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The current state and the development prospects of the Ukrainian market of antihistamines

Nowadays allergy has become a global problem for all humanity. According to the WHO about 30-40 % of the world's population suffers from allergic diseases. Environment pollution, as well as everyday use of a large number of synthetic substances, contribute to the rapid increase in incidence of allergic reactions. The therapy of these diseases is based mainly on the antihistamine drugs (AHD), which makes it reasonable to study the Ukrainian market of AHD and to identify its promising directions of development.

Aim. To study the assortment of antihistamine drugs registered in Ukraine.

Materials and methods. The analysis was based on the official sources of information and materials of the previous marketing research using the methods of systematic, graphical and comparative analysis with the subsequent obtaining of explanations and conclusions.

Results. During the analysis of the domestic pharmaceutical market regarding the assortment of antihistamines it has been found that 128 drugs are used in Ukraine for the treatment of allergic diseases. The study of distribution by dosage forms has revealed the prevalence of solid dosage forms – tablets and dragee – their percentage is 71 %. The analysis of AHD by the manufacturing countries has shown the import dependence of the Ukrainian market: the foreign manufacturers represent 61 % of the drugs. Moreover, in recent years there is a downward trend of the share of domestic manufacturers (50 % – in 2014; 39 % – in 2019). India is the largest importer of antihistamines at the market (17.2 %); the total market share of the European Union countries is 39 %. The analysis of the current state of the pharmaceutical market has determined a change in the distribution of AHD by INN in favor of the new-generation drugs. The study has revealed the absence of anti-allergic herbal medicines in Ukraine; it substantiates the development of new drugs for the phytotherapy of allergic diseases.

Conclusions. The absence of plant-based anti-allergic drugs at pharmaceutical market of Ukraine has been found. Taking into account an increasing popularity of herbal medicines and growing demand for drugs with a good safety profile we have concluded that the development of a new plant-based drug for the allergy treatment is a topical direction for further studies.

Key words: allergic diseases; pharmaceutical market; antihistamines.

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Сучасний стан та перспективи розвитку ринку антигістамінних препаратів в Україні

У наш час алергія стала глобальною проблемою для всього людства. За даними ВООЗ, близько 30-40 % населення земної кулі страждають від алергічних захворювань. Забруднення зовнішнього середовища разом із частим використанням у побуті великої кількості синтетичних речовин сприяють стрімкому розповсюдженню алергічних реакцій. Терапія цих захворювань ґрунтується більшою мірою на застосуванні антигістамінних препаратів (АГП), що обумовлює доцільність дослідження ринку АГП в Україні та виявлення пріоритетних напрямів його розвитку.

Мета: дослідження асортименту зареєстрованих в Україні антигістамінних лікарських засобів.

Матеріали та методи. Аналіз проводився на основі офіційних джерел інформації та матеріалів попередніх маркетингових досліджень із використанням методів системного, графічного і порівняльного аналізу та наступним одержанням пояснень і висновків.

Результати дослідження. У ході аналізу вітчизняного фармацевтичного ринку щодо асортименту антигістамінних лікарських засобів було встановлено, що в Україні зареєстровано 128 препаратів, які застосовуються для лікування алергічних захворювань. Дослідження розподілу за лікарськими формами виявило перевагу твердих лікарських форм – таблетки і драже становлять 71 %. Аналіз АГП за країнами-виробниками показав імпортозалежність ринку – 61 % препаратів представлено імпортними виробниками. При цьому останнім часом спостерігається тенденція до зменшення частки вітчизняного виробника (50 % – у 2014 р.; 39 % – у 2019 р.). Найбільшим імпортером антигістамінних лікарських засобів на ринок є Індія (17,2 %); сумарний внесок країн Європейського Союзу становить 39 %. Аналіз сучасного стану фармацевтичного ринку виявив зміну розподілу АГП за МНН на користь лікарських засобів нового покоління. У ході дослідження виявлено відсутність в Україні протиалергічних лікарських засобів рослинного походження, що дає підстави для розробки нових препаратів для фітотерапії алергічних захворювань.

Висновки. Установлено відсутність протиалергічних рослинних препаратів на фармацевтичному ринку України. Враховуючи зростаючу популярність рослинних лікарських засобів та високий рівень попиту на лікарські засоби з хорошим профілем безпеки, ми дійшли висновку, що розробка нового протиалергічного препарату на рослинній основі є актуальним напрямком подальших досліджень.

Ключові слова: алергічні захворювання; фармацевтичний ринок; антигістамінні лікарські засоби.

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Современное состояние и перспективы развития рынка антигистаминных препаратов в Украине

В наше время аллергия стала глобальной проблемой для всего человечества. По данным ВОЗ, около 30-40 % населения земного шара страдают от аллергических заболеваний. Загрязнения внешней среды вместе с частым использованием в быту большого количества синтетических веществ способствуют стремительному распространению аллергических реакций. Терапия этих заболеваний основывается в большей степени на применении антигистаминных препаратов (АГП), что обусловливает целесообразность исследования рынка АГП в Украине и выявления приоритетных направлений его развития.

Цель: исследование ассортимента зарегистрированных в Украине антигистаминных лекарственных средств.

Материалы и методы. Анализ проводился на основании официальных источников информации и материалов предварительных маркетинговых исследований с использованием методов системного, графического и сравнительного анализа и последующим получением объяснений и выводов.

Результаты исследования. В ходе анализа отечественного фармацевтического рынка по ассортименту антигистаминных лекарственных средств было установлено, что в Украине зарегистрировано 128 препаратов, применяемых для лечения аллергических заболеваний. Исследование распределения по лекарственным формам выявило преимущество твердых лекарственных форм – таблетки и драже насчитывают 71 %. Анализ АГП по странам-производителям показал импортозависимость рынка – 61 % препаратов представлен импортными производителями. При этом за последние годы наблюдается тенденция к уменьшению доли отечественного производителя (50 % – в 2014 г.; 39 % – в 2019 г.). Крупнейшим импортером антигистаминных лекарственных средств на рынок является Индия (17,2 %); суммарный вклад стран Европейского Союза составляет 39 %. Анализ современного состояния фармацевтического рынка установил изменение распределения АГП по МНН в пользу лекарственных средств нового поколения. В ходе исследования выявил отсутствие в Украине противоаллергических лекарственных средств растительного происхождения, что обосновывает разработку новых препаратов для фитотерапии аллергических заболеваний.

Выводы. Установлено отсутствие антиаллергических препаратов растительного происхождения на фармацевтическом рынке Украины. Принимая во внимание растущую популярность растительных лекарственных средств и высокий спрос на лекарства с хорошим профилем безопасности, мы пришли к выводу, что разработка нового растительного лекарственного средства для лечения аллергии является актуальным направлением для дальнейших исследований.

Ключевые слова: аллергические заболевания; фармацевтический рынок; антигистаминные лекарственные препараты.

Statement of the problem. Human modern life is inseparably connected with the daily use of a large number of synthetic substances. Environment pollution by industrial waste, use of chemicals in farming and daily life, the frequent use of dyes and preservatives in the food and pharmaceutical industry negatively affect the health and lead to the different types of allergic reactions. The upward trend in the incidence of allergy is also caused by nutrition disorders, uncontrolled medication, various chronic diseases and long-term stress, which are an integral part of the human existence [1, 2].

To date, about 30-40 % of the world's population suffers from the allergic diseases. In addition, statistics indicate a rapid increase in the incidence of allergic reactions over the last 50 years, especially in countries with the prowestern lifestyle [1]. There are no official data of these diseases in Ukraine, but according to literature sources, the number of patients is about 20-30 %, confirming the relatively high incidence of allergies in our country.

This problem is especially acute in pediatric practice. In recent years, there has been a steady increase in the incidence of allergic reactions in children and adolescents. The risk of allergy sensitization of the young immune system is much higher; therefore, it is sometimes very difficult to predict the risk of allergy in children. That is why doctors often recommend the prophylactic therapy, which has specific requirements for efficacy and safety [3-7].

In the modern therapeutic practice, the allergic reactions are mainly treated due to the effect on histamine receptors and the metabolism of histamine. There are two main approaches: 1) reducing free histamine; 2) blockade of histamine receptors. By the first approach the activity of the group of drugs called "stabilizers of mast cells membranes" (ketotifen, cromoglycic acid, nedocromil, etc.) is effective. They are widely used in medical practice, but their moderate and long-lasting effect allows using them for prophylactic purposes only. The group of antihistamine drugs (AHD) has faster and stronger anti-allergic activity. Thus, this group is the first line therapy in the treatment of most allergic diseases [8].

The modern AHD classification includes 3 generations. The first-generation drugs (diphenhydramine, clemastine, chloropheniramine, mebhydrolin, etc.) have been used in clinical practice for many years; it gives them an advantage in terms of the wide experience of their application. A major disadvantage is their ability to easily dissolve in lipids, pass through the blood – brain barrier (BBB), and bind to histamine, serotonin, dopamine, and m-acetylcholine receptors of the brain, affecting the central nervous system (CNS). 40-80 % of patients subjectively notice various types of cognitive impairment: drowsiness, anxiety, nervousness, dizziness, vestibular disorders, hypotension, impaired learning ability, memory impairment, etc. In addition, the first AHD generation also has a short-term effect and provides development of tachyphylaxis.

The 2nd generation of AHD (loratadine, dimethyndene, cetirizine) do not pass through the BBB and have a long and sustainable effect. But pharmacokinetic peculiarities cause the accumulation of their metabolites in the tissues of the heart and provide the cardiotoxic effect (except loratadine) [8-11].

The 3rd AHD generation includes active metabolites and stereoisomers of drugs of the previous generation (desloratadine, levocetirizine, fexofenadine), which are characterized by the best safety profile among other AHD groups [8, 10, 11].

Therefore, the wide range of applications and the peculiar pharmacological actions of each generation of this group of drugs allow us to state that AHD are indispensable for the treatment of allergic reactions of different complexity and etiology.

Analysis of recent research and publications. The studies of the domestic pharmaceutical market of AHD in different periods were carried out by L. V. Yakovleva, M. O. Syzenko, O. G. Berdnik, A. O. Gurtyakova etc. [12-14].

Identification of aspects of the problem unsolved previously. In 2019, at the Department of Industrial Technology of Drugs of the National University of Pharmacy the research on developing of a new anti-allergic medicine based on a complex plant extract began. The new drug is planned to be created in the form of tablets containing dry extracts of the following plants: *Bidens tripartita*, *Calendula officinalis* and *Cretaegus sanguinea* in the established ratio. Since the development of a new drug always requires the identification of its potential importance for the consumer, conducting the market research in order to identify the state and the potential directions of the AHD market development is an expedient and relevant task.

Objective statement of the article. The aim of our work was to analyze the assortment of antihistamines available at the pharmaceutical market of Ukraine.

Materials and methods. The analysis was based on the official sources of information, such as the State Register of Medicines of Ukraine, the directory "Compendium 2018 – medicines" and materials of the previous marketing research [12, 13]. The methods of systematic, graphical and comparative analysis were used to obtain explanations and conclusions.

In addition, the AHD affordability for the population of Ukraine was determined. The number of dosage units for the calculation of the indicator was chosen based on the average duration of the treatment of chronic allergic diseases, i.e. 5 weeks [12, 15]. The solvency index (Ca.s., %) was calculated using the formula (1):

$$Ca.s. = P / Wa.w. \cdot 100\ \% \qquad (1)$$

where P – is the average cost of the treatment course as of November 2019; Wa.w. – is the average salary as of November 2019.

The average salary was determined according to official statistics [16].

The solvency index Ca.s. was interpreted due to distribution of trade names into 3 groups:

highly affordable if the value of the index Ca.s. was less than 5 %; medium affordable if Ca. s. was in the range of 5-15 % and unaffordable where Ca.s. was above 15 % [17].

Presentation of the main material of the research. As of November 2019, the R06A group – "Antihistamine drugs" (according to the ATC-classification) accounted for 128 drugs, which are used to treat allergic diseases, at the pharmaceutical market in Ukraine (Table) [18, 19].

By the results presented in Table the study of the variability of dosage forms (DF), in which AHD were prepared, was performed. According to these results the largest share was solid DF – *tablets* and *dragee* (71 %) due to their convenience for the population; *syrups* and *oral solutions* mainly used in pediatric practice were 10.2 % and 6.3 %, respectively; *solutions for injection* had the smallest part of the domestic pharmaceutical market (4.7 %), but their importance should not be underestimated in cases of immediate type allergic reactions (shock, collapse, Quincke's edema) [10, 11, 18]. The results are presented in Fig. 1.

Table

THE LIST OF AHD PRESENTED AT THE PHARMACEUTICAL MARKET OF UKRAINE

INN	Name of the medicinal product	Pharmaceutical form	Manufacturer	Retail price (UAH)	Ca.s. (%)
1	2	3	4	5	6
Dextromethorphan hydrobromide + Levocetirizine dihydrochloride	Tsetlo Plus	Tablets	Evertogen Life Science Limited, India	N/A	N/A
Montelukast, Levocetirizine dihydrochloride	Alerhinol Plus	Tablets	Bafna Pharmaceuticals Ltd., India	364,00	3.39
Diphenhydramine hydrochloride	Dimedrol-Darnitsa	Tablets, Solution for injections	JSC "Darnytsia Pharmaceutical Firm", Ukraine	105,35	0.98
	Dimedrol	Solution for injections	JSC Galichfarm, Ukraine	70,00	0.65
Dimenhydrinate	Dramina	Tablets	Jadran-Galenski Laboratory dd. Croatia	217,88	2.03
Clemastine fumarate	Tavegil	Solution for injections, Tablets	Takeda Austria GmbH, Austria	176,75	1.65
Dimethyndene maleate	Fenokit	Oral drops	JSC Sperko Ukraine, Ukraine	308,00	2.87
	Dimetinden-Zdorovie	Oral drops, Tablets	Pharmaceutical company "Zdorovie", Ukraine	282,63	2.63
	Edermik	Oral drops	JSC "Farmak", Ukraine	280,00	2.61
	Fenistyl	Oral drops	GSK Consumer Healthcare SA, Switzerland	630,00	5.87
Chloropyramine hydrochloride	Suprastin	Solution for injections, Tablets	JSC Egis Pharmaceutical Plant, Hungary	122,50	1.14
	Chloropyramine Hydrochloride	Solution for injections	GNCLS Research Plant, Limited Liability Company, Ukraine	385,00	3.59
	Suprostylin	Tablets	JSC "Lekhim – Kharkiv", Ukraine	52,50	0.49
Cetirizine dihydrochloride	Rolinoz	Tablets, Oral drops	Abc Farmaceutici Spa, Italy	175,00	1.63
	Amertyl	Tablets	Biopharm Co., Ltd., Poland	123,55	1.15
	Zodak	Oral drops, Tablets	Ltd. "Zentiva" Czech Republic	159,95	1.49
	Allertec	Tablets	Pharmaceutical plant "Polpharma" SA, Poland	151,20	1.41

Continuation of Table

1	2	3	4	5	6
	Cetrin	Tablets	Dr. Reddy's Laboratories Ltd., India	126,18	1.18
	Cetirizine-Teva	Tablets	Merkle GmbH, Germany	106,05	0.99
	Cetyrysine-Astrapharm	Tablets	Ltd. "Astrafarm", Ukraine	90,30	0.84
Levocetirizine dihydrochloride	Hlentset	Tablets	Glenmark Pharmaceuticals Ltd., India	103,25	0.96
	Tsezera	Tablets	KRKA, dd, Novo mesto, Slovenia	525,00	4.89
	Zilola	Tablets	Ltd. "Gedeon Richter Poland", Poland	174,65	1.63
	Alerholik	Tablets, Oral drops	JSC "Technolog", Ukraine	192,50	1.79
	Tsetrylev Neo	Tablets	Hetero Labs Limited, India	126,00	1.17
	Allervey	Tablets	Dr. Reddy's Laboratories Ltd., India	178,50	1.66
	Levzirine	Tablets	Hetero Labs Limited, India	110,25	1.03
	Kontrahist Alerdzhi	Tablets	JSC "Adamed Pharma", Poland	110,25	1.03
	Cetrimac	Tablets	MacLeods Pharmaceuticals Limited, India	99,75	0.93
	Levocetyryzine-Astrapharm	Tablets	Ltd. "Astrafarm" Ukraine	134,75	1.26
	Tsetlo	Tablets	Evertogen Life Science Limited, India	N/A	N/A
	Allergofree	Tablets	Simpex Pharma Pvt. Ltd., India	262,50	2.45
	Lasin	Tablets	Hetero Labs Limited, India	N/A	N/A
	L-May	Oral drops	JSC Sperko Ukraine, Ukraine	194,25	1.81
	Erhotsetal	Tablets	JSC "Kyiv vitamin factory", Ukraine	103,25	0.96
	Aleron	Tablets	Emcure Pharmaceuticals Limited, India	110,25	1.03
	L-Cet	Tablets, Syrup	Kusum Healthcare PVT LTD, India	105,00	0.98
	Tsetrylev	Tablets, Syrup	FDS Limited, India	123,20	1.15
	Ksyzal	Tablets	UCB Farchim SA, Switzerland	1750,00	16.31
	Alerzine	Tablets, Oral drops	JSC Egis Pharmaceutical Plant, Hungary	183,40	1.71
Cyproheptadine hydrochloride	Perytol	Tablets	JSC Egis Pharmaceutical Plant, Hungary	169,40	1.58
Loratadine	Loratadine-Zdorovie	Tablets, Syrup	Pharmaceutical company "Zdorovie", Ukraine	39,38	0.37
	Lorizan	Tablets	JSC "Kievmedpreparat", Ukraine	89,25	0.83
	Claritin	Tablets, Syrup	Schering Plough Labo NV, Belgium	71,75	0.67
	Loratadine-Darnitsa	Tablets	JSC "Pharmaceutical company "Darnitsa", Ukraine	39,90	0.37
	Loratadine	Tablets	Ltd. "Astrafarm" Ukraine	28,00	0.26
	Loratadine	Tablets	JSC "Lekhim – Kharkiv", Ukraine	23,45	0.22

Continuation of Table

1	2	3	4	5	6
	Loratadine	Tablets	JSC "Farmak" Ukraine	32,90	0.31
	Erolin	Tablets	JSC EGIS Pharmaceutical Plant, Hungary	218,75	2.04
	Lorano	Oral Suspension, Tablets, ODT Tablets	Sandoz Pharmaceuticals DD, Slovenia	250,25	2.33
	Loratadine	Tablets	JSC "Kievmedpreparat", Ukraine	45,50	0.42
	Aleric	Tablets	Us Pharma Ltd., Poland	252,00	2.35
	Lorfast	Tablets	Cadila Pharmaceuticals Limited, India	N/A	N/A
	Loratadine-Stoma	Tablets	JSC "Stoma", Ukraine	43,75	0.41
	Loratadine	Syrup	DKP Pharmaceutical Factory LLC, Ukraine	117,60	1.10
Mebhydrolin	Diazoline	Tablets, Dragee	JSC "Farmak" Ukraine	28,18	0.26
	Diazoline-Darnitsa	Tablets	JSC "Pharmaceutical company "Darnitsa", Ukraine	29,75	0.28
	Diazolin-SB-PHARMA	Dragee	JSC "Vitamins" Ukraine	28,35	0.26
	Diazoline For Children	Granules for oral suspension	GNCLS Research Plant, Limited Liability Company, Ukraine	105,00	0.98
Ketotifen hydrofumarate	Ketotifen	Syrup	Borschagovsky Chemical and Pharmaceutical Plant Scientific and Production Center, Ukraine	110,43	1.03
	Ketotifen	Tablets	GNCLS Research Plant, Limited Liability Company, Ukraine	14,35	0.13
	Ketotifen	Tablets	JSC "Lekhim – Kharkiv", Ukraine	25,03	0.23
	Ketotifen Sofarma	Tablets	JSC "Vitamins", Ukraine	26,25	0.24
Fexofenadine hydrochloride	Feksofen-Sanovel	Tablets	Sanovel Ilac Sanayi ve Ticaret AS, Turkey	N/A	N/A
	Tigofast	Tablets	Flamingo Pharmaceuticals Ltd., India Arthur Pharmaceuticals Pvt. Ltd., India	227,50	2.12
	Altiva	Tablets	Sun Pharmaceutical Industries Limited, India	N/A	N/A
	Fexofast	Tablets	Micro Labs Limited, India	194,25	1.81
	Allegra	Tablets	Sanofi Winthrop Industrie – Tours, France	352,45	3.29
Desloratadine	Allergostop	Tablets	JSC "Fitofarm", Ukraine	68,25	0.64
	Allergomax	Tablets, Syrup	Pharmaceutical company "Zdorovie", Ukraine	105,88	0.99
	Lordes	Syrup, Tablets	Nobel Ilac Sanayi is also ticaret A.S., Turkey	197,75	1.84
	Eridez-Darnitsa	Tablets	JSC "Pharmaceutical company "Darnitsa", Ukraine	176,75	1.65
	Alersis	Oral Solution, Tablets	Laboratorios Normon SA, Spain	N/A	N/A

Continuation of Table

1	2	3	4	5	6
	Desloratadine	Tablets, Syrup	JSC "Technolog", Ukraine	137,90	1.29
	Alerdez	Syrup, Tablets	Borschagovsky Chemical and Pharmaceutical Plant Scientific and Production Center, Ukraine	109,90	1.02
	Eol	Oral solution	Stada Arzneimittel AG, Germany	N/A	N/A
	Blogir-3	Tablets, Oral solution	Belupo, medicine and cosmetics, dd, Croatia	N/A	N/A
	Desradine	Tablets	KRKA, dd, Novo mesto, Slovenia	227,50	2.12
	Hitaksa	Oral solution, Tablets, ODT Tablets	Famar A.V.E. Avalon Plant, Greece	192,50	1.79
	Desloratadine-Astrapharm	Tablets	Ltd. "Astrafarm" Ukraine	107,10	1.00
	Eslotin	Tablets	Word Medical A.S., Turkey	157,50	1.47
	Alleric Neo	Oral solution	Famar Ave Avalon Factory 49 km Athens-Lamia State Road, Greece	N/A	N/A
	Free-Al	Tablets	Saneca Pharmaceuticals JSC, Slovak Republic	126,35	1.18
	Allergosan	Tablets, Oral solution	JSC "Sofarma", Bulgaria	N/A	N/A
	Erius	Tablets, Syrup	Schering Plough Labo NV, Belgium	980,00	9.14
	Freebris	Syrup	Gracure Pharmaceuticals LTD, India	N/A	N/A
	Edem	Syrup, Tablets	JSC "Farmak" Ukraine	159,25	1.48
Bilastine	Nixar	Tablets	Faes Farma, SA, Spain	277,90	2.59
Hyfenadine hydrochloride	Fencarol	Tablets	JSC "Olaynfarm" Latvia	246,75	2.30
Sehifenadine hydrochloride	Gistaphen	Tablets	JSC "Olaynfarm" Latvia	422,45	3.94
Average				189,37	1.77

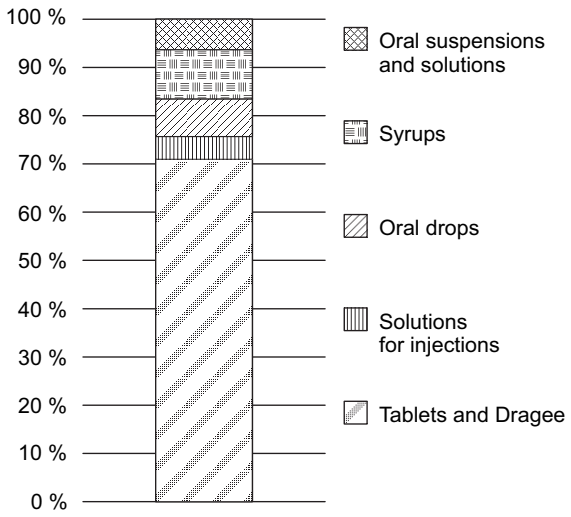

Fig. 1. Distribution of the AHD market by dosage forms

The analysis of AHD by the manufacturing countries revealed that almost 2/3 of the AHD market is occupied by imported drugs and only 1/3 by the Ukrainian ones (Fig. 2). Moreover, in 2014, this indicator was 50 % / 50 %, indicating

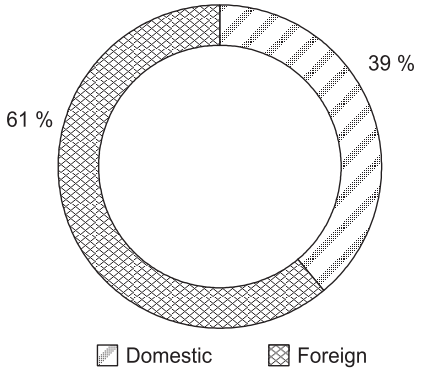

Fig. 2. The share of foreign and domestic AHD

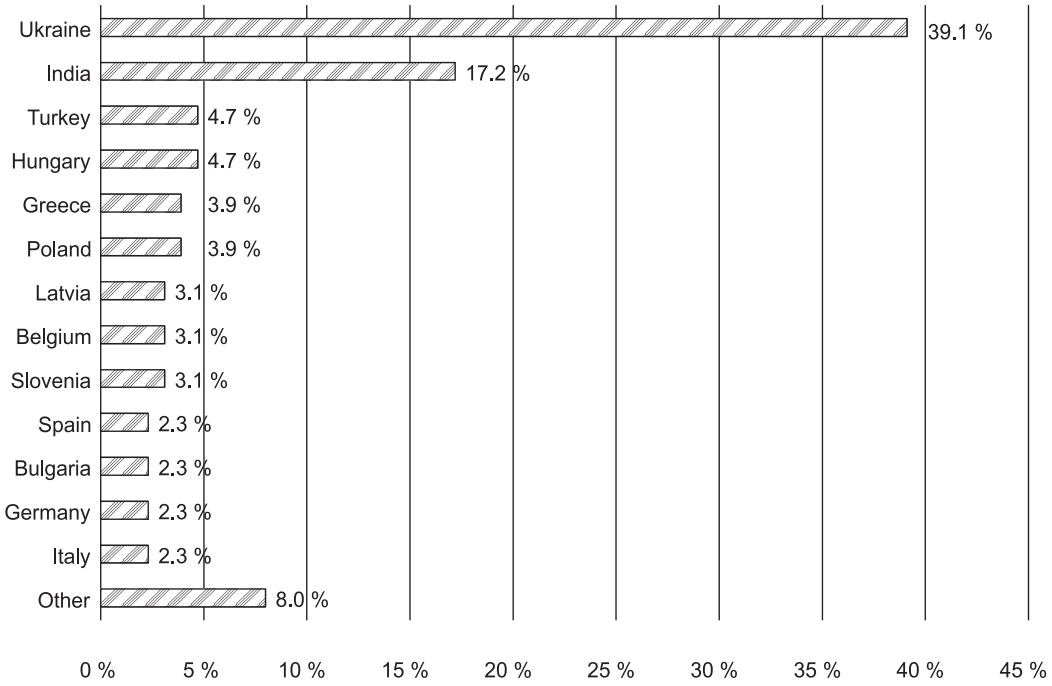

Fig. 3. Distribution of the AHD market by manufacturing countries

a decrease of the share of the Ukrainian manufacturers in the segment of the pharmaceutical market studied [12, 18].

Among the foreign manufacturers, India had a stable leading position (17.2 %). The total contribution of the European Union countries was 39 %, among them the largest share (16.4 %) was in the countries of Eastern and Southern Europe (Hungary, Greece, Poland, Latvia) (Fig. 3) [18].

According to the results of marketing analysis of this group of drugs for 2014 the following distribution of AHD by international non-proprietary names (INNs) was observed at the pharmaceutical market of Ukraine. *Loratadine* (21 %) held the leading position among the trade names (TN) registered. The 2nd, 3rd and 4th positions were taken by *Desloratadine* (16 %), *Levocetirizine* (15 %) and *Cetirizine* (13 %) (Fig. 4) [12, 13].

In 5 years (as of 2019) the following changes were observed*: Loratadine* lost 6 % of the total amount of the TN registered and its leading position; the first positions were taken by *Desloratadine,* which number of TN increased by 9 % and was 25 %, and *Levocetirizine* with the of number TN increased by 5 % and reached the mark of 20 % (Fig. 5) [18].

The data obtained show an increase in quantity of the third-generation drugs (*Levocetirizine, Desloratadine)*, indicating that health professionals and patients are increasingly guided by the safety profile considerations when choosing a course of treatment of allergic diseases.

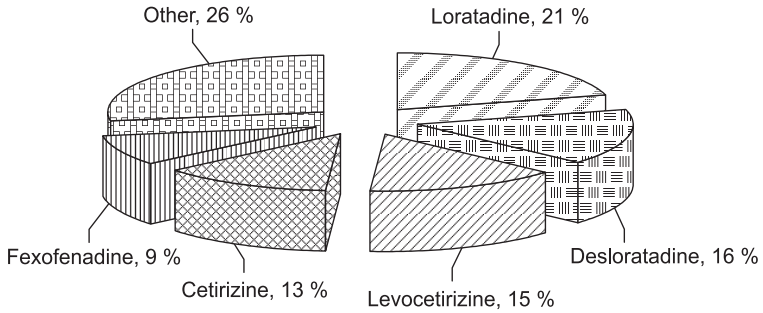

Fig. 4. Distribution of the AHD market by INN as of 2014

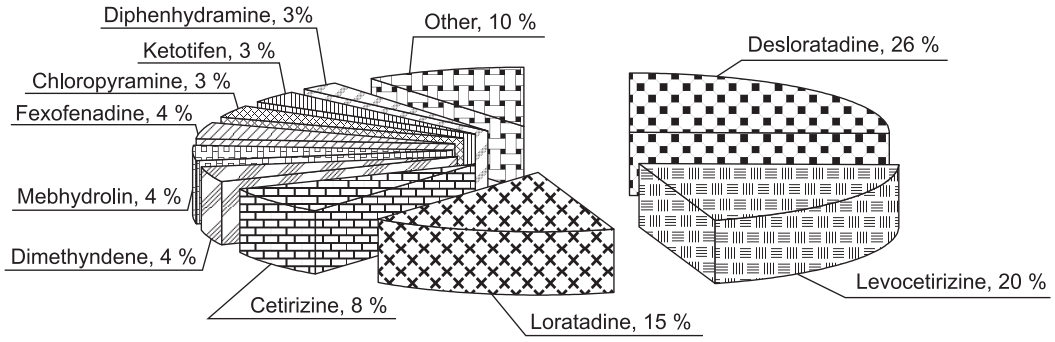

Fig. 5. Distribution of the AHD market by INN as of November 2019

The long-term administration and frequent need for treating children also contribute to the choice of safer drugs [6].

It is important to note that there are no plant-based anti-allergic drugs at the Ukrainian pharmaceutical market.

In accordance with the WHO statistics about 80 % of the world's population prefers drugs based on the plant components [20]. Herbal medicines have several advantages over synthetic ones, first of all, due to their complex action on several links of the pathogenesis of the disease. If the potent substances, such as alkaloids or cardiac glycosides, are absent in the plant raw material, the action of the herbal products is soft and safe, allowing them to be used for a long time [20, 21].

The economic factor is significant for the population of our country. Socio-political changes in recent years have led to a decrease in the standard of living of the population and have made medicines (especially imported) unaffordable to the majority of the population.

To account for this factor, the analysis of the AHD market was performed using the solvency index reflecting a percentage of the average monthly disposable income required for the AHD treatment course (1).

In order to obtain the unified results the study of affordability was performed among solid dosage forms – tablets and dragee presented the most widely at the domestic market of AHD.

The results of the calculations are presented in Table.

According to the results in Table the most of AHD are highly affordable for the working population of Ukraine. The Swiss drug "Fenistil" and the Belgian drug "Erius" have the medium affordability. The drug "Xysal" of the Swiss production has appeared to be unaffordable, its average treatment course costs about 1750,00 UAH. The average value of Ca.s is 1.77 %; it indicates the availability of the AHD market in total.

Conclusions and prospects for further research

1. The analysis of the literature sources has revealed the high incidence of allergic diseases among the population of Ukraine.

2. By analyzing the assortment of antihistamine drugs it has been found that the most common dosage form of AHD is a solid form – tablets and dragee; their number is 71 % of the total drugs registered.

3. Based on the results of the marketing research there is a tendency of increasing a number of the third-generation AHD and decreasing a number of older generations; it indicates the importance of the safety profile in the treatment of various types of allergies.

4. According to the results of the AHD affordability study based on the methodology recommended by the WHO a high availability of the most AHD for the working population of Ukraine has been determined.

5. Over the last 5 years, there has been a decrease in the share of the domestic manufacturers (by 11 %) at the pharmaceutical market of Ukraine; it indicates the import dependence of the market and the need to create new domestic AHD.

6. The absence of the plant-based anti-allergic drugs at the pharmaceutical market of Ukraine has been found; it indicates the prospect for further research in the direction of developing an herbal medicine for the systemic treatment of allergic diseases.

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References

1. Белая книга по аллергии Всемирной организации по аллергии / под ред. R. Pawankar, G. W. Canonica, S. T. Holgate, R. F. Lockey. *World Allergy Organization.* 2012. № 3 (52). С. 33-41.
2. Особенности распространения аутоиммунной крапивницы в западной Грузии / И. Пхакадзе и др. *Аллергология и иммунология.* 2019. Т. 20, № 1. С. 14-16.
3. Гацкая Д. О., Корицкая И. В. Динамика распространенности аллергических заболеваний среди детей и молодежи Винницкой области (результаты 1-го этапа эпидемиологического исследования). *Астма та Алергія.* 2015. № 1. С. 17-22.
4. Пухлик Б. М. Аллергия – проблема не только аллергологов. *Запорожский медицинский журнал.* 2011. Т. 13, № 2. С. 108-110.
5. Schuler Iv. C. F., Montejo M. J. Allergic Rhinitis in Children and Adolescents. *Pediatr Clin N Am*. 2019. 66. P. 981–993. doi: 10.1016/j.pcl.2019.06.004.
6. Apel K. Home environment: respiratory and allergic phenotypes from birth to age six in the PELAGIE cohort.*npj Primary Care Respiratory Medicine.* 2019. Vol. 29:29.P. 1-8. doi: 10.1038/s41533-019-0141-y.
7. Global Atlas of Allergy / ed. Cezmi A. Akdis, Ioana Agache. *EAACI.* 2014. 388 p.
8. Карева Е. Н. Выбор антигистаминного препарата: взгляд фармаколога. *РМЖ. Медицинское обозрение.* 2016. №12. С. 811-816.
9. Лусс Л. В. Выбор антигистаминных препаратов в лечении аллергических и псевдоаллергических реакций. ГНЦ «Институт иммунологии ФМБА РФ», г. Москва. *Астма та алергія.* 2010. № 1-2. С. 70-76.
10. Клінічна фармація : підруч. для студ. вищ. навч. закл. / за ред. В. П. Черних, І. А. Зупанця, І. Г. Купновицької. Харків : НФаУ : Золоті сторінки, 2013. 912 с.
11. Лусс Л. В., Ильина Н. И. Антигистаминные препараты в общеклинической практике: Вопросы и ответы. *В помощь практическому врачу*. 2017. 184 с.
12. Iakovlieva L. V., Berdnik O. G., Gurtyakova A. O. Analysis of assortment and volumes of consumption of antihistamine preparations in Ukraine. *Pharmaceutical journal*, 2018, № 1-2. P. 12-21.
13. Яковлєва Л. В., Сизенко М. О. Аналіз антигістамінних препаратів на українському фармацевтичному ринку. *Фармацевтичний журнал,* 2014. С. 277.
14. Яковлєва Л. В., Передерій А. В. Доступність антигістамінних засобів для українських пацієнтів у 2013-2014 роках. *Управління, економіка та забезпечення якості в фармації.* 2015. № 4 (42). С. 87-94.
15. Лукьянчук Е. Частые ОРВИ и аллергия: есть ли связь? *Еженедельник аптека.* 2013. № 4 (875). URL: http://www.apteka.ua/article/202653 (дата звернення: 03.03.2020).
16. Державна служба статистики України. URL: http://ukrstat.gov.ua/ (дата звернення: 03.03.2020).
17. Яковлева Л. В., Кириченко Н. О., Лукашевич П. Ю. Оценка доступности препаратов метформина и гликлазида на фармацевтическом рынке Украины. *Ендокринологія*. 2016. Т. 21, № 2. С. 119-124. URL: http://nbuv.gov.ua/UJRN/enkrl_2016_21_2_6 (дата звернення: 03.03.2020).
18. Державний реєстр лікарських засобів України. URL:http://www.drlz.com.ua/ (дата звернення: 03.03.2020).
19. Справочник «Компендіум. Лікарські препарати». URL: https://compendium.com.ua/ (дата звернення: 03.03.2020).
20. Шостак Т. А., Калинюк Т. Г., Гудзь Н. І. Особливості фармацевтичної розробки рослинних препаратів (Огляд літератури). *Фітотерапія. Часопис.* 2014. № 4. С. 77-82.
21. Шостак Л. Г., Пальчик К. О. Мікро– та макроелементний склад основних органів фікусу бенджаміна. *Молодий вчений.* 2018. № 3 (55). С. 425-429.
22. The role of Histamine and Histamine Receptors in Mast Cell-Mediated Allergy and Inflammation / E. B. Thangam et al. *The hunt for New Therapeutic Targets. Front. Immunol.* 2018. Vol. 9:1873.P. 1-9. doi: 10.3389/fimmu.2018.01873.
23. Comprehensive medical videolibrary. URL: http://www.Osmosis.org (дата звернення: 03.03.2020).
24. Клиническая фармакология по Гудману и Гилману : в 4 т. / под общ. ред. Г. Гилмана ; ред. Дж. Хардман, Л. Лимберд ; пер. с англ. Москва : Практика, 2006. 336 с.
25. Зайков С. В. Эффективность антигистаминных препаратов при ОРВИ у больных аллергическими заболеваниями. *Алергологія. Погляд фахівця*. 2013. С. 43.

References

1. Pawankar, R., Canonica, G. W., Holgate, S. T., Lockey, R. F. (Eds.). (2012). White book of World Allergy Organization. *World Allergy Organization, 3 (52),* 33-41.
2. Phakadze, I, Shavlakadze, N., Lezhava, D., Silagadze, A., Chkhikvadze, L. (2019). *Allergology and Immunology, 20 (1),* 14-16.
3. Hatskaia, D. O., Koritskaia, I. V. (2015). *Asthma and Allergy, 1*, 17-22.
4. Pukhlik, B. M. (2011). *Zaporozhskii meditsinskii zhurnal*, 13 (2), 108-110.
5. Schuler, Iv. C. F., Montejo, M. J. (2019). *Pediatr Clin N Am, 66,* 981–993.
6. Apel, K. (2019) *npj Primary Care Respiratory Medicine, 29:29*, 1-8. doi: 10.1038/s41533-019-0141-y.
7. Cezmi, A. Akdis, Ioana, Agache. (2014). *EAACI,* 388.
8. Kareva, E. N. (2016). *RMJ. Medical Review, 12*, 811-816.
9. Luss, L. V. (2010). *Asthma and Allergy, 1-2,* 70-76.
10. Chernykh, V. P., Zupanets, I. A., Kupnovytska, I. G. (Eds.). (2013). *Klinichna farmatsiia*. Kharkiv: NFaU: Zoloti Storinki, 912.
11. Luss, L. V., Il'ina, N.I. (2017). *V pomoshch prakticheskomu vrachu*, 184.
12. Iakovlieva, L. V., Berdnik, O. G., Gurtiakova, A. O. (2018). *Pharmaceutical journal*, *1-2*, 12-21.
13. Iakovlieva, L. V., Sizenko, M. O. (2014). *Pharmaceutical Journal*, 277.
14. Iakovlieva, L. V., Perederii, A. V. (2016). *Management, economy and quality assurance in pharmacy*, 87-94.
15. Lukianchuk, E. (2013). *Weekly Pharmacy, 4 (875).* Available at: http://www.apteka.ua/article/202653 (Date of access: 03.03.20200).
16. State Statistics Service of Ukraine. Available at:http://ukrstat.gov.ua/ (Date of access: 03.03.20200).
17. Iakovlieva, L. V., Kyrichenko, N. O., Lukashevych, P. Y. (2016). *Endocrinology*, *21 (2),* 119-124. Available at: URL: http://nbuv.gov.ua/UJRN/enkrl_2016_21_2_6(Date of access: 03.03.20200).
18. State register of drugs of Ukraine. Available at: http://www.drlz.com.ua/(Date of access: 03.03.20200).
19. Compendium on-line. Available at: https://compendium.com.ua (Date of access: 03.03.20200).
20. Shostak, T. A., Kaliniuk, T. G., Gudz, N. I. (2014). *Phytotherapy. The Chronicle,4,* 77-82.
21. Shostak, L. G., Palchik, K. O. (2018). *Young scientist, 3 (55),* 425-429.
22. Thangam, E. B., Jemima, E. A., Singh, H., Baig, M. S., Khan, M., Clinton, B. Mathias, Martin, K. Church, Saluja, R. (2018). *The hunt for New Therapeutic Targets. Front. Immunol., 9: 1873*, 1-9.
23. Comprehensive medical video library. Available at: http://www.Osmosis.org (Date of access: 03.03.20200).
24. Gilmana, G., Khardman, Dzh., Limberd, L. (Eds.). (2006). *Klinicheskaia farmakologiia po Gudmanu i Gilmanu.*Moscow: Praktika, 336.
25. Zaikov, S.V. (2013). *Allergology. Poglyad fakhivtsya,* 43.

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