UNRAVELLING THE FAT COMPOSITION OF SOYBEANS: INSIGHTS FROM SCIENTIFIC INQUIRY

Azamatjon Sh. Gulomidinov*

Lecturer, Master of Science in Biology, Department of Teaching Methods of Biology and Geography, Andijan State Pedagogical Institute, Uzbekistan,

*corresponding author: azamatjongulomidinov@gmail.com

https://orcid.org/0009-0006-6334-9172

Mirzohid Sh. Jaynaqov

Associate Professor, Doctor of Philosophy in Biological Sciences (PhD), Department of Zoology and Biochemistry, Andijan State University, Uzbekistan,
bio_jaynaqov@mail.ru

https://orcid.org/0009-0008-9125-6357

Ruhangiz A. Atamirzayeva

Researcher, Master of Science in Biology, Andijan State University, Uzbekistan,

ruhangizatamirzayeva@gmail.com

https://orcid.org/0009-0005-3328-2109

Highlight

Fat Composition of Soybeans.

Abstract

This article explores the analysis of the oil content in soybeans, providing a detailed examination of recent scientific research conducted by experts. The study offers valuable insights into the variations and determinants of fat content in different soybean cultivars through a systematic review of published literature and empirical data. The study examines different methods and strategies used by researchers to measure the oil content of soybeans, which helps enhance our knowledge of the nutritional composition and agricultural importance of soybeans. This article aims to clarify the complex dynamics that control the oil content of soybeans and its implications for different industries and research areas by combining important findings and methodologies.

Keywords

soy; grain; oyjamol; free fatty acids; agrotechnical event.

Introduction

Soybean is among the most ancient crops globally. He is from the countries in South-East Asia. The soybean seeds were planted 6 thousand years ago. Soy has been grown in Uzbekistan since 1930, originating from China via the Far East. In L.I. Krika, Ya D. Momot, D. Yormatova, and Kh.N. Otaboeva, soybean cultivation was actively promoted and elements of cultivation technology were developed [12] Scientists have studied various species and forms of the soybean plant and have identified three main centres of origin: Southeast Asia, Australia, and East Africa. Most scientists believe this plant originated in central China, including countries like China, Korea, India, and Japan [13].

Soybeans are primarily cultivated in the southern regions of Uzbekistan, specifically in Kashkadarya, Surkhandarya, and Bukhara. These regions provide optimal conditions for growing soybeans, with adequate warmth and sunlight throughout the growing period. Uzbekistan has been ramping up its soybean production in recent years. The government is encouraging the growth of soybeans to diversify agricultural production and decrease reliance on imports. Soybeans in Uzbekistan are utilized for human consumption, livestock feed, and oil production. Soybean oil is a prevalent cooking oil used in Uzbek cuisine. Uzbekistan exports soybeans, with fluctuations in volume based on domestic demand and international market conditions. Possible export destinations encompass neighboring Central Asian countries and global markets. The Uzbek government has

been offering assistance to farmers to promote the cultivation of soybeans. This assistance comprises subsidies, credit access, and technical guidance to enhance agricultural practices. Soybean production in Uzbekistan may face challenges like pests, diseases, and fluctuations in global market prices despite its growth.

Soybean is a significant oil and grain crop in global agriculture. The global prevalence of soybeans is linked to the grain and protein quality. The composition of protein, oil, organic substances, and macro and microelements in the grain enables its utilisation across multiple industries. Soybeans are used to produce oil, margarine, cheese, milk, flour, confectionery products, and canned goods. Soybean oil makes up 40% of the total vegetable oil production on Earth. [1]

Related Studies

The findings of a study on the chemical makeup of fresh early-ripening plant seeds are reported. varieties of soybeans and methods for extended storage. Suggestions are provided on how to use seeds wisely, minimize nutrient losses, and preserve germination while storing.

Information about the chemical makeup of soybean seeds, ranging from varieties selected domestically and internationally to those that grow in the wild. Its variability is dependent on agrotechnological cultivation techniques, natural and climatic conditions, and the biological traits of the variety. It is discussed whether breeding techniques can have a targeted impact on the quality of soybean seeds. Soybean applications that make sense are determined by the chemical makeup of the seeds. It draws attention to the ambiguity of conclusions regarding the functions of certain seeds' constituents and how they affect the human body. Information is provided regarding the manufacturing process, nutritional value, and usage of certain soy products for animal nutrition and human health. Various approaches have been put forth to assess soybeans.

Methodology

In this article, the following methodology has been used: sample collection, fat extraction, fatty acid analysis, lipid characterization, statistical analysis.

1. Sample Collection: The first step in studying the fat composition of soybeans is the collection of representative samples. Researchers typically collect soybean samples from different cultivars and growing regions to capture the variability in fat composition. Special care is taken to ensure that the samples are handled and stored properly to prevent oxidation and degradation of fats.
2. Fat Extraction: Once the samples are collected, researchers extract the fats from the soybeans using solvent extraction methods such as the Soxhlet extraction or cold pressing. These methods help isolate the fats from the soybean matrix while minimizing the loss or alteration of lipid components.
3. Fatty Acid Analysis: After fat extraction, researchers analyze the fatty acid profile of the soybean fats using techniques like gas chromatography or high-performance liquid chromatography (HPLC). These methods separate and quantify individual fatty acids present in the soybean fats, providing valuable information on the types and quantities of saturated, monounsaturated, and polyunsaturated fats.
4. Lipid Characterization: In addition to fatty acid analysis, researchers also characterize the lipid components of soybeans using techniques such as nuclear magnetic resonance (NMR) spectroscopy and mass spectrometry. These methods help identify specific lipid classes, such as triglycerides, phospholipids, and sterols, present in soybeans and determine their distribution within the fat fraction.
5. Statistical Analysis: To draw meaningful conclusions from the data obtained, researchers employ statistical analysis techniques to identify correlations between fat composition and factors such as cultivar, growing conditions, and processing methods. Multivariate analysis methods like principal component analysis (PCA) and cluster analysis help uncover patterns and relationships within the data set.

The Main Findings and Results

Soybean is the only protein and oil crop and is used on a wide scale: in the fields of food, fodder, technical crops and medicine.

https://doi.org/10.62441/ActaInnovations.51.4 • ISSN 2300-5599 • © 2024

Soybean is included in the list of strategic crops of the UNESCO organization due to its high nutritional value and protein storage [2].

Soybean contains protein (30-50%), all essential amino acids, fat (18-25%, does not contain cholesterol), carbohydrates (10-25%), vitamins (carotene, thiamin (B_1), riboflavin (B_2), C, D_1 , D_3, E, K, pyridoxine (B_6), niacin (PP), panpotenic acid (B_3), choline, biotin, folin) and various micro and macroelements. Soybean is widely used as a food and fodder technical crop due to its diverse and rich chemical composition [3], [4].

V.S. Petibskaya [5] in the research results, soybean oil contains 95-97% triglycerides, 1.5-2.5% phospholipids, 1.6% unhealthy fats, 0.33% sterols, 0.15-0.21% tocopherols and 0,3-0,7% free information on the presence of fatty acids and the release of 9.29 kcal of energy when 1 g of soybean oil is broken down.

J.Kh. Khojaev [6] on vegetable oils, vegetable oils contain saturated and unsaturated fatty acids, and these fatty acids include oleic, lipoic and linolenic fatty acids. And the chemical composition of vegetable oils mainly consists of glycerides - 95-98%, free fatty acids - 1-2%, phosphatides - 1-2%, sterols - 0.3-0.5%, vitamins and carotenoids. Oil and fatty substances are found in various amounts in plants, and their characteristic feature is that they are insoluble in water. But it dissolves well in ether, acetone, benzene and chloroform. Fats are abundant in plants and are found around reserve substances. The amount of fats varies in different plant seeds: in sunflower - 24-38%, in hemp - 30%, in sorghum - 23%, in sesame - 60%, in sesame - 53%, in wheat - 2%, in corn - 5%, in peas - 2%. In addition, 0.1-0.5% of fats are found in the structure of plants.

Fats are all substances in the body that participate in metabolic processes and have the effect of accelerating it. Most of the fat in the human body is used as energy material. Some fats enter the cell membrane and take part in its construction. In addition, lipids affect the use of proteins, mineral salts and vitamins in the body. With an increase in the amount of fat in the diet, it increases the release of calcium and magnesium salts and fatty acids from the body and reduces their absorption into the body, causing a decrease in the accumulation of calcium and phosphorus in bones [7], [8], [9], [10].

In our previous research, we investigated the oil content of soybean genetic collection samples. In our subsequent studies, the amount of oil in soybean grains was studied using established methods [11]. Soybean varieties such as Zamin, Oyjamol, Slaviya, To'maris, Vilana, Orzu, Baraka, UstozMM-60, Selekta-302 and Gavhar, used as research objects, were obtained from the Institute of Genetics and Experimental Plant Biology of the Academy of Sciences of the Republic of Uzbekistan and the Scientific Research Institute of Cereals and Legumes.

Our analysis of the fat composition of soybeans revealed a diverse range of fatty acids present in soybean fats, including saturated, monounsaturated, and polyunsaturated fatty acids. We found that soybeans are rich in unsaturated fats, particularly linoleic acid (omega-6 fatty acid) and alpha-linolenic acid (omega-3 fatty acid), which contribute to the nutritional value of soybeans.

Through lipid characterization using techniques such as NMR spectroscopy and mass spectrometry, we identified various lipid classes in soybeans, including triglycerides, phospholipids, and sterols. Our analysis revealed the distribution of these lipid classes within the fat fraction of soybeans, providing insights into the structural diversity of soybean fats.

Our research also investigated the influence of growing conditions on the fat composition of soybeans. We found that factors such as soil quality, climate, and cultivation practices can impact the fatty acid profile of soybeans. Soybeans grown in different regions exhibited variations in fat composition, highlighting the importance of agricultural practices in shaping the nutritional properties of soybeans in Oil content of soybean grains in shown in figure 1.

By conducting statistical analysis of the data obtained, we identified correlations between fat composition and factors such as cultivar, growing conditions, and processing methods. Our results revealed distinct patterns in the fatty acid profile of soybeans based on these factors, providing valuable insights for future research and product development.

https://doi.org/10.62441/ActaInnovations.51.4 • ISSN 2300-5599 • © 2024

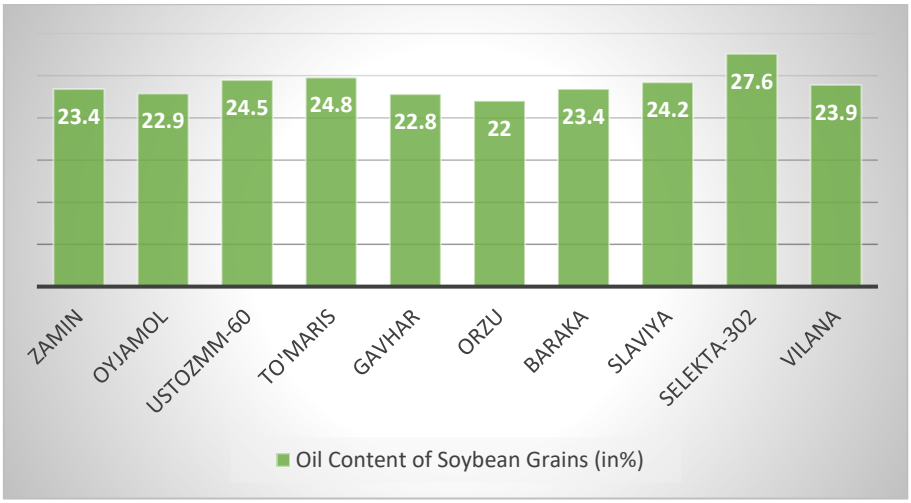

Figure 1. Oil content of soybean grains

Conclusion

Through our systematic scientific inquiry into the fat composition of soybeans, we have gained valuable insights into the nutritional and functional properties of soybean fats. Our research results highlight the diversity of fatty acids and lipid classes present in soybeans and underscore the influence of growing conditions on their composition. By understanding the factors shaping the fat composition of soybeans, we can contribute to the development of improved soybean varieties and innovative products that harness the nutritional potential of soybeans in the food and industrial sectors. According to the results of the study, among the studied varieties, Selekta-302 variety from foreign varieties (27.6%), and Tomaris variety from local varieties (24.8%) show the highest indicators. The lowest rate is observed in the local Orzu variety (22%). However, it was found that the amount of oil given in the description of the local Oyjamol, UstozMM-60 Orzu and Baraka varieties is higher than the results we obtained during the experiment. Of course, the soil-climate conditions in which the plant is grown and the agrotechnical measures used have a significant effect on the biochemical indicators of plant grain. Such cases require further research and studies.

References

[1] Kh.N. Atabaeva, SOYBEAN, T. Mil.enz, 2004. p. 95.
[2] S.V. Didorenko, G. Karyagin Yu, Soybean is the most important grain feed crop, Bulletin of Agricultural Science of Kazakhstan, (2006) 19-21.
[3] V.S. Petibskaya, V.F. Baranov, A.V. Kochegura, S.V. Zelentsov, Soybean: quality, use, production. M.: Agricultural Science, 2001, p. 64.
[4] I.V. Kobozev, I.I. Neustroev, T.P. Kobozeva, A.G. Myakinkov, E.V. Sobolev, Features of the chemical composition and optimization of storage regimes for soybean seeds (Glycine hispida Maxim.) of the Northern ecotype, News of TSKhA, (6) (2012) 101-108.
[5] V.S. Petibskaya, Soy: Chemical composition and use. Maykop: JSC “Poligraf-YUG”, (2012) 25-32.
[6] J. Kh. Khojaev, Physiology of plants, Work, (2004) 28-29.
[7] D. David, Soy as a source of edible oils in comparison with other vegetable oils, In the book: Practical guide to the processing and use of soy, Makcentre Publishing House, Moscow, 2002, p. 672.
[8] M.V. Kurzina, Healthy nutrition is the basis of the nation’s health, Food industry, (2004) 110-112.
[9] M.A. Khasina, O.A. Artyukova, A.F. Belyaev and others, Vitamins and minerals in human life: Uch, Manual, 2nd ed., revised and additional – Vladivostok: Far Eastern University Publishing House, 2001, p. 120.
[10] A.V. Shabrov, V.V. Dadali, V.G. Makarov, Biochemical basis of the action of food microelements / M. 2003, p. 150.
[11] P. Mirkhamidova, A. Zikiryaev, S.N. Dolimova, Biochemistry practical training, Tashkent University, (2002) 58-59.
[12] R.O. Oripov, N.X. Xalilov, Plant science, Publication of the National Society of Philosophers of Uzbekistan, Toshkent, 2007, p. 212.
[13] Kh.N. Atabaeva, N.S. Umarova, Plant growing, Tashkent, 2007, p. 56.