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Standardization of ingredients for syrup preparation from swallow root (*Decalepis hamiltonii* Wight & Arn.) based on organoleptic evaluation

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Abstract

An investigation was conducted to standardize the ingredient proportions for the preparation of Nannari syrup from dried roots of *Decalepis hamiltonii* Wight & Arn. Six treatment combinations involving different levels of dried Nannari roots and sugar were evaluated for their influence on the organoleptic quality of the prepared syrup. The quantity of water was maintained at 10 litres for all treatments, while the quantities of dried roots and sugar were varied. The treatments consisted of 0.75, 1.00 and 1.25 kg dried Nannari roots in combination with different levels of sugar. The standard treatment consisted of 1.00 kg dried roots, 10 litres of water and 8 kg sugar. The prepared syrups were evaluated by a semi-trained sensory panel using a nine-point hedonic scale for appearance, colour, aroma, texture, taste, after taste and overall acceptability. Among the treatments, T₅ recorded the highest sensory scores for appearance (8.8), colour (8.9) and aroma (8.9), indicating the positive influence of higher root concentration on these attributes. However, T₄ recorded the highest scores for texture (8.6), taste (8.7), after taste (8.5) and overall acceptability (8.7), with the highest total sensory score of 60.1. T₅ and T₆ also recorded high scores for appearance, colour and aroma, but their overall sensory performance was lower than T₄. The results indicated that an optimum balance between Nannari root extract and sugar was more important for overall consumer acceptability than increasing the root concentration alone. Based on the organoleptic evaluation, T₄ comprising 1.00 kg dried Nannari roots, 10 litres of water and 8 kg sugar was identified as the most acceptable formulation and standardized for the preparation of Nannari syrup.

Keywords: *Decalepis hamiltonii*, Nannari, swallow root, syrup, sharbat, ingredient standardization, organoleptic evaluation, sensory quality

1. Introduction

Decalepis hamiltonii Wight & Arn., commonly known as swallow root or Nannari, is an endangered perennial woody climber belonging to the family Asclepiadaceae. The species is native to the Indian subcontinent and is mainly distributed in parts of the Deccan Plateau and the Western Ghats. It is known by several vernacular names, including Nannari kommulu and Maredu gaddalu in Telugu, Makaliber in Kannada and Magalikizhangu in Tamil (Vedavathy, 2004) ^[11]. The growing demand for its roots has encouraged its cultivation in different parts of southern India (Sharma and Shahzad, 2014) ^[10].

The economic importance of *D. hamiltonii* is primarily associated with its tuberous roots, which are characterized by a distinctive vanilla-like aroma. The characteristic aroma is largely associated with 2-hydroxy-4-methoxybenzaldehyde (2H4MB), an important volatile constituent of the roots (George *et al.*, 2004; Nagarajan *et al.*, 2001) ^[3, 7]. The presence of this aromatic compound contributes considerably to the sensory appeal of Nannari-based beverages (Devi and Latha, 2012; Arutla *et al.*, 2012) ^[2, 1].

The roots of *D. hamiltonii* have traditionally been used for the preparation of Nannari sharbat, a popular herbal beverage. Traditional preparation involves extraction of the aromatic constituents from the roots followed by addition of sugar to produce a sweetened beverage (Raju and Ramana, 2011; Harish *et al.*, 2005) ^[8, 4]. The roots have also been used in traditional medicinal systems and are associated with several ethnomedicinal applications (Vedavathy, 2004; Reddy and Murthy, 2013; Kumuda *et al.*, 2011) ^[11, 9, 5].

Nannari syrup has considerable potential as a value-added product because of its characteristic aroma, flavour and traditional consumer acceptance. However, the quality of the final syrup depends considerably on the proportion of root material, water and sugar used during preparation. Variation in the quantity of roots may influence the intensity of aroma, colour and flavour, while variation in sugar concentration directly influences sweetness and the balance between sweetness and the characteristic flavour of the root (Monika *et al.*, 2020) [6].

Although Nannari sharbat has traditionally been prepared using the root extract and sugar, there is a need to standardize the ingredient proportions for obtaining a consistent sensory quality. Standardization based on sensory evaluation is particularly important for developing a formulation suitable for consumer acceptance and further commercial utilization.

Therefore, the present investigation was undertaken to standardize the proportion of dried Nannari roots and sugar for the preparation of Nannari syrup based on organoleptic characteristics. The study specifically aimed to identify the treatment combination producing superior appearance, colour, aroma, texture, taste, after taste and overall acceptability.

2. Materials and Methods

2.1 Materials

Dried tuberous roots of *Decalepis hamiltonii* Wight & Arn. were used for preparation of Nannari syrup. The roots were cleaned and processed in the Department of Post Harvest Technology, College of Horticulture, Anantharajupeta, Dr. YSR Horticultural University.

Sugar and potable water were used as the other major ingredients. The quantity of water was maintained at 10 litres for all the treatments, whereas the quantities of dried Nannari roots and sugar were varied according to the treatment combinations.

2.2 Treatment details

Six treatment combinations were evaluated for standardization of the ingredients used in Nannari syrup.

Treatment	Dried Nannari roots	Water	Sugar
T ₁	0.75 kg	10 L	6 kg
T ₂	0.75 kg	10 L	8 kg
T ₃	1.00 kg	10 L	6 kg
T ₄	1.00 kg	10 L	8 kg
T ₅	1.25 kg	10 L	8 kg
T ₆	1.25 kg	10 L	10 kg

2.3 Preparation of Nannari syrup

The dried Nannari roots were thoroughly washed to remove adhering soil and other foreign materials. The cleaned roots were lightly crushed using a mortar and pestle to facilitate the release of their characteristic aroma and soluble constituents.

The required quantity of crushed roots according to each treatment was added to 10 litres of water and soaked overnight for approximately 8–10 hours. The soaked roots were then boiled over medium heat for 60–90 minutes until the volume was reduced to approximately 8 litres.

The decoction was cooled and filtered through a clean muslin cloth or fine sieve to remove root particles. The required quantity of sugar corresponding to each treatment was added to the filtered decoction. The mixture was simmered over low heat with continuous stirring until a slightly thick syrup consistency was obtained, which required approximately 30–40 minutes. The prepared syrup was allowed to cool completely and was transferred into clean, dry and airtight glass bottles for sensory

evaluation.

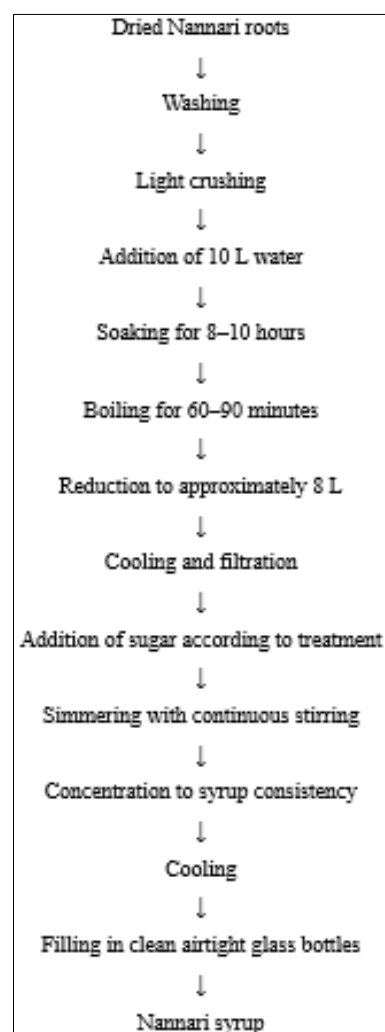


Fig 1: Flow chart for the preparation of Nannari syrup from *Decalepis hamiltonii* roots

2.4 Organoleptic evaluation

The prepared Nannari syrups were subjected to organoleptic evaluation under laboratory conditions using a semi-trained sensory panel consisting of fifteen judges. The sensory assessment was carried out using seven quality attributes viz., appearance, colour, aroma, texture, taste, after taste and overall acceptability.

A nine-point hedonic scale was used for evaluation of each attribute, where a score of 9 represented “like extremely” and a score of 1 represented “dislike extremely”. The mean sensory scores were calculated for each treatment.

2.5 Statistical analysis

The organoleptic evaluation data were analysed using Kendall’s coefficient of concordance (Kendall’s W) to determine the degree of agreement among the sensory judges. The statistical analysis was carried out using SPSS software. The values of mean sensory score and mean rank score were used to compare the treatments.

3. Results and Discussion

The sensory evaluation of Nannari syrup prepared using different combinations of dried Nannari roots and sugar revealed considerable variation among the treatments for appearance, colour, aroma, texture, taste, after taste and overall acceptability. The differences in sensory characteristics may be attributed to

variation in the concentration of Nannari root extract and sugar used during preparation.

The appearance scores ranged from 7.5 to 8.8. The highest score was recorded in T₅ (8.8), followed by T₆ (8.7) and T₄ (8.5), while T₁ recorded the lowest score (7.5). The higher concentration of Nannari roots in T₅ and T₆ may have contributed to a more pronounced and attractive appearance of the syrup.

The colour scores ranged from 7.4 to 8.9. T₅ recorded the highest colour score (8.9), followed by T₆ (8.8) and T₄ (8.6). The increased concentration of Nannari roots may have enhanced the characteristic colour intensity of the syrup, resulting in greater preference by the sensory panel.

The aroma scores ranged from 7.1 to 8.9. T₅ recorded the highest aroma score (8.9), followed by T₆ (8.8) and T₄ (8.5). The higher root concentration in T₅ and T₆ presumably resulted in a more pronounced characteristic Nannari aroma. The characteristic aroma of *D. hamiltonii* roots is associated with volatile aromatic constituents, particularly 2-hydroxy-4-methoxybenzaldehyde, which contributes to the characteristic vanilla-like aroma of the roots.

With respect to texture, the sensory scores ranged from 7.5 to 8.6. T₄ recorded the highest score (8.6), followed by T₅ (8.4), T₆ (8.1), T₂ (7.8), T₃ (7.6) and T₁ (7.5). The superior texture of T₄ may be attributed to the optimum balance between root extract and sugar, resulting in a desirable syrup consistency.

The taste scores ranged from 7.5 to 8.7. The highest score was recorded by T₄ (8.7), followed by T₅ (8.4), T₂ (8.0), T₆ (7.9), T₃ (7.7) and T₁ (7.5). Although the higher root concentration in T₅ and T₆ enhanced the characteristic Nannari flavour, T₄ provided a more favourable balance between the characteristic root flavour and sweetness.

The after-taste scores ranged from 7.4 to 8.5. T₄ recorded the highest score (8.5), followed by T₅ (8.0), T₂ (7.8), T₃ and T₆ (7.5), and T₁ (7.4). The lower after-taste scores observed in T₃ and T₆ may indicate that the particular combinations of root extract and sugar were less preferred by the sensory panel compared with T₄. The overall acceptability scores ranged from 7.6 to 8.7. T₄ recorded the highest overall acceptability score (8.7), followed by T₅ (8.5), T₂ and T₆ (8.0), T₃ (7.8) and T₁ (7.6). The higher overall acceptability of T₄ indicates that the formulation provided a desirable balance among the sensory attributes evaluated.

The total sensory score also showed considerable variation among treatments. T₄ recorded the highest total score of 60.1, followed closely by T₅ (59.9) and T₆ (57.8). T₂, T₃ and T₁ recorded total scores of 54.7, 54.0 and 52.0, respectively. Thus, the ranking of treatments based on total sensory score was T₄ > T₅ > T₆ > T₂ > T₃ > T₁.

Although T₅ recorded the highest scores for appearance, colour and aroma, it did not achieve the highest scores for taste, after taste or overall acceptability. In contrast, T₄ recorded consistently high scores across all the sensory attributes and achieved the highest total sensory score. This indicates that increasing the quantity of Nannari roots beyond 1.00 kg did not necessarily improve the overall sensory quality of the syrup.

The superior performance of T₄ may therefore be attributed to the optimum balance between Nannari root extract and sugar. The formulation containing 1.00 kg dried Nannari roots, 10 litres of water and 8 kg sugar provided a desirable combination of characteristic aroma and colour together with acceptable sweetness, taste, texture and after taste. Hence, T₄ was identified as the most acceptable treatment for the preparation of Nannari syrup.

Treatment	Appearance	Colour	Aroma	Texture	Taste	After taste	Overall acceptability	Total score
T ₁	7.50	7.40	7.10	7.50	7.50	7.40	7.60	52.0
T ₂	7.80	7.80	7.50	7.80	8.00	7.80	8.00	54.7
T ₃	7.80	7.90	7.70	7.60	7.70	7.50	7.80	54.0
T ₄	8.50	8.60	8.50	8.60	8.70	8.50	8.70	60.1
T ₅	8.80	8.90	8.90	8.40	8.40	8.00	8.50	59.9
T ₆	8.70	8.80	8.80	8.10	7.90	7.50	8.00	57.8

Treatment details

T₁: 0.75 kg root + 10 L water + 6 kg sugar

T₂: 0.75 kg root + 10 L water + 8 kg sugar

T₃: 1.00 kg root + 10 L water + 6 kg sugar

T₄: 1.00 kg root + 10 L water + 8 kg sugar

T₅: 1.25 kg root + 10 L water + 8 kg sugar

T₆: 1.25 kg root + 10 L water + 10 kg sugar

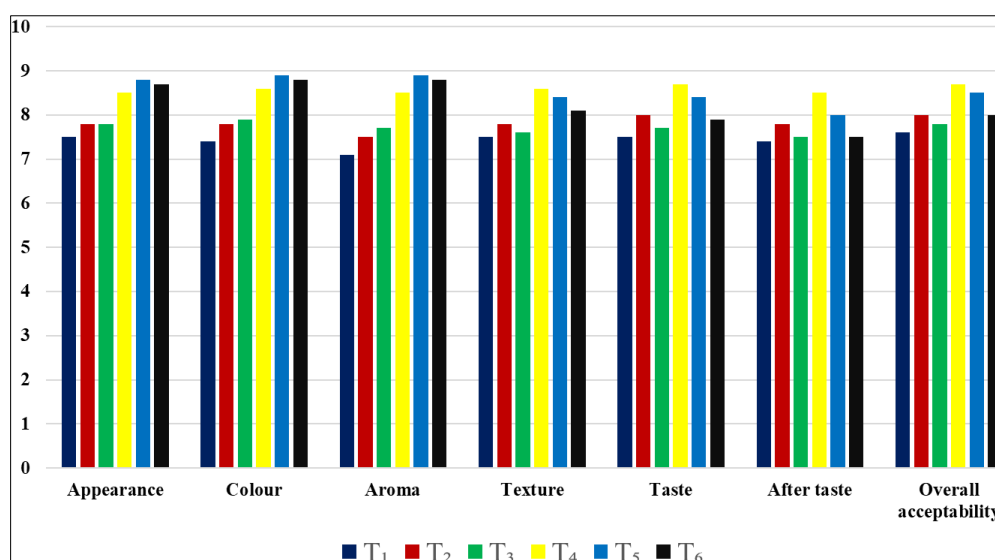


Fig 2: Mean organoleptic scores of Nannari syrup prepared with different levels of dried *Decalepis hamiltonii* roots and sugar

4. Conclusion

The present investigation demonstrated that variation in the proportion of dried Nannari roots and sugar influenced the organoleptic quality of Nannari syrup. Higher root concentration enhanced the appearance, colour and characteristic aroma of the syrup, with T₅ (1.25 kg roots + 10 litres water + 8 kg sugar) recording the highest scores for these attributes. However, the increased root concentration did not result in superior overall acceptability.

Among the six treatment combinations, T₄ (1.00 kg dried Nannari roots + 10 litres water + 8 kg sugar) recorded the highest scores for texture (8.6), taste (8.7), after taste (8.5) and overall acceptability (8.7), and achieved the highest total sensory score of 60.1. T₅ recorded a slightly lower total score of 59.9, despite having superior appearance, colour and aroma scores.

The results indicated that an optimum balance between Nannari root extract and sugar was more important for overall sensory acceptance than increasing the root concentration alone. Therefore, 1.00 kg dried Nannari roots + 10 litres water + 8 kg sugar (T₄) was identified as the standardized formulation for the preparation of Nannari syrup based on organoleptic evaluation. The standardized formulation can serve as a reference for further studies on physicochemical characteristics, storage stability, shelf life and commercial utilization of Nannari-based beverages.

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