ТЕХНІЧНІ НАУКИ

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BIODEGRADABLE FOOD PACKAGING: INSTITUTIONAL AND SOCIAL ASPECTS

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Subject. *Consumers' attitudes to the use of biodegradable food packaging materials as an alternative to conventional plastics, focusing on institutional and social aspects, including environmental challenges, consumer benefits, and barriers to adoption. Challenges of the environmental impact of traditional plastic packaging and the possibility of replacing it with biodegradable materials made from organic raw materials to reduce the environmental burden are studied.* ***Purpose.*** *To analyze consumer willingness to buy products in biodegradable packaging, in particular to assess the factors influencing their choice and to identify the barriers that hinder wider use of such materials.* ***Methods.*** *A non-representative online survey of respondents of all ages was conducted. The methods of systematization, comparative analysis, and graphical methods of data visualization were used.* ***Results.*** *High consumer awareness of biodegradable packaging (89.5%) and a positive attitude towards its use were revealed. However, despite the willingness to pay more, the majority are ready to pay a small surcharge (up to 10%). The main barriers include high price, limited range and lack of information. The survey also revealed support for changes in legislation to stimulate the wider use of biodegradable packaging.* ***Scope of results:*** *The results can be used by food manufacturers to make decisions on the transition to biodegradable packaging, as well as by regulators to formulate policies and develop appropriate programs to stimulate the use of such packaging in food industry practices and for information campaigns to raise consumer awareness.*

Key words*: food products, packaging, biodegradable packaging, food consumers, purchase threshold*

БІОРОЗКЛАДНІ ПАКОВАННЯ ХАРЧОВИХ ПРОДУКТІВ: ІНСТИТУЦІЙНІ ТА СОЦІАЛЬНІ АСПЕКТИ

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Предмет. *Ставлення споживачів до використання біорозкладних пакувальних матеріалів для харчових продуктів як альтернативи традиційним полімерним матеріалам, з фокусом на інституційні та соціальні аспекти, включаючи екологічні виклики, споживчі переваги та бар'єри щодо впровадження. Виходячи з впливу традиційних пластикових пакувань на довкілля, оцінено можливість їхньої заміни біорозкладними матеріалами, що виготовляються з органічної сировини, для зменшення екологічного навантаження.* ***Мета****. Аналіз готовності споживачів купувати продукти у біорозкладних пакованнях, зокрема оцінка факторів, що впливають на їх вибір, та виявлення бар'єрів, які стримують ширше застосування таких матеріалів.* ***Методи****. Проведено не репрезентативне онлайн-опитування респондентів різного віку. Використано методи систематизації, порівняльний аналіз, а також графічні методи для візуалізації даних.* ***Результати****. Виявлено високу обізнаність споживачів щодо біорозкладного паковання (89,5%), а також позитивне ставлення до його використання. Проте, попри готовність платити більше, більшість готова до незначної доплати (до 10%). Серед основних бар'єрів зазначено високу ціну, обмежений асортимент та недостатню інформованість. Опитування також виявило підтримку змін у законодавстві щодо стимулювання ширшого використання біорозкладних паковань.* ***Сфера застосування результатів****. Результати можуть бути використані виробниками харчових продуктів для прийняття рішень щодо переходу на біорозкладне паковання, а також регуляторними органами для формування політики та розроблення відповідних програм щодо стимулювання використання таких паковань у практиці харчової промисловості, а також для інформаційних кампаній із підвищення обізнаності споживачів.*

Ключові слова: *харчові продукти, паковання, біорозкладні паковання, споживачі харчових продуктів, поріг купівлі*

Problem statement. With the growth of global environmental challenges, more and more attention is paid to the issues of sustainable development and reduction of the plastic burden upon environment. An important element of this problem is food packaging made of polymeric materials that are not biodegradable and, therefore, have the said negative impact. Pollution of the planet forces to look for opportunities to preserve and sustainably use natural resources using renewable raw materials. This is due to the large volume of energy, resources and water required to process petroleum polymer waste generated in the agro-industrial complex. Most of this waste is thrown into landfills, which increase in size and quantity in accordance with population growth every year, which, in turn, causes pollution of aquifers with filtrates, and also causes emissions of greenhouse gases into the atmosphere [1].

An alternative to traditional hydrocarbon-based packaging materials are biodegradable packaging materials, usually made from organic renewable raw materials. The use of these materials in the food industry helps reducing the environmental impact for several obvious reasons. First, it minimizes the use of fossil mineral raw materials. Second, it reduces emissions of polluting gases. Third, it ensures the proper cyclicality of the use of renewable raw materials [2–4].

Biodegradable packaging, despite a number of known disadvantages (high cost, inadequate barrier properties, insufficient mechanical strength, etc.), is a promising alternative that allows reducing the amount of plastic that does not decompose and accumulates in nature. Biopolymers are usually used as raw materials for biodegradable packaging. Biopolymers are macromolecules formed by functional units produced by various organisms directly or as secondary products. Biopolymers or bioplastics are all plastics that are produced from biological raw materials or are

biodegradable. Thus, there are polymers that can be biodegradable and compostable depending on the chemical properties of their components [1, 5–9]. Biodegradable materials used for food packaging are made from proteins, both plant (soy, corn, wheat, peas, etc.) and animal (casein, collagen, whey, keratin, gelatin, etc.) [10-13]. Mainly such bioplastics as polylactides PLAs, polyesters such as polyhydroxyalkanoates PHAs and other polyesters, thermoplastic starches are formed [1,14,15].

Environmental awareness of the population and global initiatives to reduce plastic waste are driving the demand for biodegradable food packaging. Consumer attitudes towards biodegradable packaging are gradually changing towards greater support. The average consumer has been realizing the need to support environmental solutions, but for a complete transformation of the food packaging market, it is necessary to raise public awareness of the benefits of using biodegradable packaging, and, most importantly, the acceptable cost of food products packaged with such packaging.

Biodegradable food packaging is expected to reduce environmental problems throughout the entire life cycle, and not just after disposal, compared to the life cycle of petrochemical food packaging materials. Food packaging materials should easily return to the soil from an environmental point of view [16].

Analysis of recent studies and publications. Biodegradable packaging is receiving increasing attention from scientists and manufacturers as a way to reduce environmental pollution in non-degradable polymeric wastes. The problem is whether consumers are willing to properly perceive the need to make their small daily contribution to solving the urgent environmental problems of the planet by spending large amounts of money on purchasing food products in biodegradable packaging. The relevance of this topic is evidenced by numerous scientific papers published in recent years – for example, [17–21].

Research conducted in Latvia showed that in 2017, a significant proportion of consumers were already aware of the importance of environmental responsibility, although their willingness to overpay for environmentally friendly packaging remained limited [22]. Similar trends are observed in Ukraine, where consumers, although they support environmental initiatives, often face economic and informational barriers.

Around the world, the growing popularity of organic food products is partly based on people's positive perception of them. The concept of "organic food" is perceived by consumers in the understanding that this food is healthy. But when we start to say the same words in relation to packaging, the consumer has many doubts that such food is safe. This is due to the fact that the safety of the packaging is critical, since it can affect the quality and safety of products during transportation and storage [23]

Appropriate packaging can extend the shelf life of products, reducing food waste, but consumer perceptions can be doubtful. Some consumers believe that excess packaging is harmful, even if it helps preserve food. Manufacturers are encouraged to raise consumer awareness of the benefits of innovative packaging approaches that reduce food waste [24].

From a societal perspective, consumers are increasingly looking for eco-friendly products, in particular biodegradable packaging, that meet their expectations for safety and sustainability. Institutional aspects are also becoming more important: governments and regulators are introducing policies to support biodegradable materials and reduce the reliance on fossil resources for packaging, which is important for achieving sustainable development goals and reducing carbon footprints [25].

Many manufacturers are aware of the importance of switching to eco-friendly packaging. This is especially true for large companies that have sufficient resources to invest in biodegradable materials. However, the main limiting factor is the high cost of such materials compared to traditional plastic. For small and medium-sized enterprises, this may be a barrier to widespread adoption. At the same time, the adoption of new environmental standards in the

legislation, such as the ban on single-use plastic bags, is pushing manufacturers to look for environmental solutions.

One of the main challenges is the cost of biodegradable materials, which remains high due to more expensive production technologies. It is also important to consider that some bioplastics require special conditions (temperature, humidity) for complete decomposition, which are often not available at solid waste landfills.

Replacing traditional packaging with biodegradable materials in the food industry is a promising procedure that has its roots in the distant past. The potential of natural materials for various applications in the field of product recycling cannot be underestimated. food, natural biopolymers or their mixtures can help preserve food from spoilage.

Research objective. In this paper, the study of the institutional and social aspects associated with the use and purchase of food products packaged in biodegradable materials is characterized.

Materials and methods. To analyze the attitude of consumers to biodegradable packaging, researchers of the Institute of Food Resources of the National Academy of Agrarian Sciences of Ukraine conducted a non-representative online survey. Respondents of different ages took part in it. To evaluate the results and fulfill the set tasks and achieve the goal of the study, a set of approaches and principles of general theoretical and specialized methods of scientific research were used. For the theoretical part, the methods of systematization and generalization, comparative methods were used. Graphic charts were used to visualize the research methods and results.

Presentation of the main research results. To understand the main driving forces behind the adoption of a new packaging concept, it is important to assess what consumers currently think about this issue. We conducted a non-representative study on the awareness and attitude of the consumers to biodegradable packaging.

The vast majority of respondents, namely 89.5% of all respondents, are already familiar with biodegradable packaging. This indicates a growing awareness and interest in society regarding environmental alternatives in packaging materials (Fig. 1).

Overall, respondents expressed a “positive” 29% or even a “very positive” – 57.5% attitude towards the use of biodegradable packaging. This may be due to an understanding of its impact on the environment and health. This attitude towards environmental solutions indicates a growing interest in preserving nature, especially among people who actively pay attention to environmental issues (Fig. 2).

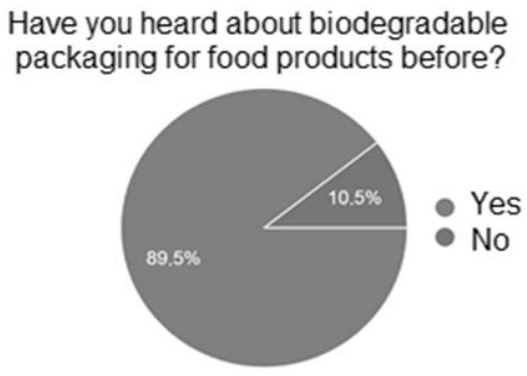

Fig. 1. Public awareness of biodegradable food packaging

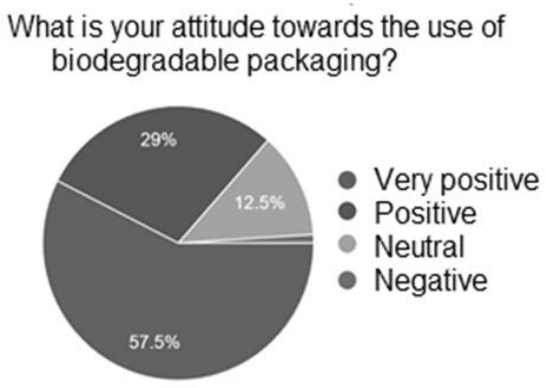

Fig. 2. Attitude to use

Although 97.5% of respondents are willing to pay more for products in biodegradable packaging, the surcharge limit is quite low. The majority, namely 60.5% of respondents, are willing to pay only up to 10%. This indicates a limited willingness to make significant

expenditures on eco-friendly materials and the impact of price as a barrier for consumers (Fig. 3).

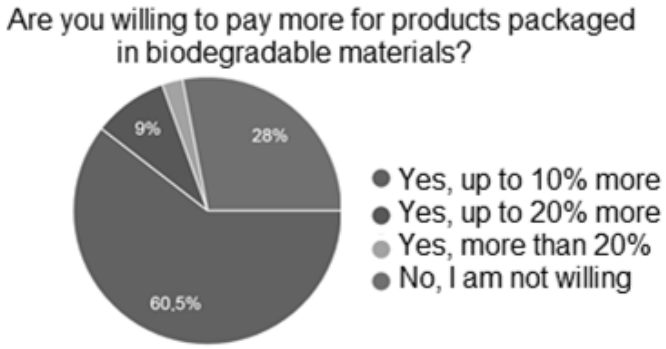

Fig. 3. Willingness to pay more

When choosing products in biodegradable packaging, respondents identified several key factors. The most important of these are the possibility of further recycling, reducing the impact on the environment, and the safety of the packaging for health. These criteria indicate that consumers want to see eco-packaging not only as environmentally friendly, but also as safe and practical to use. (Fig. 4).

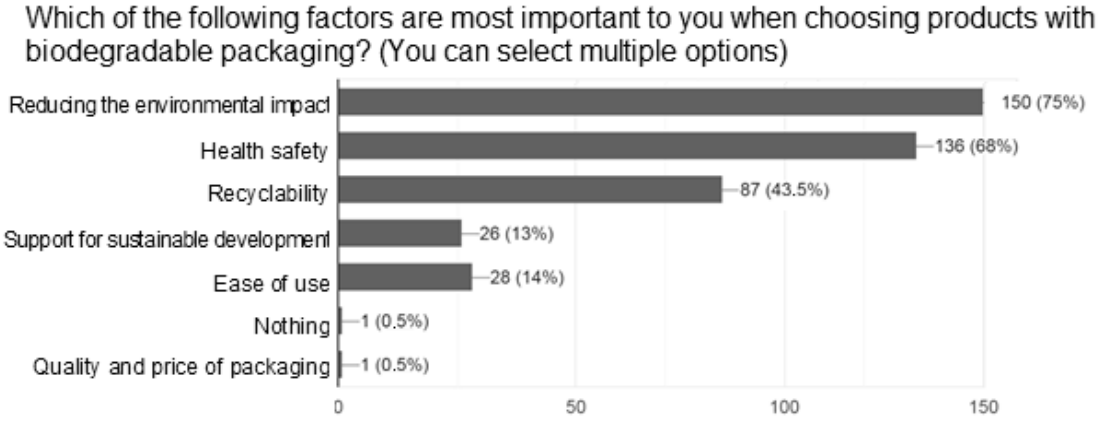

Fig. 4. Choice factors

The majority of respondents confirmed that the presence of biodegradability information on the label has a positive impact on their decision to buy products in such packaging (Figure 5). This shows how important it is to provide consumers with accessible and understandable information at the label level, which can influence their choice.

The majority of respondents noted that they rarely encounter products in biodegradable packaging. This indicates a limited range of such products in most retail chains or insufficient information about the availability of such products (Figure 6).

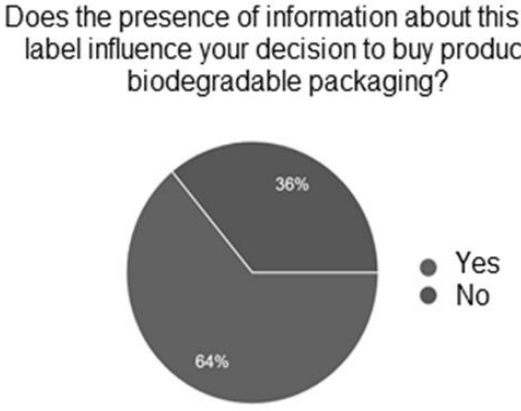

Fig. 5. The impact of information on the label

Fig. 6. Frequency of encounters with biodegradable packaging

Among the factors that motivate respondents to purchase, the most frequently mentioned were a larger range of products in biodegradable packaging, detailed information about the

benefits for the environment and an explanation of the health benefits. This indicates consumers' interest in making conscious choices and striving for more eco-friendly products in stores (Fig. 7).

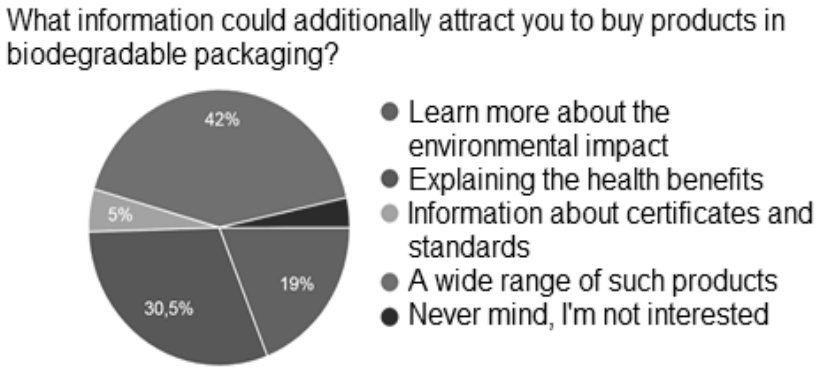

Fig. 7. Additional information for stimulation

Respondents consider the high price, limited choice of products and lack of awareness to be the main barriers. These obstacles reflect the main challenges preventing sustainable packaging from becoming mainstream. Especially important are the issues of price and information, which can be solved through support from producers and the state (Fig. 8).

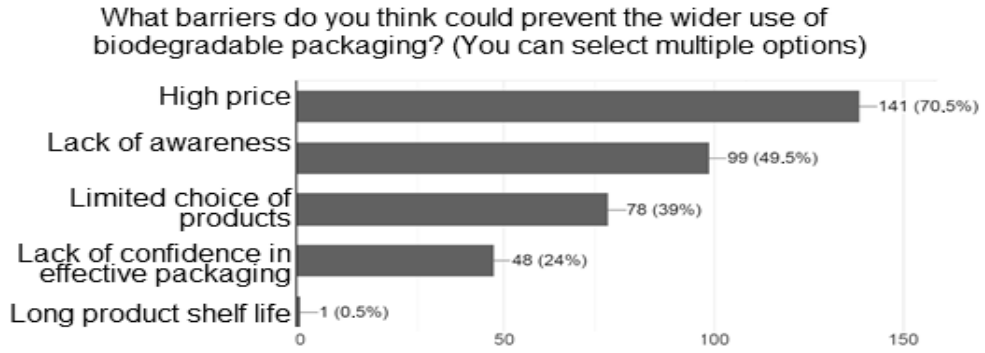

Fig. 8. Barriers to wider use

A significant part of the respondents expressed support for legislative incentives for the wider use of biodegradable packaging in the food industry. This shows the understanding of the importance of state support for environmental initiatives and the desire of citizens to see more products on the market with packaging that does not harm the environment (Fig. 9).

The survey participants were mostly middle-aged and older people who mainly buy products in supermarkets (Fig. 10). This indicates that it is precisely in such retail outlets that a wider range of products with biodegradable packaging should be presented in order to attract the attention of the main consumer group (Fig. 11).

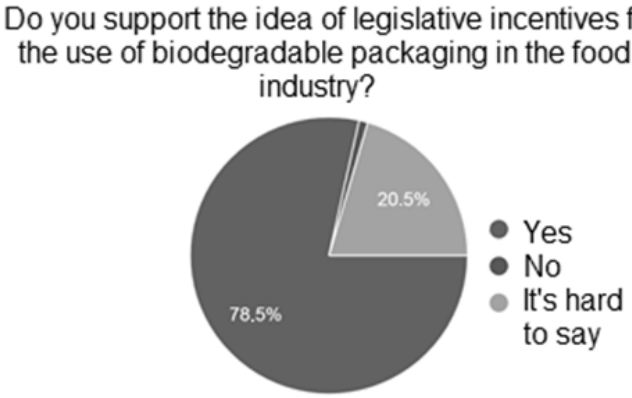

Fig. 9. Support for legislative incentives

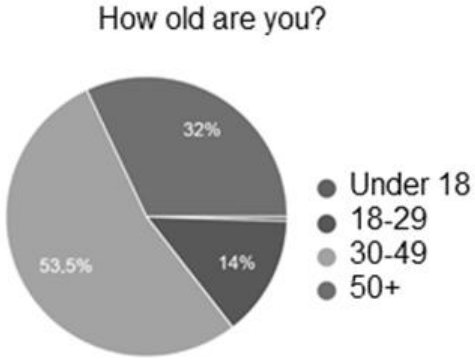

Fig. 10. Age of respondents

Fig. 11. Purchase locations

Conclusion. Demand for biodegradable packaging is growing, especially among environmentally conscious consumers. Manufacturers understand the importance of switching to more environmentally friendly solutions, but require government support and further technological development to make biodegradable packaging cost-effective for mass adoption.

The results of our study showed that, according to consumers, food packaging should correspond to the environmental qualities of the products it contains.

Biodegradable packaging is becoming increasingly relevant in the context of environmental challenges. Both Ukrainian and Latvian consumers support its use, but economic incentives and awareness are needed for mass adoption. Government support in the form of legislative initiatives, as well as information campaigns, should promote the spread of biodegradable materials as an effective alternative to traditional plastic.

The survey results show that participants expressed interest in a wider range of biodegradable packaging and information on environmental and health benefits, which may increase their willingness to purchase such products. The main barriers are high price, limited choice of products with biodegradable packaging, and insufficient consumer awareness of their benefits. Most respondents support the idea of legislative incentives for the use of biodegradable packaging, which highlights public support for environmental initiatives in the food industry.

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