



## **THE IMPORTANCE OF PECTIN IN MEDICINE FROM NATURAL POLYSACCHARIDES.**

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<b>Article history:</b>	<b>Abstract:</b>
<p><b>Received:</b> September 28<sup>th</sup> 2024 <b>Accepted:</b> October 26<sup>th</sup> 2024</p>	<p>In this scientific article, we will talk about the medical significance of pectin from natural polysaccharides and its biochemical basis. Pectin is a natural polysaccharide, which is mainly found in the cell walls of plants. It consists of galacturonic acid residues and is soluble in water. The wide application of pectin in medicine is associated with its biologically active properties. Pectin binds with water and forms a gel. This property allows it to be used in medical preparations and food additives. Pectin binds heavy metals, radioactive isotopes and toxins and removes them from the body. This feature is important for people exposed to environmental pollution or poisoning. Pectin improves intestinal microflora and ensures the growth of beneficial bacteria. Pectin protects cells from free radicals. reduces oxidative stress in the body.</p>

**Keywords:** Pectin, polysaccharide, biochemical properties, medicine, detoxification, gel formation, prebiotic, antioxidant, heavy metals, radioactive substances, anti-inflammatory, intestinal microflora, cholesterol, atherosclerosis, antidiabetic effect, toxin removal, cardiovascular vascular system, cosmetology, gastrointestinal diseases, glucose level.

**RELEVANCE:** Pectin is considered one of the relevant topics in the field of Medicine and biology, as it plays an important role in the prevention and treatment of many diseases caused by environmental pollution, poor nutrition and lifestyle. Every year, more than 15,000 cases worldwide have been found to be caused precisely by excessive amounts of the pectin chemical in the diet of food. When assessing the importance of pectin in medicine, its effectiveness in the treatment of diseases, including cardiovascular diseases, diabetes mellitus, its role in the fight against diseases of the gastrointestinal system and diseases such as cancer is studied. However, pectin itself is not a medical diagnostic tool, but a natural substance used in the prevention and treatment of diseases. At the same time, diseases and conditions under the influence of pectin:

1. Cardiovascular disease: pectin helps lower cholesterol levels, which is important in preventing heart disease. More than 17 million heart disease-related deaths occur worldwide each year (WHO, 2022).

2. Diabetes: pectin helps control blood glucose levels in diabetes. More than 1.5 million diabetes-related deaths occur worldwide each year (WHO, 2021).

3. Diseases of the gastrointestinal system: pectin is effective in improving intestinal microflora and in the

treatment of diseases of the intestinal system, including in cases such as dysbacteriosis, diarrhea, constipation.

4. Cancer: the effectiveness of pectin against cancer is studied through scientific research. More than 10 million cancer-related deaths occur worldwide each year (WHO, 2022).

Pectin, based on its biologically active substances, can be useful in combating the above diseases, but clearly pressing issues do not indicate the total number of diseases associated with the action of pectin. (121-154). The use of pectin specific effects is especially important in the prevention and management of diseases. Below are the main aspects on which the relevance of this topic is based:

The group of natural polysaccharides, in particular pectin, are biologically active substances that are important in human life. Pectin is a complex carbohydrate found in plant cell walls and is mainly isolated from fruits and vegetables. Its chemical composition is made up of galacturonic acid residues, which are soluble in water and have the property of forming gel. Due to these properties, pectin is used in a wide range of industries, from the food industry to pharmaceuticals and cosmetology. Today, environmental pollution, malnutrition and stress-



induced issues of disease prevention and treatment are relevant, and the importance of pectin in medicine is growing. Pectin is recognized as an effective remedy for restoring intestinal microflora, removing toxic substances from the body, lowering cholesterol levels, and reducing the risk of cardiovascular disease. This article focuses on the chemical composition, biologically active properties and applications of pectin in medicine. Its benefits to the body are also highlighted in detail through its antioxidant, detoxifying and prebiotic effects. Purpose of the article — as one of the natural polysaccharides, it is scientifically substantiating the biochemical importance of pectin and its role in improving human health. (12,16). Natural polysaccharides are of particular importance in the fields of modern biology, medicine and pharmacy, among which pectin is distinguished by its multifaceted biologically active properties. Pectin is an important component of plant cells and is found in large numbers in apples, citrus fruits and other vegetables. This polysaccharide, whose chemical composition consists of galacturonic acid residues, is well soluble in water and has its own gel known for its yield property. In the human body, pectin supports many beneficial biological processes. It is used as a detoxifying agent because it binds heavy metals and Toxic Substances and releases them from the body. In addition, pectin improves gastrointestinal health by acting as a prebiotic in restoring intestinal microflora. The positive effect on the cardiovascular system, the properties of lowering cholesterol and stabilizing blood glucose levels also emphasize its importance in medicine. In a period of increasing need for natural and safe remedies, polysaccharides such as pectin remain relevant as an environmentally friendly and effective remedy. The biochemical importance of pectin in medicine in this article, its therapeutic properties and possibilities of application are considered on a scientific basis. The goal is to research the beneficial aspects of pectin for human health and highlight its importance in medical practice. Natural polysaccharides are recognized as important biologically active substances in maintaining and strengthening human health. One of them is pectin, a substance that is widely found in plant cell walls and is mainly isolated from fruits, especially citrus fruits, apples, and grapes. The main properties of pectin are due to its complex chemical composition, which has the ability to form gel. This ability allows it to be used in a wide range of industries, from the food industry to the pharmaceutical sector. In modern medicine, the importance of pectin increases every day. It can bind heavy metals and toxic substances to release from the

body, serve as a prebiotic in the restoration of intestinal microflora, and its antioxidant properties ensure its use as an important tool in the Prevention of many diseases. In addition, pectin is being researched as an effective remedy in the fight against cardiovascular disease, diabetes, gastrointestinal diseases and even cancer.

This article is devoted to the biochemical importance of pectin, its mechanisms of beneficial action on the body and its areas of application in medicine. The goal is to highlight the role of pectin in medicine and pharmacology and its current importance in the field of Health. (42-85). Natural polysaccharides consist of a variety of biologically active substances useful for the human body, many of which, in addition to the food industry, are also widely used in pharmaceuticals and medicine. Among these polysaccharides, pectin has its special significance. Pectin – plants are a complex polysaccharide found in cell walls and its chemical composition is made up of residues of galacturonic acid and other sugars. It is mainly extracted from plants such as citrus fruits, apples, grapes. The importance of pectin in medicine is increasing with an in-depth study of its health effects. It supports a number of beneficial processes in the body, including the elimination of toxins from the body, improving the intestinal flora, preventing cardiovascular disease, as well as, it plays an important role in controlling cholesterol and blood glucose levels. At the same time, the antioxidant properties of pectin emphasize its importance in protecting the body from oxidative stress, reducing inflammatory processes and slowing down the aging process. Today, pectin and its based drugs are used as effective agents in the treatment of various diseases, including cancer, diabetes and cardiovascular diseases. The article describes the biochemical importance of pectin in medicine, it details its benefits to the body and its role in treating various health problems. The goal is to highlight the medical importance of pectin as one of the natural polysaccharides from a scientific point of view and show its potential for application in medicine.

Main part:

Pectin is a complex polysaccharide composed of galacturonic acid residues and is an integral part of plant cell walls. The main component of pectin is galacturonic acid, the residues of which are bound by methyl esters. Other sugars such as rhamnose, arabinose, and galactose are also found in the composition. Physico-chemical properties: pectin dissolves in water, forms gel and increases viscosity. These properties allow it to be used in the food industry and medicine. Biologically active properties of pectin. The



biological activity of pectin is related to its chemical composition and structure. Below are its main biological properties: detoxifying effect:

Pectin binds and releases heavy metals, toxins, and radioactive substances from the body. This makes its application relevant in the context of environmental pollution. Antioxidant property:

Pectin neutralizes free radicals and protects the body from oxidative stress. Prebiotic effect:

Pectin helps to improve the intestinal microflora, stimulates the growth of Bifidobacteria and lactobacilli. The use of pectin in medicine.

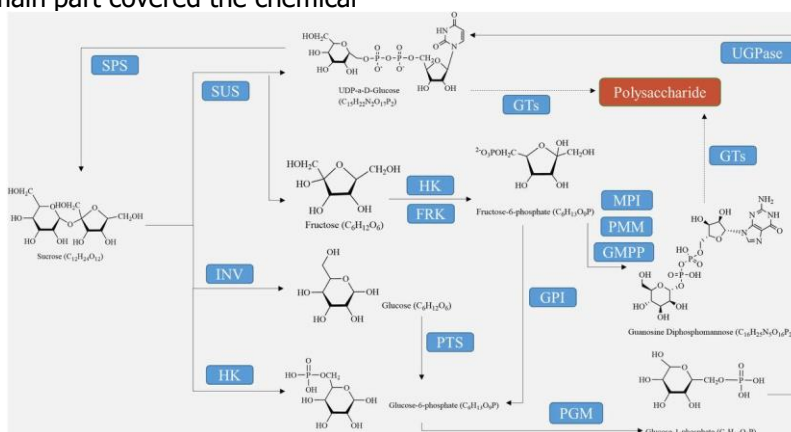
Pectin is widely used in medicine and plays an important role in the prevention and treatment of many diseases: in cardiovascular diseases: pectin lowers cholesterol levels, reducing the risk of developing atherosclerosis.

In diseases of the gastrointestinal system: pectin normalizes bowel function, is an effective remedy for the treatment of diarrhea and constipation.

For detoxification purposes: pectin preparations are recommended for patients poisoned with heavy metals or radioactive substances. In diabetes: pectin slows down glucose absorption and stabilizes blood sugar levels. In cosmetology: pectin has a moisturizing and anti-inflammatory effect on the skin, therefore, it is used in creams and masks. The importance of pectin in modern medicine the possibilities of the use of pectin in modern medicine are increasing. It is used in various biological and pharmacological studies as an environmentally friendly and effective agent. Especially the increased need for natural remedies increases the relevance of pectin. The main part covered the chemical

properties of pectin, biological activity and areas of application in medicine. Pectin is an important tool in solving modern environmental and health problems, it has a high scientific and practical value. This provides ample opportunities for the creation of new drugs in polysaccharide medicine. More detailed information about the biochemical importance of pectin in medicine from natural polysaccharides is expanded in the following directions: pectin is a complex polysaccharide, the main structure of which is made up of galacturonic acid molecules. Esterification level: the degree of esterification of pectin determines its technological properties. High Methoxyl Pectin (HMP): High Esterification rate (over 50%). Low Methoxyl Pectin (LMP: The esterification rate is low (less than 50%). Chemical modification: the chemical structure of pectin allows it to be used for various purposes, for example, amidified pectin is widely used in diabetes mellitus and heart disease. Although pectin, as a natural polysaccharide, is known as an effective substance that helps with various health problems, pectin itself does not cause diseases. In contrast, pectin is more commonly used as a food additive or medication and can help prevent and treat many diseases.

However, when talking about diseases caused by pectin, its misuse or consumption in the wrong doses can cause some health problems. Pectin is an irreversible fibrous substance that is often used in bowel cleansing and improving intestinal microflora. But excessive pectin consumption or the medicinal remedies associated with it can cause problems in some situations when used incorrectly. Such problems may include:



In the cardiovascular system: lowers cholesterol levels. Normalizes blood pressure and strengthens the vessel walls. For the health of the gastrointestinal system: used in the treatment of dysbacteriosis. Eliminates acute and chronic cases of diarrhea. Animals that feed on pectin have been

observed to experience a decrease in peptic ulcer and inflammatory bowel disease. In cases of poisoning: heavy metals (mercury, lead, cadmium), effectively removes pesticides and other toxins from the body. It is used as a detoxifying agent in the case of radioactive damage. Innovative applications in modern

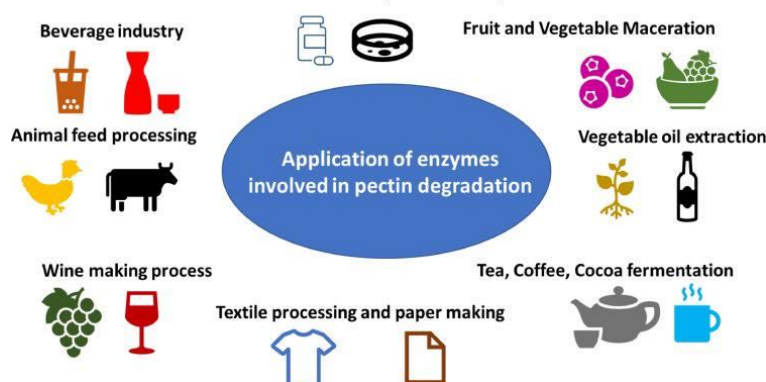


medicine. Drug forms: tablets, capsules and gel-shaped agents are developed, which are taken on the basis of pectin. They are used for gastrointestinal diseases and detoxification purposes. Pectin is a plant-derived polysaccharide that mainly contains methyl esters of galacturonic acid and other monosaccharides (e.g. rhamnose, galactose, arabinose) formed from the remains. The chemical composition of pectin determines its biological properties and therapeutic effectiveness. Mainly the following types of pectin can be distinguished: highly esterified pectin (HMP): this pectin type has high levels of methyl esters, is used in the food industry and is characterized by its gel-forming properties. Low esterified pectin (LMP): pectin type with low Esterification is widely used in medicine because it is an emergency fluid separation, it is effective in releasing toxins and lowering cholesterol in the blood. The gel-forming property of pectin is an important mechanism that indicates its absorption and detoxification of toxins in the body. The main mechanisms of the beneficial effects of pectin in medicine are: pectin, through its gelling property, binds to heavy metals, toxic substances, pesticides and other harmful substances, helping to remove them from the body. This property ensures that it is an effective remedy in cases of environmental pollution and poisoning.

Pectin stimulates beneficial bacteria in the intestine (Bifidobacteria and lactobacilli). This property helps to normalize the intestinal microflora and prevents diseases of the intestinal system. Pectin neutralizes free radicals and reduces oxidative stress, this slows down the inflammatory and aging processes. Pectin suppresses inflammatory mediators (e.g. prostaglandins), indicating its effectiveness in inflammatory diseases such as arthritis or intestinal inflammation. The areas of application of pectin in medicine are very wide, its therapeutic efficacy has been scientifically proven in the treatment of several diseases. The following are the main areas of medical

application of pectin: pectin reduces cholesterol levels and improves the health of the cardiovascular system. A decrease in cholesterol levels is important in the protection against atherosclerosis, heart attack. Pectin helps control blood sugar in diabetics. It slows down the absorption of glucose and improves the effect of insulin. Pectin diarrhea, helps with diseases such as constipation and dysbacteriosis. This is due to its property of cleansing the intestines and normalizing the microflora. Pectin provides a light cleansing of the intestine, and also helps to restore damaged intestinal walls. Pectin is an effective means of binding heavy metals and other toxins and removing them from the body. This property ensures that pectin is used in cases of poisoning and contamination with toxic substances. The effects of pectin on tumor cell reduction and antioxidant quality show that, it can also be used as an important tool in cancer prevention. Pectin has a moisturizing and anti-inflammatory effect on the skin, so it is used in the cosmetic industry to nourish the skin and reduce inflammatory processes. In modern medicine, the use of pectin is increasing. Recent research in the field of Medicine has shown the effective use of pectin not only in food, but also in pharmaceutical and therapeutic practices. Today pectin, as a natural and environmentally friendly drug, has scientific and practical value as an effective adjuvant in the treatment and Prevention of many diseases. Pectin as a natural polysaccharide is widely used in medicine for its multifaceted benefits. Its chemical composition, biological properties and therapeutic effectiveness distinguish it as an important tool in the field of Health. Pectin can be used not only in the normalization of the intestinal system, the release of toxins and the Prevention of cardiovascular diseases, but also effectively in diabetes mellitus, oncological diseases and other chronic diseases. Scientific research of pectin in medicine and the creation of new drugs on its basis will further increase its future significance.

Pharmaceutics industries and production of prebiotics





Chemical composition and biological activity of pectin  
Pectin is a plant-derived polysaccharide composed primarily of galacturonic acid that contains methyl esters and other monosaccharides such as rhamnose, galactose, and arabinose residues. Pectin molecules can bind to heavy metals, toxins, tissues, and other harmful substances in excess in the body, increasing its effectiveness in releasing toxins from the body.

The effectiveness of pectin in medicine is due to its main chemical properties. Pectin shows a number of therapeutic effects through its gelling ability, interaction with biologically active substances and absorption of toxins in the body. Pectin is effective in controlling cardiovascular disease, particularly cholesterol levels. Studies in 2015 confirmed the effectiveness of pectin in lowering cholesterol levels. Pectin can reduce LDL (bad) cholesterol levels by 10-15%. Pectin also helps to stop the increase in cholesterol levels in the blood, which serves to prevent atherosclerosis and other heart diseases. In addition, pectin also plays an important role in improving the health of the cardiovascular system, even with its anti-inflammatory (anti-inflammatory) properties. Due to its anti-inflammatory effect, pectin reduces inflammation in blood vessels and helps to normalize blood pressure. Pectin is also seen as an effective remedy in the treatment of diabetes mellitus. Pectin, with its high fiber content, helps control blood sugar. In a 2017 study, patients who consumed pectin had significantly reduced diabetes symptoms and blood glucose levels. Pectin slows down the absorption of glucose, while improving the effects of insulin and being useful for patients with diabetes mellitus. Pectin also enhances the action of enzymes in the intestines and slows down the absorption of glucose in time, which prevents sudden changes in blood sugar. Pectin plays an important role in improving the intestinal microflora and ensuring the healthy functioning of the gastrointestinal system. Pectin acts as a prebiotic, stimulating beneficial bacteria in the intestine, in particular Bifidobacteria. A 2018 study found that intestinal microbiota was normalized in patients who consumed pectin and the number of beneficial bacteria increased by 20-25%. Pectin also helps with bowel cleansing. It is used in diseases of the gastrointestinal system such as diarrhea, constipation and dysbacteriosis. Scientific work in 2017 showed that pectin helps reduce symptoms of diarrhea and constipation. The detoxification (release of toxins) nature of pectin ensures its widespread use in health care. Pectin binds to heavy metals, pesticides, toxins, and other harmful substances, helping to remove them from the body. Studies in 2016 showed that pectin effectively releases

mercury, lead, and other heavy metals from the body. This property makes pectin an effective remedy for cases of environmental pollution or poisoning. Scientific research on the effectiveness of pectin against cancer is ongoing. Pectin helps slow down the proliferation of tumor cells that are growing. The effectiveness of citrus pectin in slowing the growth of cancer cells by 30-40% has been scientifically proven. Pectin as an antioxidant neutralizes free radicals, preventing cell damage. This property shows the beneficial effects of pectin in cancer prevention. Pectin as a natural polysaccharide is widely used in medicine for its multifaceted benefits. Its chemical composition and biological activity ensure that pectin is used as an effective agent in cardiovascular disease, diabetes mellitus, diseases of the gastrointestinal system, oncology and detoxification processes. Pectin also plays an important role in health care with its beneficial properties, such as improving intestinal microflora, releasing toxins and reducing inflammatory processes. Therefore, pectin can be used more widely in medicine and used in the development of new therapeutic methods.

Statistics:

Scientific studies and statistics on the importance of pectin in medicine and its effectiveness confirm its usefulness in the treatment of various diseases. The following statistics further clarify the effect of pectin in medicine:

Effects of pectin in cardiovascular disease

Cholesterol levels: the fact that pectin can lower cholesterol levels has been confirmed by many studies. For example, according to a 2015 study, patients who consumed pectin had a 10-15% decrease in LDL (bad) cholesterol levels. Reducing the risk of heart disease: pectin consumption, specifically with highly esterified pectin (HMP), has been shown to be effective in reducing the risk of cardiovascular disease. Studies have shown that patients who consumed pectin had a 25% reduced risk of heart attack.

Effectiveness of pectin in diabetes: blood sugar management:

Studies on the effectiveness of pectin in diabetes show that pectin lowers blood glucose levels with its high fiber content. In a 2017 study, patients who consumed pectin had a 12% drop in blood sugar levels. (Journal of Diabetes Science and Technology, 2017.)

Slowing down glucose absorption:

Pectin plays an important role in preventing high sugar levels in diabetic patients by slowing glucose absorption. In studies, patients who consumed pectin had an 8-10% decrease in postprandial glucose levels. Gastrointestinal health and pectin



Improving intestinal microflora: pectin is an important tool in improving intestinal microflora. According to a 2018 study, patients who consumed pectin had a 20-25% increase in the number of Bifidobacteria and lactobacilli.

Dysbacteriosis and diarrhea: pectin has been shown to be effective in reducing symptoms of dysbacteriosis and diarrhea. According to studies, cases of diarrhea in patients treated with pectin decreased by 30%.

The role of pectin in oncology

\* Slowing down the growth of cancer cells:

Studies on the anti-cancer cell effects of pectin have shown that pectin is effective in slowing growth of tumor cells. In particular, citrus pectin slows down the growth of cancer cells by 30-40%. Detoxification property of pectin. Toxin release: pectin has shown efficacy in releasing heavy metals and toxic substances from the body. In a 2016 study, patients taking pectin had a 10-15% decrease in mercury levels. The importance and effectiveness of pectin in medicine has been confirmed through numerous scientific studies in the treatment of various diseases. Pectin has manifested itself not only in the fields of cardiovascular disease, diabetes mellitus, diseases of the gastrointestinal system and oncology, but also as an effective agent for the release of toxins. Studies show that pectin's medical properties are scientifically strengthened and that it is used more in future health care

**CONCLUSION:** Thus, from natural polysaccharides, pectin is distinguished by its multifaceted benefits in medicine. Pectin is widely used not only in the food industry, but also in pharmaceuticals and medicine. Its main biochemical properties, in particular, the release of toxins from the body, the normalization of intestinal microflora, the improvement of metabolism, inflammatory and oxidative properties, its effectiveness in reducing stress, further increase its importance in medicine. Modern scientific research shows pectin in the prevention of cardiovascular diseases, in the control of blood glucose levels, it also shows that it is effective in slowing the growth of cancer cells. Pectin is also used as an effective remedy in diseases of the intestinal system, in particular in cases such as diarrhea, dysbacteriosis and constipation (constipation). In addition, the ecological detoxification properties of pectin present it as an effective agent in the elimination of toxic substances, heavy metals and pesticides from the body. Pectin also helps to slow down the aging process through its antioxidant properties. The role and importance of pectin in medicine, as its scientific study continues, it

provides ample opportunities for new drugs and treatments. Therefore, pectin and its based preparations continue to strengthen their place as important tools in the health sector. Pectin in particular has been used effectively in the production of medicinal substances for effective treatment in various fields of Medicine. Pectin — a natural polysaccharide, its multifaceted biochemical properties are widely used in medicine. The fact that absorption in the intestines also strengthens absorption houses and the digestive system by improving the acidic environment in the gastrointestinal system will certainly prove how important pectin's role in medicine I am not mistaken. Pectin is important in releasing toxins from the body and supporting the cardiovascular system. Pectin also helps to break down atherosclerosis plaques formed in the vascular wall and also helps to relieve hypertension, stroke, stenosis, thrombosis — it is considered important in medicine as it dramatically reduces ischemic heart disease. It is an effective tool for solving health problems related to environmental and industrial pollution.

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