ISSN: 2707-1146
e-ISSN: 2709-4189

DOI: https://doi.org/10.36719/2707-1146/56/41-48

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Soy in the Fight Against Obesity: Does it Help to Reduce Weight?

Abstract

Fighting obesity is a global challenge that requires changes in lifestyle, diet, and physical activity levels. In this article, the study of healthy foods such as soy plays an important role, as it can help control body weight and improve metabolism - presenting soy as a weight loss product.

Soybeans are a valuable crop with a high protein and oil content, which is of great importance in the food, feed and technical industries. Its cultivation requires a warm climate, fertile soils, adequate moisture and balanced mineral nutrition. Optimal agrotechnical conditions ensure high yields and improved seed quality, which is especially important for processing into food products, including soy proteins used in diets to control body weight. The role of dietary soy protein in obesity.

The aim of the study is to evaluate the effects of soy products on weight loss and their role in regulating metabolism. The main findings indicate that soy products, due to their high protein content, low fat content and carbohydrates, can contribute to weight loss, improve lipid profile and appetite control. Key research results confirm that replacing animal proteins with soy products can speed up the weight loss process, reducing the calorie content of the diet and improving the feeling of satiety. However, the effect of soy products may vary depending on the individual characteristics of the body and the methods of their processing.

Keywords: *Soy, weight loss, metabolism, soy proteins, isoflavones, low-calorie diet, lipid profile, satiety, soy processing, metabolism*

Introduction

Definition of obesity and its prevalence in the world.

Obesity is a chronic disease characterized by excessive accumulation of adipose tissue in the body, which can negatively affect health. The main criterion for the diagnosis of obesity is the body mass index (BMI), the ratio of body weight (kg) to the square of height (m2). According to the World Health Organization (WHO):

BMI 25-29.9 is overweight.

BMI ≥30 is obese.

BMI ≥40 is morbid obesity (severe form).

Obesity has reached global epidemic proportions. According to WHO (Zhang, Ho, 2005).

In 2022, more than 1 billion people in the world were obese, including about 650 million adults. Every third adult is overweight. 39 million children are obese in childhood (under 5 years old), and

 ISSN: 2707-1146
e-ISSN: 2709-4189

more than 340 million among adolescents (5-19 years old). Obesity is more common in high-income countries, but in recent decades there has been an increase in rates in middle- and low-income countries (Shurtleff, Aoyagi, 2007).

Factors contributing to obesity

1. An overabundance of calories in the diet is the consumption of high–calorie foods rich in fats and sugars.

2. Sedentary lifestyle – reduced physical activity due to urbanization, office work, and technology development.

3. Genetic predisposition – certain genes can contribute to fat accumulation.

4. Hormonal and metabolic disorders – thyroid gland malfunction, insulin resistance.

5. Psychological factors – stress, emotional overeating, depression.

6. Environmental impact – availability of junk food, fast food advertising, lack of fresh vegetables and fruits in the diet.

Obesity is associated with many serious diseases, including: type 2 diabetes, hypertension and heart disease, cancer, osteoarthritis, sleep disorders (apnea).

Botanical characteristics

Soy (Glycine max) is an annual herbaceous plant from the Legume family (Fabaceae). It is widely cultivated as a food, fodder and industrial crop due to the high protein and oil content in the seeds.

Research

The root system is rod–shaped, well-branched, with nitrogen-fixing nodule bacteria (Rhizobium japonicum), which allows soybeans to enrich the soil with nitrogen. The stem is erect or curly, ranging in height from 30 cm to 2 m, depending on the variety. The leaves are compound, threefold, and covered with fine hairs. The flowers are small, white or purple, gathered in racemose inflorescences. The fruits are beans 3-7 cm long, containing 2-4 seeds. The seeds are rounded or oval, the color varies from yellow to black, depending on the variety.

Soybeans are one of the world's leading agricultural crops, which has wide application and is a universal crop raw material. The food value lies in the fact that soy is used in the production of soybean oil, milk, flour, soy protein, tofu and fermented foods (miso, tempeh). As a fodder crop, soy flour and cake are obtained from it, which is used in the production of animal feed. The use of soy in feed production improves weight gain, increases productivity and reduces the cost of protein additives in animal feed. The technical use lies in the fact that soy is used in biofuels, cosmetics, pharmaceuticals. As an important agricultural crop, soybeans are of great agrotechnical importance, and as a soil–improving crop, soybeans increase soil fertility due to their nitrogen-fixing properties.

Optimal growing conditions

Soybeans are a thermophilic crop and require certain conditions for high yields.

The optimal temperature for seed germination is 13-16°C, for growth and development 20-25°C. It does not tolerate frost, the minimum temperature for growth is not lower than 10 °C. The sum of active temperatures during the growing season should be 2500-3000 °C. Soybeans prefer fertile, well-aerated soils with a neutral or slightly acidic reaction (pH 6.0–7.0). Chernozems, gray soils, sandy loams and loams are considered the best. It is sensitive to salinity and stagnation of moisture. Soybeans are a short–day crop that requires sufficient sunlight to form a crop. The greatest need for moisture is during the flowering and formation of beans. The optimal amount of precipitation is 500-700 mm per season. It reacts well to irrigation, especially in arid areas. The main macronutrients are nitrogen (N), phosphorus (P), and potassium (K). Important trace elements are molybdenum (Mo), boron (B), and iron (Fe). Nitrogen fertilizers are used in minimal doses, since soybeans fix atmospheric nitrogen due to nitrogen-fixing bacteria infecting the roots of the plant and at the same time forming nodules on the roots.

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e-ISSN: 2709-4189

Agrotechnical significance of soybeans: In global agriculture, the main soybean growing regions are the USA, Brazil, Argentina, China, India, Canada and Ukraine. These countries provide the bulk of the world's soybean production, which is used both for domestic consumption and for export. In Azerbaijan, soybeans are also grown in certain areas, especially in areas with favorable climatic conditions, such as Ganja-Dashkasan, Tovuz-Gazakh zone and low-lying areas of the Kur-Araz valley (Abbasova, n.d.).

The nutritional value of soybeans is due to its unique composition: on average, the seeds contain 35-40% protein, which is close to animal protein in amino acid composition, as well as 18-22% oil rich in polyunsaturated fatty acids, especially linoleic and linolenic. In addition, soy contains isoflavones, which have antioxidant and hormone-regulating properties, contributing to the prevention of cardiovascular diseases, diabetes and certain types of cancer. Its high nutritional value makes soy an important component of vegetarian and healthy diets, especially in the form of tofu, soy milk, soy texturate, and fermented foods (Masoumeh, Andrade, 2018).

Due to its agrotechnical properties, soybeans are an excellent precursor for many crops, as they fix atmospheric nitrogen in the soil, reducing the need for nitrogen fertilizers and increasing soil fertility. This makes it an important element of crop rotation, especially in regions with intensive agriculture (Messina, Messina, 2010).

The chemical composition of soybeans. Soy has a unique chemical composition that makes it a valuable food and fodder crop. On average, soybeans contain 35-40% protein, rich in essential amino acids, especially arginine, lysine and glutamic acid.

The fat content of the seeds is 18-22%, while soybean oil is rich in polyunsaturated fatty acids, including linoleic acid and linolenic acid, and also contains phospholipids, especially lecithin. Carbohydrates in soy are about 30%, the main part of which is fiber and oligosaccharides. Soy contains a wide range of vitamins (B groups, vitamin E) and trace elements such as calcium, magnesium, iron, phosphorus, zinc and molybdenum. An important biologically active group of compounds are isoflavones, which have antioxidant and hormone-like properties that can contribute to the prevention of cardiovascular diseases and certain types of cancer. The high nutritional value of soy and its balanced composition make it indispensable in the production of plant proteins and functional foods.

Relevance of the topic

The growing number of obese people is one of the serious problems of modern society, leading to an increase in cases of diseases such as type 2 diabetes, cardiovascular diseases and metabolic syndrome. Excess body weight negatively affects metabolism, provoking insulin resistance, increased cholesterol levels and blood pressure, which significantly increases the risk of heart attacks and strokes. Modern research shows that proper nutrition plays a key role in the prevention and control of obesity, and soy, due to its high protein content, low glycemic index and the presence of biologically active compounds, can help control body weight and improve metabolic health. This makes studying the effects of soy on weight loss and obesity prevention an urgent task of modern science.

The popularity of soy as a source of vegetable protein in diets for weight loss is due to its high content of easily digestible protein (35-40%), low in fat and carbohydrates, as well as the presence of bioactive compounds that accelerate metabolism. Unlike animal proteins, soy protein does not contain cholesterol and is rich in essential amino acids, which makes it an ideal component for a low-calorie diet. In addition, soy has a low glycemic index, helping to control blood sugar levels and preventing insulin spikes, which is especially important for people with metabolic disorders. Isoflavones contained in soy can have a positive effect on lipid metabolism, reducing the level of harmful cholesterol and reducing the risk of cardiovascular diseases. Due to these properties, soy products such as tofu, soy milk, tempeh, and soy protein isolate are often included in diets aimed at weight loss and maintaining a healthy lifestyle.

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Studies on the effects of soy products on fat metabolism and satiety provide mixed results. Some of them indicate the positive effects of soy protein and isoflavones on the lipid profile and appetite control, while others do not reveal significant effects.

"Soy Products Ameliorate Obesity-Related Anthropometric Parameters in Overweight and Obese Subjects: A Systematic Review and Meta-Analysis of Randomized Controlled Trials" Nutrients, 2019. This meta-analysis examined the effects of soy products on weight and waist circumference in overweight and obese people. The results showed that the addition of soy products contributed to a significant reduction in body weight and improved anthropometric indicators (Yuze, Kou, Wei, Lu, Liu, Tian, Zhang, Liu, Li, Cui, Wang, 2019).

"Effects of Soy or Whey Protein on Weight Reduction in Patients with Non-Alcoholic Fatty Liver Disease: A Randomized Controlled Trial"

Clinical Nutrition Open Science, 2023. This study compared the effects of soy and whey protein on weight loss in patients with non-alcoholic fatty liver disease. Both types of protein have shown effectiveness in reducing body weight, but soy protein has also improved the lipid profile (Michiko, Imai, Yamada, Muramae, Yoshimura, Mitomo, Bando, Sugawara, Asahara, Hirota, Tamori, Takahashi, Ogawa, 2024).

"Effect of Soy and Soy Isoflavones on Obesity-Related Anthropometric Measures: A Systematic Review and Meta-analysis of Randomized Controlled Clinical Trials"

Journal of the Academy of Nutrition and Dietetics, 2016. A meta-analysis that evaluated the effects of soy and soy isoflavones on weight, waist circumference, and fat mass. It was found that soy consumption is associated with a significant decrease in these indicators (Akhlagi, Zare, Nuripur, 2017).

"Effects of Consuming a High-Protein Diet with or without Soy Protein during Weight Loss and Maintenance: A Non-Inferiority Randomized Clinical Efficacy Trial"

Obesity Science and Practice, 2018. This clinical trial assessed the effects of a high-protein diet with or without soy protein on weight loss and maintenance. Results showed that soy protein was as effective as other protein sources for weight loss and body composition improvement (Speaker, Sayer, Peters, Foley, Peng, Wyatt, Flock, Mukherjee, Hill, 2018).

"Effectiveness of a Soy-Based Compared with a Traditional Low-Calorie Diet on Weight Loss in Spanish Overweight Adults: A 12-Week Study"

Nutrition, 2007. The study compared the effectiveness of a soy diet and a traditional low-calorie diet in overweight Spanish adults. Both diets resulted in significant weight loss, but the soy diet showed additional benefits in improving the lipid profile (Liao, Shi, Yang, Lin, Jian, 2007).

The article "Soy protein: benefit or harm?" analyzes the effect of soy protein on body weight and fat mass. A review of 40 studies found no significant positive effects of soy protein on weight loss, waist circumference, and fat mass. However, it is noted that replacing meals with soy protein resulted in an average loss of 2 kg more than the standard diet (Food and Science, 2024).

The article "Composition and medicinal properties of soy products" examines the effect of soy dietary fiber on the body. Soy dietary fiber with a low fat and sodium content has high healing properties in patients with metabolic disorders, digestive disorders, atherosclerosis and other diseases (The Manual/The team of authors, n.d.).

These studies suggest that the inclusion of soy products in the diet can be an effective approach to weight loss and improve metabolic performance, especially when combined with general dietary and physical activity recommendations.

Thus, the effect of soy products on fat metabolism and satiety remains a subject of scientific debate. Further studies are needed to more accurately determine their effectiveness in controlling body weight and improving the lipid profile.

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Soy is a popular source of plant-based protein and is often used in diets aimed at weight loss. When comparing soy with other protein products such as whey protein, it is important to consider several key aspects.

Whey protein, obtained from milk, contains all nine essential amino acids and has a high biological value, which contributes to effective absorption by the body. On the other hand, soy protein is also considered complete, but its digestibility may be slightly lower (Fitness, 2025).

Both types of protein can be effective in weight loss programs. Whey protein, due to its high content of branched chain amino acids (BCAAs), can help increase muscle mass and accelerate metabolism. Soy protein, in turn, is low in fat and cholesterol, which makes it attractive to those who seek to reduce their intake of saturated fats (Product rating, 2024).

Soy protein can help reduce cholesterol levels and improve the lipid profile, which has a positive effect on the cardiovascular system.

Research methodology

There are various studies in the scientific literature on the effect of soy on fat metabolism and satiety. Below are some of them:

"The effect of a soy-enriched diet on blood lipids, liver, and brain in rats": This study examined the effects of prolonged soy consumption on blood plasma biochemistry and lipid levels in rat organs. The results showed a significant increase in vitamin E content in the liver, which may indicate the potential antioxidant properties of soy.

"The protective effect of soy proteins on excess fat in the rat diet": A study evaluated the effect of soy proteins on arterial reactivity in rats consuming a high-fat diet. It has been found that the inclusion of soy proteins in the diet improves vascular function, which may be due to their protective effect against vascular disorders caused by excess fats (Feoktistova, Starberg, Borodin, 2018).

"Analysis of the effects of soy and soy products on the human body": This paper examines the components of soy, their beneficial and potentially harmful properties, as well as their effect on processes in the human body. It is noted that certain substances in soy can have both positive and negative effects on health, depending on the individual characteristics of the body and the amount of product consumed (Ivanova, 2024).

These studies highlight the complexity and versatility of soy's effects on fat metabolism and satiety, indicating the need for further research to better understand its effects on the body.

Analysis of the biochemical composition of soy and its components affecting metabolism.

Soy contains a wide range of biologically active substances that can affect metabolism. The main components that affect metabolism include:

Proteins and amino acids. Soy protein contains all the essential amino acids, although their proportions differ from animal proteins. Soy proteins can help lower cholesterol levels and improve lipid metabolism.

Isoflavones. These are natural phytoestrogens with antioxidant properties. They can affect blood glucose levels and reduce the risk of metabolic disorders.

Lecithin and phospholipids. These substances are involved in fat metabolism, improving the absorption of fats and preventing their excessive accumulation.

Dietary fiber. The fiber contained in soy helps improve digestion and slows down the absorption of carbohydrates, which helps control blood sugar levels.

Oligosaccharides and saponins. These components can help reduce cholesterol levels and have a positive effect on the intestinal microflora.

Thus, the biochemical composition of soy makes it potentially useful for maintaining normal metabolism and preventing diseases associated with metabolic disorders.

Comparison of the effectiveness of soy and traditional low-calorie diets.

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e-ISSN: 2709-4189

Comparing the effectiveness of soy diets and traditional low-calorie diets in weight loss is an urgent topic in dietetics. Both diets are aimed at reducing body weight, but they differ in composition and mechanism of action.

The soy diet involves replacing animal proteins with soy products such as tofu, soy milk, and soy texturate. This helps to reduce the intake of fats and cholesterol, which can have a beneficial effect on the lipid profile of the blood. In addition, soy is rich in isoflavones, which have antioxidant properties and can have a positive effect on metabolism. Adherents of the soy diet note its balance, food availability and lack of hunger. However, it should be borne in mind that a sharp increase in the consumption of soy products can lead to individual body reactions (The deli, 2015).

Traditional low-calorie diets are based on a general reduction in caloric intake by reducing the intake of fats and carbohydrates, while protein sources can be diverse, including both animal and vegetable products. These diets aim to create a calorie deficit, which leads to a decrease in body weight. However, long-term adherence to low-calorie diets can be fraught with difficulties, such as hunger, decreased energy levels, and the risk of nutritional deficiencies (Komshilova, Troshina, Silina, Ershova, Dzgoeva, 2024).

In general, both diets can be effective for weight loss, provided they are followed correctly and the individual characteristics of the body are taken into account. The choice between a soy diet and a traditional low-calorie diet should be based on personal preferences, food tolerance, and expert recommendations.

Possible limitations and contraindications when using soy.

Although soy is a valuable source of plant protein and other nutrients, its use may be limited or contraindicated in some cases. Here are a few possible limitations:

1. Allergy to soy:

Soy is one of the main allergens, especially among children. An allergic reaction can manifest as skin rashes, swelling, difficulty breathing, and even anaphylaxis.

2. Hormonal disorders:

Soy isoflavones have properties similar to estrogens, which can affect hormonal balance, especially in people with hormone-dependent diseases such as breast cancer or prostate cancer. It may be contraindicated in such conditions.

3. Thyroid dysfunction:

Soy contains substances that can inhibit the activity of the thyroid gland (goitrogens), especially with insufficient iodine intake. People with hypothyroidism or other thyroid diseases should limit their intake of soy products.

4. Digestive issues:

Soy can be difficult to digest for some people, especially when consumed raw. It can cause gas formation, bloating, or other digestive system symptoms, especially in people with a sensitive gastrointestinal tract.

5. Kidney problems:

Due to the high content of phytoestrogens and protein, people with kidney problems (such as those with chronic kidney disease) are advised to limit their intake of soy products.

6. The use of soy products during pregnancy and lactation:

Although limited amounts of soy are considered safe, women during pregnancy and breastfeeding should consult a doctor before including large amounts of soy products in their diet due to exposure to isoflavones.

7. Drug interactions: Soy may interact with certain medications, including blood thinners, blood sugar control medications, and hormonal medications.

Before including soy in the diet, it is important to consult a doctor, especially if a person has one of the listed conditions or diseases (Velasquez, Bhatena, 2007).

ISSN: 2707-1146
e-ISSN: 2709-4189

Conclusion

Studies show that soy products can have a positive effect on weight loss due to several mechanisms. Soy is a low-fat and carbohydrate protein source that helps reduce total caloric intake. Soy proteins also help increase feelings of fullness, which can reduce appetite and help control food intake. In addition, soy isoflavones have antioxidant properties and can affect metabolism by improving the lipid profile and lowering cholesterol levels.

Some studies confirm the hypothesis of the benefits of soy products in the fight against obesity, showing that replacing some animal proteins with soy products can help reduce body weight and reduce fat mass. However, the results are not always clear, and in some cases the effect of soy products may be minimal. All this highlights the need for further research to better understand the role of soy in the weight loss process. In general, we can talk about the positive effects of soy products, but they are not a panacea and should be used as part of a balanced diet and a healthy lifestyle.

Further research should focus on the effects of different soybean varieties on weight loss, as the composition and nutritional value of the varieties may vary significantly. It is important to investigate how various soy processing methods (such as heat treatment, fermentation, or extraction) affect its properties, including protein digestibility and isoflavone content, which may affect metabolism. It is also necessary to study the long-term effects of soy products consumption as part of diets aimed at weight loss, as well as their impact on the intestinal microbiota and general metabolic processes.

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Received: 11.01.2025
Accepted: 16.04.2025