



Pharmacological Benefits of Soya Protein

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Abstract

Soy protein, a plant-based protein derived from soybeans, has garnered attention for its potential pharmacological benefits. This review systematically examines the scientific literature to elucidate the health-promoting properties of soy protein and its components, particularly isoflavones. Evidence suggests that soy protein contributes to cardiovascular health by reducing serum lipid levels, improving arterial compliance, and lowering blood pressure. Additionally, soy protein has been shown to modulate glucose metabolism, thereby offering beneficial effects for individuals with diabetes mellitus or at risk of developing this condition. The anticarcinogenic potential of soy protein, attributed to its isoflavone content, has also been a focal point, with studies indicating a reduced risk of certain cancers. Furthermore, soy protein may play a role in promoting bone health and preventing osteoporosis through its effects on bone mineral density. This review highlights the multifaceted benefits of soy protein consumption as part of a balanced diet, pointing to its role in disease prevention and health promotion. However, it also calls for further research to fully understand the extent and mechanisms of these benefits, particularly in diverse populations and across different health conditions.

Keywords: Soy protein, isoflavones, cardiovascular health, diabetes mellitus, cancer prevention, bone health, lipid profile, glycemic control, anticarcinogenic properties, osteoporosis

Introduction

Soy protein, derived from soybeans, is not only a rich source of high-quality protein but also harbors a range of bioactive components, including isoflavones and saponins, that offer various health benefits. Its consumption has been associated with improved lipid profiles, enhanced glycemic control, and potential protective effects against certain forms of cancer. This review aims to explore the pharmacological benefits of soy protein, focusing on its impact on chronic diseases such as cardiovascular disease, diabetes mellitus, and obesity, as well as its role in cancer prevention and bone health. By delving into the mechanisms underlying these benefits, we aim to provide insights into how soy protein may be leveraged in dietary strategies to improve public health outcomes.

Main Objective

The main objective of this review is to comprehensively evaluate the pharmacological benefits of soy protein, with a specific focus on its impact on chronic diseases, including cardiovascular disease, diabetes mellitus, and obesity, as well as its potential roles in cancer prevention and bone health enhancement.

Soya protein in Cardiovascular Health

Recent research supports the notion that soya protein positively affects cardiovascular health. Studies have confirmed that it can lower serum cholesterol levels, LDL cholesterol, and triglycerides, while possibly increasing HDL cholesterol levels. The antioxidant properties of isoflavones in soya protein are key contributors to these benefits, enhancing endothelial function and reducing cardiovascular risk factors. Soy protein has been associated with several beneficial effects on cardiovascular health. The most well-documented effect is the reduction in plasma lipid and lipoprotein concentrations. Specifically, soy protein can

lead to reductions of approximately 10% in LDL (low-density lipoprotein) cholesterol concentrations, especially for individuals with high pretreatment LDL cholesterol levels, and small increases in HDL (high-density lipoprotein) cholesterol concentrations. However, the effects on blood pressure and other lipid risk factors like triglycerides and lipoprotein (a) have been inconsistent across studies. Some studies have also indicated potential benefits of soy protein in improving arterial compliance and reducing atherosclerosis, though these findings are not universally observed (Clarkson, 2002)^[1], (Sacks *et al.*, 2006)^[2]. The cardiovascular benefits of soy protein are partly attributed to isoflavones, which are phytoestrogens found in soybeans. Isoflavones have been studied for their potential to improve systemic arterial compliance, an indicator of the extent of atherosclerosis, and their role in the modulation of cholesterol levels. However, research has shown mixed results, with some studies finding no significant effects of isoflavones on LDL cholesterol and other lipid risk factors (Ramdath *et al.*, 2017)^[3]. Dietary soy protein's effects on cardiovascular health may differ between men and postmenopausal women. Some studies have suggested that soy protein improves flow-mediated arterial dilation in postmenopausal women but might worsen it in men. Also, complete soy protein, but not alcohol-washed soy protein, has been shown to reduce atherosclerosis in postmenopausal monkey models, suggesting the importance of the intact soy protein with its isoflavones for cardiovascular benefits (Teede *et al.*, 2001)^[4]. Despite the potential benefits, the efficacy and safety of soy isoflavones for preventing or treating cardiovascular disease have not been conclusively established. There is caution against the use of isoflavone supplements in food or pills. Whole soy foods are recommended for cardiovascular and overall health due to their content of polyunsaturated fats, fiber, vitamins, minerals, and low saturated fat content (Sacks *et al.*, 2006)^[2].

Metabolic Syndrome and Diabetes Management

Soya protein's impact on metabolic syndrome and diabetes management is notable. Its ability to improve insulin sensitivity and glucose control plays a crucial role in the management of type 2 diabetes. Clinical trials have demonstrated significant reductions in fasting blood glucose levels and HbA1c with soya protein supplementation, likely due to its influence on pancreatic β -cell function and insulin signalling. Managing MetS is not just about treating existing conditions but also about preventing the development of diabetes and cardiovascular diseases. Insulin resistance is a central component of MetS, leading to other risk factors like obesity, hypertension, impaired glucose homeostasis, and dyslipidemia with elevated triglycerides. Interventions aimed at improving insulin sensitivity and addressing each risk factor are essential for the prevention and management of MetS and its progression (Sathyaprakash & Henry, 2002) ^[6]. Effective management of MetS involves sustainable changes in diet and physical activity, which are vital components in the management of diabetes and MetS. Even modest weight loss achieved through diet and exercise can favorably affect several parameters of MetS and delay the onset of diabetic complications. In cases where lifestyle modifications are insufficient, pharmacotherapy tailored to normalize blood pressure, cholesterol levels, and glucose values may be necessary (Magkos, Yannakoulia, Chan, & Mantzoros, 2009) ^[7].

Soya protein in Obesity and Weight Management

The role of soya protein in obesity and weight management is backed by research highlighting its effects on satiety, metabolic rate, and thermogenesis. Studies have shown that diets enriched with soya protein can lead to more significant weight and fat loss, emphasizing its potential in weight management strategies. A systematic review and meta-analysis evaluating the effects of soy and soy isoflavones on weight, waist circumference, and fat mass concluded that soy showed no overall significant effect on these measures. However, specific circumstances, such as in obese subjects, with intake of ≥ 40 g soy protein/d, and short-term applications (1-3 months), showed a significant increase in weight. Interestingly, soy significantly decreased waist circumference in older ages, in women, and at doses of < 40 g soy protein/d. In contrast, isoflavone studies indicated a potential for reducing body mass index (BMI), especially in dosages < 100 mg/d and intervention periods of 2-6 months (Akhlaghi, Zare, & Nouripour, 2017) ^[8]. Research comparing the effects of soy protein to other sources of protein on body composition and lipid profiles in overweight or obese individuals has shown that soy protein can reduce body weight and fat mass more effectively than casein (milk protein). This is possibly due to the unique properties of soy protein and its components, such as isoflavones, which have been associated with various biological activities beneficial to human health. Studies suggest that soy protein and its isoflavones may play a role in obesity management through different mechanisms, including enhancing insulin sensitivity, moderating hyperglycemia, and reducing plasma lipids (Velasquez & Bhathena, 2007) ^[9]. Soy protein appears to act through various mechanisms to combat obesity. These include increasing mRNA levels of peroxisome proliferator-activated receptor (PPAR)- α , reducing the expression of sterol regulatory element-binding protein-1, affecting

insulin secretion, and enhancing lipolysis. Soy protein intake has also been associated with increases in circulating levels of cholecystokinin, which regulates satiety and lipolysis, and possibly through stimulation of adiponectin and increased production of thyroid hormone. These actions collectively contribute to the improvement of obesity by inhibiting lipogenesis and enhancing lipolysis in the liver and adipocytes (Bangsumruaj, 2017).

Soya protein in cancer prevention: Soy protein has been extensively studied for its potential role in cancer prevention, with research focusing on its components, such as isoflavones, and their impact on various types of cancer. Isoflavones are phytoestrogens, which means they have a chemical structure similar to estrogenic, the female sex hormone.

Breast Cancer: The relationship between soy protein consumption and breast cancer has been a particularly active area of research. Studies have suggested that soy intake may have a protective effect, especially when consumed during adolescence. The isoflavones in soy can bind to estrogenic receptors in the body, potentially reducing the risk of hormone-related cancers like breast cancer. However, the evidence is not entirely conclusive, and research continues into how these effects may vary depending on the amount of soy consumed, the form of soy, and individual differences in metabolism.

Prostate Cancer: Research on soy protein and prostate cancer suggests that soy consumption may lower the risk of developing prostate cancer. Isoflavones may help to inhibit the growth of cancer cells by interfering with the pathways that promote cell proliferation and survival. Some studies have found that men who consume soy foods have a lower risk of prostate cancer compared to those who consume little to no soy.

Other Cancers: Studies have also explored the potential for soy protein to impact the risk of other types of cancer, including colon, lung, and stomach cancers. The findings have been mixed, with some evidence suggesting protective effects and other studies indicating no significant impact. The role of soy in cancer prevention may be influenced by various factors, including genetic differences, the microbiome, and overall diet and lifestyle.

Conclusion

In conclusion, the pharmacological benefits of soya protein are multifaceted and significant. Soya protein has been shown to improve heart health by reducing LDL cholesterol levels and possibly blood pressure, which are key factors in cardiovascular disease prevention. Additionally, it contributes to bone health, potentially reducing the risk of osteoporosis, particularly in postmenopausal women. There is also evidence suggesting that soya protein might have a role in cancer prevention, particularly in hormone-related cancers such as breast and prostate cancer. The compounds in soya protein, like isoflavones, are believed to be the key contributors to these benefits. As with any dietary component, moderation and a balanced approach to nutrition are vital, and soya protein should be considered a part of a diverse diet.

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