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HYGIENIC ASSESSMENT OF PALM OIL CONTENT IN DAIRY PRODUCTS AS A MEASURE OF HEALTH PROTECTION

Olena Matviichuk, Rymma Yeromenko, Olena Dolzhykova, Anatolii Matviichuk, Larysa Karabut

Nutrition provides the most important function of the human body, providing it with the energy it needs for an active life and longevity. Experts of the World Health Organization have proven that eating palm oil leads to obesity and the development of chronic diseases on a global scale.

The aim of the study was to examine different types of dairy products of brands popular on the modern Ukrainian market for the content of palm oil.

Materials and methods. *To carry out the research, we purchased the following dairy products: pasteurized milk, pasteurized milk-containing drink, sour cream, milk-containing sour cream product, hard cheese and cheese product, processed cheese and processed cheese product, as well as sweet cream butter and vegetable cream product of popular brands. The research was carried out using the methods described in the educational literature on the hygienic examination of milk and dairy products. The choice of methods was based on ease of implementation and reproducibility at home.*

Results. *As a result of the use of selected research methods, characteristic differences between natural products and those containing palm oil have been established. The conducted research will allow consumers to quickly determine the content of vegetable fats in dairy products under normal conditions and choose natural, healthy and safe products for their nutrition.*

Conclusion. *After analyzing the milk and milk-containing products of the most popular brands for the presence of palm oil in their composition, we found that no vegetable fats were found in dairy products (milk, cheese, butter, and sour cream). The presence of vegetable fat was detected in milk-containing products, which was indicated on the packaging as part of the products. So, as a result of the conducted research, we came to the conclusion that manufacturers comply with the requirements of current legislation and warn consumers about the presence of fats of vegetable origin in milk-containing products*

Keywords: *palm oil, vegetable fats, dairy products, milk-containing products, rational nutrition, prevention*

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1. Introduction

It is difficult to overestimate the importance of nutrition in a person's life because both health and well-being depend on it. I. I. Mechnikov believed that people age prematurely and die due to improper nutrition and that a person who eats rationally can live 120–150 years. Nutrition provides the most important function of the human body, providing it with the energy it needs for an active life and longevity. Since ancient times, people have understood the great importance of nutrition for health. Ancient thinkers Hippocrates, Celsus, Galen and others devoted entire treatises to the healing properties of various types of food. The prominent Eastern scientist Abu Ali Ibn Sina (Avicenna) considered food a source of health, strength, and vigor [1–3].

The range of modern food products is constantly expanding and there are products that contain a large

number of various flavours, dyes, modified components, preservatives, flavour enhancers, vegetable fats and proteins, etc. Therefore, today, improper nutrition becomes a serious risk factor for the development of many diseases [4–8]. Statistics of recent years show a sharp increase in the incidence of obesity, cardiovascular diseases, diabetes, and other ailments, even among young people. Such diseases can be prevented if you lead a healthy lifestyle and, first of all, eat right. Experts of the World Health Organization have proven that eating palm oil leads to obesity and the development of chronic diseases on a global scale. Inexpensive and profitable to produce, palm oil is found in many products that belong to the products of daily use. Palm oil is extracted from the pulp of the oil palm. There is a more expensive and useful oil from the seeds of this tree, but it is not used in our products [9].

Oil from the pulp of the tree is cheap, has a creamy, pleasant taste and aroma, so it is widely used in the production of confectionery and other food products. Products with the addition of palm oil do not spoil for a long time, have a good consistency, taste and appearance and are inexpensive. When preparing fast food dishes, it is also beneficial to use palm oil, because it does not burn at standard temperatures, like sunflower oil, for example, and therefore you can cook fried products without fearing the release of carcinogens. But precisely because of its refractory nature, palm oil poses a great danger to a person who constantly uses it. For the oil to melt, a temperature higher than 38 degrees is required, and when it enters the human body at a temperature of 36.6, it remains in a solid form, and therefore is poorly digested and settles on the mucous membranes of the internal organs. In addition, palm oil contains saturated fatty acids, and the use of products with the addition of oil increases their content in the body several times [10]. As a result, there is an increase in the level of cholesterol, the risk of diseases of the cardiovascular system. Oxidized oil causes considerable harm to the body. Oxidation occurs during cooking, and toxins are produced that adversely affect the heart, liver, kidneys, and lungs. With regular use of reheated palm oil for six months, the development of atherosclerosis was found. One study related to heating palm oil to 200 degrees Celsius and processing it for use in semi-finished products revealed its carcinogenic effect [11]. In 2016, the European Food Safety Agency (EFSA) expressed concern that high levels of 3-MHPA, a carcinogenic substance found in refined palm oil, may pose a risk to the kidneys and the male reproductive system [12].

Palm oil is used in food both in raw and hydrogenated form. It is in this form that it is added to food products, including dairy products and confectionery, and certainly causes harm. In the process of hydrogenation, the oil is affected by high temperature, as a result of which its molecular structure changes. After the hydrogenation process, palm oil turns into trans fats, which interfere with the full nutrition of cells and negatively affect the state of many body systems [13].

Palm oil is especially dangerous for children's bodies [14]. Unfortunately, it is often used in baby food, in particular in milk formulas. Palm oil is poorly absorbed by the child's body, which leads to disturbances in the formation of bone tissue. This is because palm oil blocks the absorption of calcium by the child's body. With regular consumption of palm oil in a mixture, the child not only does not get the fats it needs, but also calcium, which is necessary for full development.

Studying the composition of food products and not only, you can conclude that palm oil is almost everywhere. It can also be found in cosmetics and hygiene products. The presence of palm oil in a product can be indicated by one of many names, in particular: *Vegetable Oil, Vegetable Fat, Palm Kernel, Palm Kernel Oil, Palm Fruit Oil, Palmate, Palmitate, Palmolein, Glyceryl, Stearate, Stearic Acid, Elaeis Guineensis, Palmitic Acid, Palm Stearine, Palmitoyl Oxostearamide, Palmitoyl Tetrapeptide-3, Sodium Laureth Sulfate, Sodium Lauryl Sulfate, Sodium Palm Kernelate, Sodium Lauryl Lac-*

tylate / Sulphate, Hydrated Palm Glycerides, Etyl Palmite, Octyl Palmitate, Palmityl Alcohol.

Palm oil is used in the production of processed chocolate because it gives it a glossy shine and helps to stabilize it at higher temperatures. You can check what vegetable fats are contained in chocolate by taking a piece in your hands. If it does not melt, it means that palm oil has been introduced into the chocolate as vegetable fats [15]. Even ordinary bread is made using palm oil, because it is stable at room temperature, it is inexpensive, and it is easy to cook with it. If you buy margarine or eat products containing margarine, it is most likely made with palm oil because of its stabilizing qualities. In this case, it is better to give preference to real butter.

By studying the composition of the product indicated on the package, you can avoid using products that contain palm oil. But unfortunately, many do not mention the presence of a dangerous substance at all or write about it in too small a font. It is also possible to determine whether food contains palm oil without studying the composition. First of all, they are last much longer. There are also ways to test products for this harmful additive at home. The use of these methods does not require special skills or special equipment, but they allow you to find out the quality of the product you are using.

The aim of the study was to examine dairy products of popular brands on the modern Ukrainian market for palm oil content.

2. Materials and methods

To conduct the research, we purchased the following dairy products of popular brands: pasteurized milk TM "Voloshkove pole" and TM "Halychyna" with a fat content of 2.5 %; pasteurized milk-containing drink of LLC "S-Trans" with a fat content of 3.2 %; Selyansky 20 % milk-containing sour cream product of the TM "Smart Choice"; sour cream 20 % TM "President"; sour cream 20 % TM "Molokia"; hard cheese product 50 % TM "Tulchynka"; melted cheese product Druzhba 55 % TM "Tulchynka"; hard cheese Zvenigorodskyi 50 % TM "Zvenigora"; processed cheese Como Creamy tenero 55 % TM "Como"; sweet cream butter 73 % TM "Ferma"; vegetable-cream product 72.5 % TM "Vash molochnyk". The research was carried out using the methods described in the educational manual of O. P. Chagarovskiy, Milk adulteration. Determination methods [15]. The choice of methods was based on ease of implementation and reproducibility at home.

Determination of the content of palm oil in cheese was carried out using an ultraviolet lamp. Differences in the colour of the natural product compared to the product with the addition of palm oil were recorded. To test butter for palm oil content, a piece of the product was heated in a pan. Another way is to put half of the studied products in the refrigerator and leave the other half in a warm place. Characteristic changes in the consistency, smell and appearance of the product were noted.

In milk, attention was paid to the expiration date. Natural milk cannot be stored for a long time. They also checked for colour and taste.

To determine the content of palm oil in sour cream, half of the studied products were placed in the

refrigerator, the other – left in a warm place. After an hour, the consistency was checked.

3. Research results

Analyzing the information indicated on the packaging of the purchased products, we see that the manufacturers indicate in detail their composition, shelf life and suitability under various conditions. After analyzing all purchased products for the presence of palm oil in their composition, we obtained the following results:

As a result of exposure to the light of an ultraviolet lamp on the surface of cheeses, the composition of which did not indicate the content of vegetable fats, we observed a uniform yellow colour on the entire surface of the product. Any inclusions of a different colour were not identified. Instead, the colour of the cheese product was uneven, whitish, and bluish spots were observed. The samples also differed in taste: the cheese product had an unpleasant "chemical" aftertaste, while the natural cheese showed a pleasant sour aftertaste characteristic of this type of product. After heating the cheese, natural cheeses stretched well and had a pleasant aroma, but the consistency of the cheese product resembled plasticine and did not stretch at all.

When heating the studied samples of butter and vegetable cream product, it was found that the natural butter immediately "hissed" and a pleasant aroma characteristic of the butter was felt. But the vegetable-cream mixture simply spread over the pan and burned immediately. Samples of products that were left at room temperature also showed themselves differently: the natural oil became soft with a uniform consistency and drops of moisture appeared on the surface of the vegetable-cream product.

Studies of samples of sour cream and sour cream product showed that after cooling in the refrigerator for one hour, the sour cream, which did not contain vegetable fats, became thick, but the sour cream product remained liquid. On the surface of the sour cream, which was in a warm place, whey separated, while the consistency of the sour cream product remained unchanged.

4. Discussion of research results

If a dairy product contains plant components, it should be called a dairy product, not milk, a cheese product, not cheese, a sour cream product, not sour cream, etc. According to regulatory documentation, products containing substances of non-dairy origin, but in which milk components make up a significant part of the final product and determine their properties, are called milk-containing products. In ready-made dairy products, the mass share of dairy components should be at least 25 %.

Both domestic and foreign manufacturers produce milk-containing products, which are often called by their own names, which can mislead consumers (for example: "Zguschenka", "Smetanka"), mistaking them for natural dairy products. Such milk-containing products are on the shelves of Ukrainian supermarkets next to dairy products [9]. Here is an example of the composition of some milk-containing products from the labels (without indicating their proper names) sold in retail chains:

– milk-containing cheese product "Name" 50 % of total fat in dry matter. Composition: skimmed cow's milk and/or reduced skimmed cow's milk, substitute for milk fat (vegetable fats and oils in their natural and solid state are refined and deodorized), salt, calcium chloride stabilizer, potassium nitrate preservative, leavening agent, milk coagulant "Annato";

– milk-containing sour cream product "Name" 15 % fat. Composition: skimmed cow's milk, milk fat substitute (refined deodorized vegetable fats and oils: palm oil and its fractions, sunflower oil, coconut oil in transesterified form, emulsifier E 471, antioxidants E 320, E 321), food coloring beta- sourdough of pure cultures of lactic acid bacteria Mass share of milk components in the finished product is not less than 85 % (depending on the percentage of milk fat in the product);

– milk-containing condensed milk with sugar, 8.5 % fat. Composition: concentrated demineralized whey, white sugar (45 %), skimmed milk, refined deodorized palm oil, preservative E 202, milk sugar, dye E 171, flavouring "Condensed milk";

– vegetable-fat spread "Name", mass fraction of total fat 72.5 %. Ingredients: milk fat substitute (hydrogenated and transesterified vegetable oils), reduced whey, sugar, flavourings;

– cheese product "Name" 9 % with a substitute for milk fat with a mass fraction of fat 9 % (including milk – 50 %). Ingredients: normalized milk, milk fat substitute (refined deodorized vegetable oils, emulsifier E 471, antioxidant E 306), dry skimmed milk, leaven of pure cultures of lactic acid bacteria, milk coagulant, calcium chloride, potassium sorbate preservative.

The milk fat substitute must contain a mixture of oils and/or modified fats or a mixture of different fats, which are close to milk fat in terms of quality and fatty acid composition. Fat mixtures in their composition must contain at least 25 % of milk fat, but at least 99 % of total fat.

Unfortunately, not all manufacturers indicate on the labels what vegetable fat is in the products. In accordance with the requirements of the "Technical Regulation on Food Labeling Rules" (Order of the State Committee of Ukraine on Technical Regulation and Consumer Policy No. 487 dated 28.10.2010), refined oils (except olive) must be presented on a label indicating a specific vegetable origin (for example sunflower, corn, etc.), the same requirement applies to fats, and it is still necessary to specify which fat it is – vegetable or animal.

There are a number of laboratory methods for determining the vegetable fat content in milk, including chemical and physical methods.

Chemical methods of determination:

– According to Tsyog's reaction (Orzhekhovskiy's modification) - express method.

– According to the Reichert–Meissl number.

– According to iodine number.

– According to the ratio of the iodine number to the Reichert–Meissl number.

In order to determine the impurities of vegetable fat in collected milk, it is necessary to separate the fat in its pure form, that is, to free it from the protein shells. Strong acid or alkali solutions are used as protein solvents. The standard method of extracting fat from milk is called acid because it uses sulfuric acid. This method is based on the separation of

fat from milk under the action of concentrated sulfuric acid and isoamyl alcohol, followed by centrifugation.

A change in the chemical composition of the fat phase of milk also causes a change in its physical properties, such as the melting and freezing point, optical density, viscosity, refractive index, and others. Therefore, the physical properties of fats can be used in the development of methods for determining adulteration of the fatty phase of milk and dairy products. As a rule, the methods of determining adulteration of the fat phase of milk are much simpler and therefore can be basic for the development of express methods. If the laboratories have such optical devices as a photometer, spectrophotometer, fluorimeter, luminoscope, it is possible to quickly develop own methods that will allow determining impurities of vegetable fats in milk and dairy products by optical characteristics. Thus, with the help of a photocolormeter, it is possible to note the difference in the optical density of filtrates of the fat fraction of various objects of milk fat and vegetable fats. The next physical method that can be successfully used to determine the adulteration of the fat phase of milk is fluorescent radiation. It is based on the fundamental property of luminescence in ultraviolet rays of many organic compounds. Thus, milk fat in ultraviolet rays fluoresces in various shades of yellow, and vegetable fats – violet-blue.

A laboratory study of butter samples for the content of fats of vegetable origin, conducted by the Center for Certification and Examination of Agricultural Products, revealed unscrupulous producers, the list of which was made public. Fifteen brands of oil got into it:

1. Sweet cream butter "Vologodske" 82.5 % fat – manufacturer PJSC "Khmelnyska maslosyrbaza";
2. Sweet cream butter 72.6 % fat "AhMoloko" – manufacturer LLC OMPK "Slaviya";
3. Sweet cream butter "Selyanske" 73 % fat – manufacturer LLC "Bogoduhivsky Molzavod";
4. Sweet cream butter 73.5 % fat "Alma-Vita" – manufacturer PP "Alma-Vita";
5. Sweet cream butter 72.6 % fat "Halychyna" – manufacturer PJSC "Halychyna";
6. Sweet butter Extra, 80 % fat TM "April" – manufacturer LLC "April";
7. Sweet cream butter 73.0 % fat "Etalon" – manufacturer PJSC "Zarichnenskyi molokozavod";
8. Sweet cream butter "Vologodske" 82.5 % fat – manufacturer PJSC "Bashtansky syrzhavod";
9. Sweet cream butter 73.0 % fat TM "Ferma" – manufacturer "Tera-Food" LLC;

10. Sweet cream butter "organic" TM "Etnoprodukt" 73.0 % fat – manufacturer DP "Radomilk";

11. Sweet cream butter 73.0 % fat TM "Dzveny Hora" – manufacturer PJSC "Zvenygorod Syrorobny kombinat";

12. Sweet cream butter "Zolotava" 82.5 % fat – manufacturer PJSC "Bashtanskyi syrzhavod";

13. Sweet cream butter 72.6 % fat TM "Bilotserkivske" – manufacturer PE "Bilotserkivska agro-industrial group";

14. Sweet cream butter 73.0 % fat TM "Yagotynske" – manufacturer PJSC "Yagotynskiy Maslozavod";

15. Sweet cream butter 73.0 % fat TM "Zhytomyrske" – manufacturer PJSC "Zhytomyrske Maslozavod".

Study limitations. The limitation of the study is the study of the content of palm oil in products using methods available to the average consumer at home.

The prospect of further research is the use of not only qualitative, but also quantitative methods for determining the content of vegetable fats in food products.

5. Conclusions

After analyzing the milk and milk-containing products of the most popular brands for the presence of palm oil in their composition, we found that no vegetable fats were found in dairy products (milk, cheese, butter, and sour cream). The presence of vegetable fat was detected in milk-containing products, which was indicated on the packaging as part of the products. So, as a result of the conducted research, we came to the conclusion that manufacturers comply with the requirements of current legislation and warn consumers about the presence of fats of vegetable origin in milk-containing products.

Conflict of interests

The authors declare that they have no conflict of interest in relation to this research, including financial, personal, authorship or other nature, which could affect the research and its results presented in this article.

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Data availability

Data will be provided upon reasonable request.

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Olena Matviichuk*, PhD, Assistant, Department of Clinical Laboratory Diagnostics, National University of Pharmacy, Pushkinska str., 53, Kharkiv, Ukraine, 61002

Rymma Yeromenko, Doctor of Biological Sciences, Professor, Head of Department, Department of Clinical Laboratory Diagnostics, National University of Pharmacy, Pushkinska str., 53, Kharkiv, Ukraine, 61002

Olena Dolzhykova, Doctor of Pharmaceutical Sciences, Associate Professor, Department of Clinical Laboratory Diagnostics, National University of Pharmacy, Pushkinska str., 53, Kharkiv, Ukraine, 61002

Anatolii Matviichuk, PhD, Associate Professor, Department Pharmacology and Pharmacotherapy, National University of Pharmacy, Pushkinska str., 53, Kharkiv, Ukraine, 61002

Larysa Karabut, PhD, Associate Professor, Department of Clinical Laboratory Diagnostics, National University of Pharmacy, Pushkinska str., 53, Kharkiv, Ukraine, 61002

**Corresponding author: Olena Matviichuk, e-mail: matviychuklena@ukr.net*