

Formulation and Evaluation of a Functional Detox Immune Boost Revival Health Beverage

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Abstract

The present study aims to develop a Nutrient-rich Functional Detox Beverage, termed *Immune Boost Revival Health Drink*, by infusing water with selected fruits, vegetables, herbs and seeds known for their antioxidant and immune-supportive properties. The drink was formulated in three variants (T1, T2, T3) using ingredients such as beetroot, carrot, cucumber, mint, ginger, chia seeds and lemon with the primary goal of enhancing hydration and providing micronutrients critical to immune health. Sensory evaluation was conducted among 20 panelists to assess organoleptic acceptability, T3 showed the highest overall acceptance score (8.5/9). Nutritional, mineral, vitamin, and antioxidant profiles of T3 were analyzed, showing appreciable levels of vitamin A (5028 mg/100g), potassium (254 mg/100g), and antioxidant activity (FRAP: 3200.1 μ mol). Microbiological analysis confirmed the safety and shelf stability of the drink up to three months under refrigerated conditions. One-way ANOVA revealed no statistically significant differences among the three variants ($p = 0.957$), supporting the robustness of the formulation. Detox beverage showed a promising functional drink for immune support with high Nutritional and Sensory quality.

keywords: Detox beverage; Immune booster; Antioxidants; Functional beverage; Nutritional analysis

1. Introduction

Functional beverages have gained popularity as convenient sources of nutrients and bioactive compounds, particularly those targeting immune health and antioxidant defense. Detox water, a simple infusion of fruits, vegetables, herbs, and seeds in water, serves as a hydrating vehicle for delivering phytochemicals, fiber, and micronutrients. Such drinks are often attributed with benefits like detoxification, improved digestion, and metabolic enhancement, although scientific support for some claims remains limited (Kamangar et al., 2011).

The ingredients such as Ginger, chia seeds and beetroot contribute substantially to the antioxidant and anti-inflammatory potential of the drink. Ginger (*Zingiber officinale*) has been reported to exhibit immune-modulatory and anti-diabetic properties (Mashhadi et al., 2013). Chia seeds (*Salvia hispanica* L.) are rich in dietary fiber, omega-3 fatty acids, and polyphenols, contributing to lipid regulation and antioxidant status (Coorey et al., 2014). Beetroot and carrot are rich in carotenoids, vitamin A, and nitrates, offering potential cardiovascular and immune-supportive benefits (Clifford et al., 2015). The present study formulates three variants of a detox drink and evaluates their nutritional composition, antioxidant activity, sensory attributes and microbial stability, aiming to validate the drink's potential as an immune-boosting functional beverage.

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2. Materials and methods

2.1. Sample Preparation

Three formulations were developed with varying proportions of carrot, beetroot, cucumber, ginger, mint leaves, lemon juice, chia seeds and a pinch of salt in 120 mL of water, as detailed in Table 1 & Fig 1.

Table 1 Composition of Detox Drink Variants

INGREDIENTS	T1-SAMPLE	T2- SAMPLE	T3- SAMPLE
Carrot	35g	45gm	50gm
Beetroot	35gm	45gm	50gm
Cucumber	35g	45gm	50gm
Ginger	2gm	3gm	3gm
Mint leaves	5gm	5gm	5gm
Lemon	2ml	2ml	2.5ml
Chia seed	3gm	4gm	5g
Pinch of salt	1g	1g	1g
Water	120ml	120ml	120ml

2.2. Process of making Detox Drink

Wash and chop the vegetables (carrot, beetroot, cucumber) then Blend all solid ingredients with water until a smooth paste is obtained. Add freshly squeezed lemon juice, mint leaves, soaked chia seeds, and salt. Stir well, refrigerate, and serve chilled with ice (Fig 2).



Figure 1 Detox Drink Variants

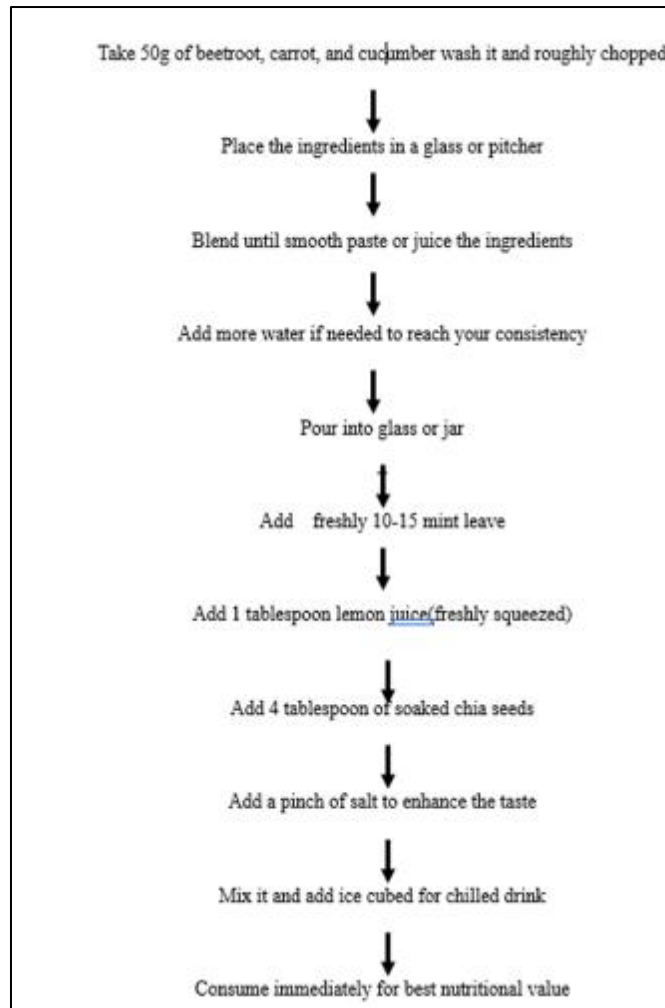


Figure 2 Process of Detox Drink

2.3. Sensory Evaluation of Detox drink

Twenty semi-trained panelists evaluated the three variants based on taste, flavor, texture, aroma, and overall acceptability using a 9-point hedonic scale. Mean scores were analyzed using ANOVA.

2.4. Nutritional, Mineral and Vitamin Analysis of Detox drink

Standard AOAC methods (AOAC, 2016) were used to estimate carbohydrates, protein, fat, fiber, moisture and ash. Mineral content (calcium, potassium, iron, magnesium, zinc) was determined by AOAC method. Vitamin A, C, D and E were analyzed by AOAC method 2016.

2.5. Antioxidant Activity of Detox drink

DPPH (2,2-Diphenyl-1-picrylhydrazyl) radical scavenging assay for free radical inhibition

FRAP (Ferric Reducing Antioxidant Power) assay to determine electron-donating capacity

2.6. Microbial Analysis of Detox drink

Standard plate count method was used to evaluate microbial safety. Parameters included total aerobic count, yeast and mold, coliforms, *S. aureus*, and *Enterobacteriaceae*.

2.7. Statistical Analysis

One-way ANOVA was conducted using Microsoft Excel to determine significant differences in sensory scores among variants. A p-value < 0.05 was considered statistically significant.

3. Results and discussion

3.1. Sensory Evaluation of Immune Boosters Detox drink

Sensory evaluation is a scientific method that systematically measures, analyzes, and interprets human responses to food. This method is essential for assessing product quality, consumer preferences, and overall acceptability. Prepared variants are sample T1, T2 and T3 to the increase in amount of beetroot to 35gm, 45gm and 50gm; carrot 35gm, 45gm and 50gm; cucumber 35gm, 45gm, 50gm respectively. Performed the 7 point hedonic Scale sensory evaluation on five factors that are taste, flavour, texture , aroma and acceptance of the drink.

Table 2 Sensory evaluations of Detox drink of three variants

Test sample	Taste	Flavor	Aroma	Texture	Overall acceptance
T1	6.0	7.5	8	7.5	7.250±0.125
T2	6.5	8.0	7.5	7.5	7.375±0.075
T3	7.0	8.8	8.5	8.5	8.500±0.150

The sensory evaluation of the three detox drink variants—T1, T2 and T3 of beetroot, carrot and cucumber—using the 9-point hedonic scale revealed a progressive improvement in consumer acceptability with increased vegetable content. T1 recorded moderate acceptability with scores of 6.0 for taste, 7.5 for flavor and texture, and 8.0 for aroma, resulting in an overall acceptance score of 7.250 ± 0.125 . T2 showed a slight improvement across all parameters, particularly in flavor (8.0) and taste (6.5), leading to an overall score of 7.375 ± 0.075 . T3, the variant with the highest concentration (50g of each ingredient), achieved the highest scores in all attributes, especially in taste (7.0), flavor (8.8), aroma (8.5), and texture (8.5), with a significant increase in overall acceptance (8.500 ± 0.150) (Table 2).

The results suggest that increasing the quantity of fresh vegetable ingredients positively influenced the sensory qualities of the detox drinks, enhancing their palatability and consumer preference. These findings support the formulation of T3 as the most acceptable variant in terms of sensory attributes. Nutritional analysis is recommended to further validate the health benefits associated with higher vegetable concentrations.

3.2. Nutritional Analysis of detox drink

The nutritional analysis of the best sample selected after sensory evaluation was analysed and the results are as follows (Table 3). The drink demonstrated high moisture content (91.07%), consistent with its liquid base and suitability as a hydrating agent. Low fat (0.2 g/100g) and moderate carbohydrates (8.3 g/100g) support its classification as a low-calorie functional beverage. The dietary fiber (1.4 g/100g) contributes to satiety and gut health.

Table 3 Nutritional analysis of drink

Test Parameter	Result	Unit
Carbohydrates	8.3	g/100g
Protein	0.6	g/100g
Fat	0.2	g/100g
Fibre	1.4	g/100g
Moisture	91.07	g/100g
Ash	0.5	g/100g

3.3. Mineral Analysis of drink

Potassium, a key electrolyte, was present in high quantity (254 mg/100g), supporting fluid balance and nerve function. Calcium and iron content support bone health and hemoglobin synthesis respectively, aligning with the drink's immune-supportive claims. (Table 4).

Table 4 Mineral Content of drink (SampleT-3)

Test Parameter	Result	Unit
Calcium	21.8	mg/100g
Potassium	254	mg/100g
Iron	1.3	mg/100g
Magnesium	12.31	mg/100g
Zinc	0.234	mg/100g

3.4. Vitamin Analysis of drink:

The vitamin C content, measured as 15mg/100g, indicates a moderate concentration of this essential nutrient. Vitamin D, measured as 0mg/100g, vitamin E is measured as 0.8mg/100g while vitamin A is present in large concentration which is measured to be 5028mg/100g. vitamin A helps in form and maintain healthy teeth, skeletal and soft tissue, mucus membranes, and skin. It is also known as retinol because it produces the pigments in the retina of the eye. Vitamin A promotes good eyesight, especially in low light. It plays a role in fighting diseases and building immunity. It also has a role in healthy pregnancy and breast feeding.

Table 5 Vitamin Content of drink

Test Parameter	Unit	Result
Vitamin C	mg/100g	15
Vitamin D	mg/100g	0
Vitamin E	mg/100g	0.8
Vitamin A	mg/100g	5028

The drink's high vitamin A content (5028 µg/100g) makes it a potent immune modulator and antioxidant. Vitamin C (15 mg/100g) also enhances immune responses and collagen synthesis. Absence of vitamin D may be due to lack of animal or fortified sources in the formulation.

3.5. Antioxidant Activity of drink

The antioxidant activity of drink was evaluated using two methods: DPPH radicals scavenging assay and FRAP assay. (Table 6). The ORAC value of 3200.1 µmol Trolox equivalents demonstrates the high antioxidant potential of the beverage. DPPH scavenging indicates effective neutralization of free radicals. This antioxidant activity can help reduce oxidative stress and inflammation (Apak et al., 2016).

Table 6 Antioxidant Activity of drink

Test Parameter	Result	Unit
DPPH	0.191	Ppm
FRAP	3200.1	µmol

3.6. Self-life studies microbial Activity of drink:

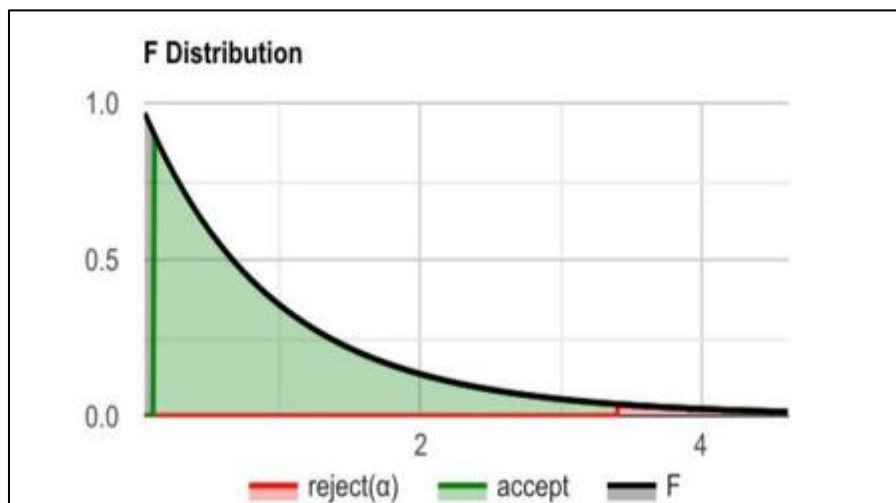
The microbial activity showed aerobic plate count, yeast & mould- <10 and coliform, Enterobacteriaceae, S. aureus were absent in the sample (Table 7). The microbial counts were within acceptable limits, indicating the product is microbiologically safe under hygienic preparation and cold storage conditions.

Table 7 Microbial Activity of drink

S.No	Test Parameter	Unit	Result
1.	Aerobic plate Count	CFU/ml	<10
3.	Enterobacteriaceae	CFU/ml	Absent
4.	<i>S. aureus</i>	CFU/ml	Absent
5.	Yeast & Mold	CFU/ml	<10

3.7. Statistical analysis

A one-way Analysis of Variance (ANOVA) was conducted to determine whether there were statistically significant differences in sensory attributes—taste, flavor, aroma, texture, and overall acceptability—among the three drink variants (T1, T2, and T3). The analysis yielded an F-statistic of 0.0437 and a p-value of 0.9573. Since the p-value exceeded the significance threshold ($\alpha = 0.05$), the null hypothesis could not be rejected, indicating no statistically significant differences in sensory scores among the three formulations (Fig 3). This suggests that all variants were similarly accepted by the sensory panel in terms of overall sensory quality. Despite observable differences in mean scores, particularly the higher acceptability of T3 (mean score: 8.5), these differences were not statistically meaningful the consistency and formulation across variations. A high p-value also strengthens the reliability of sensory data and supports the versatility of the formulation in delivering consumer satisfaction regardless of minor ingredient variations.

**Figure 3** Analysis of variance results

4. Conclusion

The formulated *Immune Boost Revival Health Drink* demonstrated significant potential as a functional, low-calorie detox beverage enriched with essential nutrients, antioxidants and immune-supportive compounds. The proximate analysis confirmed its high moisture content and low-fat profile, making it suitable for hydration and weight management. The drink exhibited appreciable levels of micronutrients such as potassium, calcium, iron and vitamin A with strong antioxidant activity supported by DPPH and ORAC assays. Moreover, microbiological analysis validated the product's safety for consumption under hygienic preparation and proper storage conditions. Sensory evaluation indicated high consumer acceptability, and statistical analysis revealed no significant differences among the three tested variants, suggesting consistency in formulation quality. The findings support the development of this detox beverage as a health-promoting product with potential applications in nutrition and wellness industries, although further clinical studies are recommended to substantiate its physiological benefits.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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