



EXPLORING THE SCIENTIFIC BENEFITS OF PHYTESTEROL ENRICHED SOYA-BUTTER- A COMPREHENSIVE REVIEW

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Abstract

Phytosterol-enriched soy butter presents a novel culinary option suitable for diverse food preparations. This plant-derived butter originates from soybeans, which furnish imperative amino acids, unsaturated fats, including oleic and linoleic acids, isoflavones, phyto-sterols, lecithins, saponins, and an array of minerals, folic acid, and B vitamins. The soybean-derived butter incorporates phytosterols extracted from vegetable oil. These compounds exhibit a structure akin to cholesterol, yet they function to lower blood cholesterol levels through competitive inhibition. This fortified soy butter holds potential advantages for individuals grappling with metabolic disorders such as cholesterolemia, juvenile diabetes, hypertension, obesity, and chronic ailments like osteoporosis, cancer, menopausal syndrome, and anemia. Consequently, this product stands to offer superior health benefits compared to alternative offerings in the market.

Keywords: *Phytosterol, Soyabutter, Cholesterol, Sensory analysis, Hedonic rating test*

Introduction:

Soybeans are rich in both protein and oil. In Asia, they are utilized in the production of various food products, including soy milk, soy sauce, tofu, natto, and soy butter, among others (Medic *et al.*, 2014). Soy milk, derived from soybeans, is nutritionally valuable. It lacks lactose, caffeine, and gluten, and has low fat content while being high in omega-3 fatty acids and protein. Additionally, soy milk contains several essential minerals, such as calcium, phosphorus, and iron, in greater quantities compared to cow's milk (Kesenkaş *et al.*, 2011; Kesenkaş *et al.*, 2013). Soy butter, a product made from soy milk, can be incorporated into various recipes and is enriched with phytosterol (PS), offering numerous health benefits.

Phytosterols are plant-based compounds that share a structural resemblance to cholesterol. The primary phytosterols found in various vegetable oils include β -sitosterol, campesterol, stigmasterol, and Δ 5-avenasterol. Rice bran oil and corn oil contain higher levels of stanols (campestanol, cycloartanol, and 24-methylene-cycloartanol) compared to other vegetable oils, which are saturated forms of phytosterols and are considered a subgroup of phytosterols. Phytosterols are present in trace amounts in many plant species but are found in high levels in certain cereal species. Rice bran oil and sunflower oil contain higher concentrations of phytosterols compared to other vegetable oils (Yung *et al.*, 2019).

Soy butter is fortified with phytosterols (PS) to provide a multitude of health benefits. In developed nations, elevated serum concentrations of total cholesterol or low-density lipoprotein (LDL) cholesterol are significant risk factors for coronary heart disease, a leading cause of illness and death. Phytosterols work by competitively inhibiting cholesterol absorption, effectively lowering serum cholesterol levels, and thereby reducing the risk of coronary heart disease (Tapiero *et al.*, 2003; Plat and Mensink, 2005).

Research indicates that high doses of phytosterols (PS), exceeding 10 grams per day and taken over a span of 3 to 5 weeks, can effectively reduce blood cholesterol levels by as much as 20% (Marangoni and Poli, 2010). This cholesterol-lowering effect of PS in the product helps mitigate the risk of cardiovascular disease (CVD) and atherosclerosis.

Nutritional Composition of PS Enriched Soy Butter

Phytosterols (PS): Phytosterol-enriched soy butter is a significant source of phytosterols, which contribute to its cholesterol-lowering properties and potential anticancer effects. **Protein:** Soybeans are naturally rich in protein, and soy butter retains a substantial protein content. **Healthy Fats:** While soy butter contains fats, it has a lower fat content compared to traditional butter and may include heart-healthy fats. **Isoflavonoids:** Soybeans are known for their isoflavonoid content, which may have estrogenic effects and contribute to various health benefits. **Vitamins and Minerals:** Soy butter may contain essential vitamins and minerals, including vitamin E, calcium, and phosphorus. **Calories:** The caloric content of soy butter can vary but is generally lower than traditional butter due to its reduced fat content.

Sensory Analysis using Hedonic Rating Test:

A Hedonic rating test is commonly used to evaluate the sensory properties of a food product, including its taste, texture, aroma, and overall acceptability. Following steps are generally followed for sensory evaluation.

Sample Preparation: Samples of PS enriched soy butter were prepared and ensured their consistency in texture and appearance.

Selection of Panel: A group of trained or untrained panelists ideally representing the target consumer demographic.

Evaluation of attributes: Sensory attributes to be evaluated, such as taste, texture, aroma, color, and overall liking.

Scoring System: A numerical scale, typically ranging from 1 to 9, where 1 represents "dislike extremely" and 9 represents "like extremely."

Blind Testing: Ensure that panelists are unaware of the product's identity to minimize bias.

Presentation: Present each sample to panelists, ensuring they have access to water or palate cleansers between samples.

Evaluation: Panelists rate each attribute for each sample independently and provide an overall liking score.

Data Analysis: Calculate the mean scores for each attribute and overall liking to assess consumer preferences.

Interpretation: Analyzing the data to understand which sensory attributes contribute to the overall liking of the product.

Benefits of PS enriched Soya- Butter:

Children often have a preference for butter, and excessive consumption of conventional butter can contribute to obesity. The use of PS-enriched soy butter not only caters to their taste preferences but also helps in reducing the obesity risk due to its lower fat content.

Obesity has emerged as a global health crisis affecting individuals of all age groups, encompassing both children and adults. It contributes to a cluster of health disorders, including insulin resistance, hyperglycemia, dyslipidemia, and hypertension (Veza, 2020). Soybeans, which naturally contain approximately 20% fat (Murugkar, 2014), yield a butter with a significantly lower fat content, around 50%, compared to other commercially available products. The addition of phytosterols (PS) to soy butter can be a valuable strategy in reducing the risk of obesity.

Soybeans contain a variety of beneficial compounds, including isoflavones, protease inhibitors, phytosterols, phytates, phenolic acids, saponins, and more, which have demonstrated anticancer effects. Isoflavones, in particular, play a role in preventing hormone-dependent cancers. Studies have shown that the consumption of soy foods during childhood and adolescence in women can reduce the risk of breast cancer later in life (Dixit *et al.*, 2011). Phytosterols also exhibit anticancer properties, inhibiting cancer cell growth, the production of carcinogens, invasion, metastasis, and promoting apoptosis. Consequently, phytosterols can help reduce the risk of

breast or prostate cancer (Ramprasath and Awad, 2015). Therefore, soy butter enriched with phytosterols is highly beneficial for cancer patients.

Additionally, dietary soy can alleviate menopausal discomfort, a challenging phase experienced by women between the ages of 45 to 55. Menopause brings physical and emotional challenges, including symptoms like hot flashes (HF), mood swings, night sweats, and reduced energy. Soy products have been found to decrease these menopausal discomforts (Dixit *et al.*, 2011).

Osteoporosis is often associated with hormonal changes following menopause, making it a common cause of age-related bone loss. Decreased ovarian estrogen production during menopause leads to hormone-related bone loss in the first decade after menopause (Gruber *et al.*, 1984). Some reports suggest that isoflavonoids found in natural food sources like soybeans may help preserve bone mass, similar to synthetic flavonoid derivatives like ipriflavone (Agnusdei *et al.*, 1989). This makes soy products beneficial for individuals dealing with osteoporosis as well (Arjmandi *et al.*, 1996).

Soybeans are packed with various nutrients and functional components, including isoflavonoids (Pipe *et al.*, 2009). Isoflavonoids have a structure similar to endogenous estrogen and can exhibit estrogenic or antiestrogenic effects by weakly binding to estrogen receptors, acting as either agonists or competitive antagonists (Lemieux *et al.*).

Estrogen plays a crucial role in preventing type 2 diabetes mellitus by reducing insulin resistance and improving insulin secretion (Knight *et al.*, 1996). Therefore, soy isoflavonoids, with their estrogenic properties, may contribute to better glucose homeostasis, and soy proteins could potentially enhance glucose metabolism. Consequently, soybeans may aid in reducing the risk of type 2 diabetes.

Discussion:

Phytosterols possess the remarkable ability to reduce blood cholesterol levels. Their structural similarity to cholesterol enables them to competitively inhibit cholesterol absorption, making this product particularly beneficial for individuals with high cholesterol levels or cholesterolemia.

For children, who often have a penchant for butter, the use of soy butter enriched with phytosterols not only caters to their taste preferences but also helps in reducing the risk of obesity. This is because soy butter contains significantly less fat (approximately 50%) compared to other commercial products, making it a healthier alternative.

Furthermore, the consumption of phytosterol-enriched soy butter may also lower the risk of juvenile diabetes. It can be recommended for patients dealing with atherosclerosis, heart disease, hypertension, and obesity.

The introduction of this new product formulation adds diversity to the culinary world, offering healthier options for families. It also contributes to advancements in food product development,

food technology, confectionary science, and related fields, shedding light on innovative possibilities in the food industry.

Conclusion:

Phytosterol-enriched soy butter is an innovative product with versatile applications in various culinary recipes and food formulations. It boasts significant nutritional value, offering essential amino acids, unsaturated fatty acids, including oleic and linoleic acids, among others. Additionally, it serves as a rich source of various minerals, folic acids, and B vitamins, which collectively contribute to disease prevention, including obesity, heart disease, and cancer.

Future Scope:

Phytosterols, a key component of this butter, play a crucial role in reducing blood cholesterol levels, making it a valuable asset for addressing various health-related concerns. We anticipate that the extensive utilization of Phytosterol-enriched soy butter in a wide range of food formulations in the future will contribute to the overall well-being and health of consumers. It's a step towards maintaining strength and promoting good health in the days to come.

Conflict of Interest: The authors have declared no conflicts of interest in the publication of this paper.

Author's Contribution: Suranjana Sen and Dishani Saha conducted the complete literature review, with Suranjana Sen taking on the task of producing all the figures and managing the references. Dr. Rupali Dhara Mitra conceived the paper's idea and title, and also performed thorough editing for the entire manuscript.

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