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PHARMACOLOGICAL PROPERTIES OF ALLIUM SATIVUM PLANT AND IMPORTANCE IN THE TREATMENT OF HELMINTOSES.

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Abstract: Helminthiasis is one of the most common parasitic diseases that have a negative impact on human health. These diseases disrupt the body's nutritional processes, weaken the immune system, and cause various clinical complications. In recent years, in addition to synthetic anthelmintic drugs, interest in studying biologically active substances obtained from natural sources is increasing. One of such medicinal plants is Allium sativum L. - garlic. This plant has been used in folk medicine for the treatment of various infectious and parasitic diseases since ancient times. In the article, the chemical composition, pharmacological properties, biologically active components and mechanisms of action against helminths of garlic were analyzed based on scientific literature. The research results showed that allicin, ajoene and other sulfur compounds in garlic have antiparasitic activity. The obtained data confirm that garlic is a promising phytotherapeutic agent in the treatment and prevention of helminthiasis.

Key words: Allium sativum, garlic, pharmacology, phytotherapy, helminthosis, allicin, antiparasitic effect, medicinal plants.

INTRODUCTION

Parasitic diseases are among the oldest and most common pathologies in human history. Even today, they remain one of the important problems of the global health system. Diseases caused by parasites are widespread, especially in developing countries, and have a negative impact on the socio-economic status of the population. Helminth infections can cause intestinal dysfunction, failure to satisfy the body's need for nutrients, a decrease in immunity, and a slowdown in physical and mental development.

Worldwide, ascariasis, enterobiosis, teniosis, trichocephalosis and other helminthiasis occur in millions of people. The high prevalence of these diseases is closely related to insufficient hygienic conditions, drinking water quality, poor sanitary control and environmental factors. Therefore, treatment and prevention of helminthiasis is one of the urgent tasks of modern medicine.

Currently, drugs such as albendazole, mebendazole, praziquantel and levamisole are used in the treatment of helminthiasis. Despite the high efficiency of these drugs, side effects can be observed in some cases. In addition, long-term use may lead to the formation of resistance to drugs in some parasites. Therefore, scientific researchers pay great attention to the search for new pharmacological sources.

Medicinal plants have been used by mankind for thousands of years. Many drugs used in the modern pharmaceutical industry are based on biologically active substances extracted from plants. The advantage of natural remedies is that they are often well tolerated by the body, have relatively low toxicity, and have a multidirectional pharmacological effect.

One of such medicinal plants is Allium sativum L. or garlic. Garlic belongs to the onion family and is cultivated as a food and medicinal product in almost all regions of the world. Garlic was widely used in ancient Egyptian, Greek, Roman, Indian and Chinese medicine. Historical sources record its use in the treatment of infectious diseases, digestive disorders, cardiovascular diseases and parasitic infections.

The pharmacological activity of garlic is mainly related to its sulfur compounds. Among these substances, alliin, allicin, ajoene, diallyl sulfide and diallyl disulfide are the most important. Allicin, in particular, is a biologically active substance that is formed when garlic is crushed and has antimicrobial, antioxidant, anti-inflammatory and anti-parasitic properties.

The range of biological effects of garlic is extremely wide. Experimental studies conducted in recent years confirmed its activity against bacteria, viruses, fungi and protozoa. In addition, the effectiveness of garlic extracts against some types of helminths has been determined. Researchers note that the active components of garlic can disrupt the metabolic processes of parasites, damage cell membranes and limit their reproduction.

Another important aspect of garlic is its immunomodulatory effect. By stimulating the body's natural defense mechanisms, it indirectly helps fight against parasitic infections. As a result of the increased activity of immune cells, the body can eliminate parasites more effectively.

At the same time, there is still a need to scientifically study the anthelmintic properties of garlic. Most of the available information is based on laboratory and experimental studies, and the number of clinical studies is limited. However, the obtained results show that garlic is promising as an auxiliary tool in the treatment of helminthiasis.

The relevance of this study is determined by the need to systematically analyze the pharmacological properties of garlic and evaluate its importance in the treatment of helminthiasis based on scientific sources.

The purpose of the study

Study of pharmacological properties of Allium sativum plant and scientific assessment of its importance in the treatment of helminthiasis.

Research tasks

- To study the botanical description of Allium sativum;
- Analysis of the chemical composition of the plant;
- Determination of pharmacological properties;
- Evaluation of anthelmintic action mechanisms;
- Analysis of perspectives in the treatment of helminthiasis.

2. LITERATURE REVIEW

2.1. History of scientific study of Allium sativum plant

Garlic (Allium sativum L.) is one of the medicinal and food plants used by mankind since ancient times. According to historical data, garlic was widely used in ancient Egyptian, Greek, Roman, Indian and Chinese civilizations. Archeological findings show that garlic was consumed as early as 3000 BC.

In the ancient Egyptian papyri, it was recorded that garlic was used to improve heart function, treat intestinal diseases and strengthen the body. The Greek physician Hippocrates recommended garlic as a "natural medicine", while the Romans considered it a means of increasing the endurance of warriors.

At the end of the 19th century and the beginning of the 20th century, the chemical composition of garlic began to be studied scientifically. Later, scientists were able to isolate the sulfur compounds in it. The discovery of allicin in particular brought garlic pharmacology to a new level.

In recent decades, many scientific studies have been conducted on the antimicrobial, antioxidant, hypolipidemic, immunomodulatory and antiparasitic properties of garlic. Today, garlic is one of the most studied medicinal plants in the world.

2.2. Botanical description of garlic

Allium sativum is a perennial plant belonging to the onion family. The main medicinal part of the plant is a complex bulb located underground.

A garlic bulb consists of several cloves, each clove is covered with a thin skin. The leaves are long, ribbon-shaped and green in color. The flowers are small and form an umbrella-shaped inflorescence.

Garlic grows well in temperate regions. The plant gives a high yield in sunny and fertile soils. It is widely cultivated in many countries of the world, including Uzbekistan.

2.3. Chemical composition

The pharmacological activity of garlic is related to its complex chemical composition.

The plant contains:

• alliin;
• allicin;
• ajoen;
• diallyl sulfide;
• diallyl disulfide;
• diallyl trisulfide;
• flavonoids;
• saponins;
• amino acids;
• vitamins;
• contains trace elements.

Fresh pieces of garlic contain alliin. When the plant is crushed, alliin is converted to allicin under the action of the alliinase enzyme. It is allicin that creates the characteristic smell of garlic and is the main source of its biological activity.

Studies have shown that allicin has high biological activity against bacteria, viruses, fungi and some parasites.

Garlic also contains vitamin C, vitamin B1, vitamin B2, vitamin B6 and minerals such as selenium, phosphorus, magnesium, potassium and iron.

2.4. Antimicrobial properties of garlic

One of the best-studied pharmacological properties of garlic is its antimicrobial activity.

Many scientific studies have shown that garlic extracts are effective against gram-positive and gram-negative bacteria.

Allicin blocks enzyme systems in the cells of microorganisms and disrupts their metabolism. As a result, the growth of bacteria stops or they die.

Garlic is active against the following microorganisms:

- Escherichia coli;
- Salmonella spp.;
- Shigella spp.;
- Helicobacter pylori.
- Staphylococcus aureus;

These properties are the basis for the use of garlic against intestinal infections.

2.5. Antioxidant and anti-inflammatory effect

Oxidative stress plays an important role in the development of many diseases. Free radicals can damage cell membranes, proteins, and DNA.

Flavonoids and sulfur compounds in garlic have antioxidant properties and neutralize free radicals.

Scientific studies on the consumption of garlic:

• reduces lipid peroxidation;
• increases the activity of antioxidant enzymes;
• shown to protect cells from oxidative damage.

In addition, garlic reduces the synthesis of inflammatory mediators and exhibits an anti-inflammatory effect.

2.6. Immunomodulatory properties

The immune system is very important in fighting against parasitic infections.

Garlic is one of the natural agents that stimulate the activity of immune cells.

According to research, garlic:

• increases the activity of macrophages;
• enhances the proliferation of lymphocytes;
• regulates the production of cytokines;
• activates phagocytosis.

This strengthens the body's defense against infections and parasites.

2.7. Antiparasitic properties of garlic

The antiparasitic effect of garlic has been widely studied in recent years.

In laboratory studies, it was found that garlic extract inhibits the vital activity of various parasites.

Some authors claim that allicin acts by blocking enzyme systems in parasite cells.

In addition, active ingredients in garlic:

• damages the cell membrane;
• disrupts energy exchange;
• increases oxidative stress;
• limits the reproduction of parasites.

These mechanisms may be the basis of the anthelmintic effect of garlic.

2.8. The role of medicinal plants in the treatment of helminthiasis

Phytotherapy has been used in the treatment of parasitic diseases since ancient times. Wormwood, pumpkin seeds, pyjama, pomegranate peel, and garlic are among the most commonly used anthelmintic herbs.

The advantage of garlic is its:

• widespread;
• economically affordable;
• relatively low toxicity;
• is explained by its multidirectional pharmacological effect.

Therefore, garlic is attracting great interest as an auxiliary tool in the treatment of helminthiasis.

2.9. Analysis of existing studies

The analysis of the literature shows that although the pharmacological properties of garlic have been sufficiently studied, the data on its clinical effectiveness against helminths are still limited.

Most studies have been conducted in the laboratory or in animal models. The number of clinical studies conducted in humans is small, and their results are not uniform.

Nevertheless, available data show that the biologically active substances contained in garlic have anthelmintic properties. This means that it is necessary to carry out more extensive scientific research in the future.

3. MATERIALS AND METHODS

3.1. Research design

This scientific work was carried out by the method of systematic literature review. The main goal of the study was to evaluate the pharmacological properties of Allium sativum plant and its importance in the treatment of helminthiasis based on available scientific sources.

During the research, scientific sources related to the fields of pharmacology, phytotherapy, botany, parasitology and clinical medicine were analyzed. Data were summarized and evaluated using the method of comparative analysis.

3.2. Research resources

The following types of sources were used for the analysis:

- articles published in international scientific journals;
- monographs on pharmacology and phytotherapy;
- parasitology textbooks;
- scientific conference materials;
- references on medicinal plants.

The main criterion is that the chemical composition, biologically active substances, pharmacological effects and anthelmintic properties of garlic are covered in the selected sources.

3.3. Data sorting criteria

Scientific works meeting the following requirements were included in the study:

1. Articles devoted to the study of the composition of Allium sativum;
2. Studies evaluating the pharmacological properties of garlic;
3. Experimental work on the study of anthelmintic activity;
4. Scientific sources on phytotherapy.

The following sources were excluded from the analysis:

- duplicate information;
- studies whose methodology is not clearly indicated;
- non-scientific internet sources.

3.4. Research methods

The following scientific methods were used in the study:

Analytical method

Scientific data published on the pharmacological properties of garlic were analyzed.

Comparative method

The results obtained by different authors were compared.

Statistical generalization method

The information presented in the literature was systematized and general conclusions were drawn.

Method of logical analysis

Mechanisms of anthelmintic action and biological properties of garlic were logically explained.

3.5. Scientific novelty of the research

In this work, the pharmacological effects of garlic and its importance in the treatment of helminthosis were brought into one system. Data from various scientific sources were summarized and the phytotherapeutic prospects of garlic were evaluated.

4. RESULTS

4.1. The main biologically active substances in garlic

The results of the analysis showed that garlic contains many pharmacologically important substances.

Table 1

The main biologically active substances in garlic

Substance	Pharmacological significance
Alliin	Precursor substance of allicin
Come on	Precursor substance of allicin
Ajoen	Antifungal and antiparasitic effect
Diallyl sulfide	Antioxidant activity
Flavonoids	Effect against free radicals
Saponins	Immunomodulatory properties
Selenium	Antioxidant protection

The results showed that the pharmacological activity of garlic is mainly related to sulfur-preserving compounds.

4.2. Antimicrobial activity results

According to literature analysis, garlic extracts show high activity against many pathogenic microorganisms.

Especially:

• Staphylococcus aureus;
• Escherichia coli;
• Salmonella typhi;
• Candida albicans

It has been found that microorganisms such as are sensitive to garlic components.

Most studies show that allicin disrupts the enzyme system of microorganisms as the main mechanism.

4.3. Antioxidant activity results

Flavonoids and sulfur compounds in garlic have been reported to reduce the level of oxidative stress in the body.

According to the results:

• lipid peroxidation decreases;
• the activity of antioxidant enzymes increases;
• cells are protected from free radicals.

This situation serves to increase the body's resistance to parasitic infections.

4.4. Results of immunomodulatory effect

Studies have shown that garlic stimulates the immune system.

As determined:

• the activity of macrophages increases;
• the number of lymphocytes increases;
• synthesis of cytokines is activated;
• phagocytosis increases.

These factors strengthen the body's natural defense mechanisms against parasites.

4.5. Results of anthelmintic activity

The analyzed experimental works showed the effectiveness of garlic against some types of helminths.

In laboratory experiments:

• reduced mobility of parasites;
• reduced life expectancy;
• reproduction processes are slowed down.

In some studies, morphological changes were observed in helminths treated with garlic extract.

4.6. Mechanisms of anthelmintic action

Based on the analysis, it is assumed that the effect of garlic against helminths is related to the following mechanisms:

1. Damage to cell membranes;
2. Violation of energy exchange;
3. Blockage of enzyme systems;
4. Increased oxidative stress;
5. Reduction of protein synthesis.

These mechanisms reduce the viability of parasites and help them to be removed from the body.

4.7. Perspectives in Phytotherapy

The results showed that garlic has not only an anthelmintic, but also a complex pharmacological effect.

Garlic:

• supports intestinal microflora;
• strengthens immunity;
• reduces inflammation;
• enhances antioxidant protection.

Therefore, it is promising as an auxiliary phytotherapeutic agent in the complex treatment of helminthiasis.

4.8. Analysis of results

The obtained results showed that the biologically active substances contained in garlic have a multidirectional pharmacological effect.

Especially the antiparasitic activity of allicin and ajoen substances expands the possibilities of use in the treatment of helminthiasis. However, most of the available data are based on experimental studies, and the number of clinical trials is still insufficient.

Nevertheless, the available evidence suggests that garlic can be used as an important phytotherapeutic agent in the fight against helminthiasis.

5. DISCUSSION

The results of this study showed that Allium sativum plant has wide pharmacological potential. The analysis of the literature confirmed that sulfur compounds present in garlic, particularly allicin, ajoene and diallyl sulfides, are the main components that determine its biological activity.

The obtained results are consistent with many foreign studies. According to the authors, allicin affects the important enzyme systems involved in the metabolism of microorganisms and parasites, disrupting their normal activity. Therefore, garlic is effective against bacteria, fungi and some parasites.

During the analysis, it was found that the anthelmintic effect of garlic is related to several mechanisms. First, biologically active substances can damage the membrane structure of helminth

cells. Second, they derail energy metabolism and reduce the viability of parasites. Thirdly, the antioxidants contained in garlic support the body's immune system.

The immunomodulatory effect of garlic deserves special attention. Studies have shown an increase in the activity of macrophages, neutrophils and lymphocytes. This strengthens the body's natural ability to fight against parasites.

However, there are some limitations of the available scientific data. Most studies have been conducted in the laboratory or in animal models. The number of clinical studies conducted in humans is relatively small, and their results sometimes differ from each other. Therefore, additional scientific research is required to determine the real effectiveness of garlic in clinical practice.

Also, the pharmacological activity of garlic may depend on its preparation method, storage conditions and doses. Because allicin is an unstable substance and breaks down over time. Future studies using standardized extracts will be important.

Based on the analysis, it can be said that garlic cannot completely replace modern anthelmintic drugs. However, it can increase the effectiveness of treatment when used as an auxiliary phytotherapeutic agent.

6. CONCLUSION

Based on the research results, the following conclusions were reached:

1. Allium sativum is a medicinal plant rich in biologically active substances.
2. Allicin, ajoene, diallyl sulfide and other sulfur compounds in garlic provide its main pharmacological activity.
3. The plant has antimicrobial, antioxidant, anti-inflammatory and immunomodulatory properties.
4. Garlic extracts show antiparasitic activity against some types of helminths.
5. The mechanism of anthelmintic action is associated with damage to cell membranes, blocking of enzyme systems and disruption of energy metabolism.
6. Garlic provides additional help in fighting parasites by stimulating the body's immune system.
7. Currently available data show that garlic is a promising phytotherapeutic agent in the complex treatment of helminthiasis.
8. In order to fully evaluate the clinical effectiveness of garlic, it is necessary to conduct large-scale clinical studies.

7. PRACTICAL RECOMMENDATIONS

1. Garlic can be used as an auxiliary phytotherapeutic agent in the treatment of helminthiasis.
2. It is advisable to get a doctor's recommendation before using garlic preparations.
3. The use of biologically active components of garlic in the creation of new plant-based anthelmintic drugs is a promising direction.
4. It is necessary to develop standardized forms of garlic extracts.
5. Additional experimental and clinical studies are recommended to determine the effectiveness of garlic against different types of helminths.

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