

БИОМЕДИЦИНА ВА АМАЛИЁТ ЖУРНАЛИ ЖУРНАЛ БИОМЕДИЦИНЫ И ПРАКТИКИ JOURNAL OF BIOMEDICINE AND PRACTICE

Tamarxon Uktamovna ARIPOVA

Director of the Immunology institute of the AS RUz,

Shoxista Sobirovna TASHMUKHAMEDOVA

Department of Microbiology and Biotechnology,
National University of Uzbekistan named after Mirzo Ulugbek,

Lola Tairxonovna PULATOVA

Department of customs expertise and classification of goods,
Military Customs Institute,

Malika Alisherovna ISKANDAROVA

Department of Ophthalmology, Pediatric Ophthalmology,
Tashkent Pediatric Medical Institute.

PLANT CARBOHYDRATE-RECOGNIZING PROTEINS AND THEIR PRACTICAL SIGNIFICANCE

For citation: T.U. Aripova, Sh.S. Tashmukhamedova, L.T. Pulatova M.A. Iskandarova PLANT CARBOHYDRATE-RECOGNIZING PROTEINS AND THEIR PRACTICAL SIGNIFICANCE Journal of Biomedicine and Practice. 2021, vol. 6, issue 3, pp.58-62



<http://dx.doi.org/10.26739/2181-9300-2021-3-8>

ANNOTATION

In this article plant lectins and their specifications as biologically active substances of non-immune origin, possessing a common property of specifically binding to the surface of bacterial cells and viral protein are examined. The main attention is paid to the possibility of using plant lectins in medicine and biomedical practice.

Key words: Lectins, phytohemagglutinin, proteins, virus, cancer cells.

Тамархон Уктамовна АРИПОВА

Директор Института Иммунологии АНРУз

Шохиста Собировна ТАШМУХАМЕДОВА

Кафедра «Микробиологии и Биотехнологий»,
Национальный университет Узбекистана им. Мирзо Улугбека,

Лола Таирхановна ПУЛАТОВА

Кафедра «Таможенная экспертиза и классификация товаров»,
Таможенный институт ГТК РУз,

Малика Алишеровна ИСКАНДАРОВА

Кафедра «Офтальмологии, детской офтальмологии»
Ташкентский Педиатрический Медицинский институт.

РАСТИТЕЛЬНЫЕ УГЛЕВОДУЗНАЮЩИЕ БЕЛКИ И ИХ ПРАКТИЧЕСКОЕ

ЗНАЧЕНИЕ

АННОТАЦИЯ

В данной статье рассматриваются растительные лектины и их значение как биологически активных веществ неиммунного происхождения, обладающих общим свойством специфично связывающихся с поверхностью бактериальных клеток и вирусным белком. Основное внимание уделено возможности применения лектинов растений в медицине и биомедицинской практике.

Ключевые слова: Лектин, фитогемагглютинин, белки, вирус, опухолевые клетки.

Тамархон Уктамовна АРИПОВА

ЎзР ФА Иммунология институти директори

Шохиста Собировна ТАШМУХАМЕДОВА

Микробиология ва Биотехнология кафедраси,

Мирзо Улуғбек номидаги Ўзбекистон Миллий университети

Лола Таирхановна ПУЛАТОВА

Божхона экспертизаси ва товарларни таснифи кафедраси

ЎзР ДБК Божхона институти

Малика Алишеровна ИСКАНДАРОВА

Офтальмология, болалар офтальмологияси кафедраси

Тошкент Педиатрия Тиббиёт Институти

УГЛЕВОДЛАР БИЛАН БОҒЛАНУВЧИ ЎСИМЛИК ОҚСИЛЛАРИ ВА УЛАРНИНГ АМАЛИЙ АҲАМИЯТИ

АННОТАЦИЯ

Ушбу мақолада вирус оқсиллари ва бактерия хужайраларининг қобиғи билан специфик боғланадиган, иммун табиатга эга бўлмаган ўсимликлардан олинган биологик фаол моддалар, яъни лектинларнинг аҳамияти ҳақида маълумотлар келтирилган. Асосий эътибор ўсимлик летинларининг тиббиётда ва биотиббиёт амалиётида қўлланилиш имкониятига қаратилган.

Калит сўзлар: Лектин, фитогемагглютинин, оқсиллар, вирус, ўсма хужайралари.

Relevance

In recent decades, glycobiology has been actively developing and has made a number of amazing discoveries. The role of glycoproteins in particular plant lectins with various unique properties has been clarified. Glycoproteins are a special group of proteins that are capable of highly specific recognition and reversible binding of certain carbohydrate structures without causing chemical modifications in them. This unique biological property distinguishes glycoproteins, in particular plant lectins, from enzymes and other proteins, making them invaluable tools in solving various biomedical problems (1-2). It should be noted that plant glycoproteins - lectins are a group of proteins of non-immune origin that have the general property of specifically binding with the cell surface of bacterial cells and viral protein. They perform recognition at the cellular and molecular level and play numerous roles in the phenomena of biological recognition of glycolipids, viral glycoproteins, carbohydrates and proteins (3) This property of glycoproteins has allowed researchers to focus on the structure of the protein molecule. They discovered a new important property of protein molecules to promote smaller protein structures, the so-called domains, within large molecules. These are, as it were, separate parts of a large molecule that perform an important biological role. It is these domains that are actively involved in the attachment of erythrocytes to the receptor site and their adhesion and in the implementation of agglutination.

Materials and methods

To isolate lectin from beans, a weighed portion of 100 grams was taken and homogenized in 100 ml of 0.1 M phosphate buffer, pH 7.5. Then the homogenate was filtered through cheesecloth, the resulting precipitate was washed three times with 0.01 M phosphate buffer. The supernatant was separated. For this, 60% ammonium sulfate was precipitated and centrifuged for 30 minutes at 10,000

rpm. After centrifugation, the supernatant was separated and the lectin activity in the sediment was determined using the hemagglutination method.

Results and discussion

One of the methods allowing to increase the sensitivity of the reaction of hemagglutination of lectins with erythrocytes and at the same time to increase the activity of lectins is the modification of erythrocytes with proteolytic enzymes with trypsin. Enzymatic treatment of erythrocytes with a proteolytic enzyme leads to the removal of glycoproteins, including sialoglycoproteins, from the surface of erythrocyte membranes. As a result of this process, a decrease in the surface of the charge and the release of receptors for interaction with lectin are observed on the surface of erythrocytes. (4) This approach provides an opportunity to assess the activity of lectins and their use in medical practice.

Thus, having preparations of lectins of plant origin called phytohemagglutinins (PHA) with specificity and the ability to selectively bind to carbohydrate receptors of cells, they can be used in the diagnosis of various diseases, in the determination of blood groups, in the isolation of certain forms of lymphocytes during bone marrow transplantation, they are necessary reagents in protein chemistry research.

In addition, some lectins are used as antiviral drugs and have an antibacterial effect and to a greater extent inhibit the proliferation of tumor cell lines. The most pronounced cytotoxic effect is manifested against tumor cells of human breast cancer. These lectins include toxic plant glycoproteins isolated from castor bean seeds. These toxic proteins can cause fatal poisoning when consumed by animals and humans, but toxic lectins from castor bean, mistletoe, abrus, momordica have a pronounced antitumor effect.

Among these, mistletoe lectins have slightly greater therapeutic breadth and less toxicity to normal cells. Mistletoe is a plant of the genus *Viscum* from the sandalwood family of plants. Popular names for mistletoe are druidic leg, witch's broom, and witch's grass. The expressions themselves already indicate the special importance of the plant in medicine and biomedicine. Mistletoe has long been known in the German-speaking world as one of the most commonly used drugs in the field of complementary cancer medicine. The antitumor activity of mistletoe was identified by M.D. Lutsik. The author, in his experiments with intraperitoneal administration to mice at a dose of 10 µg / kg, lectin isolated from mistletoe showed high antitumor activity and efficiency. At the same time, the author noted that various tumor cells were unequally sensitive to the action of lectin isolated from mistletoe. Mistletoe lectins had a more suppressive effect on tumor cells in Sarcoma 37 (C-37). On the basis of scientific research, the antitumor effect of mistletoe lectin and its mechanism of action have been established. At the same time, it was noted that the use of lectins in the native state in medicine is impractical. This is due to the fact that lectins are foreign toxic proteins and they are able to accumulate in the body.

In this regard, immunotoxin conjugates based on monoclonal antibodies have been synthesized to increase the efficiency of toxic lectins. These immunoconjugates, the so-called carbohydrate-binding conjugated proteins, are targeted to tumor cells at early stages of their development and destroy them without damaging normal cells. It should be noted that conjugated lectin exerts different types of influence on the cell, depending on the receptor with which it binds. Some conjugated lectins reduce the formation of blood vessels in the tumor area, but they also inhibit apoptosis. When lectin interacts with a carbohydrate-specific receptor, autophagy or apoptosis is triggered. This process proceeds along one of the possible pathways - a transmembrane change in the electric potential of the mitochondria or the formation of reactive oxygen species.

It should be noted that despite the fact that lectins appeared in oncology relatively recently, commercial test systems have already been created on the basis of carbohydrate-binding proteins, in some oncopathologies, for example, the AFP test for hepatocellular carcinoma from Wako Diagnostics. GP Biosciences Ltd. manufactures microchips including a panel of 41 lectins for biomarker diagnostics. Despite the great potential for the use of lectins in the diagnosis and therapy of cancerous tumors, however, they still remain a class of compounds that require more close attention. Perhaps, in the next decade we will witness major victories over cancerous tumors.

Undoubtedly, lectins will play an important role in these achievements and victories.

The unique property of glycoproteins has led to the discovery of another important property of some plant lectins. It is known that at present the world community has exacerbated the problems associated with the treatment and removal of viral infections, in particular coronaviruses and viral particles from the blood of patients to reduce the viral load in the infected plasma. Today, for quality control and treatment of the population, various medical methods are used, in particular, combined antiviral drugs are mainly used. It should be noted that drug therapy for viral diseases gives a good effect, but during treatment, drugs often limit the effectiveness of therapy and show side effects on the body. In addition, the use of drug combinations for the treatment of viral infections results in the emergence of drug resistant mutants and the presence of untreatable viral reserves. Therefore, existing treatments do not completely eliminate the virus and the protein of the virus.

In order to increase the effectiveness of treatment and to reduce the viral load in infected plasma, certain measures are required to ensure the safety of the population from contracting viral infections. Despite the results obtained in the treatment of Covid-19, the development of new scientific approaches to optimize the treatment of patients is required in the field of immunobiotechnology, medicine and biomedicine. Analysis of the literature data showed that at present, to reduce the viral load and to remove viral particles from the blood, special attention is paid to glycoproteins of plant origin (5-6) The main natural function of lectins, as noted above, is the recognition of carbohydrate receptors on macromolecules and cells, therefore it is logical to assume that in this direction their application will be the most effective. In this regard, in this work, the purification of lectin from beans was carried out and some carbohydrate specificity was studied. It should be noted that, as mentioned above, the use of lectins in the native state is impractical. Therefore, at present, for example, when purifying blood from viral particles or pathologically altered cells and glycoproteins, some immobilized lectins can be used.

It can also be noted that with the help of lectins mitogenic stimulation of human lymphocytes is possible, which increases their protective function. With the help of lectins, blood cells can be separated under mild conditions. For example, peanut lectin is a unique tool for separating human cortical (immature) and medullary (mature) thymocytes. In addition, the possibility of using lectins for targeted drug delivery is being considered, since they are able to bind to certain types of cells or tissues, creating increased concentrations in those places.

Summarizing the above, we can say that biomedicine of the future will be able to use various lectins of plant origin in the treatment of various human diseases and diagnostics, pharmaceuticals, but this requires the latest approaches and methods, which are currently beginning to develop.

Conclusions

1. In this work, lectins are considered as the main biologically active substances of many plants, which are effective for the treatment of many human diseases. It was also noted that lectins of plant origin called phytohemagglutinins have specificity and the ability to selectively bind to carbohydrate receptors of bacterial cells and viruses.

2. The paper presents data on the lectins of the mistletoe of the genus *Viscum* from the sandalwood plant family, and its antitumor activity, mechanism of action. The possibilities of using conjugated lectin, which reduce the formation of blood vessels in the tumor area, are also shown.

Bibliography:

1. V.V. Ignatov Carbohydrate-binding proteins - lectins. *Sorosovskiy obrazovatelnyy jurnal* 1997, № 2, P. 14–15
2. M.V. Lakhtin, V.M. Lakhtin, S.S. Afanasyev, L.V. Pozhalostina, N.A. Kakhanovskaya, V.F. Karsun Healing and probiotic potential of lectin-containing herbal remedies. *Prakticheskaya fitoterapiya*. Moscow, 2009. P5-12.
3. V.F. Karsun, V.M. Lakhtin, E.V. Karsun, A. Mishkina Phytolectins. - Moscow. Practical medicine. 2007, P 288.
4. A.V. Babosha Biokhimiya. 2008. Вып. 7. P.1007.

5. Chikalovets I.V., Molchanova V.I., Bulnakov A.A., Chernikov O.V., Petrova I.Yu., Lukyanov P.A. (2010). The use of lectins for the diagnosis of a number of socially significant human diseases. Bulletin No. 5.2010 1–6 p.
6. O. L. Kandelinskaya, E.R. Grishenko, L.V. Obukhovskaya et al. Lectins of medicinal plants of the wild-growing flora of Belarus: prospects for use. Bulletin. No. 2, 2011, pp. 169-182