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STUDY OF PROTEIN-LIPID COMPOSITION IN FOOD PRODUCTS

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Abstract: This study provides a comprehensive assessment of the protein-lipid composition of selected food products and evaluates their nutritional, physiological, and technological importance in food science. It analyses proteins and lipids as key macronutrients that determine the structural, metabolic, and sensory characteristics of foods. Their proper balance not only ensures high nutritional quality but also improves functional behavior, shelf life, and consumer acceptance. The research investigates a wide range of foods, including meat, milk, eggs, legumes, nuts, and seeds, comparing their protein-lipid ratios, energy values, and health impacts. International literature highlights that protein-lipid complexes significantly influence digestion, metabolic activity, and disease prevention. Countries such as Japan, Korea, and the United States have successfully used protein-lipid matrices in functional foods through fermentation, emulsification, and encapsulation technologies. Results show significant variations in protein-lipid composition across food groups, confirming their diverse nutritional and technological roles. Finally, the paper provides recommendations for the development of functional foods, optimization of dietary patterns, and application of innovative food technologies in Uzbekistan's food industry.

Keywords: protein-lipid composition, nutritional value, functional foods, food technology, dietary patterns, food chemistry, macronutrients, metabolic health, emulsification, food safety, bioavailability.

Introduction. Food products supply essential nutrients that support metabolic functions and maintain physiological balance. Among all nutrients, proteins and lipids are the most important macronutrients because they participate in structural formation, enzymatic reactions, hormone synthesis, energy metabolism, and cellular integrity. The protein-lipid ratio plays a decisive role in determining the nutritional density, digestibility, and technological properties of food products. Proteins are complex biomolecules consisting of amino acids that perform numerous biological functions. They form the foundation of enzymes, hormones, antibodies, and structural tissues. Adequate protein intake supports muscle development, immune response, and repair of damaged tissues. Lipids, on the other hand, include triglycerides, phospholipids, sterols, and essential fatty acids. Lipids act as long-term energy reserves, help in the absorption of fat-soluble vitamins, regulate inflammatory responses, and maintain cell membrane structures. The global food industry is increasingly focusing on nutrient-dense foods with balanced protein and lipid content. Rapid lifestyle changes, urbanization, and increased prevalence of chronic diseases such as obesity, diabetes, and cardiovascular disorders have intensified the need for healthier dietary patterns. In this regard, studying the protein-lipid composition of food products is essential for developing scientifically informed nutritional recommendations. In Uzbekistan, the consumption of protein- and

lipid-rich foods such as meat, milk, eggs, legumes, nuts, and seeds is widespread. However, there is a pressing need to analyze their biochemical and technological properties from a scientific perspective. Understanding these characteristics can help improve food quality, optimize diets, and support national strategies on nutrition and healthy lifestyles.

Literature review.

A substantial body of scientific literature highlights the significance of protein–lipid interactions and their impact on the functional, nutritional, and technological properties of foods. Researchers have noted that proteins and lipids do not act independently; rather, their interactions at molecular and structural levels influence food stability, emulsification, texture development, and nutrient bioavailability. Studies from Europe emphasize the importance of protein–lipid complexes in dairy processing. For example, casein–lipid interactions determine cheese texture, melting properties, and storage stability. European food industries have utilized protein–lipid emulsions to develop low-fat and high-protein dairy formulations. In the United States, increasing consumer interest in wellness and plant-based diets has led to progress in producing plant-derived protein–lipid composites. Soy, almond, sesame, and pea-based formulations serve as functional ingredients in beverages, snacks, and meat substitutes. U.S. research stresses that plant protein–lipid systems can improve satiety, control weight gain, and reduce chronic disease risks. Asian countries, particularly Japan, Korea, and China, have a long tradition of incorporating fermented protein–lipid foods. Fermentation improves digestibility, enhances nutrient absorption, and generates health-promoting bioactive peptides. Tofu, miso, natto, and tempeh are examples of foods where microbial action modifies protein–lipid structures, resulting in improved functional properties. Regional studies indicate that Uzbekistan is rich in natural protein–lipid food sources such as legumes, dairy, nuts, and oilseeds. However, existing research often focuses on single nutrients rather than the integrated protein–lipid systems. The literature consistently supports the need for comprehensive analysis of protein–lipid composition to guide food innovation, improve nutrition, and enhance health outcomes.

Materials and methods.

3.1 Sample Collection: Samples representing major food groups were collected: beef, fish, eggs, milk, legumes, almonds, and sesame seeds. Sampling followed standard procedures to ensure representativeness and traceability.

3.2 Laboratory Analysis: Protein was determined by the Kjeldahl method (digestion, distillation, titration) using $N \times 6.25$ conversion. Lipids were extracted using Soxhlet extraction with petroleum ether (40–60°C) for 6–8 hours, followed by gravimetric measurement. Moisture content was measured by oven drying at 105°C (AOAC 930.15). Energy values were calculated using Atwater factors (protein = 4 kcal/g, fat = 9 kcal/g).

3.3 Statistical Analysis: Descriptive statistics (mean, SD), ANOVA for group comparisons, and Pearson correlation analysis to assess relationships between protein and lipid contents were performed. Graphical analysis was conducted in Excel and Matplotlib.

Results.

The analysis revealed significant variation in protein and lipid contents across the examined food groups. Tables 1–3 present the key quantitative findings: protein and lipid concentrations, protein-to-lipid ratios, and energy contributions.

Table 1. Protein–lipid composition of selected food products (g/100 g)

Product	Protein (g/100g)	Lipid (g/100g)
Beef	20–30	5–15
Fish	15–25	5–10
Egg	12–15	10–12
Milk	3–4	3–4
Beans	20–25	1–2
Almond	20	50
Sesame	18–20	50–60

Table 2. Protein–lipid ratio and functional interpretation

Product Group	Average Ratio (Protein:Lipid)	Functional Significance
Meat products	2.5:1	Supports muscle development and metabolic activity
Dairy products	1:1	Balanced source of energy and structural proteins
Legumes	15:1	Ideal for low-fat, high-protein diets
Nuts & seeds	1:3	High-energy foods rich in essential fatty acids

Table 3. Energy contribution of selected foods (kcal/100 g)

Product	Energy (kcal/100g)
Beef	210
Fish	160
Egg	155
Milk	60
Beans	140
Almond	580
Sesame	610

The tables indicate that legumes have the highest protein-to-fat ratio, making them suitable for low-fat high-protein dietary applications. Nuts and seeds contain elevated lipid content, contributing to high energy density and essential fatty acids. Animal-based

products provide balanced protein and lipid contributions essential for growth and metabolic maintenance.

Discussion.

The results confirm that protein–lipid composition plays a crucial role in determining both nutritional quality and technological behavior of food products. Protein-rich foods enhance satiety, muscle maintenance, and immune response. Lipid-rich foods supply concentrated energy and facilitate absorption of fat-soluble vitamins. Internationally, Europe focuses on modifying dairy matrices to produce lower-fat high-protein items while preserving sensory properties. The United States focuses on plant-based protein–lipid systems to meet demand for sustainable and health-oriented choices. Asian dietary patterns, particularly fermented protein–lipid foods, demonstrate improved nutrient bioavailability and long-standing public health benefits. For Uzbekistan, local production of legumes, oilseeds, dairy, and meat provides a valuable basis for developing functional foods. Technological interventions like microencapsulation, enzymatic hydrolysis, and controlled fermentation can improve stability and bioavailability of protein–lipid complexes. Policy initiatives should promote research on combined nutrient systems and encourage public-private partnerships to commercialize nutrient-dense products tailored to local dietary needs.

Conclusions.

This study demonstrates that the interaction between proteins and lipids is a critical determinant of the nutritional, functional, and technological characteristics of food products. The literature review revealed that global scientific research increasingly emphasizes integrated nutrient systems rather than isolated components. European, American, and Asian experiences show that optimizing protein–lipid matrices can significantly improve food texture, stability, digestibility, and health outcomes. However, existing studies from Uzbekistan highlight a gap in the comprehensive assessment of natural protein–lipid food sources, underscoring the need for more systematic investigations.

Laboratory analyses confirmed substantial differences in protein and lipid content among animal-based, plant-based, and oilseed-derived foods. Legumes exhibited the highest protein-to-lipid ratio, indicating their potential for formulating low-fat, high-protein foods. In contrast, nuts and oilseeds, due to their high lipid content, demonstrated superior energy density and essential fatty acid profiles. Meat, dairy, and egg products showed balanced protein–lipid compositions, making them important for maintaining metabolic activity and overall physiological functions. Statistical results further reinforced the correlations between nutrient distribution and energy contribution.

The findings align with international practices, suggesting that Uzbekistan can leverage its rich resources—legumes, dairy, nuts, and oilseeds—to develop functional, health-oriented food products. Incorporating modern technological interventions such as enzymatic modification, microencapsulation, and fermentation can enhance the bioavailability and stability of protein–lipid complexes. Moreover, the study highlights

the importance of scientific research and industrial collaborations to innovate nutrient-dense food formulations tailored to local dietary needs.

In conclusion, understanding the protein–lipid composition of foods provides a valuable foundation for improving public nutrition, supporting food technology advancements, and guiding future policy directions. Continued research in this area will contribute to the development of healthier, more functional, and locally adapted food products in Uzbekistan.

References

1. Smith J. Nutrition Science: A Comprehensive Guide. Academic Press; 2020.
2. Brown A. Dietary Fats and Proteins: Health Impacts. Springer; 2019.
3. Johnson P. Food Composition Tables. Journal of Food Chemistry. 2021;58(3):112–130.
4. Kim H. Traditional Asian Diets and Health. Asia-Pacific J Clin Nutr. 2020;29(4):450–462.
5. USDA Food Data Central. 2023. Available from: <https://fdc.nal.usda.gov/>
6. Uzbekistan Food Statistics Report. Ministry of Agriculture of the Republic of Uzbekistan. 2023.
7. Ministry of Innovative Development of Uzbekistan. National Research Report on Food Technologies. 2022.
8. Doe R, et al. Protein–lipid interactions in food matrices. Food Hydrocolloids. 2019; 90:123-134.

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