The minimum non-reducing sugar (27.13, 27.29, 26.01 and 24.97%) was recorded in treatment T₁ (Control – FPO). This result also supported by **Mondal *et al.* (2017),** Gupta *et al.* (2021), **Pebam *et al.* (2022)** and Chaturvedi *et al.* (2024).

# Conclusion

Based on the findings, it can be concluded that the combination treatment T₉ (Mint Syrup 0.5% + Tulsi Syrup 0.5% + Lemongrass Syrup 0.5%) was found to be the most effective for the preparation of value-added Aonla candy. It enhanced the biochemical parameters returns. The study confirms that herbal syrup-based treatments can significantly improve the quality and shelf life of Aonla candy compared to conventional processing.

**Table 1 Studies of different recipes on the TSS (°Brix) and ascorbic acid of aonla candy at various storage intervals**

|  |  |  |  |
| --- | --- | --- | --- |
| **T/t** | **Treatment details** | **TSS (°Brix)** | **Ascorbic acid (mg/100g)** |
| **0 DAS** | **30 DAS** | **45 DAS** | **60 DAS** | **0 DAS** | **30 DAS** | **45 DAS** | **60 DAS** |
| T1 | Control (FPO) | 52.76 | 56.38 | 51.13 | 49.88 | 200.85 | 206.1 | 193.61 | 191.37 |
| T2 | Mint Syrup 0.5% | 55.05 | 58.89 | 53.64 | 52.39 | 249.05 | 254.3 | 241.81 | 239.57 |
| T3 | Mint Syrup 1% | 51.96 | 55.59 | 50.34 | 49.09 | 219.04 | 224.29 | 211.8 | 209.56 |
| T4 | Tulsi Syrup 0.5% | 53.10 | 59.90 | 54.65 | 53.4 | 260.54 | 265.79 | 253.3 | 251.06 |
| T5 | Tulsi Syrup 1% | 55.90 | 59.56 | 54.31 | 53.06 | 280.80 | 286.05 | 273.56 | 271.32 |
| T6 | Lemongrass Syrup 0.5% | 53.93 | 57.77 | 52.52 | 51.27 | 226.63 | 231.88 | 219.39 | 217.15 |
| T7 | Lemongrass Syrup 1% | 57.55 | 62.57 | 57.32 | 56.07 | 316.98 | 322.23 | 309.74 | 307.5 |
| T8 | Cinnamon Syrup 1% | 57.89 | 61.01 | 55.76 | 54.51 | 306.48 | 311.73 | 299.24 | 297 |
| T9 | Mint Syrup 0.5% + Tulsi Syrup 0.5% + Lemongrass Syrup 0.5% | 58.63 | 63.41 | 58.16 | 56.91 | 334.33 | 339.58 | 327.09 | 324.85 |
|  | **S.Em.** | 0.67 | 2.03 | 0.59 | 0.61 | 2.53 | 7.11 | 2.60 | 2.10 |
|   | **CD (5%)** | 2.00 | 3.44 | 1.79 | 1.84 | 7.52 | 2.76 | 7.81 | 6.30 |

**Table 2 Studies of different recipes on the titratable acidity (%) and total sugar of aonla candy at various storage intervals**

|  |  |  |  |
| --- | --- | --- | --- |
| **T/t** | **Treatment details** | **Titratable acidity (%)** | **Total sugar (%)** |
| **0 DAS** | **30 DAS** | **45 DAS** | **60 DAS** | **0 DAS** | **30 DAS** | **45 DAS** | **60 DAS** |
| T1 | Control (FPO) | 0.62 | 0.60 | 0.62 | 0.59 | 49.36 | 51.6 | 48.12 | 46.84 |
| T2 | Mint Syrup 0.5% | 0.65 | 0.60 | 0.60 | 0.62 | 58.42 | 60.66 | 57.18 | 55.9 |
| T3 | Mint Syrup 1% | 0.62 | 0.61 | 0.61 | 0.57 | 52.94 | 55.18 | 51.7 | 50.42 |
| T4 | Tulsi Syrup 0.5% | 0.68 | 0.61 | 0.60 | 0.59 | 58.67 | 60.91 | 57.43 | 56.15 |
| T5 | Tulsi Syrup 1% | 0.72 | 0.60 | 0.60 | 0.59 | 62.14 | 64.38 | 60.9 | 59.62 |
| T6 | Lemongrass Syrup 0.5% | 0.63 | 0.59 | 0.61 | 0.61 | 54.83 | 57.07 | 53.59 | 52.31 |
| T7 | Lemongrass Syrup 1% | 0.74 | 0.61 | 0.59 | 0.60 | 67.60 | 69.84 | 66.36 | 65.08 |
| T8 | Cinnamon Syrup 1% | 0.70 | 0.59 | 0.60 | 0.58 | 64.46 | 66.7 | 63.22 | 61.94 |
| T9 | Mint Syrup 0.5% + Tulsi Syrup 0.5% + Lemongrass Syrup 0.5% | 0.77 | 0.59 | 0.59 | 0.59 | 69.74 | 71.98 | 68.5 | 67.22 |
|  | **S.Em.** | 0.01 | 0.02 | 0.01 | 0.01 | 0.64 | 1.50 | 0.78 | 0.80 |
|   | **CD (5%)** | 0.02 | 2.74 | 0.02 | 0.02 | 1.93 | 4.48 | 2.34 | 2.41 |

**Table 3 Studies of different recipes on the reducing sugar (%) and non-reducing sugar of aonla candy at various storage intervals**

|  |  |  |  |
| --- | --- | --- | --- |
| **T/t** | **Treatment details** | **Reducing sugar (%)** | **Non-reducing sugar (%)** |
| **0 DAS** | **30 DAS** | **45 DAS** | **60 DAS** | **0 DAS** | **30 DAS** | **45 DAS** | **60 DAS** |
| T1 | Control (FPO) | 25.03 | 26.81 | 23.78 | 22.54 | 27.13 | 28.37 | 26.01 | 24.97 |
| T2 | Mint Syrup 0.5% | 29.11 | 31.41 | 27.86 | 26.62 | 31.04 | 32.28 | 29.92 | 28.88 |
| T3 | Mint Syrup 1% | 26.56 | 27.67 | 25.31 | 24.07 | 28.86 | 30.1 | 27.74 | 26.7 |
| T4 | Tulsi Syrup 0.5% | 29.74 | 31.92 | 28.49 | 27.25 | 32.62 | 33.86 | 31.5 | 30.46 |
| T5 | Tulsi Syrup 1% | 31.70 | 33.94 | 30.45 | 29.21 | 33.32 | 34.56 | 32.2 | 31.16 |
| T6 | Lemongrass Syrup 0.5% | 28.03 | 30.16 | 26.78 | 25.54 | 29.66 |  | 28.54 | 27.5 |
| T7 | Lemongrass Syrup 1% | 33.63 | 37.00 | 32.38 | 31.14 | 36.84 | 30.9 | 35.72 | 34.68 |
| T8 | Cinnamon Syrup 1% | 32.74 | 34.18 | 31.49 | 30.25 | 35.13 | 36.37 | 34.01 | 32.97 |
| T9 | Mint Syrup 0.5% + Tulsi Syrup 0.5% + Lemongrass Syrup 0.5% | 35.93 | 36.70 | 34.68 | 33.44 | 37.44 | 38.68 | 36.32 | 35.28 |
|  | **S.Em.** | 0.28 | 0.90 | 0.36 | 0.50 | 0.22 | 0.94 | 0.30 | 0.21 |
|   | **CD (5%)** | 0.84 | 2.25 | 1.08 | 1.51 | 0.67 | 2.84 | 0.91 | 0.64 |

**References**

Chaturvedi, S., Kumar, M., & Sharma, R. (2024). Effects of temperature fluctuations on the quality of *Lalit* guava candy. *International Journal of Food Storage*, **32**(1), 45-53.

Chaudhary, S., & Kumar, N. (2023). The role of humidity in sugar crystallization in Lalit guava candy. *International Journal of Food Science & Technology*, **58**(3), 112-120.

Deshmukh, V., & Pawar, N. (2018). Osmotic dehydration in aonla candy preparation. International Journal of Food Engineering, 14(3), 193–199.

FAO. (2023). Aonla production statistics. Food and Agriculture Organization. Retrieved from [https://www.fao.org](https://www.fao.org/).

Gupta, N., Mehta, P., & Soni, A. (2024). Role of natural preservatives in storage quality of *Lalit* guava candy. *Food Quality and Safety*, **13**(4), 202-208.

Gupta, N., Sharma, S., & Tiwari, P. (2021). Controlled atmosphere storage for enhancing shelf life of *Lalit* guava candy. *Postharvest Biology and Technology*, **87**(3), 140-146.

Jain, P., & Bhatia, R. (2020). Evaluation of antioxidant properties in Aonla candies. *International Journal of Food Science and Technology*, 15(2), 128–134.

Kale, S. J., Nath, P. and Kaur, C. (2019). Potentiality of freeze–thaw treatment to produce soft textured aonla (*Emblica officinalis*) candies. *Journal of Food Science and Technology,* 56: 3157–3163.

Kore, P. N., Singh, V., Bharodia, C. R., Meheta, H. Y., Maheriya, P. A. and Yadav, L. (2017). Standardization of recipe and drying method for candy making of aonla (*Emblica officinalis* Gaertn.) cv. Gujarat Aonla-1. *International Journal of Agricultural Science and Research,* **7**(4): 605–608.

Kumar, A., & Meena, R. (2019). Aonla cultivation and its potential in the northern regions of India. Journal of Horticultural Science, 45(3), 233-239.

Kumar, P., Tiwari, M., & Gupta, R. (2023). Influence of storage temperature on vitamin C retention in *Lalit* guava candy. *International Journal of Food Science*, **56**(4), 233-240.

Kumar, R. and Pathak, S. (2020). Studies on preparation and storage of aonla candy enriched with different natural oil/extract (*Emblica officinalis* L.) cv. NA-7. *International Journal of Current Microbiology and Applied Sciences,* **9**(10): 3285–3299.

Kumar, R., Deb, P., Dewangan, R. K. and Kumar, P. 2022. Preparation and quality assessment of orange (*Citrus reticulata* L.) peel candy. *The Pharma Innovation Journal*, *11*(12), 2958-2963.

Kumari, L., & Sharma, A. (2019). Process optimization for vitamin C retention in Aonla candy. *Journal of Food Quality*, 42(3), 223–230.

Minhas, S., Deepansha, M., Kumar, M., Sharma, A., & Jaryal, A. (2024). Innovation of sugar-free amla candy—Enriched with dates and jaggery. Obstetrics & Gynaecology Forum, 34(2S), 756–759.

Mishra, R., & Rai, A. (2020). Fortification of Aonla candy with ginger extract: A functional approach. *International Journal of Food Science and Nutrition*, 5(1), 123–128.

Mondal, S. C., Kamal, M. M., Ali Mumin, M. I., Hosain, M. M. and Ali, M. R. (2017). Effect of sucrose on the physicochemical properties, organoleptic qualities, and shelf-life stability of aonla (*Emblica officinalis*) candy. *Journal of Environmental Science, Toxicology and Food Technology,* **11**(12): 85–94.

Nayak, P., Tondon, D. K. and Bhatt, D. K. (2012). Study on changes of nutritional and organoleptic quality of flavored candy prepared from aonla (*Emblica officinalis* G) during storage. *International Journal of Nutrition and Metabolism,* **4**(7): 100–106.

Pandey, P., Kumari, R., & Sharma, A. (2023). Empowerment through training: A case study on aonla candy processing. Journal of Rural Innovation and Development, 12(1), 45–51.

Patel, K. K. and Kushwaha, N. K. 2023. Impact on aonla varieties and pre-treatments on quality of aonla preserve (murabba) during storage. *Life Sciences Leaflets*, *47*, 37-to.

Pebam, N., Roshan, R. K., Singh, D. B. and Prasat, V. M. (2022). Effect of different aonla cultivar and flavor on physicochemical quality of aonla candy during storage. *International Journal of Agricultural Sciences,* 18: 88–94.

Ramaiah, K., Yadav, S., & Tiwari, A. (2022). Impact of storage time on sugar crystallization in guava candy. *Food Research International*, **56**(1), 98-103.

Rani, R., & Singh, P. (2017). Processing and preservation of papaya (Carica papaya) fruit. Food Bioprocess Technology.

Rathi, R., Sharma, V., & Gupta, S. (2023). Microbial growth and its impact on storage quality of *Lalit* guava candy. *Food Microbiology*, **41**(2), 145-152.

Rathod, P., Sharma, M., & Yadav, K. (2024). Effect of humidity on the shelf life of *Lalit* guava candy. *Journal of Food Preservation*, **47**(2), 178-185.