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Optimization of RTS Beverage: Tinospora Cordifolia and Kiwi Juice Fusion

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Abstract:- The study aims to develop a functional Ready-to-Serve (RTS) beverage using Tinospora cordifolia. This herb is rich in phytochemicals like polyphenols, flavonoids, and tannins, known for their potent antioxidant properties and ability to address various health disorders. By blending the juice of the Kiwi plant with Tinospora cordifolia extract, a nutraceutical-rich RTS beverage is crafted, promising to revitalize and invigorate while meeting nutritional needs. Different formulations are prepared with varying proportions of Tinospora cordifolia extract (S1: 5%, S2: 10%, S3: 15%, S4: 20%, S5: 25%). Each formulation undergoes sensory evaluation against a control sample, and those receiving favorable scores are subjected to physio-chemical analysis. Among these, sample S4, containing 20% Tinospora cordifolia extract, emerges as optimal based on panelist preference. This selected formulation is then further analyzed for its physico-chemical properties.

Keywords:- *RTS Beverage, Tinospora Cordifolia, Nutraceutical-Rich, Formulation Variation.*

I. INTRODUCTION

Ready-to-serve fruit beverages made from natural fruit juice have gained immense popularity due to their refreshing taste and widespread appeal across all age groups (Chandra et al., 2018). These beverages, containing at least 10.0 percent total soluble solids and fruit juice content, cater to the increasing consumer demand for accessible and convenient products (FSSR, 2011). As consumers seek healthier alternatives, the preference for natural ingredients over artificial ones continues to drive the growth of this market segment.

Traditional medicinal plants have long been valued for their therapeutic properties, with Tinospora cordifolia standing out as a prominent herb in Ayurvedic medicine (Jagetia, 2019). Also known as Guduchi, it is hailed for its adaptogenic properties, enhancing the body's resilience to stress and illness (Journal et al., 2015). With its extensive usage in treating various ailments and its presence in traditional medical systems, Tinospora cordifolia exemplifies the growing interest in harnessing natural plant compounds for health benefits.

The kiwifruit, a relatively recent addition to global consumption, has seen a surge in production and utilization, owing to its nutritional richness and versatility (Göksel & Atak, 2015). High in antioxidants and nutrients, kiwifruit offers numerous health benefits, including DNA protection against oxidative damage and potential cardiovascular improvements (Collins et al., 2001; Karlsen et al., 2013). Its diverse applications in both raw and processed forms highlight its growing significance in the food industry and health-conscious consumer preferences.

The present research study was carried out to develop the Tinospora cordifolia based RTS with kiwi juice in different proportions with the following objectives

- *Standardization of Guduchi at Various Levels.*
- *To Study Physico-Chemical Properties of the Products.*
- *To Study the Organoleptic Properties of Products*

II. MATERIALS AND METHODS

The study titled "Development of Herbal Ready-to-Serve (RTS) Beverages Based on Tinospora cordifolia" was conducted at the School of Food Technology, JNTUK. This investigation involved the creation of an RTS beverage by incorporating guduchi extract in various proportions. The resulting product underwent comprehensive analysis, including physico-chemical assessments and sensory evaluation.

- *Selection of Raw Materials.*
- *Criteria for Material Selection.*
- *Preparation of Tinospora cordifolia Leaf Extract.*
- *Development of RTS Beverage.*
- *Formulation of Product with Guduchi Leaf Extract and Kiwi Juice.*
- *Sensory Evaluation Procedures.*
- *Physico-Chemical Property Estimation.*

- *Selection of Raw Materials*

- Guduchi leaves were sourced from the garden of the School of Food Technology, while kiwis and sugar were obtained from the local market.
- Chemicals and Glassware: Chemicals and glassware were sourced from the food analysis laboratory of the School of Food Technology, JNTUK.

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➢ *Criteria for Material Selection*

Guduchi leaves were chosen for their known adaptogenic properties, enhancing the body's resilience to stress and disease, along with their medicinal qualities as reported by Sinha et al. (2004). Kiwis, recognized for their high ascorbic content and delightful juicy taste, were selected to enhance the acceptability of the product.

➢ *Preparation of Aqueous Extract of Guduchi via Maceration Process*

The aqueous extract was prepared following the method described by Jyothi et al. (2015). Guduchi plant material was first rinsed under running water to remove impurities and then dried for 15 days in the shade at room temperature. The dried material was finely powdered, sealed in airtight polythene bags, and stored at room temperature for future use. To create the aqueous extract, 50 grams of crushed leaves and stems were thoroughly mixed with 200ml of water. After allowing the mixture to stand at room temperature for 72 hours, the solutions were filtered using Whatman No. 1 filter paper. The resulting filtrates and extracts were then utilized for subsequent research.

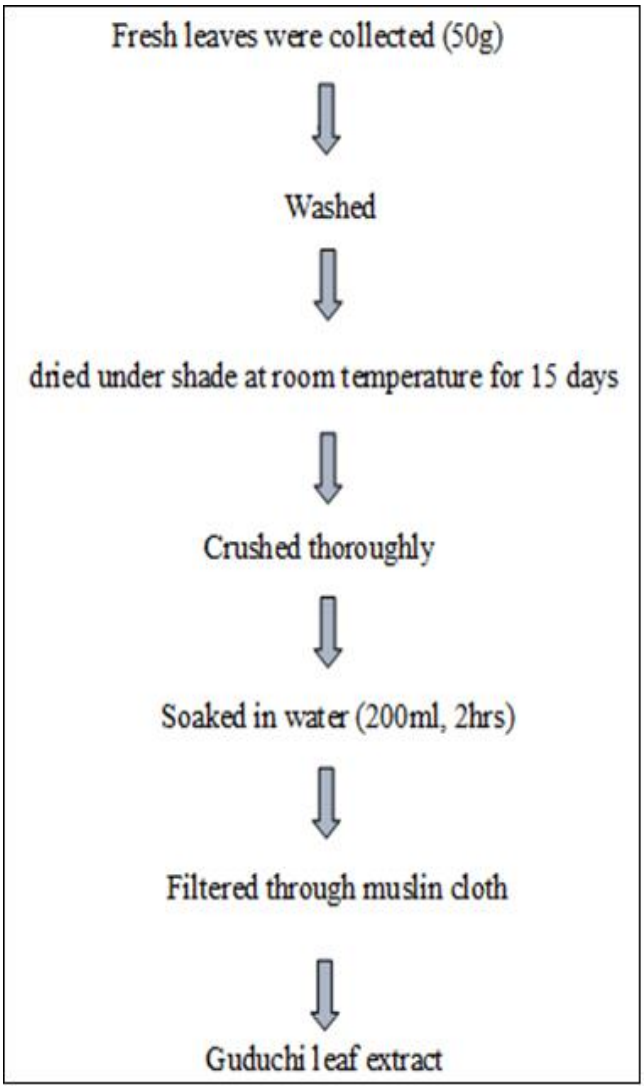

Fig 1 Process Flow Sheet of Guduchi Leaf Extract

➢ *Preparation of RTS*

Ready to Serve Fruit Beverage produced from the juice, pulp, puree, concentrated juice, or pulp of sound, mature fruit, and must have a fruit juice content of at least 10% and a total soluble solid content of at least 10%. (FSSR 2011).

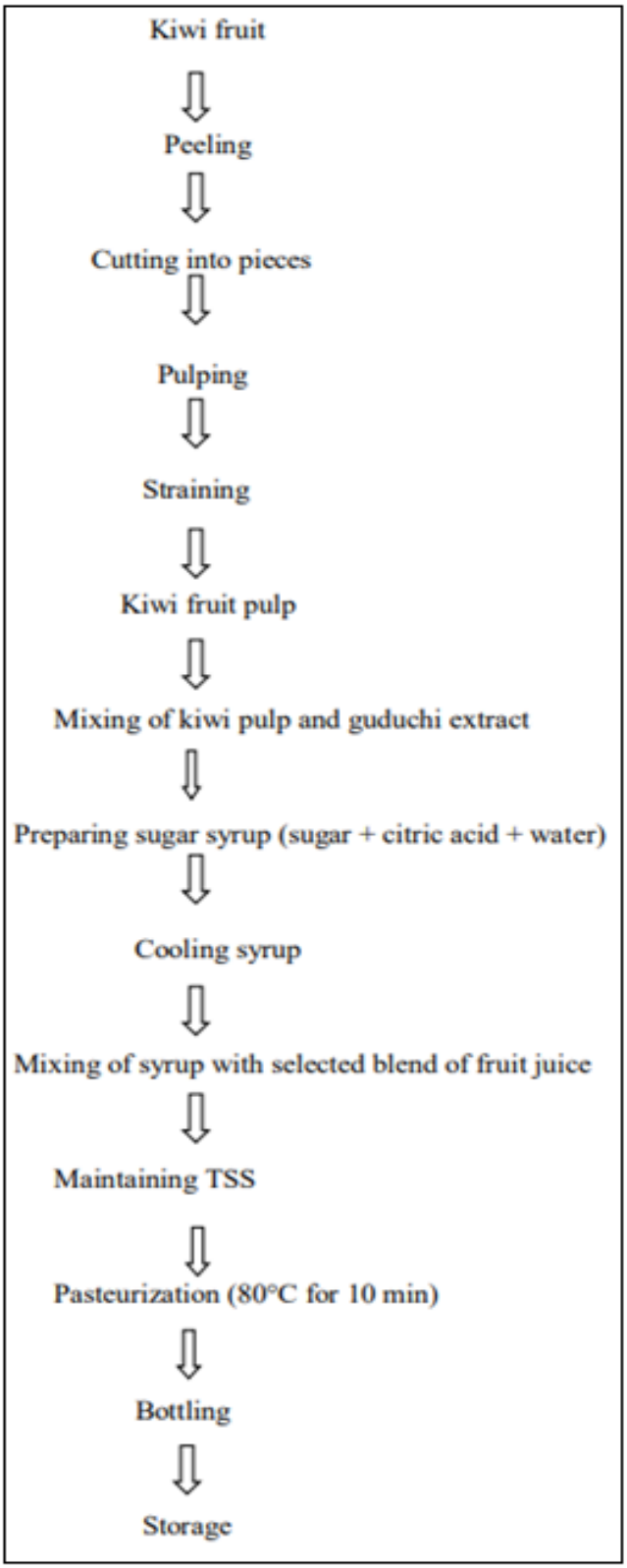

Fig 2 Process Flow Sheet of RTS of Tinospora Cordifolia and Kiwi Juice

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➢ *Product Formulation:*

Table 1 Formulations of Guduchi Squash Samples

Ingredient	Control	S1	S2	S3	S4	S5
Leaf extract	-	5%	10%	15%	20%	25%
Sugar syrup	70%	70%	70%	70%	70%	70%
Kiwi juice	30%	25%	20%	15%	10%	5%

➢ *Sensory Evaluation:*

An affective test was conducted to evaluate the Guduchi RTS beverages containing various proportions, utilizing panelists from the staff of the School of Food Technology, JNTUK. Each panelist was provided with a rating card and instructed to assign a score based on their preference for the sample's color, appearance, consistency, flavor, taste, mouthfeel, and overall acceptability.

➢ *Physico-Chemical Properties*

Chemical parameters such as Total Soluble Solids (T.S.S.), pH, titratable acidity, and ascorbic acid content of the RTS beverages were determined.

- *Total Soluble Solids (T.S.S.)*

The dragon fruit pulp or product was crushed uniformly using a mortar and pestle. A drop of the pulp was placed on the prism of a hand refractometer (ERMA brand), and the total soluble solids were measured in terms of °Bx.

- *Titratable Acidity*

Titratable acidity was measured following the method described by Ranganna (2007). A 100 ml volumetric flask was filled with 10g of macerated material, homogenized in a mortar with distilled water, and the volume was adjusted. A 10 ml aliquot of the filtrate was titrated against standard 0.1 N NaOH using 1% phenolphthalein indicator until a light pink color persisted for 15 seconds. The percentage of titratable acidity was expressed in terms of anhydrous citric acid using the provided formula

- *Estimation of pH*

The pH content of the samples was measured using a digital pH meter. Buffer solutions with pH values of 4.0 and 7.0 were prepared by dissolving buffer tablets in pure water. These solutions were used to calibrate the pH meter before measuring the pH of the samples. The electrode was cleaned and dried before each measurement, and the pH of the fruit drink sample was recorded.

III. RESULTS AND DISCUSSIONS

Tinospora cordifolia was used in the current work to investigate the development of functional RTS.

➢ *Organoleptic Analysis for the Developed RTS.*

Organoleptic evaluation score of different RTS samples S1, S2, S3, S4 developed by incorporation of guduchi was shown graphically in Fig. 3 and presented in Table 2.

Table 2 Organoleptic Analysis for the Developed Guduchi Squash Samples

Attributes	S1	S2	S3	S4	S5
Appearance	7	7	8	9	6
Colour	7.5	8	8	8	6.5
Consistency	7	8	8	9	7
Flavour	7	7.5	8	8	6.5
Taste	7	7.5	7	8	7
Mouth feel	6	7	7	8.5	7
Overall acceptability	7	7.5	8	8.5	7

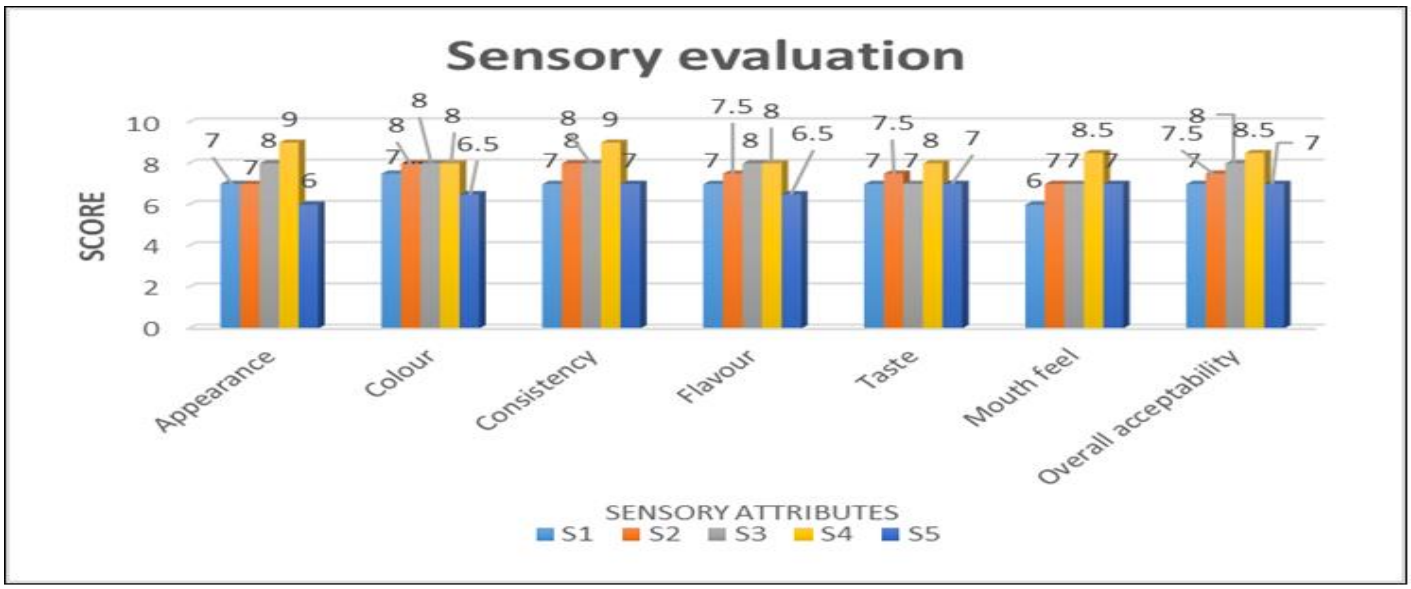

Fig 3 Graphical Representation of Sensory Evaluation of Samples

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The standardized optimization procedure for Ready-to-Serve (RTS) beverages was implemented, followed by organoleptic evaluation. The best RTS variant was determined through an organoleptic test conducted using a 9-point hedonic scale, assessing attributes such as appearance, color, consistency, flavor, taste, mouthfeel, and overall acceptability. Upon analysis of the results presented in Table 3.1, it was evident that the S4 sample exhibited higher ratings across all parameters compared to S5, indicating superior organoleptic characteristics. Consequently, the S4 sample was preferred by the panelists and selected for further physio-chemical analysis.

- *pH Values in Leaf Extract and RTS Sample Developed by Incorporation of Guduchi Leaf Extract (S4) was Presented in Table no: 3*

Table 3 pH Content of Leaf Extract and RTS Sample (S4) with 20% of Guduchi

pH	Mean
Leaf extract	4.10
S4	4.32

pH values in Leaf extract and RTS sample developed by incorporation of guduchi leaf extract (S4) was found to be 4.10 and 4.32 respectively.

- *Titratable Acidity*

Titratable acidity content in Leaf extract and RTS sample developed by incorporation of guduchi leaf extract (S4) was presented in table no: 4

Table 4 TA of Leaf Extract and RTS Sample (S4) with 20% of Guduchi

TA	Mean
Leaf extract	0.32
S4	0.15

Titratable acidity in Leaf extract and RTS sample developed by incorporation of guduchi leaf extract (S4) was found to be 0.32 and 0.15 respectively. There was significant decrease from leaf extract (0.32) to S1 sample (0.15).

- *Vitamin-C*

Vitamin-C content in Leaf extract and RTS sample developed by incorporation of guduchi leaf extract (S1) was presented in Table no: 5.

Table 5 Vitamin-C of Leaf Extract and RTS Sample (S4) with 20% of Guduchi

Vitamin C	Mean±std
Leaf extract	127.00
S4	242.33

IV. SUMMARY AND CONCLUSION

Tinospora cordifolia, a widely utilized herb in Ayurvedic medicine, possesses numerous health benefits despite its bitter taste, which often limits its use in the food industry. Recognizing its potential to enhance the body's resilience to stress and illness, this study aimed to develop a functional Ready-to-Serve (RTS) beverage by incorporating Guduchi leaf extract into Kiwi RTS.

The sensory evaluation of the developed RTS samples provided valuable insights into various attributes such as appearance, color, consistency, flavor, taste, mouthfeel, and overall acceptance. Notably, the S4 sample received the highest scores across these sensory parameters, while the S5 sample received the lowest. Consequently, the S4 sample was preferred by the panelists and selected for further physico-chemical analysis.

Comparative analysis revealed significant differences between the leaf extract and the RTS samples in terms of sensory attributes and physico-chemical properties:

- The titratable acidity (TA%) was highest in the leaf extract (0.32%) and lowest in the S4 sample (0.15%).
- The pH value was highest in the S4 sample (4.32) and lowest in the leaf extract (4.10).
- The Vitamin C content exhibited the highest concentration in the S4 sample (242.33mg/100ml) and the lowest in the leaf extract (127.00mg/100ml).
- Total soluble solids (TSS) content was highest in the leaf extract (11.23) and lowest in the S4 sample (10.45).

In conclusion, the incorporation of Guduchi leaf extract into Kiwi RTS resulted in a product (S4) with superior sensory attributes and favorable physico-chemical characteristics, indicating its potential for further development and commercialization in the food industry.

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