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## PEDAGOGICAL SCIENCES

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### ЗНАЧЕНИЕ ПЕДАГОГИЧЕСКОЙ НАУКИ В РАЗНЫЕ ИСТОРИЧЕСКИЕ ПЕРИОДЫ.

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### THE SIGNIFICANCE OF PEDAGOGICAL SCIENCE IN DIFFERENT HISTORICAL PERIODS.

**Аннотация:**

*В данной статье дана информация о истории педагогики и образования, подходов к рассмотрению явлений педагогической теории и практики. Главной задачей историко-педагогических исследований является описание и объяснение фактов и явлений педагогической теории и практики, а также их эволюции.*

**Abstract:**

*This article provides information about the history of pedagogy and education, approaches to the consideration of the phenomena of pedagogical theory and practice. The main task of historical and pedagogical research is the description and explanation of the facts and phenomena of pedagogical theory and practice, as well as their evolution.*

**Ключевые слова:** становление и развитие педагогики, педагогическая теория, история педагогики и образования.

**Key words:** formation and development of pedagogy, pedagogical theory, history of pedagogy and education.

История становления и развития педагогики как науки до сих пор является сложным процессом. В образовании выполняло задачи периодизации историко-педагогического знания.

Своё начало педагогика берет от первобытного общества, Древнего мира, Средних веков, до новейшего времени. В истории педагогики и образования традиционно сложилось несколько подходов к рассмотрению явлений педагогической теории и практики. Главной задачей историко-педагогических исследований является описание и объяснение фактов и явлений педагогической теории и практики, их эволюции.

История помогает нам воссоздать картину развития историко-педагогического процесса с древнейших и до наших времен, на территории различных государств в соответствии с процессами эволюции человеческого общества, культуры, цивилизации и науки. К источникам исследования в истории педагогики и образования относятся письменные источники, они дают объяснения, с их помощью выявляются сущность и значение историко-педагогических событий, выделяется в них главное и второстепенное, причинно-следственные связи, происходит познание закономерностей функционирования и развития педагогических событий прошлого.

История педагогики и образования как учебная дисциплина имеет своей целью формирование системы знаний, во-первых, о ходе и результатах взаимодействия общества, с одной стороны, и школы и педагогики – с другой; во-вторых, о процессах воспроизведения школой и педагогикой обществ и цивилизации; в-третьих, о механизме закрепления в сфере воспитания и обучения приобретенных человечеством культурных ценностей; в-четвертых, о том, что школа и педагогика всегда были заметным, хотя и не единственным, двигателем культурной и общественной эволюции. Таким образом, изучение истории образования и педагогической мысли помогает освоить современную науку о воспитании, дает ценные и незаменимые знания об обществе и человеке, об истоках сегоднешнего мирового педагогического процесса.

Воспитание возникло вместе с появлением человеческого общества и существует на протяжении всей его истории, с самого начала выполняя общую функцию передачи от поколения к поколению социального опыта. Как свидетельствуют источники, первые школы в Древнем Египте появились в III тысячелетии до н. э. Они были небольшими по числу учеников, за обучение в них взималась высокая плата. Школу посещали в основном мальчики

из семей чиновников, жрецов, землевладельцев, зажиточных граждан, девочки чаще обучались дома. Обучение было индивидуальным, его продолжительность зависела от старания и способностей ученика. На начальном этапе обучения дети учились считать, читать и писать, на втором этапе происходила дифференциация: одни изучали музыку, литературу, грамматику, другие осваивали математику, третьи – основы ведения хозяйственной деятельности. Процесс обучения был рутинным и сводился к переписыванию и заучиванию стандартных текстов, поучений, примеров и т. п. Образование носило специализированный характер и считалось залогом успешной карьеры в будущем. Обучение имело целью подготовку к профессии в зависимости от того вида деятельности, которым занималась семья.

В Древнем Китае обучение строилось на опыте семейно-общественного воспитания. Такое воспитание сохранилось до наших времен. В основе школьного обучения лежало почитание старших, наставник воспринимался как второй отец. Первые школы в Древнем Китае появились в III тысячелетии до н. э., чуть позднее для их названия стали употреблять иероглиф «сюэ» (учить, учиться). Во II тысячелетии до н. э. школу посещали в основном дети состоятельных людей, главной целью школы было стремление научить их пользоваться иероглифическим письмом, это умение передавалось по наследству и распространялось очень медленно.

В античные времена, основной упор в воспитании делался на гимнастические и военные упражнения. В те времена появились новые типы школ, система образовательных учреждений, философами Античности были сформулированы идеи и концепции воспитания и обучения молодежи. Чтение, письмо, счет, музыка не являлись приоритетными предметами в содержании образования. Особое внимание уделялось способности кратко и точно изъясняться. Мальчики участвовали в ежегодных публичных состязаниях, в ходе которых им предстояло показать все, чему они научились. Воспитание спартанских девушек мало чем отличалось от воспитания спартанских юношей и проходило в постоянных гимнастических упражнениях. Физическое здоровье спартанок должно было обеспечить воспроизводство здорового потомства.

Воспитание и обучение в Афинах было по-другому. Идеал афинского воспитания сводился к всестороннему формированию личности, прежде всего с развитыми интеллектом и культурой тела. Считалось, что стремиться к достижению подобного идеала был вправе лишь свободный и имущий гражданин Афин.

Юноши постоянно состязались в гимнастике, танцах, музыке, словесных спорах, самоутвержда-

ясь и оттачивая свои лучшие качества. Дети в основном получали домашнее воспитание. Сыновья свободных граждан обычно воспитывались в семье до 7 лет. Затем за мальчиками из состоятельных семей присматривал особый раб - педагог. После семи лет мальчики-дети свободных граждан получали возможность учиться в частных и общественных учебных заведениях.

В палестрах занимались развитием культуры тела. Как говорил Платон, гимнастические школы помогали тому, чтобы "не приходилось от плохого свойства тел плоховать на войне и в прочих делах". Ученики интенсивно занимались бегом, борьбой, прыжками, метанием диска, копья, фехтованием. Все это было необходимо будущим воинам. Афинский тяжеловооруженный пехотинец во время сражений должен был делать частые перебежки, вступать в единоборство с врагом, пользуясь копьем и мечом. Такому воину полученная в палестрах подготовка была необходима.

Иначе, девушки в Афинах получали образования и воспитание. Афинская традиция предусматривала для девочек и девушек вплоть до замужества исключительно домашнее воспитание. В семье они получали элементарные навыки чтения и письма, музыкальную подготовку. Ведя жизнь затворниц, девочки и девушки появлялись на людях весьма редко, например, во время религиозных церемоний. По суждениям афинян, женщина не могла претендовать на обладание упомянутой "совокупностью добродетелей". Ее уделом было домашнее хозяйство.

Таким образом, при изучении истории педагогической науки, в основе воспитательных отношений лежало поклонение младших старшим, школьный наставник почитался как отец. Роль воспитателя и воспитания была в древности чрезвычайно велика, а деятельность учителя-воспитателя считалась весьма почетной.

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## НАУКОВІ ПІДХОДИ ДО ВИКЛАДАННЯ ІНТЕГРОВАНОГО КУРСУ «Я ДОСЛІДЖУЮ СВІТ» У ПОЧАТКОВІЙ ШКОЛІ

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## SCIENTIFIC APPROACHES TO TEACHING THE INTEGRATED COURSE "I EXPLORE THE WORLD" IN PRIMARY SCHOOL

### **Анотація**

У даній науковій статті розглядаються наукові підходи до викладання інтегрованого курсу «Я досліджую світ» у початковій школі. Висвітлюється зміст та важливість інтегрованого, компетентнісного, тематичного, діяльнісного та дослідницького підходів, які дозволяють залучати учнів до активного процесу пізнання та розвивати ключові компетентності.

Досліджені та проаналізовані наукові підходи є важливими для майбутніх фахівців і для вчителів початкових класів, які вже працюють з курсом «Я досліджую світ».

### **Abstract**

This scientific article discusses scientific approaches to teaching the integrated course "Exploring the World" in elementary school. The content and importance of integrated, competency-based, thematic, activity-based, and research-based approaches are highlighted, which allow students to be actively involved in the process of learning and develop key competencies.

The researched and analyzed scientific approaches are important for future professionals and for elementary school teachers who are already working with the "Exploring the World" course.

**Ключові слова:** науковий підхід, інтегрований курс, інтегрований підхід, компетентнісний підхід, тематичний підхід, діяльнісний підхід, дослідницький підхід, пізнавальна активність, ключові компетентності.

**Keywords:** scientific approach, integrated course, integrated approach, competency-based approach, thematic approach, activity-based approach, research-based approach, cognitive activity, key competencies.

**Постановка проблеми.** Інтегрований курс «Я досліджую світ» є одним з найбільш інноваційних та підхоплюючих популярність педагогічних напрямків в початковій школі. Цей курс розроблено з метою сприяння формуванню ключових компетенцій учнів та розвитку їхніх інтелектуальних здібностей. Цей курс поєднує у собі різноманітні наукові дисципліни та відображає їхній взаємозв'язок в реальному житті.

Нинішня освітня система вимагає від педагогів швидко адаптуватися до нових вимог, зокрема, до викладання інтегрованих курсів у початковій школі. Одним із таких курсів є «Я досліджую світ»,

який зосереджується на розвитку у дітей загальної компетентності в галузі науки і технологій. Однак, викладання інтегрованих курсів може стати проблемою для вчителів, які не мають достатнього досвіду у цій галузі.

Однією з головних проблем викладання інтегрованого курсу «Я досліджую світ» є відсутність чіткої методики та підходів до викладання цього курсу у початковій школі. Це може привести до неефективного навчання, втрати інтересу учнів до науки та негативного впливу на їх розвиток.

**Мета статті** полягає в описі та аналізі наукових підходів до викладання інтегрованого курсу «Я досліджую світ» у початковій школі.

**Аналіз основних досліджень та публікацій.** У результаті впровадження концепції «Нова українська школа» та реалізації компетентнісного навчання в освітній процес початкової школи введено новий інтегрований навчальний курс «Я досліджую світ». Дослідженню різних аспектів організації освітнього процесу в Новій українській школі присвятили свої праці Н. Бібік, І. Большакова, Я. Гасвець, Л. Гриневич, І. Коберник, М. Пристінська, О. Савченко, С. Скворцова, Н. Софій, Л. Оніщук, О. Онопрієнко, Р. Шиян та інші. Особливості та специфіку інтегрованого курсу «Я досліджую світ» у початковій школі розглянуто Н. Андрук, І. Андрусенко, І. Баландіною, Н. Будною, О. Ващенко, О. Волощенко, Т. Воронцовою, І. Гарбузюк, Т. Гільберт, Т. Гладюк, Т. Грітченко, І. Грущинською, О. Іщенко, О. Козак, М. Корнієнко, В. Пономаренко, С. Тарнавською, О. Хомич та іншими.

Виявилось, що науковці приділяли більше уваги лише окремим аспектам впровадження інтегрованого курсу «Я досліджую світ» в освітній процес початкової школи, таких як: інтеграція в освіті, тематичне навчання (М. Пристінська, С. Большакова), ключові ідеї та зміст курсу (Т. Воронцова, В. Пономаренко), дослідницька діяльність молодших школярів (Т. Гільберт), особливості викладання інтегрованого курсу «Я досліджую світ» у контексті педагогіки партнерства (М. Єпіхіна), розвиток пізнавальної діяльності в інтегрованому курсі (О. Дешко), підручник із курсу «Я досліджую світ» як засіб формування екологічної грамотності молодших школярів (І. Андрусенко), однак мало уваги приділено вивченню питання наукових підходів до викладання курсу.

**Виклад основної проблеми.** Мета інтегрованого курсу «Я досліджую світ» полягає у розвитку учнів молодшого шкільного віку за допомогою формування цілісної картини світу та засвоєння досвіду попередніх поколінь. Це досягається шляхом надання комплексу інтегрованих знань про природу, суспільство, ціннісні орієнтації та способи дослідницької поведінки, які допомагають учням розв'язувати практичні завдання. Крім того, цей курс має на меті підготувати учнів до розуміння складної природи світу, у якому вони живуть, розвивати їх пізнавальну допитливість та здатність виявляти інтерес до вивчення різноманітних наукових дисциплін.

Щоб досягти зазначену мету інтегрованого курсу «Я досліджую світ», необхідно вирішувати наступні завдання:

- формування та розвиток дослідницьких навичок та вмінь, оволодіння методами пізнання природи, навколишнього середовища та суспільства;
- виховання активної життєвої позиції та розвиток громадянських, соціально-культурних та моральних якостей;

- заохочення інтересу до України та її історії, природи, видатних постатей, а також виховання поваги до державних символів, традицій, звичаїв та культури рідного краю;

- формування уявлень про багатоманітність світу, розвиток толерантності, терпимості та поваги до інших людей, а також вміння дотримуватись правил та застосовувати соціальні навички у різних видах діяльності;

- створення комфортних умов для самореалізації молодших школярів, їх самовираження та самоідентифікації.

В контексті дослідження варто зазначити, що інтегрований курс «Я досліджую світ» у початковій школі має декілька особливостей. Перш за все, це інтеграція кількох освітніх галузей відповідно до програми О. Савченко (природнича, громадянська та історична, соціальна та здоров'язбережувальна) або за програмою Р. Шияна (природнича, технологічна, інформативна, соціальна та здоров'язбережувальна, громадянська та історична, частково мовно-літературна та математична). Друга особливість – це використання активних методів навчання, таких як інтерактивна технологія, проєктне навчання, технологія розвитку критичного мислення та кооперативне навчання. Третя – це компетентнісне навчання, що включає формування ключових та предметних компетентностей, визначених Державним стандартом початкової освіти.

На основі виокремлених особливостей курсу «Я досліджую світ» у початковій школі, можна сформулювати різні наукові підходи до його викладання. Розглянемо детальніше кожен з цих підходів.

Перш за все, варто розглянути інтегрований підхід викладання курсу «Я досліджую світ». Інтегрований підхід передбачає об'єднання різних предметів навчання в один комплексний курс, що дозволяє учням сприймати інформацію як систему взаємозв'язків.

Використання інтегрованого навчання дозволяє скоротити терміни вивчення окремих тем та уникнути дублювання матеріалу з різних предметів. Крім того, воно стимулює молодших школярів будувати зв'язки між різними дисциплінами та використовувати знання з різних предметних галузей. Оскільки світ складається з загальної картини, а не з окремих елементів, інтегроване навчання заохочує молодших школярів бачити цілісну картину світу та будувати зв'язки між різними дисциплінами. Таким чином, цей підхід забезпечує збільшення ефективності навчання, зменшення навчального навантаження на учнів та підвищення їх мотивації.

Використання інтегрованого підходу при викладанні курсу «Я досліджую світ» має кілька переваг. По-перше, це дозволяє підвищити ефективність уроку та збільшити інформативну складову частину. По-друге, інтегрований підхід стимулює розвиток інтересу до навчального курсу, підвищує творчий потенціал учнів, розвиває креативність та нестандартне мислення. По-третє, цей

підхід допомагає глибше вивчити навчальний предмет, зрозуміти його глибинну суть, побудувати зв'язки з реальним життям та використовувати здобуті знання у практичній діяльності [1, с. 13].

Виходячи з зазначених переваг можна зробити висновок, що з використанням інтегрованого підходу до викладання курсу «Я досліджую світ» у початковій школі можна сформувані цілісні зв'язки між окремими об'єктами, що сприяє поглибленому, усебічному та ґрунтовному вивченню найважливіших понять та явищ навколишнього світу. Інтегрований підхід дозволяє молодшим школярам підвищити інформаційну складову уроку, розвиває їхній інтерес до навчального матеріалу, стимулює творчість та нестандартне мислення, а також навчає використовувати отримані знання у практичній діяльності.

Однак варто не забувати, що зловживання інтеграцією може призвести до небажаних наслідків, адже інтегрований підхід можливий і доцільний за дотримання певних вимог та умов.

Наступний науковий підхід – це компетентнісний підхід, який у викладанні передбачає, що навчальний процес має бути спрямований на формування учнями компетенцій, які дозволять їм не лише засвоїти конкретний матеріал, а й зрозуміти, як використовувати цей матеріал у різних життєвих ситуаціях. Одним із головних завдань компетентнісного підходу є формування учнів готовності до життя в сучасному світі, де вимоги до людей стають все більш складними і високими.

Для викладання курсу за компетентнісним підходом, вчителі повинні виявляти ті компетенції, які є найбільш важливими для успішної адаптації учнів до сучасного життя. Під час навчання важливо створювати ситуації, які допоможуть учням застосувати набуті знання та навички у реальному житті. Наприклад, викладання інтегрованого курсу може допомогти учням розвивати критичне мислення, якщо вони змушені аналізувати інформацію з різних джерел та дійти висновку [10, с. 15].

Крім того, компетентнісний підхід забезпечує здатність учнів до самоорганізації та самовдосконалення. Викладання курсу за цим підходом має бути спрямоване на створення умов для розвитку в учнів навичок самостійної роботи, вміння організувати свій час та здійснювати пошук необхідної інформації.

Учні, які вивчають курс «Я досліджую світ» за компетентнісним підходом, активно залучаються до процесу навчання, оскільки їх цікавить не лише отримання нових знань, але і розвиток навичок, які їм допоможуть у житті. Цей підхід дає можливість учням досліджувати світ, формулювати запитання, шукати відповіді та розв'язувати проблеми в різних контекстах. В результаті цього вони стають більш самостійними, креативними та готовими до різних життєвих викликів. Крім того, компетентнісний підхід до викладання курсу допомагає учням розвивати свою особистість та відчувати відповідальність за своє власне навчання і розвиток.

Отже, компетентнісний підхід до викладання курсу «Я досліджую світ» сприяє формуванню учнями компетенцій, необхідних для успішного функціонування у сучасному світі. Це включає не лише академічні знання, але й такі розумові і практичні навички, як критичне мислення, проблемне та творче мислення, самостійність, комунікація, соціальна та етична компетентність, здатність до співпраці та тимчасового лідерства.

Проаналізувавши роботи Л. Виготського, П. Гальперіна, В. Давидова, О. Леонтєва, С. Рубінштейна, Н. Галізіної, ми визначили, що в науці закладено основи діяльнісної теорії розвитку психіки особистості та теорії навчальної діяльності. М. Варій тлумачить діяльність як зовнішню та внутрішню активність індивіда, яка спрямована на внутрішні зміни, повну трансформацію предметів, явищ і уподобань залежно від потреб, а також створення нових [3, с. 718]. Діяльнісний підхід – «персоналізація педагогічної взаємодії, яка передбачає відмову від рольових масок, адекватне включення особистісного досвіду (почуттів, переживань, емоцій, відповідних до них дій і вчинків)» (О. Пасічник) [13, с. 154].

Тобто, наступний підхід, який ми розглянемо – це діяльнісний. Діяльнісний підхід базується на активній діяльності учнів, що дозволяє їм самостійно здобувати знання та досвід. Викладання курсу «Я досліджую світ» за діяльнісним підходом дозволяє учням створювати власні проекти, дослідження та експерименти, що сприяє активному засвоєнню матеріалу та розвитку творчих здібностей.

Крім того, діяльнісний підхід передбачає персоналізацію педагогічної взаємодії, що означає відмову від рольових масок та адекватне включення особистісного досвіду учнів, таких як почуття, переживання та емоції, що мають відповідні до них дії та вчинки. Це дозволяє створити більш особистісно зорієнтовану навчальну середу, де учень відчуває себе затишно та вільно для самовираження, що в свою чергу сприяє позитивному настрою та підвищенню мотивації до навчання.

Діяльнісний підхід до викладання курсу «Я досліджую світ» сприяє розвитку в учнів таких важливих навичок як планування, організація та координація своїх дій, робота в команді, розвиток критичного мислення та рефлексії. Він також дозволяє учням більш глибоко зрозуміти зв'язки між різними аспектами світу, що допомагає формувати цілісне бачення дійсності та розвивати уяву.

Таким чином, діяльнісний підхід є важливим елементом в навчанні молодших школярів та формуванні компетентних та творчих особистостей. Діяльнісний підхід у викладанні курсу «Я досліджую світ» сприяє активному залученню молодших школярів до навчального процесу, дозволяє їм планувати та прогнозувати свої дії та досягнення, регулювати свої вчинки та прагнути до їх покращення, а також вибирати найбільш оптимальні засоби досягнення навчальних цілей. Цей підхід сприяє розвитку учнівської самостійності та творчості, що є важливими компетенціями у сучасному світі.

Тематичне навчання – це цілеспрямований процес інтеграції змісту навчального матеріалу з різних дисциплін навколо певної теми. Н. Божко зауважує, що освіта повинна розглядатися крізь призму суцільної картини, а не ділитися на окремі навчальні дисципліни, отже, предметні кордони часто зникають, якщо вчитель спонукає школярів будувати зв'язки між дисциплінами, спиратися на знання й уміння з різних областей у межах однієї теми [2, с. 80].

На думку М. Пристінської та І. Большакової, тематичне навчання «забезпечує формування в молодших школярів цілісної картини світу, здатності сприймати предмети і явища різнобічно, системно, емоційно, сприяє поглибленню та розширенню знань учнів, діапазону їх практичного застосування» [10, с. 85].

Тематичний підхід у викладанні курсу «Я досліджую світ» передбачає організацію навчального матеріалу за тематикою, що відповідає інтересам та потребам учнів. Учні зосереджені на вивченні конкретної теми, яка об'єднує знання з різних предметів і забезпечує їх більш повним сприйняттям.

Викладання курсу за тематичним підходом дозволяє забезпечити єдність навчального процесу і врахувати різноманітні потреби учнів. Під час вивчення однієї теми учні мають можливість розглядати її з різних точок зору, вивчати матеріал з різних предметів, використовуючи тим самим інтегрований підхід до навчання.

Таким чином, тематичний підхід до викладання курсу «Я досліджую світ» забезпечує глибоке засвоєння матеріалу учнями та розвиток їх критичного мислення та творчих здібностей.

Підсумовуючи вищезазначене, ми можемо виділити ще один науковий підхід у викладанні курсу «Я досліджую світ». Дослідницький підхід можна розглядати як спеціально організовану форму самоосвіти для молодших школярів, яка повинна бути цікавою, доступною та корисною. Цей підхід передбачає залучення учнів до власного активного процесу пізнання, де вони самі стають дослідниками свого навколишнього світу. В процесі викладання дослідницького підходу учні отримують знання та навички не тільки за допомогою теоретичних матеріалів, а й через власні дослідження, спостереження та експерименти.

Якщо дослідницький підхід буде впроваджено, то молодші школярі зможуть розвивати ключові та предметні компетентності, уміння дискутувати, шукати та використовувати здобуті знання, розвивати допитливість, цікавість, нестандартне мислення та самокритичність, планувати дії та співпрацювати з іншими. Такий підхід дає можливість розвивати навички, які стануть корисними в майбутньому, допоможуть у навчанні та житті загалом.

Варто зауважити, що в типовій освітній програмі (під керівництвом О. Савченко), у процесі реалізації програми інтегрованого курсу «Я досліджую світ» передбачається впровадження завдань дослідницького характеру: дослідження-розпізнавання (Що це? Яке воно?), дослідження-

спостереження (Як воно діє? Що відбувається? Для чого призначене?), дослідження-пошук (Чому? Яким чином? Із чим пов'язано?) [16, с. 39].

Таким чином, використання дослідницького підходу в навчанні інтегрованого курсу «Я досліджую світ» є ефективним засобом розвитку творчого мислення та підготовки молодших школярів до життя в сучасному світі. В результаті такого підходу формується глибоке розуміння предметів, розвивається допитливість та інтерес до вивчення навколишнього світу, а також розвиваються ключові компетентності, необхідні для успішного життя в майбутньому.

**Висновки.** Отже, у новій українській школі наголос ставиться на компетентнісну модель освіти, яка враховує особисті здібності та інтереси учнів. Використання наукових підходів (інтегрований, компетентнісний, тематичний, діяльнісний, дослідницький) має потужні можливості для розширення знань учнів у процесі викладання інтегрованого курсу «Я досліджую світ» надає можливість для поглиблення знань, розвитку різних умінь та навичок і використання їх у практичній діяльності. Для подальших досліджень можна вивчити особливості та наукові підходи до вивчення інших предметів.

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### СУЧАСНІ МЕТОДИ ВІДНОВЛЕННЯ МОВЛЕННЯ ПРИ АФАЗІЇ

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### MODERN METHODS OF SPEECH RESTORATION IN APHASIA

Учення про афазію сформувалося в окрему галузь наукового знання у XIX столітті і знаходиться на межі багатьох наук – філософії, психології, фізіології, клінічної неврології, лінгвістики, спеціальної педагогіки, що визначило різні підходи і напрями до її вивчення.

У структурі порушень вищих психічних функцій при локальних церебральних ураженнях особливою складністю в аспекті відновлення і корекції відзначається афазія (Ю. Я. Варакін, Т. Г. Візель, А. М. Савицький, В. В. Тарасун, Л. С. Цветкова, М. К. Шеремет, В. М. Шкловський та ін.). Афазія спостерігається більше ніж у третини всіх випадків церебрального інсульту (О.С. Кадиков, М. Крітчлі, Ю. Б. Мещерякова, В. М. Шкловський, R. Chen, R. David, S. Engelter, M. Gostynski, M. Hoffmann, P. Pedersen) і часто інтегрується з різними видами агнозій, апраксії, правосторонніми геміпарезами, залишаючи тяжкі наслідки, що обмежують працездатність хворого, призводячи до інвалідності.

Сучасні методи відновлення мовлення при афазії можна поділити на декілька категорій:

1. *Комунікаційні стратегії.* Ці методи спрямовані на полегшення комунікації пацієнта з афазією зі своїм оточенням. Наприклад, це може бути використання спрощеного мовлення, жестів, міміки, піктограм, електронних пристроїв для комунікації, таких як аугментативно-альтернативні комунікаційні засоби.

2. *Компенсаторні стратегії.* Ці методи спрямовані на заміну порушеного мовлення іншими способами комунікації. Наприклад, це може бути використання записувальних пристроїв, щоб зберегти ключові слова або речення, які можна повторювати, або використання словників або перекладачів.

3. *Реабілітаційні стратегії.* Ці методи спрямовані на відновлення мовлення пацієнта з афазією. Наприклад, це може бути використання різних видів терапії, таких як артикуляційна терапія, фонетична терапія, терапія лексики та граматики. Також можуть використовуватися комп'ютерні програми та ігри для покращення мовленнєвих навичок.

4. *Комбіновані стратегії.* Ці методи поєднують в собі елементи різних підходів для досягнення максимального ефекту. Наприклад, це може бути використання комунікаційних стратегій та реабілітацій.

5. *Психологічні стратегії.* Суть стратегій психологічної корекції мовлення полягає в тому, щоб допомогти пацієнтам з афазією знизити рівень стресу та тривоги, які можуть ускладнювати процес відновлення мовлення.

Найпопулярніші комунікаційні стратегії, які використовуються для полегшення комунікації пацієнтів з афазією зі своїм оточенням, включають наступні:

1. Спрощене мовлення: використання коротких та простих фраз та слів, щоб зрозуміти повідомлення.

2. Зображення та піктограми: використання ілюстрацій та символів для передачі повідомлень. Це може бути корисним, якщо пацієнт має проблеми з розумінням або використанням слів.

3. Жести та міміка: використання жестів та міміки, щоб передати повідомлення або показати емоції. Наприклад, махання рукою для показу напрямку або усмішка для показу задоволення.

4. Електронні пристрої для комунікації: використання аугментативно-альтернативних комунікаційних засобів (ААС), таких як спеціальні програми для смартфонів або інших електронних пристроїв, які дозволяють пацієнтам з афазією комунікувати з

іншими людьми за допомогою тексту, голосу або символів.

5. Розмовні групи: участь у розмовних групах може допомогти пацієнтам з афазією поліпшити свої комунікаційні навички та навчитися новим стратегіям комунікації.

Ці стратегії можуть використовуватися окремо або в комбінації, залежно від потреб пацієнта та ситуації.

Комбіновані стратегії відновлення мовлення полягають в використанні різних підходів та методів одночасно з метою забезпечення оптимальних результатів реабілітації пацієнтів з афазією. Зазвичай комбіновані стратегії включають в себе елементи реабілітаційних, комунікаційних та психологічної корекції мовлення.

Наприклад, комбінована стратегія може включати в себе:

- Використання комп'ютерних програм та мобільних додатків для відновлення мовлення, які можуть поєднувати в собі елементи комунікаційних та реабілітаційних стратегій. Ці програми можуть включати в себе вправи на поліпшення мовленнєвого розуміння та висловлювання, тренування розуміння та використання слів, фраз та речень, а також використовувати інтерактивні елементи для збільшення мотивації пацієнтів.

- Групові терапевтичні заняття, які можуть включати в себе елементи реабілітаційних та комунікаційних стратегій. Наприклад, учасники групових занять можуть вправлятися у використанні мовленнєвих стратегій, таких як перефразування або коротке висловлювання, а також займатися спілкуванням між собою з використанням відповідних вправ.

- Індивідуальні заняття з мовленнєвою терапією, які можуть поєднувати в собі елементи реабілітаційних, комунікаційних та психологічної корекції мовлення. У цьому випадку тер

Отже, комбіновані стратегії відновлення мовлення можуть залучати різні методи та підходи для досягнення найкращих результатів. Ці стратегії можуть бути індивідуалізовані для кожного пацієнта в залежності від типу та ступеню афазії.

Психологічна корекція мовлення – це підхід, що базується на психологічних принципах та методах для відновлення мовлення. Суть стратегій психологічної корекції мовлення полягає в тому, щоб

допомогти пацієнтам з афазією знизити рівень стресу та тривоги, які можуть ускладнювати процес відновлення мовлення.

Відновлення мовлення з позиції психологічної корекції мовлення спрямоване на відновлення мовленнєвої функції та поліпшення комунікації пацієнтів з афазією, враховуючи психологічні аспекти цього процесу.

Основна мета психологічної корекції мовлення полягає у зменшенні психологічного дискомфорту пацієнта під час відновлення мовленнєвої функції. Ці стратегії можуть включати в себе психологічну підтримку, підвищення мотивації та самооцінки, зменшення страху перед спілкуванням та збільшення позитивного настрою.

Психологічні корекції можуть включати в себе вправи на покращення самооцінки та психологічної готовності до спілкування, техніки зниження рівня тривоги, тренування засобів міжособистісного спілкування та відповідальності за своє поведінку та мовлення.

Отже, суть психологічної корекції мовлення полягає у психологічній підтримці та підвищенні мотивації пацієнта під час відновлення мовлення, зменшенні психологічного дискомфорту, зниженні рівня тривоги та тренуванні засобів міжособистісного спілкування. Це може покращити результати реабілітації та збільшити задоволення від процесу відновлення мовлення

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# AGRICULTURAL SCIENCES

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## FORMATION OF A COMPLEX OF POLYPHENOLS IN FRUITS COMMON LATE VARIETIES OF APPLE GROWN IN THE CONDITIONS OF FOREST-STEPPE OF UKRAINE

### **Abstract.**

*The influence of weather growing conditions and varietal features on the formation of a complex of natural polyphenols of apple fruit is analyzed. It was revealed that the fruits of varieties had a greater concentration of polyphenols: Priscilla, Plamennoye, Ruby Duki, Sapphire, Mekintosh. It has been established that the dependence of the formation of polyphenols depending on some elements of weather conditions for some varieties. A more stable content of polyphenols over the years of research was found in varieties: Priscilla, Plamennoye, Mekfrey, lower in the varieties Liberty, Delicia, Renet Simirenko.*

**Keywords:** *fruits, apple, fruits, fruits, weather, polyphenols, stability.*

### **Introduction.**

Apple tree is the most common fruit crop in Ukraine. It occupies more than 80-85% of the area of gardens. Currently, over the past 20 years, the area under the gardens has decreased by almost 39% and amounts to 171 thousand hectares. Given the favorable soil and climatic conditions, Ukraine has a great prospect of this industry [1-4].

Apple fruits are the most affordable fruits for the population of Ukraine and Europe. Its fruits have valuable preventive and curative properties. Apples contain a complex of polyphenols, which have antioxidant properties. One of these polyphenols is the flavonoid epicatechin, which can help lower blood pressure. Sufficient consumption of natural flavonoids helps to reduce the risk of stroke by 20%. Flavonoids can help prevent some heart disease by reducing the "bad" oxidation of low-density lipoproteins. With the daily consumption of apples and the intake of statins (reduce the level of bad cholesterol), an effective reduction in mortality from heart disease is observed. Daily consumption of apples potentially reduces the risk of developing type 2 diabetes by 28%. Even eating only a few apples a week has a positive protective effect. Apple polyphenols prevent damage to pancreatic beta cell tissue. Beta cells produce insulin in the body and are often damaged in people with type 2 diabetes [5-12].

The formation of the biochemical composition of the fruit largely depends on the conditions of the grow-

ing season, especially the last 20-40 days before harvesting. To obtain a more complete description of the variety, namely: the stability of individual components of the fruit, the reaction to agrotechnical and weather conditions, etc., it is advisable to use 3 or more years of observation [13-14].

The formation of a specific complex of polyphenols varies significantly in most fruit and berry crops over the years and in most cases is a varietal trait. Excessive precipitation during the formation and ripening of fruits, the amount of these substances increases, and drought reduces them. Warm sunny weather with sufficient rainfall, especially in the second half of summer, contributes to the formation of higher concentrations. There was a slight increase in polyphenols for damage by pests and diseases. The formation of a complex of polyphenols in the fruits of an apple tree in the conditions of the forest-steppe of Ukraine has not been sufficiently investigated. This is especially true of the influence of lighting (in the qualitative context of direct, scattered and photosynthetically active solar radiation (FAR) [15-16].

### **Materials and methods.**

Research conducted at the Institute of Horticulture (IS) of the Academy of Sciences of Ukraine and NULES of Ukraine. Used data from many years of research. Concentration of the complex of polyphenols carried out with the use of Folin-Denis reagent. Data on active temperatures and precipitation during the years of research are provided by the meteorological group of

the IS NASU. Statistical data processing was carried out according to generally accepted methods. The calculation of stability is carried out on the example of calculating the coefficient of variation [17-18].

#### Results and discussion.

The conducted studies made it possible to investigate the average content, the stability of the complex of polyphenols in the fruits of common varieties and the reaction of individual varieties of apple trees to the meteorological conditions of formation and ripening of fruits. For some varieties, a significant influence of weather elements on the formation of the content of polyphenols has been identified.

The content of the amount of phenolic substances in the fruits of the apple tree is quite different (table). On average, the variety value is 187.05 mg/100 g of crude matter. The highest content of phenolic substances on average during the years of research had varieties Priscilla (252.8 mg/100 g), Plamennoe (222.7), Ruby Duki (216.7), Sapphire (208.62), Mekintosh (210.37 mg%). The deviation of the content of phenolic substances by variety ranges from 17.5 mg% (Mekfrey), to 123 mg% (Liberty). High stability among the studied varieties for this indicator was observed in the varieties Priscilla, Plamennoye, Mekfrey, lower in the varieties Liberty, Delicia, Renet Simirenko.

Table-1.

Phenolic content in apple fruits, mg per 100 g

Variety	Average for research years	Fluctuations by year		Maximal deviation	CV, %
		minimal	maximal		
Aidared	132,93	106,5	159,8	53,3	26,6
Boiken	163,51	145,1	190,1	45,0	17,6
Jonathan	198,22	180,1	223,5	43,4	16,9
Calville snow	150,82	135,3	162,1	26,8	8,9
Delicia	110,96	69,0	125,3	56,3	19,6
Winter lemon	156,03	138,1	181,4	43,3	22,5
Liberty	192,93	105,1	228,1	123,0	38,4
Mekintosh	210,37	108,0	160,6	52,6	21,2
Mekfrey	194,22	185,1	202,6	17,5	9,3
RenetSimirenko	199,09	152,4	244,9	92,5	33,6
Ruby Duci	216,7	205,4	236,2	30,8	16,9
Plamenne	222,72	208,0	227,9	19,9	11,1
Priam	191,72	158,6	233,6	75,0	30,8
Priscilla	252,8	240,1	260,4	20,3	9,5
Sapphire	208,62	183,2	221,2	38,0	17,6
Florina	191,17	158,5	218,5	60,0	23,2
Average	187,05	154,90	204,76	49,85	8,9
LSD05	47,8	-	-	53,1	5,28

The concentration of phenolic substances in fruits is mostly a varietal feature, but fluctuations have been observed, depending on changes in weather conditions in different years of cultivation. For the Aidared variety, a large relationship was found with the amount of precipitation during the growing season ( $\eta_{yx}=0.997\pm 0.014$ ;  $y = 0.3497x + 4.9657$ ). The fruits of the Boyko variety dramatically increase the content of

poly phenol with excessive moisture for the 30-day period before harvesting ( $\eta_{yx}=0.92\pm 0.08$ ;  $y = 0.7579x + 146.54$ ). It was noted that an increase in GTC for a 20-day period before harvesting in the fruits of the Ruby Duki variety contributes to an increase in the content of polyphenols ( $\eta_{yx}=0.999\pm 0.0043$ ;  $y = 5.3417x + 204.74$ ). (figure 1).

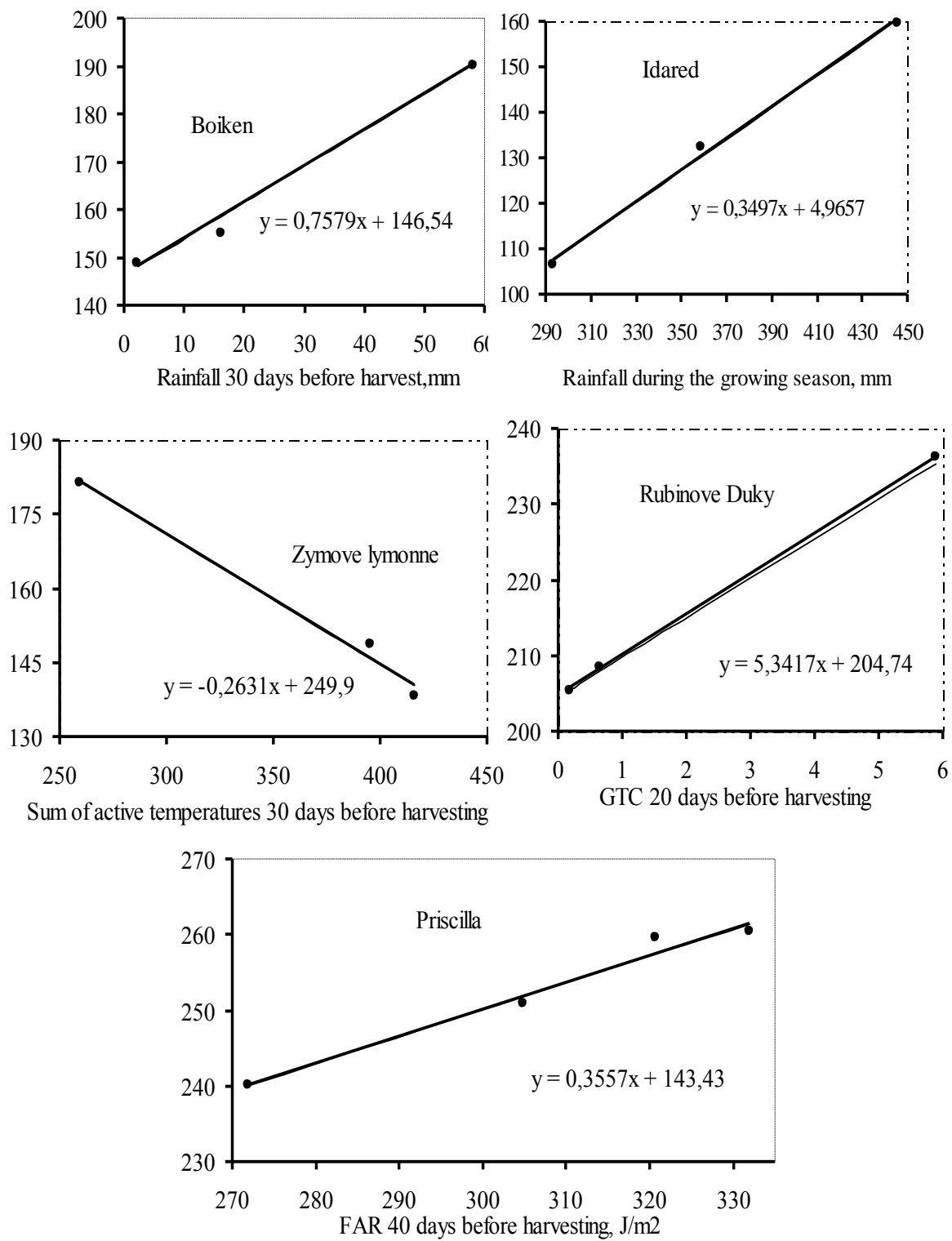


Fig. 1. The influence of elements of weather conditions on the formation of the content of complex polyphenols in apple fruits

A comparative analysis of the obtained data revealed that the content of phenolic substances in fruits significantly depends on the amount of precipitation during the growing season and the intensity of direct solar radiation for 20- and FAR 20-, 30-day period before harvest.

Dispersion analysis of the influence of weather growing conditions and varietal features on the formation of the concentration of a complex of polyphenols in the fruits of the studied apple varieties over the years of research has shown that the formation of the concentration of polyphenols most depends on the varietal characteristics of the crop and the interaction of the studied factors (Figure 2).

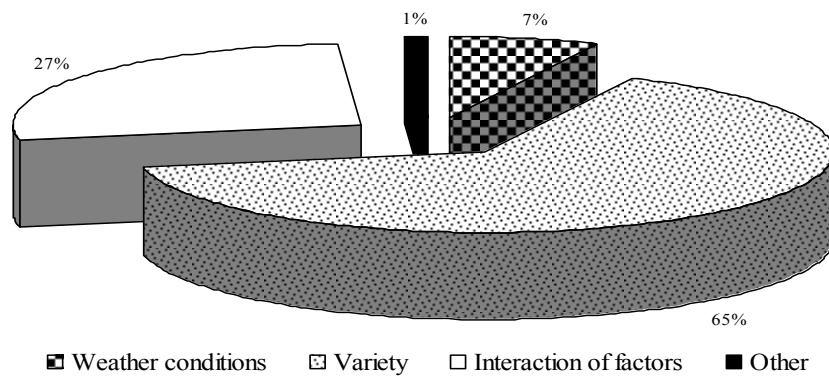


Fig. 2. Influence of the studied factors on the formation of the complex of polyphenols in apple fruits

### Conclusions and suggestions.

Meteorological conditions have a complex effect on the formation of a complex of polyphenols in the fruits of the studied varieties of apple trees. The highest content of polyphenols had the fruits of varieties: Priscilla, Plamennoye, Ruby Duki, Sapphire, Mekintosh. It has been established that the dependence of the formation of polyphenols depending on some elements of weather conditions for some varieties. A more stable content of polyphenols over the years of research was found in varieties: Priscilla, Plamennoye, Mekfrey, lower in the varieties Liberty, Delicia, RenetSimirenko. Knowledge of these features should be used in the selection of varieties whose fruits will be used for storage and certain types of processing. The obtained data should be taken into account in the production of fruits and products of processing of high quality and biological value.

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## TECHNICAL SCIENCE

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### BROWN COAL HUMIC SUBSTANCES HYBRID MODIFIED BIODEGRADABLE COMPOSITES WEAR SIMULATION

#### Abstract

*Researching on wares modeling from brown coal humic substances hybrid modified biodegradable composites based on polylactide and coffee waste technology are carried out in this work. New wares are pots for seedlings and vases for planting greenery that can be used for landscaping for urban territories. The products design was made, the mathematical modeling of the designed products was carried out. The process of modeling products based on brown coal humic substances hybrid modified biodegradable composites based on polylactide and coffee was carried out in the SolidWorks 2020: 3D CAD environment with subsequent receipt of g-code, which is intended for machines for the production of molds for plastic injection.*

**Keywords:** modeling, humic substances, brown coal, biodegradable, composite, polylactide, coffee waste, wares

#### Introduction

Currently, in the area of landscaping for urban territories, a numbers of different polymeric materials and compositions are widely used, which have a number of operational and aesthetic advantages over other materials. These include properties such as high strength and durability, light weight and ample opportunities in design, color scheme and other important aesthetic characteristics.

At the same time, the last 10 years the current world's trend is the use of biodegradable polymeric materials. Such biodegradable polymeric materials implement the principle of "Zero waste" throughout the life cycle - "production-use-disposal", so this class of polymers today is widely used in the market [1, p. 2653]. Based on the possibility of using biodegradable polymeric materials in a wide areas in urban spaces landscaping, today research on the study, development and design of various parts, products from such materials are important and popular[2, p. 6310].

Polylactide is today widely used in packaging as a special product. Many branded companies use products from this particular bio-plastic to pack their goods [3, p. 535]. Highly efficient polylactide grades can be used as an alternative to polyethylene, polypropylene, polystyrene and ABS plastics.

Polylactide can be used even in fairly critical areas of engineering and instrumentation. The wide distribution of products from polylactide in Ukraine is limited by the high cost of finished products. So, a 200 ml coffee cup costs about \$ 25. The cost of polylactide products can be reduced by introducing of various fillers

that do not affect the physicochemical and operational properties of the finished product. using of coffee grounds waste as a filler, you can get a product that haven't negative environmental impact with low price [4, p. 1712]. That is why the development of biodegradable polymer composite materials based on polylactide and coffee grounds waste is very relevant.

One of the main approaches that ensure the fulfillment of the tasks set is the transition to computer-aided design of products from biodegradable polymer materials [5, p. 118580].

In such cases, it becomes possible to use complex models based on biodegradable polymer materials, take into account the physical, chemical characteristics, features and requirements of production processes, as well as the possible behavior of the material during the wares made from them operation.

Modeling products made from biodegradable polymer materials cannot be carried out without understanding the areas of their application and predicting the prospects for use in specific products or functional systems.

Thus, the design of products from polymeric materials is a very difficult task in terms of creating new polymeric materials, because it requires appropriate technological and design information, for the developed wares, equipment for their manufacture, as well as different technological parameters of their processing.

Thus almost always high quality and durability of polymeric products and details is caused by a complex

of material's correct choice and selection of the most effective method of their processing.

Bioplastic polymer matrices filled with coffee husk waste have also been studied in [6, p. 134841], however, these works are more research than applied industrial in nature. That's why it's very relevant to develop and study biodegradable polymer composite materials based on polylactide and coffee grounds waste in order to use them for the manufacture of dishes for catering establishments: coffee cups, glasses, plates, cutlery, etc. We have previously studied [7, p. 154] chemical, physical, mechanical and operational properties of new high-filler composite based on polylactide.

It is also noticed, that using coffee grounds as fillers for polymer materials can decrease the total volume of it at landfills faster than any other method of coffee ground reuse. Further research the level of sorption stability for developed materials to the most characteristic environments of their operation is perspective [8, p. 646].

The aim of the research was to design modeling of brown coal humic substances hybrid modified biodegradable composites based on polylactide and coffee waste wares for the improvement of urban spaces.

#### **Raw materials and test methods**

The objects of study were:

- extrusion polylactide of the Terramac TP-4000 brand;
- coffee grounds waste, gathered in 8 different coffee shops in Kharkiv and dried to moisture content 50%. Coffee grounds waste have a polyfractional composition in the particle size limit from 0.5 to 1 mm;
- humic substances, which were obtained by extraction of brown coal with alkaline solution of sodium pyrophosphate, followed by extraction with 1 % sodium hydroxide solution and precipitation with mineral acid.

Brown coal humic substances hybrid modified biodegradable composites based on polylactide and coffee were obtained by extruding pre-prepared raw materials in a single-screw laboratory extruder at a temperature of 170–200 °C and a roll rotation speed of 30–100 rpm. The L / D ratio of the extruder is 25, and in order to increase the uniformity of dispersed waste distribution in the finish compositions, 2 mass passes were used to obtain finished samples. It was made 20 parallel experiments for each composition, statistical processing was made by characteristics such as arithmetic mean, standard deviation and variation coefficient.

The process of modeling products based on brown coal humic substances hybrid modified biodegradable composites based on polylactide and coffee was carried out in the SolidWorks 2020: 3D CAD environment with subsequent receipt of g-code, which is intended for machines for the production of molds for plastic injection.

#### **Results and discussion**

The design of ware's outward appearance for urban spaces landscaping was carried out in the form of vases for gardening and vases for planting greenery on the basis of an optimized brown coal humic substances hybrid modified biodegradable composites on polylactide and coffee waste in the SolidWorks 2020: 3D CAD environment.

Regardless of whether you will be using a CNC milling or turning machine, the typical process for creating injection molds for the production from polymer materials consists of the following steps:

- SolidWorks 2020: 3D CAD used to parts design;
- using additional tools SolidWorks 2020: 3D CAD to optimize the further use of CAD models for injection mold manufacture on a machine;
- SolidWorks 2020: 3D CAD analyzes the CAD drawing and outputs G-Code control commands to the machine controller;
- the operator of the machine, based on the commands received from the G-code-commands, activates the corresponding electrical circuits in the desired sequence and with the specified duration, which forces the machine to perform the operations specified by the program.

In fact, G-Code is the most common language understood by CNC machines.

Table 1 below shows the G-Code model for the ware design for urban spaces landscaping in the form of pots for seedlings and vases for planting from an optimized brown coal humic substances hybrid modified biodegradable composites based on polylactide and coffee waste [10, p. 168]. In fig. 1 presents 3d model outward appearance of a typical wares for urban spaces landscaping in the form of pots for planting seedlings of greenery with the indication of the main dimensions that made of optimized brown coal humic substances hybrid modified biodegradable composites based on polylactide and coffee waste.

Table 1

**G-Code models of ware design for urban spaces landscaping in the form of pots for seedlings and vases for planting from an optimized brown coal humic substances hybrid modified biodegradable composites based on polylactide and coffee waste**

G-Code	Responsive action
O0001 ( VAL );	Program number.
N5 G00 X40 Z50;	Accelerated movement to the tool change point.
N10 T0202 (FINISHING TOOL SVJC (08));	Changing the tool, turning on the corrector on the tool.
N15 M3 S2000;	Rotation of the spindle counterclockwise with a speed of 2000 rpm
N20 G00 X22 Z0;	Accelerated movement to point 1
N25 G01 X-2 F0.12;	Moving to point 2 with a feed of 0.12 mm / rev.
N30 Z1;	Moving to point 3.
N35 G00 X19 S1600;	Accelerated movement to point 4, changing the spindle speed by 1600 rpm
N40 G01 Z-20 F0.1;	Moving to point 5 with a feed of 0.1 mm / rev.
N45 X22;	Moving to point 6.
N50 G00 Z1;	Accelerated movement to point 7.
N55 X15;	Accelerated movement to point 8.
N60 G01 X18 Z-0.5 S1700 F0.05;	Moving to point 9 with a feed of 0.05 mm / min and the spindle speed of 1700 rpm
N65 Z-9.5;	Moving to point 10.

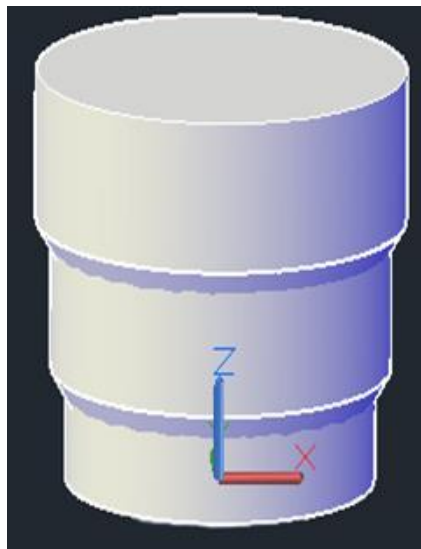


Figure 1. 3d model outward appearance of a typical wares for urban spaces landscaping in the form of pots for planting seedlings of greenery with the indication of the main dimensions that made of optimized brown coal humic substances hybrid modified biodegradable composites based on polylactide and coffee waste

SolidWorks 3d model outward appearance of a typical wares for urban spaces landscaping in the form of pots for planting seedlings of greenery with the indication of the main dimensions that made of optimized brown coal humic substances hybrid modified biodegradable composites based on polylactide and coffee waste can be used for injection molds creation within the production processes of polymeric materials processing.

### Conclusion

The article conducts research on modeling of wares from the brown coal humic substances hybrid modified biodegradable composites based on polylactide and coffee waste for urban landscaping in the form of pots for seedlings and vases for planting greenery.

The design of new wares was constructed, the mathematical modeling of the designed products from brown coal humic substances hybrid modified biodegradable composites based on polylactide and coffee waste was carried out. Created in SolidWorks 3d, a model of a typical ware design for urban landscaping in the form of pots for seedlings of green plantings with the indication of the main dimensions making from optimized brown coal humic substances hybrid modified biodegradable composites based on polylactide and coffee waste can be used to create molds in the production processes of polymer materials.

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## ALGORITHM FOR OPTIMIZING THE OPERATION OF THE EVAPORATOR OF ABSORPTION-REFRIGERATION INSTALLATIONS UNDER THE CONDITIONS OF THE MULTI-PARAMETER EFFECT OF EXTERNAL DISTURBANCE

### **Abstract.**

*An analysis of the operating conditions of the evaporators of absorption-refrigeration units of the secondary condensation unit of ammonia production as control objects is carried out. There is a well-founded need to minimize the cooling temperature of the circulating gas, the reduction of which increases the energy efficiency of ammonia production by reducing consumption of natural gas.*

*Algorithmic support for optimizing the operation of the evaporator of absorption-refrigeration units in the conditions of multiparametric action of disturbing factors with the determination of the optimal flow of phlegm to minimize the cooling temperature of the circulation gas in the evaporators has been developed.*

**Key words:** *ammonia production, evaporator, phlegm consumption, absorption-refrigeration plant, optimization algorithm, energy efficiency.*

**Introduction. Formulation of the problem.** The final removal of production ammonia is provided by the technological complex of secondary condensation, which is one of the main ones in the synthesis department of ammonia production. As a part of many complexes of this production, as well as in the complex of secondary condensation, air and water cooling devices are actively used, which sometimes has a very negative effect on the quality of work of individual departments, and therefore on the production of ammonia in general. The disadvantage of such devices is the significant impact on their work of seasonal and daily fluctuations in temperature and humidity of the surrounding air [1].

In particular, the use of air cooling devices in the refrigerant condensation unit of absorption refrigeration

units (ARU) included in the secondary condensation complex causes constant disturbances in their operation. This, in turn, leads to significant fluctuations in the cooling temperature of the circulating gas (CG) in the evaporators of the ARU ( $-8^{\circ}\text{C} \div +4^{\circ}\text{C}$ ) [2]. Such fluctuations lead to significant changes in the flow of natural gas into the additional steam boiler, and an increase in this temperature, as is known [3], due to an increase in the flow of natural gas causes a decrease in the energy efficiency of the synthesis unit in general.

Therefore, the minimization of the temperature regime of cooling of CG in the evaporators of ARU is an urgent task in the general process of increasing economic efficiency of ammonia synthesis units.

The peculiarity of the operation of the evaporator is connected with the inflow of refrigerant (ammonia)

with water impurities, which necessitates the removal (drainage) of the remaining water in the form of phlegm. However, in the literature [4] there is practically no information on determining the necessary intensity of phlegm drainage depending on constantly acting external disturbances. At the same time, insufficient as well as excessive drainage ultimately reduces the cooling capacity of the unit, which negatively affects the energy efficiency of production.

**The purpose of research.** The purpose of the research is to develop algorithmic support for establishing a quantitative assessment of the optimal value of phlegm consumption from the evaporator of the ARU of the secondary condensation complex in the production of ammonia under the conditions of multiparametric action of external disturbing factors and making decisions for its implementation. This will determine the solution to the problem of minimizing the cooling temperature of the central heating system in the context of increasing the energy efficiency of ammonia production.

**Main research results.** Previous studies [5-7] have proved the significance of the influence of phlegm consumption for such powerful ARU on the efficiency of cooling CG, and therefore on the energy efficiency of production. At the same time, the use of controlling action on the consumption of phlegm in the range from 0.2 t/h to 0.8 t/h ensures a decrease in the annual consumption of natural gas by an average of 500 thousand cubic meters.

The analysis of the conducted studies [5, 6, 8], as well as the literature [9-13], shows that the most appropriate method for solving the optimization problem in the conditions of multi-parameter action of external disturbances will be a gradient-free step-type method using one-dimensional extremum search algorithms, namely the method scanning in the space of only one variable. Due to the application of a small search step, this method guarantees that the extremum will not be missed [14].

The results of the studies on the effect of external disturbances on the efficiency of cooling of CG in the evaporators of ARU allow to determine the parametric sensitivity of disturbing factors and the amount and direction of the shift of the optimal flow rate of phlegm, which determines the minimum temperature regime for cooling CG. Parametric sensitivity [15] is determined by a dimensionless coefficient that can be calculated using the formula

$$K = \frac{(M_{R1} - M_{R2})}{M_{R1}} \cdot \frac{Z_{i1}}{(Z_{i1} - Z_{i2})}, \quad (1)$$

where  $M_{R1}$  and  $M_{R2}$  - optimal consumption of phlegm, respectively, under the disturbing factors  $Z_{i1}$  and  $Z_{i2}$ .

The results of calculations according to Formula (1) are presented in the Table 1.

Table 1

**Parametric sensitivity of the optimal amount of phlegm consumption to changes in disturbing factors**

Limits of changes in the optimal flow of phlegm $M_R$ (t/h) under the relevant disturbing factors $Z_i$		Coefficient of parametric sensitivity $K$
$Z_1$ - pressure of the boiling refrigerant in the evaporator, MPa	$M_R = (0,35 \div 0,45)$ $P_{IP} = (0,29 \div 0,3)$	8,28
$Z_2$ - refrigerant concentration at the evaporator inlet, kg/kg	$M_R = (0,8 \div 0,35)$ $\xi_X^{IN} = (0,994 \div 0,998)$	-320,78
$Z_3$ - consumption of liquid refrigerant to the condenser receiver, t/h	$M_R = (0,3 \div 0,4)$ $M_X^{IN} = (9,5 \div 10,5)$	3,16
$Z_4$ - concentration of ammonia in CG at the evaporator inlet, % vol.	$M_R = (0,3 \div 0,4)$ $a_{NH_3}^{IN} = (9 \div 11)$	1,5

Analysis of the data of Table 1 shows that the concentration of the refrigerant at the evaporator inlet has the greatest influence on the value of the optimal flow of phlegm, and therefore on the extreme value of the CG cooling temperature  $\xi_X^{IN}$ , and the least – the concentration of ammonia  $a_{NH_3}^{IN}$  in the CG at the evaporator inlet.

In Figure 1 an algorithm is shown that provides an extremum search for the CG temperature at the evaporator outlet  $\Theta_{2CG}$  using the scanning method for only one variable  $M_R$ .

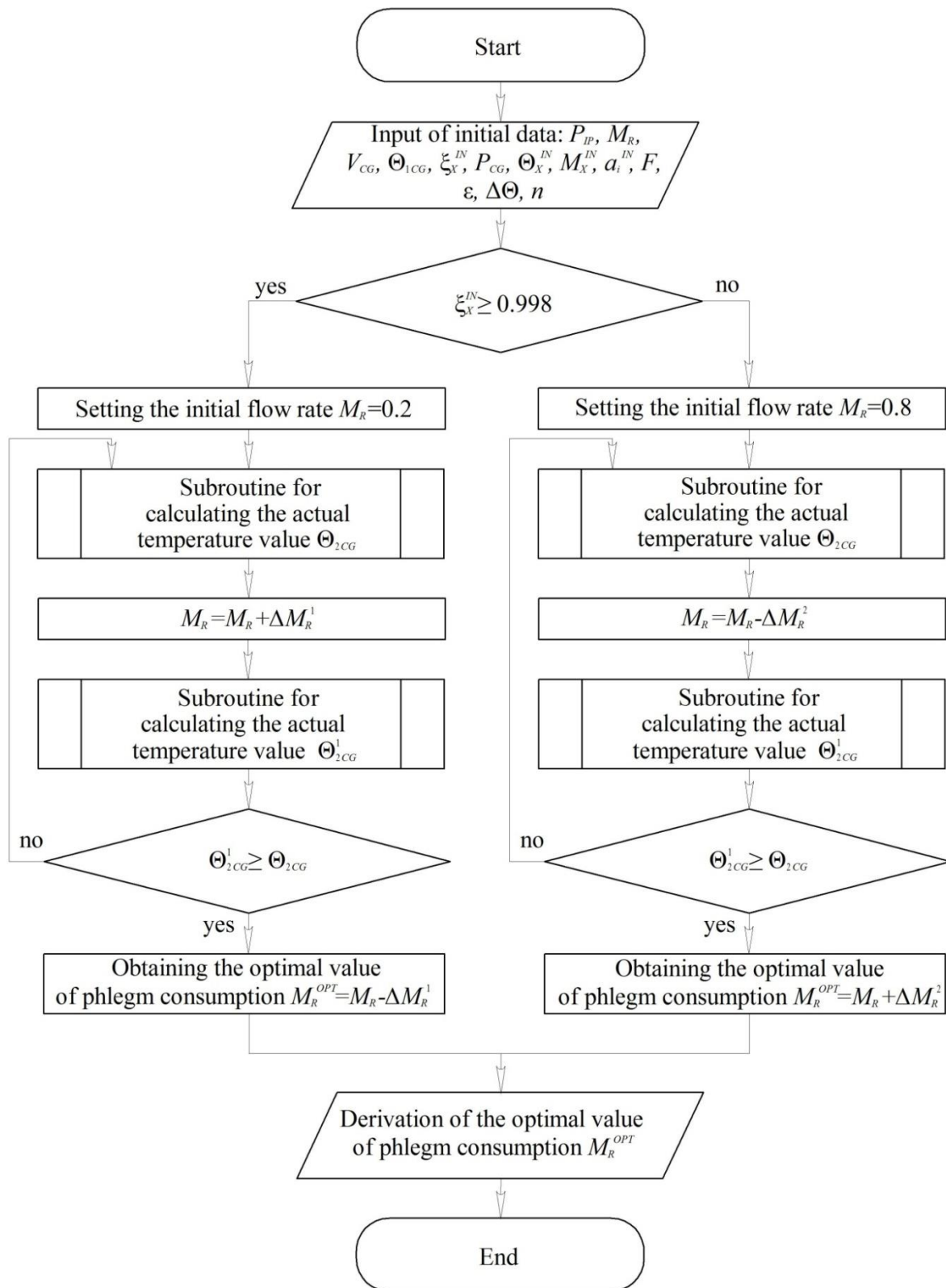


Figure 1 Algorithm for finding the extremum for the temperature of the circulating gas at the outlet of the evaporator  $\Theta_{2CG}$  by the method of scanning one variable  $M_R$ .

The designations shown in Figure 1, correspond to the following physical values:  $V_{CG}$  – volume flow rate of CG,  $\text{m}^3/\text{s}$ ;  $a_i^{IN}$  – volume concentration of constituent components of CG at the entrance, % vol.;  $F=520 \text{ m}^2$  – total heat exchange surface;  $\varepsilon=0.2\%$  – is the specified value of the calculation error;  $\Delta\Theta=0,1 \text{ }^\circ\text{C}$  – temperature change step;  $\xi_X^{IN}$  – refrigerant concentration,  $\text{kg}/\text{kg}$ ;  $M_X^{IN}$  – consumption of liquid refrigerant to the condenser receiver,  $\text{kg}/\text{s}$ ;  $P_{CG}$ ,  $P_{IP}$  – pressure of CG and boiling refrigerant, respectively,  $\text{MPa}$ ;  $n=526$  – total number of heat exchange pipes;  $\Theta_{1CG}$ ,  $\Theta_{2CG}$ ,  $\Theta_X^{IN}$  – temperature, respectively, of CG at the evaporator inlet, CG at the evaporator outlet and refrigerant at the evaporator inlet,  $^\circ\text{C}$ ;  $M_R$  – phlegm consumption,  $\text{kg}/\text{s}$ .

The obtained indicators for the coefficient allow determining the initial value for in the algorithm for finding the extremum for the cooling temperature of the central heating system. At the same time, according to research, the following conclusion can be drawn.

Under the condition of  $\xi_X^{IN} \geq 0.998 \text{ kg}/\text{kg}$ , which is observed in the spring-summer season of operation of the ARU, the initial value for the flow of phlegm should be at the level of  $0.2 \text{ t}/\text{h}$ , and the search direction should be carried out in the direction of increase  $M_R$  with a step of  $\Delta=0.02 \text{ t}/\text{h}$ . In the case of  $\xi_X^{IN} \leq 0.998 \text{ kg}/\text{kg}$  observed in the autumn-winter period, the initial value for phlegm consumption should be at the level of  $0.8 \text{ t}/\text{h}$ , and the search direction should be carried out in a decreasing direction  $M_R$  and with a slightly increased search step  $\Delta=0.05 \text{ t}/\text{h}$ . The latter is explained by a much lower steepness of the dependence of the characteristics on the change  $M_R$ .

This algorithm, unlike the previously developed one [16], additionally contains two transition conditions, namely the determination of the initial value of the phlegm flow and the search step and the determination of convergence and comparison of the objective function  $\Theta_{2CG}$  with the previously calculated one. If the previously calculated one  $\Theta_{2CG}$  turns out to be less than the next one, the cycle ends, otherwise, the transition to the next search step is carried out.

**Conclusion.** The developed algorithmic support for establishing a quantitative assessment of the optimal value of phlegm consumption from the evaporator of the ARU under the conditions of multiparametric action of external disturbing factors provides the solution of the optimization problem by a gradient-free step-type method using the methods of one-dimensional search for extremum. The parametric sensitivity of the optimal flow of phlegm to the change of disturbing factors acting on the evaporator is established. The application of the developed algorithm ensures the creation of a decision-making subsystem in the mode of supervisory optimal software control of low-temperature evaporators of absorption-refrigeration units of the technological complex of secondary condensation of ammonia production.

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# PHYSICAL EDUCATION AND SPORTS

JEL: L83; Z20; Z21

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## KEY SPORT COMPLEX MANAGEMENT IN ARMENIA: CURRENT STATE AND PERSPECTIVES

### **Abstract.**

*The issue of efficient management of Armenian sport facilities is complex due to lack of adequate management model, funding and public management quality issues, and influence of current trends and drivers, including safety and security, accessibility, and inclusivity. To overcome these obstacles, a comprehensive strategy must be developed that incorporates efficient communication, strategic planning, and ongoing improvement. The goal of this paper is to identify peculiarities of comprehensive approach to Armenian sport complex management including both organizational and societal goals based on adequate funding. The paper examines the condition of Armenia's sport organizations, stressing the variety of organizations and sport professionals who participate in them. It highlights the need for efficient management of sports complex, with a focus on operational and strategic management using KPIs. The paper proposes a set of KPIs, which should include current diversity and inclusiveness concerns and span several directions of management. The financing options for sporting complex are also covered, with an emphasis on the need of striking a balance between organizational and societal goals as well as ensuring accessibility and inclusivity. In order to manage sports complexes effectively, the paper suggests creating a comprehensive framework that includes both company and social objectives. This study may be of interest for sport management researchers, sport industry organizations, thinktanks, sport sector management both in public and private areas, public authorities and non-for-profit organizations. Further directions for this field's research are focused on creating a Balanced Scorecard-style approach that is comprehensive and incorporates organizational and societal goals for managing sport complex.*

**Keywords:** *sport complex management; organizational goal; sport management KPI; diversity; financing mix.*

**Introduction.** Efficient management of sport complex under volatile exogenous and endogenous environment is one of the main concerns for a number of stakeholder groups. Therefore, this necessitates a complex solution on both business-level and public-level on the part of major stakeholders. Lack of adequate management model is a significant limitation in this case. Further the issue is aggravated by lack of public funding and potential global recession over 2023-2025 period. Hence, it's an urgent task to develop an adequate managerial approach for Armenian sport facilitated based on management model encompassing multiple aspects, i.e. key drivers of exogenous and endogenous nature, stakeholder needs and motivations, leading technologies used both in public and business sectors.

The issue of efficient management of Armenian sport complex is complex by its nature. That encompasses funding and public management quality issues, which is more challenging under modern conditions of strained government budget and public spending cuts. Moreover, efficient management of Armenian sport complex has to deal with issues of safety and security. Accessibility and inclusivity are another aspect to consider in the field in question. Stakeholder needs are also to be included in the consideration for managerial approach towards Armenian sport complex under current situation. Therefore, overcoming these obstacles calls for a thorough and integrated strategy that incorporates

good communication, strategic planning, and ongoing improvement.

The studies **goal** is to determine the integrated approach for sport complex management in Armenia encompassing both organizational and societal goals supported by adequate financing component.

This goal is supported by a number of **tasks**, i.e. study the context of sport complex management in Armenia; determine key performance indicators for sport complex management; analyze diversity and inclusivity goal for sport complex management; study revenue sources in terms of relevant financing mix for supporting organizational and societal goals of sport complex management in Armenia.

**Literature Review.** Issues of sport complex management under complex exogenous and endogenous environment are considered in a number of research papers.

Body of research considers strategic and operational aspects of business models in managing sport complex. In particular, Hassin, Zaidi, Ali (2022) analyze strategic component of managerial model for sport complex in Malaysia. In turn, Elasri-Ejjaberi, Aparicio-Chueca, Triadó-Ivern (2020) propose an insight into factors determining expenditure structure in managing key sport facilities in Spain. Further, Santacruz Lozano, Espada Mateos, Clemente Remón, Jiménez-Beatty Navarro (2020) research peculiarities of business models for public and private sport facilities in Spain. Puglisi,

Baiardi (2019) analyze peculiarities of cost-focused and revenue-focused management models for sport facilities. In turn, Llagjevic-Govori, Tahiraj, Llagjaj (2022) study peculiarities of management model for sport facility in Indonesia. Further, Lyberger, Yim, McCarthy (2020) analyze management model for sport complex in terms of feasibility analysis. Kwon, Kim (2021) study managerial approaches towards customer management model for sport complex.

Number of papers analyze public policy aspects in managing sport complex. In this field of research paper Kayode, Tunrayo (2022) analyzes issues of managing sport complex in terms of budgeting in Nigeria. In turn, a specific issue is considered in paper by Cocco, Mayer, Montanaro (2022) studying peculiarities of managing abandoned sport facilities. In turn, Wang, Wang (2020) study management of Chinese sport facilities in terms of public policy on promoting healthy lifestyle. Further, Nasrulloh, Sumaryanto, Sumarjo, Nugroho (2022) analyze issues of managing sport facilities under COVID-19 pandemics. Lumintuarso, Suharjana, Widiyanto, Ndayisenga (2021) study management issues of Indonesian sport complex in terms of Asian Games 2018 preparations.

National and regional peculiarities of managing sport complex are studied in a body of research papers. In this particular field, Anam, Taufikurrahman (2021) outline a complex of managerial issues for sport complex in Central Java region, Indonesia. Further, Haofan, Jing (2022) research managerial approaches towards urban and rural sport complex in China. In turn, Chen (2019) study issues of planning and managing large sport complex in China. Sizeable input for the outlined discussion is added by Gebreyohannis (2020) analyzing factors influencing accessibility of sport complex in Ethiopia. In turn, Bergsgard, Borodulin, Fahlen, Høyer-Kruse, Iversen (2017) analyze national structures in terms of managing sport complex in Northern Europe.

Sustainability and diversity issues in managing sport complex are studied in a set of research papers. Particularly, León-Quismondo, García-Unanue, Burillo (2020) analyze issues of efficient sport complex management in terms of sustainability. Further, Orynycz, Tucki (2020) research issue of energy efficiency in managing sport facilities. In turn, Reza Ghasemi, Khoshnam, Tork Far, Mohammadzadeh (2020) analyze management of sport complex within sustainability concept. Further, McDowell, J., Pickett,

A. C., & Pitts, B. G. (2022) indicate a need for diversity component in implementing contemporary sport management aimed at achieving higher results in terms of social development goals. Paper Love, A., Bernstein, S. S., & King-White, R. (2021) further develop the need for diversity and inclusion component in sport management supporting social changes on community and state levels.

Technology factor in managing sport complex is analyzed in several papers. Discussion in this field is developed by paper Yang (2022) researching innovative managerial approaches for sport complex based on cloud technology. Further, Li, Zhang (2021) study approaches towards planning sport complex based on Big Data modelling techniques.

However, the issue of integrated approach towards sport complex management, in particular in combining organizational and societal goals supported by adequate financing is not studied sufficiently.

**Methodology.** In this research, the following methodology was used to study the peculiarities of sport complex management: *synthesis* – to identify trends and structure peculiarities for sport sector in Armenia; *statistical analysis* – to determine the viability of the suggested solutions for sport complex management based on Armenia's macroeconomic data and sport sector data; *strategic analysis* – to establish key priorities and integrated goals for sport complex management in Armenia based on endogenous and endogenous environment.

Data basis for this research is data of Armstat – Statistical Committee of the Republic of Armenia, i.e. Armenia's GDP and consolidated budget deficit, and Armenia's sport sector data over 2017-2021 period. Technical basis for data analysis of this research is MS Excel.

**Results.** Armenia's economy is in a relatively good shape. National GDP has been growing year by year over 2017-2021 period (Figure 1), in particular, GDP in real prices has grown from 5564 AMD billion up to 6983 AMD billion, which is +25,3% growth over 5-year period. However, the consolidated budget deficit is also increasing – from 264 AMD billion in 2017 to 318 AMD billion, which is +20,4% growth over 2017-2021 period. That indicates a complex macroeconomic situation for Armenia development, including capacity for sport sector's current state and perspectives for development.

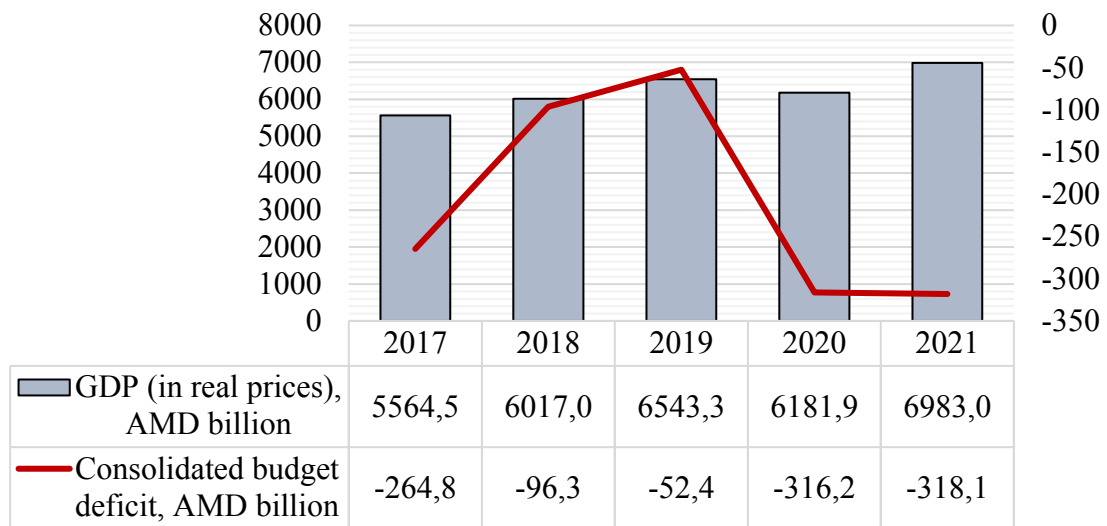


Figure 1. Armenia's GDP and consolidated budget deficit dynamics, AMD billion, 2017-2021

Source: Armstat. Main Socio-Economic Indicators. 2017-2021

Various government bodies, as well as non-profits and commercial entities, are in charge of managing the sport complex in Armenia. The primary government agency in charge of planning and overseeing the nation's sports infrastructure is the Ministry of Education, Science, Culture and Sports. Along with privately owned sports clubs, fitness centers, there are public facilities controlled by the government that provide sports and recreation services. These facilities are often run by private persons or businesses that are in charge of managing, maintaining, and caring for them. Armenian government has recently made large expenditures in the creation of sporting facilities, including the building of new stadiums, arenas, and training facilities. This has made it simpler for sport professionals and the general public to use sports facilities and helped to raise the overall standard of sports complex in the nation. To offer the greatest sports infrastructure for Armenian sport professionals and the general public, a mixture of governmental and private groups oversees the country's sports facilities.

It has to be noted that number of sport organizations in Armenia is stable and does not demonstrate volatility. According to Armstat, there are 174 sport organizations as of 2021 and the number has not fluctuated over 5-year period. The dynamics for sport organizations in Armenia are presented on Figure 2. These sport

organizations encompass versatile directions, i.e. National Olympic Committee of Armenia, Armenian Football Federation, Armenian Wrestling Federation, Armenian Boxing Federation, Armenian Chess Federation, Armenian Weightlifting Federation and others.

Speaking of number of sport professionals in Armenia there are 43 thousand of them for 2021 (Figure 3). That number encompasses all sport professionals engaged in sport sector in Armenia both on state and community level. It has to be noted that Armenia has a robust Olympic team represented by top sport professionals in the respected fields. More specifically, National Olympic Committee of Armenia reported that as of 2021, 159 sport professionals represented Armenia in 24 different sports at the 2020 Summer Olympics. Armenia also has a large number of sports clubs, associations, and federations that employ coaches, administrators, and other sports professionals.

Considering the breakdown in term of sport professionals by Olympic sports in Armenia, the major Olympic sports segments in terms of number of sport professionals are football (17,5% as of 2021), Greco-Roman wrestling (11,2%), Freestyle wrestling (10,7%), boxing (8,5%), which determines the specific focus for sport complex management in Armenia (Figure 4).



Figure 2. Number of sport organizations in Armenia, units, 2017-2021

Source: Armstat. Activities of Sports Organizations. 2017-2021



Figure 3. Number of sport professionals in Armenia, persons, 2017-2021

Source: Armstat. Activities of Sports Organizations. 2017-2021

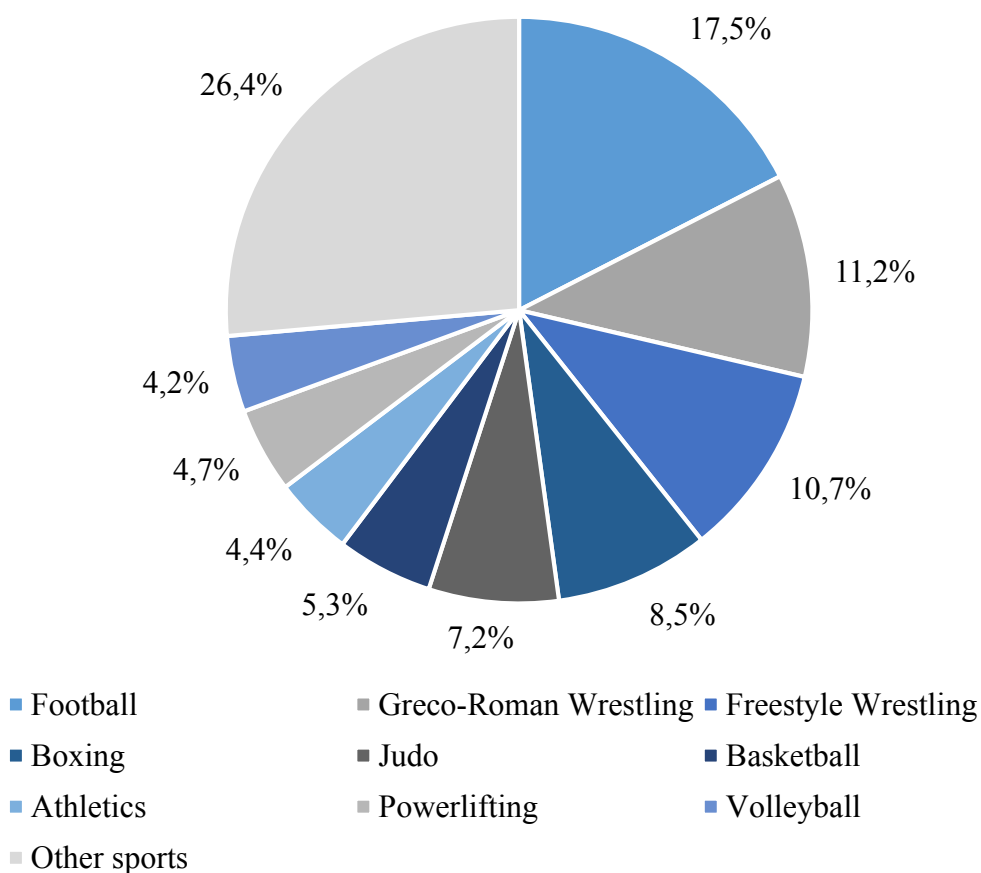


Figure 4. Structure of sport professionals by Olympic sports in Armenia, %, 2021

Source: Armstat. Activities of Sports Organizations. 2021

This specific focus has to be reflected in goals and metrics which guide sport managers. In order to measure how effectively plans are performing, sport manager must first develop system of key performance indicators (KPIs). KPIs will also provide a notion on the trajectory manager is on toward achieving sport complex’s major objectives.

KPIs for a sport complex will differ depending on the facility's unique goals and objectives, but the following are some potential KPIs to take into account: 1. Utilization Rate; 2. Revenues; 3. Customer Satisfaction; 4. Attendance rate; 5. Target Financing Mix; 6. Facility Maintenance; 7. Employee Performance; 8. Participation in Events; 9. Safety and Security; 10. Accessibility. In greater detail these proposed KPIs are presented in Table 1.

Table 1

Key KPIs for sport complex management	
KPIs	Comments
Utilization Rate	This KPI monitors how frequently athletes, teams, or members use the facility. It can be calculated by keeping track of how many hours or days the facility is reserved.
Revenues	KPI measures how much money the sport complex brings in through membership fees, leasing costs, and event fees, among other sources.
Customer Satisfaction	This indicator quantifies how happy users of the facility are (athletes, coaches, event planners.) Reviews, feedback forms, and surveys are the major tools to measure this KPI.
Attendance rate	KPI evaluates the dynamics of rising or decreasing number of visitors of sports events who bought a ticket or paid an entrance fair. Number of sold tickets sold and paid registrations may be used as measures for this particular KPI.
Target Financing Mix	This indicator is based on the financial objectives, risk appetite, and capital requirements of the sport complex. Organizations with predictable cash flows and low risk may choose a larger percentage of debt

	financing since the total cost of financing may be reduced as a consequence. Target financing mix should be carefully researched and periodically evaluated to make sure it is in line with the organization's objectives and financial situation. It depends on a number of organization-specific elements.
Facility Maintenance	KPI evaluates how well the facility is maintained, including the equipment's condition, the cleanliness of the restrooms and locker rooms, and the facility's general appearance.
Employee Performance	This KPI gauges how well the facility's staff, which may include front desk agents, trainers, coaches, and maintenance employees, is doing. Metrics like attendance, timeliness, and customer satisfaction can be used to measure it.
Participation in Events	Indicator counts the number of tournaments, competitions, and games that are held at the venue. The quantity of events held, the number of attendees, and the amount of money made from these events can all be used to monitor this.
Safety and Security	The facility's and its users' safety and security are tracked by this KPI. The quantity of reported occurrences, the efficacy of safety protocols, and the security measures in place can all be used to gauge this.
Accessibility	This KPI assesses how accessible a facility is to people with disabilities, including if there are accessible parking places, restrooms, and entrances, as well as whether adaptive tools and services are offered.

Sources: author's analysis.

Sport complex management has to be up-to-date and follow the major global trends of developed and developing countries, including focus of diversity and inclusivity. A focus on diversity can assist guarantee that public sports facilities are friendly and inclusive of people from all backgrounds. Hence, we consider a set of potential diversity and inclusivity objectives.

Increase the representation of various populations among facility users. Public sports facilities can make it a point to attract more users who identify as people of other nations, persons with disabilities, or those who come from lower-income families. This can be done through providing these populations with programs and activities that are inexpensive and accessible, as well as by reaching out to various communities to encourage facility use.

Recruit more people from varied backgrounds and offer training and professional development opportunities to encourage diversity and inclusion in the workplace are two ways public sport facilities can work toward increasing the diversity of their employees.

Adaptive sports programs for people with disabilities can be offered at public sport facilities. They can also offer gender-inclusive locker rooms and collaborate with neighborhood groups to create programming that is sensitive to and relevant to different cultures. Expand programming to meet the needs of diverse populations.

Create an environment that is welcoming and inclusive for all users. Public sport facilities can set a goal to create an environment that is welcoming and inclusive for all users. This can be done by putting policies and procedures in place that support diversity and inclusion, training staff on these topics, and designing spaces that are accessible and welcoming to people of all backgrounds.

To identify areas for development and track advancement toward diversity and inclusion goals, public

sport facilities can make it a priority to perform continuous diversity evaluations. This may entail gathering information on how various populations use the facilities, the demographics of the personnel, and the levels of customer satisfaction before using this information to guide decisions about facility policies and programming.

It's crucial to balance the organizational and societal aims of the sport complex while deciding on the finance mix for a sports facility. From an organizational standpoint, the finance strategy should seek to collect enough cash to pay for the construction and upkeep of the facility as well as to generate income to support operations. Government grants, business sponsorships, and private contributions are a few examples of the public and private money that might be used for this. To guarantee that the facility can continue to function and achieve its organizational objectives, it is crucial to make sure that the finance mix is sustainable over time.

The facility should be able to fulfill the demands of a larger community by maximizing accessibility and inclusion, which should be a goal of the funding mix from a social standpoint. This can include charging reasonable membership dues, funding programs for disadvantaged populations, and collaborating with neighborhood groups to encourage community involvement. Making ensuring that the finance mix does not create obstacles to access or maintain imbalances within the community is crucial. In order to guarantee a sport complex's long-term viability and social effect, the finance mix for the facility should be created to strike a balance between its organizational and social purposes.

Several variables, such as the facility's size and breadth, the degree of government assistance, and the financial objectives of local communities, might affect the financing mix of public sport facilities. Here are a few typical funding options for public sport facilities:

*Government Grants:* To fund facility development, renovation, and programming, public sport facilities may be eligible to receive grants from local, and state government sources. These grants may be distributed directly from government agencies, through competitive grant programs, or both.

*Public-private partnerships* allow public sports facilities to split the costs of building, running, and maintaining the facility with private businesses or groups. Private businesses may occasionally contribute money or goods in exchange for naming rights or other advantages related to the facility.

*User Fees:* User costs, such membership dues, leasing fees, or participation fees for events and activities, are one way that public sports facilities might make money. These fees may be completely eliminated for those who cannot afford them or set at amounts that low-income groups may afford.

Public sport facilities can accept *donations from charitable groups or people* to help with facility development, programming, and equipment requirements. These contributions may be utilized to support ongoing facility operations or to finance particular programs or initiatives.

*Bonds:* To finance facility development, renovation, or expansion, public athletic facilities may issue bonds. To raise money for the facility, these bonds can be backed by governmental bodies or offered for sale to private investors.

*Tax Levies:* Tax levies, which are taxes taken from local citizens or corporations, are one way that public sports facilities might get money. These taxes may be used to pay for continuing facility operations or to build new or renovate existing facilities.

**Discussion.** Therefore, the peculiarities of sport complex management in Armenia is identified. The results of this study are confirmed by previously obtained results. The obtained results are presented below in greater details.

This study indicates that operational and strategic components of the business model must be taken into account while managing sport complex. Key point is to determine the value proposition and determine relevant goals. This strategic directions has to be described through relevant KPIs. This is confirmed by the previously obtained results in a number of studies. In particular, Hassin, Zaidi, Ali (2022) indicate a strategic need in terms of sport complex management targeted at long-term development. Further, this statement is confirmed by Puglisi, Baiardi (2019) analyzing revenue and cost components in determining business model in terms of sport management. Additionally the obtained result is confirmed by results in paper Kwon, Kim (2021) in terms of focusing on key customer segment needs in terms of sport management.

This study points out a key need for sustainability and diversity component in sport complex management. Diversity in sport management is crucial because it enables the contribution of many viewpoints, experiences, and skill sets. Better decision-making, problem-solving, and innovation might result as a result in the industry. This result is supported by McDowell, J., Pickett, A. C., & Pitts, B. G. (2022) indicating higher

results in social development due to incorporation of diversity and inclusion component in sport management. Additionally, the obtained result is supported by Love, A., Bernstein, S. S., & King-White, R. (2021) outlining significant social change due to implementation of diversity and inclusion principles in sport management.

However, the component of financing operational and strategic development under key organizational and social goals for sport complex is not articulated sufficiently in the existing body of research. In particular, the results of this paper indicate that financing has to be oriented on diversity and social development goals. Both financing mix and means of monitoring and controlling a balanced combination of revenue streams have to be coherent with the set of organizational and social goals in terms of sport complex management. In turn, the results of this paper specifically stress that efficient achievement of organizational and social goals is possible only under stable and sufficient financing for sport complex.

**Conclusion.** Armenia has a robust sport sector which is characterized by a focused development. As of 2021, there are 174 sport organizations in Armenia, and their number has not changed during the 5-year period. These organizations cover a variety of areas such as football, wrestling, chess, powerlifting and others. The number of sports professionals in Armenia is estimated at 43 thousand for 2021. In particular, 159 sports professionals represented Armenia in 24 different sports at the 2020 Summer Olympics. The main Olympic sports in Armenia are football (17,5% of all of sport professionals involved), Greco-Roman wrestling (11,2%), freestyle wrestling (10,7%), boxing (8,5%), which determines the specific direction of sports management in Armenia.

The challenges facing the Armenian sports sector necessitate effective management. The key tool for such management of both operational and strategic directions is sport complex KPIs. These indicators should cover multidirectional areas of management of the sports complex in the context of key groups of stakeholders, as well as the main tasks of operational and strategic management of the sports complex. In accordance with modern needs, we offer the following list of KPIs: 1. Utilization Rate; 2. Revenues; 3. Customer Satisfaction; 4. Attendance rate; 5. Target Financing Mix; 6. Facility Maintenance; 7. Employee Performance; 8. Participation in Events; 9. Safety and Security; 10. Accessibility. These KPIs have to encompass key contemporary issues for sport complex management, in particular diversity and inclusivity. A focus on diversity can assist guarantee that public sports facilities are friendly and inclusive of people from all backgrounds. It is also outlined that when deciding on the finance mix for a sports facility, it is important to balance the organizational and societal aims of the facility. From an organizational standpoint, the financing of sport complex should seek adequate funding and generate income to support operations. From a social standpoint, the facility should be able to fulfill the demands of a larger community by maximizing accessibility and inclusion. Additionally, the finance mix

should not create obstacles to access or maintain imbalances within the community. Factors such as the facility's size and breadth, the degree of government assistance, and the financial objectives of local communities can affect the financing mix of public sport facilities. Moreover, national priorities in terms of focused sport sector development have to be taken into account in the financing mix for sport complex.

Further perspectives for the research in this field are in the direction of developing a comprehensive system encompassing both organizational and societal goals for sport complex management in the form of Balanced Scorecard.

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## PHILOLOGICAL SCIENCES

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## DISCOURSE IN FOREIGN LINGUISTS' VIEWPOINT

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## ДИСКУРС С ТОЧКИ ЗРЕНИЯ ЗАРУБЕЖНЫХ ЛИНГВИСТОВ

**Abstract**

*The article deals with discourse in foreign linguists' viewpoint.*

*The term of discourse was derived from the Latin word *discursus*. The meaning of the word is known to create connection between writing and speech. In general, it should be noted that there are different opinions about the meanings of discourse. This term is mainly associated with the name of the French philosopher M. Foucault and other social theorists who agree with him. According to M. Foucault, discourse is 'the unity of a sequence of signs used as a sentence.' A sentence is not a union of signs, but an abstract concept that allows specific repeatable connections to signs, objects, subjects, and other sentences.*

**Аннотация**

*В статье рассматривается дискурс с точки зрения зарубежных лингвистов.*

*Термин «дискурс» произошел от латинского слова «*discursus*». Известно, что значение слова создает связь между письмом и речью. В целом следует отметить, что существуют разные мнения о значениях дискурса. Этот термин в основном связан с именем французского философа М. Фуко и других согласных с ним социальных теоретиков. По М. Фуко, дискурс — это «единство последовательности знаков, используемых в качестве предложения».*

**Key words:** *discourse, text, oral, written, research, functional, meaning*

**Ключевые слова:** *дискурс, текст, устный, письменный, исследование, функциональный, значение*

**Introduction**

The term of *discourse* was derived from the Latin word *discursus*. The meaning of the word is known to create connection between writing and speech. In general, it should be noted that there are different opinions about the meanings of discourse. This term is mainly associated with the name of the French philosopher M. Foucault and other social theorists who agree with him. According to M. Foucault, discourse is 'the unity of a sequence of signs used as a sentence.' A sentence is not a union of signs, but an abstract concept that allows specific repeatable connections to signs, objects, subjects, and other sentences.

The services of T. A. Van Dijk in the study of the discourse problem cannot be denied. According to this scientist, *the process of voicing and understanding information that creates an image of the participants (characterizes them), depends on the social context, can be defined as a discourse.*

F.Y. Veysalli defines the concept of discourse as following: "Discourse is defined as *discurs* in German, *discourse* in English, *discourtion* in French, etc. (1) It is understood as a basic concept that refers to different aspects of a text; (2) It is explained as a spoken text. In this sense, the discourse differs from the text taken as a formal-grammatical structure. Discourse is a text that the speaker builds on the basis of his relationship to his interlocutor. It is the product of an interactive process

in a sociocultural context. (3) It is meant as an analysis carried out for the purpose of revealing the truth.

**Analyses**

Without delving into the history of discourse theory, it is noteworthy to note that the transformation of discourse into a reality for the modern science of linguistics is the importance of W. von Humboldt, then F. de Saussure, as well as E. Benveniste and L. Bloomfield, to the importance of the human factor in linguistic research, thus in linguistics the foundation of replacing the structural paradigm with the functional paradigm was laid.

Modern discourse theory as an independent field of research began to be formed in the framework of text linguistics from the 60s of the 20th century, while discourse theory and the term 'discourse' itself belong to ancient rhetoric. It was during this period that linguistics called the frame of an isolated utterance (sentence) and began to investigate the text created by a chain of utterances whose main features are integrity, coherence and cohesion. At first glance, the term "text linguistics" seemed unsuccessful to many linguists, and some scientists explained it as a communicative spoken text and began to call it *discourse* [Benveniste 1985, p.147].

F. de Saussure rarely used the term "discourse". He considered the concept "language" to be the only subject of linguistics and confronted it with speech, which he considered to be the practical realization of

language. However, his followers, for example, E. Benveniste, generally did not use the term “conversation” instead of it he used the term “discourse” many times [Benveniste 1974, p. 46]. E. Brussans adds a third component - discourse - to F. de Saussure’s “language-speech” dichotomy. Discourse in the language-speech dichotomy acts as a mediator. According to E. Brussans, the language abstract system, discourse represents certain combinations used by the language carrier, and speech in itself represents the mechanism and process of speech activity [Brazil, et al., 1980, p.56].

The analysis of the sources that form the basis of discourse theory allows us to say that there are three different research traditions in its study - Anglo-American, French and German-Austrian. Although several attempts have been made to study discourse in Russian linguistics, these attempts do not demonstrate an independent position, and they are mainly based on the functional-stylistic traditions of speech. In the Anglo-American linguistic tradition, connected speech is understood under the name of discourse, and discourse is equated with dialogue. Discourse analysis mainly focuses on oral communication, the interaction between the speaker and the listener. The analysis of the discourse, understood as a connected text, consisted in revealing the semantic-syntactic mechanism of its internal connection. The American school focuses on the text and inter-speech relations within the text, focusing on the logical-pragmatic direction in discourse analysis.

A considerable number of studies devoted to the study of discourse and its interpretation from different aspects in different sources have created the impression that the concept of “discourse” is even wider than the concept of “language”. In this regard, S. Slembroek’s “What does discourse analysis mean?” article is notable. In this article, the author uses analytical philosophy, linguo-pragmatics, stylistics, sociological linguistics, linguistic anthropology, etc., in order to reveal the essence of the concept of “discourse” [Slembrouck 2002, p.101]. Another linguist, M. Stubbs, notes three main characteristic aspects of discourse:

- 1) a sentence is a large language unit due to the volume of discourse in a formal relationship;
- 2) the discourse in the content plan is related to the use of language in a social context;
- 3) in terms of organization, the discourse is interactive, that is, dialogic [Stubbs 1983, p. 55].

According to M.A. Makarova, the characteristic features of discourse analysis in England and America can be summarized as following: “communication taking place in natural conditions is preferred; the content aspect of communication is studied; attention is first focused on the social organization of communication, and then on the formal-linguistic organization; inclination to the context and the author’s intention, to the logical-pragmatic direction; preference is given to the direction of cognition and the interaction of the inner and outer world of a person, individual and social aspects” [Makarov 1998, p. 102].

In the 60s of the 20th century in France, the direction of conversation research was formed in the direction of revealing and describing the structures of

narration (speech). We would like to note that the French school formed in the 70s of the 20th century laid the foundation of the socio-semiotic approach in discourse analysis.

D. Crystal in the “Dictionary of Linguistics and Phonetics” notes that discourse is “a set of utterances of an organized speech event, for example, conversation, joke, interview, etc.” monologues, speeches, ceremonies, insults, narrations, etc. [Crystal 2003, p. 141].

N.L. Faiklow and P. Vodak evaluate the discourse as a “form of social activity” [Fairclough 1997, p. 273]. In this approach, discourse is simply defined as “combination of words and sentences above the language”. So, “discourse” means two or more sentences with semantic relations between them. In the German book “Deutsches Wörterbuch” (1860) (German dictionary) prepared by Y. and W. Grimm, we read the following interpretation of the term discourse: 1) dialogue, conversation; 2) speech, lecture [Grimm et al., 1954, p. 91].

M. Foucault, who laid the foundation of discourse analysis, when he says discourse, he understands the socio-historically formed system of human knowledge and practice. According to the author, discourse is “a set of anonymous, historical, always time- and space-determined rules that determine the conditions of influence of speech for a certain period and social, economic, geographical or linguistic scope” [Foucault 1996, p. 29]. It turns out that the discourse analysis is based on the diachronic aspect in its meaning, and what is interesting is that in the dynamic approach to the language, the most important thing is to give place to the systematic description of the language, while taking a transformational transition to the previous knowledge system. From here it is clear that discourse analysis is closely related to extralinguistic factors and refers to them. M. Foucault writes: “The description of discourse phenomena poses the question: ‘Why do such sayings arise here and not elsewhere?’ The uniqueness of how speech is used, how to define the conditions of its existence, the ways to draw its boundaries, ... to define the uniqueness of its existence is not revealed anywhere else, but only when it is spoken?” [Foucault 1996, p. 31]. In our opinion, the answer to the question is reflected in the question of M. Foucault. Since the discourse is related to the time of speaking, it is observed that the unfolding of its meaning is realized when it is spoken.

According to E. Benvenist, the distinctive feature of the discourse emphasizes its unity with the specific participants of the communicative act (speaker and listener), as well as the intention of the speaker to influence the listener in any way [Benveniste 1985, p.156]. The anthropocentric paradigm proposed by E. Benvenist in the study of language allows us to look at the discourse as “language in action in live communication”. E. Benvenist believes that “the language mastered by the speaker” managed to give meaning to the discourse as a term. In doing so, he expanded the understanding of discourse as “talk in communication” in the French linguistic tradition. The

author opposes discourse to objective narration [Benveniste 1985, p. 137].

P. Serio talks about the eight meanings of the term “discourse”: 1) the equivalent of the concept of “conversation”, that is, any specific statement; 2) larger unit than saying; 3) taking into account the speech situation, its effect on the listener; 4) as the main type of conversation; 5) do not speak from the speaking position contrary to the narration; 6) use of language units, their actualization in conversation; 7) socially and ideologically limited type of speech, for example, feminist discourse; 8) a theoretical construct designed to investigate the conditions of the creation of the text [Serio 1999, p. 26].

Fundamental changes in the understanding of discourse theory occurred after the emergence of structural linguistics in the 60s of the last century - language is a universe that carries coded information about the surrounding reality, and the structure of language is an instrument for creating and changing reality. A bright representative of the structural approach to language and discourse analysis is C. Lévi-Strauss [Levi-Strauss 1993, p. 11]. The study of the discourse of ancient myths and their open structure is known to have taken place in his work.

The structural-linguistic approach to the study of discourse can be found in the works of representatives of the French discourse-analysis school. The originality of M. Peshe's interpretation is that there is a correlation of linguistic and ideological approaches. M. Peshe treats discourse as a center where ideology and language intersect, discourse serves as a tool for analyzing ideological concepts in the development of language, and ideological intentions are realized through language. M. Pesche attributes the discourse process itself to the sphere of ideological class relations [Stubbs 1983, p. 159].

T.A. van Dijk equates discourse to full communication in a broad sense. Discourse is a communicative event that takes place between the speaker and the listener in the communicative process in a certain space and time context. This communicative event can be in written and oral, verbal and non-verbal forms. A typical example is a conversation between a friend and a doctor, a conversation between a doctor and his patient [Dijk 1997, p.300].

In the narrow sense of discourse, T.A. van Dijk considers only the verbal content of the communicative event and talks about it as ‘text’ or ‘conversation’. In this sense, discourse means the finished or ongoing written or oral result of a communicative act, that is, discourse is the written or spoken product of communicative activity in the most general sense of T.A. van Dijk. The common point in van Dijk's narrow and broad understanding of discourse is that in both cases ‘discourse’ refers to specific objects in specific conditions and contexts –“this discourse”, “his discourse”, “these discourses” [Dijk 1997a, p.301].

The position of French researchers in the study of discourse attracts attention with its multiplicity, methodological base and diversity of theoretical judgments. It is difficult to talk about a single school of

French discourse analysis. Here it is more appropriate to talk about schools and different approaches. Among these approaches, the more popular ones prevail in terms of style and ideological directions. In the stylistic analysis, the discourse is interpreted as an ensemble of expressive means of certain communicative purposes. It is necessary to state that this kind of approach, on the one hand, is directly related to the typological characteristic of discourses, and on the other hand, it is related to the situation (context) corresponding to one or another type of discourse. Ideological analysis, first of all, predicts the interpretation of the content of the discourse as a means of political, ideological position, in a broader sense of struggle for power. When comparing the dominant traditions of discourse analysis in the French and English-speaking worlds, it is possible to reveal significant differences. The differences between those traditions can be summarized as following:

1) in the tradition of French discourse analysis, as a rule, organized (constructed) discourses are preferred, and in the tradition of English-language discourse, preference is given to oral, everyday speech;

2) the French discourse tradition has a textological purpose and in the course of this analysis a research object is created, while the English-speaking tradition is communicative and studies the characteristics of language use;

3) French scientists refer to structuralism, linguistics and historical analysis of documents in discourse analysis, and English scientists refer to the provisions of interactionism, psychology and sociology in their research. The French tradition of discourse analysis has its origins in linguistics, and the English discourse analysis in anthropology.

Among these approaches, the following common features can be noted: going beyond the limits of the text, taking into account extralinguistic factors in the communication process, tending to the social in language.

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## ЛЕКСИКО-СЕМАНТИЧЕСКИЙ АНАЛИЗ ДЕЛОВЫХ ДОКУМЕНТОВ В СОВРЕМЕННОМ АНГЛИЙСКОМ ЯЗЫКЕ

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## LEXICAL-SEMANTIC ANALYSIS OF BUSINESS DOCUMENTS IN MODERN ENGLISH

**Аннотация:** *Деловая лексика — слова и обороты, характерные для официально-делового стиля речи, т.е. обладающие, соответствующим стилевым компонентом.*

*В состав деловой лексики входит юридическая, дипломатическая, канцелярская терминология, например: лишение свободы, моральный ущерб, аккредитация, баланс, ревизия; наименования участников деловых отношений, например: истец, ответчик, отправитель, арендатор; жанровые обозначения деловых документов, например: договор, инструкция, повестка; названия учреждений, например: администрация, министерство, управление, квалификаторы деловых процедур, например: надзор, уведомление, привлечь к ответственности, противоправные действия и др. лексико-семантические группы слов.*

**Abstract:** *Business vocabulary - words and phrases that are characteristic of the official business style of speech, i.e. having the corresponding style component.*

*The business vocabulary includes legal, diplomatic, clerical terminology, for example: imprisonment, moral damage, accreditation, balance, revision; names of participants in business relations, for example: plaintiff, defendant, sender, tenant; genre designations of business documents, for example: contract, instruction, agenda; names of institutions, for example: administration, ministry, management, qualifiers of business procedures, for example: supervision, notification, hold accountable, illegal actions, and other lexical-semantic groups of words.*

**Keywords:** *business speech, business communication, business discourse, official business speech, Russian language*

**Ключевые слова:** *деловая речь, деловое общение, деловой дискурс, официально-деловая речь, русский язык*

A special group of business vocabulary is made up of evaluative book words and set expressions (fatherland, encroachment, indestructible, aspirations), which are used in a solemn official setting.

Within its style, business vocabulary is normative, outside these limits it represents a stylistic deviation from the norm or is stylized in artistic speech as a characterological means.

English business vocabulary is divided into many types and categories. The bulk of the English dictionary is the so-called Neutral lexis (neutral vocabulary), which does not belong to any type and has no classifications, it seems to penetrate into almost all categories

of business vocabulary. Its main characteristics are neutrality, versatility and simplicity.

In the English literary language, in the process of its development, another speech style has become isolated, which is called the style of business speech, or the style of business documents (official style). Like other speech styles, socially recognized as independent systems, this style has certain goals of communication, has its own patterns and linguistic characteristics common to this style.

The language of official business speech, as different from other functional styles, includes a number of international features that are the result of the unity

of the issues they solve: it serves as a tool for business communication, a way of documenting official service and management data. At the same time, a number of national features can be distinguished for the Russian language in official business speech, which clearly stands out against the background of the American English language that prevails today.

As you know, in the Russian language in business communication it is not recommended to use colloquial, colloquial, slang vocabulary, historicisms, archaisms and phraseological units. Since English is less structured than Russian in stylistic terms, in English-speaking business speech, language forms are not used differentially, they can refer to both business and colloquial style, sometimes even colloquial.

Business speech has several varieties. In the field of international relations, the style of diplomatic documents stands out; in the field of trade and economics, the style of commercial correspondence; in the field of jurisprudence - the language of laws, codes, court documents, government decrees, and parliamentary decisions. As a special kind of business speech in modern English, the language of military documents is distinguished: orders, charters, reports, etc.

The main goal of a business speech is to determine the conditions that will ensure normal cooperation between the two parties, i.e. the purpose of a business speech is to reach an agreement between two interested parties. This applies to business correspondence between representatives of various firms, and to the exchange of notes between states, and to the establishment of the rights and obligations of a soldier, recorded in the military regulations of the British army, and to the procedure for meetings. All these relations find some form of expression in the form of an official document—letters, notes, treaties, pacts, laws, charters, etc. the main task of a business speech is to reach an agreement between two or more interested persons or organizations.

Official business documents exist, as a rule, in a written regulated form and regulate the legal and business relations of individuals and legal entities. The language of such documents has its own specifics associated with its belonging to one of the subsystems of the language, called functional styles, which are associated with certain areas of human activity and differ from the national norm and from each other by the originality of the vocabulary used, the structure of syntactic structures, as well as evaluative and expressive properties of language means.

However, in the dialogic business discourse, there may be a deviation from the norms, the regulation of communication. Communicators of business discourse in the process of communication can make a change of register, i.e., move from business communication to interpersonal communication, which will entail changes

both at the lexical and grammatical levels of the statement. The point of view of V. I. Karasik is fair that “the elimination of the personal principle turns the participants in institutional communication into dummies” [2, p. 195]. For example, as the researcher Tarnaeva L.P. notes, the following speech means are found in the English-language dialogic business discourse: the use of short forms of the names of the addressee and the addressee instead of the full ones; the use of lexical units related to the colloquial style of speech; interjections, abbreviated forms of auxiliary verbs and much more [3, p. 173].

Also, various extralinguistic factors can affect the structure of the text, for example, a change in the number of participants in communication [1, p. 32–33]. Thus, the analysis of the literature on our subject showed that at present the concepts of discourse and business discourse are considered in modern linguistics from different positions. Institutional business discourse functions in the conditions of status-role relations and is implemented in various forms of business communication. In our work, business discourse was characterized from the positions of sociolinguistics and linguistics. In the course of the study, we considered business discourse as a complex multi-level phenomenon with specific parameters, goals, unique lexical, grammatical, extralinguistic and pragmatic characteristics.

The above examples clearly demonstrate the above features that are found in both oral and written business discourse. As a result of studying various sources, we came to the conclusion that the problem of discourse that we touched upon was considered quite widely, however, many characteristics and a number of issues related to the linguistic features of business discourse remain insufficiently developed and studied. However, there will always be enough materials for research on this issue, which makes it possible to further study the linguistic features of both written and oral business vocabulary.

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## ИНТЕРАКТИВНЫЕ ФОРМЫ ОБУЧЕНИЯ ИНОСТРАННОМУ ЯЗЫКУ В ВУЗЕ ЭКОНОМИЧЕСКОГО ПРОФИЛЯ

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## INTERACTIVE FORMS OF TEACHING A FOREIGN LANGUAGE AT A FACULTY OF ECONOMICS

### **Аннотация:**

*Бизнес – это жесткая и конкурентная среда, которая не прощает ошибок, поэтому на современном этапе своего развития рынок труда требует от людей, желающих сделать карьеру в сфере бизнеса, экономики и финансов, знаний и навыков, часто весьма далеких от стандартного знания иностранного языка. Это не только проведение телефонных бесед и составление деловых писем, но и многое, многое другое. Для решения данной задачи в большинстве национальных высших учебных заведений обучение иностранному языку будущих специалистов базируется на двух ключевых элементах: базовый курс и деловой иностранный язык.*

### **Abstract:**

*Business is a tough and competitive environment that does not forgive mistakes, therefore, at the present stage of its development, the labor market requires people who want to make a career in business, economics and finance to have knowledge and skills that are often very far from standard knowledge of a foreign language. This is not only conducting telephone conversations and compiling business letters, but also much, much more. To solve this problem in most national higher education institutions, teaching a foreign language to future specialists is based on two key elements: a basic course and a business foreign language.*

**Ключевые слова:** *интерактивные формы, обучение английскому языку, учителя-лингвисты, иностранный язык, развивающие игры*

**Key words:** *interactive forms, teaching English, linguistic teachers, foreign language, educational games*

The concept of teaching English is determined by the specifics of the target setting at the faculty. Linguistic teachers set themselves the task of preparing a professional specialist who is competitive in the world market of intellectual labor, who is able to continue his education and conduct professional activities in a foreign language environment. Language should become a practical means of intercultural communication. The EPP (English for Professional Purposes) course at the Faculty of Economics is based on the communicative-cognitive method of teaching English. This suggests that the information layer is organically connected with the communication one: language models containing this or that information about the goals and nature of international business transactions are worked out not only in texts, but also in dialogues / situations, work in the formats of case study, information gaps, interviews, role-playing games, the style of which is as close to reality as possible. [1. p. 123-133].

Modern methods used by FEC teachers to develop oral speech skills and aimed at consolidating economic terminology and vocabulary of a professional nature provide for the completion of the consideration of certain economic problems with role-playing games, both autonomous and included in the structure of project work.

Guidelines for organizing and conducting business games, project work and case-study in English have been developed.

Business educational game is one of the forms of practical training. The purpose of the interactive game is to develop and improve the professional competence of students, to involve them in discussions, where they can show their creative thinking and offer alternative solutions to the problems under consideration. At the same time, students have the opportunity to compare their ideas and traditional ideas with the concepts of representatives of foreign cultures. The theme and content of the game are determined in accordance with the curriculum and calendar plans for practical classes and the subject content of the professional training of future specialists. [4. p.155-157]

It is obvious that at present the importance of the English language is increasing in society as an effective factor in socio-economic, scientific, technical and general cultural progress, a means of communication between different peoples and cultures. The development of the banking system, management, Azerbaijan's entry into the system of international economic relations, the expansion of the securities market caused the emergence of new English-language concepts, terms, understanding and competent operation of which underlie the formation of economic culture among high school students. [3. p. 105]

A foreign language as an academic subject has a great educational, educational and developmental potential. Due to its “non-objective” character, it can serve to form economic knowledge and skills, to develop economically significant personality traits. Thus, the English language can serve as a means of shaping the economic culture of high school students.

p. To verify this, we organized and conducted experimental work on the formation of economic culture among high school students in the process of teaching English, in which students of first course took part. To determine the level of formation of economic culture among high school students, we have identified three criteria: [2. p. 159-165]

1. economic knowledge (functions of money, banking system, wages, types of taxes, forms of business, types of securities, factors of economic growth);
2. economically significant personality traits (thrift, independence, rationality, hard work and enterprise);
3. economic skills (obtaining and evaluating economic information, drawing up a family budget, evaluating one's own economic activities).

We believe that economic knowledge, economically significant personality traits and economic skills are the components of the economic culture of high school students. In this regard, we have developed and implemented in the educational process in the English language a set of pedagogical conditions that contribute to the effective formation of economic culture among high school students. Let's take a closer look at each condition.

The specificity of active and interactive learning methods is that they encourage high school students to act and facilitate communication with each other and with the teacher. In the course of experimental and search work, we conducted such business games as "Preparing for the birthday", "Company presentation", "Economic auction" and others. We also used other methods of active and interactive learning: "discussion tables" and press conferences. Arranging discussions, we set ourselves the goal of developing the ability of high school students to express their thoughts, actively defend their point of view, and express their thoughts logically and reasonably. [5. pp. 1286-1302]. So, we offered high school students to express their opinion on the validity of English proverbs of economic content, which boil down to a person's attitude to money, wealth, and work. First, high school students were asked to translate the proverb into native language word for word, and then try to find an equivalent in their native language and, finally, express their opinion about this or that proverb in a foreign language. At the same time, we set ourselves a double goal: firstly, the devel-

opment of foreign language communicative competence; and secondly, they contributed to the formation of economically significant personality traits in them. We then held a press conference on "Money: Origin and Variation." A week before it was held, high school students were divided into two teams: experts and journalists. The team of experts was given the task to prepare a material on a given topic in English according to the following plan:

1. The concept of money.
2. Reasons for the appearance of money.
3. Forms of money in history.
4. Modern types of currency.
5. Money substitutes: stocks, checks, bonds, etc.

A team of journalists - to prepare questions on a given topic;

“Activity presupposes not only the actions of an individual, but also his actions in the conditions of the activities of other people, i.e. involves some joint activity”. Taking this into account, we organized the economic activities of high school students in such a way that in the process of this activity they constantly interact with each other in order to achieve results.

Teaching a foreign language in modern conditions requires the use of new approaches, since the educational process is increasingly shifting towards the independent work of students, which, in turn, requires the teacher to use new most effective methods and technologies that allow intensifying the processes of assimilation of new and systematization of already acquired knowledge. Today, a student should be able to independently acquire knowledge, applying it in practice, work with various types of information, analyzing and summarizing, be able to think critical.

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# ECONOMIC SCIENCES

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## FORMATION, FUNCTIONING AND EFFICIENCY OF USING PERSONNEL POTENTIAL OF UKRAINIAN ENTERPRISES IN THE CONDITIONS OF WAR

### **Abstract.**

*The article analyzes modern theoretical and methodological approaches to the assessment of personnel potential formation. The main requirements for the mechanism of the functioning of the personnel potential of Ukrainian enterprises in the conditions of war have been studied. Considered a number of factors that led to a change in the structure of the supply of qualified labor in Ukraine. The principles of introducing flexibilization into the management practice of the country's enterprises are revealed. The concept of personnel management is defined, which takes into account new trends in human resources management, using practically non-standard management approaches. The components of the development of personnel potential, which are directly related to the development of the economy in general, taking into account the military actions in Ukraine, are determined. It has been established that the rational formation of personnel, their development and proper management of personnel is a guarantee of increasing the efficiency of enterprises today in the conditions of war and in the post-war period.*

**Key words:** *personnel potential, formation, functioning, efficiency, Ukraine, war, post-war period.*

**Introduction.** Uninterrupted provision of the enterprise with various types of resources is one of the most important economic tasks of its strategic development. Effective use of resources affects the competitiveness of the enterprise itself, its at least break-even operation. Therefore, in the modern economy, the study of the efficiency of management of various types of resources is of great importance. One of the most important types of resources is human resources, since the personnel of the enterprise takes a direct part in the production of goods and the provision of services, is engaged in the sale and supply of products, and the management makes important strategic and financial decisions on which the efficiency of the enterprise as a whole depends. In addition, the effectiveness of the company's activity is achieved due to the high level of professionalism of employees, their high work productivity and timely completion of tasks. It is the personnel potential that enables the enterprise to carry out its activities and improve them, is one of the factors that forms the competitiveness of the enterprise, the region, and the country as a whole. The war made its corrections - it increased risks and uncertainties, creating barriers to the free movement of factors of production, including workforce, leading to the destruction of labor market institutions and their effective functioning [1].

The war in Ukraine destroyed industrial and economic activity and affected changes in the structure of the labor market, a decrease in the number of jobs, the loss of relevant specialists in the occupied territories,

which led to their relocation and forced migration to safe regions and other countries. The war exacerbated the imbalance between labor supply and demand. The demand for labor fell as it became dangerous and impossible to work in war zones. In addition, the domestic labor market is shrinking significantly. In Ukraine, there is a significant decline in the labor market - many vacancies are offered without registration, such as part-time jobs, etc. Therefore, in the conditions of the war, the research of this topic is quite relevant and timely, the war continues.

In the works of many foreign and domestic scientists and specialists-practitioners, the theoretical and methodological aspects of the formation and functioning of the company's personnel were studied at a sufficient level, the basic principles of building an effective personnel management system and other directions were analyzed. In particular, it is worth paying attention to the works of such domestic scientists as: P.T. Sabluka, M.Y. Malik, L.I. Ulanchuk, D.P. Bogyni, M.G. Akulova, I.L. Petrov, as well as foreign scientists: H. Shein, G. Ford, F. Gilbert and others.

However, despite this, the economic literature does not sufficiently cover the issue of the formation, functioning and management of personnel potential, and in fact no measures are proposed (taking into account new trends in the development of society and technology) that improve the work of enterprises as a whole and taking into account military actions in the country.

**The purpose of the work.** The purpose of the article is to find ways to increase the effectiveness of the formation and functioning of personnel potential and the development of measures that contribute to a better quality of their management during the war.

**Results and discussion.** In the analytical report "Directions for optimization of state policy in the field of labor potential development of Ukraine" [2, p.3] it is stated that one of the global challenges facing Ukraine today is the establishment of an economy whose development is based on people. The ILO Convention on the Basic Goals and Norms of Social Policy No. 117 declares that any policy must first of all be aimed at achieving the well-being and development of the population (Article 1). Raising the standard of living is considered the main goal of economic development planning (Article 2), the core element of which is ensuring full and productive employment [3].

I.L. Petrova notes that in the process of management, reactions of employees to organizational changes caused by economic transformations are possible [4]. The real asset of the enterprise is human capital, the effective use of which creates sustainable competitive advantages of the organization. New requirements are put forward for the selection, development, evaluation, and remuneration of personnel, which coherently solve the task of creating the competence necessary for the successful implementation of the organizational strategy [19, p.12].

In the conditions of war, the need to increase the number of labor resources used to ensure the normal functioning of the country is increasing. One of such resources is the involvement of able-bodied people in socially useful works [17].

As noted by O.O. Pszyk-Kowalska and O.I. Kowalsky, in the conditions of martial law, business in Ukraine found itself in a critical situation due to a decrease in production volumes, problems with logistics and supply chains, and limited finances. All these business processes at enterprises are implemented by personnel, the management of which has become especially relevant. Through the prism of strategic, anti-crisis management, there is an urgent need to change the functional model of personnel management at enterprises, which should be based on one's own experience of working with one's employees, limited financial resources and force majeure operating conditions [6].

In our opinion, businesses in the occupied regions have suffered heavy losses due to the destruction or damage of their facilities, or have simply faced suspension of operations and difficulties in selling their products. Undoubtedly, even during a war, enterprises must work as hard as possible, pay taxes, and provide the country with resources for its further defense. Displacement and forced migration have led to changes in labor market structures, supply and national saturation of skilled labor.

The Ukrainian Institute of the Future investigated the current migration problems of Ukraine and developed recommendations for their solution. In the new study "Fight for people: Ukraine lost the battle, but

must win the war", experts noted the consequences of the migration crisis for the Ukrainian economy, analyzed the experience of other countries that faced this problem and revealed how Ukraine can emerge victorious in the struggle for labor resources [18].

**Presenting main material.** Effective management of the company's personnel potential is a rather complex management process, because each employee, entering into industrial relations, has unique characteristics peculiar only to him. In market conditions, the development of the enterprise in general depends on the efficiency of the use of personnel potential, its abilities, knowledge and skills. For this reason, human resources must be considered as the main element of efficient production, but the war made its corrections.

Business and the labor market in Ukraine experienced several evolutionary stages of its activity in the new conditions of martial law. At the end of February and March 2022, activity on the labor market decreased sharply. Many business structures in the country closed and people lost their jobs en masse. Only some companies were able to move the entire team or part of the staff to safe regions or other countries and continue work [1, p.4].

In the first days of the war, among the main actions that Ukrainian enterprises could introduce to their personnel was the establishment of constant communication, psychological assistance, compliance with social guarantees, payment of salaries, that is, everything that made it possible to support employees and guarantee their employment.

By March 1, 2023, 150 thousand people will remain without work. By article: in the total number of registered unemployed, men made up 43.3 thousand (or 29%), women – 106.7 thousand (or 71%). By age: 23% of the registered unemployed were under the age of 35; 29% – 35-44 years old; 29% - aged 45-55; 19% are over 55 years old. By education: 43% of the registered unemployed have higher education, 36% have vocational and technical education, and 21% have general secondary education. By type of economic activity: 21% of the registered unemployed were previously employed in trade, 16% – in industry, 16% – in agriculture, forestry and fishing, 12% – in the sphere of public administration, defense, mandatory social insurance [5].

According to the Law of Ukraine "On Mandatory State Social Insurance in Case of Unemployment" during martial law, the maximum amount of unemployment benefits cannot exceed the amount of the minimum wage established by law on January 1 of the calendar year. Thus, from January 1, the maximum amount of unemployment benefit is 6.700 hryvnias, the minimum is 1.000 hryvnias [20].

The level of unemployment in Ukraine, during the war, for the period January-February 2022-2023, is shown in Table 1.

A number of factors led to a change in the structure of the supply of qualified labor in Ukraine:

- increased mortality of people of working age;
- increase in the number of migrants abroad;

Table 1

**Unemployment rate in Ukraine, in war conditions, January-February 2022-2023, thousands of people**

INDEXES	2022 year (January February) thousands of people	2023 year (January February) thousands of people	2023 to 2022 (January February) thousands of people	
			%	+/- thousand people
Total received services	442,1	288,4	65,2	-153,7
They had the status of unemployed	402,9	240,8	59,8	-162,1
In total, they got a job	49,4	29,1	58,9	-20,3
of them, employed unemployed	40,0	21,4	53,5	-18,6
Participated in public works and other works of a temporary nature	8,5	1,2	14,1	-7,7
Underwent professional training	17,2	5,6	32,6	-11,6
of them, in the CPTO	10,4	3,3	31,7	-7,1
The number of persons covered by career guidance services	394,5	193,8	49,1	-200,7
of them, unemployed	331,9	153,7	46,3	-178,2
They received unemployment benefits	362,5	132,9	36,7	-229,6
The number of employers who cooperated with employment centers	42,2	24,1	57,1	-18,1
Number of vacancies	116,8	64,1	54,9	-52,7

Source: calculated [5]

- an increase in the number of employees with disabilities, and the level of their work capacity and the list of jobs they can perform differs from the pre-war period;

- increasing the supply of women in the labor market, including due to the postponement of marriage and childbearing due to war (the presence of a breadwinner in the Armed Forces or the loss of one has led to the fact that women have to take on more responsibilities to provide for the basic necessities of life for their families);

- an increase in child labor indicators due to the spread of poverty and the loss of opportunities for education, especially higher education, is also expected [1].

Relocation and forced migration have led to a change in the structure of the labor market, as well as the structure of offers and the saturation of specialists across regions. In the region's most affected by Russia's military aggression, the number of jobs has decreased and competition has increased. The relocation of enterprises to safe regions of Ukraine, the internal and external migration of qualified personnel caused the number of job offers in the western regions to be almost three times lower than in January due to an increase in the

number of job seekers [14].

In our opinion, the main factor that provoked the latest wave of migration was, of course, the large-scale military attack of the Russian Federation, the destruction of settlements, enterprises, infrastructure inflicted on Ukraine and the devastating impact of the war on the Ukrainian economy.

During the war, in January-February 2023, there were significant changes in the labor market, employers informed the employment centers about the planned mass layoffs of 20.2 thousand workers (in January-February 2022 – 16.1 thousand), but the availability of vacant positions remained 64,000. There is still an imbalance of supply and demand in the labor market. As of March 1, 2023, nine unemployed people apply for one vacant job. On average, in Ukraine for 2022, six unemployed people applied for one vacant job (2021 – 5 people). In 2021, the average registered number of employed people was 15.6 million, of which 7.4 million were women and 8.2 million were men [5]. For clarity, we will show the number of applicants for 1 vacancy for the period 2021-2023 (Fig. 1).

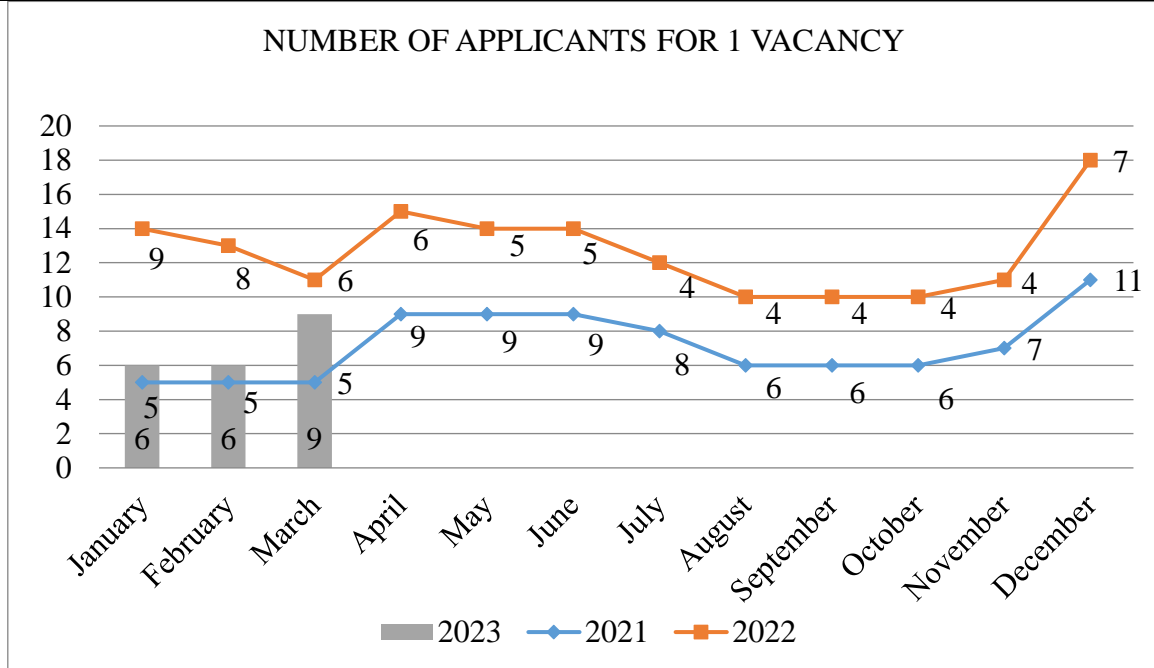


Fig. 1. Number of applicants for 1 vacancy, persons [5]

Half of the Ukrainians who had a job before the war are now unemployed. This is evidenced by the survey data conducted by the Rating Sociological Group on March 19, 2023. At the same time, according to a survey by the Rating group, as a result of hostilities in the country, on average, 53% of the able-bodied population remained unemployed (in the east of Ukraine, this figure reaches 74%), 22% continue to work in the usual mode, and 21% switched to remote work or work part-time and only 2% were able to find a new job [15].

Director of the Institute of Demography and Social Research named after M.V. Ptuhly, academician of the National Academy of Sciences of Ukraine Ella Libanova emphasized that there are many hopes for the Marshall Plan for Ukraine, its role in shaping the conditions of post-war life. The successful implementation of the plan primarily means the creation of new jobs. Moreover, they will be created mainly under the control of Western partners, who will not allow paying an indecent salary for the relevant work [16]. That is, the Marshall Plan from international partners will help stop the migration process, protect labor resources and stabilize the Ukrainian labor market.

The introduction of martial law, active hostilities change the usual order of things. Procedures that were logical and worked under normal circumstances cannot now be followed fully or at all. Therefore, the organization of labor relations has undergone some changes.

Systematic changes to the labor legislation of Ukraine were introduced by the Law of Ukraine "On the Organization of Labor Relations in the Conditions of Martial Law" dated March 15, 2022 [10]. The function of personnel regulation under martial law should be correlated with state regulation, in particular through the Law of Ukraine "On the Organization of Labor Relations under Martial Law". In our opinion, during martial law, this law restricts some constitutional rights and civil liberties.

On July 1, 2022, the Law of Ukraine "On Amendments to Certain Legislative Acts of Ukraine on Optimizing Labor Relations" was adopted, which changed certain provisions of the aforementioned Law, as well as provisions of the Labor Code of Ukraine [11]. This Law will create conditions for the restoration of the normal operation of enterprises and institutions in wartime, in particular, it will ensure the appropriate flexibility of labor relations that employers need in modern realities, as well as overcome outdated legislative gaps and current conflicts in labor legislation.

On September 26, 2022, amendments were also adopted to the Law of Ukraine "On Employment of the Population", No. 2622-IX regarding the reform of the employment service, social insurance in case of unemployment, and the payment of unemployment insurance compensation for employed among the unemployed, which entered into force on October 29, 2022 [12]. Functional changes and additions - to replace the ineffective mechanism of employment quotas, namely to introduce compensation to employers of a part of the costs of labor wages or EMS for the employment of certain categories of registered unemployed, in particular, young people; to promote the employment of the long-term unemployed by providing compensation to employers for the costs of the EU; introduce the provision of financial assistance for starting entrepreneurial activities; to change approaches to: the conditions, duration and amounts of unemployment benefits, in particular, to strengthen insurance principles (the longer the insurance period, the higher the amount of unemployment benefits) and to relax the sanctions against the unemployed for leaving their last place of work at their own will without valid reasons; financing of public works and abolition of temporary works, as those that do not contribute to motivation to work; selection of a suitable job for the unemployed (taking into account, in particular, transport availability, the amount of wages depending on the duration of unemployment).

When every minute is worth a life, states have to make tough decisions in favor of public interests, namely defense. Therefore, ensuring social rights during war is not an easy task. War is the worst evil for establishing high labor standards. The issue of possible deviation from obligations during wars is "programmed" in the system of international labor regulation. The International Labor Organization (ILO), which emerged from the flames of the First World War, provides for the temporary suspension of labor guarantees for workers in connection with war or other extraordinary circumstances [13].

As a result of the globalization of the world labor market, the development of information and communication technologies, national labor markets have their own characteristics, which must be taken into account when choosing ways that increase the efficiency of the use of human resources.

The only tripartite organization of the UN since 1919, the ILO brings together the governments, employers and workers of 187 member states, whose main activity is to set labor standards, develop policies and develop programs that promote decent work for all women and men. The new ILO plan to support Ukraine's labor and employment sector is aimed at meeting humanitarian needs, as well as reconstruction needs after a year of war, which has resulted in huge economic and job losses and threatens millions of people with poverty [7].

At the same time, it should be noted that the real situation may not be as destructive as predicted by the International Labor Organization. The ILO methodology for calculating the unemployment rate has been tested on the "official" labor market. However, a significant share of the shadow segment [5] was always observed in Ukraine, which significantly corrected the statistics. Yes, the level of unemployment, according to the ILO methodology, is many times higher than the level of unemployment recorded by official statistics.

In this regard, it is worth paying attention to such a modern concept of personnel management, which takes into account new trends in human resources management, using almost non-standard management approaches. In Western literature, it is called the concept of flexicurity or the theory of flexicurity (from the English "flexicurity" – flexible response to social shocks) [8]. It is based on three main principles:

1. The labor market is "liberal", that is, hiring and firing employees is quite easy, which implies the adaptability of the enterprise to changes in the work schedule

in accordance with the new conditions in which the enterprises found themselves, taking into account modern technologies. Thus, it makes it easier for employers to lay off workers during recessions and allows them to hire new workers during economic upswings.

2. The state acts as a guarantor of payments of social and other types of assistance, which means the existence of a complex system of daily rather high and on a long-term basis monetary and social payments in case of job loss, illness or disability. In modern conditions, such a system ensures social security of employees, their higher employment in the labor market and a sufficiently low level of unemployment. Hence, it helps regulate labor supply and demand over the wartime labor market.

3. Preservation of the labor market in a stable state through the existence of a system of collective agreements, which will contribute to the social security of employees, since it is believed that organizations better manage the situation and know the state of affairs in the labor market and therefore more effectively resolve industrial disputes at any time and for any -what state of affairs.

Borrowing the basic principles of the theory of flexibilization and implementing into domestic management practice the above-mentioned ways of increasing the efficiency of the use of personnel resources (Fig. 2) leads to the development of the following measures that contribute to the effective management of the enterprise:

1. As a result of the globalization of society, the company's use of flexible working hours for certain categories of employees, providing employees with safe working conditions during the war, working in conditions of necessary self-isolation and largely preventing many negative consequences of emergency and special situations. The introduction of flexible regulation should meet the interests of both employers and employees and ensure labor productivity, motivation and realization of the creative potential of employees.

2. The development of computer technologies causes the company to create remote workplaces (with the help of the Internet) and to provide work under the conditions of part-time and temporary employment. Remote work (remote work) during the war is very convenient, because the fulfillment of assigned tasks or the fulfillment of one's duties can be carried out independently at any time and in any place with the use of information and communication technologies.

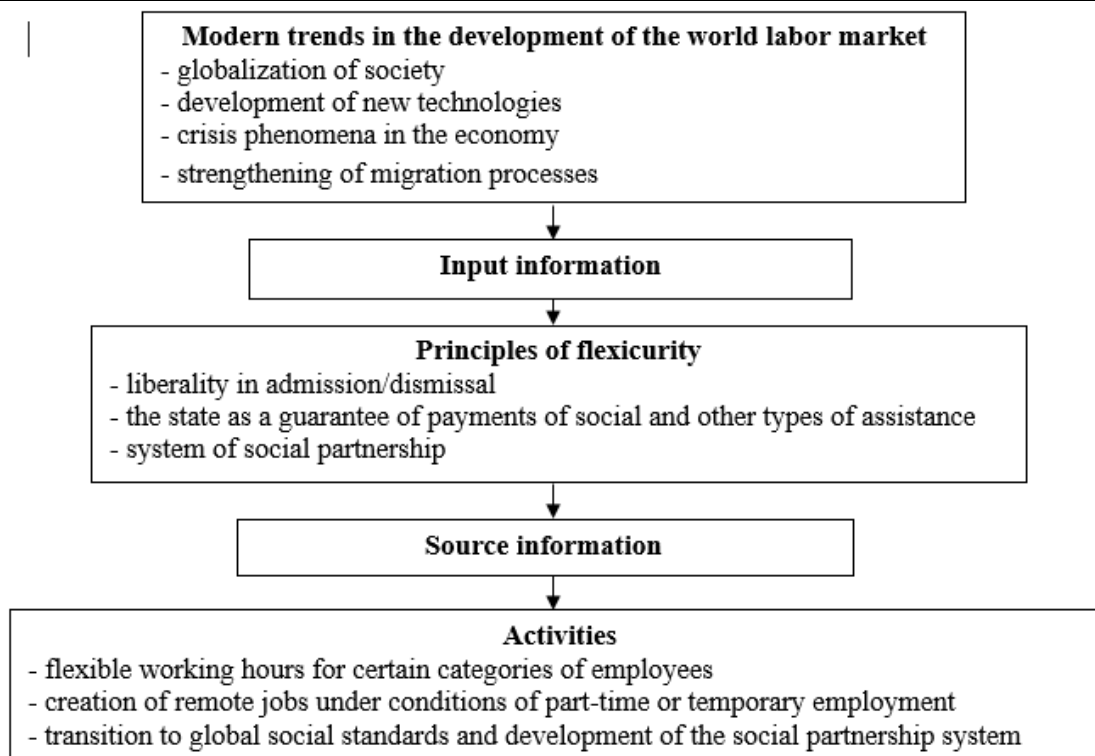


Fig. 2. Introduction of flexibilization principles into enterprise management practice

3. Transition to global social standards with the aim of providing a more comprehensive package of social guarantees and compensations that take into account all the realities of modern social development. Based on world experience, Ukrainian society can answer the difficult question of how market relations interact with social development, taking into account the realities of today. It is necessary to improve our domestic social legislation; this became possible thanks to the determination of the position and role of international social standards in the law of social security.

4. Development of an effectively functioning system of social partnership taking into account the trends of national legislation and the development of the global labor market. Therefore, in order for social partnership to become an effective mechanism in the conditions of war and the post-war period, it is necessary to create a single social space with a common system of social protection, common social standards and general acceptance of social law. Today, the declared principles of social partnership are not as important as the mechanisms and forms of their implementation.

Thus, on the basis of the above material, we state that enterprises need to create a holistic system of formation, functioning and efficiency of the use of the enterprise's personnel potential, aimed at the optimal efficiency of its activity and based on the principles of integrity and stability.

In the management of the personnel potential of the enterprise, all modern trends in the development of society must be taken into account, since personnel management is a set of one-time actions, and an ongoing process aimed at the maximum realization of the organization's goals, that is, the efficiency of the enterprise directly depends on a well-developed personnel management system. The processes taking place in the

labor market under the influence of globalization have led to a change in the content of social and labor relations. In view of this, the creation of an effective system of regulation of labor relations is possible under the condition of the formation of uniform tasks and the spread of general principles, which also include the principles of flexibilization.

**Conclusion.** Based on the above, it can be concluded that the development of personnel potential is directly related to the development of the economy in general, taking into account the military actions in the country. Rational formation of personnel, their development and proper management of personnel is a guarantee of increasing the efficiency of the enterprise during the war and the post-war period.

Resettlement and mass migration from war zones to western regions and abroad have created shortages in key areas of the labor market, especially in active war zones. Thus, the study of personnel portals shows that there are now significantly more unemployed specialists on the labor market than before.

Addressing the problem of returning workers, wartime job shortages, and post-war reconstruction must become a cross-cutting social policy program, which a difficult task is given the socio-political situation.

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## MEDICAL SCIENCES

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### SOME ASPECTS OF PATHOGENESIS, CLINIC AND TREATMENT OF CROHN'S DISEASE

#### **Abstract.**

*In modern conditions, the prevalence of diseases of the large intestine continues to grow, which is caused by constant stress, late referral due to fear and the inconvenience of discussing clinical symptoms and masking the clinic with extraintestinal manifestations. Crohn's disease is one of the most common chronic inflammatory bowel diseases. Given the severity of the course, the frequency of serious complications and disability, this pathology is an important social problem. The article provides a review of modern literature related to the pathomorphological changes of transmural lesions in Crohn's disease. Features of the classic course and extraintestinal manifestations of Crohn's disease are highlighted. Special attention is paid to pharmacotherapeutic methods of treatment from the standpoint of evidence-based medicine.*

**Key words:** *Crohn's disease, pathomorphology, clinic, treatment.*

Crohn's disease (CD) is a chronic recurrent disease of the gastrointestinal tract of unknown etiology, manifested by transmural segmental granulomatous inflammation mainly of the small and upper parts of the large intestine, with the development of local and systemic complications [1]. This disease was first described by L. Ginzberg and G.D. Oppenheimer in 1932, later it was described by the American doctor V. Srohn (1884-1983), under whose name she entered the practice. In many countries of the world, there is a trend towards an increase in the incidence of CD. Data on the prevalence of CD in different countries of the world are ambiguous and indicate the frequency of the disease from 10 to 150 cases per 100,000 population, and such discrepancies are due to the difficulties of diagnosing the disease, especially before the appearance of complications, often the non-specificity of clinical manifestations, the lack of specific instrumental and laboratory methods research for the purpose of its diagnosis [2].

CD begins with inflammation of the crypts and the formation of abscesses, which then progress to the formation of small individual aphthoid ulcers. In the future, changes on the part of the mucous membrane can take the form of deep slit-like longitudinal and transverse ulcers, with areas of swelling of the mucous membrane, which gives it a characteristic "cobblestone" appearance.

Transmural spread of inflammatory changes is accompanied by lymphostasis, thickening of the intestinal wall and mesentery. Mesenteric fat spreads to the serous membrane of the intestine. Mesenteric lymph nodes may enlarge. Widespread inflammation can lead to thickening of the muscular plate of the mucous membrane, fibrosis and the development of strictures, which provokes intestinal obstruction. Abscesses and fistulas often develop, spreading to the surrounding organs - intestinal loops, bladder, lumbar muscle. Fistulas can open on the surface of the skin of the anterior abdominal wall and the lateral parts of the abdomen. Re-

ardless of the degree of intraperitoneal disease activity, perianal fistulas and abscesses form in 25–33% of cases; these complications are often the most uncomfortable manifestations of Crohn's disease.

Non-caseous granulomas can be found in the lymph nodes, peritoneum, liver and all layers of the intestinal wall. Such granulomas are very pathognomonic, but in half of patients with Crohn's disease, they cannot be detected. Of course, the presence of granulomas is related to the patterns of the course of the disease. Areas of the affected intestine are intermittently and sharply demarcated from adjacent normal intestinal tissues (so-called unaffected segments), which is why it is called regional enteritis.

In approximately 35% of cases, Crohn's disease affects only the ileum (ileitis). In some cases, the entire small intestine is affected (jejunoileitis). Clinical signs of damage to the stomach, duodenum and esophagus are very rare, although microscopic signs of the disease are often detected in an antral biopsy, especially at a younger age. In the absence of surgical intervention, inflammation almost always spreads to areas of the small intestine. About 45% are lesions of the ileum and colon (or ileocolitis), with the predominant lesion of the right half of the colon. About 20% are lesions of only the colon (granulomatous colitis), most of which, unlike ulcerative colitis, do not affect the rectum [3].

At the moment, the etiology of CD is not completely known. According to the main theory, this is related to the development of a pathological reaction of the immune system to the intestinal flora and to food residues that enter the intestines. The autoimmune theory of the development of the pathology is considered - antibodies are formed against intestinal tissues, which are defined as foreign, accordingly, a large number of leukocytes appear in this area. This leads to inflammation, the appearance of ulcers and erosions in the intestinal tract. Provocative factors are distinguished: predisposition at the genetic level; tendency to allergic manifestations; excessive smoking, alcohol consumption; frequent intake of medicines; adverse ecology.

CD has a chronic, multi-year course, periods of exacerbations and remissions usually alternate, but often the symptoms are observed constantly and cause significant disability and the need for surgical operations due to complications of the disease (60% of patients after 10 years); relapses after surgical treatment — up to 70%.

Clinical picture of CD - general, intestinal and extraintestinal symptoms. General non-specific symptoms - weakness, rapid fatigue, lethargy, a slight increase in temperature, often of a wave-like nature.

Intestinal manifestations:

- frequent, constant abdominal pain, pain during defecation;
- nausea and vomiting;
- flatulence;
- diarrhea from 2-3 to 8-10 times a day. Feces may contain pus, blood, mucus;
- weight loss.

Extraintestinal manifestations. Skin manifestations. According to scientists, the prevalence of skin

manifestations in inflammatory bowel diseases among people aged 20-40 years is up to 40% [4,5]. The development of skin symptoms is associated with certain types of HLA antigens, namely HLADRB1\*0103, HLA-B\*27 and HLA-B\*58, as well as with the TRAF3IP2 gene. The most frequent skin manifestations are erythema nodosum, gangrenous pyoderma [6].

Lesions of the locomotor system. They are characterized by minor joint damage or its absence. They are manifested by seronegative arthralgia or arthritis, which are noted in 10-20% of cases in people with CD. In patients with Crohn's disease and ankylosing spondylitis, the HLA-B27 antigen is determined in 25-75% of cases [7].

Ophthalmological manifestations. Damage to the organ of vision is in third place among extraintestinal manifestations. The most common visual manifestations are anterior uveitis and episcleritis, while scleritis, intermediate and posterior uveitis are extremely rare. Episcleritis is usually manifested by painless redness of the sclera and conjunctiva, as well as itching and a burning sensation. Uveitis is accompanied by more severe manifestations, such as headache and eye pain, photophobia, blurred vision [6,8].

Damage to the oral cavity. The oral cavity is often involved in the pathological inflammatory process. 10% of patients have periodontitis, aphthous stomatitis, and in more severe cases, vegetative pyostomatitis. Aphthous lesions are usually located on the mucous membrane of the lips and cheeks, but may also be present on the tongue and in the oropharyngeal region. Vegetative pyostomatitis is manifested by multiple pustular, sometimes hemorrhagic, rashes on any areas of the mucous membrane of the oral cavity, which have the appearance of "cobblestones" [6,9].

Treatment of CD. The first-line drugs are 5-aminosalicylates (5-ASA). Mesalazine is usually the drug of choice. With a severe refractory course, mesalazine is combined with its use in microenemas. Regular intake of 5-ASA drugs reduces the risk of developing colorectal cancer. Glucocorticoids (budenofalk) are used in combination with mesalazine in the absence of an effect from treatment with 5-ASA drugs and in severe forms of chronic inflammatory bowel diseases. When using budenofalk, the frequency of side effects characteristic of corticosteroids decreases, while the effectiveness of budenofalk in active forms of CD reaches 53-70%, but depends on the localization of the process. Therapy with 5-ASA drugs and glucocorticosteroids in CD is insufficiently effective in 20-25% of cases. In such cases, immunosuppressants are prescribed. Antibacterial therapy - prescribed taking into account the microbiological examination of the intestinal contents, prevents the activation of opportunistic flora and the occurrence of sepsis [10].

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## SOME ASPECTS OF THE PATHOGENESIS OF GASTRODUODENOPATHY ASSOCIATED WITH NON-STEROIDAL ANTI-INFLAMMATORY DRUGS

### **Abstract.**

*Nonsteroidal anti-inflammatory drugs have a wide spectrum of therapeutic action, uniquely combining anti-inflammatory, analgesic, antipyretic and antithrombotic effects, influencing the processes of neogenesis, cell adhesion and apoptosis. That is why NSAIDs are the most widely used drugs in medicine. Every year, 500 million prescriptions for these drugs are written in the world, about 30 million people take them every day, 2/3 of patients - without a prescription and medical supervision. NSAID-induced gastroduodenopathy develops when NSAIDs are taken at a dose that inhibits prostaglandin production and increases gastric motility, causing increased mucosal permeability, neutrophil infiltration, and free radical formation, which ultimately leads to gastric damage.*

**Key words:** *gastropathies, nonsteroidal anti-inflammatory drugs, pathogenesis*

The therapeutic and side effects of non-steroidal anti-inflammatory drugs (NSAIDs) are provided by the pathogenetic mechanism of inhibiting the activity of the enzyme cyclooxygenase (COX) in the metabolism of arachidonic acid, as a result of which the synthesis of prostaglandins (PG) decreases. To date, two

isoforms of cyclooxygenase have been identified - COX-1 and COX-2. The COX-1 enzyme is constantly present in the alimentary canal (AC), kidneys, platelets and ensures the synthesis of thromboxane A<sub>2</sub>, PG E<sub>2</sub> and prostacyclin, which have a cytoprotective effect. Under physiological conditions, COX-2 is localized in

small amounts in the brain and kidneys. In other tissues, it is detected only during a pathological process and induces the synthesis of PGs, which are involved in inflammation, cell proliferation and destruction. During inflammation, the synthesis of leukotrienes, the release of biogenic amines, free radicals, nitrogen monoxide, and others also increases, which determines the development of the early stage of inflammation. The level of COX-2 is regulated by cytokines, growth factors, and tumor-inducing factors [1-3]. In addition, anti-inflammatory and analgesic effects of NSAIDs are associated with suppression of activation and chemotaxis of neutrophil granulocytes and reduction of production of toxic free radicals in activated neutrophil granulocytes. NSAIDs also inhibit the stimulation of nitric oxide. By inhibiting the synthesis of PG, NSAIDs affect apoptosis and allow the normalization of the life cycle of cells in the focus of inflammation and inhibit the uncontrolled proliferation of tumor cells [4]. It is the ability of NSAIDs to suppress the functional activity of COX-2 that provides their therapeutic effect, but at the same time, they also reduce the activity of COX-1, which causes adverse reactions. However, even short-term use of NSAIDs can lead to the development of serious complications, primarily from the AC side. Approximately 20% of all gastric ulcers and 10% of peptic ulcers are associated with the use of NSAIDs, more than half of which are complicated by bleeding and perforation [5]. In the United States, the use of NSAIDs is the cause of 100,000 hospitalizations and 16,000 deaths annually [6]. Features of erosions and ulcers caused by NSAIDs are multiple, asymptomatic or mildly symptomatic course, most often located in the antral part of the stomach, high risk of bleeding, absence of an inflammatory wall around the ulcer, foveolar hyperplasia of the mucous membrane (MM), rapid healing after withdrawal of NSAIDs [7]. In 1986, S. Roth proposed the term "NSAID-gastropathy" (NSAID-gastropathy) to define stomach damage due to taking this group of drugs. According to the recommendations of the American Rheumatology Association (2002), a low risk of NSAID-GDP is noted only in patients who do not have any established risk factor for their occurrence. In the presence of one risk factor, the probability of developing NSAIDs-GDP is considered moderate, and in the presence of two different factors - as high. The main risk factors for NSAIDs-GDP are old age and old age, female sex, history of AC disease, *Helicobacter pylori* infection, concomitant diseases (cardiovascular, renal and hepatic failure, arterial hypertension, diabetes), complex therapy with the use of anticoagulants and antiplatelet agents, combined use of NSAIDs and glucocorticosteroids, high doses of NSAIDs, simultaneous use of several NSAIDs, long-term prescription (more than 3 months) of NSAIDs, smoking and alcohol abuse. General contraindications for the appointment of NSAIDs are exacerbation of peptic ulcer disease and gastritis, diseases accompanied by a decrease in blood clotting (hemophilia), bleeding, hemocytopenia, allergic reactions to any drug from the group of NSAIDs [8,9].

Two mechanisms of direct and indirect action of NSAIDs are distinguished in the pathogenesis of the

damaging effect on the gastric mucosa and MM of the gastric mucosa. Direct damage to MM AT NSAIDs are caused by weak organic acids that are in non-ionized form in the acidic environment of the stomach, therefore they directly act on the surface epithelium, destroy it, increase the permeability of hydrogen ions and contribute to their excessive retrodiffusion. A few hours after taking NSAIDs, acute damage to the stomach occurs in the form of submucosal bleeding and erosions. Further use of NSAIDs in most cases leads to the healing of surface erosions, which is explained in the literature by the phenomenon of adaptation to the action of drugs. The mediated effect of NSAIDs on MM is ensured by a sharp inhibition of COX-1 activity, as a result of which the activity of PGs, which provide cytoprotection of MM, decreases. Deficiency of PG I<sub>2</sub> leads to the deterioration of blood flow in the stomach wall, disruption of the stabilization of mast cell membranes by lysosomes, increased production of oxygen radicals and enzymes by neutrophils, and disruption of vascular endothelium regulation. A decrease in PG E<sub>2</sub> contributes to a decrease in the secretion of bicarbonates and gastric mucus, as a result of which there is an increase in gastric secretion. NSAIDs are also able to switch the metabolism of arachidonic acid from the prostaglandin to the lipoxygenase pathway and promote the synthesis of leukotrienes, which have a toxic effect on AT and induce the development of local inflammation due to the adhesion of neutrophils to the endothelium [10,11]. Inhibition of COX-1 also disrupts platelet aggregation, which explains the increased risk of gastrointestinal bleeding [12].

Symptoms of NSAID gastropathy are well known to doctors of all specialties. This is a pain that is more often localized in the epigastric area, associated with taking the drug (mostly patients switch to taking it after a meal to reduce unpleasant sensations), dyspeptic syndrome - a feeling of heaviness after a meal, a feeling of rapid satiety, bloating in the epigastrium, less often nausea, vomiting, pain and dyspeptic syndromes are not characterized by seasonality, unlike "classic" gastroduodenal ulcer. However, it should not be forgotten that patients may not have pain and dyspeptic symptoms, which could alert, worry patients and indicate a possible adverse side effect of the drugs, which may be related, first of all, to the analgesic effect of NSAIDs. In this case, unfortunately, the first clinical manifestations of drug therapy complications are gastrointestinal bleeding or ulcer breakthrough. When deciding on the appointment of NSAIDs, both the expected benefit from their use and the risk of developing complications should be taken into account. It was noted that erosive-ulcerative lesions, as a rule, occur during the first 1-3 months from the start of treatment, then the risk decreases somewhat and remains stable during the next several years of treatment. That is why patients who have started taking NSAIDs for the first time need explanations and increased attention from the doctor regarding possible complications and their symptoms for timely diagnosis and treatment. That is why timely prevention and diagnosis of NSAIDs-induced lesions of the mucous membrane of the gastrointestinal area, as

well as a rational and individual approach to prescribing NSAIDs, are of primary importance. Currently, the search for drugs that will be more gentle on the MM of the gastrointestinal tract and have a lower cardiovascular risk, nephro- and hepatotoxicity, and therefore greater safety, in particular when using them in patients with concomitant pathology, is ongoing. If there is an unavoidable need to prescribe NSAIDs to patients with comorbid conditions, prescribe preventive therapy to prevent complications.

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Bukovinian State Medical University;*[DOI: 10.24412/2520-6990-2023-9168-53-55](https://doi.org/10.24412/2520-6990-2023-9168-53-55)**STRESS AND PEPTIC ULCER OF THE STOMACH AND DUODENUM****Abstract.**

*The article presents modern scientific data on the role of stress factors in the pathogenesis of peptic ulcer of the stomach and duodenum. The main theories of the development of this pathology are highlighted. The mechanisms of damage to the mucous barrier of the gastroduodenal zone due to a violation of vegetative regulation, depolymerization of mucoproteins of the mucous barrier of the stomach, activation of oxidative stress against the background of damage to the microcirculatory channel are described. These data prove the essential role of stress as a factor in ulcerogenesis.*

**Key words:** *stress, peptic ulcer of the stomach and duodenum;*

One of the serious problems of modern society is stress. It is one of the main factors that cause many diseases. Scientists have proven that not too strong stress often mobilizes all our reserves and helps us achieve results and solve tasks quickly. However, if the stress is very strong and prolonged, the body begins to wear down, the nervous system suffers, and immunity decreases. The most common diseases caused by stress are heart and thyroid diseases, diabetes, psoriasis, peptic ulcers, hypertension, bronchial asthma, rheumatoid arthritis, obesity, eczema, depression, etc. In a broad scientific context, the term "stress" was first introduced into medicine by the Canadian physiologist János Selye in 1946.

Peptic ulcer (PU) of the stomach and duodenum is one of the most frequent diseases of the gastrointestinal tract. The prevalence of the disease is estimated at 5–10% of the adult population. The ratio of duodenal to gastric ulcer localization is 4:1. There are 5 million patients with PU registered in Ukraine. Over the past 15 years, an increase in the absolute and relative number of patients with a complicated course of duodenal ulcer has been registered by more than 2.5 times [1-4].

Peptic ulcer is a chronic recurrent polycyclic disease of the mucous membrane of the gastroduodenal zone with the formation of local erosive damage with a violation of the balance between the factors of "aggression" and "defense".

Gastric ulcer disease has very diverse symptoms. In different cases of the disease, individual patients may

have certain symptoms of the disease, possibly in combination, with different frequency of occurrence:

1. Painful sensations in the epigastrium with centralization to the midline of the abdomen. The pain syndrome is considered early in onset if it develops approximately one hour after eating; late - when it occurs three to four hours after eating; separate "hungry" pains that occur at night. A number of patients note pain in the morning before taking the first meal in the epigastric area or with significant breaks in eating. Taking alcoholic beverages in the vast majority of cases causes a pain attack;

2. For ninety percent of patients with gastric ulcer, heartburn is a common symptom;

3. Decreased appetite has a "protective" nature, as it were: the patient avoids eating so as not to provoke the onset of painful sensations;

4. Burping with the taste of acid and bitterness is often noted during the development of an ulcer;

5. An inconstant, but quite frequent sign is the radiation of pain in the navel and lower back. When such abdominal pain occurs, it is necessary to take into account the possibility of concomitant reactive cholecystitis and pancreatitis;

6. A feeling of fullness in the epigastric area, in some cases without a clear connection with eating;

7. An almost constant symptom of peptic ulcer disease is increased salivation and nausea. Vomiting is also observed in a number of cases, which sometimes leads to the disappearance of nausea and abdominal pain!

Peptic ulcer disease is characterized by various dyspeptic disorders, increased gas formation (including concomitant pancreatitis), weight loss, and a whitish coating on the tongue.

The main theories of PU development [5]:

1. The theory of the duodenal-gastric reflex – the throwing of intestinal juice from the duodenum, which is alkaline, to the stomach, where the acidic environment prevails. Neutralization takes place with the release of a large amount of carbon dioxide, digestion processes in the stomach are disturbed.

2. The theory of reverse diffusion of hydrogen ions, that is, excessive acidity that damages the mucous membrane of the stomach.

3. Vascular theory (proposed by Virkhov) – when blood supply to organs of the gastrointestinal tract is disturbed, their tissues do not receive oxygen and nutrients, which causes atrophy, insufficiency of excretory glands, etc. Stress is part of the pathogenesis of the vascular theory.

4. The theory of medicinal gastritis is the use of drugs, especially non-selective non-steroidal anti-inflammatory drugs, which suppress cyclooxygenase, and this, in turn, suppresses the production of prostaglandins responsible for the protection of the mucous membrane.

5. Alimentary theory - errors in nutrition, irregular eating, abuse of spices, overeating, etc.

6. Harmful habits – smoking and alcohol abuse. 95% of patients with PU are smokers, because nicotine causes hyperplasia of cells in the mucous membrane of the stomach, suppresses the formation of bicarbonate by the pancreas, increases the level of pepsinogen-I in the blood and mucus formation in the stomach and duodenum, strengthens the motility of the stomach, leads to duodenogastric reflux.

7. Alcohol, in turn, damages the mucous barrier of the stomach, increases the back diffusion of H<sup>+</sup> ions through the mucous membrane. Systematic alcohol consumption leads to dystrophy and/or atrophy of the gastric mucosa with the appearance of areas of intestinal metaplasia.

8. An infectious factor (*Helicobacter pylori*) can play a major role in the development of PU. It has been proven that approximately 80% of gastric ulcers and approximately 95% of duodenal ulcers are caused by *Helicobacter pylori* infection.

In recent years, there has been a renaissance in the study of the impact of psychological stress as an important factor in ulcer formation of the gastrointestinal tract, in the pathogenesis of which psychoemotional and psychosocial factors, such as physical (trauma, long-term pain syndrome) and psychological (fear, anxiety, insecurity, social maladaptation) play an important role, which are characterized by unpredictability and uncontrollability [4,6]. Stress can cause the appearance of any disease of the gastrointestinal tract, including autoimmune. At the same time, stress alone does not cause an ulcer. Other, more important factors are necessary for the development of this process. A key role in this is played by the hormones of the adrenal glands, which massively produce the hormone cortisol. Cortisol plays a key role in maintaining the body's daily

rhythms, regulating homeostasis, and adapting to environmental changes. During stress and anxiety, the body produces an excessive amount of cortisol, which leads to jumps in blood pressure, hot flashes, exacerbation of skin inflammation, etc. Elevated blood pressure against the background of stress occurs with persistent narrowing of blood vessels, including vessels that feed the organs of the abdominal cavity, which reduces the level of nutrition of tissues several times. And long-term stress causes the appearance of functional diseases and aggravation of already existing problems, which were previously only in the initial stages. In the implementation of the stressor response, the leading role belongs to the hypothalamic-reticular structures of the brain, which closely interact with the hippocampus and make up a single hypothalamic-pituitary-adrenocortical system, which directly affect the neuroendocrine regulation of the synthesis of biologically active substances, hydrochloric acid, microcirculation processes and immune protection of the mucous membrane. era of the gastrointestinal tract, motor function of the stomach. In the pathogenesis of PU, an important place belongs to autonomic dysfunction, which is characterized by reduced vagal activity against the background of increased tone of the sympathetic division of the autonomic nervous system, which contributes to the disruption of neurohumoral and neuromuscular activity of the stomach [4,7]. Stress ulcers, as a rule, have a number of differences from ordinary peptic ulcers. Stress ulcers, as a rule, are small in size and do not show signs of chronicity. They can be single or multiple, localized in the body and the bottom of the stomach. Stress ulcers also have differences in the pathogenesis of their development. The mechanism has not been fully elucidated. The main pathogenetic links of the formation of stress ulcers: ischemia of the gastric mucosa, increased production of hydrochloric acid, decreased secretion of bicarbonate [8].

Stress is a protective reaction of the body to external stimuli. It manifests itself mentally, physically, emotionally and allows you to adapt to changes. Primary prevention of peptic ulcer is aimed at improving nutrition, improving conditions and quality of life. Secondary prevention involves anti-relapse treatment of peptic ulcer using modern anti-secretory drugs in optimal doses and avoiding stressful situations.

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## CHOLERA AND THE ONGOING WAR

### **Abstract.**

*During military operations, for a number of reasons, such as deterioration in the quality of drinking water, inadequate compliance with sanitary standards due to the occupation of territories, etc. Among the acute intestinal infections, cholera outbreaks pose a great danger. The issue of prevention of acute infectious diseases is urgent.*

**Keywords.** *Cholera, vibriion cholera, war, pandemic, seven cholera pandemics, Ukrainian cases of cholera*

**Introduction.** According to the International Health Regulations (IHR) 2005, due to the ease of infection, high rate of spread, severe course, and high mortality, cholera is an infectious disease that significantly affects public health and can spread rapidly on an international scale.

Cholera has plagued humans for hundreds, if not thousands, of years, particularly in the areas around the Bay of Bengal, with some of the first records of cholera-like illness reported in ancient Sanskrit medical texts written around 500–400 BCE[1]. One of the first descriptions of cholera dates back to the campaigns of Alexander the Great, whose soldiers probably suffered from the disease during an Indian campaign. One source describes the patient's condition as follows: "The lips turn pale, the gaze becomes meaningless, the eyes roll back, the arms and legs shrivel as if by fire, and the disease affects many thousands of people."

Favorable conditions for the spread of the disease include a hot climate, high rainfall, the presence of water bodies contaminated with feces, and high population density. The peculiarities of India as the primary center of cholera "preserved" the disease without significant changes until the nineteenth century. However, since the 1800s, the spread of cholera has suddenly and tragically for humanity become a pandemic, which has been recorded since 1817. The reasons for this rapid spread of the disease are the explosive growth of international trade, numerous colonial wars, and significant migration.

Since then, cholera has become a pandemic. The first pandemic (1817-1824) began in India during the colonial war and spread to neighboring regions of India - China, Ceylon, and then to Japan. In 1820, the disease was discovered in East Africa. The following year, the British brought it to Arabia, then to Persia, Turkey, and the Transcaucasus[2].

### *II pandemic (1826-1851)*

In 1826-1828, the disease spread east of India, to China, Indochina, and northwest to Afghanistan, Khiva, and Bukhara[3]. Meanwhile, in 1830, the disease made its way to the Middle East. Up to 150 thousand people died in Egypt. During the Russo-Polish War of 1830-1831, more than 12 thousand soldiers died of cholera in the Russian army alone. The following year, French colonial troops introduced cholera to Africa, and emigrants to North America and Australia[4]. In the Russian Empire, 534,000 people fell ill with cholera in two years, and 230,000 died. Cholera appeared in Central and Western Europe in 1831. The disease pandemic spread to all continents. In 1848, 60-100 soldiers died of cholera every day in the Russian army of Field Marshal Paskevich in Galicia[3].

### *III pandemic (1852-1860)*

From India, the spread of cholera to Persia was associated (and later it happened often) with the Shiite pilgrimage to the sacred graves of Kerbala and Najaf. Cholera was brought to Arabia by pilgrims traveling to the Muslim shrines in Mecca and Medina[2]. In those years, there were problems with water stored in con-

taminated cisterns, there were not enough public restrooms, and crowds and swarms of flies had a negative impact. These sacred Muslim cities were an additional hotbed of cholera until the mid-20s of the 20th century, as pilgrims from North Africa, the Middle East, and the Middle East carried it from their native places after receiving it from Indian believers[3].

#### *IV pandemic (1863-1875)*

It is notable for the rapid spread of the disease by rail and ship after the opening of the Suez Canal, which "provided" courier transportation of the infection from India to Europe. Now cholera could reach Europe not in two or three years, but in a few weeks. The ships that sailed from Alexandria, Egypt, carried it to the ports of Italy, France, and Spain.

#### *V pandemic (1881-1896)*

For the first time, the pandemic started not in India but in Egypt. It was there, in Cairo, in 1883, that German scientist Robert Koch isolated a pure culture of cholera vibrio from the corpses of cholera victims and described the causative agent of the disease in detail[5]. According to various estimates, over 10 million people died of cholera in the nineteenth century[6].

#### *Pandemic VI (1899-1923)*

It emerged again from India and lasted longer than any other before it. It covered all continents except Antarctica. Until 1905, only the classical cholera vibrio was considered the causative agent of cholera. However, in 1905, German bacteriologist Felix Gottschlich isolated another vibrio from the intestines of pilgrims returning from Mecca who died of diarrhea at the El Tor quarantine station in the Sinai Peninsula, which got its name from the station itself[7].

The VII cholera pandemic began in 1961, but, unlike the previous ones, it was caused by the El Tor biotype, although in recent years an increase in morbidity caused by both the classical cholera vibrio and other serogroups has been recorded again. This pandemic continues to this day[4].

Cases of cholera in Ukraine have been detected during all pandemics. During the Second Pandemic, cholera was introduced to Ukraine in 1830. The spread of cholera was facilitated by the Russo-Ottoman war, when the army began to return from combat. Cholera reached its peak in Ukraine in 1831. In 1847, the Third Pandemic reached the shores of the Black and Azov Seas, first in Odesa, and then throughout Ukraine and Poland. In 1847, cholera reached Kyiv, where it claimed many lives. At that time, the Ukrainian pathologist Ivan Mykolaiovych Reypolskyi was engaged in the study of cholera. In 1853-1855, cholera was especially rampant in the Crimea during the Crimean War. During the Fourth Pandemic, cholera spread in August 1865 from Constantinople, first to Odesa, and from 1866 to almost all communities in Ukraine. An investigation organized by the military governor revealed that many citizens in the suburbs either secretly dumped corpses into the Dnipro or buried them in secluded places.

During the fifth pandemic in late 1885, cholera reached Galicia, central and eastern Ukraine.

The VI cholera pandemic - in Ukraine, there were initially isolated cases. With the outbreak of the First

World War (1914), cholera spread in the Russian army, mainly on the Southwestern Front. In the next two years, the epidemic decreased significantly, but in 1918, due to the intensive movement of refugees, demobilized and prisoners of war, and then because of the civil war, a new large outbreak of cholera occurred. It spread throughout Ukraine. The mortality rate from cholera was very high; for example, in Odesa in 1918 it was 55.8%, in 1919 - 47.2%, in 1920 - 65.0%, and in 1921 - 48.8%. The highest mortality rate was among the youngest and oldest groups of patients. After the end of the civil war, the authorities launched a vigorous fight against cholera, and as a result, cholera was finally eliminated throughout the USSR by 1926[8].

Given the history of the spread of cholera across the globe, we can draw certain conclusions about the causes of its spread. After all, every pandemic coincides with armed conflicts, occupation of territories and a large number of refugees who were forced to live in poor sanitary conditions. During any armed conflict, especially one that escalates into a large-scale war, sanitary conditions deteriorate not only among the military but also among the local population.

More than 35,000 suspected cases of cholera have been reported across the Syria, according to the United Nations' children's agency. UNICEF said only approximately 2,500 have been tested, of which nearly half were confirmed positive[9].

For example, the Yemeni Civil War (2014–present) has led to widespread destruction that has triggered the world's largest cholera outbreak [10].

The large-scale Russian aggression against Ukraine is no exception.

Many cities and villages have suffered and continue to suffer from aerial bombardment and fighting on their territories. A humanitarian catastrophe is developing in many settlements in the eastern part of Ukraine. Due to the constant shelling and destroyed infrastructure, local residents are unable to receive water of adequate quality. Residents of the occupied territories have not had access to proper medical treatment for a long time, which significantly reduces the chances of a positive outcome in the event of an infection.

Water infrastructure is often indirectly damaged due to secondary reverberating effects of attacks on urban infrastructure. For example, the Alouk water station in the Al-Hasakeh governorate in Syria, which serves 460 000 people directly and another half a million indirectly via truck transport, has faced numerous deliberate disruptions as a result of Turkish occupation. In northwest Syria, substantial water infrastructure damage occurred in July, 2019, when eight facilities in the Al-Ma'ra district were attacked by Syrian Government forces, leaving a quarter of a million people without water[11].

Prolonged exposure to shelling and lack of access to drinking water forces people to use water from any source: puddles, pipes, open wells, filled open containers, etc. in the destroyed villages and cities of Ukraine, including Mariupol, is a well-known fact. All this can lead to the development of acute intestinal infections,

including cholera. There is a suspicion of cholera outbreaks in this city, but reliable data is not available due to the occupation.

The mechanism of cholera transmission is fecal-oral. This mechanism can be realized in several ways, and depending on the predominance of one or another way, cholera epidemics are distinguished as waterborne, contact, foodborne, and mixed. Mixed epidemics occur more often. In the case of waterborne cholera, there is a rapid increase in the incidence within a few days. Infection occurs when people swim in open water or consume infected water for drinking and other household needs. The number of cases depends on the degree of contamination of water bodies, the number of people using this water, and the effectiveness of anti-epidemic measures [12].

The WHO does not recommend quarantine measures or a ban on the movement of people and goods in the prevention of cholera. The few cases of cholera linked to imported food have involved food that belonged to individuals who traveled.

The WHO's recommendations for the public to prevent cholera (1992) have three basic rules:

- Heat food;
- Boil water;
- Wash your hands.

Preventive measures to prevent the further spread of cholera in the event of an outbreak in a particular area. Immediately after an outbreak is identified, the usual intervention strategy should aim to reduce mortality by providing rapid access to treatment and limiting the spread of the disease by disinfecting water, providing adequate sanitation, and conducting active health education to improve hygiene and safe food handling practices in individual communities, which are critical factors in reducing cholera.

Therefore, in order to minimize water loss in the body in case of lack of access to it and poisoning by substances contained in it (biological and toxic), the following rules should be followed:

- be sure to have and take a supply of water with you when moving to a bomb shelter, basement or other places;
- clothing should be adequate to the temperature and humidity conditions, it should not be too hot or too cold;
- if possible, reduce physical activity in the shelter or at home;
- boil water: in the absence of suspicion of infection with bacterial agents from the moment of boiling - 10 minutes, if such infection is suspected - 1 hour.
- if the supply of safe water is exhausted and there is no possibility of boiling, you can disinfect water with special tablets - Aquatabs, Aquacid, Pantocid and its variants, etc [13].

Some experts cite ways to purify water in extreme conditions using iodine drops, potassium permanganate, hydrogen peroxide, or hydroperite tablets, etc.

During a war, water is sometimes more important than food, any strategic actions, and ammunition, because it can be a source of much greater mass destruction than the military actions themselves, especially in the absence of access to medical care.

The search for options to reduce the spread of the disease has been ongoing throughout the history of the disease. Ukrainian scientists also did not stand aside.

In 1888, the Ukrainian microbiologist Mykola Fedorovych Gamaleya tested the safety of an oral vaccine made from killed vibrios, which he proposed for the prevention of cholera, on himself and his wife. Volodymyr Aronovych Khavkin, a bacteriologist and epidemiologist from Berdiansk and Odesa, a student of Ilya Ilyich Mechnikov, devoted much of his time to cholera research. The world owes him the introduction of the anti-cholera vaccine, which he tested on himself in 1892. Danylo Zabolotnyi, a Ukrainian microbiologist and epidemiologist, together with Ivan Savchenko, a pathologist and microbiologist, conducted a dangerous experiment in 1893. They drank a live culture of cholera vibrio after a preliminary test immunization to confirm the effectiveness of the oral vaccine.

According to WHO recommendations, in areas where cholera is endemic and where outbreaks are at risk, immunization with existing whole-cell killed oral cholera vaccines should only be used in combination with the usual recommended control measures. Vaccines provide only short-term protection while longer-term measures such as improved water and sanitation are being implemented.

Currently there are three WHO pre-qualified oral cholera vaccines (OCV): Dukoral®, Shanchol™, and Euvichol-Plus®. All three vaccines require two doses for full protection.

In October 2017, GTFCC partners launched a strategy for cholera control Ending Cholera: A global roadmap to 2030. The country led strategy aims to reduce cholera deaths by 90% and to eliminate cholera in as many as 20 countries by 2030. [14].

**Conclusions.** Cholera is a particularly dangerous infectious disease. It is characterized by rapid spread under appropriate conditions and in the absence of control of sanitary and epidemiological standards. Wars are accompanied by the destruction of critical infrastructure, which contributes to the use of unfit water for consumption. The inability to use safe water causes outbreaks of acute intestinal infections, including cholera. It is impossible to achieve a significant reduction in cholera outbreaks if armed conflicts continue on the planet.

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## DESCRIPTION OF CASES OF GENERALIZED TETANUS AND THE ROLE OF PREVENTION OF THIS DISEASE: A REVIEW.

### **Introduction:**

*Tetanus is a rare disease caused by anaerobic bacteria, Clostridium tetani causing painful muscle spasms and respiratory failure. This bacterium can enter the human body via a deep wound, burn injury or medical procedure. However, in addition to this, the following were described tetanus also originate from odontogenic infection.*

Tetanus is an illness that mainly affects the central and peripheral nervous systems. The clinical features of tetanus and its relationship to wounds and injuries are well known, dating back to ancient times. Clostridium tetani is an obligate anaerobe that produces a toxin found in soil and mammalian intestines. C. tetani transforms into a vegetative bacterium which then travels to the spinal cord and brainstem via the motor neurons. It then produces neurotoxin tetanospasmin, which interferes with the nervous system inhibitory neurotransmitters. C. tetani also produce tetanolysin, which has hemolytic properties and causes membrane damage. It's role is currently unknown.

Tetanus is now rare in developed nations due to effective immunization programs, but it remains a threat to all unvaccinated people, especially in undevel-

oped nations. Most reported cases are attributed to unvaccinated individuals and improper identification and treatment of wounds and traumatic injuries.

Tetanus has high morbidity and mortality worldwide before the development of tetanus toxoid. The first vaccine was not very effective and had significant adverse effects, but one of the next and safer options was used during World War II for soldiers, which led to a 95% reduction in tetanus rates. Nowadays, tetanus toxoid is considered the safest and most effective medicine in the world.

Tetanus prophylaxis includes understanding and knowing the current tetanus immunization guidelines, recommendations, and indications for prophylaxis.

The key to the prevention of tetanus is immunization, identification of those at risk, and proper identification and treatment of wounds and traumatic injuries.

Tetanus has four manifestations, including localized, generalized, cephalic, and neonatal:

- Localized tetanus often have localized muscle rigidity.
- Generalized tetanus often presents with trismus, dysphagia, and nuchal rigidity associated with systemic rigidity and tonic contractions.
- Cephalic tetanus may present with cranial nerve paralysis.
- Neonatal tetanus presents with an irritable infant and develops severe rigidity.

**How the pathogen works:** *C. tetani* enter the body through a break in the skin or mucous membranes. Once within the body and in anaerobic conditions, the bacteria travel to the spinal cord and brainstem within the motor neuron. It then produces highly potent neurotoxin tetanospasmin. The toxin enters inhibitory interneurons and blocks neurotransmission at the synapses. There is then inactivation of inhibitory neurotransmission that normally modulates anterior horn cells and muscle contraction. Loss of inhibition of anterior horn cells will cause increased muscle tone and painful spasms. Loss of inhibition of autonomic neurons will cause widespread autonomic instability, mainly manifests as sweating, tachycardia, and hypertension. These effects are long-lasting, and recovery requires the growth of a new nerve terminal.

The incubation period for tetanus ranges from three days to 21 days but usually starts about 8 days. Predisposing factors must be present with the absence of inadequate vaccination plus the following: penetrating or devitalizing type injuries, polymicrobial infections, missed foreign body in wounds or injuries, and any blood flow compromise. Approximately 25% with tetanus has no identifiable causes. Important! Tetanus rarely occurs in patients who are timely and properly receive immunizations.

**How the vaccine works:** Tetanus vaccine is a type of artificial active immunity. This type of immunity produces antibodies when a dead or weakened version of *C. tetani* is inoculated. Thereby, when there is actual exposure, the immune system will recognize the antigen and will rapidly produce antibodies. Antibodies wane over time, so periodic vaccines will be needed to boost the production of antibodies.

**The first case:** A 44-year-old man went to the hospital because he could not open his mouth. Initially, he felt well, but a week before his hospitalization he felt stiffness in his neck and jaw. He also complained of pain in the same area. These symptoms worsened over several days and he had difficulty swallowing. The patient denied fever, ear infection, neck pain, neck trauma, or external perforation wound. He was not taking any medications. He also denied a history of seizures. The doctors found that the patient often pokes his gums with a toothpick. He has not been vaccinated against tetanus and does not remember being vaccinated as a child.

General examination showed that the patient's vital signs were normal. He had neck stiffness and trismus. A routine blood test showed an increased activity of the liver enzyme aspartate aminotransferase (AST) up to 107 U/l. The patient was consulted in the Department of Oral and Maxillofacial Surgery, and an intraoral examination revealed poor oral hygiene and the presence of dental caries. In the right upper quadrant of

the oral cavity (teeth № 11, 12, 15 and 16), caries and chronic gingivitis were detected. There was no visible swelling in the neck and submandibular space.

The patient was diagnosed with tetanus, and based on the Ablett classification, he suffered from moderate severity of the disease. The patient was administered a single intramuscular dose of 3000 IU of human tetanus immunoglobulin (HTIG), two grams of ceftriaxone intravenously twice daily, 500 mg of metronidazole intravenously three times daily, five mg of midazolam/hour and 1 g of paracetamol three times daily. A nasogastric tube was placed to ensure fluid intake/feeding and prevent aspiration. Dental treatment was postponed until the trismus disappeared.

While in the hospital, the patient felt stiffness and rigidity in his abdomen, and on the third day of hospitalization he had one episode of generalized muscle spasm. His blood pressure also fluctuated between 140/90 and 110/70 mm Hg, and his heart rate was 70 and 90. Over the next six days, the trismus gradually weakened. The patient was able to open his mouth to eat a week after the start of treatment. After two weeks of hospitalization, the patient was discharged.

The patient's written informed consent was obtained for the publication of this report.

**The second case:** A 76-year-old married farmer from a rural area came to our ambulance with a seven day non-healing wound on the back of his left thigh that he had received after falling from a tree. The patient had no history of medical or surgical interventions. He also denied having any allergies. The patient did not smoke, but regularly drank alcohol.

On examination, a 3×2 cm purulent ulcer was found on the back of the left thigh. The emergency physician on duty examined the wound, treated it for suspected foreign body and bandaged it, and injected tetanus toxoid. If an infected wound was suspected, a wound swab was sent for culture and sensitivity. The patient was discharged taking oral Fluloxacillin, Metronidazole and analgesics and was advised to follow up in the outpatient department.

After being wounded, he sought treatment at a local medical center, where the wound was thoroughly cleaned and painkillers were given. There was a temporary relief of the pain, but it returned and gradually increased along with swelling and purulent discharge, which brought him to this center.

The next day, the patient went to the emergency department because his pain was not relieved by analgesics. The emergency room examination showed an increase in the number of white blood cells and the presence of purulent cells in the urine. He was discharged home, and was taking Ofloxacin in addition to the antibiotics he had been taking previously.

The patient was admitted to the emergency department again the same day with slurred speech and disorientation. On examination, he had plank-like abdominal rigidity, muscle spasms, and sardonic rhizosis. These symptoms were easily triggered by minor stimuli such as noise, light. During the neurological examination, bilateral plantar reflexes were decreased, but the jaw reflex was increased. With a serious suspicion of tetanus, the patient was hospitalized in the intensive care unit and started intravenous immunoglobulin (IVIG). The antibiotics were changed to Tazobactam-Piperacillin, Vancomycin, and Metronidazole.

A lumbar puncture was impossible due to a stiff back, and a CT scan of the head without contrast was normal. The patient was routinely intubated in anticipation of airway obstruction due to laryngeal and pharyngeal spasms. To relieve the pain and spasms, the patient was administered the sedatives Fentanyl and Midazolam. However, sedation alone was not enough to control the spasms, so he began taking the neuromuscular blocker Vecuronium via an infusion pump. A blood culture sent on admission came back with *Clostridium tetani* growth.

Over the next few days, the patient's kidney function deteriorated, and he underwent 4 sessions of hemodialysis. His hemoglobin also dropped to 3, and he received five units of packed red blood cells. The patient's family was counseled about the course of the disease and the required cost of treatment. Due to financial difficulties, the patient left the intensive care unit against the doctor's advice on the eighth day after hospitalization and died of the disease one day after discharge.

**Discussion:** Due to universal vaccination with tetanus toxoid, the incidence of tetanus has declined dramatically in resource-rich countries. In contrast to resource-rich countries, tetanus remains endemic in resource-poor countries. The true incidence is unknown, as in many countries the disease is not reported.

The World Health Organization's Maternal and Newborn Prevention Initiative has shown the elimination of neonatal tetanus in 45 countries. In addition, cases of generalized tetanus in adults are very rare, even in developing countries.

Tetanus is caused by the spore-forming bacterium *C. tetani*, which is found in soil contaminated with animal and human excrement under anaerobic conditions. *C. tetani* releases two toxins: tetanospasmin and tetanolysin. Tetanolysin can locally damage viable tissue surrounding the infection and optimize conditions for bacterial growth. Tetanospasmin is a powerful neurotoxin that causes skeletal muscle contraction or autonomic dysfunction. It is well known that trismus is the main characteristic and initial sign of tetanus before progressing to generalized spasm. In addition to trismus or closed jaw, a common early sign of tetanus is abdominal rigidity and generalized spasms, which are often triggered by sensory stimuli.

In these reports, the diagnosis of tetanus was made using clinical findings along with standard case definitions available on the official World Health Organization (WHO) website. The survival rate of tetanus patients is increased if they are treated in intensive care units in large institutions (the first case). The patient was treated with the best available resources, but financial constraints sometimes made it difficult to follow the latest treatment methods (the second case).

In a similar report (the second case), a 78-year-old man diagnosed with generalized tetanus recovered after twenty-two days in the MICU. Another case in Saudi Arabia survived after more than forty days in the intensive care unit after being diagnosed with tetanus.

Tetanus of odontogenic origin (the first case) is rare, but has been reported in several previous studies. To the best of our knowledge, only six cases of tetanus

associated with odontogenic infection have been reported in the last decade. The suspicion of tetanus was reinforced by the patient's history, according to which the patient frequently used a toothpick to poke his interdental gum, which may have predisposed him to an oral wound.

There are certain principles of treatment for tetanus, including wound care at the site of penetration, antimicrobial therapy of *C. tetani*, neutralization of unbound toxin, and symptomatic treatment aimed at muscle spasm and autonomic dysfunction. For an external wound, care should be taken to clean the wound to ensure an aerobic condition; however, for an odontogenic infection, treatment of a dental infection can be difficult due to trismus.

Tetanus is a vaccine-preventable disease. The focus should be on regular revaccinations for the general population to prevent tetanus. Although tetanus infections from intraoral sources are rare, practitioners should be aware of the possibility of tetanus infections, as the disease is potentially dangerous and associated with a high mortality rate. It is recommended to identify high-risk patients, recognize the clinical manifestations of tetanus, and refer cases immediately to the appropriate department to ensure a better prognosis.

**Inference:** Although tetanus is rare nowadays, cases of the disease still occur. Tetanus continues to cause significant mortality in developing countries. Approximately two out of every ten people in such countries will not survive. Tetanus does not confer any immunity; those who do survive must be actively immunized.

Complications are rare in developed countries, they occur due to non-vaccination, missed booster shots, and improper treatment of wounds and traumatic injuries. When tetanus is diagnosed, it is only supportive care and often too late with high morbidity and mortality.

Educating people is key to reducing vaccine-preventable diseases. Awareness of vaccination is low, and people depend on their healthcare providers to educate them on their recommendations.

Prevention of tetanus infection through tetanus prophylaxis depends on the intervention of specialists. Information can be collected by a dedicated team that includes emergency physicians, nurse practitioners, physician assistants, surgeons, nurses, and pharmacists about the patient's history and reasons for presenting to the clinic, office, or emergency department. This ensures that a patient who has risk factors for tetanus is prophylactically treated in a timely manner, thus preventing the disease.

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## HEPATITIS C: STATE OF THE ART, PROGRESS AND PROBLEMS DIAGNOSTICS AND TREATMENT.

### **Abstract**

*Hepatitis C virus (HCV) continues to pose a serious threat to public health, causing a significant burden both epidemiologically and clinically. New HCV infections are still occurring, especially in some of the poorest regions of the world where HCV is endemic and the long-term consequences carry a growing economic and health burden. Transmission by known parenteral routes is frequent; other routes of spread are less common and may represent latent, percutaneous dissemination.[2] After infection, most people apparently remain carriers of the virus, with varying degrees of hepatocyte damage and fibrosis. Chronic hepatitis can lead to cirrhosis and hepatocellular carcinoma. However, disease progression varies widely: from less than 2 years to cirrhosis in some patients to more than 30 years with only chronic hepatitis in others. There is still no vaccine against HCV despite years of research and discovery, but the variability of the virus and its ability to adapt are major challenges in vaccine development. In this review we discuss modern concepts of epidemiology, clinic, diagnosis, therapy and prevention of hepatitis C.[1]*

**Keywords:** *Hepatitis C virus diagnostics; hepatitis C virus epidemiology; hepatitis C virus vaccine; direct-acting antivirals; predictors of response to hepatitis C virus therapy.*

**HCV EPIDEMIOLOGY.** HCV has a single-stranded RNA and belongs to the family Flaviviridae. Its genome encodes the synthesis of structural (protein C, or so-called core protein), envelope (E1- and E2/NS1-glycoproteins) and non-structural (NS2, NS3, NS4, NS5) proteins. Today there are 11 genotypes of the virus, more than 100 subtypes and a large number of so-called quasi-species. The latter play a major role in the formation of treatment-resistant strains of the virus. Genotypes 1a, 1b, 2a, 2b, 2c and 3a account for more than 90% of all virus isolates obtained in North and South America, Europe, Russia, China, Japan, Australia and New Zealand. Genotypes 4, 5a and 6, respectively, are found in Central and Southern Africa, Southeast Asia. In Ukraine and other CIS countries, genotypes 1b (about 70%) and 3a predominate.[6]

**HCV PREVENTION.** Primary prevention of new infections and treatment of existing infections (secondary prevention) are fundamental approaches to controlling the HCV epidemic. As already noted, HCV is characterized by high genetic diversity and variability due to the lack of corrective activity of its polymerase. In addition, HCV is able to disrupt the CD4+ T cell response early in the infection and causes rapid immune depletion of CD8+ T cells as the infection progresses. Strategies for the development of a preventive HCV vaccine should take these aspects into account: in particular, an effective HCV vaccine should induce both a strong humoral immune response by inducing neutralizing antibodies targeting numerous conserved epitopes of B- and T-cells, and a cellular immune response by stimulating rapid activation of T helper 1 lymphocytes as well as CTL.

Several approaches have been adopted to develop an effective preventive HCV vaccine: they can be classified based on the targeted immunity (humoral immunity, cellular immunity, or both) or the strategy used (recombinant protein or viral peptide vaccines, virus-like particle-based vaccines, DNA/recombinant vaccines, DNA/viral vector-based vaccines). DNA vaccines have the advantage of inducing cytotoxic lymphocyte responses; however, the induced immunity is often short-lived, weak and unlikely to be effective in preventing infections. Adenoviral vectors have shown the most promising results in inducing strong and broad CD4+ and CD8+ T cell responses. Vaccine strategies based on these vectors reduce peak viremia and induce protection against chronic infection in primates, but do not prevent primary HCV infection.[1]

### **DIAGNOSTIC TOOLS IN HCV INFECTION**

**Serological tests.** Detection of anti-HCV antibodies: Several enzyme-linked immunosorbent assays (ELISAs), microparticle ELISAs, and chemiluminescent immunosorbent assays have been developed for the detection of anti-HCV antibodies. Currently, assays that include core antigens and recombinant antigens from NS3, NS4 and NS5 regions in the solid phase are widely used.

Avidity assays used to distinguish between primary and chronic or relapsing viral infection in many other diseases have also been tested in HCV infection. Although these assays can sometimes be useful for estimating the time of HCV infection after the onset of symptoms, they are nevertheless of low utility in clinical practice.[2]

The CDC currently recommends the use of an approved screening test, either ELISA or rapid test, and the use of another assay to confirm a positive result as a true positive.

**Detection of HCV antigen:** In addition to the previously described tests that allow simultaneous detection of antigens and antibodies, assays have also been developed to detect HCV core antigen alone. Automated quantitative chemiluminescent immunoassays are now available with sensitivities and specificities of 80% to 99% and 96% to 99%, respectively. Several studies have demonstrated that the test can equally detect and quantify all genotypes and that HCV core antigen quantification shows good correlation with HCV RNA levels.

**Molecular tests.** Detection of HCV RNA: HCV RNA is detected in plasma and serum 1-3 weeks after infection, approximately 1 month before the appearance of anti-HCV antibodies, and is a sign of ongoing viral replication. Nucleic acid testing (NAT), used to detect and quantify HCV RNA, is the gold standard for HCV diagnosis and can be performed by polymerase chain reaction (PCR), branched DNA (bDNA) signal amplification and transcription-mediated amplification. Currently, all NTCs for HCV RNA detection and quantification are standardized using the WHO International Standard, and HCV RNA results are expressed in International Units (IU/ml).[1]

**Determination of HCV genotype:** HCV genotype, together with baseline HCV RNA levels, is considered the main predictor of SVR to antiviral therapy. In clinical practice, HCV genotype can be assessed by commercially available methods based on real-time PCR using genotype-specific probes/primers, semi-automated sequencing, and automated reverse hybridization that analyze the 5' NC region of the HCV genome, which is the most conserved region. However, analysis of the 5' NC region can lead to errors in subtype attribution, as it is not the most suitable for distinguishing subtypes. For this reason, a new version of automated reverse hybridization, the most commonly used method, analyzes both the 5' NC as well as the core region. The gold standard of genotyping is the sequencing of the NS5B region, which is able to accurately determine the genotype, with the advantage that the resulting sequence can be used for phylogenetic analysis for epidemiological purposes.[5]

**NEW THERAPEUTIC ERA.** To date and for many years, the peg-IFN/RBV combination, capable of eliminating the virus in approximately 50% of treated patients, has characterized the standard of care (SOC) for chronic hepatitis C virus (HCV). The recent development and availability of new molecules called DAAs are expanding the options for HCV therapy.[2]

Currently, only TVR and BOC, the first two NS3 protease inhibitors, are available and approved for use in Europe in combination with SOC in chronically infected patients with HCV genotype 1. Both drugs are linear ketoamide molecules that act on the catalytic site of the NS3/4A protease, blocking the release of HCV NS proteins required for the assembly of the viral replication complex.[4]

The efficacy of TVR and BOC was evaluated in phase III clinical trials. In total, two studies were conducted for each of them: in naïve patients with chronic HCV (advance for TVR and sprint 2 for BOC) and in patients with SOC treatment experience who failed treatment (realize for TVR and respond 2 for BOC). All these studies demonstrated a significant improvement in PFS with DAA compared to SOC.[7]

**CONCLUSIONS.** Hepatitis C virus (HCV) is an RNA virus that is distantly related to flaviviruses and pestiviruses. The viral genome is a linear positive-sense RNA molecule about 9.4 kilobases long. It has a single large open reading frame that encodes a polypeptide precursor of approximately 3000 amino acids. Viral isolates from different geographic regions show considerable genetic diversity; in addition, different HCV genotypes can coexist in infected individuals.[3]

HCV infection can be detected in serum by measuring HCV antibodies or by direct measurement of HCV RNA in the blood. HCV RNA measurement is the most sensitive of the currently available tests and allows for specific diagnosis in the early acute phase of infection.

Hepatitis C virus (HCV) remains a global public health problem, despite the fact that more than 95% of infections can be cured with direct-acting antiviral treatment. Resolution of viremia after antiviral therapy does not lead to protective immunity, and therefore reinfections can occur.[8]

The rapidly evolving field of DAAs is moving towards the development of interferon-free regimens with higher CER and pangenotypic activity and less susceptibility to side effects. However, the emergence of RAV remains an important problem.

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## CLINICAL, LABORATORY AND RADIOLOGICAL FEATURES OF BACTERIAL PNEUMONIA OF VARIOUS ETIOLOGIES IN PRESCHOOL CHILDREN

### **Abstract.**

*Despite the undeniable success of modern medicine in terms of instrumental and laboratory methods in the diagnosis of pneumonia, the issue of clinical diagnosis remains relevant. This study presents data on the clinical, laboratory and radiological features of pneumonia caused by various pathogens in children aged 1 to 6 years of age.*

**Keywords:** bacterial pneumonia, etiology, children

**Introduction.** Today, community-acquired pneumonia (CAP) in children is one of the leading health problems in the world.

Community-acquired pneumonia is an acute non-specific inflammation of the lung tissue, namely the respiratory system, based on infectious toxicosis, respiratory failure, water and electrolyte and other metabolic disorders with pathological changes in all organs and systems. The prerequisite is the immunological and functional, as well as anatomical immaturity of the child's body, and, in turn, a wide range of pathogens. [1-3]

The World Health Organization (WHO) estimates that lower respiratory tract infections (including 90% of pneumonia) cause about 20% of deaths among children under five worldwide, which according to the United Nations Children's Fund, is about 3 million. According to statistics, pneumonia most often affects children living in countries with limited resources. In Central and Northern Europe, approximately 300 out of 100,000 children and adolescents aged 0-16 years suffer from pneumonia every year.[4-7] The most common causes of infectious genesis of CAP in children are Streptococcus pneumoniae, Mycoplasma pneumoniae and Chlamydia pneumoniae. [8] CAP can be prevented by immunization, adequate nutrition and elimination of environmental factors, and the basis for successful treatment of pneumonia is the appointment of rational etiotropic therapy, namely such groups of antibiotics as: semi-synthetic penicillins, semi-synthetic penicillins with clavulanic acid, cephalosporins, macrolides, aminoglycosides of II-III generations; expectorants, antihistamines and antipyretics.[9-11]

**Objective.** To determine the clinical, laboratory and radiological features of pneumonia caused by pneumococcus, chlamydia and mycoplasma in children aged 1 to 6 years.

**Materials and methods.** We analyzed 57 clinical cases of community-acquired pneumonia caused by

such pathogens as Streptococcus pneumoniae, Mycoplasma pneumoniae and Chlamydia pneumoniae in children from 10 months to 6 years old who were treated in the Chernivtsi Regional Children's Clinical Hospital in 2013-2018. Group I included patients with chlamydial pneumonia (n=22), group II - with mycoplasma pneumonia (n=19), and group III - pneumococcal etiology (n=16). For the etiologic interpretation of pneumonia, enzyme-linked immunosorbent assay and culture method were used.

**Results and discussion.** In the vast majority of cases, the disease began acutely with the development of fever (in 79% of children in group I, 70.3% in group II and 75.8% in group III), cough (in all subjects in group I, 84.8% in group II, and 86.2% in group III). At the onset of the disease, cough was mostly nonproductive (in 73.7% of cases in group I, 70.7% in group II, and 56.7% in group III). Some children had complaints of breathing difficulties due to bronchial obstruction (22.7% of patients in group I, 18% in group II and 33.5% in group III). A quarter of all patients on admission to inpatient treatment had a severe condition due to respiratory failure and intoxication syndrome (14.5% in group I, 24.7% in group II, and 42.3% in group III). At the time of admission, wheezing was absent in children of group III (35%) compared to groups I (19%) and II (26.8%). The majority of patients had leukocytosis, a left shift in the leukocyte count, lymphopenia, and an accelerated ESR in the complete blood count. According to the X-ray examination, focal forms of pneumonia prevailed in groups I and II (62% and 58%, respectively), and focal and draining forms in group II (59.8%).

**Conclusions.** At present, it is difficult to differentiate the clinical picture of CAP caused by pneumococcus, mycoplasma and chlamydia in children under 6 years of age. Pneumococcal pneumonia is more often more severe than mycoplasma and chlamydia pneumo-

nia and is accompanied by the development of bronchial obstruction. In contrast to atypical pneumonia, pneumococcal pneumonia is characterized by more pronounced inflammatory changes in the complete blood count, such as leukocytosis, neutrophilia, and an accelerated ESR. The most common morphologic form of pneumococcal pneumonia is focal and focal-fluid, and mycoplasma and chlamydial pneumonia is focal.

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## VIRAL HEPATITIS D: ETIOLOGY, EPIDEMIOLOGY, PATHOGENESIS, CLINIC, TREATMENT, DIAGNOSIS AND PREVENTION

### **Abstract.**

*Today, chronic hepatitis is one of the most important problems in modern gastroenterology. Every year, more than 1 million people die from chronic liver disease and its complications. Timely diagnosis, treatment and prevention can prevent the progression of the disease, the development of complications, liver fibrosis and cirrhosis and, accordingly, reduce the percentage of fatalities.*

*Hepatitis D is the most severe form of viral hepatitis with rapid progression to cirrhosis, increased risk of hepatocellular carcinoma and mortality compared to hepatitis B mono-infection.*

**Key words.:** *Hepatitis D, relevance, prevention.*

### **Etiology.**

Hepatitis D virus (HDV) occupies an intermediate position between viruses and viroids. HDV is a small (35-37 nm in diameter) RNA-containing virus discovered in 1977 [ 5 , 17 ]. It does not have its own outer envelope. HDV contains a nucleus with a single-stranded RNA of negative polarity. The virion is defective because it requires the hepatitis B surface antigen (HBsAg) for infection [ 18 ]. The outer

envelope is composed of HBsAg of the hepatitis B virus. Therefore, HDV cannot exist without HBV, because it needs it as a source of HBsAg. HBsAg serves as a coat protein, allowing HDV to enter hepatocytes [19]. Both HBV and HDV bind to heparan sulfate proteoglycans for adsorption to hepatocytes [20] and use the sodium taurocholate cotransporter polypeptide receptor to enter cells [19].

Hepatitis D virus RNA is a small genome consisting of 1700 nucleotides [7]. There are two hepatitis delta antigens (HDAg): small HDAg (24 kDa) and large HDAg (27 kDa), which is 214 amino acids long. Small HDAg accelerates genome synthesis, while large HDAg inhibits HDV RNA synthesis but is required for virion morphogenesis [7].

Eight different genotypes of IOP have been identified [15,21]. The geographical distribution of IOP genotypes has changed over time, most likely due to human migration. Currently, genotype 1 is the most common and predominant genotype in Europe and North America. Genotype 2 was previously restricted to Asia, but has now appeared in the Middle East, including Iran and Egypt. Genotype 3 is mainly found in the Amazon basin in South America. Genotype 4 is mainly found in Taiwan, China and Japan. Meanwhile, genotypes 5, 6, 7 and 8 have traditionally been found only in Africa, but recent reports describe the migration of genotypes 5, 6 and 7 to different parts of Europe. However, Central Africa is considered to be the main site of IHD diversification with the presence of genotypes 1, 5, 6, 7 and 8. It is well known that the specificity of the IHD genotype affects clinical outcomes. Genotype 3 of IHD is the most pathogenic of all IHD genotypes. It has been shown that patients with genotype 1 of IHD have lower remission rates, more aggressive disease and worse outcomes than patients with genotype 2 of IHD [6,15,16].

The core of HDV is an HD-Ag of protein nature. HDV is resistant to high temperatures, acids, UV light, but sensitive to alkalis. Repeated freezing and reflow do not affect its activity [7].

#### **Epidemiology.**

IHD is described as the most severe form of viral hepatitis with progression to cirrhosis in 10-15% of patients within 2 years and in 70-80% of patients within 5-10 years [6]. It is estimated that hepatitis delta virus (HDV) coinfection occurs in approximately 5-10.6% of patients with chronic hepatitis B virus (HBV) infection, affecting up to 72 million people worldwide [1-4]. The prevalence of HDV infection is believed to be increasing in many parts of the world due to increased injecting drug use, sexual transmission, and immigration from high endemic areas [3, 5-8,12].

The main source of infection is patients with acute or chronic hepatitis D. The mechanism of transmission is hemocontact, and the main route of transmission is parenteral, mainly through the blood [9]. People who have not had hepatitis B and people with chronic HBV infection are susceptible to HDV. The risk of infection is especially high in regular recipients of donated blood and its products (haemophiliacs), frequently ill people receiving parenteral treatment, injecting drug users, etc. Transplacental transmission is possible, especially in HBe-positive mothers infected with HDV. Perinatal transmission is rare, but the development of HBV and HDV coinfection in newborns is possible. Sexual transmission is also possible. People who are immune to hepatitis B (anti-HBs are detected in the blood) are not susceptible to HDV [18].

#### **Pathogenesis.**

The development of the pathological process in hepatitis D is possible only in the presence of HBV. Infection with HDV occurs simultaneously (or together) with HBV.

There are two possible ways of getting infected:

- Co-infection - when a healthy person becomes infected.

- Superinfection - when a person with acute hepatitis B or chronic HBV infection becomes infected.

From the blood, HDV enters hepatocytes and localises in the nucleus. Here, HDV RNA replicates in the hepatocyte cytoplasm and HBsAg is synthesised. As a result, new HDV virions are formed, which infect healthy hepatocytes. HDV also inhibits HBV replication by using HBsAg[6,13].

If it is a coinfection, then the plastic material (HBsAg) is exhausted over a certain period of time and the formation of new HDV virions stops. In case of coinfection, hepatitis D in most cases has an acute course with a high probability of HDV elimination from the body and recovery[13].

If it is a superinfection, then large amounts of HBsAg are constantly produced in the liver cells. As a result, a fairly large number of new HDVs are formed. With a pronounced cytopathic effect, HDV causes severe liver damage with possible parenchymal necrosis. In case of superinfection, hepatitis D has a severe course with frequent development of fulminant forms of the disease. In the case of chronic hepatitis D, the pathological process is highly active and cirrhosis occurs very quickly. There is no immune response to HD. Antibodies to HDV appear late. IgM on the 1st-15th day of the disease, IgG on the 5th-9th week [13].

#### **Clinical picture and typical course of the disease:**

Simultaneous acute infection with hepatitis B and hepatitis D (coinfection) is known as hepatitis B. Therefore, the symptoms of hepatitis D are similar to those of hepatitis B:

- yellowing of the skin and eye sclera (jaundice);
- darkening of urine;
- discoloured faeces;
- digestive disorders;
- pain in the liver (in the right hypochondrium);
- nausea, vomiting;
- increased fatigue;
- loss of appetite;
- arthralgia (joint pain);
- fever (prolonged increase in body temperature);
- skin rashes.

These signs usually appear 3-7 weeks after the initial infection [28,31].

HDV (hepatitis D) superinfection accelerates the development of cirrhosis - it develops almost 10 years earlier compared to patients with chronic HBV (hepatitis B virus) monoinfection, despite the fact that HDV inhibits HBV replication [23,35].

Chronic HBV is defined as the presence of infection for more than 6 months. The clinical course of the disease may be asymptomatic, and patients may present with nonspecific symptoms of fatigue, malaise and anorexia [32,22]. Three distinct chronic HBV/HCV types have been described. Most patients will have

predominantly HBV replication with suppressed HBV replication and negative HBeAg levels. A similar phenomenon is also observed in hepatitis C and D virus infected patients, in which the hepatitis D virus suppresses hepatitis C virus replication [25,30].

The period of remission of chronic hepatitis D:

1. No complaints. Signs of the disease are detected only by the results of histological examination of liver biopsies - a 2-fold decrease in the histological activity index and the absence of further fibrosis;

2. Absence of replication markers (HBeAg, HDV DNA, anti-HDcor IgM) for 6 months;

3. ALat and AsAt levels are normal [38,26].

#### **Diagnosis of viral hepatitis D:**

Diagnosis and treatment of acute hepatitis B and D is performed by an infectious disease specialist, and chronic hepatitis by a hepatologist or gastroenterologist. The diagnosis is made on the basis of the clinic, medical history, and laboratory tests [24, 27].

The main method of diagnosis of hepatitis D virus is the detection of high titres of immunoglobulin G (IgG) and immunoglobulin M (IgM) to HDV, and is confirmed by detection of HDV RNA in the serum by polymerase chain reaction (PCR). IgM persists for about 6 weeks (exceptionally, 12), after which it is replaced by IgG antibodies. HBsAg is detected in low titres or is undetectable (suppression by hepatitis D virus, often also true for IgM anti-HBc antibodies) [29,33]. In superinfections, IgM anti-HDV antibodies are present, which are later replaced by IgG. If chronic HDV infection is associated with active hepatitis, then anti-HDV IgM antibodies persist in the blood. People who have been cured of HDV infection retain IgG antibodies.

The necessary research methods include general clinical tests (complete blood count, urinalysis, biochemical analysis, coagulogram) to determine the degree of liver damage and identify complications. There is an increase in ESR with high activity of the inflammatory process; dysproteinemia with moderate and high activity of the CHB; increased ALT, AST, GGT, ALP, total bilirubin and its fractions, total cholesterol in cholestasis syndrome, thymol test; decreased T-lymphocytes, increased levels of immunoglobulins, circulating immune complexes, mainly with high and moderate activity of the process [36,37].

Ultrasound examination of the liver is also performed, which shows compaction of the liver parenchyma, intrahepatic bile ducts and liver vessel walls; radioisotope studies (bilyscintigraphy) - a decrease in the hepatic capture index, the percentage of accumulated RFP, a decrease in the retention rate of RFP in the blood; conjunctival biomicroscopy - the presence of vascular, intravascular, extravascular disorders that correspond to the degree of liver damage. Liver biopsy - performed to determine the progression of the disease [34].

#### **Basic principles of treatment:**

- proper, balanced nutrition;
- limiting medication intake;

- elimination of factors that can provoke exacerbations (insolation, frequent respiratory diseases, contact with toxic substances);

- drug therapy:

1. alpha-interferons (Intron A, Laferon, etc.) - 5-6 MMU/sq.m 3 times a week for 6-12 months or lamivudine (for children from 3 months to 12 years - 3 mg/kg body weight 2 times a day, but not more than 100 mg/day).

2. Sorbents (enterosgel, otonil, etc. for 7 days) in age-appropriate doses;

3. Antioxidants - ayevit, unithiol 5% solution at the rate of 5 mg/kg body weight for 10-14 days twice a year (D).

4. Dufalac (lactulose)

5. Hepatoprotectors and drugs that improve bile secretion (Antral, Milk Thistle, Carsil, Glutargin, Essentiale, Darcil)

6. Prebiotics, probiotics (according to indications, 3 weeks - 3-4 times a year).

The goal of treatment is complete eradication of HDV, elimination of the active inflammatory process in the liver, and prevention of progression and development of complications [24].

#### **Differential diagnosis is carried out with the following diseases:**

- exacerbation of chronic hepatitis;
- toxic liver damage (drug, alcohol);
- cirrhosis of the liver;
- autoimmune hepatitis;
- non-alcoholic steatohepatitis;
- acute liver ischaemia [33].

#### **Prevention of the spread of hepatitis D:**

A specific method of preventing hepatitis D is vaccination against hepatitis B.

Nonspecific prevention methods include:

- use of sterile instruments during cosmetic procedures;
- compliance with the rules of asepsis and antisepsis in medical institutions;
- compliance with personal hygiene rules;
- use of barrier methods of contraception during sexual intercourse;
- refusal from drugs;
- avoiding casual sex;
- use of sterile injection equipment [37].

In case of untimely and improper treatment, a number of complications arise: liver cirrhosis, liver cancer, hepatic coma, biliary tract pathology, and death.

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## DIPHTHERIA AND ITS CHANGING EPIDEMIOLOGY

### **Abstract:**

*In 1999, in an article published in La Revue de Médecine Interne, it was mentioned that in 1997 two epidemics arose in Algeria and Independent States Community [1]. And as it is not so far from Europe we must attach great importance to this in order to prevent the spread of infection in time. In particular, we should pay attention to the fact that imported cases were diagnosed in neighboring European countries, which is evidence of the ability of the infection to spread quickly. Also, it is important that since 1997 there has been significant progress in modern technologies, as well as in the field of tourism, which leads us to think about a faster spread of the infection.*

**Keywords:** *Diphtheria; Corynebacterium diphtheria; Epidemiology; Infectious disease outbreaks; Cases among migrants.*

### **Introduction**

Diphtheria is an infection caused by *Corynebacterium* species, especially *Corynebacterium diphtheria*. It causes skin lesions and mucosal infection and can rarely cause focal infection. The course of the infectious process of *C. diphtheria* infection is influenced by the anatomic site of lesions, the immune status of the human organism, and the production and systemic distribution of toxins [2].

Diphtheria is a toxin-mediated infection and it is an important and potentially fatal threat to patients. Nowadays during the current dramatic influx of refugees into Europe, our objective is to control and prevent the prevalence of infection.

### **Results**

In fact, in 2017, nearly 8,819 cases of diphtheria were reported worldwide, the most since 2004 [9].

One of the studies describes observations on the spread of an infection brought into the country. In this case, we are talking about an outbreak of imported diphtheria with *Corynebacterium diphtheriae* among migrants arriving in Germany [3].

In 2018, WHO recorded 16,611 new recorded cases of diphtheria. Outbreaks of respiratory diphtheria have been reported in several countries, including Nigeria in 2011 and India during 2010–2016. Refugee resettlement centers (such as Bangladesh) are highly vulnerable, with an increase in diphtheria cases and asymptomatic carriers due to the low availability of public health services. Between 2015 and 2018,

diphtheria outbreaks occurred in Haiti, Venezuela, and Yemen due to socioeconomic crisis or war, resulting in poor access to health care and vaccination [4].

It has been a significant increase in cases of imported, mainly cutaneous, diphtheria caused by toxigenic *Corynebacterium diphtheriae* among migrants who have recently arrived in Germany since the end of July 2022. Other European countries also have reported similar cases. The list of countries includes Austria, Belgium, France, Norway, Switzerland, and the United Kingdom. One of the researches describes the first epidemiological data officially registered in Germany between 1 January and 30 September 2022. It was noted a total of 44 such cases [3].

### **Causes of spread**

Toxigenic *C. diphtheriae*-associated wound infections are currently observed more frequently in Europe. This is because refugees travel in poor hygienic conditions. It is often possible to observe that only a few patients received the vaccination. [4].

Talking about the general epidemiology of diphtheria, many studies show us the following analysis, according to which the average incubation period is 1.4 days. On average, untreated cases are colonized within 18.5 days, and 95% are cleared of *Corynebacterium diphtheriae* within 48 days. Asymptomatic carriers cause 76% fewer cases of infection than symptomatic cases. Receiving 3 doses of diphtheria toxoid vaccine is 87% effective against symptomatic disease and reduces transmission by 60%.

Vaccinated individuals can be colonized and transmitted; this fact tells us that vaccination alone can interrupt transmission in only 28% of outbreaks, making isolation and antibiotics necessary. Although antibiotics shorten the duration of infection, they must be combined with diphtheria antitoxin to reduce morbidity [5].

Various studies describe the statistical data of different countries. This indicates that the prevalence of this infectious disease may increase if prevention is not followed.

Also, in this work, we considered one interesting case of a diphtheria outbreak.

In 2016, Venezuela faced a major diphtheria outbreak that continued till 2019. From November 2017 to November 2018, nasopharyngeal or oropharyngeal specimens were obtained from 51 suspected cases, and retrospective data from 348 clinical records were taken from 14 hospitals between November 2017 and November 2018 [6].

The given statistical data show that patients between the ages of 10 and 19 were mostly affected. The case fatality rate (CFR) was higher among men (19.4%) than in women (15.8%). The highest CFR (31.1%) was observed among patients under the age of 5 years, followed by the age group 40 to 49 years (25.0%).

The recurrence and duration of this outbreak suggest problems with vaccination coverage and an inadequate control strategy.

The CDC also reports that the United States has achieved a high level of prevention and control of diphtheria. Proof of this is the fact that from 1996 to 2018, there were 14 reported cases of diphtheria in the United States, an average of less than 1 per year. One fatal case occurred in a 63-year-old man returning to the United States from a country with endemic diphtheria [7].

It is impossible to mention that 63 cases of diphtheria were reported to the ECDC in 2018; 62 due to toxigenic *Corynebacterium diphtheriae* or *C. ulcerans* and one case with an unknown pathogen. The highest proportion of *C. ulcerans* cases was among adults 65 years and older, while *C. diphtheriae* cases were more common in younger age groups. Among the cases of *C. diphtheriae*, 60% were imported. High vaccination coverage is critical to preventing diphtheria [8].

**Conclusion:** To make a conclusion, it is important to say that implementation of case-based diphtheria surveillance, combined with the availability of subnational coverage data, will lead to a better understanding of diphtheria epidemiology and enhanced opportunities for prophylaxis and response to outbreaks. A 2017 analysis of diphtheria diagnostic capacity gaps in the European Union identified significant gaps, including the lack of sufficient laboratory systems with toxigenicity assays, difficulties in obtaining primary culture media, and problems in obtaining diphtheria antitoxin for both laboratory diagnosis and clinical use treatment of cases [9].

Currently, it is very important to arrange the logistics and delivery of the vaccine to the country to be sure that all children will be vaccinated according to

the calendar. It is also important to conduct educational work among the population and skillfully convey all the risks of refusing vaccination.

Prevention of diphtheria is one of the most important ways to prevent the development and spread of infection.

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