



OCCUPATIONAL HEALTH AND SAFETY STANDARDS OF PROBIOTIC YOGURT (*Lactobacillus bulgaricus*) ENHANCED WITH KARUNKURUVAI RICE EXTRACT: A NUTRITIONAL OVERVIEW

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Abstract

The growing global demand for functional foods has led to the development of probiotic products, which offer significant health benefits beyond basic nutrition. Probiotic yogurt, particularly those containing *Lactobacillus bulgaricus*, has been widely recognized for its positive effects on gut health, digestion, and overall immune system support. Probiotics, such as *Lactobacillus bulgaricus*, are beneficial microorganisms that, when consumed in adequate amounts, can confer health benefits to the host. As the popularity of probiotic foods increases, food manufacturers are exploring innovative ways to enhance the nutritional value of these products, one of which includes fortifying yogurt with additional natural ingredients like Karunkuruvai rice extract. Yogurt is a widely consumed dairy product known for its rich nutritional content and probiotic benefits. Incorporating traditional rice varieties such as Karunkuruvai, an indigenous black rice with exceptional therapeutic and nutritional properties, can further enhance the functional value of yogurt. This study aims to evaluate the nutritional composition and potential health benefits of probiotic yogurt incorporated with Karunkuruvai rice extract. The Probiotic (*Lactobacillus bulgaricus*) is added for the fermentation process involves the conversion of lactose (milk sugar) into lactic acid, which thickens the milk and gives yogurt its distinctive flavor and texture. Probiotic yogurt is prepared from Karunkuruvai rice (KR) extract. Rice extract is obtained by extracting the KR. It is highly nutritious and has a low glycemic index. Parboiled KR supports health by preventing infectious diseases of the skin, urinary tract, and nervous system. The study aim at formulating and evaluation of nutrients in Probiotic (*lactobacillus bulgaricus*) yogurt from Karunkuruvai rice extract.

Control (T_0) Aavin green magic milk yogurt contain 59 ± 1.27 kcal of energy, 6.63 ± 0.16 g of carbohydrate, 2.15 ± 0.05 g of fat, 3.21 ± 0.06 g of protein respectively. Probiotic (*Lactobacillus bulgaricus*) yogurt (T_2) had 71 ± 1.53 kcal of energy, 7.8 ± 0.19 g of carbohydrate, 2.5 ± 0.06 g of fat, 4.3 ± 0.09 g of protein. Compared to control (T_0), Probiotic (*Lactobacillus bulgaricus*) yogurt (T_2) had higher content of energy, carbohydrate, fat, protein. Thus, it can be concluded that the T_2 can be incorporated in yogurt to be a value-added product.

Key words: Yogurt -Nutritional composition-functional food-probiotic

1.Introduction

This traditional rice (*Oryza sativa L.*), varieties contain bioactive phyto-chemicals and micronutrients that, when taken as dietary supplements, are anticipated to significantly reduce the prevalence of non-communicable illnesses like cardiovascular disease, diabetes, cancer, and stroke (Vichapong *et al.*, 2010). In many parts of the world, particularly in Asia and Sub-Saharan Africa, rice is the main food source. With an output of 700 MT of raw rice and 470 MT of milled rice, it is grown over an area of 162.06 M ha (Shahbandeh, 2021).

Numerous records describing the medicinal properties of rice (*Oryza sativa L.*), varieties like Sivappukavuni rice, Black kavuni rice, Kitchadi samba rice, Garudan samba rice, Kattuyanam rice, Jeerga samba rice, Mappillai samba rice, Thooyamalli rice, Kuliyaadichaan rice, Aruvathamkuruva rice, Karunkuruvai rice, Poongaar rice, Vaalaan samba rice, Illupaipoosamba rice, Karuthakkar rice, Kullakaar rice, Sigappukudavaazhai rice and etc.

Traditional rice types take 60 to 200 days to reach maturity. Therefore, traditional rice varieties can be divided into short, medium, and long duration variations based on duration (Prakash *et al.*, 2019).

The growing global demand for functional foods has led to the development of probiotic products, which offer significant health benefits beyond basic nutrition. Probiotic yogurt, particularly those containing *Lactobacillus bulgaricus*, has been widely recognized for its positive effects on gut health, digestion, and overall immune system support. Probiotics, such as *Lactobacillus bulgaricus*, are beneficial microorganisms that, when consumed in adequate amounts, can confer health benefits to the host. As the popularity of probiotic foods increases, food manufacturers are exploring innovative ways to enhance the nutritional value of these products, one of which includes fortifying yogurt with additional natural ingredients like Karunkuruvai rice extract.

Beneficial bacteria that are typically found in the gastrointestinal tracts make up Lactobacillus. One of the bacteria used to make yogurt is *Lactobacillus bulgaricus* (binomial name *Lactobacillus delbrueckii subsp. bulgaricus*). Gram-positive, acid-tolerant, facultatively anaerobic, non-motile, and non-spore-forming *L. bulgaricus* are rod-shaped members of the industrially important lactic acid bacteria (Metchnikoff, 1908)

They are also non-motile and non-spore-forming. Beneficial bacteria *Streptococcus thermophilus* with *L. delbrueckii subsp. bulgaricus* and/or *L. helveticus* are present in cultures. They are classified as generally recognized as safe (GRAS) and also considered as "food grade" organisms because they are

engaged in several food fermentations and as a result have been known to man for millennia (Siitonen *et al.*, 1990).

The main objective of the study is explore the intersection of occupational health and safety with the nutritional analysis of probiotic yogurt enhanced with Karunkuruvai rice extract.

2. Materials and methods

The experiment was conducted in the laboratory of the Department of Home science, Madurai Mother Teresa University, Madurai.

2.1 Purchase of raw material

Karunkuruvai rice was purchased from Maran Natural Products, Madurai, Tamil Nadu, India. The ingredients like cow milk were purchased from Aavin milk from aavin milk depot Madurai. Gelatin was purchased from the local market.

2.2 Formulation of Probiotic (*Lactobacillus bulgaricus*) yogurt from Karunkuruvai rice extract.

Probiotic (*Lactobacillus bulgaricus*) yogurt from Karunkuruvai rice extract various composition as given in Table 2.1

Table 2.1 Formulation of Probiotic (*Lactobacillus bulgaricus*) yogurt from Karunkuruvai rice extract

Ingredients	T ₀	T ₁	T ₂	T ₃
Karunkuruvai rice extract (ml)	-	50	70	90
Aavin green magic milk (ml)	200	150	130	110
Culture (Commercial yogurt+ <i>Lactobacillus bulgaricus</i>) (ml)	10	10	10	10
Gelatin (g)	6	6	6	6

2.3 Nutritional composition of Probiotic (*Lactobacillus bulgaricus*) yogurt from Karunkuruvai rice extract.

Developed Probiotic (*Lactobacillus bulgaricus*) yogurt from Karunkuruvai rice was analyzed by standard procedure created by the Food Safety and Standards Act (FSSAI) and the Association of Analytical Chemicals (AOAC) were used. The Fat was analyzed by Soxhlet method. Protein was analyzed by the amount of nitrogen available in the sample by Micro Kjeldhal method. The Energy was determined by calculation method.

2.4 Statistical analysis

All the experiments were carried out in triplicate and calculated the mean and standard deviation developing MS Excel. The results were analyzed by ANNOVA using data Entry modules for AGRES

statistical software (Version 3.01 and used Factorial completely Randomized Design (FCRD) for testing the statistical significance at $p < 0.05$ (Cochran and Cox, 1957).

3. Result and discussion

3.1. Nutritional composition of Probiotic (*Lactobacillus bulgaricus*) yogurt from Karunkuruvai rice extract.

Nutritional composition of Probiotic (*Lactobacillus bulgaricus*) yogurt from Karunkuruvai rice extract were presented in Table 3.1 and Figure 3.2

Table 3.1 Nutritional composition of Probiotic (*Lactobacillus bulgaricus*) yogurt from Karunkuruvai rice extract.

Nutrients	T ₀ *	T ₂	SEd	CD (0.05)
Energy (Kcal)	59±1.27	71±1.53	1.8384	5.1042**
Carbohydrate (g)	6.63±0.16	7.8±0.19	0.1838	0.5104**
Fat (g)	2.15±0.05	2.5±0.06	0.0477	0.1325**
Protein (g)	3.21±0.06	4.3±0.09	0.0827	0.2297**
Sugar (%)	10.43±0.22	6.2±0.13	0.1845	0.5123**

*Source : Soni *et al.* (2020)

T₀ = AGMM (200%) + Culture (10g)

T₂ = KRE (70%) + AGMM (130%) + Culture (10g)

Table 3.1 reported that T₀ Aavin green mafic milk yogurt contain 59±1.27 kcal of energy, 6.63±0.16g of carbohydrate, 2.15±0.05g of fat, 3.21±0.06g of protein respectively.

T₂ Probiotic (*Lactobacillus bulgaricus*) yogurt had 71±1.53kcal of energy, 7.8±0.19g of carbohydrate, 2.5±0.06g of fat, 4.3±0.09g of protein. Compared to T₀, T₂ had higher content of energy, carbohydrate, fat, protein.

Benchimol *et al.* (2004) concluded on the probiotic strain combination had a substantial impact on the nutritional composition of the produced probiotic dairy products, according to nutritional analyses. 100 g of probiotic yogurt had 86–88% moisture, 0.6–0.8 g of fat, 3.19–3.93 g of protein, 2.0 g of carbohydrates, 5.0–8.0 g of fat, 53–63 calories, 98–125 mg of calcium, 75–93 mg of phosphorus, 0.32–0.36 mg of zinc, and 0.2–0.23 mg of iron. With the exception of iron and zinc, samples nutritional compositions varied significantly ($P < 0.05$).

Note : Results reported are means of triplicate samples ± standard deviation. Values in the same column with different superscripts are significant different at $p < 0.05$

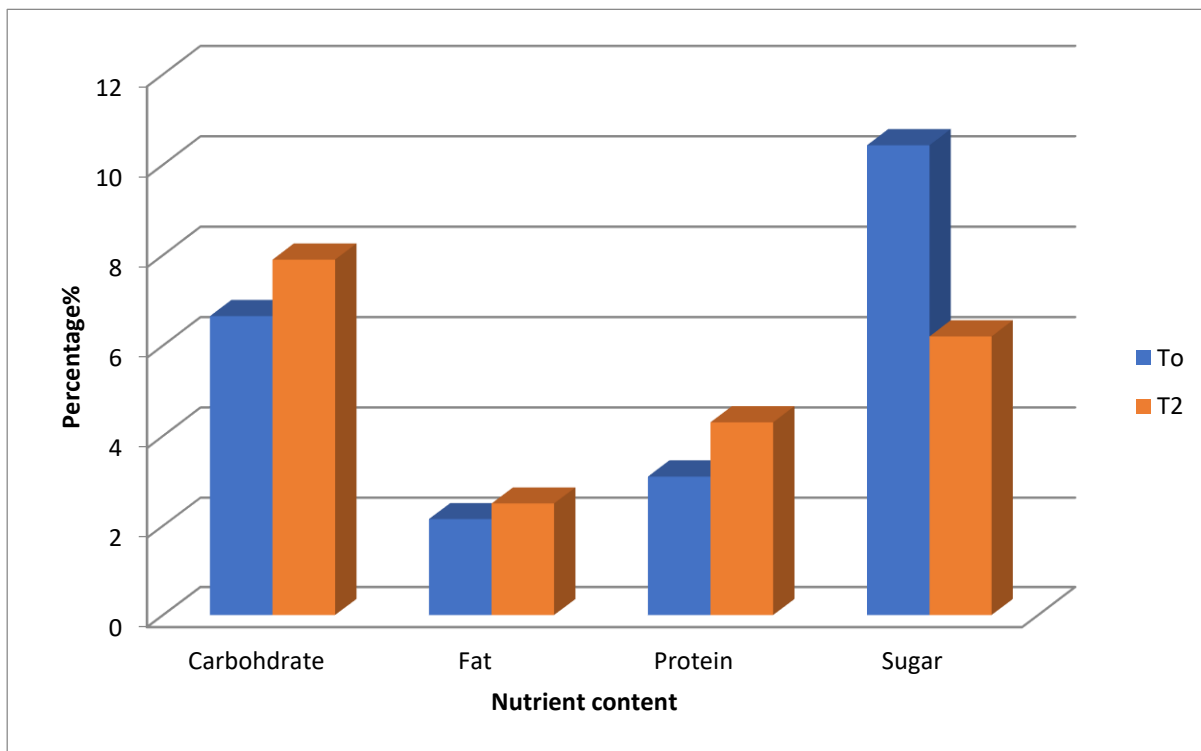


Figure 3.1 Nutritional composition of Probiotic (*Lactobacillus bulgaricus*) yogurt from Karunkuruvai rice extract

4. Conclusion

The finding of this study of nutritional evaluation of yogurt incorporated with karunkuruvai rice extract reveals that T₂ has higher nutrient content compared to T₀. Probiotic (*Lactobacillus bulgaricus*) yogurt made with Karunkuruvai rice has a higher protein content than plain yogurt. Scientific research is being conducted to determine the effects of the production of food products from rice milk on human health. The desire for comfort foods with single portions that don't require any additional preparation are growing quickly. In comparison to control yogurt, probiotic (*Lactobacillus bulgaricus*) yogurt made from Karunkuruvai rice is particularly acceptable. The integration of *Lactobacillus bulgaricus* probiotics with Karunkuruvai rice extract offers a promising avenue for enhancing the nutritional profile of yogurt, aligning with the growing consumer interest in functional and health-promoting foods. The addition of Karunkuruvai rice extract not only amplifies the yogurt's antioxidant properties, fiber content, and overall nutritional value, but it also supports various health benefits such as improved digestion, immune function, and better blood sugar regulation. This innovation presents an opportunity for food manufacturers to offer a more nutrient-dense and beneficial product to the market.

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