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# LECTINS IN THE DIAGNOSIS OF ATROPHIC PROCESSES OF THE GASTRIC MUCOSA. OPINIONS AND PERSPECTIVES

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**Annotation:** Lectins are proteins and glycoproteins that have the ability to bind carbohydrate residues on the cell surface in a highly specific manner, in particular, causing their agglutination. Lectins are often involved in cellular recognition, for example, some pathogenic microorganisms use lectins to attach to the cells of the affected organism. Lectins were originally isolated from plant seeds, but they are found in most living organisms. Lectins can cause agglutination of erythrocytes, and also have selective mitogenic activity against various subpopulations of blood cells.

Their high specificity is also manifested in the case of pathological processes of atrophy - the direction of using lectins as markers of atrophy in chronic gastritis is considered promising. The prospects for the use of lectins go even further than diagnosis, but even into treatment. There are a number of studies on their use in the treatment of certain forms of cancer.

**Keywords:** lectin, atrophy, chronic gastritis, gastric mucosa, carbohydrates.

Carbohydrates are the most abundant complex biomolecules that play a key role in many cellular interactions, such as signaling to other cell molecules or cell

surface receptors. Lectins, which are found in the cells of animals, plants, and fungi, are specific analogs of some receptors in cell membranes.

Each change in the cell membrane is capable of potentially possessing its lectin binding, which makes it possible to use them as a separate diagnostic method. A large scale of work was carried out in the field of biosensors using lectins, as well as the method of lectin histochemistry for the diagnosis of precancerous conditions and cancer [1].

Some tissues show a high affinity with lectins, such as the gastric mucosa - there are several signaling pathways for the internal regulation of the function of parietal exocrinocytes and cervical mucocytes of the gastric mucosa, which used endogenous carbohydrates like F-type and C-type lectins [2].

The cell surface is a rather complex "mosaic" consisting of a double layer of phospholipids, various proteins, glycoproteins, and glycolipids. The last two classes of compounds contain hetero-oligosaccharides, which are composed of different monosaccharide units, such as galactose, glucose, fucose, mannose, sialic acid, and several others [3]. Numerous studies conducted since the 50s of the XX century have established that changes in these structures invariably accompany the processes of malignant tumor growth [4].

And all these changes can be tracked using lectins. This is the first weakness of the tumor cell: it allows carbohydrate-binding proteins to "reveal" themselves. The most striking example of such complicity is the development of a tumor with the participation of galectin-3, a carbohydrate-binding protein from the galectin family [5].

Sialylation of carbohydrate chains of various glycoproteins is a common sign of malignant progression [1, 6]. It is this factor that was taken as a basis by a Mexican-Portuguese group of scientists who tried to create a biosensor system based on SNA lectin from the black elderberry Sambucus nigra. They managed to develop a method based on the binding of STn antigen (sialylated glycoprotein expressed in various oncopathologies) with SNA. The amazing features of this method are the high accuracy of determining the antigen level, the almost complete absence of the

influence of other glycoproteins in the serum, as well as the great versatility of use since the STn antigen is found in many types of diseases.

For various types of oncopathologies it is convenient to study changes in different glycoproteins since the features of their overglycosylation are not determined by conventional methods and in a complex way depending on a specific disease [7]. One of these markers are oncofetal antigens (OFA) - tumor-associated antigens that normally appear only during the embryonic development of the fetus. When expressed on the cells of an adult organism, these antigens are regarded as "foreign" and cause an immune response. The best-studied are alpha-fetoprotein (AFP), cancer embryonic antigen (CEA), and trophoblast-specific beta-1 glycoprotein (TBG). Based on these and several other specific antigens, various lectin-enzymatic methods of analysis are created for the diagnosis of oncopathologies, including gastric cancer [2, 8].

Group of scientists from the Pacific Institute of Bioorganic Chemistry has developed a lectin-enzyme-linked immunosorbent assay to identify differences in CEA glycosylation in benign and malignant pathologies of the cervix. Lectin MBL-AJ, isolated from the Far Eastern sea cucumber Apostichopus japonicus, showed high sensitivity and high accuracy of the diagnosis (87.8% - positive prognosis, 95.2% - negative) [9]. Another distinctive aspect of the method is its low cost compared to existing commercial test systems. Given the equally high sensitivity and specificity, this criterion may become decisive in choosing a method that will be widely used in the differential diagnosis of cancer.

The most famous and well-studied lectin is concanavalin A (Con A), isolated from the xiphoid canal of Canavalia ensiformis. For almost a century of its research its structure, carbohydrate specificity, and many other characteristics have been fully established. However, studies were showing the presence of antitumor activity in this lectin. A team of scientists from China summarized the data obtained in numerous experiments and concluded that Con A is capable of triggering apoptosis in tumor cells in some oncopathologies, and it can do this in different ways - by detecting the

activation of caspases, disorders of apoptosis induction and autophagy [10]. Research in this direction continues.

A similar function, albeit by a different mechanism, is performed by the soluble mannose-binding lectins (MBLs) of mammalian serum and liver [11]. These proteins bind to oligomannosides of infectious microorganisms, causing activation of complement without participation of antibody, and subsequent lysis of the pathogens, thus acting in innate immunity. The spatial arrangement of the CRDs in the MBLs provides a structural basis for their ability to bind ligands with repetitive, mannose-rich structures, such as found on fungal and microbial surfaces, but not to the oligomannose units of mammalian glycoproteins. This is associated with the pathogenesis of chronic gastritis at the stage of atrophy.

**Conclusions.**  Because of their ubiquitous nature, carbohydrates have long been used as a diagnostic tool for cancer and in the development of safe low molecular weight therapies. Although several carbohydrate agents have been successfully synthesized and processed for clinical trials, therapeutic responses have not met their expectations in cancer treatment. It has also not been shown that the results from the use of commercially available carbohydrate-based therapeutic agents are very significant. Consequently, more comprehensive research is needed to study effective therapeutic agents that can not only treat cancer but also prevent it through cheap and high-quality diagnostics.

More and more methods of histochemical, enzyme immunoassay, and other types of analysis based on lectins are used in medical practice. The great potential for the use of lectins in the diagnosis and therapy of cancerous tumors is gradually beginning to be realized, but they remain a class of compounds that require more close attention. In the next decade, we will witness major victories over cancerous tumors. We believe that lectins will play an important role in these victories.

# REFERENCES.

1.      Hossain F, Andreana PR. Developments in Carbohydrate-Based Cancer Therapeutics. *Pharmaceuticals (Basel)*. 2019;12(2):84. Published 2019 Jun 4. doi:10.3390/ph12020084

2.      Mahajan S., Ramya T.N.C. F-type Lectin Domains: Provenance, Prevalence, Properties, Peculiarities, and Potential. In: Chattopadhyay K., Basu S. (eds) Biochemical and Biophysical Roles of Cell Surface Molecules. Advances in Experimental Medicine and Biology, vol 1112. *Springer, Singapore*. 2019. https://doi.org/10.1007/978-981-13-3065-0_24

3.      Brooks S.A. (2017) Lectin Histochemistry: Historical Perspectives, State of the Art, and the Future. In: Pellicciari C., Biggiogera M. (eds) Histochemistry of Single Molecules. *Methods in Molecular Biology, vol 1560. Humana Press, New York, NY*. https://doi.org/10.1007/978-1-4939-6788-9_6

4.      Masahiro Nagata, Kenji Toyonaga, Eri Ishikawai; Helicobacter pylori metabolites exacerbate gastritis through C-type lectin receptors. *J Exp Med* 4 January 2021; 218 (1): e20200815. doi: https://doi.org/10.1084/jem.20200815

5.      Rayane Bernardes Estevam, Natalia Maria Jacom Wood da Silva, Wood da Silva; Modulation of Galectin-3 and Galectin 9 in gastric mucosa of patients with chronic gastritis and positive Helicobacter pylori infection, *Pathology - Research and Practice*, Volume 213, Issue 10, 2017, Pages 1276-128, https://doi.org/10.1016/j.prp.2017.08.005.

6.      Nathan Sharon, Halina Lis, History of lectins: from hemagglutinins to biological recognition molecules*, Glycobiology*, Volume 14, Issue 11, November 2004, Pages 53R–62R, https://doi.org/10.1093/glycob/cwh122

7.      Roy B, Chattopadhyay G, Mishra D, Das T, Chakraborty S, Maiti TK. On-chip lectin microarray for glycoprofiling of different gastritis types and gastric cancer. *Biomicrofluidics*. 2014; 8(3):034107. Published 2014 Jun 6. doi:10.1063/1.4882778

8. M. Luísa S. Silva; Chapter One - Lectin biosensors in cancer glycan biomarker detection. *Advances in Clinical Chemistry*, Elsevier, Volume 93, 2019, https://doi.org/10.1016/bs.acc.2019.07.001.

9. Benildo Sousa Cavada, Vinicius Jose Silva Osterne, Vanir Reis Pinto-Junior and Kyria Santiago Nascimento; ConBr, the Lectin from Canavalia brasiliensis Mart. Seeds: Forty Years of Research, *Current Protein & Peptide Science (2019)* 20: 600. https://doi.org/10.2174/1389203720666190104123210

10. Oliveira Figueiroa E, Albuquerque da Cunha CR, Albuquerque PBS, et al. Lectin-Carbohydrate Interactions: Implications for the Development of New Anticancer Agents. *Curr Med Chem*. 2017; 24(34):3667-3680. doi:10.2174/0929867324666170523110400

11. Алешин, В. Н., Лобанов, В. Г., & Минакова, А. Д. (2005). Лектины: свойства, сферы применения и перспективы исследования. *Известия высших учебных заведений*. Пищевая технология, (1), 5-7.