PHENOLOGICAL OBSERVATION OF ALLERGIC PLANTS AND IMPACT ON HEALTH

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SUMMARY

Background: *For the last 40 years, allergies have been presented as diseases of modern lifestyle, which affect more and more people. Furthermore, they are becoming an increasing social problem, burdening society economically, through absence from work, school, daily activities, but also through treatment costs. Allergies are becoming a reason for difficult social contact for an increasing number of people.*

Subjects and methods: *The materials used are the results of laboratory research and data collected during 2021, 2022 and 2023 from patients allergic to pollen at the Mostar Health Center. The Microsoft Excel 2013 software system was used to process the results.*

Results: *The most common disease during 2021, 2022 and 2023 in the city of Mostar was vasomotor and allergic rhinitis, followed by rhinitis, nasopharyngitis and pharyngitis. The age group from 19 to 64 years was most susceptible to these diseases, and the age group from 7 to 14 years had a high percentage of these diseases. The other age groups studied did not stand out in terms of the frequency of the disease in any of the diseases.*

Conclusion: *The research found that the most common disease during 2021, 2022 and 2023 was vasomotor and allergic rhinitis. The use of the globe protocol can help people suffering from pollen allergies. When monitoring phenological changes, no major deviations in the occurrence of leafing and flowering were found, except for the church grass, which is high in June. All other grasses had moderate concentrations during 2021, 2022 and 2023. There is a connection between the time of appearance of allergens in the air (spring) and the appearance of allergy symptoms.*

Keywords: *Rhinitis, nasopharyngitis, pharyngitis, Allergies, Allegic plant*

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INTRODUCTION

The term allergy was first mentioned in 1906 as a “specifically altered reaction of the organism” (Ring, 2014). As air pollution continuously and long-term affects the health of the population, especially the urban population, it has become an increasingly important public health problem in today's civilized environment. Urbanization and increased emissions of exhaust gases are associated with an increase in the frequency of allergic respiratory diseases caused by the most powerful natural allergenic pollen. Since these are the most widespread diseases of today, i.e. pollen allergies, and pollen is transmitted through the air and as such is the main source of respiratory diseases. The main source of allergenic pollen in our area are woody plants. Most woody plants that bloom from February to May are characterized by a short but very intense pollination period, during which high and very high pollen concentrations in the air are reached, especially in March and April when pollination is most intense. This is followed by a long flowering period of grasses, from April to September. Allergies to multiple pollen types are becoming more common, while a small percentage of people are allergic to only one type of pollen. Pollination by plants from three botanical groups: trees, grasses, and weeds is important for the development of allergic diseases (Bulat –Kardum, 2013).

Despite differences in the frequency, intensity, and structure of allergies in different countries, the incidence and prevalence of allergic diseases, including allergic asthma, rhinitis, and conjunctivitis, have shown an increasing trend in recent decades (Subbarao et al. 2009). Over the past 40 years, allergies have emerged as diseases of modern lifestyles, affecting more and more people. There is no single explanation for the dramatic increase in these diseases that has been recorded since the second half of the 20th century. Allergies are no longer just a problem in industrialized countries; atopic eczema and severe forms of asthma are also common in developing countries. Furthermore, they are becoming an increasingly serious social problem, burdening society economically, through absenteeism from work, school, and daily activities, as well as through medical costs. Furthermore, they are becoming a reason for the difficulty of social contact for an increasing number of people.

Human health is directly affected by weather and climate. Changes in the phenological cycle of plants affect the frequency and severity of allergic diseases, as plant responses to climate change are also reflected in changes in plant growth, distribution, yield, and the length of the pollination season. Experts predict a further increase in allergic problems due to air pollution, climate change, changes in society's eating habits, exposure to cigarette smoke, and the increasing use of antibiotics. All of these environmental changes also affect the amount of pollen in the air and plant pollination, the length of flowering, and the spread of weed species, especially ragweed, which is a highly allergenic plant (Hrga et Stjepanović 2013).

According to the World Health Organization (WHO), as many as 300-400 million people suffer from symptoms of pollen allergy. Pollen allergy is linked to genetic predisposition and environmental factors, and occurs during the pollination period of the causative agent, most often from spring to autumn, and sometimes persists throughout the year. An allergen (plural allergens) is any substance that the body recognizes as foreign and potentially harmful, and against which it creates specific antibodies. There is a wide range of allergens that can be divided into groups according to their source: aeroallergens, food allergens, drugs, animal venoms or insect stings, contact allergens and occupational allergens. If one parent has some form of respiratory allergy, in 20-40% of cases the child will be faced with allergy symptoms. Twelve percent of children with no family history of allergies, 30% to 50% of children with allergies from one parent, and 60% to 80% of children with allergies from both parents can develop allergic disease (Ownby, 1990).

Pollen allergy is a hypersensitive reaction of the immune system to otherwise harmless substances (pollen) that we inhale or come into direct contact with. When the body is exposed to an allergen for the first time, immune cells called macrophages are activated, which transmit information about the first contact with the allergen to B lymphocytes. These cells mature into plasma cells and produce specific IgE that bind to mast cells (in the mucous membranes) and basophils (in the blood). Other immune cells - T lymphocytes - store information about the allergen. This phase is called sensitization and passes without visible symptoms. The period between the first contact with the allergen and the manifestation of allergy symptoms upon re-exposure can occur even after 10 years (Galli et al. 2008). The second phase of a true allergic reaction occurs upon re-exposure to the allergen (antigen). Specific IgE on cells (e.g. mast cells) are activated and bind allergens, which stimulates cell degranulation by releasing (histamine, heparin, carboxypeptidase A, tryptase, chymase, cathepsin G, etc.) and synthesizing prostaglandins, leukotrienes and cytokines that result in the appearance of various symptoms.

In the later stages of the allergic reaction (after 3-6 hours), eosinophils, basophils and Th2 lymphocytes are activated. Due to constant exposure to the allergen, activation of Th2 lymphocytes, production of eosinophils, immunoglobulin IgE and other specific factors, chronic forms of the disease may occur (eg chronic rhinitis, chronic asthma) (Galli et al. 2008). The diagnosis of pollen allergy is based on history, specific clinical picture and diagnostic tests. In assessing a person's allergic status, laboratory tests are also indispensable: skin allergy testing for inhalation allergens (in some cases also for individual types of pollen); number of eosinophils in blood, nasal swab and sputum (cough); total and specific IgE; determination of eosinophil cationic protein (ECP). For the past thirty years, skin-prick testing (SPT) has been used in skin allergy testing for inhalant allergens. It is more specific, less painful, cheaper and correlates better with bronchoprovocation tests than the previously used intradermal test. In the diagnosis of allergic asthma in adults and children (older than 5 years), in addition to the above tests, spirometry and measurement of peak flow (PEF) and measurement of nitric oxide concentration in exhaled air are used. These methods provide insight into lung capacity, airway flow and the occurrence of airway narrowing. Sometimes, radiological findings of the lungs and paranasal sinuses are also performed for more detailed diagnostics.

In order for a particular plant species to be considered an allergen, it must meet 3 essential conditions (Coca et al. 1932):

1) must be pollinated by the wind - Plants that are pollinated by the wind (anemophilous plants) are the most common cause of allergic reaction symptoms. Their pollen is carried by the wind for kilometers and lifted up to 2-3 meters in height, since it is very dry and small (30-35 μm) and therefore light. The wind carries the male gametes in pollen grains to the pistil of the female flower of the same species, where the female gamete is. Plants that are pollinated by insects (entomophilous plants) are much less likely to cause allergic reactions because their pollen has a sticky surface and is therefore more difficult to fly through the air.

2) must produce pollen in large quantities - In order for pollination to occur in anemophilous plants, the pollen must accidentally hit the pistil of the egg cell of another plant, and therefore significantly more pollen is needed for wind pollination, which is smaller and more aerodynamic, which facilitates dispersal over greater distances. On the other hand, entomophilous plants produce much less pollen because they are pollinated by insects that transfer pollen much more precisely.

3) pollen must have allergenic properties - The structure of the pollen grain must contain allergenic compounds that will cause an allergic reaction when they come into contact with the mucous membrane.

Late winter (February) and spring (May) are the times when trees bloom and their pollen appears in the air. Late spring (May) and early summer (July) are the times when grasses bloom and their pollen is dominant in the air, while late summer (July) and early autumn (September) are when weeds bloom and their pollen concentration in the air is highest (Maleš, 2006). The morphology of plants and pollen grains is adapted to the mode of transport. Simpler-looking plant species are pollinated by amenophily (by wind) and produce large quantities of pollen grains, making them the main source of aeroallergens. In Europe, the pollination season lasts from spring to autumn. Weather conditions affect the beginning and duration of the pollination season. Dry and warm weather during flowering promotes a higher concentration of pollen grains in the air, while the concentration is lower during cold and rainy weather (Trkulja et al. 2009).

Aeroallergens are divided according to their location:

1. indoor (dust mites, cockroaches and their secretions, hair, epithelium and secretions of mammals, damp spaces - mold spores) - are related to human activity in the apartment, house or at work, are often year-round or have an extended annual duration
2. outdoor (pollen, fungal spores and mold) - are related to natural sources and partly to products of human activity, occur regionally, depending on the flora and fauna, and their period of distribution and prevalence in the air is usually seasonal (Ostojić et al. 1992).

For patients whose complaints make everyday activities difficult and reduce their quality of life, information about the movement of pollen allergens, i.e., pollen concentrations in the air and their variations, is of utmost importance. Such answers can be provided by aerobiological research conducted daily throughout the year. The analysis of these results includes meteorological parameters that have the greatest influence on pollen concentrations in the air, such as: air temperature and humidity, precipitation, and wind speeds and directions, and in addition to pollen forecasts and weather forecasts (Maleš et Topovec 2005).

By measuring the concentration and determining the type of pollen in 〖1m〗^3 of air in an area, the dynamics of pollination and the distribution of vegetation are monitored. Based on this information, a pollen calendar is created. It differs from year to year, because it depends on meteorological parameters (temperature, wind, precipitation, etc.), climate changes and environmental factors. In 1986, the European Aeroallergen Network (EAN) database was established in Vienna, which collects data on pollen concentrations from the so-called "monitoring units", located in almost all European countries. From there, data on the occurrence, types and concentration of pollen in the air are sent weekly to national centers, which forward the data to the European coordination center (Durmić, 2014). Pollen allergens are divided into 29 protein families, the most important of which are: profilins, calcium-binding proteins, beta-expansins, Bet v 1 homologs, lipid-transfer proteins, etc. There are hypothetical claims about the possibility of pollen grains bursting due to osmotic shock (during storms and thunderstorms). Submicrobial fragments and/or released starch grains can be carriers of allergens and cause asthma attacks.

SUBJECTS AND METHODS

The materials used were the results of laboratory research and data collected during 2021, 2022 and 2023 from patients allergic to pollen at the Mostar Health Center.

Over the course of three years (2021, 2022 and 2023), pollen monitoring in the air was conducted in the city of Mostar. The monitoring was conducted at the Faculty of Agronomy and Food Technology, University of Mostar. Phenological research for allergenic plants was organized according to literature data and the GLOBE server. The laboratory part of the work was carried out in the Laboratory for Biology and Applied Biology, Faculty of Agronomy and Food Technology, University of Mostar.

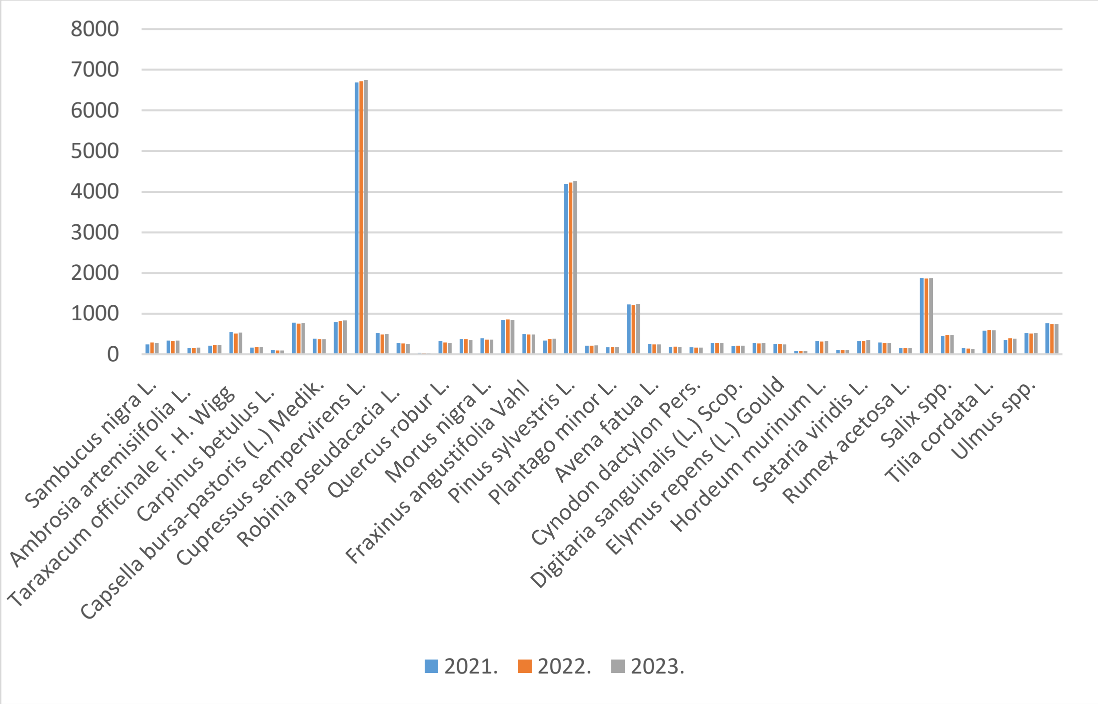
RESULTS

By collecting and analyzing data in the city of Mostar during 2021, 2022 and 2023, different types of pollen grains in the air were identified, dominated by grass, weed, cypress and pine pollen. The allergenic properties of different plant species vary from weak to strong. (Table 1).

Table 1. Pollen prevalence in the city of Mostar for 2021, 2022 and 2023

Type	Family	2021.	2022.	2023.	Allergic potential
Sambucus nigra L.	*Adoxaceae*	240	287	272	Low
Amaranthus retroflexus L.	*Amaranthaceae*	341	320	336	Mild
Ambrosia artemisiifolia L.	*Asteraceae*	160	155	163	Very high
Artemisia absinthium L.	*Asteraceae*	209	225	230	Very high
Taraxacum officinale F. H. Wigg	*Asteraceae*	540	511	538	Low
Alnus spp.	*Betulaceae*	165	177	182	Mild to high
Carpinus betulus L.	*Betulaceae*	102	98	96	High
Corylus avellana L.	*Betulaceae*	780	753	767	Mild to high
Capsella bursa-pastoris (L.) Medik.	*Brassicaceae*	386	370	367	Low
Chenopodium album L.	*Chenopodiaceae*	796	820	831	Low to mild
Cupressus sempervirens L.	*Cupressaceae*	6690	6720	6751	Low to mild
Juglans regia L.	*Juglandaceae*	524	490	502	Low to mild
Robinia pseudacacia L.	*Fabaceae*	279	266	254	Low
Castanea sativa L.	*Fagaceae*	36	28	25	Mild to high
Quercus robur L.	*Fagaceae*	328	294	285	Mild
Morus alba L.	*Moraceae*	381	367	349	Low
Morus nigra L.	*Moraceae*	392	360	358	Low
Fraxinus excelsior L.	*Oleaceae*	849	854	850	Mild to high
Fraxinus angustifolia Vahl	*Oleaceae*	496	490	485	Mild to high
Olea europaea L.	*Oleaceae*	338	374	386	Mild
Pinus sylvestris L.	*Pinaceae*	4193	4225	4267	Low
Plantago major L.	*Plantaginaceae*	216	211	220	Low to mild
Plantago minor L.	*Plantaginaceae*	170	184	182	Low to mild
Platanus spp.	*Platanaceae*	1223	1208	1240	Mild
Avena fatua L.	*Poaceae*	260	243	240	Very high
Bromus erectus Huds.	*Poaceae*	180	185	184	Very high
Cynodon dactylon Pers.	*Poaceae*	175	168	164	Very high
Dactylis glomerata L.	*Poaceae*	277	284	279	Very high
Digitaria sanguinalis (L.) Scop.	*Poaceae*	204	213	215	Very high
Echinochloa crus-galli (L.) P.Beauv.	*Poaceae*	284	265	274	Very high
Elymus repens (L.) Gould	*Poaceae*	257	249	246	Very high
Hordeum bulbosum L.	*Poaceae*	81	86	85	Very high
Hordeum murinum L.	*Poaceae*	321	315	320	Very high
Secale cerale L.	*Poaceae*	102	106	112	Very high
Setaria viridis L.	*Poaceae*	324	330	346	Very high
Reynoutria japonica Houtt.	*Polygonaceae*	289	273	281	Mild
Rumex acetosa L.	*Polygonaceae*	154	148	156	Mild
Populus spp.	*Salicaceae*	1879	1865	1872	Low
Salix spp.	*Salicaceae*	457	479	480	Low
Acer campestre L.	*Sapindaceae*	154	140	137	Low to mild
Tilia cordata L.	*Tiliaceae*	581	594	590	Low
Tilia platyphyllos L.	*Tiliaceae*	352	394	386	Low
Ulmus spp.	*Ulmaceae*	520	510	517	Mild
Urtica dioica L.	*Urticaceae*	764	740	748	Low

During 2021, 2022 and 2023, the most prevalent pollen in the city of Mostar was cypress, pine, poplar, platinum, grass and weed pollen. Pollen concentration is variable, but according to the results, it can be seen that the results did not differ much and the pollen concentration was approximately similar from year to year (Graph 1).



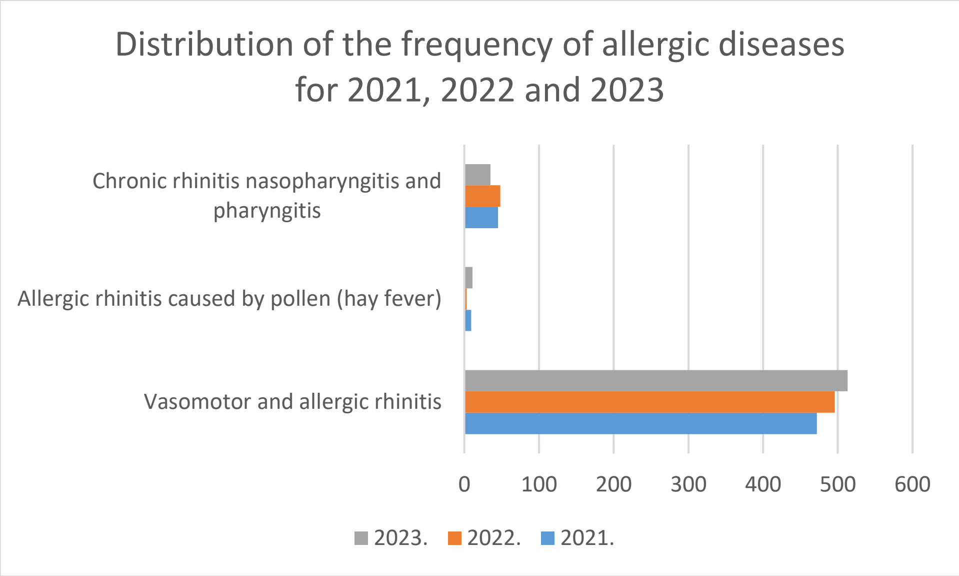
Graph 1. Prevalence of pollen grains of different plants in the city of Mostar

Based on the data obtained for the city of Mostar, a breakdown was made by types of allergic diseases (Table 2).

Table 2. Types of diseases for 2021, 2022 and 2023

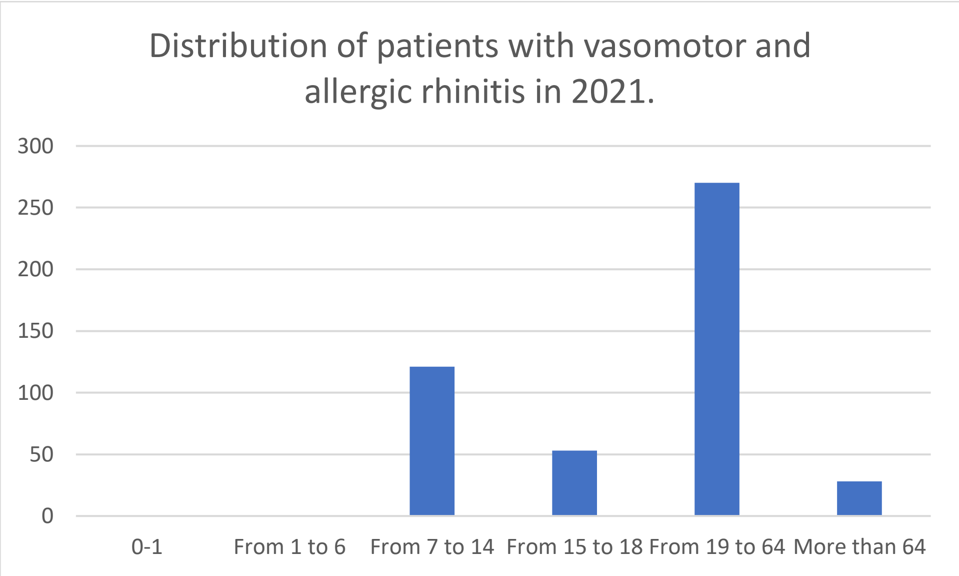
	2021	2022	2023	TOTAL
Vasomotor and allergic rhinitis	472	496	513	**1481**
Allergic rhinitis caused by pollen (hay fever)	9	3	11	**28**
Chronic rhinitis, nasopharyngitis and pharyngitis	45	48	35	**128**

The most common disease in the city of Mostar was vasomotor and allergic rhinitis, which was experienced by 513 people (35%) in 2023, 496 people (33%) had a problem with this disease in 2022, and 472 people (32%) had a problem with vasomotor and allergic rhinitis in 2021. During 2023, 35 people suffered from chronic rhinitis, nasopharyngitis and pharyngitis, which is less than in 2022 when there were 48 patients in the city of Mostar, as well as in 2021 when there were 45 patients. Allergic rhinitis caused by pollen (hay fever) was present in 11 people in 2023, while it was poorly represented in 2022, with three patients in the city of Mostar, and in 2021, the prevalence of this disease was nine people (Graph 2).



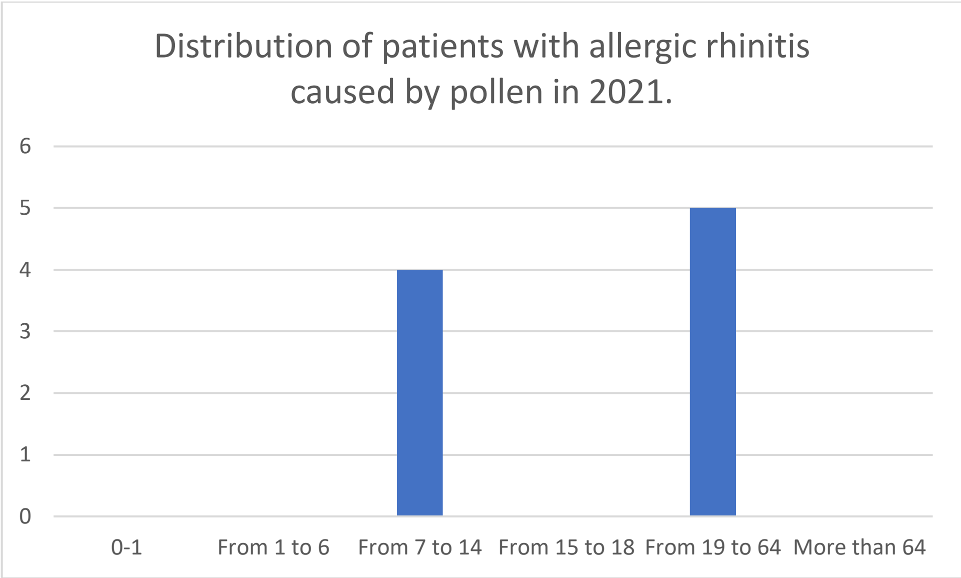
Graph 2. Distribution of the frequency of allergic diseases for 2021, 2022 and 2023.

The age group most susceptible to vasomotor and allergic rhinitis during 2021 was from 19 to 64 years old with 57% of sufferers, sufferers from 7 to 14 years old were represented by 26%, the age group from 15-18 years old had a representation of 11%, and in the group of sufferers over 64 years old the percentage was 6% (Graph 3).



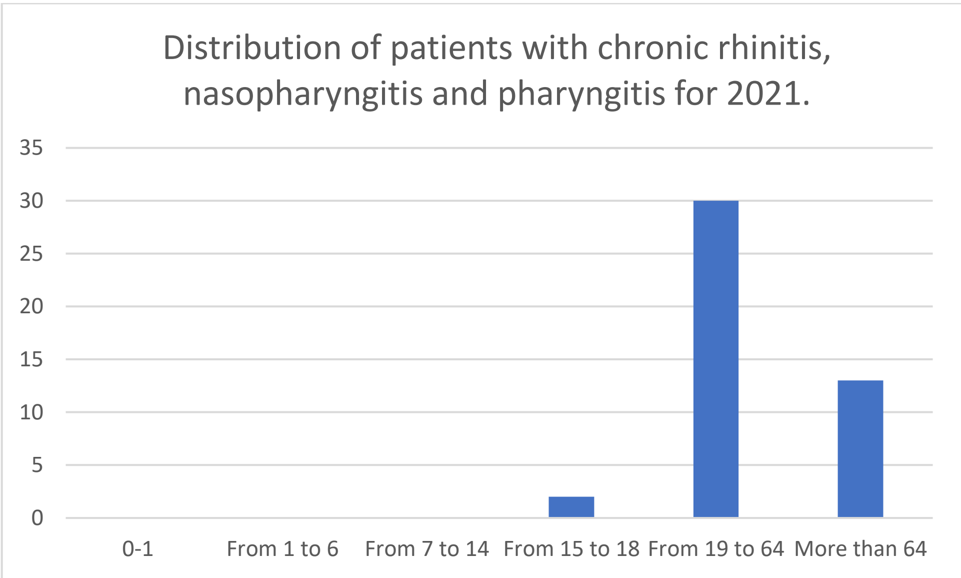
Graph 3. Age distribution of patients with vasomotor and allergic rhinitis for 2021

During 2021, the most susceptible age group of patients with allergic rhinitis caused by pollen was from 19 to 64 years old with 56% of patients, patients from 7 to 14 years old were represented by 44%, other age groups did not have this type of disease for 2021 (Graph 4).



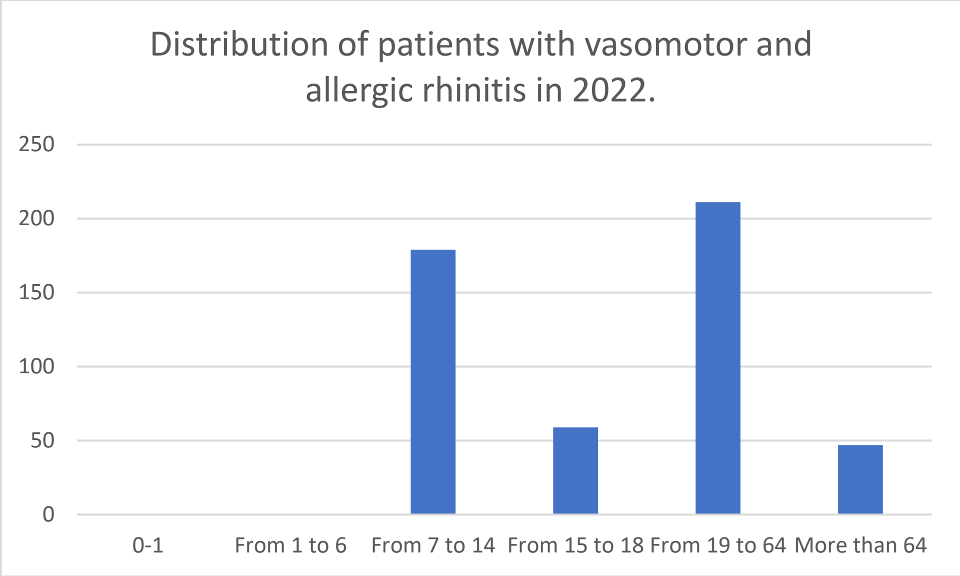
Graph 4. Age distribution of people suffering from allergic rhinitis caused by pollen in 2021

The age group from 19 to 64 years during 2021 was most susceptible to chronic rhinitis, nasopharyngitis and pharyngitis with 67% of sufferers, 29% of sufferers were older than 64 years, and the age group from 15 to 18 years had 4% of sufferers (Graph 5).



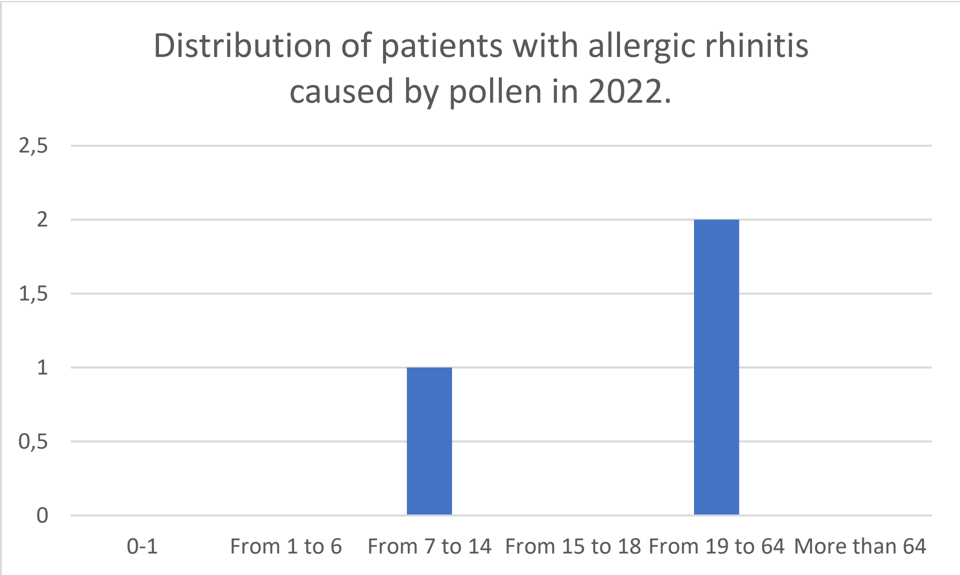
Graph 5. Age distribution of patients with chronic rhinitis, nasopharyngitis and pharyngitis for 2021

During 2022, the most susceptible age group of patients with vasomotor and allergic rhinitis was from 19 to 64 years old with 43% of patients, patients from 7 to 14 years old were represented by 36%, the age group from 15 to 18 years old had 12% of patients, while people older than 64 years were represented by 9% of patients (Graph 6).



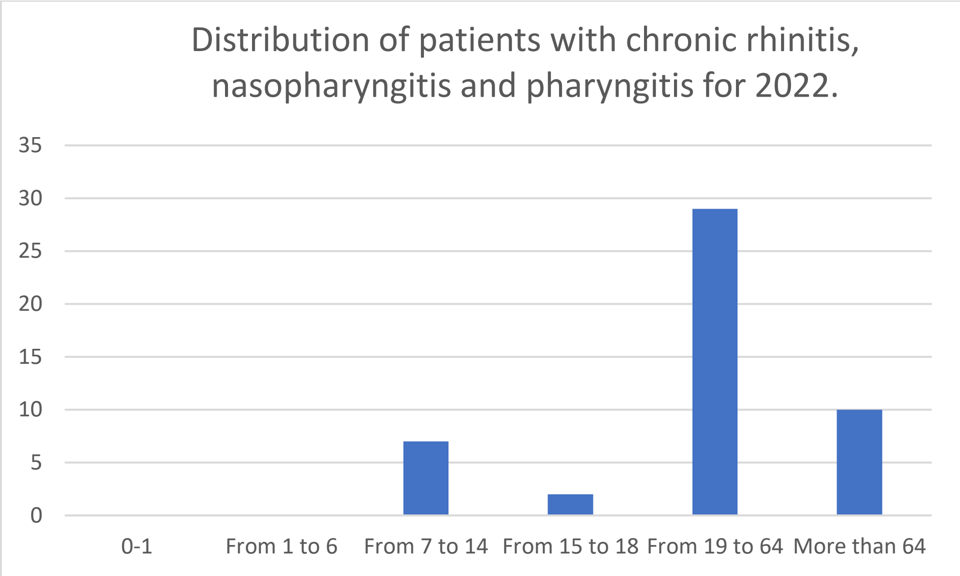
Graph 6. Age distribution of patients with vasomotor and allergic rhinitis for 2022

Patients with allergic rhinitis caused by pollen for 2022 were again in the age group of 19 to 64 years with two patients and one patient belonging to the age group of 7 to 14 years (Graph 7).



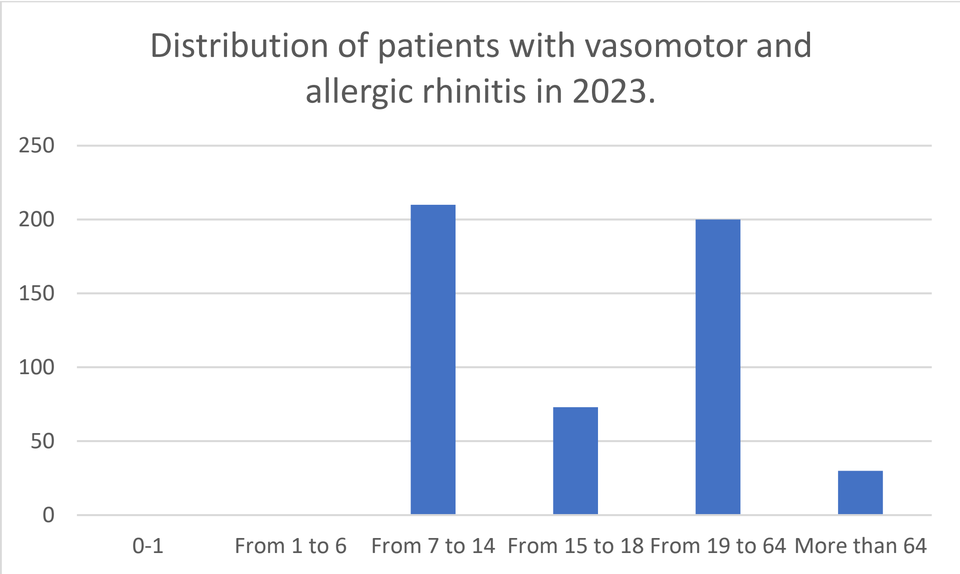
Graph 7. Age distribution of allergic rhinitis patients caused by pollen in 2022

The age group from 19 to 64 years during 2022 was the most susceptible to chronic rhinitis, nasopharyngitis and pharyngitis with 60% of patients, 21% of patients were older than 64 years, and the age group from 7 to 14 years had 15% of patients. The age group from 15 to 18 years had a low representation with 4%, while children under 7 years of age did not show symptoms of this disease (Graph 8).



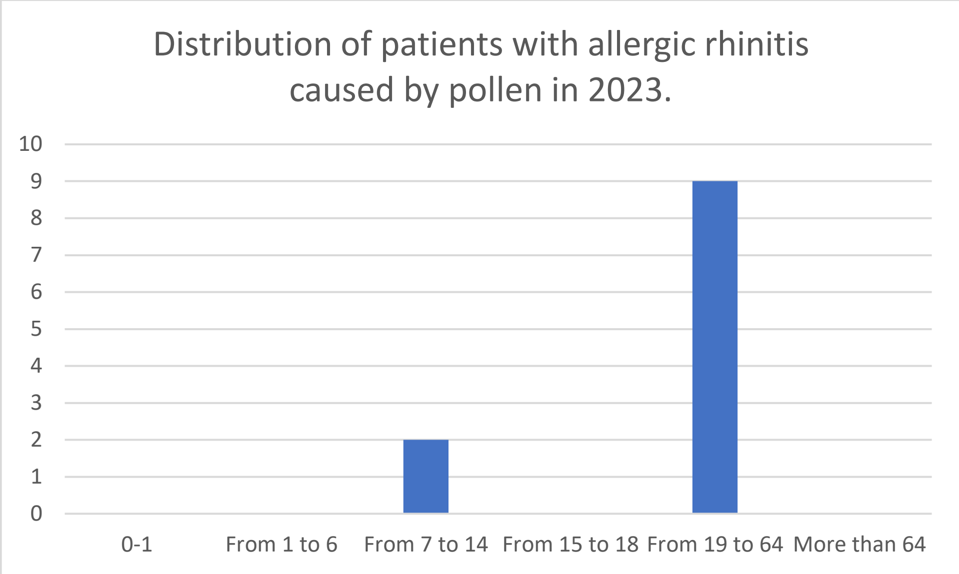
Graph 8. Age distribution of chronic rhinitis, nasopharyngitis and pharyngitis sufferers in 2022

The age group from 7 to 14 years had the most problems with vasomotor and allergic rhinitis in 2023 with 41%, followed by the age group from 19 to 64 years with 39% of sufferers. The age group from 15 to 18 years had 14% of sufferers, and sufferers older than 64 years accounted for 6% (Graph 9).



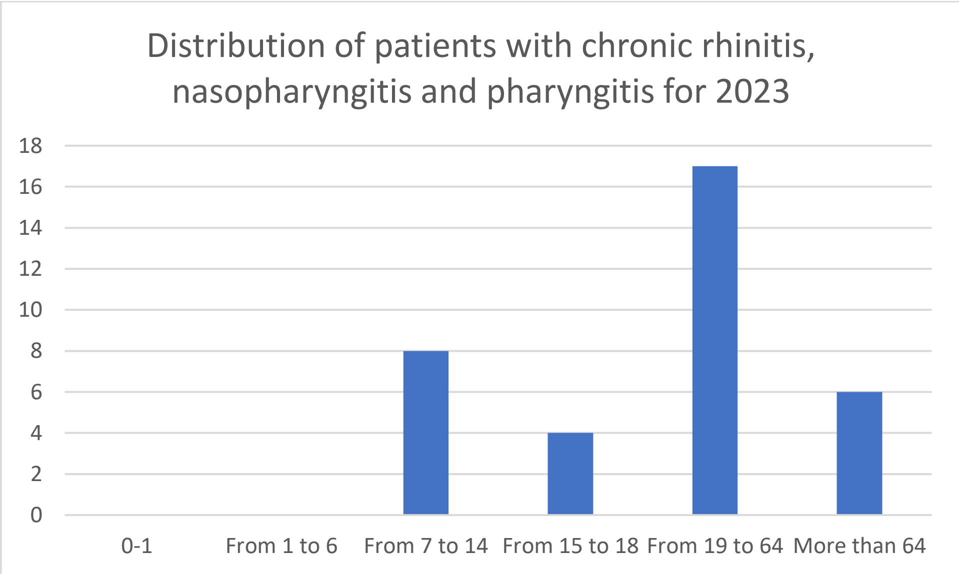
Graph 9. Age distribution of patients with vasomotor and allergic rhinitis for 2023

The largest number of patients with allergic rhinitis caused by pollen for 2023 was in the age group 19-64, 82% of them, followed by those in the age group 7 to 14 with 18% of patients (Graph 10).



Graph 10. Age distribution of patients with allergic rhinitis caused by pollen for 2023

The highest percentage of patients with chronic rhinitis, nasopharyngitis and pharyngitis was in the age group 19 to 64 years, 49%, the age group 7 to 14 years with 23% of patients. Those older than 64 years were represented with 17%, while the lowest number of patients was in the age group 15-18 years, 11% (Graph 11).



Graph 11. Age distribution of patients with chronic rhinitis, nasopharyngitis and pharyngitis for 2023

DISCUSSION

The results of the study showed that the most common disease in the city of Mostar during 2021, 2022, 2023 was vasomotor and allergic rhinitis.

The age group from 19 to 64 years was most susceptible to vasomotor and allergic rhinitis, allergic rhinitis caused by pollen, and chronic rhinitis, nasopharyngitis, and pharyngitis during the three years of follow-up. Allergic rhinitis is often accompanied by other diseases associated with hypersensitivity. This primarily refers to allergic conjunctivitis, which occurs in slightly less than half of patients with allergic rhinitis. 20-40% of patients with allergic rhinitis have asthma, and 70-90% of patients with asthma have allergic rhinitis (Bayar Muluk, 2019). Senile rhinitis or rhinitis in the elderly is a condition that affects people over 65 years of age, and is characterized by clear rhinorrhea with the presence of pathology of the nasal mucosa Papadopoulos et al. 2019). The pathophysiology of rhinitis in the elderly is not fully understood, but it is associated with cholinergic hyperreactivity (Tran et al. 2015). Due to its cholinergic basis, this disease responds well to anticholinergic therapy such as ipratropium bromide. The immune system has a perfect memory and every time it comes into contact with a substance to which it is allergic, an allergic reaction occurs. Most often, harmless reactions occur on the nasal mucosa in the form of sneezing and watery discharge, but sometimes a potentially fatal reaction, anaphylactic shock, can occur. (Popović-Grle, 2007).

Plants that were observed during 2021, 2022, 2023 in the city of Mostar are: pines, cypresses, poplars, plane trees, elms, hazel, ash, alder, hornbeam, grasses, olives, sorrel.

In addition to these plants, ragweed also occurs, its concentration is moderate in early September but its pollen has a very high allergic potential and causes problems in humans and animals (Laaidi, 2003). Grass pollen is moderate in June and July. Grass pollen (*Poaceae*) is also the most common allergen causing allergic rhinitis and conjunctivitis. In the Netherlands and France, more than 80% of allergic individuals are sensitive to their pollen (Weeke et Spieksma 1991). Some grass species show strong cross-reactivity between allergens on pollen structures (Singh et Kumar 2003). *Cuppresus sempervirens* is highly prevalent, which is often grown as a horticultural product and planted as an ornament in urban green spaces (Agea et al. 2002). Urban cultivation contributes to the spread of large amounts of allergenic pollen, so exposure to cypress pollen has been steadily increasing in recent decades. Cypress trees produce pollen in large quantities, with measured allergenic potential, and pollen is most often present from January to the end of June. The first cases of rhinoconjunctivitis caused by cypress pollen were described in 1945 in South Africa and in 1962 in France (Odman, 1945; Panzani 1962). An ecological study was conducted in cities in central Italy that confirmed a direct link between allergenic flora and urban characteristics of cities, concluding that urban phytoallergic potential depends on the geographical location of the city, the type and duration of human influence in correlation with the ecological conditions of the individual city, and on the layout of urban areas and the ecosystem of the surrounding area (Ciferri et al. 2009). It is important to emphasize that weather conditions affect the beginning and duration of the pollination season. Dry and warm weather during flowering promotes a higher concentration of pollen grains in the air, while the concentration is lower during cold and rainy weather (Trkulja et al. 2009).

According to these data, people aged 19 to 64 should carefully monitor the pollen calendar. For patients whose symptoms make everyday activities difficult and reduce their quality of life, information about the movement of pollen allergens, i.e. pollen concentrations in the air and their variations, is of utmost importance. Aerobiological studies conducted daily throughout the year can provide such answers. The analysis of these results includes meteorological parameters that have the greatest influence on pollen concentrations in the air, such as: air temperature and humidity, precipitation, and wind speed and direction (Maleš et Topovec 2005). Meteorological conditions accompanied by variations in temperature, air humidity, wind direction and strength, insolation, and precipitation (fog, rain) significantly affect the occurrence of pollen in the air (pollination). At optimal temperatures (18-20°C) and humidity (70-75% relative humidity), a large number of pollen grains are explosively released, which is especially noticeable in grasses and species from the Betulaceae, Pinaceae, Salicaceae, Fagaceae families (Peternel, 2006). Pollen grains can remain stable in a dry atmosphere for years, so pollination by wind (anemophily) is of particular importance for the development of allergic diseases, because pollen grains can be transported up to 175 km at a wind speed of 10 m per second (Taketomi 2006).

Therapeutic guidelines for the treatment of allergic rhinitis include patient education, environmental control, pharmacotherapy, allergen-specific immunotherapy and possibly surgical treatment. Patient education includes: avoiding contact with allergens, an appropriate level of home hygiene, planning outdoor activities, and showering after outdoor activities. The use of the GLOBE protocol can help people suffering from pollen allergies. The beginning of flowering and leafing of trees whose pollen is allergenic can be monitored through the GLOBE protocol for greening (Green up), thus warning citizens in time and thus contributing to the preservation of their health.

CONCLUSION

The study found that the most common disease during 2021, 2022 and 2023 was vasomotor and allergic rhinitis. The age group from 19 to 64 years was most susceptible to vasomotor and allergic rhinitis, allergic rhinitis caused by pollen, and chronic rhinitis, nasopharyngitis and pharyngitis during the three years of follow-up. According to the duration and severity, vasomotor and allergic rhinitis can be intermittent or permanent, and mild or severe. Due to the model of minimal persistent inflammation and non-specific nasal hyperreactivity, the clinical division into seasonal and perennial forms has been abandoned today. For example, a person with allergic rhinitis and hypersensitivity to grasses and even tree pollen often has problems outside the pollen season, often in winter.

The use of the GLOBE protocol can help people suffering from pollen allergies. The beginning of flowering and leafing of trees whose pollen is allergenic can be monitored through the GLOBE protocol for greening (Green up), thus warning citizens in time and thus contributing to preserving their health.

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