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FORMULATION AND STANDARDISATION OF FUNCTIONAL FLAXSEED SOYMILK-SHAKE

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ABSTRACT: In addition to nutrients, functional foods contain other components that may be beneficial to health. Soymilk is a plant-based drink produced by soaking and grinding soybeans, boiling the mixture, and filtering the remaining particulates. It is a stable emulsion of oil, water, and proteins. Soy milk is prepared from soybeans or full-fat soy flour. The dry beans were soaked in water for a minimum of three hours up to overnight, depending on the water temperature. The rehydrated beans then undergo wet grinding with enough added water to give the desired solid content to the final product, which has a protein content of 1–4%, depending on the method of production. Flaxseed is commonly used to improve digestive health and to relieve constipation. Flaxseed may also help lower the total blood cholesterol and low-density lipoprotein cholesterol levels, which may help reduce the risk of heart disease. Flaxseed has new prospects as a functional food owing to consumers' growing interest in food with superb health benefits. This study aimed to formulate and standardize flaxseed-incorporated soymilk shakes. Organoleptic evaluation was performed using a 9-point hedonic scale by 30 trained and semi-trained panel members. The milkshake samples were subjected to nutrient and shelf life analysis. Nutrients such as Protein, Carbohydrates, Fat, Crude fiber, iron, calcium, and vitamins A, B6, and D were analyzed. The formulated flaxseed soy milkshake was analyzed for microbial plate count, which can be stored in the refrigerator for 10 days because it has no preservative added condition.

Keywords: Functional food, Flaxseed, Soymilk, Milkshake, Novel food

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1.INTRODUCTION

The term “functional food” itself was first used in Japan, in the 1980s, for food products fortified with special constituents that possess advantageous physiological effects [1]. The concept of functional foods was first promoted in 1984 by Japanese scientists who studied the relationships between nutrition, sensory satisfaction, fortification, and modulation of physiological systems. In 1991, the Ministry of Health introduced rules for approval of a specific health-related food category called FOSHU (Food for Specified Health Uses) which included the establishment of specific health claims for this type of food [2]. Functional foods, one of the major food categories in the global health and wellness market, are becoming a major focus for new product development (NPD) in the food industry. Functional food product development (FFPD) is a complex process with success factors that differ somewhat from those of traditional new food product development. This study focuses on the need to evolve from a traditional NPD approach to an integrative and innovative approach involving cooperative networks and techniques of commercialization. Greater focus on a product-oriented NPD portfolio and diverse multiple external partners has been suggested as a key factor in accelerating the progress of FFPD [3].Many health-conscious individuals incorporate functional foods and beverages into their daily lives with the hope of maintaining or enhancing their quality of life. As the costs of health care and prescription drugs increase, a growing trend towards self-medication with natural food-based ingredients occurs [4]. The market for functional foods is growing, and the food industry is actively searching for natural food-based ingredients that may positively affect health, disease prevention, and management [5]. The soya bean is a stable food with great nutritional value. It has been recognized as an ideal grain to meet the protein and energy requirements of both humans and animals. Dehulled soybeans contain 20% oil, 40% protein, 35% carbohydrates, and 5% minerals on a dry-matter basis. Soybean has more than twice the amount of most of the minerals, especially calcium, iron, phosphorus, and zinc, than any other legume and has a very low sodium content. Soybean contains all the important vitamins and is a very good source of B-complex vitamins and Vitamin E [6]. However, the macronutrient profile of soybeans differs from that of most other legumes in some important ways. Soybeans are higher in both protein and fat than other beans and are relatively low in carbohydrates.It addition to containing good quality nutrients, Soybean base food products also known as soy foods, reported as potential functional foods, are implicated in several health-enhancing properties which include antioxidant, anti-obesity, anti-diabetes, properties and prevention of osteoporosis and cancers such as breast and prostate cancer. Soybean-based foods have generated much interest because of the evidence that the consumption of large amounts of soybean can lower the risk of chronic diseases such as cardiovascular disease and cancer, which is particularly noticeable among Asian populations

because of their high soy food intake. Soy proteins also have cholesterol-lowering effects, and protein hydrolysates or hydrolyzed peptides of soybeans decrease blood cholesterol and glucose levels. In addition, the consumption of soy foods may reduce the risk of osteoporosis and help alleviate menopausal symptoms, which are major health concerns in women[7].Flax (Linumusitassimum) belongs to the family Lineaceae and is a blue-flowering annual herb that produces small flat seeds varying from golden yellow to reddish brown. Flaxseed possesses a crispy texture and nutty taste [8]. Flaxseed is also known as linseed and these terms are used interchangeably. Flaxseed is often used to describe flax when consumed by humans, whereas linseed is used specifically for industrial applications [9]. Almost all parts of the linseed plant are used for various purposes. Seeds contain oil, which is used for edible purposes after refining [10]. The stem yields good-quality fibers with high strength and durability. It is currently cultivated in more than 50 countries, predominantly in the Northern Hemisphere (NH). Canada is the world's largest producer and exporter of flaxseeds [11]. Important flaxseed growing countries include India, China, the United States, and Ethiopia [10]. India ranks first among the leading flaxseed-producing countries in terms of acreage, accounting for 23.8 % of the total, and third in production, contributing to 10.2 % of the world's production [12]. In India, flaxseed is cultivated mainly in Madhya Pradesh, Maharashtra, Chattisgarh, and Bihar. It is interesting to note that flaxseed is native to India and is a staple food crop. In India, flaxseed is still consumed as food and for medicinal purposes [13]. It enjoys good status among oilseeds because of its versatility. It has emerged as an attractive nutritional food because of its exceptionally high content of alpha-linolenic acid (ALA), dietary fiber, high-quality protein, and phytoestrogens. Flaxseeds contain approximately 55 % ALA, 28–30 % protein, and 35 % fiber [14]. Functional foods can be defined as foods or food ingredients that may provide physiological benefits and help prevent and/or cure diseases [15]. Presently, flaxseed has new prospects as a functional food owing to consumers' growing interest in food with superb health benefits. Owing to its excellent nutritional profile and potential health benefits, it has become an attractive ingredient in diets specifically designed for specific health benefits [16]. ALA is an essential polyunsaturated fatty acid that exhibits anti-inflammatory, antithrombotic, and anti-arrhythmic properties [17].Edible flaxseed products include whole flaxseed, ground meal, extracted oil, and mucilage. These products have been proposed as nutritional additives in the preparation of several dietary items such as baked cereal products, ready-to-eat cereals, beverages, fiber bars, salad toppings, meat extenders, bread, muffins, and spaghetti [18].The plant-based drink (PBD) market is rapidly expanding worldwide, substituting cow's milk for many different reasons. This is related to the fact that consumers seek a more sustainable diet, at least partially, by substituting animal products with plant-based products. PBDs have been reported to exert beneficial effects on human health, being a major choice for lactose intolerance and for people allergic to cow milk proteins [19]. The demand for plant-based beverages has rapidly increased in recent years. Among the

various PBD options, soy beverages rank second in popularity, with oat-based drinks being the most widely consumed. From a nutritional point of view, soy-based drinks are an excellent source of high-quality protein, vitamin B, unsaturated fatty acids, phytosterols, soy lecithins, and Isoflavones [20]. Although soy-based drinks are known as soy milk worldwide, European regulations prohibit the use of the word milk for drinks that are not made from mammary secretions. However, the Food and Drug Administration (FDA) recently issued a recommendation concerning the labeling of plant-based dairy alternatives, describing the legality of using the term "milk" in such products. Given consumers' increased familiarity with plant-based dairy alternatives, previous terminological restrictions are no longer necessary. Instead, a clear labeling that highlights the nutritional properties of these products is recommended [21]. By accurately labeling and fortifying plant-based products already on the market, consumers will be able to evaluate the adequacy of vitamins and other micronutrients typically found in lower quantities than cow milk [22].The present study intends to formulate a functional milkshake that is highly composed of flaxseed and soymilk and can be consumed by vegetarians, lactose intolerant, and age category people. The objectives of the study was,

- To Formulate and standardize the flaxseed incorporated soybean Milkshake
- To Study the organoleptic evaluation of the standard and flaxseed-incorporated soy milkshake.
- To analyze the nutrient and microbial contents of the standard and flaxseed-incorporated soy milkshake.
- To Study the shelf life of standard and flaxseed-incorporated soy milkshakes.

2. MATERIALS AND METHODS

2.1 Selection of Raw Materials

The ingredients selected for the study were flaxseed (Linumusitatissimum), Soymilk, Sugar, Ice cream (vanilla flavor), and toppings (Almonds, Cashew nuts, and pistachio), which were purchased from a nearby supermarket in Coimbatore District, Tamil Nadu.

2.2 Processing and Preparation of Soy-Milk

Soybean and Flaxseed were cleaned with water to make the sample free from foreign materials. After washing the Soybean, Flaxseed was allowed to sundry for a particular period until it became dry. The Flaxseed was ground to a fine powder, and other ingredients were measured using a weighing machine. Preparation of soymilk was conducted as shown in Figure 1. Initially, the soybeans were washed, soaked for 12 hrs, and boiled for 15 min. The obtained slurry was squeezed to produce soy milk [23].

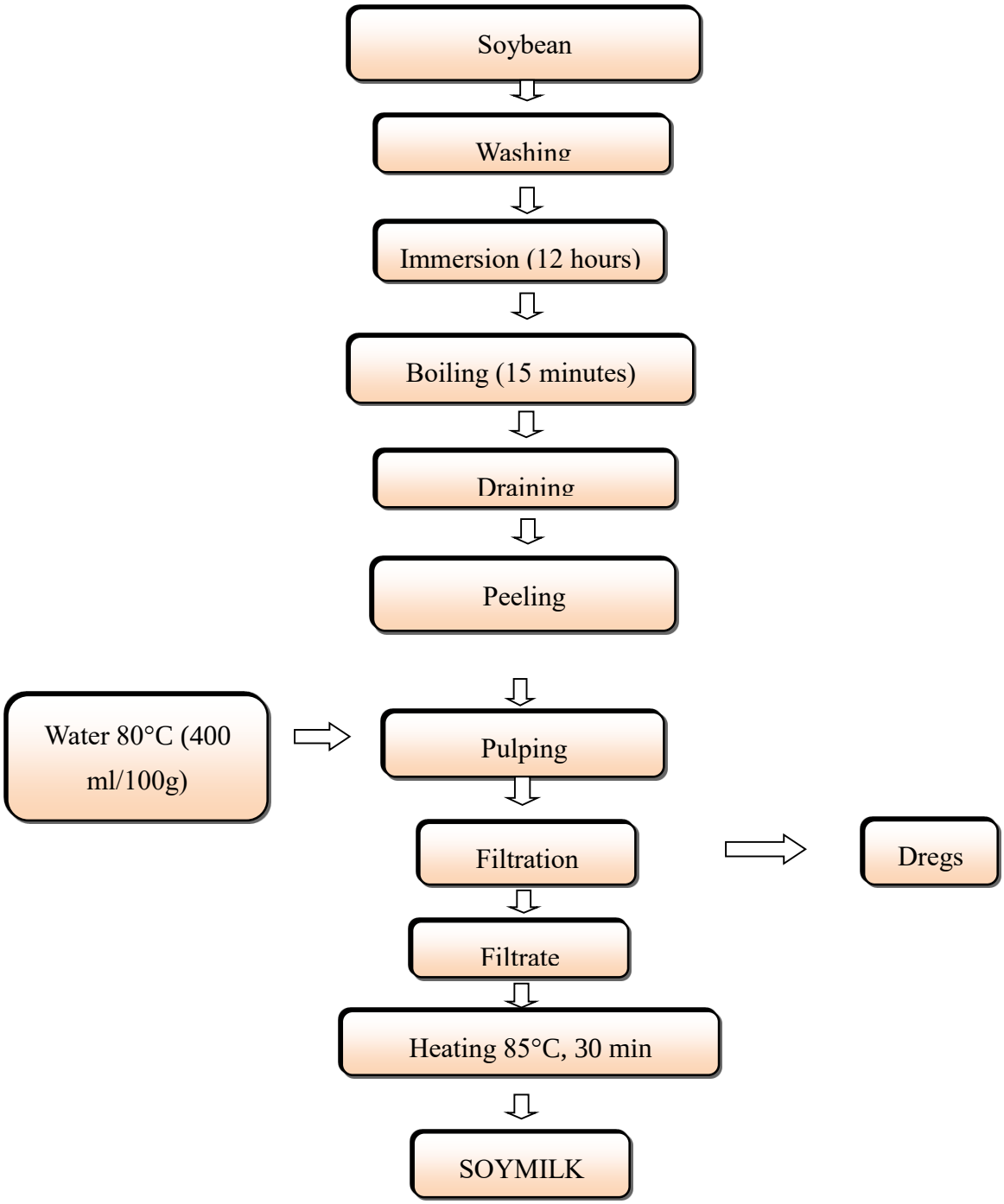

Figure 1 Preparation of Soymilk

2.3 Formulation and Standardisation of Flaxseed Soy Milkshake

Soymilk and flaxseed were selected for milkshake preparation. The milkshake was prepared using a standard procedure. In the present study, flaxseed was incorporated, and soy milkshake was formulated as shown in Table 1 and Figure 2.

Table 1: Ingredients for the formulation of Flaxseed soy milkshake along with Variation

Ingredients (100ml)	Standard	Variation 1	Variation 2	Variation 3	Variation 4	Variation 5
Soymilk (ml)	70	60	50	70	75	80
Flaxseed(g)	30	40	50	30	25	20
Icing Sugar(g)	20	20	20	20	20	20
Ice cream (ml)(Vanillaflavour)	20	20	20	20	20	20

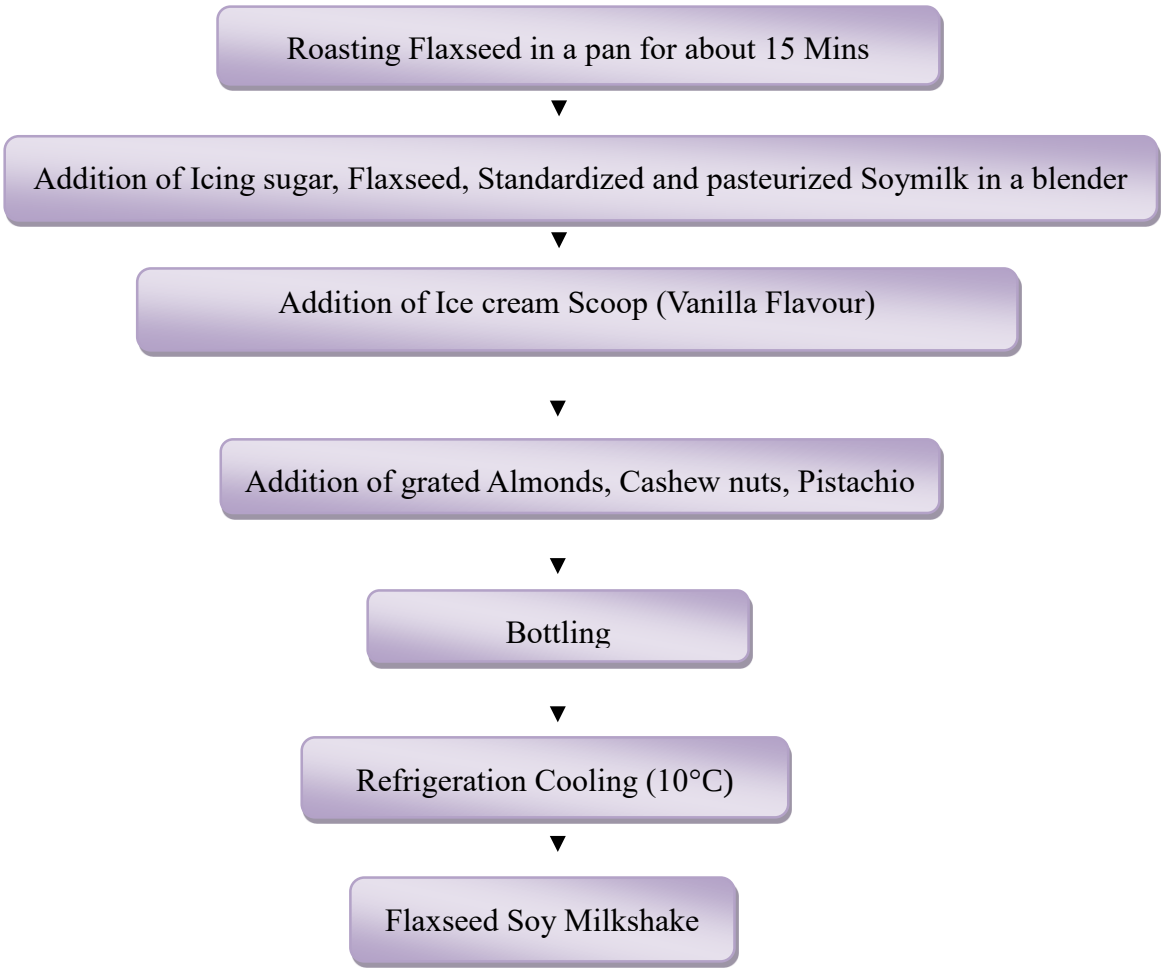

Fig 2: Formulation of Flaxseed Soy Milkshake

2.4 Sensory Evaluation

Sensory assessments were evaluated based on the quality description, that is, appearance, color, flavor, texture, taste, and overall acceptability. Sensory evaluation was done using 9 point hedonic scale with 30 trained and semi-trained panel members [24].

2.5 Nutrient Analysis

In this study, nutrients such as Energy, Protein, Carbohydrates, Fat, Crude fiber, iron, calcium,

phosphorus, and vitamins A, B6, and D were analyzed using the AOAC method [25].

2.6 Shelf-Life Evaluation

The microbial content of the standard and flaxseed-incorporated soy milkshakes was stored in a glass container at room temperature.

2.7 Statistical Analysis

The primary data were collected, consolidated, and subjected to statistical analysis, such as mean, standard division, one-way ANOVA- F, and P value [26].

3. RESULTS AND DISCUSSION

3.1 Organoleptic Evaluation of the Standard and Flaxseed incorporated Soy milkshake

Milkshakes were prepared using different quantities of ingredients. The formulated milkshake was subjected to an acceptability trial, which is discussed below. The mean and standard deviation scores of the five variations in the Formulated Flaxseed Soy milkshake are presented in Table 2.

Table 2: Organoleptic Evaluation of the Standard and Formulated Flaxseed Soy milkshake

Particulars	Standard	V- 1	V-2	V-3	V-4	V-5	One way Anova	
							F Value	P value
Appearance	8.3 ± 0.8	8.5 ± 0.6	8.9± 0.3	8.5± 0.5	8.7 ± 0.4	8.5±0.6	6.058	.000
Colour	8.0 ± 0.7	8.3 ± 0.6	8.7± 0.4	8.1± 0.7	8.8 ± 0.3	7.8±0.7	13.877	.000
Flavour	7.8 ± 0.8	8.5 ± 0.6	8.7± 0.5	8.1± 0.7	8.8 ± 0.5	7.9±0.8	12.612	.000
Texture	7.9 ± 0.6	8.5 ± 0.6	8.7± 0.4	8.0± 0.7	8.7 ± 0.5	8.1±0.8	12.324	.000
Taste	7.7± 0.5	8.3± 0.7	8.7± 0.6	8.3± 0.7	8.6±0.7	7.9±0.5	12.525	.000
Overall acceptability	7.8 ± 0.6	8.5 ± 0.5	8.8± 0.5	8.1± 0.5	8.5 ± 0.6	7.9±0.5	14.998	.000

P Value is ≤0.05 so null hypothesis is rejected alternate hypothesis accepted

The results showed that Variation 4 reached the maximum scores in sensory qualities such as appearance, flavor, texture, taste, and overall acceptability. The Variation 4 had secured the highest score in Colour (8.8 ± 0.3), Flavour (8.8 ± 0.5) and Texture (8.7 ± 0.5) compared to other variations due to the combination of ingredients, namely, Flaxseed (Linumusitatissimum), Soymilk, Sugar, Ice cream (Vannila Flavour), Toppings (Almonds, Cashew nuts, Pistachio).The standard had the lowest overall acceptability score. However, Variation 4 was selected as the best based on the overall rating for further recommendation for people around different age groups, particularly those who are allergic to animal-based products.

3.2 Nutritional Composition of Standard and Flaxseed Incorporated Soy Milkshake

Nutrients were analyzed using standard and selected products. AOAC methodologies were used to analyze the nutrients in the Variation 4. The Liquid sample was then washed and diluted. Nutritional content was determined using a diluted ash sample. The nutrient contents of the standard and flaxseed-incorporated soy milkshake are tabulated in Table 3.

Table 3: Nutritional Composition of Standard and Flaxseed Incorporated Soy Milkshake

NUTRIENTS	Standard Milkshake (100g)	Flaxseed Incorporated Milkshake (100g)
Energy (Kcals)	100.8	110.6
Protein (g)	5.78	10.45
Carbohydrates (g)	10.8	11.5
Fibre (g)	2.38	5.72
Iron (mg)	0.07	1.5
Fat (g)	11.45	10.5
Calcium (mg)	505	405
Vit-A(µg)	4.5	7.5
Vit - B6 (mg)	0.13	0.17
Vit-D(IU)	345	453

The proximate values included 110.6 Kcals of energy, 11.5 grams of carbohydrate, 10.45 grams of protein, 10.5 grams of fat, and 5.72 grams of fiber. Calcium was 405 mg and iron 1.5 mg in the Flaxseed soy milkshake mineral content and also contributed 7.5 (µg) of Vit- A, 0.17 mg of Vit- B6 and 453 international units (IU) of Vit- D were found in selected Milkshake. Compared with the standard sample, the contribution of nutrients is highly involved in enhancing the immunity of an individual and is considered functional food product development.

3.3 Microbial Analysis of Standard and Flaxseed Incorporated Soy Milkshake

The perusal of data pertaining to the total plate count of standard and flaxseed-incorporated soy milkshake is shown in Table 4.

Table 4: Total plate count (CFU/ml) of standard and Flaxseed incorporated Soy milkshake during storage

Dilution	Total microbial count (cfu/gm) Time Line					
	0th Day		5th day		10th Day	
	Standard	Selected sample	Standard	Selected sample	Standard	Selected sample
10^2	0	0	3.89	3.42	17.18	15.15
10^3	0	0	3.57	3.28	16.23	17.23
10^4	0	0	3.24	2.98	15.23	15.15

Data shows that Flaxseed-incorporated soy milkshakes prepared without any added preservative were free from microbial contamination for up to 9 days of storage. On the 10th day, contamination was detected in both standard and flaxseed-incorporated preserved soy milkshakes. Since organoleptically accepted milkshake samples had a microbiological count below the acceptable level, they were all safe to consume during the 10 days of storage period because no preservative was added. Similar results were reported by Hossin [27].

4. CONCLUSION

Thus, the present study concluded that 25% flaxseed-incorporated milkshake had the maximum scores for sensory qualities, such as appearance, flavor, texture, taste, and overall acceptability. The standard and formulated products had more Energy, Protein, Carbohydrates, Fat, Crude fiber, iron, calcium, phosphorus, vitamin A,B6, and D than the standard product. The shelf life study showed that the standard and formulated products were acceptable for up to 9 days without any added preservatives.

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ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

HUMAN AND ANIMAL RIGHTS

No Animals/Humans were used for studies that are base of this research.

CONSENT FOR PUBLICATION

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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