

# THE IMPACT OF THE PRESENCE OF PROTEIN SUBSTANCES IN THE DIET ON THE APPEARANCE OF THE SKIN

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## Abstract

The development and functioning of the body requires the consumption of ingredients necessary for metabolic processes and the construction and renewal of its structures. The basic element determining the implementation of these tasks is the availability of energy. Therefore, energy production is a key process occurring in the body's cells. Energy is produced primarily from carbohydrates and fats. Food proteins are used mainly to build body proteins, which means that they become substrates for energy production to a lesser extent. Dietary modifications delay, prevent or treat many diseases associated with aging, such as cancer and diabetes. However, chronic nutritional interventions are likely unfeasible for most people since it is difficult to adhere to nutritional protocols, or they are reluctant to make drastic lifestyle changes. These interventions may even cause harmful effects, possibly through negative effects on the immune system and wound healing. Therefore, the aim of this study was to assess the impact of proteins consumed in food by students from the Lomza University of Applied Sciences (LUAS) on the condition of their skin.

60 students from LUAS were qualified for the study.

The following research methods were used:

1. assessment of the subjects' body composition - performed using the InBody 770 body composition analyzer,
2. assessment of protein intake using a food diary completed by students - data prepared using the Diet 5 program,
3. diagnostic survey method using an original questionnaire, which was used to assess students' knowledge of the basic principles of proper nutrition.

The obtained results were subjected to statistical analysis using non-parametric U-Mann-Whitney tests and Spearman correlation.

Conclusions

1. Students of LUAS know the principles of proper nutrition well and most of them apply them.
2. Students of LUAS are aware that a diet low/high in proteins may have negative effects on skin health.

**Key words:** protein, diet, skin

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## Introduction

Proteins are a fundamental component of food, essential for the existence of life. The term "protein" comes from the Greek word "protos", meaning the first, basic ingredient of food and at the same time indicating the role of this ingredient in the human diet [1].

Without proteins, the structure and proper functioning of each of the body's cells would be impossible. Therefore, adequate protein intake, both quantitatively and qualitatively, is crucial for human health [2].

Proteins are the main structural and functional components of every cell present in the human body. They are necessary for the development and proper growth of young organisms. Moreover, they are regulators of gene expression and are components of many enzyme systems and participate in the regulation of many metabolic processes [3].

The nitrogen contained in proteins distinguishes it from other macroelements. It gives proteins the unique function of building and repairing all body tissues, ensuring the production of hormones and digestive enzymes and the maintenance of the immune system. Although this is not the main role of proteins, they can also break down, release nitrogen and serve as an energy source. Even if sufficient carbohydrates and fats are provided, some of the protein consumed is used for energy rather than building and repairing body tissue [4].

Proteins can be divided according to their valency: (1) complete protein - contains all irreplaceable amino acids in appropriate amounts and proportions, as comparable as possible to its own. Useful sources of protein are: meat products, milk, eggs, chicken, (2) partially incomplete proteins - they are sufficient for life, but do not meet the needs of the developing body - they contain all the essential amino acids, but in insufficient quantities - e.g. lysine-deficient cereal proteins, (3) incomplete

proteins - at least one protein was found missing an amino acid essential for life.

Different protein sources complement each other. A combination of plant and animal proteins or some additional plant protein sources (such as rice and legumes) can provide healthy protein [5].

The effects of protein deficiency, i.e. too little protein in the meals consumed, result in impaired skin regeneration and weakening of collagen fibres, growth inhibition, weakening of the body, hair loss, brittle nails, susceptibility to infections, diminished sex drive, depression, joint swelling, osteoporosis, premature aging, wrinkles, loss of firmness, tooth decay, and anaemia [5-8].

Long-term excess protein in the diet may cause many negative and undesirable effects, such as: heart disease, joint degeneration, colon cancer, persistent constipation, negative mood, acidification of the body, dehydration, unpleasant breath, and the leaching of minerals from bones [5, 9].

Too many protein products can aggravate acne and stimulate the sebaceous glands, which cause oily skin, eruptions, pimples, blackheads, enlarged pores, as well as stimulate skin inflammation, intensify dermatological problems, accelerate the skin aging process and the appearance of wrinkles, and cause hair loss - a high-protein diet is usually associated with a deficiency of vitamins and minerals necessary for proper hair growth [10, 11].

### Objective of the work

Dietary modifications, including calorie restriction, dietary restriction, intermittent fasting, and even limiting the time at which food is consumed, can have a marked impact on life expectancy. Reducing the intake of amino acids and proteins generally reduces the likelihood of age-related diseases and therefore increases the quality of life. Additionally, dietary modifications delay, prevent, or treat many aging-related diseases, such as cancer and diabetes. However, chronic nutritional interventions are likely unfeasible for most people since it is difficult to adhere to nutritional protocols, or they are reluctant to make drastic lifestyle changes. These interventions may even cause harmful effects, possibly through negative effects on the immune system and wound healing.

Therefore, the aim of this study was to assess the impact of proteins consumed in food by students from the Lomza University of Applied Sciences (LUAS) on the appearance of their skin.

### Material and methods

60 students from the Lomza University of Applied Sciences were qualified for the study.

Tab. I. Characteristics of the study group.

<b>Sex</b>	
Female	39
Male	21
Age of respondents (mean $\pm$ standard deviation)	24.0 $\pm$ 4.8
<b>Place of residence</b>	
City	35
Village	23
<b>Education</b>	
Primary	3
Secondary	36
Higher	20

The following research methods were used:

1. assessment of the subjects' body composition - performed using the InBody 770 body composition analyzer,
2. assessment of carbohydrate intake using a food diary completed by students - data prepared using the Diet 5 program,
3. diagnostic survey method using an original questionnaire, which was used to assess students' knowledge of the basic principles of proper nutrition.

The obtained results were subjected to statistical analysis using non-parametric U-Mann-Whitney tests and Spearman correlation

### Results

66.7% of respondents eat a proper diet or usually eat a proper diet. 33.3% of respondents are aware that they eat poorly.

33.3% of respondents to the question: What food products do you choose when reaching for a snack between meals? answered that these are carbohydrate products, naturally rich in sugar (fruits, cereal snacks), 43.3% that these are carbohydrate products, sweetened: sweets, rolls, sweet snacks, 41.7% that these are salty snacks - chips, pretzels, crisps, 46.7% that these are dairy snacks - yogurts, cottage cheese, dairy desserts, 15% that these are other products. 33.3% of respondents do not snack between meals.

Over 93.3% of respondents answered that they drink 1 to 1.5 litres of fluids or more a day. 6.7% of respondents drink less than a litre of fluids.

45% of respondents indicated poultry as the main source of protein in their diet, 38.3% - milk and milk products and 36.7% - meat of slaughtered animals (pork, beef). 11.7% of respondents indicated fish as the main source of protein in their diet, and 3.3% - pulses.

90% of respondents answered positively to the question How do you assess your health? (60% - good, and 30% - very good). 10% of the respondents answered that their health was poor.

When asked about following any particular diet, 95% of respondents answered that they did not follow one. 5% of respondents follow a special diet. When asked about the impact of the food consumed on the condition of the skin, 71.6% of respondents answered yes, and 8.37% said no.

When asked about the dermatological treatment used, 91.6% of respondents answered that they did not use any, and 8.3% said that they were under the care of a dermatologist.

45% of the respondents answered positively to the question about psychological discomfort resulting from the condition of their skin, including almost 3.3% of respondents answered that they definitely had such psychological discomfort. Over 55% of respondents answered that they definitely do not have any psychological discomfort resulting from the condition of their skin.

Respondents were asked whether only a proper diet will reduce the discomfort associated with the condition of their skin? 40% of them answered yes, and 60% said no.

When asked whether combining proper care and prevention with a proper diet will reduce the discomfort associated with the condition of the skin, respondents answered yes (55%) and no (45%).

36.7% of respondents struggle with skin problems, while 63.3% do not.

21.6% of respondents have blackheads as a skin problem, 16.7% have discolorations, and 15% have acne. 10% of respondents struggle with enlarged blood vessels, and 5% with enlarged skin pores.

The total water content in the subjects' bodies was  $36.2 \pm 9.2\%$  (maximum 55.6%, minimum 36.2%).

Men from the study group consume statistically significantly more protein products than women ( $p=0.022$ ).

### Discussion and discussion of the results

The development and functioning of the body requires the consumption of ingredients necessary for metabolic processes and the construction and renewal of its structures. The basic element determining the implementation of these tasks is the availability of energy. Therefore, energy production is a key process occurring in the body's cells. Each cell produces energy for its own use using energy substrates from the food consumed. Energy is produced primarily from carbohydrates and fats. Food proteins are used mainly to build body proteins, which means that they become substrates for energy production to a lesser extent [1].

Too many protein products in the diet can:

- aggravate acne and stimulate the sebaceous glands, which cause oily skin, eruptions, pimples, blackheads, enlarged pores
- stimulate skin inflammation and intensify dermatological problems
- accelerate the skin aging process and the appearance of wrinkles
- cause hair loss - a high-protein diet is usually associated with a deficiency of vitamins and minerals necessary for proper hair growth [10, 11].

Our own research showed that women from the study group consume statistically significantly more protein products than men ( $p=0.022$ ). 33% of respondents are aware that they eat poorly. Almost 47% of respondents as snacks choose dairy snacks - yogurts, cottage cheese, dairy desserts. 45% of people qualified for the study indicated poultry as the main source of protein in their diet, 38% - milk and milk products and 37% - meat of slaughtered animals (pork, beef). 10% of the respondents answered that their health was poor. 72% of respondents are aware that the food they eat affects the condition of their skin. 5% of respondents follow a special diet. At the same time, almost half of the respondents answered positively when asked about psychological discomfort resulting from the condition of their skin, including over 3% of respondents who said they definitely felt such psychological discomfort. 40% of respondents are convinced that a proper diet will reduce the discomfort associated with the condition of their skin, and 55% that combining proper care and prevention with a proper diet will reduce this discomfort. 37% of respondents struggle with skin problems - blackheads, discoloration, and acne.

An important aspect is the water-protein interaction. Body fluids consist mainly of water, which in turn contains many substances. One such group of substances are electrolytes such as sodium, potassium, magnesium, phosphates, chlorides, etc. Another group includes metabolites such as oxygen, carbon dioxide, glucose, urea, etc. The third important group of substances contained in the water in the human body contain proteins, most of which are necessary for human existence. Examples of proteins are clotting factors, immunoglobulins, albumin, and various hormones. Since the distribution of fluid in the body and the substances it contains is crucial for maintaining intracellular and extracellular functions that are crucial for survival, the body has developed mechanisms for tightly controlling their composition [12].

Free water molecules with longer hydrogen bonds are the main forms of adsorbed water for the triple helix of collagen, gelatin (separated single chains), and peptide (broken peptide fragments). At the same time, water is also absolutely necessary for the proper functioning of the skin, especially its outer layer, the stratum corneum. Water loss from the skin must be carefully regulated, a function dependent on the complex nature of the stratum corneum. Water retention in the stratum corneum depends on two main elements: (1) the presence of natural hygroscopic factors in corneocytes (collectively referred to as the natural moisturizing factor) and (2) intercellular lipids of the stratum corneum arranged to form a barrier to transepidermal water loss [13].

A properly hydrated adult body contains about 60% water (the norm for women is 45-60%, and for men it is 50-65% - on average 47.5-62.5%). In the presented research, the total water content in the body was  $36.2 \pm 9.2$  (maximum 55.6%, minimum 36.2%), which proves the deficiency of water resources in the bodies of LUAS students, despite the answers given that (over 93% respondents) drink from 1 to 1.5 litres of fluids a day or more. Nearly a century of research has shown that nutritional interventions can delay aging and age-related diseases in many

animal models and possibly in humans. The most robust and widely researched intervention is caloric restriction, while restriction of protein and various amino acids (methionine, and tryptophan) also delays aging. However, there is still debate as to whether the main effect on aging is secondary to caloric intake, protein intake, or specific amino acids. A growing field, nutritional geometry, provides new insights into the relationship between nutrition and aging by focusing on calories, macronutrients, and their interactions, and by considering compensatory feeding in ad libitum feeding experiments.

Nutritional geometry is a state-space modelling approach that examines how animals respond to and balance changes in nutrient availability. Such studies in insects and mice have shown that low-protein, high-carbohydrate diets are associated with the longest lifespan in animals fed ad libitum, suggesting that the interaction between macronutrients may be as important as their total intake [14].

### Conclusions

1. LUAS students know the principles of proper nutrition well and most of them apply them.
2. LUAS students are aware that a low/high protein diet may have negative effects on skin health.

### Literature

- [1] Jarosz M.: Praktyczny podręcznik dietetyki. Wydawnictwo Instytut żywności i żywienia, Warszawa 2010: 53-55.
- [2] Jarosz M., Charzewska J., Wajszczyk B.: Czy wiesz, ile potrzebujesz białka? Wydawnictwo Instytut żywności i żywienia, Warszawa 2019.
- [3] [https://www.doz.pl/czytelnia/a15802-Bial-ko\\_w\\_organizmie\\_funkcje\\_rodzaje\\_i\\_zapotrzebowanie\\_Produkty\\_bogate\\_w\\_bialko](https://www.doz.pl/czytelnia/a15802-Bial-ko_w_organizmie_funkcje_rodzaje_i_zapotrzebowanie_Produkty_bogate_w_bialko). (data pobrania 16.10.2023).
- [4] Peckenpaugh NJ: Podstawy żywienia i dietoterapia. Wydawnictwo Elsevier Urban & Partner, Wrocław 2011: 61-71.
- [5] Pietkun K.: Zdrowe odżywianie. Porady lekarza rodzinnego. Wydawnictwo Literat, Toruń 2012: 3-6.
- [6] Mayerson D., Thompson K.: Menu planning in long term care with Canada's food guide. Wydawnictwo Dietitians of Canada, OPDQ and CNS/CMTF, Kanada 2020: 19-20.
- [7] Kostecka M., Kostecka J.: Wpływ diety na wygląd skóry. Wydawnictwo Kosmetologia Estetyczna, Wrocław 2013.
- [8] Cichosz G.: Dyskredytowanie białka pochodzenia zwierzęcego. Wydawnictwo Żywność i żywienie, Olsztyn 2018.
- [9] Gluza E.: Wpływ diety i stylu życia na skórę kobiety. Wydawnictwo Kosmetologia Es-tetyczna, Wrocław 2012.
- [10] <https://www.vichy.pl/blog/nadmiar-bialka-w-organizmie-%e2%80%94-czy-ma-wplyw-na-stan-naszej-skory/vmag62739.aspx> (data pobrania 11.10.2023).

- [11] Wyka J., Malczyk E., Misiarz M.: Assessment of food intakes for women adopting. The high protein dukan diet. Wydawnictwo PZH, Nysa 2015.
- [12] Tobias A, Ballard BD, Mohiuddin SS. Physiology, Water Balance. 2021. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022;PMID: 31082103
- [13] Verdier-Sevrain S, Bonte F. Skin hydration: a review on its molecular mechanisms. J Cosmet Dermatol. 2007;6(2):75-82.
- [14] Simpson SJ, Le Couteur DG, Raubenheimer D, Solon-Biet SM, Cooney GJ, Cogger VC, Fontana L. Dietary protein, aging and nutritional geometry. Ageing Res Rev. 2017;39:78-86.

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