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"UTILIZATION OF FRESH INGREDIENTS (FRUITS, VEGETABLES, AND HERBS) FOR THE DEVELOPMENT OF VALUE-ADDED FOOD PRODUCTS"

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Abstract

The study focused on developing and evaluating two value-added functional foods—a fermented beverage and pineapple-based Shrikhand—by assessing their sensory, nutritional, functional, and economic qualities. The fermented drink, prepared with pineapple (80 g), beetroot (15 g), lemongrass (2 g), and Tulsi (2 g), showed the most promising results in Treatment T_1, which demonstrated superior antioxidant activity, higher mineral content, and strong acceptability, with a low production cost of Rs. 1.15 per 100 mL, making it suitable for small- and medium-scale enterprises. Pineapple-based Shrikhand (T_2), formulated with 20 g pineapple pulp, 45 g chakka, and 35 g powdered sugar, recorded enhanced sensory attributes, nutritional acceptability, and affordability at Rs. 6.7 per 100 g. Both products exhibited excellent sensory appeal, functional benefits, and economic feasibility, indicating strong potential for commercialization to meet consumer demand for natural, nutritious, and affordable functional foods, while further studies on shelf life, microbial safety, packaging, and consumer perception are recommended to ensure product stability and market success.

Keywords – Functional drink, shrikhand Antioxidant, Lemongrass, Tulsi, Pineapple, Beetroot, Good Health Benefits, etc.

Introduction

Fermented fruits and vegetables are rich in phenolic compounds, minerals, and vitamins, which have potential health benefits for the prevention of many diseases such as cardiovascular disease and Type 2 diabetes. There is a growing demand for the development of non-dairy fermented products based on fruits and vegetables, given

changing lifestyles (e.g., vegetarianism, veganism, and allergy to dairy products) and the rise of nutritional diet therapy. Fermented fruits and vegetables outline the process of transformation of bioactive components, and systematically summarize the possible mechanisms of antioxidant, anti-inflammatory, and blood pressure-lowering effects.

The health effects of fermented fruits and vegetables depend mainly on the microorganisms present in the fermentation process and the bioactive components they produce, such as phenols, vitamins, and organic acids. These active compounds exert many health effects such as antioxidant, anti-inflammatory, anti-obesity, hypotensive, hypoglycemic, and other health benefits. Therefore, the development of fermented foods based on fruits and vegetables can be a promising way to adapt to the market demand and reduce the wastage of agriculturally produced fruits and vegetables**. Liu 2024**.

Pineapple (*Ananas comosus*) is a tropical fruit highly prized for its unique aroma and sweet taste. It is renowned as a flavourful fruit since it contains many volatile compounds in small amounts and complex mixtures. Pineapple is also a rich source of minerals and vitamins that offer many health benefits. Ranked third behind banana and citrus, the demand for pineapple has greatly increased within the international market. The growth of the pineapple industry in the utilisation of pineapple food-based processing products as well as waste processing, has progressed rapidly worldwide**. Ali *et al*., 2020**.

Beetroot is one of the natural foods that boosts energy as it has one of the highest nitrates and sugar contents of any plant **Yadav *et al*., 2016.** Beetroot makes an excellent dietary supplement as it is not only rich in minerals, vitamins, and nutrients but it also has unique Phytochemical compounds which have many medicinal uses. **Chauhan *et al*., 2020.**

Fermented beetroot juice is a beverage obtained from the fermentation of beetroot, most commonly red beet (*Beta vulgaris* L. *var. conditiva*). Nowadays, this product is increasingly recognized as a functional food with potentially beneficial health properties. It has been suggested to have antioxidant, anti-inflammatory, anticancer, antihypertensive, immunomodulatory, and fermented effects, among others. Moreover, with the increasing popularity of their fermentation, newer variants are appearing in the food market, obtained by modifying the traditional recipe and adding other raw materials, herbs, and spices. Therefore, this study aimed to evaluate and compare the antioxidant potential and phytochemical composition of the selected fermented beetroot juices in different flavor variants available in the Polish food market. **Jakubczyk *et al*., 2023.**

MATERIALS AND METHODS

The present research, entitled **Utilization of fresh fruit pineapple, vegetable beetroot, and medicinal herbs for the development of value-added food products,** was conducted in the Nutrition Research laboratory, Department of Food Nutrition and Public Health, Naini Agriculture Institute, Sam Higginbottom University of Agriculture, Technology, and Sciences, Prayagraj, UP.

1) PROCUREMENT OF RAW INGREDIENTS:

Raw materials such as Lemongrass, Pineapple, and holy basil were collected from the local area of SHUATS. Other ingredients were purchased from the local market of Prayagraj.

2) TREATMENTS AND REPLICATIONS OF THE PREPARED VALUE-ADDED PRODUCTS

Fermented drink and Shri Khand

Various treatment combinations, such as T_0, T_1, T_2, and T_3, were prepared. All were standardized for the treatment. treatments were replicated three times to get an average score for sensory evaluation.

Table 2.1: Treatments and Replications of Fermented Drink.

	Ingredients	**T_0** **Warad *et al.*, 2023**	**T_1**	**T_2**	**T_3**	**Replications**
Fermented functional drink	Pine apple(g)	50	80	60	45	**6**
	Beetroot(g)	50	15	30	45	
	Lemongrass(g)	-	2	3	5	
	Tulsi(g)	-	2	3	5	

Treatment (T_0): The Fermented drink was prepared by using 50 grams of pineapple, 40 grams of beetroot, 0 grams of lemongrass, and 0 grams of Tulsi

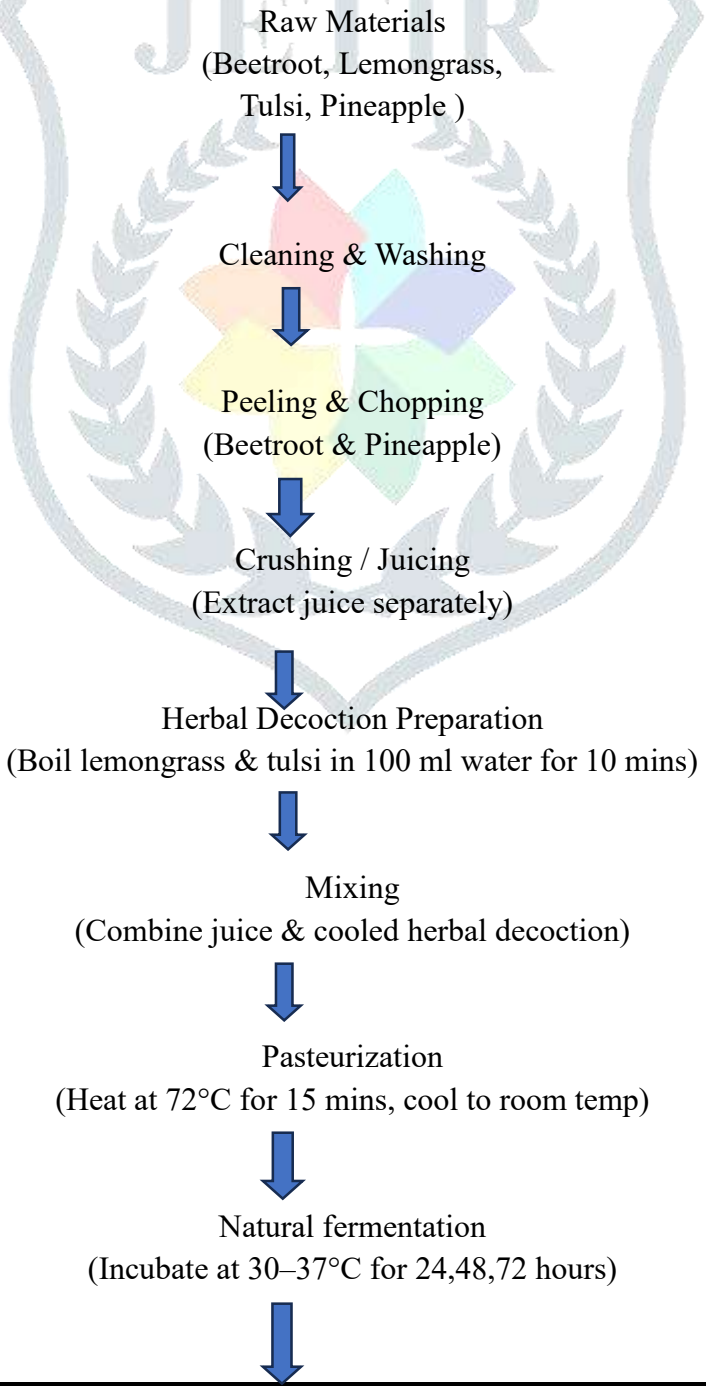
Treatment (T_1): The Fermented drink was prepared by using 80 grams of pineapple, 15 grams of beetroot, 2 grams of lemongrass, and 2 grams of Tulsi

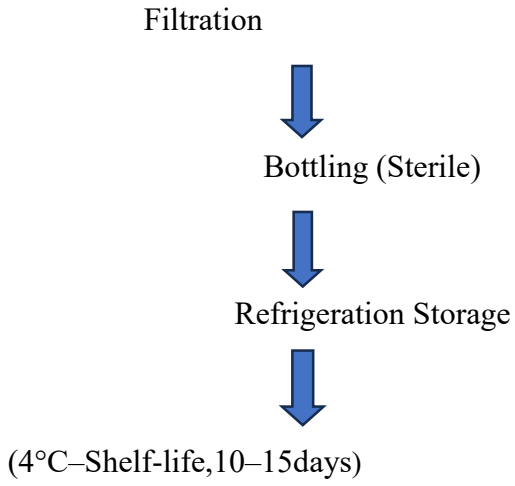
Treatment (T_2): The fermented drink was prepared with 60 grams of pineapple, 30 grams of beetroot, 3 grams of lemongrass, and 3 grams of Tulsi

Treatment (T_3): The fermented drink was prepared by using 45 grams of pineapple, 45 grams of beetroot, 5 grams of lemongrass, and 5 grams of Tulsi.

3) Preparation of 'Fermented Drink'

3.1) Preparation of a Fermented drink





Source: Sahu *et al*., (2021)

Fig. Flow diagram of the Preparation of a Fermented drink

4) Organoleptic evaluation of the developed products.

Sensory evaluation of food products for acceptability was conducted by a panel of five Judges. A scorecard based on the 9-point Hedonic Scale was used for sensory evaluation based on evaluation of attributes like color and appearance, body and texture, taste and flavour, and overall acceptability of the developed food product **Srilakshami, 2018.**

5) **Determination of the Nutritional composition, Antioxidant, pH, and TSS of the developed Fermented drinks**.

- The antioxidant potential was assessed by 2,2-diphenyl-1-picrylhydrazyl (DPPH). **Khuntia *et al., (*2023)**
- Determination of pH. **AOAC (2005)**
- The refractometer measures total soluble solids (TSS) concentration based on the principle of refraction of light. **AOAC (2005)**
- Determination of protein content by the **Lowry method.**
- Determination of carbohydrate content by Anthrone Method **(AOAC, 2005)**

6) Results and Discussion

This chapter discusses the data of the present study, **Utilization of Fresh Ingredients (Fruits, Vegetables, and Herbs) for the Development of Value-Added Products**. The study was conducted in the Nutrition Research Laboratory, Department of Food, Nutrition, and Technology and Sciences, Prayagraj (211007), U.P., India.

7) Sensory Attributes of the Fermented Drink

Table 7.1) Average sensory score of different parameters in the treated sample of "fermented drink"

Experimental Treatment	Aroma	Colour	Consistency	Flavour and taste	Overall Acceptability
T_0	8	8	7.5	7	7.6
T_1	8.8	8.5	8.8	8.8	8.8
T_2	8.4	8.1	8.7	8.3	8.6
T_3	8.1	8.1	8.6	7.8	7.9
F cal	12.01	8.0	9.76	49.23	21.88
F tab	4. 10	4.10	4.10	4.10	4.10
CD (P_<0.05)	0.197	0.63	0.64	0.26	0.34
S.A	S*	S*	S*	S*	S*

Fig. 1) Average Sensory score for different attributes of fermented drink

8) TSS, PH, and Antioxidant Activity of the Fermented Drink

Table 8.1) Determining the Total Suspended Solids (TSS) of the fermented drink

Parameter	T_0	T_1
Total Suspended Solids (TSS)	10.5 ° Brix	12.8 ° Brix

Table 8.2) Determining the pH of the fermented drink

Parameter	T_0	T_1
pH	4.1	3.9

Figure 2) Determination of TSS and pH OF Treatments T_0 vs T_1

Table 8.3) Antioxidant Activity of the best treatment product against the control, Fermented drink.

S. no.	Test Parameters	T_0	T_1
1.	Antioxidant activity	43.01%	71.94%

Antioxidant Activity (% DPPH scavenging)

- **T_1** exhibited significantly higher antioxidant activity (71.94%) compared to **T_0** (43.01%)

The antioxidant activity of a substance is a measure of its ability to neutralize free radicals, which are unstable molecules that can cause oxidative stress and damage to cells. Antioxidants are essential for maintaining overall health and preventing chronic diseases such as cancer, heart disease, and neurodegenerative disorders.

9) TFC (TOTAL FLAVANOID COUNT), Minerals, and Vitamins of the Fermented Drink.

Table 9.1): Minerals and TFC of the Comparison of control and best treatment, (T_0) and (T_1) Fermented drink. (Per 100g)

S. no.	TFC, Vitamins, and Minerals	T_0	T_1
1	Total Flavonoid content mg QE/gm	53.1	57.45
2.	Energy (kcal)	45	53
3	Carbohydrate (g)	11	15
4.	Protein (g)	1.05	0.97
5.	Iron (mg)	0.55	1.88
6.	Calcium (mg)	16.5	22.6
7.	Phosphorus (mg)	13	20.5
8.	Potassium (mg)	159.35	219
9..	Vitamin C (Ascorbic acid) (mg)	11	20.4

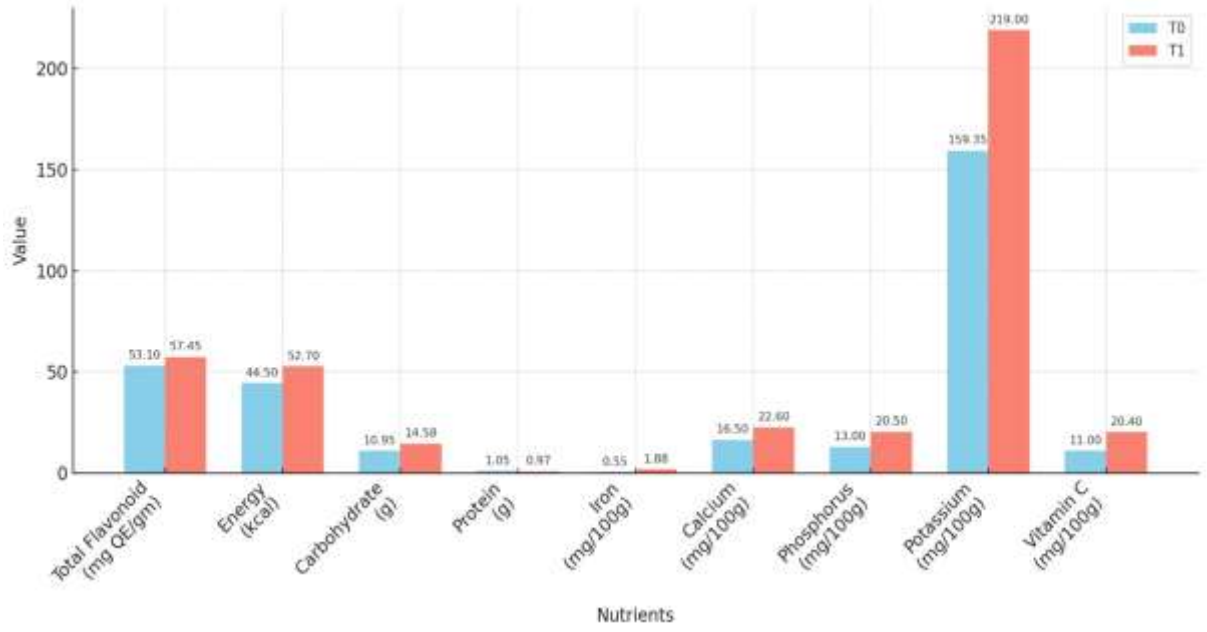


Fig 3) Comparison of Minerals and TFC of the control and best treatment, (T_0) vs (T_1) Fermented drink

10) ORGANOLEPTIC CHARACTERS OF THE DEVELOPED PRODUCT "Fermented drink"

Table 11.1) Average sensory score of different parameters in the treated sample of Fermented drink.

Parameters	T_0	T_1	T_2	T_3
	Mean ±SE	Mean ±SE	Mean ±SE	Mean ±SE
Aroma	8±0.5	8.8±0.2	8.4±0.4	8.1±0.6
Colour and appearance	8±1.5	8.5±0.5	8.1±0.7	8.1±0.6
Consistency	7.5±1.00	8.8±0.2	8.7±1.30	8.6±0.4
Flavour and Taste	7±0.5	8.8±0.3	8.3±0.8	7.8± 0.2
Overall Acceptability	7.6±0.3	8.8±0.4	8.6±0.2	7.9±0.4

CONCLUSION

The study developed and evaluated two innovative products—a fermented drink and a pineapple-based Shrikhand—designed to enhance nutrition, sensory appeal, and functional properties using fruits, vegetables, and medicinal herbs.

The fermented drink, prepared with pineapple, beetroot, lemongrass, and Tulsi, showed excellent sensory, nutritional, and antioxidant qualities. Among four formulations, T1 (pineapple 80 g, beetroot 15 g, lemongrass 2 g, Tulsi 2 g) was most preferred, with the highest acceptability score (8.8) due to its balanced aroma, taste, color, and consistency. It was rich in calcium, phosphorus, potassium, vitamin C and exhibited the highest antioxidant activity (71.94% DPPH scavenging), highlighting its bioactive compounds.

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