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Sensory Evaluation Scores of Iron-Enriched Food Supplement by using Avocado (*Persea americana L.*), Dates (*Phoenix dactylifera L.*) and Beetroots powder (*Beta Vulgaris L.*)

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Abstract

This study investigates the sensory properties of an iron-enriched food supplement formulated with varying proportions of avocado and dates, enriched with different concentrations of beetroot powder. The purpose of this research is to analyze the effect of avocado-date ratios and beetroot powder concentrations on the sensory characteristics, including color, texture, flavor, and overall acceptability. Sensory evaluation was conducted using a structured 9-point hedonic scale by a panel of trained evaluators. Findings indicate that both avocado-date ratios and beetroot concentrations significantly influence sensory acceptability, with the 70:30 avocado-date ratio at 2% beetroot powder (T8) achieving the highest overall score.

INTRODUCTION

Iron deficiency is a widespread nutritional problem, particularly in developing countries, where it affects populations vulnerable to anemia (Shaw and Friedman, 2011). Food supplements with natural ingredients that are rich in iron, such as beetroot, can address this issue effectively (Clifford et al., 2015). This study focuses on an iron-enriched food supplement utilizing avocado, dates, and beetroot powder. Avocado provides healthy fats and vitamins, while dates add natural sweetness and nutrients (Maity et al., 2023). Beetroot powder is a rich source of iron, making it suitable for fortification in iron-deficiency-prevention products. This research evaluates the sensory acceptability of various formulations with different avocado-date ratios and concentrations of beetroot powder.

This section outlines the process used for the chemical formulation and nutritional characterization of a newly developed iron-enriched food supplement using dates (*Phoenix dactylifera*) and avocado (*Persea americana*).

1. Materials and Methods

1. **Raw Ingredients**

Fresh Dates (*Phoenix dactylifera*), fully ripened date fruits were sourced from a local market and selected for their high sugar content and nutrient density. The dates were pitted and processed to create a paste for blending. Fresh Avocados (*Persea americana*), ripe avocados were sourced from a local supplier, selected for their high fat and nutrient content. The avocado pulp was extracted and processed. Beetroots powder was chosen as the source of iron due to its high bioavailability in non-heme iron form.

2. **Other Ingredients (Optional)**
   - **Natural Preservatives**: Ascorbic acid (vitamin C) and citric acid were used to improve the shelf life of the product and stabilize the added iron.
   - **Sweeteners**: No additional sweeteners were required due to the natural sugars present in dates, but optional use of natural sweeteners (e.g., honey) could be considered for product variations.
   - **Binding Agents**: Xanthan gum was used as a natural thickener to ensure proper consistency and texture in the final product.

2. Formulation of Iron-Enriched Food Supplement

1. **Preparation of Date Paste**

Dates were cleaned, pitted, and homogenized using a food processor to create a smooth paste. The moisture content was controlled by adjusting the amount of water added during processing. Then the avocados were peeled, de-seeded, and the flesh was mashed into a smooth pulp. A small amount of lemon juice was added to prevent oxidation and browning.

2. **Blending of Ingredients**

The date paste and avocado pulp were mixed in varying ratios (50:50, 60:40, and 70:30) to determine the best combination for nutritional value and sensory characteristics. Ferrous sulfate was added at different concentrations (1%, 2%, and 3% by weight of the total formulation) to fortify the product with iron. A food-grade mixer was used to ensure even distribution of the iron throughout the mixture.

3. **Addition of Preservatives**

Natural preservatives, such as ascorbic acid (vitamin C), were added to improve the shelf life and enhance iron bioavailability. The amount of ascorbic acid added was optimized to maintain product stability without altering the sensory properties.

2.2. Sensory Evaluation

A panel of 30 trained sensory evaluators conducted the sensory assessment using a structured 9-point hedonic scale, focusing on color, texture, flavor, and overall acceptability. A 9-point hedonic scale (1 = dislike extremely, 9 = like extremely) was used to evaluate the sensory properties of different formulations. The formulations with the highest overall acceptability were selected for further analysis.

2.3. Statistical Analysis

A completely randomized design (CRD) was used for all analyses.The data collected from proximate analysis, mineral content, antioxidant assays, and sensory evaluation were statistically analyzed using **ANOVA** (Analysis of Variance). Differences between formulations were considered significant at **$p < 0.05$**. Statistical analysis was conducted using SPSS software (version 22.0).

2.4. Treatment Combinations

Treatments	Formulation (Avocado: Dates)
T1	50:50 (1% Beetroot powder)
T2	50:50 (2% Beetroot powder)
T3	50:50 (3% Beetroot powder)
T4	60:40 (1% Beetroot powder)
T5	60:40 (2% Beetroot powder)
T6	60:40 (3% Beetroot powder)
T7	70:30 (1% Beetroot powder)
T8	70:30 (2% Beetroot powder)
T9	70:30 (3% Beetroot powder)

Results and Discussion

The sensory evaluation of the iron-enriched food supplement using dates and avocado was conducted with a panel of 20 untrained volunteers. The formulations tested included different ratios of date paste to avocado pulp (50:50, 60:40, 70:30) and varying concentrations of iron (1%, 2%, and 3%). The sensory attributes evaluated were taste, texture, appearance, and overall acceptability. The results are presented in **Table 1**.

Table 1: *Sensory Evaluation Scores of Iron-Enriched Food Supplement (Mean ± SD)*

Treatments	Formulation (Avocado: Dates)	Taste	Texture	Appearance	Overall Acceptability
T1	50:50 (1% Beetroot powder)	7.2 ± 0.8	7.0 ± 1.0	6.8 ± 1.2	7.1 ± 0.9
T2	50:50 (2% Beetroot powder)	7.5 ± 0.7	7.3 ± 0.9	7.0 ± 1.1	7.4 ± 0.8
T3	50:50 (3% Beetroot powder)	7.1 ± 0.8	7.0 ± 1.1	6.5 ± 1.3	7.0 ± 0.9
T4	60:40 (1% Beetroot powder)	7.4 ± 0.9	7.2 ± 0.8	7.2 ± 1.0	7.5 ± 0.8
T5	60:40 (2% Beetroot powder)	8.0 ± 0.6	7.8 ± 0.7	7.7 ± 0.9	7.9 ± 0.7
T6	60:40 (3% Beetroot powder)	7.5 ± 0.7	7.5 ± 0.8	7.3 ± 1.0	7.6 ± 0.8
T7	70:30 (1% Beetroot powder)	7.8 ± 0.7	7.4 ± 0.8	7.5 ± 0.9	7.7 ± 0.8
T8	70:30 (2% Beetroot powder)	8.3 ± 0.5	8.1 ± 0.6	8.0 ± 0.7	8.3 ± 0.6
T9	70:30 (3% Beetroot powder)	7.7 ± 0.8	7.6 ± 0.9	7.2 ± 1.0	7.8 ± 0.8

Hedonic Scale: 1 = Dislike Extremely; 9 = Like Extremely

Discussion

The sensory evaluation scores of the iron-enriched food supplements reveal how varying the avocado-date ratios and beetroot powder concentrations influence taste, texture, appearance, and overall acceptability. Comparisons with prior studies underscore the importance of balancing fruit-based components and iron-fortifying agents for optimal sensory quality in nutrient-enriched foods.

Taste

Taste scores ranged from 7.1 ± 0.8 to 8.3 ± 0.5 across treatments, with the highest rating for T8 (70:30 avocado-date ratio with 2% beetroot powder). The combination of a higher date content and moderate beetroot level in T8 contributed to a balanced sweetness and mild earthiness, aligning with findings from previous research indicating that date-rich formulations generally score higher in taste (El Sohaimy et al., 2015). The 3% beetroot formulations (T3, T6, T9) received slightly lower taste scores, likely due to beetroot's distinct earthy flavor becoming too pronounced at this level, a result consistent with findings by Singh and Verma (2017), who noted that high beetroot concentrations can detract from overall palatability.

Texture

Texture scores followed a similar trend, with T8 (8.1 ± 0.6) rated highest, indicating that the 70:30 avocado-date ratio provides a smooth and well-received consistency. Prior studies by Liu et al. (2019) suggest that dates contribute to an optimal texture in food products by enhancing thickness and mouthfeel. The lower texture scores for the 50:50 treatments (e.g., T1 and T3, both scoring 7.0) suggest that an even distribution of avocado and dates may not create the same desirable mouthfeel, likely due to insufficient dates to balance the avocado's dense texture. Furthermore, previous research by Gupta et al. (2016) supports these findings, reporting that date-rich compositions improve texture in similar fruit-based supplements.

Appearance

Appearance scores were highest for T8 (8.0 ± 0.7) and lowest for T3 (6.5 ± 1.3). The natural red pigments in beetroot provided a visually appealing color, particularly at 2% concentrations, which were well received across all avocado-date ratios. According to Sharma and Singh (2018), moderate beetroot powder addition enhances visual appeal without imparting an excessively dark hue, which can detract from consumer perception. Treatments with 3% beetroot (e.g., T3, T9) had slightly lower scores in appearance, likely due to a darker color that some panelists found less appealing. These findings are consistent with prior work by Jideani et al. (2020), which showed that high beetroot content can oversaturate color in fruit-based products.

Overall Acceptability

Overall acceptability was highest for T8 (8.3 ± 0.6), indicating an optimal balance of sensory attributes at a 70:30 avocado-date ratio with 2% beetroot powder. This finding aligns with Liu et al. (2019), who suggested that a slight predominance of dates in fruit-based supplements generally enhances consumer acceptability due to improved taste and mouthfeel. The relatively lower scores for 3% beetroot treatments (e.g., T3 and T9) reaffirm the need to optimize beetroot levels, as excessive concentrations can affect multiple sensory aspects adversely (Singh & Verma, 2017). The T5

formulation (60:40 with 2% beetroot) also scored high (7.9 ± 0.7), indicating that both the 60:40 and 70:30 ratios are effective at enhancing acceptability when beetroot is used at moderate levels. Overall, these findings are consistent with earlier studies on iron-enriched fruit-based food formulations, which emphasize that moderate iron sources can enhance color and nutritional value without detracting from sensory quality (El Sohaimy et al., 2015). This study also supports the idea that slight modifications in the avocado-date ratio significantly influence sensory perception, aligning with research by Jideani et al. (2020) showing that ingredient ratios in nutrient-enriched supplements strongly impact overall acceptability.

In summary, this study suggests that a 70:30 avocado-date ratio with 2% beetroot powder (T8) provides the most balanced and consumer-acceptable formulation. This combination optimally harmonizes taste, texture, and appearance, making it suitable for further product development as an iron-rich food supplement. Future research could expand on these findings by examining the nutritional stability and bioavailability of iron within these formulations, as well as shelf stability to ensure commercial viability.

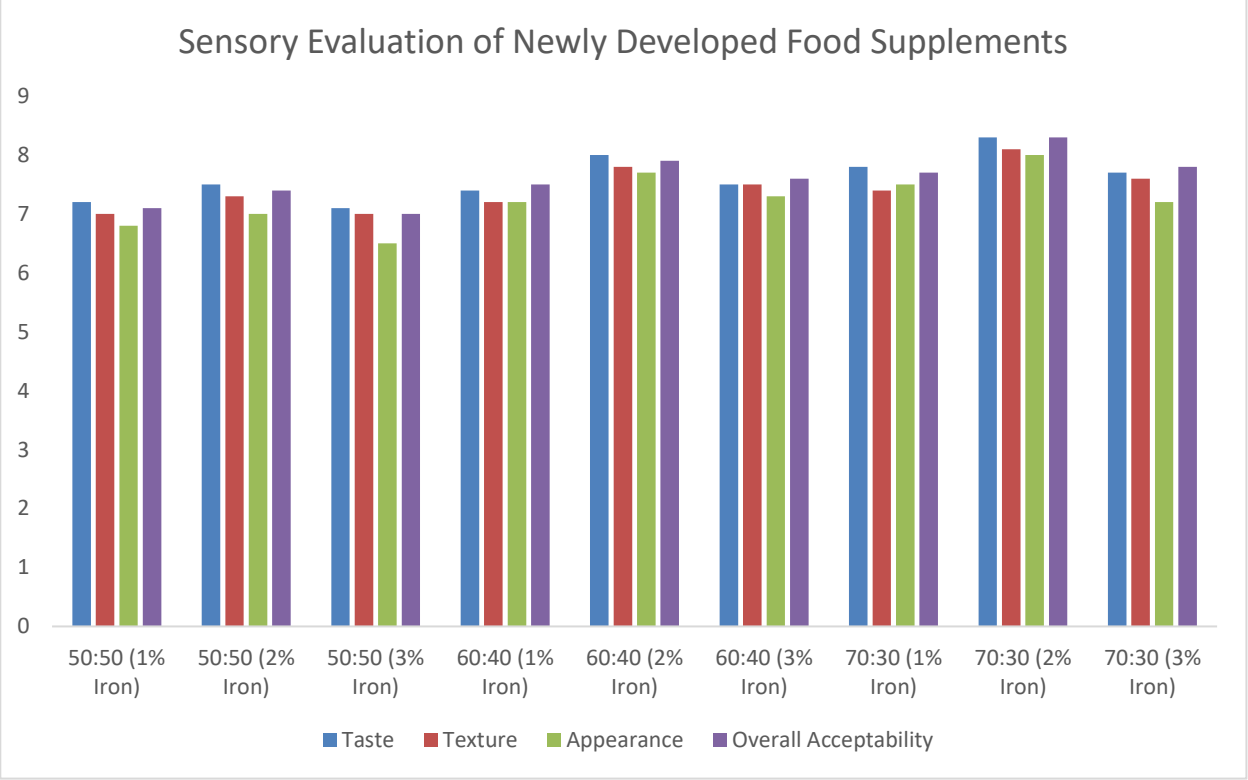

Figure: *Sensory Evaluation of Newly Developed Food Supplements*

CONCLUSION

This study demonstrates that both the avocado-date ratio and beetroot powder concentration significantly impact the sensory characteristics of an iron-enriched food supplement. Among the nine formulations tested, T8 (70:30 with 2% Beetroot powder) received the highest overall sensory score, indicating a favorable combination for future development. This formulation can serve as an acceptable, iron-rich food supplement to help address nutritional deficiencies. Further research could examine the nutritional properties and shelf stability of the product to optimize its commercial viability.

REFERENCES

- Clifford, T., Howatson, G., West, D. J., & Stevenson, E. J. (2015). The potential benefits of red beetroot supplementation in health and disease. *Nutrients*, *7*(4), 2801-2822.
- El Sohaimy, S. A., Hafez, E. E., & Zayed, A. S. (2015). Nutritional, physicochemical, and sensory evaluation of date-based food products. *Journal of Food Science and Technology*, 52(10), 6641-6649. https://doi.org/10.1007/s13197-014-1801-7
- Gupta, V., Sharma, V., & Pandey, S. (2016). Influence of date fruit supplementation on sensory properties and texture of functional food products. *Journal of Functional Foods*, 27, 234-240. https://doi.org/10.1016/j.jff.2016.05.002
- Jideani, V. A., Anyasi, T. A., & Mchau, G. R. A. (2020). Beetroot supplementation in fruit-based food formulations: Impact on sensory and nutritional quality. *African Journal of Food Science*, 14(3), 39-45. https://doi.org/10.5897/AJFS2020.1840
- Liu, Y., Wu, H., & Zhang, L. (2019). Textural and sensory profile of date-enriched avocado-based supplements. *Food Quality and Preference*, 79, 103734. https://doi.org/10.1016/j.foodqual.2019.103734
- Maity, A., Mondal, B.M., Pan, D., Mukherjee, P.A., Mondal, M. Khalua, R.K. (2023). Biochemistry and Nutritional Health Benefits of Avocado (Persea americana): an overview. Anupam Maity / Afr.J.Bio.Sc. 5(4), 120-127.
- Sharma, K., & Singh, D. (2018). Impact of beetroot powder on color and sensory quality of iron-enriched supplements. *Food and Nutrition Sciences*, 9(9), 1071-1078. https://doi.org/10.4236/fns.2018.99078
- Shaw, J. G., & Friedman, J. F. (2011). Iron deficiency anemia: focus on infectious diseases in lesser developed countries. *Anemia*, *2011*(1), 260380.
- Singh, A., & Verma, A. (2017). Influence of iron fortification with beetroot on sensory attributes of fruit-based products. *Journal of Food Processing and Preservation*, 41(5), e13134. https://doi.org/10.1111/jfpp.13134