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PHARMACOLOGY OF NON-STARCH POLYSACCHARIDES

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Abstract: The review is devoted to the analysis of the pharmacological effects of non-starch polysaccharides as sources of new drugs and as biologically active food additives. The structure and physicochemical properties of pectins, alginates, carrageenans, fucoidans and chitosan are briefly described, as well as the effect of drugs based on polysaccharides in cardiovascular diseases, diseases of the gastrointestinal tract, viral and bacterial infections.

Keywords: Pharmacological effect, npolysaccharide, drug, food.

INTRODUCTION

Non-starch polysaccharides are a group of substances called low-digestible carbohydrates or dietary fiber in various sources. These substances are the subject of nutritional science, but in recent years, numerous data on their medicinal properties have appeared, which has forced pharmacologists and pharmacists to pay attention to them as possible objects for the creation of new medicines and biologically active food additives.

RESULTS AND DISCUSSION

Chemical structure of polysaccharides

From a chemical point of view, carbohydrates are divided into “sugars” (mono- and disaccharides), oligosaccharides and polysaccharides. Oligo- and polysaccharides include compounds whose molecules are built from monosaccharide residues connected by O-glycosidic bonds. The distinction between oligosaccharides and polysaccharides cannot be made strictly, but from a methodological point of view, it is advisable to consider compounds containing up to 8–10 monosaccharide units to be oligosaccharides, and higher molecular weight sugars to be considered polysaccharides. The main components of dietary fiber are polysaccharides, forming both linear and branched chains. An important role in determining the physical properties and ability of polysaccharides to form associations with other polysaccharides and proteins is played by carbohydrate side chains and the configuration of their glycosidic bonds. Some of the polysaccharides consisting of D-glucose residues connected by 1®4 and 1®6 a-glycosidic bonds (starches) are hydrolyzed by amylases of the salivary and pancreatic glands of mammals, absorbed in the small intestine and, together with mono- and disaccharides, form the so-called available, or digestible, carbohydrates. The other part of the polysaccharides (non-starch polysaccharides) is not hydrolyzed by amylases, is not absorbed into the blood and is partially or completely subject to enzymatic degradation by the microflora of the colon.

Treatment and prevention of cardiovascular diseases

Epidemiological studies conducted in different countries indicate an inverse relationship between dietary fiber intake and the risk of cardiovascular diseases, including myocardial infarction. Lack of fiber in the diet can contribute to the development of obesity. Overweight individuals have significantly lower fiber intake than thin individuals. In this regard, for more successful treatment of obesity, a diet rich in fiber began to be recommended. Dietary fiber, on the one hand, can provide a feeling of early satiety by stretching the walls of the stomach, and on the other, reduce the absorption of exogenous glucose, probably due to the slow diffusion of carbohydrates

through the gel layer of the polysaccharide. Experimental studies on animals and clinical observations in humans prove that non-starch polysaccharides reduce such an important risk factor for cardiovascular diseases as serum cholesterol levels.

Treatment and prevention of diseases of the gastrointestinal tract The first effect that non-starch polysaccharides have after administration is associated with a change in the viscosity of the contents of the stomach and intestines, which leads to a slowdown in gastrointestinal transit. After passing through the small intestine, the polysaccharides are fermented in the large intestine by anaerobic bacteria into short-chain fatty acids. In the colon, the presence of polysaccharides and their bacterial degradation products results in increased stool volume, accelerated transit through the colon, and increased formation of intestinal gases. Due to their strong water-holding capacity, non-starch polysaccharides increase the water content of stool [2]. On the surface of the mucous membrane of the stomach and intestines, high-molecular polysaccharides form a gel and, thanks to this, have an enveloping and protective effect, protecting the mucous membranes from the irritating influence of aggressive factors.

Antibacterial, antiviral and immunomodulatory properties

Of great interest are data on the antimicrobial activity of non-starch polysaccharides. It has been established that pectins have a bactericidal effect on gram-positive and gram-negative microorganisms.

Under in vitro conditions in a 4% pectin solution, the number of streptococci, Pseudomonas aeruginosa and spore-bearing bacilli decreased until complete disappearance within 4 hours, and the number of Shigella, Klebsiella, Proteus, Escherichia coli and staphylococci - within 24 hours. Under similar conditions, representatives of the indigenous microflora of the gastrointestinal tract (lactic acid bacteria) retained their viability. Probably, under body conditions, the antimicrobial effect of pectins is due to acid damage to the surface structures and proteins of the microbial cell and inhibition of bacterial adhesion to the cellular epithelium. When studying the effect of pectins on antibiotics, it was found that in a pectin solution, the antibacterial activity of potassium and sodium salts of benzylpenicillin is lost after 24 hours.

CONCLUSION

One of the important areas of scientific and technological work based on data on the sorption activity of non-starch polysaccharides is the development of drugs, biologically active additives and food products with a high content of alginates and pectins. This direction may be promising in solving medical problems of the population living in areas with high levels of radioactive isotopes in the environment. It has been experimentally established that these drugs have an antitoxic effect in experimental toxic hepatitis, reduce the level of lipid peroxidation products, normalize the level of cholesterol and triglycerides in hyperlipidemia, and remove heavy metals such as lead and cadmium from the depot [1]. Clinical observations have established that these supplements can be used as adjuncts for hypermicroelementosis, gastric and duodenal ulcers, viral hepatitis, intestinal infections complicated by dysbiosis, chronic renal failure, as well as for diseases accompanied by elevated blood cholesterol levels [3]. It should be emphasized that many polysaccharides are not inferior in their ability to bind heavy metals, reduce blood lipid levels, and have antitoxic and antiviral effects, and some even surpass the corresponding drugs in this regard.

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