ISSN - 2544-9346

OPEN ACCESS
PEER-REVIEWED JOURNAL

SCIENCE REVIEW

Scientific Edition
Published by:

RS Global

ISSN 2544-9346

Open Access Peer-reviewed Journal

Science Review

3(38), July 2021

DOI: https://doi.org/10.31435/rsglobal_sr

Editorial board:
Lina Anastassova
Full Professor in Marketing, Burgas Free University, Bulgaria
Mikiashvili Nino
Professor in Econometrics and Macroeconomics, Ivane Javakhishvili Tbilisi State University, Georgia
Alkhawaldeh Abdullah
Professor in Financial Philosophy, Hashemite University, Jordan
Mendebaev Toktamys
Doctor of Technical Sciences, Professor, LLP "Scientific innovation center "Almas", Kazakhstan
Yakovenko Nataliya
Professor, Doctor of Geography, Ivanovo State University, Shuya
Tsymbaliuk Vitalii
Professor, Doctor of Medicine, The State Institution Romodanov Neurosurgery Institute National Academy of Medical Sciences of Ukraine
Suprun Elina
Professor, Doctor of Medicine, National University of Pharmacy, Ukraine
Imangazinov Sagit
Director, Ph.D, Pavlodar affiliated branch "SMU of Semei city"
Peshcherov Georgy
Professor, Moscow State Regional University, Russia
Mustafin Muafik
Professor, Doctor of Veterinary Science, Kostanay State University named after A. Baitursynov
Ovsyanik Olga
Professor, Doctor of Psychological Science, Moscow State Regional University
Nino Abesadze
Associate Professor Tbilisi State University, Faculty of Economics and Business
Sentyabrev Nikolay
Professor, Doctor of Sciences, Volgograd State Academy of Physical Education, Russia
Harlamova Julia
Professor, Moscow State University of Railway Transport, Russia

All articles are published in open-access and licensed under a Creative Commons Attribution 4.0 International License (CC BY 4.0). Hence, authors retain copyright to the content of the articles.CC BY 4.0 License allows content to be copied, adapted, displayed, distributed, re-published or otherwise re-used for any purpose including for adaptation and commercial use provided the content is attributed. Detailed information at Creative Commons site: https://creativecommons.org/licenses/by/4.0/.

Publisher –
RS Global Sp. z O.O.,

Warsaw, Poland

Numer KRS: 0000672864
REGON: 367026200
NIP: 5213776394

Publisher Office's address:
Dolna 17,
Warsaw, Poland,
00-773

Website:
https://rsglobal.pl/
E-mail:
editorial_office@rsglobal.pl
Tel:
+4(822) 602 27 03

DOI: 10.31435/rsglobal_sr
OCLC: 1036699169
Publisher - RS Global
Country – Poland
Format: Print and Electronic
Frequency: monthly
Content type: Scholarly

CONTENTS

PHARMACY

MEDICINE

COMPUTER SCIENCE

PHYSICS AND MATHEMATICS

AGRICULTURE

PHARMACY

PHARMACOLOGICAL VIEW ON THE PROBLEM OF COMORBIDITY IN THE PHARMACOTHERAPY OF CHRONIC PANCREATITIS

Iryna Tukhar, *Lviv Medical Professional College "Monada", Lviv Regional Clinical Hospital, Ukraine, ORCID ID: https://orcid.org/0000-0002-6827-402X*
Viktoriya Shapovalova, *Kharkiv Medical Academy of Postgraduate Education, Doctor of Pharmacy, Professor, Ukraine, ORCID ID: https://orcid.org/0000-0003-4770-7292*
Valentyn Shapovalov, *Kharkiv Medical academy of Postgraduate Education, Doctor of Pharmacy, Professor; Advocates Company "Apotheosis", corresponding author, Ukraine, ORCID ID: https://orcid.org/0000-0002-9329-0195*
Valeriy Shapovalov, *Lviv Medical Institute LLC, Doctor of Pharmacy, Professor, Ukraine, ORCID ID: https://orcid.org/0000-0002-6696-6380.*

DOI: https://doi.org/10.31435/rsglobal_sr/30072021/7591

ARTICLE INFO

Received 08 April 2021
Accepted 25 May 2021
Published 30 July 2021

KEYWORDS

clinical pharmacy, chronical pancreatitis, comorbidity, drugs, pharmacotherapy.

ABSTRACT

The article presents the results of the research concerning the pharmacotherapy of patients with chronic pancreatitis with comorbidity from the pharmacological view. During the study pharmacological approach to the problem of comorbidity among patients with chronic pancreatitis was analyzed. A survey among doctors and pharmacists was used during the research along with normative and legal, documentary, retrospective, bibliographic, systemic, forensic-pharmaceutical, sociological (questionnaire survey), comparative, graphic, mathematical analysis methods. The most common comorbid diseases that patients suffer from alongside with chronic pancreatitis were highlighted. Authors came to conclusion, that development of safe and affordable pharmaceutical therapy for patients with chronic pancreatitis and comorbidity is very important.

Citation: Iryna Tukhar, Viktoriya Shapovalova, Valentyn Shapovalov, Valeriy Shapovalov. (2021) Pharmacological View on the Problem of Comorbidity in the Pharmacotherapy of Chronic Pancreatitis. *Science Review*. 3(38). doi: 10.31435/rsglobal_sr/30072021/7591

Copyright: © 2021 **Iryna Tukhar, Viktoriya Shapovalova, Valentyn Shapovalov, Valeriy Shapovalov.** This is an open-access article distributed under the terms of the **Creative Commons Attribution License (CC BY)**. The use, distribution or reproduction in other forums is permitted, provided the original author(s) or licensor are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.

Introduction. In recent years, the topic of comorbidity or "double disorders" is devoted to numerous studies in Western literature – pharmacological, epidemiological, clinical, forensic, pharmaceutical, pharmacoeconomic, legal [1, 2, 3].

The term "comorbidity" or "dual diagnosis" recognizes the presence of two or more health disorders of same patient at the same time [4, 5].

In the English-language literature, special attention is paid to the problem of "double disorders" or "double diagnoses". However, in the Ukrainian-language literature this problem has not yet received sufficient coverage [6].

Special importance given to the comorbidity in the ICD-10, as the emphasis is on unified and standardized criteria for health disorders, which allows diagnosing several health disorders simultaneously [7].

Only 12% of clinical guidelines used in Australia and 44% of clinical guidelines in the United States provide specific guidelines for patients with comorbid conditions [8].

From a pharmacological point of view, the problem of comorbidity is relevant in the pharmacotherapy of health disorders, when it is necessary to properly prescribe drugs. Comorbidity in the pharmacotherapy of chronic pancreatitis (CP) is no exception in this sense. The name CP is understood as a chronic inflammatory disease of the pancreas, accompanied by irreversible structural changes (fibrous, cystic – to limbs atrophic), the development of excretory and incretory insufficiency manifested by abdominal pain and characterized by a significant decrease in quality of life. Current world data show an increase in the number of patients with CP. The incidence of CP in European countries ranges from 5 to 10 per 100,000 population. In general, the world has a tendency to increase the incidence of CP over the past 30 years by more than 2 times [9].

The purpose of the research was to analyze the pharmacological approach to the problem of comorbidity among patients with CP.

Materials and methods. The current research was carried out using the system approach during April 2020 – April 2021. A survey of doctors and pharmacists (57), who underwent thematic improvement at the Department of Medical and Pharmaceutical Rights, General and Clinical Pharmacy of the Kharkiv Medical Academy of Postgraduate Education. The questionnaire included questions that allowed describing the respondents: age, gender, position, qualification category, work experience. The questionnaire also included questions for clinical and pharmaceutical analysis in the following areas: 1) frequency of contact with a doctor per year of patients with CP in the absence of comorbid diseases; 2) the frequency of contact with the doctor for a year of patients with CP in the presence of one comorbid disease; 3) frequency of contacts with the doctor for a year of patients with CP in the presence of 2 comorbid diseases; 4) frequency of contacts with the doctor for a year of patients with CP in the presence of more than 3 comorbid diseases; 5) comorbid conditions that accompanied patients with CP.

The information base of the study consisted of scientific works of foreign and domestic scientists on issues related to the clinical pharmacy, organization of pharmaceutical business, management, forensic pharmacy, pharmaceutical supply, pricing policy for drugs [10-13].

Modern research methods were used: normative and legal, documentary, retrospective, bibliographic, systemic, forensic-pharmaceutical, sociological (questionnaire survey), comparative, graphic, mathematical analysis. Mathematical processing and statistical evaluation of data was performed using Microsoft Excel.

The study of the article is a fragment of research work of the Kharkiv Medical Academy of Postgraduate Education on "Improving the organizational and legal procedure for providing patients with drugs from the standpoint of forensic pharmacy, organization and management of pharmacy" (state registration number 0116U003137, deadline 2016-2020) and "Pharmaceutical and medical law: integrated approaches to the drug circulation system from the standpoint of forensic pharmacy and organization of pharmaceutical business" (state registration number D/21U000031, deadline 2021-2026) [14-16].

Research results. Based on a review of the scientific literature, there are several classifications of types of comorbidity. According to the time of onset of the main disorder (CP), comorbidity is divided into primary, secondary and independent. Due to the complexity of establishing the primacy, the following types of pharmacological relationship between primary (CP) and comorbid health disorders can be identified: 1 – comorbid disorders increase the risk of complications of CP; 2 – the course of CP is exacerbated by mental, narcological, cardiac, surgical, oncological, immune, addictive and other diseases; 3 – symptoms of CP may be under the indirect (psychosocial) influence of comorbid disorders; 4 – over time, due to the strength of the relationship, it is impossible to establish the primacy of the main and comorbid disorders; double disorders can develop at different intervals [17].

It is important to assess the severity of underlying (CP) and comorbid disorders. There are four possible combinations: both problems are easy (1); severe underlying disorder (CP) and mild comorbid disorder (2); mild underlying disorder (CP) and severe comorbid disorder (3); severe underlying disorder and severe comorbid disorder (4).

For example, in Brazil, over 88% of people over the age of 40 have at least one major chronic disease, and 26% have more than two major comorbid conditions [18].

The next task of the study included the analysis of a sociological survey by questionnaires of respondents. The characteristics of the respondents of the Department of Medical and Pharmaceutical Law, Forensic and Clinical Pharmacy are given in Table 1.

Table 1. Characteristics of respondents

No.	Question	Result
1.	Age	Average age is 49,5 ± 2,5 years
2.	Sex	Female 24% Male 76%
3.	Position	Head of department – 14% Narcologist – 28% Family doctor – 32% Pharmacist – 26%
4.	Qualification category	Highest category – 43% The first category – 30% The second category – 20% Did not had a category – 7%
5.	Work experience	Up to 10 years – 20% More than 10 years – 80%

According to the results of a survey of respondents of the Department of Medical and Pharmaceutical Rights, General and Clinical Pharmacy of the Kharkiv Medical Academy of Postgraduate Education, it was found that patients with CP had an average of two visits per year in the absence of comorbid diseases; and in the presence of one, two and more than three comorbid diseases, their number increased to seven, eleven and fourteen, respectively.

The results of the questionnaire showed that CP was accompanied by comorbid gastroenterological, surgical, therapeutic, cardiac, addictive, neurological, psychiatric, oncological conditions in 5-65% of cases. The share of comorbid pathology of gastroenterological practice was 33% of cases (chronic gastritis – in 17% of cases; duodenal ulcer – in 15%; chronic cholecystitis – in 19%); surgical practice – from 10% to 25% of cases; therapeutic practice – up to 12% of cases; cardiac practice – from 6% to 35% of cases; addictive practice – up to 65% of cases; neurological practice – up to 24% of cases; psychiatric practice – from 5% to 11% of cases; oncological practice – up to 29% of cases.

On the other hand, for patients with addictive health disorders, the most common among comorbid diseases were diseases of the digestive system: intestinal diseases (colon irritation syndrome, chronic colitis) in 59%; diseases of the liver, gallbladder and biliary tract (chronic hepatitis, non-alcoholic fatty hepatosis) – 43%; diseases of the pancreas (chronic pancreatitis) – 28%; diseases of the stomach and duodenum (gastroesophageal reflux disease, gastric and duodenal ulcers, chronic gastritis) – 40%. The number of prescribed drugs increased from five to seven, and from ten and fourteen respectively.

The importance of the problem of comorbidity for practical activities is primarily due to the fact that the presence of several chronic diseases leads to deterioration in quality of life. Thus, a questionnaire survey using the SF-36 questionnaire, conducted among respondents to the Department of Medical and Pharmaceutical Rights, General and Clinical Pharmacy of the Kharkiv Medical Academy of Postgraduate Education, showed a significant decrease in quality of life, especially in everyday activities. Comorbidity leads to increased costs for diagnostic examinations and treatment, increases the length of hospitalization, is the most common cause of non-specialized hospitalization of patients and reduces the operational activity of health care facilities.

Discussion. In clinical pharmacy, comorbid disorders or comorbidities are a problem when prescribing drugs to patients suffering from both CP and bipolar disorder. The most common comorbid diseases among patients with CP – abusing of psychoactive substances: drugs and alcohol. Alcohol abuse (up to 60%) or drugs (up to 50%) are often accompanied by bipolar disorder on the background of CP. This means that 50 to 60 percent of patients with CP suffer from comorbid addictive addiction to psychoactive substances at least once in their lifetime. On the other hand, addictive dependence on surfactants has a bad effect on the course of the underlying disease, resulting in an increase in the frequency of attacks, more cases of hospitalization. The problem of polymorbidity of therapeutic patients is also growing, which is due to the tendency to general aging of the population, "rejuvenation" and an increase in the number of cases of chronic diseases, increasing the impact of negative environmental factors [19].

According to studies conducted in the Netherlands, among people aged 45-64, 7% have more than four comorbid diseases; in the age group 65-74 years the frequency increases to 30%; among persons older than 75 years the frequency is 55%. A 2005 study in Quebec province found that among patients aged 45 to 64, more than 95% of women and more than 89% of men had more than two comorbid diseases. The prevalence of comorbid conditions ranges from 69% among young patients to 93% among middle-aged patients and up to 98% among elderly patients. The number of multimorbid conditions increases from 10% among patients over 19 years of age to 80% among patients over 80 years of age [20].

For comparison: information from the Australian National Registry shows that more than 50% of cancer patients had comorbid arthritis; 15.1% – bronchial asthma; 16.1% – concomitant mental illness; 14.6% – cardiovascular pathology. Among the participants in the registry, 32.3% of patients had one major disease; among 9.6% – two (basic and comorbid); among 2.5% – three (basic and two comorbid) [8].

In the Netherlands, 79% of older patients have more than two diseases. Among patients with the national cancer registry of the Netherlands, comorbidities range from 12% (age group over 45 years) to 60% (over 70 years). In the United States and Australia, 55 to 80% of patients over the age of 65 have more than two chronic diseases [21].

Comorbid, polymorbid diseases can significantly affect the diagnosis and pharmacotherapy of patients with CP. Blind use of the provisions of the recommendations and clinical guidelines without taking into account the clinical condition of a particular patient, in particular the presence of comorbid pathology, can lead to deterioration of treatment results and the development of complications [22, 23].

According to foreign scientists, the provision of medical and pharmaceutical care to patients with comorbid diseases requires an increase in health care costs. Thus, in the United States, more than 80% of medical insurance (Medicare program) goes to cover the cost of medical care for patients with more than four diseases with a chronic course [24 - 26].

Conclusions. The search for pharmacological ways to solve the problem of comorbidity among patients with chronic pancreatitis (CP) is a topical issue. Therefore, the development of safe pharmacotherapy regimens for chronic pancreatitis (CP) and comorbid health disorders is important for pharmacology and remains little studied for clinical pharmacy. Thus, future researches needed in the field of the study.

Declaration of Interest Statement. The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

REFERENCES

1. Boyd C.M., Darer J., Boult C. et al. (2005) Clinical practice guidelines and quality of care for older patients with multiple comorbid diseases: implications for pay for performance. JAMA, 294(6): 716–724.
2. Dawes M. (2010) Co-morbidity: we need a guideline for each patient not a guideline for each disease. Fam. Pract., 27(1): 1–2.
3. Fortin M., Bravo G., Hudon C. et al. (2005) Prevalence of multimorbidity among adults seen in family practice. Ann. Fam. Med., 3(3): 223–228.
4. Comorbidity. Retrieved from http://www.plaintest.com/psychiatry/comorbidnost.
5. Belousov Yu. V. (2012) Comorbidity in diseases of the digestive system. Zdorovya rebenka, 1 (36): 134–136.
6. Campbell-Scherer D. (2010) Multimorbidity: a challenge for evidence-based medicine. Evid. Based Med., 15(6): 165–166.
7. Ministry of healthcare of Ukraine official site. Retrieved from http://moz.gov.ua/ (application date 07.05.2018). Title from the screen.
8. Caughey G.E., Vitry A.I., Gilbert A.L., Roughead E.E. (2008) Prevalence of comorbidity of chronic diseases in Australia. BMC Public Health, 8: 221.
9. Löhr J. M. United European Gastroenterology evidence-based guidelines for the diagnosis and therapy of chronic pancreatitis // United European Gastroenterology Journal. 2017. Vol. 5, Issue 2. P. 153–199. doi: http://doi.org/ 10.1177/2050640616684695
10. Experience of Great Britain in organization of healthcare system for pharmaceutical provision with medicines for privileged categories of citizens / V.V. Shapovalov (Jr.), V.O. Shapovalova, V.V. Andrieieva, V.V. Shapovalov. Health of society. 2019. Vol. 78, N. 1. P. 36–40. (doi: 10.22141/2306-2436.8. 1.2019.172617).
11. Experience of Poland concerning and organization of healthcare system for the pharmaceutical provision for privileged categories of citizens / V.V. Shapovalov (Jr.), A.O. Gudzenko, V.A. Shapovalova, V.V. Andrieieva, V.V. Shapovalov. Proceeding of articles the international scientific conference «Advance of Science». Czech Republic, Karlovy Vary – Ukraine, Kyiv, 17 May 2019. Czech Republic, Karlovy Vary: Skleněný Můstek – Ukraine, Kyiv: MCNIP, 2019. P. 16-22.

12. Experience of the USA concerning and organization of healthcare system for the pharmaceutical provision for privileged categories of citizens / V.V. Shapovalov (Jr.), A.A. Gudzenko, V.V. Andrieieva, V.A. Shapovalova, V.V. Shapovalov Annals of Mechnikov Institute. 2019. N. 1. P. 81–87. (doi: 10.5281/zenodo.2639521).
13. Freeman J. S. Providing whole-person care: integrating behavioral health into primary care. *N.C. Med. J.* 2015. Vol. 76, N 1. P. 24–25, 27–28.
14. Concerning the importance of forensic and pharmaceutical researches to improve patients' accessibility to medicines / V. Shapovalov, A. Gudzenko, L. Komar, A. Butko, V. Shapovalova, V.Shapovalov. Pharmacia. 2017. Vol. 65. N. 2. P. 23–29.
15. Forensic and pharmaceutical study of the presence of a causal link between the degree of alcohol abuse and qualification level of the respondents / V. Shapovalov, A. Gudzenko, V. Shapovalova, A. Osyntseva, V. Shapovalov. Pharmacia. 2017. Vol. 66, N. 3. P. 31–39.
16. Organizational and legal evaluation of availability of medicines' circulation for cancer patients / V.V. Shapovalov, S.I. Zbrozhek, V.O. Shapovalova, V.V. Shapovalov. Pharmacia. 2018. Vol. 65, N. 2. P. 17-22.
17. Chernobrovkina T.V., Artemchuk A.F. The problem of comorbidity and modern forms of alcoholic disease (clinical and pathogenetic aspect). Narcology, 12/2006, 47-74 pp.
18. Carvalho A.K., Menezes A.M., Camelier A. et al. (2012) Prevalence of self-reported chronic diseases in individuals over the age of 40 in São Paulo, Brazil: the PLATINO study. Cad. Saude Publica, 28(5): 905–912.
19. Caughey G.E., Roughead E.E. (2011) Multimorbidity research challenges: where to go from here? Journal of Comorbidity, 1: 8–10.
20. Coebergh J.W., Janssen-Heijnen M.L., Post P.N., Razenberg P.P. (1999) Serious co-morbidity among unselected cancer patients newly diagnosed in the southeastern part of The Netherlands in 1993–1996. J. Clin. Epidemiol., 52(12): 1131–1136.
21. Caughey G.E., Ramsay E.N., Vitry A.I. et al. (2010) Comorbid chronic diseases, discordant impact on mortality in older people: a 14-year longitudinal population study. J. Epidemiol. Community Health, 64(12): 1036–1042.
22. Health insurance and mortality in US adults / A. P. Wilper, S. Woolhandler, K. E. Lasser, D. McCormick, D. H. Bor. American Journal of Public Health. 2009. Vol. 99. N. 12. P. 2289-2295.
23. WHO Drug Information. Retrieved from http://www.who.int/medicines/publications/druginformation/en. (application date 07.05.2018). Title from the screen.
24. Ford, C. D., Killebrew, J., Fugitt, P., Jacobsen, J., & Prystas, E. M. (2006). Study of medication errors on a community hospital oncology ward. Journal of oncology practice, 2(4), 149–154. Retrieved from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2793607/. (application date 07.05.2018).
25. Heilmann P. To have and to hold: personnel shortage in a Finnish healthcare organisation. Scand. J. Public. Health. 2010. Vol. 38. N. 5. P. 518-523.
26. Meta D., Shukhov V., Chuchalin A. The British national form (politics, structure, features, example for imitation). Retrieved from http://evbmed.fbm.msu.ru/rwinwww/publica/bnf.html (application date 24.07.2017). Title from the screen.

MEDICINE

PHARMACOTHERAPY OF SYSTEMIC AUTOIMMUNE DISEASES IN CONDITIONS OF THE COVID-19 PANDEMIC: INNOVATIVE EXPERIMENTAL STUDY

Ihor Hayduchok, *PhD in medicine, associate professor, Lviv Medical Institute LLC, Ukraine, ORCID ID: https://orcid.org/0000-0003-2897-8417*

DOI: https://doi.org/10.31435/rsglobal_sr/30072021/7619

ARTICLE INFO

Received 23 April 2021
Accepted 14 June 2021
Published 30 July 2021

KEYWORDS

pharmacotherapy, evidence-based medicine, forensic pharmacy, evidence-based pharmacy, systemic autoimmune diseases, drugs, content analysis.

ABSTRACT

The article presents the results of an innovative experimental study of pharmacotherapy of systemic autoimmune diseases in a pandemic of coronavirus infection is a timely and socially oriented way. The methodology of conducting a content analysis based on the theoretical principles of pharmaceutical and medical law and its components. Author used the method of drug selection developed by the Department of Medical and Pharmaceutical Law, General and Clinical Pharmacy of the Kharkiv Medical Academy of Postgraduate Education. Content analysis performed by dosage forms by grouping them using the Sturgess formula, followed by construction of discrete series of variations and distribution polygon. Received data made possible to state, that in some circumstances, doctors have a choice of both drugs and dosage forms. However, the data obtained show a lack of balance between supply and demand for patients and physicians. The analysis allows to obtain a complete description of the balance of "supply and demand" between the range and types of dosage forms of drugs INN Silymarin ATC code A05BA03, that approved for use.

Citation: Ihor Hayduchok. (2021) Pharmacotherapy of Systemic Autoimmune Diseases in Conditions of the Covid-19 Pandemic: Innovative Experimental Study. *Science Review*. 3(38). doi: 10.31435/rsglobal_sr/30072021/7619

Copyright: © 2021 **Ihor Hayduchok.** This is an open-access article distributed under the terms of the **Creative Commons Attribution License (CC BY)**. The use, distribution or reproduction in other forums is permitted, provided the original author(s) or licensor are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.

Introduction. In the current context of the spread of the coronavirus pandemic, the role of innovative methods in the study of pharmacotherapy of systemic diseases among patients with dual health disorders is growing. Despite numerous publications on COVID-19, conceptual thinking of the mentioned problem is currently in its first steps. Pharmacotherapy of patients with systemic autoimmune diseases during the COVID-19 pandemic is a topical issue. Further analysis of COVID-19 among patients with systemic autoimmune diseases is important [1, 2, 3].

Among the systemic autoimmune diseases are systemic lupus erythematosus, systemic vasculitis, psoriasis, rheumatoid arthritis. The introduction of innovative approaches to pharmacotherapy to determine the balance of "supply and demand" for drugs of different clinical and pharmacological, classification and legal, nomenclature and legal groups is timely in a pandemic COVID-19. Medicines for privileged categories of patients with systemic autoimmune diseases purchased at the expense of the budget and are subject to release on a free basis or 50.0% discount from their price. Today it is important to use modern, effective and safe drugs for pharmacotherapy of systemic autoimmune diseases, which are selected on the principles of evidence-based medicine, forensic pharmacy, evidence-based pharmacy, medical and pharmaceutical law [4, 5, 6, 7, 8, 9].

The use of innovative experimental methods in the study of pharmacotherapy of systemic autoimmune diseases in a pandemic of coronavirus infection is a timely and socially oriented scientific task. The social focus of pharmacotherapy of systemic autoimmune diseases needs to be personalized.

At the same time, a fair balance between the supply and demand of drugs needs its implementation. Patients with systemic autoimmune diseases form demand for drugs. Domestic and foreign drug manufacturers form the offer. It is hard to achieve a fair balance if patients do not receive the pharmacotherapy prescribed by doctors on time [10].

Pharmacoeconomic studies in the pharmacotherapy among patients with systemic vasculitis using antiviral drugs described in study [11].

In continuation of studies, the purpose of the research was to conduct an innovative experimental study of pharmacotherapy of systemic autoimmune diseases using content analysis on the example of drugs by the International nonproprietary name (INN) Silymarin ATC code A05BA03 in healthcare facilities (hospitals, clinics, pharmacies).

Materials and methods. The methodology of conducting a content analysis of drugs according to INN Silymarin ATC code A05BA03 was based on the theoretical principles of pharmaceutical and medical law and its components: pharmaceutical and medical legislation; forensic pharmacy in the framework of forensic and pharmaceutical practice; evidence-based medicine and evidence-based pharmacy; clinical pharmacology and pharmacotherapy [12, 13, 14, 15, 16].

To conduct content analysis, the method of drug selection developed by the Department of Medical and Pharmaceutical Law, General and Clinical Pharmacy of the Kharkiv Medical Academy of Postgraduate Education (Head of the Department – Prof. Viktoriya Shapovalova) was used, which included seven criteria [17, 18, 19].

Criteria for selection of drugs for INN Silymarin ATC code A05BA03 shown on the Fig. 1.

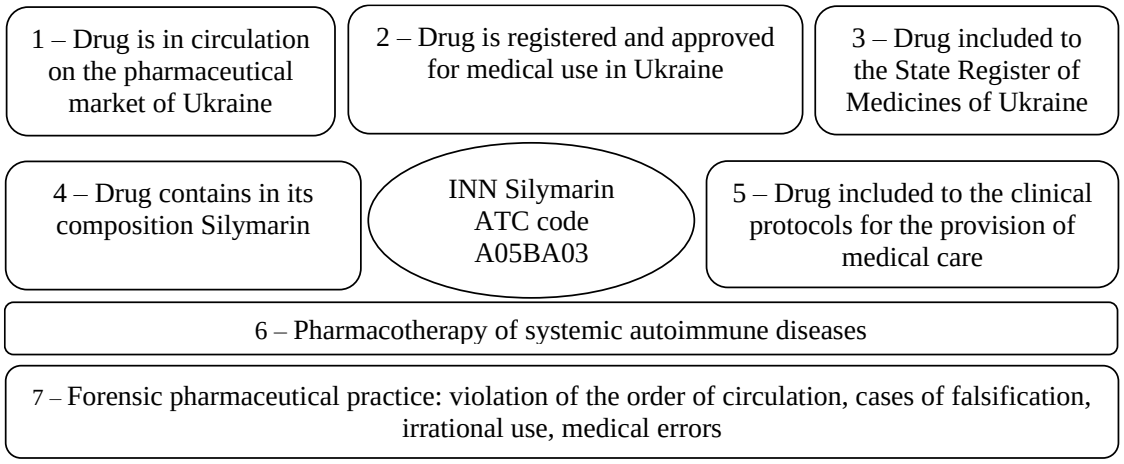

Fig. 1. Criteria for selection of drugs according to the INN Silymarin ATC code A05BA03 of innovative experimental study

Study material were drugs by the INN Silymarin ATC code A05BA03. All drugs meet six criteria, forensic and pharmaceutical practice (the 7th criteria Fig. 1) is absent as of June 2021. Names of drugs were systematized by the INN Silymarin ATC code A05BA03, trade names, range and types of dosage forms.

Content analysis of INN Silymarin ATC code A05BA03 was performed by dosage forms by grouping them using the Sturgess formula, followed by construction of discrete series of variations and distribution polygon: n=1+3,322lg N, where n – is the number of groups; N – is the number of drugs. The boundaries of the step of certain groups of drugs were determined by the formula:

$$h = \frac{X\,\max - X\,\min}{n},$$

where h – is the step size of the group; X_{max} – is the maximum value of the number of dosage forms; X_{min} – is the minimum value of the number of dosage forms [17, 18, 19].

The information base of the study consisted of scientific works of foreign and domestic scientists on the topic of the article. The review of scientific sources of literature was carried out taking into account the recommendations of the Cochrane Society for PICO: P (population) – the population suffering from systemic autoimmune diseases; I (intervention) – pharmacotherapy, drugs by the INN Silymarin ATC code A05BA03; C (comparison) – comparison in research technology, innovative experimental study; O (outcomes) – research results [20, 21, 22, 23, 24].

Among the additional research methods, used regulatory, documentary, clinical and pharmacological, marketing, forensic and pharmaceutical and graphic. Microsoft Excel 2010 (descriptive characteristics: minimum and maximum value, average value) was used to process the results and determine the consistency between the studied parameters.

The research of the article is a fragment of research works of Lviv Medical Institute LLC on the topic of "Improvement of the drug circulation system during pharmacotherapy on the basis of evidence-based pharmacy and forensic pharmacy, organization, technology, biopharmacy and pharmaceutical law" (state registration number 0120U105348, terms 2021-2026), Kharkiv Medical Academy of Postgraduate Education on "Improving the organizational and legal procedure for providing patients with drugs from the standpoint of forensic pharmacy, organization and management of pharmacy" (state registration number 0116U003137, terms 2016-2020) and "Pharmaceutical and medical law: integrated approaches to the system of drug circulation from the standpoint of forensic pharmacy and organization of pharmaceutical business" (state registration number D/21U000031, terms 2021-2026) [25, 26, 27].

Research results. At the first stage author conducted of the innovative experimental study, a marketing analysis of the INN Silymarin ATC code A05BA03 drug range. During the marketing analysis of the range of drugs on the national market, an information array of marketing information about drugs was initially formed using the content analysis of official reference publications. Primary data for content analysis: drugs, which according to the regulatory and documentary analysis as of June 2021 were registered, allowed for circulation in Ukraine, allowed for inclusion into the pharmacotherapy of systemic autoimmune diseases. After summarizing the processed data, a marketing list of drugs was compiled according to the INN Silymarin ATC code A05BA03, which has ten names of drugs (Table 1).

Table 1. Marketing list of drugs according to the INN Silymarin ATC code A05BA03 for pharmacotherapy of patients with systemic autoimmune diseases

No.	Trade name	Dosage form, strength, amount per unit
1	2	3
1.	Triosil	Tablets 22.5 mg N.30
		Tablets 22.5 mg N.50
		Tablets 22.5 mg N.100
2.	Legalon	Capsules 140 mg N. 20
		Capsules 140 mg N. 30
		Capsules 140 mg N. 60
		Capsules 70 mg N. 20
		Capsules 70 mg N. 30
		Capsules 70 mg N. 60
3.	Silibor forte	Capsules 70 mg N. 20
		Capsules 70 mg N. 40
4.	Silibor max	Capsules 140 mg N. 20
		Capsules 140 mg N. 40
5.	Silibor 35	Coated tablets 35 mg N. 20
		Coated tablets 35 mg N. 25
		Coated tablets 35 mg N. 30
		Coated tablets 35 mg N. 80
6.	Fumart	Capsules 50 mg N. 20
		Capsules 50 mg N. 30
7.	Carsil forte	Hard capsules 90 mg N. 30
8.	Darsil	Coated tablets 22,5 mg N. 30
		Coated tablets 22,5 mg N. 50
		Coated tablets 22,5 mg N. 100
9.	Carsil	Coated tablets 22,5 mg N. 80
10	Hepabene	Hard capsules N. 30

For the next stage of the content analysis of drugs according to INN Silymarin by dosage forms, primary data on the types of dosage forms and the range of drugs of INN Silymarin ATC from the marketing list (Table 2) were selected and processed.

Table 2. Primary data for content analysis drugs of the INN Silymarin ATC code A05BA03 from the list of dosage forms

No.	Dosage form	Assortment
1	Hard capsules	2
2	Tablets	3
3	Coated tablets	8
4	Capsules	12
	Total	25

In the pharmacotherapy of systemic autoimmune diseases, doctors use four dosage forms of the drug INN Silymarin ATC code A05BA03.

Subsequently, the number of groups (three) and the step of group (two) for drug formulations for INN Silymarin were determined. The distribution of groups according to the initial and final values of the step (Table 3) showed that the dosage forms of drugs for INN Silymarin formed three groups.

Table 3. Determination of the boundary of the step groups of drugs INN Silymarin ATC code A05BA03 when summarizing the dosage forms

Group No.	Initial step value	Final step value
1st group	1	4
2nd group	5	8
3rd group	9	12

Next, the distribution of drugs by the INN Silymarin ATC code A05BA03 conducted according to the range and type of dosage forms, which presented in Table 4.

Table 4. Distribution of drugs of the INN Silymarin ATC code A05BA03 by range and type of dosage forms

No.	Dosage form	Drugs assortment
The first group		
1.	Hard capsules	2
2.	Tablets	3
	Total	5
The second group		
1.	Coated tablets	8
	Total	8
The third group		
1.	Capsules	12
	Total	12

Based on the content analysis of drugs by dosage forms and range, statistical processing of research results performed by constructing discrete variation series and polygons of distribution of the obtained data. Discrete variation series of drug distribution shown in Table 5.

Table 5. Discrete variation series by the INN Silymarin ATC code A05BA03

Group No.	Group range	Frequency, f_i
1	1-4	5
2	5-8	8
3	9-12	12

Discussion. Content analysis is a widely used innovative method of analysis of pharmacotherapy schemes for systemic connective tissue diseases. There are three approaches to conduct content analysis: conventional, directed, and summative. All three approaches used to interpret meaning from the content of text data and, hence, adhere to the naturalistic paradigm. The major differences among the approaches are coding schemes, origins of codes, and threats to trustworthiness. In conventional content analysis, coding categories derived directly from the text data. With a directed approach, analysis starts with a theory or relevant research findings as guidance for initial codes. A summative content analysis involves counting and comparisons, usually of keywords or content, followed by the interpretation of the underlying context. An innovative experimental study is that the content analysis based on the creation of a neutral framework for the classification of efficacy descriptions drugs of the INN Silymarin ATC code A05BA03. The use of innovative experimental methods for personalized drug selection for patients with systemic autoimmune diseases in a pandemic of coronavirus infection is promising and socially justified [28, 29, 30, 31].

Received data of an innovative experimental study on dosage forms of drugs of the INN Silymarin ATC code A05BA03 given in the Table 4. The first group included five drugs of the INN Silymarin in double dosage forms (hard capsules and tablets). When prescribing pharmacotherapy, doctors have a choice of both drugs and dosage forms. The range of drugs in the second group consists of eight names of drugs of the INN Silymarin ATC code A05BA03, which doctors have to prescribe only in one dosage form – coated tablets. The data obtained show a lack of balance between supply and demand for patients and physicians. The picture is similar in the third group: twelve drugs have one dosage form – capsules. Unfortunately, in last group there is also no balance in dosage forms.

However, the obtained discrete variation series (Table 6) indicates that in the third group the studied quantitative indicator has the highest frequency (f_i = 12). It is possible to assume that the capsules are more widely used in the pharmacotherapy of systemic autoimmune diseases.

Graphically discrete variation series of the studied drugs INN Silymarin ATC code A05BA03 presented on Fig. 2 in the form of a distribution polygon.

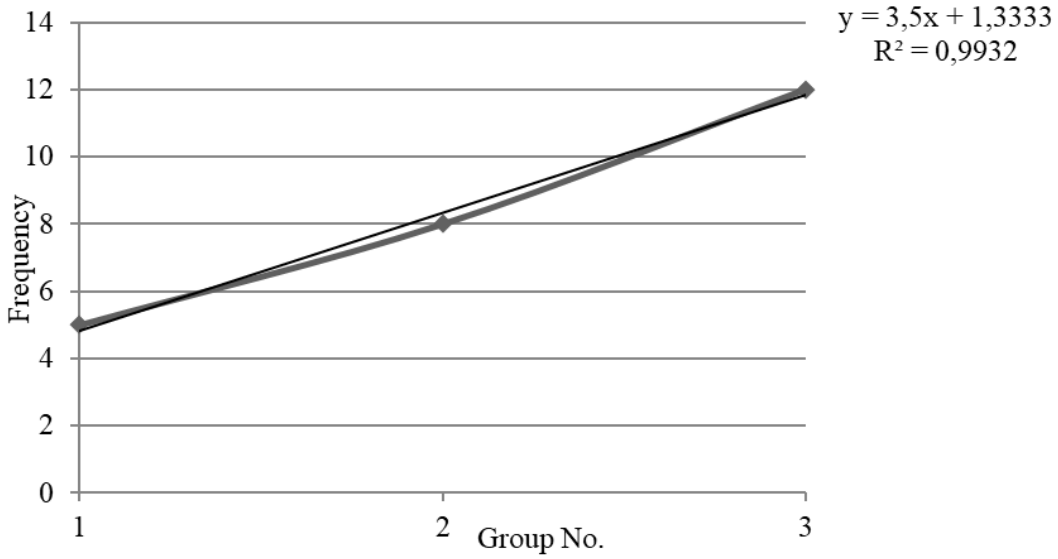

Fig. 2. Distribution polygon of drugs of the INN Silymarin ATC code A05BA03 by dosage forms from innovative experimental study.

In doctors' arsenal during pharmacotherapy of systemic autoimmune diseases, there are three groups of drugs with INN Silymarin ATC code A05BA03 (Fig. 2). In the first group, there are five drugs in two dosage forms. The second group – eight drugs in one dosage form (coated tablets). The third group – twelve names of drugs with INN Silymarin ATC code A05BA03 in one dosage form (capsules).

Conclusions. Conducted an innovative experimental study of pharmacotherapy of systemic autoimmune diseases using content analysis on the example of drug of the INN Silymarin ATC code A05BA03 in healthcare facilities (hospitals, clinics, pharmacies). The analysis allows to obtain a complete description of the balance of "supply and demand" between the range and types of dosage forms of drugs INN Silymarin ATC code A05BA03, that approved for use. Doctor has a choice of the appropriate drug

and dosage form that corresponds to social personalized pharmacotherapy. Content analysis is a widely used innovative method of analysis of pharmacotherapy schemes for systemic connective tissue diseases. We hope it serves to orient and encourage a more creative use of methods in future studies.

Gratitude. Author thanks the administration, doctors and nurses of the Lviv Medical Institute LLC, Kharkiv Medical Academy of Postgraduate Education, State Institution «Kundiiev Institute of Occupational Health of the National Academy of Medical Sciences of Ukraine», Danylo Halytsky Lviv National Medical University, for their help and support when working with clinical protocols and drugs during a qualitative innovative study.

Conflict of interests. There is no conflict of interest to disclose for author.

REFERENCES

1. Hayduchok I.G., Shapovalova V.O., Shapovalov V.V., Shapovalov V.V. Control regime of antibacterial drugs for pharmacotherapy of coronavirus disease (COVID-19) among patients with dual disorders. An information letter about innovations Ukrmedpatentinform of the Ministry of Health of Ukraine. Kyiv: Ukrmedpatentinform of the Ministry of Health of Ukraine. 2020. N. 230–2020. 6 p.
2. Hayduchok I. G., Shapovalova V. O., Shapovalov V. V., Shapovalov V. V. Control regime of drugs for pharmacotherapy of coronavirus disease (COVID-19) among patients with systemic diseases. An information letter about innovations Ukrmedpatentinform of the Ministry of Health of Ukraine. K.: Ukrmedpatentinform of the Ministry of Health of Ukraine. 2020. N. 225 – 2020. 6 p.
3. Beketova TV, Blank LM, Lila AM. COVID-19 in a patient with ANCA-associated systemic vasculitis, receiving anti-B cell therapy (rituximab) // Rheumatology Science and Practice. 2019. Retrieved from https://rsp.mediar-press.net/rsp/article/view/2889?locale=ru_RU#
4. Hayduchok I. Pharmacotherapy of immunopathological syndromes among patients with systemic lupus erythematosus based on ABC/VEN analysis // Acta Scientific Medical Science. 2021. Vol. 5, Iss. 6. P. 67-73. DOI: 10.31080/ASMS2020.05.0925
5. Hayduchok I. G., Shapovalova V. O., Shapovalov (Jr.) V. V. Shapovalov V.V. Control regime of drugs for pharmacotherapy vasculitis of Shenlein-Genoch: An information letter about innovations Ukrmedpatentinform of the Ministry of Health of Ukraine. K.: Ukrmedpatentinform of the Ministry of Health of Ukraine, 2021. N. 64–2021. 7 p.
6. Yemchenko Y. O., Ishcheikin K. E., Kaidashev I. P. Analysis of the incidence and prevalence of psoriasis in Ukraine and Poltava region. Bulletin of VDNZU "Ukrainian Medical Dental Academy". 2014. Vol. 14, N. 3. P. 72–76.
7. Hayduchok I. G., Shapovalova V. O., Shapovalov V. V., Shapovalov V. V. Control regime of drugs for pharmacotherapy Rheumatoid arthritis. An information letter about innovations Ukrmedpatentinform of the Ministry of Health of Ukraine. Kyiv: Ukrmedpatentinform of the Ministry of Health of Ukraine. 2020. N. 36 –2021. 7 p.
8. Shapovalov (Jr.) V., Gudzenko A., Komar L. et al. Concerning the importance of forensic and pharmaceutical researches to improve patients' accessibility to medicines. Pharmacia. 2017. Vol. 65, N. 2. P. 23–29.
9. Shapovalov V. Use of innovative technologies in pharmacotherapy with target nanotherapy on the principles of evidence-based medicine and pharmacy. Actual problems of medicine and pharmacy. 2020. Vol. 1, N 1-2. Retrieved from http://apmplmi.com
10. Davis J. Content analysis of efficacy descriptions on branded pharmaceutical websites. Journal of Medical Marketing. 2012. Vol.12, N. 4. P. 211-220**.** DOI:10.1177/1745790412465425.
11. Hayduchok I. Pharmacotherapy of Systemic Vasculitis Combined with Cryoglobulinemic Syndrome using Pharmacoeconomic Approaches // Global Journal of Health Science. 2021. Vol. 13, N. 7. P. 78-88. DOI: 10.5539/gjhs.v13n7p78. Retrieved from https://doi.org/10.5539/gjhs.v13n7p78).
12. ATC-classification. Compendium on-line. Retrieved from http://www.compendium.com.ua/atc
13. Ministry of healthcare of Ukraine official site. Retrieved from http://www.moz.gov.ua
14. National list of basic medicines. – Resolution of the Cabinet of Ministers of Ukraine. 2009 March 25. N. 333. Retrieved from http://www.zakon4.rada.gov.ua
15. On approval of the twelfth issue of the State formulary of medicines and ensuring its availability. Order of the Ministry of Health of Ukraine. 2020 May 06. N. 1075. Retrieved from http://www.zakon4.rada.gov.ua
16. Shapovalova V. System of drugs circulation based on medical and pharmaceutical law. Actual problem of medicine and pharmacy. 2020. Vol. 1, N. 1-2. Retrieved from http://apmplmi.com
17. Shapovalova V.O., Zbrozhek S.I., Shapovalov V.V. (Jr.), Shapovalov V.V. Content analysis of pharmacies in Ukraine, which produce extemporaneous drugs. Public health. 2017. T.6, №3–4. P. 77–83. DOI: 10.22141/2306-2436.6.3.2017.123498
18. Shapovalova V.O. et al. Content analysis of alcohol circulation in healthcare facilities at the stage of budget procurement. Copyright N. 79456 (Ukrainian). Publ. 05/31/18

19. Gudzenko A.A., Osyntseva A.A., Shapovalova V.O. Content analysis of alcohol circulation by dosage forms and registration certificates. Copyright 79473 (Ukrainian). Publ. 06/01/18
20. Management Science for Health. Managing Medicines Selection. Managing Access to Medicines and Health Technologies. USA: Arlington, 2012. P. 16.1–16.15.
21. Parnes O. Autoimmune disease. The Lancet. 2018. N. 367. P. 389.
22. Anderson P.D., O'Donnell J. The Forensic Pharmacist. Drug Injury: Liability, Analysis, and Prevention. Hardcover. 2017. N 23. P. 761-770.
23. Takakubo K., Konttinen Y. Immune-regulatory mechanisms in systemic autoimmune and rheumatic diseases. Clin. Dev. Immunol. 2012. Vol. 37, N. 3. P. 341–346.
24. Shapovalov (Jr.) V. et al. Forensic and pharmaceutical study of the presence of a causal link between the degree of alcohol abuse and qualification level of the respondents. Pharmacia. 2017. Vol. 66, N. 3. P. 31–39.
25. Hayduchok I., Shapovalov V. Organizational and legal measures of state control of reforming and modernizing the health care on principles of pharmaceutical and medical law. Actual problems of medicine and pharmacy. 2020. Vol. 1, N. 1-2. Retrieved from http://apmplmi.com
26. Shapovalova V. A., Zbrozhek S. I., Shapovalov V. V, Shapovalov V. V. Forensic pharmacy: some risk factors in the formation of addictive health disorders. Acta Scientific Pharmaceutical Sciences. 2021. Vol. 4, N. 1. P. 7–12. DOI: 10.3180 / ASPS.2020.05.0651
27. Shapovalova V. A., Zbrozhek S. I., Shapovalov V. V, Shapovalov V. V. Organizational and legal evaluation of availability of medicines' circulation for cancer patients. Pharmacia. 2018. Vol. 65, N. 2. P. 17-22.
28. Hsieh Hsiu-Fang, Shannon Sarah E. Three approaches to qualitative content analysis. ResearchGate. 2005. DOI:10.1177/1049732305276687. Retrieved from https://www.researchgate.net/publication/7561647_Three_Approaches_to_Qualitative_Content_Analysis
29. Davis J. Content analysis of efficacy descriptions on branded pharmaceutical websites. Journal of Medical Marketing. 2012. N.12 (4). P. 211-220**.** DOI:10.1177/1745790412465425
30. Shapovalov (Jr.) V. et al. Organizational and legal analysis of the pharmaceutical provision for the most common diseases of society. International Journal of Pharmaceutical Sciences Review and Research. 2018. Vol. 51, N. 18. P. 118–124.
31. Shapovalova V.O., Zbrozhek S.I., Shapovalov (Jr.) V.V., Shapovalov V.V. Coronavirus disease pandemic 2019: growth of epidemic dangers. Acta scientific pharmaceutical sciences. 2020. Vol. 4, N. 7. P. 61–68.

SCIENTIFIC DISCUSSION ON NORMATIVE ISSUES OF OCCUPATIONAL HEALTH, SANITARY AND HYGIENIC EPIDEMIOLOGICAL DEMANDS IN PHARMACY ESTABLISHMENTS DURING COVID DISEASES IN THE REPUBLIC OF GEORGIA

Nana Gorgaslidze, *MD, PhD, Doctor of Pharmaceutical Sciences, Professor of Tbilisi State Medical University, Head of The Department of Social and Clinical Pharmacy, Tbilisi, Georgia*
Nodar Sulashvili, *MD, PhD, Doctor by Theoretical Medicine in Pharmaceutical and Pharmacological Sciences, Associate Professor of Tbilisi Open University, International School of Medicine, Division of Pharmacology, Tbilisi, Georgia*

DOI: https://doi.org/10.31435/rsglobal_sr/30072021/7637

ARTICLE INFO

Received 23 May 2021
Accepted 12 July 2021
Published 30 July 2021

KEYWORDS

Occupational, health, normative, sanitary, hygienic, pharmacy, covid diseases.

ABSTRACT

Protecting safe working conditions involves the use of ineffective and reliable means of preventing industrial injuries and occupational diseases, technologies, equipment and others. It is natural that the fields, technological processes, etc., are characterized by their specifics and the safety rules should be different for them. In pharmacies, laboratories, training and scientific research laboratories, warehouses, production equipment are subject to daily cleaning. Cabinets in storage rooms should be cleaned as needed, but at least once a week. Wet cleaning of the pharmacy, laboratory/ factory (floor and equipment) before starting work. Only dry cleaning of laboratory / production using disinfectants is not allowed. Waste and rubbish should be collected in special containers with a moving lid and should be removed at least once a day. Hand-washed sinks, toilets and garbage containers should be cleaned, rinsed and disinfected daily. Personnel are required to follow the rules of personal hygiene and industrial sanitation, to carry out the relevant personnel to perform food, smoking, as well as storage of food, tobacco and personal medicines in pharmacies, training and scientific research laboratories and departures. Pharmaceutical establishments do not comply with the hygienic norms of the internal and external environment, physical, chemical and biological factors of the labor process. The facility also does not take into account psychosocial factors related to safety (stress, communication, post-traumatic stress, etc.); Most pharmaceutical establishments (50-60%) do not have a fire board with appropriate equipment, evacuation exit and scheme. Also has no person responsible for the matter; Disobsibility and specialist protection/separation facility prior to pandemic were minimal (increased by 99%) during pandemic; The state should create an appropriate legislative and institutional framework; We think this will help transform the existing department into an effective labor inspectorate. The possibility will be created of the institutional capacity of its independence and efficiency, and the law will also provide guarantees for the individual independence of inspectors. Also, the bill should directly refer to the Labor Inspectorate as the body responsible for law enforcement.

Citation: Nana Gorgaslidze, Nodar Sulashvili. (2021) Scientific Discussion on Normative Issues of Occupational Health, Sanitary and Hygienic Epidemiological Demands in Pharmacy Establishments During Covid Diseases in the Republic of Georgia. *Science Review*. 3(38). doi: 10.31435/rsglobal_sr/30072021/7637

Copyright: © 2021 **Nana Gorgaslidze, Nodar Sulashvili.** This is an open-access article distributed under the terms of the **Creative Commons Attribution License (CC BY)**. The use, distribution or reproduction in other forums is permitted, provided the original author(s) or licensor are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.

Introduction. The purpose of the labor legislation in Georgia is to regulate the relationship between the employer and the employee through clearly defined legal regulation that excludes the

exploitation of the employee and creates the possibility of work based on human dignity, freedom and self-development [1-2]. Accordingly, the purpose of labor legislation is to regulate private legal relations at the normative level to the extent that it is necessary for the proper social protection of workers [3, 4]. The employer is obliged to provide the candidate with information about the work to be performed, working conditions, contract form, remuneration and legal status of the employee during the employment relationship [5, 6].The performance of the assigned work is usually subject to organizational regulation and the daily and/or weekly hourly work schedule set by the employer. Under such organizational arrangements, it is important to classify time into work, break, and leisure time [7, 8].

Working time includes the time that an employee must use to fulfill a contractual obligation. Break time is the period of time between working hours, while break time is defined by labor law as leave periods and days off [9] .Overtime work is voluntary, although the Labor Code provides for exceptional cases where overtime work becomes mandatory for an employee. These cases are:- To prevent natural disasters and/or to eliminate their consequences;-Unpaid; To prevent an industrial accident and/or to liquidate its consequences with appropriate compensation [10, 11]. The Labor Code establishes the right of the employer to take paid leave of 24 working days and unpaid leave of 15 calendar days [12]. Depending on the specifics of the work, the Labor Code provides for additional leave for those working in heavy, harmful or hazardous work in the amount of 10 calendar days a year. The list of such works is approved by the order of the Minister for Internally Displaced Persons from the Occupied Territories of Georgia, Labor, Health and Social Protection [13, 14].

The employer is obliged to provide the employee with the safest working environment for health. The need for individual measures to protect and maintain the health of employees is particularly high in some areas of employment [15]. In order to protect the health of employees in the workplace, as well as the importance of the work performed, national legislation provides for cases and rules for mandatory periodic medical examination of an employee at the expense of the employer. Periodic and regular medical examinations are required depending on the content of the activity. With the exception of cases provided for by a regulatory enactment, the employer has the right to determine additional conditions for a medical examination [16, 17].

Working conditions. An important prerequisite for the rational use of employees' working time and, in general, for increasing the efficiency of their work are normal working conditions and the establishment of rational internal rules for work and rest at the enterprise. Work should be carried out in normal, favorable conditions, and when planning a workplace and its technological equipment, it is necessary to take into account the latest advances in technology and technology [18,19]. This significantly helps to reduce staff fatigue, save time, improve staff efficiency and ultimately improve work efficiency and success. Quite common in the West is the so-called. "The theory of human capital". According to this theory, the knowledge and skills of employees are considered to belong to their organization, which generates income. And the costs of acquiring this knowledge (personnel recruitment, selection, salary, adaptation, training, certification, improvement of working conditions) are considered an investment. Although the efficiency of such investments is the highest and, in addition, people are the most important resource for them, there are still records in the educational and scientific literature of these countries that seem to be the least developed, for example, finance, manufacturing. , marketing, materials Management of technical supply [20,21]. In the Georgian realities, only the first steps are being taken in this direction against a very poor background of economic development, wages, employment and living standards. Thus, when it comes to the successful management of an organization, it should in principle be said that limiting investments in human resources, ignoring the factor of trust and respect, inadequate staff motivation, reducing concern and social insecurity by boomerangs return to the development of the company [22, 23, 24].

The International Labor Organization (ILO) was formed in 1919 as part of the League of Nations to protect workers' rights. Later, the ILO joined the United Nations. The UN itself protects the rights of workers.

1. Everyone has the right to work, free choice of work, fair and favorable working conditions and protection from unemployment;

2. Everyone has the right to equal pay for equal work without any discrimination;

3. Everyone who works has a just and favorable standard of living that ensures the dignity of himself and his family and, if necessary, provides other means of social protection;

4. Everyone has the right to form trade unions and join trade unions to protect their interests.

5. Everyone has the right to rest, including reasonable limitations of working hours and paid vacation.

The International Labor Organization has developed international labor standards, which are set out in the Declaration of Fundamental Principles and Rights, which are widely recognized and of particular importance. They are widely used regardless of a country's level of development or ratification of cultural property and related conventions [25, 26].

These standards are composed of qualitative rather than quantitative standards and do not define specific levels of working conditions, wages, or occupational safety and health standards. They are not intended to measure comparative advantage. The main labor standards are human rights, they are recognized in internationally ratified international human rights instruments, including the Convention on the Rights of the Child [27, 28].

Employees' rights in the UK include the right to work, a paid disciplinary process during which they are eligible for escort, daily breaks, paid leave and more. Safety and social resilience include: protecting employees' rights and safe working conditions, preventing human trafficking and eliminating child labor. In pharmaceutical institutions, hygiene standards are required and adhered to. Pharmacy institutions are all institutions in which pharmaceutical activities are carried out. When carrying out pharmaceutical activities under the influence of high-risk factors, possible cases of occupational diseases of an employee may develop [29, 30].

An occupational disease (acute or chronic) develops under the influence of factors that threaten the working environment and the production process, causes a deterioration in his health and/or restriction of his professional ability to work in the short or long term, and is determined by the legislation of Georgia. [31, 32]. Therefore, the specifics of pharmaceutical activities should be taken into account, in particular: the development of a new pharmaceutical product (molecule), the use of various chemicals and technologies, which, in turn, require special precautions. Also, one cannot ignore the necessary characteristics during storage, transportation, delivery, consumption of finished products, and, as a result, the need to comply with sanitary and hygienic working conditions [33, 34].

Related to the pharmaceutical industry: measures related to waste collection, processing, waste disposal, pollution control and other waste management processes. Therefore it is necessary to consider:

1. Sanitary-hygienic characterization of working conditions - physical, chemical, biological factors of the production and/or working environment and the labor process;

2. The permissible norms of chemical substances in the air of the working zone of the pharmaceutical institution shall be used for the hygienic assessment of the working conditions for the following purpose: A) To determine the conformity with the hygienic norms to check the working conditions of the employees and to make a hygienic conclusion; B) To determine the priority direction during the implementation of remedial measures and to determine its effectiveness; C) To create a database at the level of enterprise, field, region, republic; D) To determine the level of occupational risk, to take preventive measures and to justify social protection measures; E) To investigate cases of occupational diseases and poisoning.

ISO – The normative act of the International Organization for Standardization provides:

1. The purpose of labeling and marking hazardous chemicals is to inform the contact persons and the user about the harmful effects of these substances on health and the environment, in order to ensure their safe use;

2. In order to safely treat a hazardous chemical and maintain its consumer properties, the creator/manufacturer shall classify the substance / preparation according to the hazard before submitting it to the state examination and registration application, as well as develop a draft of the mark and label;

3. Each category of hazard classification shall be abbreviated, accompanied by the relevant risk phrase or phrases;

4. If the substance is classified as flammable, sensitizing or hazardous to the environment, only the phrase risk shall be used;

5. If a substance is classified as carcinogenic, mutagenic or toxic, the appropriate abbreviation is used to indicate the category (eg 1,2,3) [28, 29].

6. Hazard classification categories are expressed by the following abbreviations: a) Explosive: E b) Oxidizing: O c) Particularly flammable: F + d) Highly flammable: F flammable: R10 f) Highly toxic: T +

g) Toxic: T h) Harmful: Xn i) Corrosive: C j) Irritant: Xi l) Sensitizing: R42 and / or R43 m) Carcinogenic: Carc. Cat. (1) n) Mutagenic: Muta. Cat. (1) n) For toxic reproduction: Repr. Cat. (1) o) for hazardous environment: N and / or R52, R53, R59.

7. Hazard classification categories are represented by symbols with risk R-phrases and safety S-phrases.

8. The user who carries out the use of hazardous chemicals is obliged to ensure the maintenance of the label and mark on the container.

In order to investigate and study the possible danger, the data are important, in particular the information on the label, which is emphasized in the mentioned normative act. Required:

A) For the substance - trade name, chemical name, synonyms common according to IUPAC and CAS number; B) For the drug - trade name, chemical names of the constituents according to IUPAC, CAS numbers and concentrations; C) State registration number; D) Scope of application; E) Complete information about the manufacturer, importer or distributor of the substance / preparation: name, surname, address, telephone; F) Date of manufacture, expiration date, batch or series number, storage conditions, net, mass; G) Symbols and signs of the relevant classification of danger; H) R-phrases indicating a specific hazard; I) S-phrases denoting security measures; J) Information on first aid.

The same document defines:

1. How to provide the required information on the label: A) For hazardous chemicals used within the country - in Georgian; B) For export chemicals in several foreign languages (English, Russian, German, French, Spanish, etc.); C) The inscription should be easy to understand for the carrier and the professional user.

2. The label shall indicate the prohibition of re-use of packaging or material, as well as recommendations for its disposal and decontamination;

3. The label must be firmly affixed to the packaging container or material as soon as the chemical is packaged;

4. The dimensions of the label are determined according to the volume of the container. The size of the label should not exceed: A) in case of volume up to 3 liters - 52X74 mm; B) in case of volume more than 3 liters and not more than 50 liters - 105X148 mm; C) in case of volume more than 50 liters and not more than 500 liters - 148X210 mm;

5. Each symbol on the label should occupy 1/10 of the surface of the container and at the same time should not be less than 1 cm;

6. Danger symbols shall be displayed in accordance with Annex 3. If the danger is indicated by more than one symbol, then on the label: A) When displaying the necessary E symbol, it is not necessary to display the F, F + and O symbols; B) It is not necessary to display the symbols Xn, Xi, C when the necessary T + or T symbol is displayed; C) it is not necessary to display the symbols Xn, Xi when displaying the necessary C symbol; D) Necessary Xn, display of the symbol Xi is not required when displaying the symbol;

7. Symbols should be drawn in a square on a black, orange-yellow background;

8. Risk phrases for the label are selected according to the hazard criteria. A maximum of six phrases are used to describe the risk. Mixed risk phrases are used when necessary. If a substance is characterized by several categories of hazard the standard phrases should cover all of them;

9. Safety S-phrases for the label are selected according to the risk phrases. A maximum of six S-phrases are usually sufficient to form security measures [35, 36].

From a safety point of view, special importance is attached to the transportation of a pharmaceutical product, which is set out in the same Act as follows:

1. In case of transportation of a chemical substance, the label of the transport container shall include additional information on the number of packed container places placed in the transport container, the net and gross mass of each place, an indication on the normative-technical documentation;

2. If it is practically impossible to label and mark the container of a hazardous chemical due to the size of the container or the nature of the packaging, the relevant information must be reflected in the attached documentation;

3. Requirements for marks include: A) The markings on the label must reflect accurate information about the hazardous chemical; B) The label must be firmly attached to the container. Its

size must comply with the requirements set by the norms. The inscription should be clear and easy to understand; C) Labels with signs and symbols depicted on them must be uniform, including the R-phrases of risk and the S-phrases of safety used in the colors used [37].

This document addresses the safety issues of the pharmaceutical product in pharmaceutical establishments, as well as the cases when the patient uses the pharmaceutical product. The Ministry of Labor, Social Affairs, and the Ministry of Internally Displaced Persons from the Occupied Territories of Georgia (hereinafter referred to as the Ministry) is the Labor Safety Supervision Authority in Georgia. Protecting the health of the employed population, preventing occupational and occupational diseases, promoting a safe environment in the workplace. The beneficiaries of the program are citizens of Georgia. The program provides state-sponsored occupational health research for various services, including state-owned enterprises [38, 39].

Among the main tasks and functions of the mentioned department, the implementation of state supervision is defined:

- Implementation of technical regulations and labor safety mechanism for compliance with working conditions in the field of labor safety requirements, observance of safety rules during the production process and other work environment safety control, in case of violation of which the department is authorized to use the sanctioning mechanism;
- Supervise the observance of labor legislation and the investigation and registration of accidents at the place of employment;
- Take preventive measures against human trafficking in order to prevent forced labor;
- Analysis of labor law, violations of labor and health safety and the causes of industrial injuries, development of proposals and recommendations for their elimination and prevention;
- Review of applications, complaints and proposals within the scope of authority granted by the legislation of Georgia.
- Other rights provided by the statute [14, 17, 21].

By the decree of the Government of Georgia, the state program for monitoring the working conditions was approved, the implementation of which was entrusted to the central office of the Ministry. The target group of the program includes employers who give their prior consent to the monitoring. In addition, under this program, employers receive a notification about the inspection 5 working days before the monitoring procedure. Within the program, the target group is selected and the monitoring sequence is determined. The program does not establish the rules for conducting monitoring and its regulation is linked to the issuance of an individual act of the Minister. Violation of labor safety norms is controlled by a labor safety specialist - a person with appropriate qualifications appointed/ invited by the employer, who ensures the introduction and management of labor safety measures to prevent violations of labor safety norms [11, 12, 15].

According to the Georgia-EU Association Agenda for 2014-2016, Georgia has committed itself to establishing a labor inspection mechanism and institution that would have adequate potential to test working conditions and meet International Labor Organization standards.This issue is also defined in Chapters 13 and 14 of the Georgia-EU Association Agreement, the implementation of which is a future perspective.

Aim and objectives of the research.

The aim of the research was to study the legal-normative basis of labor safety, equipment and sanitary-hygienic requirements of activities in pharmaceutical institutions, to identify their strengths and weaknesses, pros and cons, to reflect a specific problem and to find ways to solve, eliminate and resolve it. In order to achieve the above-mentioned goal, we considered it necessary to determine the quality and compliance of the work space safety of the research facilities with the Organic Law of Georgia on Labor Safety. Assessing the risk of harm to personnel and consumers was considered an existing epidemic. Regarding safety - according to the data of the study period.

Materials and methods.

The information source of the paper is the materials of the survey of pharmacists, international economic journals, reports of the Ministry of Internally Displaced Persons from the Occupied Territories, Labor, Health and Social Affairs, statistical collections of the State Department of Statistics, Georgian laws, bylaws and other legal acts.

In general, the subject of research was the Georgian pharmaceutical market, which creates a danger not only for consumers but also for employees. The objects of research are pharmacies operating in the market, pharmaceutical companies, pharmaceutical companies, regulatory bodies and employees working there.

Based on the existing theoretical foundations of occupational safety, we considered it necessary to identify the methodological and practical issues, the set of materials from which we selected the objects of research.

The 2 types of questionnaires for pharmacists were selected. The questionnaire, on the one hand, considers whether there is a regulatory legal framework on labor safety in Georgia and, on the other hand, whether all the requirements provided by the legal framework are met, to what extent they comply with the requirements and standards.

Through this questionnaire, we focused on the following key issues:

- What information do pharmacists have about occupational safety, including sanitation?
- Is labor safety in pharmaceutical institutions regulated in Georgia;
- Is there a legal normative basis for sanitary requirements;
- If regulated, then how much is actually done in pharmaceutical establishments;
- Whether employees are provided with information on safety rules when hired and whether there is an appropriate entry in the employment contract.

As a research method, we used specific quantitative and qualitative studies, based on the results of which we drew some conclusions and developed recommendations.

Results and discussion:

The target segment of the research was 5 objects,

- 2 of them were pharmaceutical factories:
- GMP Ltd;
- Neopharm Ltd.
- 2 Drugstores
- Pharmacy PSP Ltd
- Aversi-Pharma Ltd
- And the regulatory body

Ministry of Internally Displaced Persons from the Occupied Territories, Labor, Health and Social Affairs of Georgia, LEPL Agency for Regulation of Medical and Pharmaceutical Activities.

The answers to each question from each of the five objects are presented in summary form (we did not consider it necessary to present the results separately at this stage). With this we tried to present an overall picture of the data actually available. The survey was conducted with a pre-compiled questionnaire, the anonymity of the respondents was protected.

The start date of the study was October 2019, which lasted until May 2020. Thus, the data were collected, which we conditionally divided before the Covid-19-related contraction (February) and and during the Covid-19 activation period. In both cases, due to the current situation, we used the same topical questions. Accordingly, an average of 142 respondents (from all five facilities) were interviewed. The answers are presented with two data. All the first diagrams presented are data up to Covid-19. Second, even the data obtained during Covid19.

Table 1. Q 1. Is labor safety regulated in Georgia?

Before Covid-19 (%)		Differences (%)	During Covid-19 (%)	
Yes	30.7	43.9	Yes	74.6
No	25	5.5	No	19.5
I do not know	44.3	38.4	I do not know	5.9

The data show that 44.3% of respondents were not informed about labor safety regulations in Georgia. And, 25% thought that security was not regulated at all. However, it should be noted that during the pandemic, the survey was conducted again and 74.6% of respondents believe that occupational safety is regulated by law. We also note that the need for labor safety regulation is growing, accounting for 43.9%. See Table 1.

Table 2. Q 2. Do you know the law on labor safety?

Before Covid-19 (%)		Differences (%)	During Covid-19 (%)	
Yes	34.8	33.8	Yes	68.6
No	65.8	43.4	No	31.4
I do not know	-	-	I do not know	-

The answers to this question show that if 34.8% knew about the Labor Law of Georgia before the pandemic, the developed situation necessitated knowledge with a difference of 33.8%. See Table 2.

Table 3. Q 3. Is labor safety regulated in pharmaceutical institutions?

Before Covid-19 (%)		Differences (%)	During Covid-19 (%)	
Yes	30.3	40.0	Yes	70.3
No	33.1	11.9	No	21.2
I do not know	36.6	28.1	I do not know	8.5

The data show that 30.3% of the respondents did not know about the regulation of occupational safety in a pharmaceutical facility before the pandemic. In the conditions of the pandemic, the interest in this direction increased by 40.0% and also the number of respondents who were unaware decreased from 36% to 28.1% from 8.5%, which somehow indicates a necessary tendency for self-development. See Table 3.

Table 4. Q 4. Do you know the legal normative based on sanitary requirements?

Before Covid-19 (%)		Differences (%)	During Covid-19 (%)	
Yes	41.8	319	Yes	73.7
No	58.2	31.9	No	26.3
I do not know	-	-	I do not know	-

The answers to the question about the degree of informativeness about the sanitary requirements of the legal normative base in pharmaceutical institutions do not look very good. The data show that it seems that all respondents are familiar with this issue, but it seems that the current situation also played a role here and the degree of improvement of knowledge amounted to - 31.9%. See Table 4.

Table 5. Q 5. Are sanitary requirements regulated in pharmaceutical facilities?

Before Covid-19 (%)		Differences (%)	During Covid-19 (%)	
Yes	32.4	45.6	Yes	78
No	34.5	17.6%	No	16.9
I do not know	33.1	28	I do not know	5.1

Unfortunately, 31.1% of respondents did not have information about the regulation of sanitary requirements. In this regard and 34.5% believed that it was not regulated. But in a re-survey, informatics increased by 45.6%, with 78% believing it to be regulated. The number of those who did not know decreased by 28% to 5.1%. See Table 5.

Table 6. Q 6. On the territory of Georgia, is there any registration of occupational disease at work with the existing high-risk, severe, harmful hazardous conditions?

Before Covid-19 (%)		Differences (%)	During Covid-19 (%)	
Yes	41.8	9.0	Yes	50.8
No	25.5	0.8	No	26.3
I do not know	32.6	9.7	I do not know	22.9

On this question, we think that the level of informatics is low and it should also be noted that before the pandemic and during the pandemic, interest in this area changed by only 9.0%. There are small gaps between the responses of respondents who do not know whether accounting is taking place. See Table 6.

Table 7. Q 7. Did the employer introduce you to the rules of labor safety when hiring you?

Before Covid-19 (%)		Differences (%)	During Covid-19 (%)	
Yes	49.3	22.7%	Yes	72
No	50.7	22.7	No	28
I do not know	-	-	I do not know	-

Interest in hiring employers to learn about occupational safety rules increased from 49.3% to 72% to 22.7%. Respondents who did not know and were not informed when hiring accounted for 50.0% which decreased by 22.7% and amounted to 28%. It should be noted that a high rate would be high on all of the above questions to maintain a high degree of information on all occupational safety regulations when hiring. We think that this information is important and should be taken into account. See Table 7.

Table 8. Q 8. Is there occupational safety at your workplace?

Before Covid-19 (%)		Differences (%)	During Covid-19 (%)	
Yes	48.9	30.8	Yes	79.7
No	51.1	30.8	No	20.3
I do not know	-	-	I do not know	-

It is noteworthy that 48.9% of respondents in the workplace believe that occupational safety is protected and 51% state that it is not protected, which changed significantly during the pandemic and increased by 30%. We think more attention is needed in this direction. See Table 8.

Table 9. Q9. Is the essence of your job a labor safety specialist?

Before Covid-19 (%)		Differences (%)	During Covid-19 (%)	
Yes	39.4	12.3	Yes	51.7
No	28.2	4.9	No	33.1
I do not know	32.4	17.1	I do not know	15.3

The urgency of this question has increased during the pandemic, but the respondents' answers are not in full compliance and a shortcoming has been identified. It is estimated that 51.7% of the institutions are security specialists. And the difference between pandemic and pandemic time is only 12.3%. See Table 9.

Table 10. Q 10. Are you aware of the health risk factors in your workspace?

Before Covid-19 (%)		Differences (%)	During Covid-19 (%)	
Yes	49.6	37.6	Yes	87.2
No	50.4	37.6	No	12.8
I do not know	-	-	I do not know	-

It is unfortunate that 50% were unaware of the existence of health hazards in the workplace and the degree of interest in information during the pandemic changed by 37.6% to 87.2%. It should definitely be noted that pharmaceutical activity is associated with life-threatening substances. And especially if the touch is long. See Table 10.

Table 11. Q 11. Is the compliance of the production environment and the physical, chemical and biological factors of the labor process with the hygienic norms of your facility?

Before Covid-19 (%)		Differences (%)	During Covid-19 (%)	
Yes	44.7	11.2	Yes	55.9
No	22.7	6.1	No	28.8
I do not know	32.6	17.3	I do not know	15.3

According to the answers to this question, there is no favorable situation in the pharmaceutical facility in this regard, the need for permanent identification of health hazards in the workplace has been identified. See Table 11.

Table 12. Q 12. Is there an evacuation board/drawing in your workspace?

Before Covid-19 (%)		Differences (%)	During Covid-19 (%)	
Yes	62.4	32.5	Yes	94.9
No	37.6	32.5	No	5.1
I do not know	-	-	I do not know	-

Before the pandemic, 62.1% said that during the pandemic - 94.9%, according to the survey results, during the pandemic, the number of medical institutions where the evacuation board was posted increased by 32.5%. It is known that the evacuation board is a plan of the floors of a building (pharmacy), which shows the evacuation exits, rescue facilities and their locations, etc. The spread of the evacuation board in the pharmacy was due to the sharply increased number of patients in pandemic conditions and the stressful environment created by the situation caused the pharmacists to lose attention, thus increasing the risk of harmful events (flammable substance ignition, fire hazard, etc.). See Table 12.

Table 13. Q 13. Do you think that all workplaces should have the appropriate safety requirements? (Fire extinguisher, hood, alarm, etc.)?

Before Covid-19 (%)		Differences (%)	During Covid-19 (%)	
Yes	73.2	20.8	Yes	94
No	26.8	20.8	No	6
I do not know	-	-	I do not know	-

Prior to the pandemic, 26.8% of respondents thought that appropriate safety precautions were not necessary in the facility, however, the current situation changed the majority view on this issue and 94% of respondents after the pandemic noted the need for appropriate security equipment, which was completely logical. The quarantine and isolation declared during the pandemic led to a change in the usual rhythm of life before adapting to the existing situation, people had to deal with a situation that was foreign and unusual to them, and mistakes were often made at high risk of adverse events. There has been an increase in rescue services, fire and emergency medical services and, consequently, continuous work in a busy schedule. All this made it necessary to place appropriate safety equipment in the workplace to be able to respond in a timely manner to the situations created. See Table 13.

Table 14. Q 14. Do you think the institution should take into account psycho-social factors (stress, communication, post-traumatic stress)?

Before Covid-19 (%)		Differences (%)	During Covid-19 (%)	
Yes	66.2	16	Yes	82.2
No	19	2.1	No	16.9
I do not know	14.8	13.9	I do not know	0.9

Almost all respondents to this question state that psycho-social factors should be taken into account in the institution. And positive responses, i.e. necessity before pandemic and pandemic time difference was 16%. Difference (66.2% before pandemic and 82.2% during pandemic). But it should also be noted that 33.8 (19 + 14.8) does not know the psycho-social factors should be taken into account in the institution. See Table 14.

Table 15. Q 15. Do you think if it is necessary to teach labor safety rules as a discipline?

Before Covid-19 (%)		Differences (%)	During Covid-19 (%)	
Yes	84.5	13	Yes	97.5
No	15.5	13	No	2.5
I do not know	-	-	I do not know	-

Quite interesting answers to the question of whether safety rules need to be learned. In both cases, the difference between the responses of the respondents is small and 13%. Nearly 90% believe that occupational safety needs to be taught. And as far as I know to date this issue is included in the Pharm Case and Organization and Economics curriculum. See Table 15.

Table 16. Q 16. Is there a dezo-barrier in the pharmaceutical facility / pharmacy?

Before Covid-19 (%)		Differences (%)	During Covid-19 (%)	
Yes	63.4	36.5	Yes	99.9
No	36.6	36.5	No	0.1
I do not know	-	-	I do not know	-

It is noteworthy that before the pandemic, 36.6% of respondents reported that there were no dezo barriers in pharmacies. The results of the survey differ significantly from the data obtained during COVID-19 infection. 99.9% of respondents confirm that there are dezo barriers in pharmacies. See Table 16.

Table 17. Q 17. Are there safety / separation glasses at pharmacy counters?

Before Covid-19 (%)		Differences (%)	During Covid-19 (%)	
Yes	75.2	23.5	Yes	98.7
No	24.8	23.5	No	1.3
I do not know	-	-	I do not know	-

In this case, the protective glasses at the pharmacy counters, or the specialist and patient separating glasses mentioned above, were significantly increased during the pandemic. But more than 23% of respondents think they do not know. See Table 17.

Conclusions.

Based on the study of the problems of this issue and the results of the research, we can draw the following conclusions:

- At present, the legal-normative base of labor safety, equipment and sanitary-hygienic requirements in Georgia creates a safe environment for activities in pharmaceutical establishments, the permanent control of compliance with the norms of which guarantees full protection for those in contact with the pharmaceutical product;
- We believe that the right, legal approach, strict control and state policy in the field of drug trafficking are a prerequisite for creating a safe environment. Most importantly, despite the interests of the owners of the Georgian pharmaceutical industry and modern marketing approaches, the safety of the population and employees remains a priority;
- Evaluation and analysis of the data obtained from our research suggest that there is a need to tighten and control safety regulations in the pharmaceutical facility;
- 44.3% of respondents are not informed about labor safety regulations in Georgia;
- More than 33% of respondents are unaware of the regulation of occupational safety in a pharmaceutical facility;
- Low legal-normative base and level of awareness on sanitary requirements in pharmaceutical institutions;
- 50% of respondents were unaware of the presence of potential or existing health hazards in the workplace.
- Pharmaceutical establishments do not comply with the hygienic norms of the internal and external environment, physical, chemical and biological factors of the labor process. The facility also does not take into account psychosocial factors related to safety (stress, communication, post-traumatic stress, etc.);
- Most pharmaceutical establishments (50-60%) do not have a fire board with appropriate equipment, evacuation exit and scheme. Also has no person responsible for the matter;
- Disobsibility and specialist protection / separation facility prior to pandemic were minimal (increased by 99%) during pandemic;
- 97% of respondents believe that labor safety should be taught in all its characteristics.

Recommendations.

Based on the analysis of the literature, the current situation and the results of the research, we have made the following recommendations:

- Healthcare is the area of activity that is most strictly regulated by the state. Today, the health care system, which includes all departmental and sectoral levels of the state economy, is not only a combination of medical-prophylactic, rehabilitation and recovery institutions, but also it is closely connected with ecology, labor protection, social programs, etc.
- One of the most important functions of health is to promote and restore the balance and harmony of individual and public health. We think we need:
- Expand the scope of the draft law on labor safety and extend it to all places of employment, without exception;
- Equip the Labor Inspectorate with an unconditional and free access to the places of employment, which implies the authority of the mechanism, by its own decision, to carry out inspections of the places of employment without the prior permission of the court;
- The Law of Georgia on Labor Safety envisages an appropriate system of sanctions, including the proper rules for the application of sanctions and adequate amounts of fines, which will have both preventive and responsive effects;
- The state should create an appropriate legislative and institutional framework; We think this will help transform the existing department into an effective labor inspectorate. The possibility will be created of the institutional capacity of its independence and efficiency, and the law will also provide guarantees for the individual independence of inspectors; Also, the bill should directly refer to the Labor Inspectorate as the body responsible for law enforcement.

REFERENCES

1. Technical Regulation on Fire Safety Terms and Conditions, 2011, Annex №1
2. Labor Code, Minister of Labor, Health and Social Affairs of Georgia; Article 17.1.
3. N. Sulashvili, M. Beglaryan, S. Kocharyan, N. Gorgaslidze; Scientifically Study Of Prospects of Modern Scientific Achievements And Research Challenges of Pharmacists Occupational Features In Pharmaceutics And Medicine; Удк 615.1:339.188 ISSN 2415-8593 Materials of IX International Scientific-Practical Conference- "Management And Marketing In The Modern Economy, Science, Education and Practice".Ministry of Health of Ukraine; Ministry of Education and Science of Ukraine; Ukrainian Marketing Association, National Pharmaceutical University of Ukraine,Department Of Pharmaceutical Management and Marketing. March 18, 2021, Kharkiv. Pp:26-41.
4. Julakidze E. Fundamentals of Management, Kutaisi, Khandzta Publishing House, 2013.Ashbourne Eide, Katharina Krause, Alan Rosa, Economic, Social and Handbook of Cultural Rights , Second Revised Edition, p. 263. 2 Ibid., P. 268.
5. European Commission - EudraLex - Volume 4 - Good Manufacturing Practice (GMP) guidelines; 2017.
6. FDA - Food and Drug Administration. 2018.
7. ICCCS-International Confederation of Contamination Control Societes, 2014.
8. Institute of Environmental Sciences and Technology - IEST-RP-CC023- "microorganisms in cleanrooms", 2016.
9. Institute of Environmental Sciences and Technology - IEST-RP-CC027 – "Personnel practices and procedures in cleanroom and controlled anviroments"; 2018.
10. ISO - International Organization for Standardization. 2020.
11. Resolution N38 of the Government of Georgia of 5 February 2015 "On the Approval of the State Program for Monitoring Labor Conditions" 189 Ibid., Article 3; 191 Ibid., Article 3.3.
12. Order N147 / N of the Minister of Labor, Health and Social Affairs of Georgia of May 3, 2007 "On Approval of the List of Hard, Harmful and Dangerous Jobs"
13. Order N01-10 / N of the Minister of Labor, Health and Social Affairs of Georgia of April 21, 2015, Article 2.1.
14. N. Sulashvili, M. Beglaryan, N. Gorgaslidze, S. Kocharyan, N. Chichoyan; The Scientific Discussion of the Features of Pharmaceutical Occupational Principles Adjustment, Challenges, Perspectives and Innovations; Tbilisi State Medical University, Faculty of Public Health; Conference Book; of the First Interanational Conference "Future of Health Care in the 21 Century", Tbilisi-2021; Pp:108-135.
15. Order N215 / N of the Minister of Labor, Health and Social Affairs of Georgia of July 11, 2007 "On the List and Approval of the Rules for Compulsory Periodic Medical Examination of the Employee at the Employer's Expense". 195 Ibid., Annex N1, first paragraph.
16. Retrieved from http://www.matsne.gov.ge 30016007010003017653, 2008, Article 5-6.
17. Retrieved from http://www.matsne.gov.ge 30016007010003017653, 2008, Article 5.
18. PHSS-Pharmaceutical Regulation And Pharmaceutical Science. 2019.
19. TOM PETERS RE-IMAGINE! October 6, 2003 Edition.
20. Victor H. Vroom Expectancy Theory, Encyclopedic Dictionary.
21. William L. ("Bill") White "Cleanroom Technology" 2008 Edition.

22. Ejibadze O. The Future of Management, Electronic Journal "Social Sciences", 2011, №2, p.
23. Markozashvili N. Human Relations Ethics in Organization - Part I; 2014.
24. Markozashvili N. Trust. Magazine - Business: People, Methods, Strategies. March, 2007, №1, p. 39-44.
25. Journal - Business: People, Methods, Strategies. Tbilisi, 6 (35), 2010., p. 24.
26. Magazine - Business: People, Methods, Strategies. October, 2007, №7, p. 47-50.
27. Ramishvili B., Strategic Management, Chapter I. The Essence and Importance of Strategic Management, Tbilisi, 2013.
28. Civil Code, Minister of Labor, Health and Social Affairs of Georgia 2017; Article 12.
29. N. Sulashvili., M. Beglaryan., N. Gorgaslidze., S. Kocharyan; Peculiarities of Priorities and Challenge of Pharmaceutical Sciences to Be Considere in Improvement of Regulation Issues of Pharmacists Profession; ISSN 1987 − 8826 Nano-Studies; Nano Studies 2020, № 20; Nano Studies is an annual International Scientific Journal; Nano Studies' topics include Nanoscience and Nanotechnology, and related problems of Physics, Chemistry, and Materials Science; Retrieved from http://www.nanostudies.org/ Nano Studies, 2020, №20, Tbilisi-Georgia, Pp 149-162.
30. Civil Code, Minister of Labor, Health and Social Affairs of Georgia 2017; Article 5.6.
31. Law of Georgia on Fire Safety 12.05.1998.
32. Law of Georgia on Drugs and Pharmaceutical Activities, 1997.
33. Resolution N650 of the Government of Georgia of December 2, 2014 "On Approval of State Health Care Programs for 2014".
34. Retrieved from http://www.matsne.gov.ge 30016007010003017688, 2009, Appendix 1, 2, 3
35. N. Sulashvili, M. Beglaryan N. Gorgaslidze; The Higher Educational Challenges, Recent Pharmaceutical Professional Issues and Occupational Specification of Pharmacists In Georgia;Удк 615.1:339.188ISSN 2415-8593 Materials of IX International Scientific-Practical Conference- "Management and Marketing In The Modern Economy, Science, Education And Practice". Ministry of Health Of Ukraine; Ministry of Education And Science of Ukraine; Ukrainian Marketing Association, National Pharmaceutical University Of Ukraine, Department of Pharmaceutical Management And Marketing. March 18, 2021, Kharkiv-2021. Pp 53-68.
36. Van Mil J. F., Schulz M., Tromp TFD. Pharmaceutical care, European developments in concepts, implementation, teaching, and research: a review // Pharm World Sci. 2014;26(6); pp. 303–321.
37. N. Sulashvili, M. Beglaryan, N. Gorgaslidze; Pharmacist Vocational Features, Regulations Framework and Profession Enhancement Challenges of Pharmaceutics.Caucasus Journal of Health Sciences and Public Health; E ISSN 2449-2450; ISSN 2449-2647; The University of Georgia Publishing House.www.caucasushealth.ge; Official Journal of the University of Georgia and Iv. Javakhishvili Tbilisi State University with Support of the Arctic University of Tromsø/Norway. Volume 4, Supplement 8, July 20-24, 2020; Pp 31-36.
38. Michael Ira Smith, Albert I. Wertheimer, Jack E. Fincham; Pharmacy and the US Health Care System; Pharmaceutical Press // 4th Revised edition edition (April 15, 2013); pp. 402-426.
39. International Pharmaceutical Federation (FIP). Continuing Professional Development/Continuing Education in Pharmacy // Global Report 2014. The Hague: International Pharmaceutical Federation; 2014.

COMPUTER SCIENCE

INTERVAL EDGE COLORING OF TREES WITH STRICT RESTRICTIONS ON THE SPECTRUMS

Albert Khachik Sahakyan, *Chair of Discrete Mathematics and Theoretical Informatics, Faculty of Informatics and Applied Mathematics, Yerevan State University, Armenia*

DOI: https://doi.org/10.31435/rsglobal_sr/30072021/7592

ARTICLE INFO

Received 19 April 2021
Accepted 10 June 2021
Published 30 July 2021

KEYWORDS

trees, interval t-coloring, interval edge coloring, restrictions on spectrums, dynamic programming.

ABSTRACT

An edge-coloring of a graph G with consecutive integers $c_1, \dots, c_t$ is called an interval t-coloring if all the colors are used, and the colors of edges incident to any vertex of G are distinct and form an interval of integers. A graph G is interval colorable if it has an interval t-coloring for some positive integer t. For an edge coloring α and a vertex v the set of all the colors of the incident edges of v is called the spectrum of that vertex in α and is denoted by $S_\alpha(v)$. We consider the case where the spectrum for each vertex v is provided $S(v)$, and the problem is to find an edge-coloring α such that for every vertex v, $S_\alpha(v) = S(V)$. We provide an $O(N)$ algorithm that finds such an edge-coloring for trees that satisfies all the restrictions. If it is impossible to have an edge-coloring that satisfies the restrictions of the spectrums the algorithm will tell that too.

Citation: Albert Khachik Sahakyan. (2021) Interval Edge Coloring of Trees with Strict Restrictions on the Spectrums. *Science Review*. 3(38). doi: 10.31435/rsglobal_sr/30072021/7592

Copyright: © 2021 **Albert Khachik Sahakyan.** This is an open-access article distributed under the terms of the **Creative Commons Attribution License (CC BY)**. The use, distribution or reproduction in other forums is permitted, provided the original author(s) or licensor are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.

Introduction. All graphs considered in this paper are undirected (unless explicitly said), finite, and have no loops or multiple edges. For an undirected graph G, let $V(G)$ and $E(G)$ denote the sets of vertices and edges of G, respectively. The degree of a vertex $v \in V(G)$ is denoted by $d_G(v)$, the maximum degree of vertices by $\Delta(G)$. Let T be a tree (a connected undirected acyclic graph).

For a directed graph $\vec{G}$ if there is an edge from a vertex u to a vertex v we will denote it as $u \to v$ or $(u, v) \in E(\vec{G})$. The graph G is called the underlying undirected graph of a directed graph $\vec{G}$ if $V(G) = V(\vec{G})$ and $E(G) = \{(u, v) | iff\ u \to v\ or\ v \to u\}$ (between any pair of vertices u and v, if the directed graph has an edge $u \to v$ or an edge $v \to u$, the underlying undirected graph includes the edge (u, v)).

For a tree T and a vertex r let T_r be the directed graph whose underlying undirected graph is T and in T_r each edge is directed in such a way that for all vertices $v \in T_r$ there is a path in T_r from r to v. We will say that T_r is a rooted tree with the root r. Fig. 1 illustrates the rooted tree T_{v_1} with the root v_1.

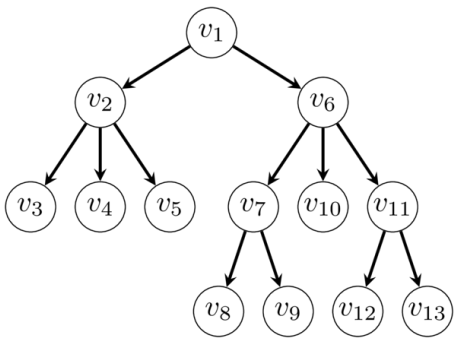

Fig. 1. A rooted tree T_{v_1} with the root v_1.

A vertex u is said to be the parent of the vertex v, denoted by $p(v)$ if $(u,v) \in E(T_r)$ and in such a case, the vertex v is said to be a child of the vertex u. The children of a vertex $v \in V(T_r)$ are the set of all vertices $W \subseteq V(T_r)$ such that $(v,w) \in E(T_r)$ for all $w \in W$. A vertex having no children is said to be a leaf vertex. For a vertex v let $ST(v)$ be the subtree induced by all the vertices w such that there is a path from v to w in T_r [4].

An edge-coloring of a graph G is an assignment of colors to the edges of the graph so that no two adjacent edges have the same color. An edge-coloring of a graph G with the colors $1, \dots, t$ is an interval t-coloring if all the colors are used, and the colors of edges incident to each vertex of G form an interval of integers. A graph G is interval colorable if it has an interval t-coloring for some positive integer t. The set of all interval colorable graphs is denoted by $\mathfrak{N}$. The concept of interval edge-coloring of graphs was introduced by Asratian and Kamalian [2] in 1987. This means that an interval t-coloring is a function $\alpha: E \to \{1, \dots, t\}$ such that for each edge e the color of that edge $\alpha(e)$ is an integer from 1 to t, for each color from 1 to t there is an edge with that color and for each vertex v all the edges incident to v have different colors and the set of these colors forms an interval of integers. For an interval coloring α and a vertex v the set of all the colors of the incident edges of v is called the spectrum of that vertex in α and is denoted by $S_\alpha(v)$. The smallest and the largest numbers in $S_\alpha(v)$ are denoted by $\underline{S_\alpha}(v)$ and $\overline{S_\alpha}(v)$.

In [1] it was shown that every tree is from $\mathfrak{N}$. In this paper, we consider the case where there are strict restrictions on the spectrums and the problem is to find an interval t-coloring that meets those restrictions. In [6] a solution for the simplified version of this problem was provided when the restrictions are on the spectrums, the restrictions are strict, and all the spectrums contain the color 1. In [8] another limited version was considered where each vertex had at most one interval of forbidden colors. In [3] and [9] it was shown that for bipartite graphs with maximum degree equal to 3 and with strict restrictions on spectrums the problem of finding an interval t-coloring that meets the restrictions is an NP-complete problem. In [7] another problem with restrictions is considered for bipartite graphs where the restrictions are provided for one "part" of the bipartite graph.

An $O(N)$ algorithm for edge coloring with given spectrums

We will reduce the interval t-coloring of the tree with restrictions on spectrums to edge-coloring of a tree with restrictions on spectrums.

Problem 1: Given an arbitrary tree T with $N = |V(G)|$ vertices and given strict spectrum restrictions $[l(v), r(v)]$ for every vertex v with $1 \leq l(e) \leq r(e) \leq N$ and $r(v) - l(v) + 1 = d_T(v)$. Determine whether it's possible to have an interval t-coloring $\alpha: E(G) \to \{1, \dots, N\}$ such that for each edge $e = (u,v)$, $l(u) \leq \alpha(e) \leq r(u)$ and $l(v) \leq \alpha(e) \leq r(v)$.

Problem 2: Given an arbitrary tree T with $N = |V(G)|$ vertices and given strict spectrum restrictions $S(v)$ for every vertex v with $|S(v)| = d_T(v)$. Determine whether it's possible to have an edge coloring α such that for each edge $e = (u,v)$, $\alpha(e) \in S(u)$ and $\alpha(e) \in S(v)$.

Note that in Problem 1 we require the restriction spectrums to be intervals while in Problem 2 the restriction spectrums can be arbitrary as long as the number of elements in the spectrum is equal to the degree of the vertex for all vertices. Problem 1 can be reduced to Problem 2 the following way. First if $\cup_{v \in V(G)} [l(v), r(v)] \neq [1, t]$ then it's impossible to have an interval t-coloring since the restrictions are strict. If the union forms an interval, then we just change the interval restrictions $[l(v), r(v)]$ for each vertex v to a spectrum restriction $S(v) = \{l(v), l(v)+1, \dots, r(v)\}$ and solve the second problem. If we find such an edge-coloring α then that coloring will also satisfy the first problem, because for every vertex the set of colors of its incident edges will be the $[l(v), r(v)]$ interval.

Now we will provide and $O(N)$ algorithm for the second problem. Without loss of generality, we can assume that $S(v) \subseteq \{1, \dots, N\}$ and can assume $N \geq 2$ since the case $N = 1$ is obvious. In that case every tree with $N \geq 2$ has a vertex v with $d_T(v) = 1$ (a leaf vertex). Let v_0 be an arbitrary leaf vertex. We are interested in the rooted tree T_{v_0}. Let the vertex connected to v_0 be v_1. In that case T_{v_0} would look like the tree shown in Fig. 2.

We are going to solve the problem using dynamic programming on trees. For every vertex v that has parent $p(v)$ let's denote the edge $(p(v), v)$ by e_v. If we can detect the color of e_v for all the non-root vertices then we will detect the color of all the edges of the tree. Now imagine that for some vertex v we already calculated the values for its children $u_1, \cdots, u_k$ $(k = d_T(v) - 1)$ and we have all the colors $c_i = e_{u_i}$ for every $1 \leq i \leq k$. In that case $\{c_1, \dots, c_k\} \subset S(v)$ and all those colors should be different, otherwise it would be impossible to continue the coloring since the edge e_{u_i} is also incident to vertex v hence its color should be inside $S(v)$. But $|S(v) \setminus \{c_1, \dots, c_k\}| = 1$ this means there is a

unique color $c \in S(v)$ that is not equal to any of the colors $c_1, \dots, c_k$ hence $\alpha(e_v)$ should be the color c. Fig. 3 illustrates that.

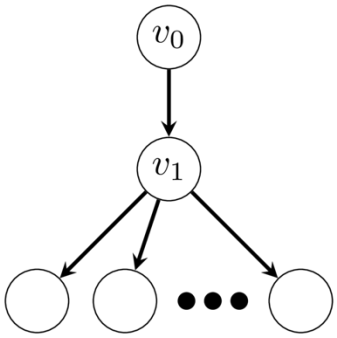

Fig. 2. The rooted tree T_{v_0}.

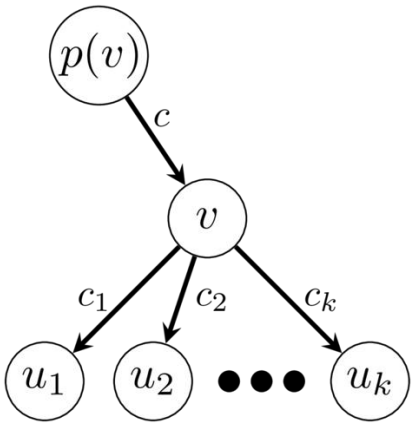

Fig 3. The colors of the children of vertex v.

This means that we can uniquely identify the color of edges incident to leaf vertices and construct all the other colors by moving up and subtracting all the used colors. If for some vertex we already constructed the colors of its children and there is conflict with the restrictions for the vertex v we can continue constructing the color for the edge e_v otherwise there is no coloring that satisfies the restrictions. Since for each vertex v we would do $d_T(v)$ operations for finding the color that is different from the colors of the edges that connect to its children the complexity of the algorithm will be $\sum_{v \in V(T)} d_T(v) = 2 \cdot |E(T)| \leq 2 \cdot N$ hence the algorithm is $O(N)$.

Conclusions. In this article we provided an efficient algorithm for checking and constructing interval coloring for trees on given strict spectrum restrictions. It uses dynamic programming.

REFERENCES

1. R.R. Kamalian "Interval colorings of complete bipartite graphs and trees", Preprint of the Computing Centre of the Academy of Sciences of Armenia, Yerevan, 1989
2. A.S. Asratian, R.R. Kamalian, Interval colorings of edges of a multigraph, Appl. Math. 5 (1987) 25–34. (in Russian).
3. R.R. Kamalian. “Interval edge-colorings of graphs.” Doctoral Thesis, Novosibirsk, 1990.
4. D.B. West, Introduction to Graph Theory, Prentice-Hall, New Jersey, 1996.
5. Kuhn, H. (1955). The Hungarian method for the assignment problem. Naval research logistics quarterly, 2, 83-97. doi: 10.1002/nav.3800020109
6. Caro, Yair & Schönheim, J. (1981). Generalized 1-factorization of trees. Discrete Mathematics. 33. 319-321. 10.1016/0012-365X(81)90275-2.
7. A. S. ASRATIAN, "Investigation of Some Mathematical Model of Scheduling Theory," Doctoral dissertation, Moscow University, 1980
8. Kubale, M. (1989). Interval vertex-coloring of a graph with forbidden colors. Discret. Math., 74, 125-136.
9. Even, S., Itai, A. & Shamir, A. (1976). On the Complexity of Timetable and Multicommodity Flow Problems. SIAM J. Comput., 5, 691-703.

PHYSICS AND MATHEMATICS

INFLUENCE OF WALL SCATTERING EFFECT ON ELECTRONS GAS DYNAMICS PARAMETERS IN ELECTRIC PROPULSION THRUSTERS WITH CLOSED ELECTRON DRIFT

Guo Zongshuai, *postgraduate student of National Aerospace University "Kharkiv Aviation Institute", Kharkiv, Ukraine*
Huang Zhihao, *postgraduate student of National Aerospace University "Kharkiv Aviation Institute", Kharkiv, Ukraine*

DOI: https://doi.org/10.31435/rsglobal_sr/30072021/7629

ARTICLE INFO

Received 07 May 2021
Accepted 05 July 2021
Published 30 July 2021

KEYWORDS

plasma-ion thruster,
Hall effect thruster, wall scattering,
thermal conductivity, viscosity, pressure tensor,
Langmuir layer.

ABSTRACT

The analysis is represented of some works devoted to the mathematical modeling of processes in plasma-ion thrusters and Hall effect thrusters. It is shown that the common in these works is the use of approximate forms of the equations of gas dynamics, which are applicable to the description of relatively dense gases, but not to analyze the processes in the rarefied plasma of electric propulsion thrusters. As a result, the above mathematical models do not represent the processes that are significantly responsible for the values of the thruster operating parameters.
Authors try to partially correct this drawback by insertion into the initial approximate forms of the equations written for a point in the plasma volume, the parameters that actually represent the boundary effects and should be written not in the equations of gas dynamics themselves, but in the boundary conditions for these equations.
The most complete forms of the necessary equations are given in this paper. It is shown that it is necessary to take into account electrons thermal conductivity as well as at least one (radial-azimuth) component of viscosity tensor to describe the "wall scattering" effect.
It is concluded that the most productive approach in mathematical modeling is to write the most complete forms of equations with their subsequent simplification – removing the terms responsible for the processes recognized on the basis of primary numerical estimates as such, which can be neglected.

Citation: Guo Zongshuai, Huang Zhihao. (2021) Influence of Wall Scattering Effect on Electrons Gas Dynamics Parameters in Electric Propulsion Thrusters with Closed Electron Drift. *Science Review*. 3(38). doi: 10.31435/rsglobal_sr/30072021/7629

Copyright: © 2021 **Guo Zongshuai, Huang Zhihao.** This is an open-access article distributed under the terms of the **Creative Commons Attribution License (CC BY)**. The use, distribution or reproduction in other forums is permitted, provided the original author(s) or licensor are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.

Introduction. Plasma-ion thruster with radial magnetic field and Hall effect thruster relate to electrostatic electric propulsion thrusters with almost axial electric field for ions acceleration and almost radial magnetic field, which is used to prevent the extreme axial electrons current. In the absence of other factors these fields combination would lead to absolutely closed electrons drift without displacement in axial direction.

The most initial attempts to explain the axial electrons current by electron-atom and electron-ion collisions inside the volume had given the value of this current much less than real existing in the thrusters. The main effect of the axial flow of electrons was named the lost of their rotation moment because of non-mirror reflection from a potential barrier in a Langmuir layer near the surface, which was called "near-wall conductivity" or "wall scattering" [1].

However, at the same time, problems arose with the way of describing this effect using the equations of plasma-dynamics, which led to the conclusion that such a description is impossible and that it is necessary to use empirical data or the "particle in a cell" method.

The purpose of this study is to show that these problems are in fact associated with the use of not the most complete forms of the equations of plasma dynamics, but approximate ones, suitable for describing relatively dense gases in contrast to the rarefied plasma of electric propulsion thrusters.

Materials and Methods. The authors of [1] propose to use empirical data to substitute the relaxation frequency of the electrons momentum ν_m as a result of "wall scattering" into the expression for the electrons mobility coefficient $\mu_{e\perp}$. The axial projection $j_{e\perp}$ of electrons current density (formula (7.4-4) [1, 367]) is proposed to be found as:

$$j_{e\perp} = \mu_{e\perp}\left(e n_e E_\perp + \frac{\partial P_e}{\partial x}\right) + \ldots, \tag{1}$$

where e, n_e, P_e – electrons charge, population and pressure; $E_\perp$ – axial projection of electric field tension.

In turn, the electrons energy equation (formula (7.4-22) [1, 370]) is written as:

$$\frac{\partial}{\partial t}\left(\frac{3}{2} n_e \frac{k T_e}{e}\right) + \nabla \cdot \left(\frac{5}{2} T_e \vec{J}_e\right) = \vec{E} \cdot \vec{J}_e - R - S - P_w, \tag{2}$$

where $\vec{J}_e$, T_e – electrons current density and temperature (in eV); R, S, P_w – the radiative energy loss, the ionization energy loss, and the electrons energy loss to the walls.

At the same time, authors do not give any comments on the method of finding the value P_w.

With the use of Clapeyron equation the expression (2) can be written as:

$$\frac{3}{2}\frac{\partial P_e}{\partial t} + \frac{5}{2}\nabla \cdot \left(\vec{V}_e P_e\right) + e n_e \vec{V}_e \cdot \vec{E} = \frac{\delta \varepsilon_e^{(V)}}{\delta t} - P_w, \tag{3}$$

where P_e, $\vec{V}_e$ – electrons pressure and mass flow velocity; $\frac{\delta \varepsilon_e^{(V)}}{\delta t}$ – electrons energy density change in collisions (excitation, ionization).

Typical in both the cases is the authors' attempt to include boundary effects ("wall scattering" and the electrons energy flow to the walls) into the plasma dynamics equations written for a point in the plasma volume. The need for such an attempt, in fact, appears because the authors in both cases use an incomplete form of the equations themselves and an incomplete form of some terms.

For example, the complex inside the brackets in the first term of (3) must be energy density:

$$\varepsilon_e^{(V)} = \frac{3}{2} P_e + \frac{m_e n_e V_e^2}{2}. \tag{4}$$

The complex inside the brackets in the second term – electrons energy flow density $\vec{q}_e$:

$$\vec{q}_e = \vec{V}_e\left(\frac{3}{2} P_e + \frac{m_e n_e V_e^2}{2}\right) + \vec{V}_e \cdot \boldsymbol{P}_e + \vec{q}_e^{(cond)}, \tag{5}$$

where $\vec{q}_e^{(cond)}$, $\boldsymbol{P}_e$ – electrons thermal conductivity and pressure tensor [2].

The last parameter is the static part of momentum flow density – the second rank tensor $\boldsymbol{\Pi}_e$, which component:

$$\Pi_e^{(mn)} = m_e n_e V_{em} V_{en} + P_e^{(mn)}, \tag{6}$$

is the flow density of m-projection of momentum into n-direction.

So the pressure tensor represents the momentum flow in the absence of mass flow.

Pressure as scalar is defined only as average value of diagonal components of $\boldsymbol{P}_e$:

$$P_e = \frac{P_e^{(11)} + P_e^{(22)} + P_e^{(33)}}{3}. \tag{7}$$

The component of pressure tensor can be represented as:

$$P_e^{(mn)} = \begin{cases} P_e + \pi_e^{(mn)}, & m = n \\ \pi_e^{(mn)}, & m \neq n \end{cases}, \tag{8}$$

and expression (5) can be transformed as:

$$\vec{q}_e = \vec{V}_e \left(\frac{5}{2} P_e + \frac{m_e n_e V_e^2}{2} \right) + \vec{V}_e \cdot \boldsymbol{\pi}_e + \vec{q}_e^{(cond)}. \tag{9}$$

Thus, the most complete forms of three basic gas dynamics equations set are:

- continuity equation:

$$\frac{\partial n_e}{\partial t} + \nabla \cdot \left(n_e \vec{V}_e \right) = \frac{\delta n_e}{\delta t}; \tag{11}$$

- motion equation:

$$m_e \left(\frac{\partial}{\partial t} \left(n_e \vec{V}_e \right) + n_e \vec{V}_e \cdot \nabla \vec{V}_e + \vec{V}_e \nabla \cdot \left(n_e \vec{V}_e \right) \right) + \nabla P_e + \\ + \nabla \cdot \boldsymbol{\pi}_e + e n_e \left(\vec{E} + \vec{V}_e \times \vec{B} \right) = \frac{\delta \vec{p}_e^{(V)}}{\delta t} \tag{12}$$

;

- energy equation:

$$\frac{\partial}{\partial t} \left(\frac{3}{2} P_e + \frac{m_e n_e V_e^2}{2} \right) + \nabla \cdot \left(\vec{V}_e \left(\frac{5}{2} P_e + \frac{m_e n_e V_e^2}{2} \right) + \vec{V}_e \cdot \boldsymbol{\pi}_e + \vec{q}_e^{(cond)} \right) + \\ + e n_e \vec{V}_e \cdot \vec{E} = \frac{\delta \varepsilon_e^{(V)}}{\delta t} \tag{13}$$

, (13)

where $\frac{\delta n_e}{\delta t}$ – electrons population change in collisions (ionization).

Viscosity and thermal conductivity together are named as dissipative corrections.

The neglect of viscosity in the motion equation, as was done in [1], as well as in [3, 4] and both dissipative corrections in the energy equation was the reason for the subsequent artificial insertions.

Results. The "wall scattering" is the boundary effect and should be represented as the boundary condition in a mathematical model of thruster. Of course, the equations of gas dynamics must contain a parameter, for which this boundary condition is formulated. Non-mirror reflection of electrons from the near-wall potential barrier means their return to the plasma with a smaller value of the azimuth projection of the momentum – there is a flow of the azimuth projection of momentum into the radial direction without a mass flow in this direction and is represented in radial-azimuth component of pressure and viscosity tensor:

$$P_e^{(r\varphi)} = \pi_e^{(r\varphi)}. \tag{14}$$

The factors exist in plasma-ion thruster with radial magnetic field and Hall effect thruster, which make the dispersions of all three projections of electrons velocity almost equal to each other. Thus approximate equivalence exists between diagonal components of pressure tensor:

$$P_e^{(\varphi\varphi)} \approx P_e^{(\varphi\varphi)} \approx P_e^{(\varphi\varphi)} \approx P_e, \tag{15}$$

$$\pi_e^{(xx)} \approx 0, \qquad \pi_e^{(rr)} \approx 0, \qquad \pi_e^{(\varphi\varphi)} \approx 0. \tag{16}$$

Due to essentially subsonic electrons flow it is possible to neglect axial-radial and axial-azimuth components of both the tensors:

$$P_e^{(xr)} \approx 0, \qquad P_e^{(x\varphi)} \approx 0, \tag{17}$$

$$\pi_e^{(xr)} \approx 0, \qquad \pi_e^{(x\varphi)} \approx 0. \tag{18}$$

But neglecting the value $P_e^{(r\varphi)} = \pi_e^{(r\varphi)}$ would mean losing of "wall scattering" effect in the description.

As for radial projection of electrons energy flow density it means:

$$q_{er} = V_{er}\left(\frac{5}{2}P_e + \frac{m_e n_e V_e^2}{2}\right) + V_{e\varphi}\pi_e^{(r\varphi)} + q_{er}^{(cond)}, \tag{19}$$

where boundary condition for q_{er} must be obtained as:

$$q_{ew} = \frac{m_e}{2}\int\limits_{v_{r\,max}}^{\infty}\int\limits_{-\infty}^{\infty}\int\limits_{-\infty}^{\infty} f_{ew}\left(v_r, v_{||1}, v_{||2}\right)\left(v_r^2 + v_{||1}^2 + + v_{||2}^2\right) v_r\, d\,v_r\, d\,v_{||1}\, d\,v_{||2}, \tag{20}$$

where f_{ew} – electrons velocity distribution function; v_r, $v_{||1}$, $v_{||2}$ – normal and two parallel to the wall electrons velocity projections.

For comparatively dense plasma it is possible to use Maxwell form of f_{ew}. But for plasma-ion and Hall effect thruster it is better to obtain the approximate solution of kinetic equation for electrons.

The boundary condition for the value $\pi_e^{(r\varphi)}$ was obtained in [5] as a result of solving the kinetic problem of the motion of electrons in a Langmuir layer:

$$\pi_{ew}^{(r\varphi)} = \eta_P \frac{v_e}{4} m_e n_e V_{e\varphi}, \tag{21}$$

where v_e – electrons velocity mean absolute value; η_P – electron's motion relaxation factor in "wall scattering".

The will to write the equation not for the total energy, but only for its thermal component is quite natural, but the simple exclusion of the terms quadratic in the velocity from (13), as was done in (2) and (3), is unacceptable. This can be shown with a simple example. Let us imagine the case of a uniform distribution of all parameters in space in the absence of energy losses for ionization, excitation, and on the walls. In this case, equation (3) would have the form:

$$\frac{3}{2}\frac{\partial P_e}{\partial t} + e\, n_e \vec{V}_e \cdot \vec{E} = 0, \tag{22}$$

which would mean the direct influence of the electric field on the velocity dispersion of electrons – the energy of their thermal movement. But the electric field changes the velocity of each separate electron

by the same value, that is, it does not change the difference in electrons velocities and cannot directly affect the pressure.

There is an absolutely correct way to transform the total energy equation into a separate thermal energy equation using the equality:

$$\frac{3}{2}\frac{\partial P_e}{\partial t}=\frac{\partial}{\partial t}\left(\frac{3}{2}P_e+\frac{m_e n_e V_e^2}{2}\right)-m_e\vec{V}_e\cdot\frac{\partial}{\partial t}\left(n_e\vec{V}_e\right)+\frac{m_e V_e^2}{2}\frac{\partial n_e}{\partial t}. \quad (23)$$

Thus, from the energy equation it is necessary to subtract the motion equation, all the terms of which are multiplied by $\vec{V}_e$ (in the dot product), and add the continuity equation, all the terms of which are multiplied by the complex $\frac{m_e V_e^2}{2}$. Finally it will mean:

$$\frac{3}{2}\frac{\partial P_e}{\partial t}+\frac{5}{2}\nabla\cdot\left(\vec{V}_e P_e\right)-\vec{V}_e\cdot\nabla P_e+$$

$$+\nabla\cdot\left(\vec{V}_e\cdot\boldsymbol{\pi}_e\right)-\vec{V}_e\cdot\left(\nabla\cdot\boldsymbol{\pi}_e\right)+\nabla\cdot\vec{q}_e^{(cond)}=\frac{3}{2}\frac{\delta P_e}{\delta t}, \quad (24)$$

$$\frac{3}{2}\frac{\delta P_e}{\delta t}=\frac{\delta\varepsilon_e^{(V)}}{\delta t}-\frac{\delta\vec{p}_e^{(V)}}{\delta t}+\frac{m_e V_e^2}{2}\frac{\delta n_e}{\delta t}. \quad (25)$$

The right part in (24) as well as the last term in the left part relate to the loss of electrons both total and thermal energy. But the complex $\nabla\cdot\left(\vec{V}_e\cdot\boldsymbol{\pi}_e\right)-\vec{V}_e\cdot\left(\nabla\cdot\boldsymbol{\pi}_e\right)$ in our case is equal to:

$$\nabla\cdot\left(\vec{V}_e\cdot\boldsymbol{\pi}_e\right)-\vec{V}_e\cdot\left(\nabla\cdot\boldsymbol{\pi}_e\right)\approx-\pi_e^{(r\varphi)}\frac{V_{e\varphi}}{r}. \quad (26)$$

The sign of $\pi_e^{(r\varphi)}$ is the same that the sign of $V_{e\varphi}$ – azimuth projection of momentum is transported into radial direction. Minus in the right part of (26) means the part of electrons thermal energy transport from the wall into plasma – "wall scattering" effect means an increase in the dispersion of electrons in velocities, converting part of the rotation energy of electrons into thermal energy.

The terms quadratic in velocity can indeed be neglected in motion equation of electrons. In this case, the axial and azimuth projections of equation (12) in radial magnetic field take the form:

$$m_e\frac{\partial}{\partial t}\left(n_e V_{ex}\right)+\frac{\partial P_e}{\partial x}+e n_e\left(E_x-V_{e\varphi}B\right)=\frac{\delta p_{ex}^{(V)}}{\delta t}, \quad (27)$$

$$m_e\frac{\partial}{\partial t}\left(n_e V_{e\varphi}\right)+\frac{1}{r^2}\frac{\partial}{\partial r}\left(r^2\pi_e^{(r\varphi)}\right)+e n_e V_{ex}B=\frac{\delta p_{e\varphi}^{(V)}}{\delta t}, \quad (28)$$

where "wall scattering" is represented by the second term in the left part of (28).

The discussion of the results. It is possible to imagine two approaches to mathematical modeling:

- writing the most complete forms of equations with their following simplification – removing the terms responsible for the processes recognized on the basis of primary numerical estimates as such that can be neglected;

- writing of known approximate forms of equations with their following correction for processes not taken into account in the primary approximate forms.

The first approach is the most clear – someone sees the compound, which can be deleted and understands the reasons of this deletion. The second approach inevitably has the character of speculations and depends on the ability of the researcher to imagine in detail all the circumstances that require additional consideration.

Thus, the first approach is the only acceptable one.

Conclusions. The analysis of existing publications devoted to the mathematical modeling of processes in plasma-ion and Hall thrusters showed a tendency to use approximate forms of equations applicable to relatively dense gases. Attempts to correct these approximate forms for describing the rarefied plasma of electric propulsion thrusters often lead to losses in the description of the processes responsible for the thruster performance, underestimated or overestimated values of many parameters.

The system of equations is presented, built by reasonable simplification of the most complete primary equations.

It is shown that an adequate description requires taking into account the thermal conductivity and at least one off-diagonal component of the viscosity tensor.

REFERENCES

1. Goebel, Dan M., and Katz, Ira. Fundamentals of Electric Propulsion: Ion and Hall Thrusters. California Institute of Technology. Jet Propulsion Laboratory. – 2008. – 493 p.
2. Rossi, B., Olbert, S.: Introduction to the physics of space. McGraw-Hill, New York (1970), 454 p.
3. Çinar Yüncüler, İsmail Rafatov, Demet Uluşen. One-dimensional fluid and hybrid numerical analysis of the plasma properties in the discharge channel of a Hall thruster. Turkish Journal of Physics. (2018) 42. pp. 649-658.
4. F. Taccogna, Laurent Garrigues. Latest progress in Hall thrusters plasma modelling. Reviews of Modern Plasma Physics, Springer Singapore, 2019, 3 (1), 52 p.
5. Roshanpour, S. Electron gas parameters change inside Langmuir layer in electric propulsion devices. Eastern European Journal of Enterprise Technologies, 2013. – № 4/5(64). – С. 36-39.

AGRICULTURE

HEALING PROPERTIES OF YUCCA GLORIOSA AND ITS CULTIVATION PERSPECTIVES IN AGRO-ECOLOGICAL ENVIRONMENT OF IMERETI

Roza Lortkipanidze,
Doctor of Agricultural Sciences, Professor, Akaki Tsereteli State University, Kutaisi, Georgia,
Shorena Tvalodze,
Ph.D. student, Akaki Tsereteli State University, Kutaisi, Georgia

DOI: https://doi.org/10.31435/rsglobal_sr/30072021/7630

ARTICLE INFO

Received 11 May 2021
Accepted 08 July 2021
Published 30 July 2021

KEYWORDS

Yucca, healing properties, introduced, adaptation.

ABSTRACT

Yucca Gloriosa species belong to a very interesting group of plants, their consumption is diverse. As biochemical studies reveal, some types of Yucca leaves contain tigogenin and stereogenic sapogenin, which is the source of syntheses of steroidal hormonal medicine. Yucca as a raw material is a valuable set for the pharmaco-chemical industry. Yucca was introduced in Georgia in the 19th century.

Yucca has a great ability to be adapted to the different ecological environment. Among 11 introduced species in Transcaucasia, Yucca Gloriosa L. is distinguished with its relatively high content of healing substances. Yucca gloriosa L. blooms well in climatic conditions of Georgia, although, they don't provide seeds. The plant easily vegetates by dividing into 10-20cm length parts that later are introduced in the soil. Propagation is also processed by rooting of the 1-year young rosette. It is noteworthy that the Yucca stem does not lose its ability to take root even after a few days in air-dry conditions.

Citation: Roza Lortkipanidze, Shorena Tvalodze. (2021) Healing Properties of Yucca Gloriosa and Its Cultivation Perspectives in Agro-Ecological Environment of Imereti. *Science Review*. 3(38). doi: 10.31435/rsglobal_sr/30072021/7630

Copyright: © 2021 **Roza Lortkipanidze, Shorena Tvalodze.** This is an open-access article distributed under the terms of the **Creative Commons Attribution License (CC BY)**. The use, distribution or reproduction in other forums is permitted, provided the original author(s) or licensor are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.

Introduction. There is a great set of synthetic samples in modern medicine, but the demand for natural, healing raw materials and the medicine prepared by them is growing daily. Therefore it is applicable to study not only the healing/treating/curing properties of wild flora but also of introduced species, to observe the bio-ecology process and determine the possibility of cultivation in diverse agro-ecological environments. Yucca Gloriosa species arise great interest, they have been used multi-functionally. Initially, it was considered as a plant that provides decorative and technical fiber, but later, biochemical studies of some species of Yucca revealed that their leaves (Mostly old leaves) contain tigogenin and stereogenic sapogenin, which is the source of syntheses of steroidal hormonal medicine.

Yucca as a raw material is a valuable source for the pharmaco-chemical industry.

Yucca originates from the Southern part of Northern America and Central America. Naturally, it is mainly distributed in semi-desert and desert zone.

Yucca was first introduced to Europe by the British in the second half of the 16th century. In the next century, Yucca is found in many European countries, but most of the current species have been distributed in Europe since the 1800s.

Yucca was introduced in Georgia in the second half of the 19th century and it is quite widespread. It was mainly used in green construction - decorating gardens, and squares. Yucca is still considered to be one of the essential elements of green areas.

Research methods and results.

11 species of Yucca have been introduced in the Transcaucasia. Yucca gloriosa L. is distinguished from these species by its relatively high content of healing substances.

Yucca gloriosa L. belongs to Liliaceae Familiae, Dracaenoideae Engl, it is an evergreen plant, that is characterized by a short, ramified large stem, which ends in a tightly spaced rosette of bound leaves.

Some of Y.gloriosa reach up to 5 meters in height. The leaves are erect, thick, leathery, and dark green. The leaf edges are bordered by a yellowish-brown ridge. The leaf length average is 70cm. The area is 150-160cm. The leaves are narrow in shape at the base, gradually they are widening and the base becomes 2/3 length, then it gets narrow again and ends with a large and sharp thorn.

The Yucca flower is an upright ovate or sometimes broad pyramidal up to 1-2 meters long. The arrowhead of the flower stem emerges from the middle of the leaf rosette and develops a large number of 200-400 bell-shaped, inverted flowers. The perianth consists of two rows of the three-top leaf. The color of the perianth is white or beige and sometimes purple or yellow.

The bio-ecological properties of the Yucca were formed phylogenetically in desert and semi-desert conditions, but it is one of the rarest plants. Its plasticity in terms of adaptation is indeterminable by exposure to the different ecological environments. This is vivid by the example of Y.gloriosa.

Yucca gloriosa L. is characterized by a wide range of adaptability to different soils. They are found on almost all types of soils in Imereti, starting from clay loam soils to light mechanical soils.

The soil surface/cover of the Imereti region is characterized as diverse. Subtropical humid climate has a great influence on the soil formation process in Imereti, therefore, Imereti is represented by yellow, loamy, humus-carbonate, red earth, and alluvial soil types, together with the soil sub-types.

Yellow soil is loamy, medium, and thick, with deep humus and heavy loamy soil.

Loamy, acidic, large and with medium thickness, slightly humus light clay, medium loamy soil.

Humus-carbonate, limestone, large and medium thickness, small humus soil.

Red soils are medium-thick, high content humus, light clay, and loam soils develop on zebra clay.

Alluvial soils are developed in riverside valleys and on the lower terraces of the rivers. Which are periodically covered with water. This process produces specific signs of alluvial soil structure. Alluvial soils are characterized by the accumulation of river sediments - alluvium.

Yellow, podzol soils are developed in humid subtropical climates on river terraces. It is one of the most common soil types. It has a large thick profile, insufficiency of the bases in the absorbed complex, neutral, and weakly acidic reaction. Yellow, podzol soils are found on slopes as well as on plain terrain. From the morphological description, it can be seen that the soil has a large thickness of the profile and does not contain carbonic acid lime.

The data of mechanical analysis showed that the soil is loamy, rich with humus, nitrogen corresponds to humus (0.219%). The soil is depleted cause of soluble phosphorus and mobile potassium. The sum of absorbed stems is not high. Its rate is 9, 23 -16.25 million equivalent. There is observed the presence of hydrogen ions in the absorbed complex and its advantage over the absorbed bases (Ca + Mg). The soil area reaction is acid the pH in the water equation is equal to 4.1-5.0.

The humus layer in the upper arable (Ап) layer is small: 1,08-3, not exceeding 62%. At depth, its content decreases sharply. It is deficient in nutrients. The exception is the area of tea plantations, where the content of soluble phosphorus is big (47.25-50.0 mg per 100 g of soil).

Fertilizers are very important in increasing the fertility of yellow, podzol soils. The preference is given to organic fertilizer because in cultivating Yucca the focus is on its raw healing material and in this respect, organic fertilizer does not change the structure of the plant.

Yucca is propagated by seeds as well as vegetatively. In conditions of Georgia, Y.gloriosa does not develop seeds, its reproduction is mainly vegetative.

From the other ways of vegetative propagation, the highest rate of propagation is marked by cutting the stem base, which is divided into 4 segments. The plant easily vegetates by dividing into 10-20cm length parts and placing them in the soil. Propagation is done also by rooting young 1-year rosette. 2/3 of the leaves of the rosette should be pruned for rooting. The stay of Yucca stem in air-dry conditions during several decades does not lose the ability to get roots, although, in this case, the duration of rooting is significantly increased.

Due to its height, the stem of Yucca Gloriosa develops many eruptions in the form of rosettes, which significantly increases the number of raw materials got for medical purposes.

Conclusions. Yucca is quite adaptable to adverse environmental conditions, though, while cultivation it must be considered that it requires bright insolation conditions for further development. Its seedlings somehow wither and grow poorly in semi-shady or shady conditions. The nutrition area must be well determined for having optimal crop/harvest, cause the vegetative part of Yucca (leaves) is bred as a healing raw material. The best feeding area for cultivating Yucca is considered to be 3.0m between rows and 1.5-2.0 m. among plants in agro-ecological conditions of the Imereti region.

The proposed layout of plants is optimal for further development, herewith, it ensures the normal procedures for various agricultural activities.

Thus, vegetative propagation of Yucca is preferred over yucca propagation methods. This produces a seedling suitable for planting in a relatively short time and costs less than sowing. Yucca do not suffer from pests and diseases and are not demanding on climatic conditions, which makes them easier to grow.

Open Access Peer-reviewed Journal

Science Review

DOI: https://doi.org/10.31435/rsglobal_sr

3(38), July 2021

SCIENTIFIC EDITION

Indexed by:

RS Global

INDEX COPERNICUS INTERNATIONAL

Academia.edu share research

BIBLIOTEKA NARODOWA

Passed for printing 25.07.2021. Appearance 30.07.2021.
Typeface Times New Roman.
Circulation 300 copies.
Publisher RS Global Sp. z O.O., Warsaw, Poland, 2021
Numer KRS: 0000672864
REGON: 367026200
NIP: 5213776394
https://rsglobal.pl/