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Content

Historical sciences

"AVOIDING THE RISKS OF RESISTANCE": THE CZECHOSLOVAKS IN WORLD WAR II

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«УНИКНЕННЯ РИЗИКІВ ОПОРУ»: ЧЕХОСЛОВАКИ В ДРУГІЙ СВІТОВІЙ ВІЙНІ

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Abstract

The article examines the peculiarities of the struggle of Czechoslovak citizens against the German occupation during the Second World War. The author emphasizes the pragmatic way of life and the avoidance of the risk of resistance and repression during the German occupation, which is associated with the conscious choice of "rational" and "logical" policy by the emigration government in London and the neglect of the stable and inviolable principles of protecting the homeland in the face of the threat of extinction. A comparison is made with the anti-fascist position of Slovakia, where a few groups opposed participation in the war, the establishment of an authoritarian regime, dependence on Germany, etc. The Slovak Resistance movement culminated in the Slovak National Uprising in 1944. The uprising played an important role in history. It is concluded that the policy of Czechoslovak elites during World War II led to integration into the Soviet security structure and political system.

Анотація

У статті вивчено особливості боротьби громадян Чехословаччини проти німецької окупації в роки Другої світової війни. Наголошено на прагматичному способі життя й уникненні ризику опору та репресій під час німецької окупації, яку пов'язано із свідомим обранням «раціональної» та «логічної» політики еміграційним урядом у Лондоні й знехтуванням стійкими і непорушними принципами захисту вітчизни перед загрозою зникнення. Здійснено порівняння з антифашистською позицією Словаччини, у якій нечисленні групи виступали проти участі у війні, встановленні авторитарного режиму, залежності від Німеччини тощо. Апогеєм словацького руху Опору було Словацьке національне повстання 1944 року. Повстання увійшло в історію як визначна подія. Зроблено висновок, що політика чехословацьких еліт в роки Другої світової війни спричинила інтеграцію до радянської структури безпеки та політичної системи.

Keywords: *World War II, Munich Agreement, Czech anti-fascist struggle, Slovak National Uprising, policy of Czechoslovak elites.*

Ключові слова: *Друга світова війна, Мюнхенська угода, чеська антифашистська боротьба, Словацьке національне повстання, політика чехословацьких еліт.*

Друга світова війна певною мірою була продовженням Великої Війни, принаймні у частині причин її початку – розподіл територій між державами при відсутності ефективної системи колективної безпеки. Первинну небезпеку становила Німеччина, але також Радянський Союз, який мав свої територіальні наміри щодо західноукраїнських і західнобілоруських земель та Бессарабії. З територіальними претензіями на Балканах і Північній Африці виступав фашистський уряд Італії. І, нарешті, на Далекому Сході імперські плани плекала Японія.

В особливо складній ситуації опинилася Центрально-Східна Європа. Мала Антанта розпалася. Німеччина та Італія висунули територіальні вимоги до низки країн регіону. В одиннадцяти поневолених країнах Європи встановився «новий порядок». Суверенітет країн було ліквідовано, адміністрування здійснювали окупаційні органи із залученими колаборантами, ліквідовано політичні свободи, економіки стали на військові рейки задля поповнення ресурсу ведення війни, повсюдно використовувалася підневільна праця.

Більшість народів «новий порядок» сприймали негативно. Створені еміграційні уряди Польщі, Чехословаччини, Югославії, Греції орієнтували своїх громадян на пасивний опір. Навіть широко розгорнутий в другій половині війни польський та югославський рухи Опору не вели активної боротьби. Першими елементами непокори було видання газет, листівок та ін., що підтримували дух людей в окупації. Множилися акти саботажу в промисловості і на транспорті. Населення надавало посильну допомогу потребуючим – військовополоненим, євреям тощо. Збройну боротьбу на окупованих територіях розпочали громадяни різних суспільних верств. У країнах Центрально-Східної Європи ширився повномасштабний рух Опору.

Воєнний досвід чехословаків був особливим, принаймні, цілком відмінний від польського, щоправда їх доля після Другої світової війни склалася подібно. В той час, як поляки в 1939 році воювали проти німців, чехословацький режим капітулював у 1938 році, хоча його шанси змагання з німецькими територіальними претензіями були кращими. Чехи, переміщені до своєї нейтральної зони поза межі досяжності британських і американських бомбардувань, одержували засоби на життя, працюючи на німецьких промислових підприємствах, дотримувалися прагматичного, спокійного способу життя і уникали ризику опору та репресій. Загалом тільки чеські євреї та інтелігенція зазнавали переслідувань. У той час як польський емігрантський уряд викликав обурення Сталіна, виступивши проти його претензій на територію Польщі, чехословацький емігрантський уряд[1], що також перебував у Лондоні, догоджав і підлещувався до нього. Чехословаччина нічого не виграла від цього підлабузництва, а кінець-кінцем, була інтегрована до радянської структури безпеки та її політичної системи.

Чехословаччина увійшла передмюнхенську кризу літа 1938 року з досить хорошими економічними й військовими козирями [3, с. 23–34]. В конституційному і політичному відношенні уряд мав міцну підтримку в демократично обраному парламенті і серед чеської громадськості. Можна припускати, що лідери судетської німецької меншості були тоді під упливом бунтарських настроїв і лояльних настроїв багатьох словацьких лідерів виглядала сумнівною. Але чеська нація послідовно йшла назустріч критичному літу 1938 року [4, с. 97–101]. Її військовий істеблішмент був цілком компетентний і професійний. Гітлер, уже під час війни відзначав, що лише його рейх і Чехословаччина готувалися до війни. А на післявоєнному Нюнберзькому процесі над головним нацистськими військовими злочинцями фельдмаршали Вільгельм Кейтель та Еріх фон Манштейн підтвердили, що в 1938 році чехословацькі фортифікаційні споруди могли вчинити серйозний опір вермахту [5, с. 46]. Тож капітуляція Бенеша в Мюнхені, за яку він ніколи не брав на себе відповідальності, а звинувачував виключно великі держави, була не наслідком розсудливого розрахунку у зв'язку з військовою і політичною нерівністю, а глибоким падінням в політичному і психологічному відношенні. Справа в тому, що керівництво країни мало б мати стійкі, непорушні принципи, що визначають навіть більше в моральному долю майбутніх поколінь, принципи, якими лідери навіть невеликих держав не можуть із міркувань «раціональності» або «логіки» поступатися перед своїми великодержавними патронами, не йдучи на компроміс зі своєю совістю. Джозеф Ротшильд, описуючи міжвоєнну політику першої Чехословацької республіки звернув увагу на суб'єктивний фактор у чехословацькій політиці, вочевидь ця риса зіграла злий жарт напередодні Другої світової війни.

У результаті Мюнхенської конференції Чехословаччина зазнала величезних втрат територіально і ресурсно на користь Німеччини, Угорщини та Польщі [6, p. 97–102]. Країна позбулася трьох десятих своєї території, одну третину людності і чотири десятих національного доходу [1, с. 167]. Країна перестала бути економічно і стратегічно життєздатною. Левова частка втрат пішла у Німеччину, але поживилися також Польща та Угорщина, які висунули свої територіальні претензії. Польща відплатила за шантаж 1920 року, захопивни Тєшин (Цєшин) після 24-годинного ультиматуму 30 вересня 1938 року. Угорщина

[1] *Тимчасовий уряд у вигнанні створив президент довоєнної Чехословаччини Едвард Бенеш у Парижі, у жовтні 1939 року, в 1940 році перемістився у Лондон і був законним урядом Чехословаччини продовж її окупації в Другій світовій війні [2, с. 181–186].*

отримала південні долини Словаччини та Закарпаття з рук Німеччини та Італії, які виступили в ролі арбітрів 2 листопада. Хоча приводом розчленування була етнічна справедливість, виявилося, що майже п'ять мільйонів людей, переданих під німецьку, польську та угорську юрисдикцію лишилися у поділеній країні. Цей факт яскраво свідчить наскільки важко встановити справедливі кордони за етнічним принципом в Центрально-Східній Європі [1, с. 168].

Ці втрати було повернуто наприкінці Другої світової війни. Більш глибшою (і менш виліковною) була не матеріальна, а психологічна шкода, якою скористався Радянський Союз і місцеві комуністи. Віра народу в довоєнну міжнародну систему і його власних лідерів біла підірвана; мораль еліти – уражена. В цій психологічній травми уможливили комуністам прихід до влади після завершення війни.

Бенеш покинув пост президента 5 жовтня, а 22 жовтня 1938 року виїхав із країни [7, p. 181–186]. Французький уряд відмовився від контактів із Бенешем, тому він відбув у Велику Британію; уряд цієї країни також досить довго тримав його на відстані. У країні пост президента посів 66-річний Еміл Гаха [8, p. 134]. 6 жовтня Словаччина отримала широку автономію, 8 жовтня – Карпатська Україна – східна провінція країни. Назву країни почали писати через дефіс – Чехо-Словаччина [9, с. 47]. Політичні лідери, що залишилися, добре усвідомили, що їх держава (відома як «Друга Республіка») віднині перебуває в повній залежності від милості Гітлера, і, що краще висловити йому готовність до співробітництва. З огляду на це, конституцію 1920 року було ліквідовано, чеську партійну систему призупинено, діяльність комуністів заборонено (лише у Чехословаччині в міжвоєнний період комуністична партія працювала легально), німецькій меншості, що залишилася надали привілейований статус, права євреїв обмежили, цензуру розширили, а демократію спаплюжили в публічній пропаганді. В своє розпорядження Німеччина одержала колишній шлях між Сілезією і Австрією; їй було передано важке озброєння окупованої країни. Нарешті, новий міністр закордонних справ Чехословаччини Франтішек Хвалковський у благальній формі пообіцяв дотримуватися цілковитої узгодженості дій з Німеччиною в політиці і покладатися на неї, «коли б Німеччина це дозволила» [5, с. 48]. Впродовж короткого часу здавалося, що ця підлесливість матиме успіх. Під час першого арбітражу 2 листопада 1938 року щодо нового кордону з Угорщиною німецька делегація, ставилася до чехо-словацького питання не з таким мстиво-ворожим настроєм, як італійська. Німці також підтримували відносно більш помірковане крило Словацької Народної Партії, готове погодитися на автономію в рамках тієї території, що залишилася. За незалежність Словаччини автономістсько налаштованих депутатів Словацького сейму проголосувало 14 березня 1939 року. Словаки вперше створили свою державу – Словацьку Республіку (також Перша Словацька Республіка, Словацька Держава), але це було зроблено через домовленості з Гітлером. Згодом були підписані політичні та економічні договори, які повністю поставили молоду державу під німецький контроль.

Перші роки існування незалежної республіки принесли словакам певні вигоди. Вона була визнана 24-ма державами світу, вдалося запобігти окупації, змінилися позиції словацького капіталу, чеських чиновників змінили словацькі (вони зросли, отримавши хорошу освіту в міжвоєнній Чехословаччині), поліпшилися умови розвитку словацької освіти, включаючи вищу, книговидавництва, культури тощо. Офіційні кола всіляко живили ідею національної єдності. На перших порах суспільство охопила ейфорія. Обраний у листопаді 1939 року президентом республіки лідер Глінкінської Словацької Народної Партії[2] священик Йозеф Тісо і його прихильники в уряді міністр закордонних і внутрішніх справ Фердинанд Дюрчанський намагалися провадити нейтральну, більш-менш самостійну політику [8, p. 245–246; 9, p. 96–97]. Але Гітлер не дозволив впровадження автономної політики. У липні 1940 року він викликав Тісо у Зальцбург, на якій словаків примусили копіювати тоталітарний нацистський режим. В уряді головну роль почали відігравати відверті фашисти. Войтех Тука став прем'єр-міністром і міністром закордонних справ, командувач воєнізованої Глінокової гвардії Олекасндр Мах – міністром внутрішніх справ. Було створено міністерство пропаганди, яке поширювало культ Тісо як вождя нації, існувала лише одна словацька партія – Словацька Народна Партія, – яка була визнана керівною силою суспільства. Роль сейму була зведена нанівець, розпорядження уряду мали силу закону. Здійснювалися репресії проти опозиції, перед усім проти комуністів. Однак, жодного смертного вироку словацьке правосуддя не винесло (подібною була ситуація в Польщі в 1948 – 1956 роках,

[2] *8 жовтня 1938 року Словацька Народна Партія утворила профашистську, напіввійськову Глінкову гвардію, розпущену 8 травня 1945 року.*

жоден польський комуніст не був скараний смертним вироком, в усіх інших країнах Центрально-Східної Європи – так). Під німецьким тиском у Словаччині була здійснена «арізація» і депортація єврейського населення [10, p. 3–12].

У листопаді 1940 року Словаччина, приєднавшись до Троїстого пакту, вступила у війну. Дві моторні дивізії було відправлена на східний фронт. Вступ у війну, посилення грабування, погіршення матеріального становища населення, втручання німецьких радників у діяльність міністерств – усе це вплинуло на зміну настроїв у суспільстві. Стала очевидною ілюзорність незалежності.

У 1940 – 1943 роках на антифашистських позиціях у Словаччині стояли декілька нечисленних груп : «Демець», «Флора», «Захист нації» [11, с. 478]. Вони виступали проти участі у війні, встановлення тоталітарного режиму, залежності від Німеччини. Проте реальних кроків до змін існуючого становища вони не робили. Підпільна Комуністична Партія Словаччини намагалася створювати партизанські загони, але більшість її спроб були невдалими. Становище різко змінилося у 1943 році, чому сприяли зміни на фронтах, а також підписання Бенешем у грудні 1943 року Договору про дружбу, взаємодопомогу та післявоєнне співробітництво з Радянським Союзом.

У грудні 1943 року представники Комуністичної Партії та колишніх аграрної та національної партій підписали таємну «Різдвяну угоду» та створили керівний орган – Словацьку Народну Раду. В угоді зазначалося, що головним її завданням є боротьба проти нацистсько-німецького диктату і місцевих узурпаторів політичної влади. Було взято курс на підготовку загальнонаціонального збройного повстання. Декларувалася необхідність створення нової демократичної Чехословаччини на засадах рівності чехів і словаків. У першій половині 1944 року у підпіллі виникли національні комітети, до підготовки повстання було залучено частину офіцерів словацької армії. У липні 1944 року був створений військовий центр з підготовки повстання на чолі з підполковником Яном Голіаном, який координував свою діяльність із Національної Радою [11, с. 479;].

Наближення початку повстання зумовила поява наприкінці липня – початку серпня 1944 року у Словаччині груп партизанів-організаторів, підготовлених Українським Штабом Партизанського Руху на прохання чехословацьких представників. Про підготовку повстання їм було невідомо, але зустрівши сприятливі умови (підтримку населення, лояльність словацьких військових і значної частини поліції), вони швидко перейшли до партизанської війни, чим прискорили рішення німецького командування про окупацію Словаччини 28 серпня 1944 року. Наступного дня почалося Словацьке Національне Повстання, яке охопило середню Словаччину і продовжувалося до 27 жовтня 1944 року. На боротьбу з окупантами виступили частини словацької армії і партизани [11, с. 479].

1 вересня 1944 року Словацька Національна Рада опублікувала Декларацію, в якій відзначала, що своїм повстанням словацький народ приєднався до об'єднаних націй у боротьбі з фашизмом, а також виступає за об'єднання двох народів Чехословацької Республіки. На території повстання законодавчу владу здійснювала Словацька Національна Рада, а законодавчу – Колегія Уповноважених і національні комітети на місцях. Почалася боротьба проти профашистських партій. Оголошено про необхідність часткової націоналізації промисловості і банків, про проведення аграрної реформи тощо. Для роз'яснення позиції словаків до Лондона була відряджена делегація і зустрілася із Бенешем. Бенеш змушений був проголосити про визнання самобутності словацького народу (Томаш Масарик у 1918 році переконував Антанту, що словацький народ є гілкою чеського, а отже, по-суті, вони разом – один народ).

Німецька армія придушила повстання і вчинила розправу над словаками, убивши 5 тис. і 19 тис. відправивши у табори. У Словаччині встановлено нацистський режим. Тісо і соратники фактично втратили владу.

Звільнення Словаччини Червоною армією тривало до квітня 1945 року. На визволених територіях влада переходила до Словацького Національного Комітету, Корпусу Уповноважених (законодавчий орган) і національних комітетів на місцях. У лютому 1945 року Словацький Національний Комітет у своєму маніфесті підтвердив, що Словаччина є складовою частиною відродженої Чехословацької Республіки. У березні 1945 року спеціальна делегація Комітету виїхала в Москву, де взяла участь у переговорах з приводу формування уряду Національного Фронту чехів та словаків та його програми [11, с. 480].

Отже, повернімося до дій Гітлера щодо Словаччини аби дати пояснення шляху, обраного Гітлером у Чехословаччині. У середині березня 1939 року, скориставшись внутрішньою кризою

між центральним урядом у Празі і словацькою автономією, Гітлер нав'язав позицію словацьких радикалів поміркованим політичним колам і, у такий спосіб, домігся прийняття декларації про незалежність Словаччини під захистом Німеччини. Одночасно він домігся згоди у президента Гаха згоди на окупацію залишків Чехословаччини й перетворив їх на німецький політико-адміністративний протекторат Богемії і Моравії. В оперативному плані військова окупація була суто поліцейською акцією, бо всі фортифікаційні споруди чехи здали після Мюнхена, а спроби чинити опір паралізувала капітуляція Гаха.

У підсумку Гітлер з 13 по 16 березня 1939 року допустився грубої помилки. В політичному плані він не здобув більшого контролю над територіями, що перейшли тепер під його офіційну опіку і захист, ніж він фактично мав після Мюнхена. Водночас в міжнародному плані він допоміг британському уряду остаточно звільнитися від ілюзій умиротворення. Німецька окупація залишків Чехословаччини призвели до надання Британією 31 березня гарантій Польщі з наслідками, вирішальними для світу і фатальними для Гітлера і його третього рейху [12, p. 253].

На відміну від Генерал-губернаторства для Польщі, Гітлер зберіг юридичну фікцію чеської автономії у вигляді протекторату Богемії та Моравії. Маріонетковий уряд Гаха формально підтримувався, було дозволена на нечисельну міліцію та єдину масову політичну організацію – Національний Рух Солідарності. Однак справжній центр влади очолювала, звичайно, служба представника рейху або німецького протектора з німецьким апаратом і контрольними функціями.

Існувала своя вибіркова специфіка ставлення до населення: євреїв звичайно ж знищували, більшість інтелігенції і фахівців (від 36 до 55 тис.) знищувалися або вони померли в концентраційних таборах. А ось робітники, селяни і ремісники толерувалися. Вони мали хороші заробітки, достатнє харчування і постійну можливість купівлі товарів за низькими цінами. Ця політика «підкупу через шлунок» мала успіх у перетворенні протекторату на одну з найбільш спокійних і продуктивних частин Європи. Лише дві події, які можна прийняти як опір були вчинені в 1942 і 1945 році: перша – убивство «імперського протектора» Генріха Гейндріха 27 травня 1942 року (щоправда убивці надсилалися з Британії і були видані гестапо чехами); незначне повстання у Празі з 5 до 9 травня 1945 року, коли війна в Європі фактично закінчилася і нацистський режим був повалений. Отже, чехи не вели активних дій проти окупантів. Та все ж війна залишила глибоку психологічну травму, можливо із причини такої пасивної політики опору окупанту [13, p. 314].

Цікаво, що більш енергійний опір чинила номінально суверенна словацька держава. «Сподіваючись використати той факт, що словацький націоналізм мав антическое і антиугорське, але не антинімецьке спрямування, нацисти спочатку прагнули перетворити Словаччину у вітрину, що демонструвала б усій Європі переваги співробітництва з ними. Потім, у ході війни Словаччина стала прикладом більш загальної політики нацистської Німеччини воєнного часу – небажаного жертвування привабливішими, але неспокійними місцевими правими радикалами заради політичної стабільності і продуктивності економіки, що у Словаччині забезпечувалися клерикально-авторитарним режимом консерваторів» [5, с. 50]. Тож, уклавши угоду з словацькими консерваторами, Гітлер надав допомогу Словаччині у формуванні її незалежності і модернізації її економіки. А Словаччина у відповідь поставляла продукти харчування, сировину і напівфабрикати для німецьких воєнних потреб. Словаччина також співпрацювала у проведенні облав і нищенні євреїв.

Однак у вересні 1939 року стали помітними певні бунтівні прояви на знак протесту проти співробітництва із Німеччиною, особливо виражені після нападу Німеччина на Польщу. Словаки відчували велику спорідненість долі з польським народом. На початку 1943 року угода з гітлерівською Німеччиною в очах словаків почала втрачати привабливість, тим більше, що робітників почали мобілізувати для роботи в рейху і для військ на східному й італійському фронтах. Після років саботажу й опору комуністи і не-комуністи створили спільний рух Опору – Словацьку Національну Раду [5, с. 479], про яку щойно йшлося. Рада схвально поставилася до Радянського Союзу «як захисника свободи і загального прогресу всіх малих і, зокрема, слов'янських народів». Гітлер, відчувши ці настрої, посилені переходом до західних союзників Румунії 23 – 25 серпня 1944 року, 29 серпня окупував Словаччину.

Кілька міркувань про Бенеша, як «героя чи антигероя» чехословацької політики. Як згадувалося раніше, уряди Британії та Франції, сподіваючись, що Мюнхеном «купили» собі мир, ставилися до Бенеша, як до «пропащого». Навіть після року війни Бенеш зі своїми чехословацькими колегами – були визнані не урядом, а національним комітетом. Річ у тім, що у

вересні 1938 року, в пошуку виходу із напруженої ситуації в Судетах, що загрожувала перерости в міжнародні кризу, президент (від 18 грудня 1938 року) Бенеш запропонував урядам в Парижі і Лондоні свій «секретний план», який передбачав передачу Німеччині частини Судет із одночасним виселенням до Німеччини ще 1 млн. німців до Німеччини. Цей план був повідомлений, як посланцям Франції і Великої Британії в Празі, так і французькому кабінету через особистого представника Бенеша Міністра соціальної опіки Яромира Нечаса. Після прийняття на Мюнхенській конференції 30 вересня 1938 року цього рішення, Бенеш схвалив цей крок. Однак після поразки Франції і приходу до влади в Британії противників умиротворення – Вінстона Черчилля і Ентоні Ідена, Лондон підняв статус емігрантів до Тимчасового чехословацького уряду. Слово «тимчасовий» викликало велике роздратування Бенеша, оскільки вказувало на нижчий статус його уряду у порівнянні із іншими еміграційними урядами, а особливо польським. Його усунули лише після нападу Німеччини на СРСР 22 червня 1941 року, коли Черчилль і Сталін одночасно визнали уряд Чехословаччини на еміграції. Нарешті Бенешу вдалося переконати британський уряд скасувати 5 серпня 1942 року Мюнхенську угоду.

Правові аспекти платформи Бенеша тепер виглядали так: 1) Чехословацька республіка, утворена в 1918 році, продовжує безперервно існувати і носієм її правосуб'єктності є уряд в еміграції; 2) його відставка з поста президента не має юридичною сили і він ніколи не припиняв бути президентом; 3) ні створення протекторату, ні окремої словацької держави не мають юридичної сили; 4) Мюнхенська угода не була чинною з самого початку, а не тоді, коли німці окупували її залишки в березні 1939 року; 5) захоплення чехословацької території Німеччиною, Угорщиною, Польщею із тієї ж причини не є дійсним.

Бенеш мав дивовижні таланти, як «майстер» переговорів і казуїстики: ці риси – інтелектуальна самовпевненість, наполегливість, глибока віра в свої здібності складати на папері пишномовні формули з політичних питань в контактах із лідерами «Великої Трійки» тощо. «У своєму лондонському уряді Бенеш нападав на кожну особу з незалежним складом розуму, поки він не звільнявся від необхідності комусь щось доповідати і встановлював свій контроль над усіма органами і політичними сферами. Він піддавав утиску еміграційні представництва тих чеських і словацьких партій, яким він, на його думку, завдав шкоди Мюнхеном. Жменька політиків-демократів із судетських німців, що під страшним ризиком і з великою мужністю не підкорилися нацистам, відчували з його боку погане ставлення. До Сталіна, навпаки, Бенеш ставився одночасно, і інтелігентно, і поблажливо. До літа 1943 року, коли британські й американські армії ще товклися в Італії, а радянські безупинно просувалися вперед, Бенеш швидко зміркував, що Центрально-Східна Європа буде звільнена Радянським Союзом, і у зв'язку з цим вирішив здобути прихильність Сталіна і показати йому, що можуть відповідати справжнім радянським інтересам в регіоні» [5, с. 55]. Тому 12 грудня 1943 року президент Бенеш підписав у Москві Договір про дружбу, взаємодопомогу і післявоєнне співробітництво між Радянським Союзом і Чехословаччиною, який визнав необхідність відродження Чехословацької Республіки у довоєнних кордонах. А також провів переговори з керівництвом Закордонного Бюра Комуністичної Партії Чехословаччини про формування національного фронту чехів і словаків, про першочергові заходи після звільнення, склад уряду, роль національних комітетів як нових народних органів влади на місцях. Було досягнуто згоди майже з усіх обговорюваних питань, окрім становища Словаччини у відродженій спільній державі. Починаючи з 1939 року Бенеш незмінно відзначав у своїх виступах необхідність «покарання словаків за розвал Чехословацької Республіки». Він стояв на позиціях створення нової спільної держави двох народів на принципах чехословакізму. Висловлені на переговорах пропозиції визнати самобутність словацької нації і хоча б декларувати рівноправність двох народів при відродженні Чехословаччини були ним відкинуті [11, с. 477].

Востаннє Бенеш з'явився на публіці 13 березня 1948 року на похоронах Яна Масарика, сина його товариша, президента Чехословаччини, Томаша Г. Масарика. Продовж усього часу президент не вимовив ані слова. Після двох інсультів його фізичний стан був украй важкий. А перипетії останніх місяців виснажили президента фізично. Закінчувалася не тільки кар'єра Бенеша, закінчувалася ціла епоха країни, котру він власноруч творив [14]. Опісля Бенеш покинув Прагу і оселився в містечку Семізово-Усті та зробив ще кілька промовистих кроків: у травні відмовився підписати нову комуністичну конституцію, у червні подав у відставку з поста

президента (14 червня Національна Асамблея обрала президентом комуніста Климента Готвальда); 3 вересня 1948 року Бенеш помер[3].

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Journalism

THE CREATIVITY IN CHINESE PRINT PUBLIC SERVICE ADVERTISING

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Abstract

The modern sense of public service advertising originated in the 1940s in the United States. During the World War II, James Young, a famous American advertiser, put forward a new concept of advertising, that is, "The mission of advertising is to promote the public interest. As a powerful means of communication, advertising can help rebuild people's respect for commerce and the economic system on which it depends." This is also the earliest concept of public service advertising. (He, 2011) After the war, the Advertising Commission of the United States proposed a guiding principle: declare war on many of the problems facing this country, and only advertising can provide assistance. (Yu, 2004) Therefore, since its inception, public service advertising has established a "mission relationship" with social public welfare undertakings and played an important role in social development. The Chinese advertising industry started relatively late, and the public service advertising industry was even more backward, with its emergence in the 1950s. At that time, China was in the early stages of construction, and public service advertising, as the most effective medium of communication, played a role in guiding people's thoughts and behavior, establishing a new social order, and so on. But at that time, the modified type of advertising had a certain political color, so it could not be regarded as a true modern public service advertisement, but it already had certain characteristics in certain aspects. Since the recovery of the advertising industry in the 1980s, the prosperity of commercial advertising has promoted the development of public service advertising. [3] Until the 1990s, public service advertising received attention from the state and social organizations, and China began to hold various themed public service advertising activities. [4] After entering the 21st century, China's public service advertising industry has entered a preliminary period of prosperity and maintained a strong development momentum, gradually embarked on a standardized and long-term development path. [7] During this period, print public service advertising played an important role. As the longest existing mass media, paper media has witnessed the development process of public service advertising. Therefore, the study of print public service advertising is indispensable in the history of Chinese advertising. This paper attempts to explore the creativity of print public service advertising from the perspective of Communication studies and aesthetics, analyze its development path, and summarize the use of creative means.

Keywords: *public service advertising, Chinese society, print advertising, creative industry, graphic design.*

Form of graphic public service advertising

The traditional four major media refer to radio, television, newspapers, and magazines. Print advertising should refer to the form of advertising carried by paper media, including advertisements published in newspapers, magazines, and outdoors.

Public service advertising is a type of advertising activity that is closely related to society, that is, society. The focus of attention is on models of human social behavior. The main purpose of public service advertising is to influence habits that are harmful from the point of view of society, forming behavioral models that are useful for society. In general, s public service advertising contributes to the education and humanization of society, therefore it is actively used by government agencies, as well as by various non-profit organizations. The object of the impact of public service advertising can be ideas, attitudes or values. The contribution to the formation of each of these phenomena in the direction necessary for society can be made with the help of effective public service advertising. Changing the consciousness of every citizen, such advertising campaigns lead to a gradual change in the behavior model of society as a whole. This process cannot be called fast. It can rather be characterized by the proverb "Water sharpens a stone".

1. Public service advertising in newspapers and magazines.

Newspapers and media are the oldest information dissemination channels, which convey information to the audience in an illustrated form. The audience of newspapers and periodicals is very wide, from heads of state to ordinary people, newspapers and periodicals can convey public service advertising messages to readers at all levels. Therefore, newspapers and magazines have the advantage of wide dissemination.

Secondly, it can convey public welfare information to the audience in a timely manner. For example, public service advertisements after disasters need to allow the public to obtain and take relevant disaster prevention actions in the first place, so newspaper public service advertisements have the advantage of timeliness.

Newspapers and periodicals are issued on schedule, and it is difficult for outdated newspapers and periodicals to attract people's attention anymore. Therefore, the timeliness of public service advertisements in newspapers and magazines is not strong; due to the large circulation, the cost of newspapers and magazines is relatively low, and the printing picture is bound to not be too exquisite, so public service advertisements in newspapers and magazines are also limited by the quality of printing; moreover, the circulation of newspapers and magazines is large, and in the face of readers of all colors, newspapers and magazines cannot cover all the preferences of the audience, so readers of public service advertisements in newspapers and magazines are selectively read.

2. Outdoor public service advertising

Our country's outdoor media has shown a rapid development trend since 1990. Data show that 'China's investment in outdoor advertising in 1990 was 611 million yuan, and by 1999 it rose to 4.73 billion yuan. According to a 2001 survey by the staff of the"Sino-Japanese Public Service Advertising Comparison Research Group"on "the public's attitude towards the effectiveness of public service advertising in various media": The public believes that the best effect is television. Television is the mass media, and the people have the most exposure. Moreover, the expression forms of sound and painting are more convincing and penetrating than other media, and the advantages are easier to accept. But what cannot be ignored is that 43.31% of the public believe that outdoor public service advertising has the best effect, second only to television and far better than radio (Ni, 2003).

The location of outdoor advertising generally occupies the window position of the city. For example, at railway stations, where the flow of people and traffic is relatively concentrated, and the format is very large, some billboards reach hundreds of square meters, and there is a lot of space for creation. Therefore, outdoor public service advertising can bring extraordinary visual impact to the audience. And with the increase of transportation, people spend more time outdoors, so outdoor public service advertising is the most frequently exposed form of people. Outdoor public service advertising is a kind of kindness that penetrates public service information into people's hearts in a gentle and silent manner. Good outdoor public service advertising will make people feel that they are full of kindness and care everywhere.

The development of creativity in Chinese advertising

In 1942, the United States established the "Advertising Council", an organization dedicated to the planning and implementation of national public service advertising campaigns. Drawing on the experience of the United States, Japan established the "Japan advertising federation" in 1953 to promote public service advertising activities in Japan. After the establishment of the People's Republic of China in 1949, the advertising operation mechanism was still imperfect. In this context, there is no specialized agency to manage public service advertisements, and there are various problems in the operation of print public service advertisements. Therefore, at that time, the launch of public service advertising campaigns was mostly led by the government. (Gao, 1999)

Print public service advertisements in the 1950s and 1970s were formally restricted by the media. At that time, the main way of disseminating public service information was billboards and posters. Its creation was generally highly propagandistic, with a preaching or even imperative tone, such as the frequent use of political slogans and symbolic images to influence the public's ideology and social behavior. The application of this method was in the early stage of the establishment of social order. When laws and regulations had not been perfected, some issues need to be educated to the public through moral propaganda. However, with the economic reform in 1978 and the introduction of advanced Western concepts, the quality of life and education level of Chinese people had improved, and the disadvantages of traditional advertising had gradually emerged: the audience's attention was low, and it even caused public disgust, which was contrary to the original intention of social advertising. (Pan, 2001)

In the case of such advertising campaigns gradually unable to meet the needs of the public, many advertisers began to turn their attention to advertising creativity. In the 1980s, the restoration of commercial advertising, the development of design theory, the holding of various graphic art exhibitions, and the collision of Chinese and Western art forms all promoted the rapid progress of advertising design, which also played a positive role in the development of public service advertising.

Modern Chinese public service advertisements have received national attention since the 1990s. In order to stimulate the development of public service advertisements, the state has introduced a series of policies to increase the exposure of outstanding public service advertisements. It can be said that although public service advertising started early in China, it has not had modern significance and value for a long time. The inspiration and application of creative consciousness is a key turning point in the development of print public service advertising.

The implementation of creativity in Chinese advertising

Print advertising is constrained by many factors, such as time, space, and format. In order to capture the audience's heart in a picture, print public service advertisements must have absolute shock power. Every print advertisement is a test for the creator, with enough power to transform the audience from automatic to action. If the author's creativity cannot impress the audience, the kindness of investors in public service advertising will be in vain. So creators must put more effort into creativity when creating print public service advertisements, as creativity is the soul of print public service advertisements.

The creativity of "print public service advertising" requires creators to demonstrate their professional communication skills, utilize the expression of public service information in print, and most effectively convey it to the audience. Due to various limitations, graphic public service advertising requires creativity more, but it has a broader creative space than commercial advertising. Because graphic public service advertisements are far from sales purposes and are not constrained by factors such as advertisers and the market, creators are more proficient.

The following creative strategies were mainly used in Chinese print public service advertisements from the 1980s to the 21st century:

1. From an emotional perspective

Due to the significant social responsibility of public service advertising, such as advocacy and persuasion, it is possible to approach works from an emotional perspective to create specific emotional experiences for the audience, thereby touching their hearts and changing their attitudes. And internalize the public welfare information that needs to be expressed into one's future words and actions, so that the audience can identify with it.

The emotional creativity of print public service advertisements can start from positive subjective experiences, such as caring for specific social groups. It can also be viewed from a negative emotional perspective, such as using the audience's compassion to generate empathy for others' experiences and voluntarily providing care and assistance to the weak. Another creative way to use negative emotions is fear. By using certain images and text to make the advertising audience feel uneasy and frightened, they receive warnings and take warning from it. Fear often "shakes" people and is often used in public service advertisements to prevent human bad habits and social vices, causing the audience to feel fear after being stimulated by the information conveyed by the advertisement. (Jin, 2008)

In 1991, a public welfare photo named "I want to go to school" was popular all over China. In the picture, the little girl was holding a pencil head and her eyes were full of thirst for knowledge, which aroused people's sympathy for the out of school children in poor areas. This photo was quickly reprinted by major domestic newspapers and magazines, becoming the publicity symbol of the "Project Hope" (a public welfare undertaking in China aimed at helping out the out of school children) (Figure 1). (Zhang, 2000)

Figure 1 – Chinese print public service advertising, 1991.

2. From a rational perspective

If a print public service advertisement expresses a public service message in a very straightforward way, or uses a relatively serious and logical way to make people accept a certain concept, such as setting up an example image or depicting a spectacular scene like a news report, it can to some extent stimulate the audience's patriotic enthusiasm and resonance, thus achieving the purpose of public service advertising. However, it is easy to lack excellent artistic expression, rigidity, and emptiness, Finally, it became a slogan like preaching. So rational creativity needs to be more vivid, and character shaping with flesh and blood can enhance persuasiveness.

Figure 2 is a famous print public service advertisement, which won many advertising awards in China in 1999, such as the Guangzhou Daily Gold Award and Yangcheng Evening News Award. In 1998, most parts of southern China were hit by a huge flood disaster. Armed police soldiers, led by their generals, responded to the call to rescue the lives and property of citizens at the forefront of the flood and labor disaster. This work changes its preaching style from the past, without shouting slogans. Instead, it uses Chinese chess to describe the disaster scene and various soldiers. Contrary to the rule that the higher the intermediate level, the safer the position, the generals in the picture are at the forefront of danger, highlighting their brave image, making the public welfare theme clear and intuitive, and strengthening the image in the audience's minds.

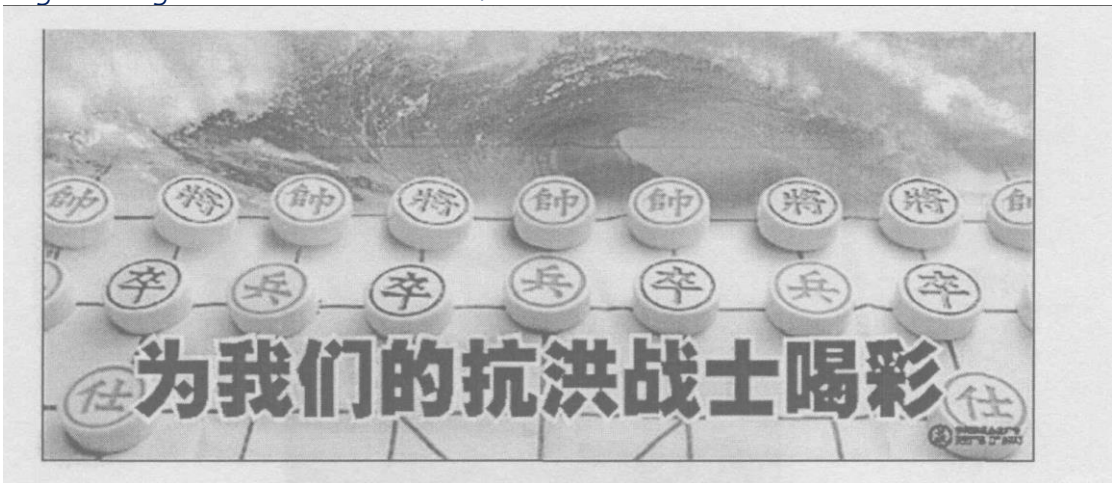

Figure 2 – Chinese print public service advertising, 1990s.

3. The Shaping of an Imagined Space

Through a creative approach, indirectly conveying an opinion or a moral message to the audience, expressing the intention in a subtle way. Some advertising scholars refer to this creativity as a "hidden stimulus". In response to people's general unwillingness to accept preaching, they do not directly articulate their ideas, but instead use artistic imagination to lure people's thinking into the creator's implied meaning.

Figure 3 is the award-winning work of the 7th China Advertising Festival. The lack of a nail zipper has become the core visual symbol of the advertisement. The copy in the advertisement: "None can be missing", suggesting that any jerry building in projects may cause huge consequences.

From this, it can be seen that leaving the audience with a space to derive advertising concepts from implicit logic weakens the preaching color of public service advertising, and the audience can consciously accept public service concepts. This kind of advertising effect is better than direct appeal.

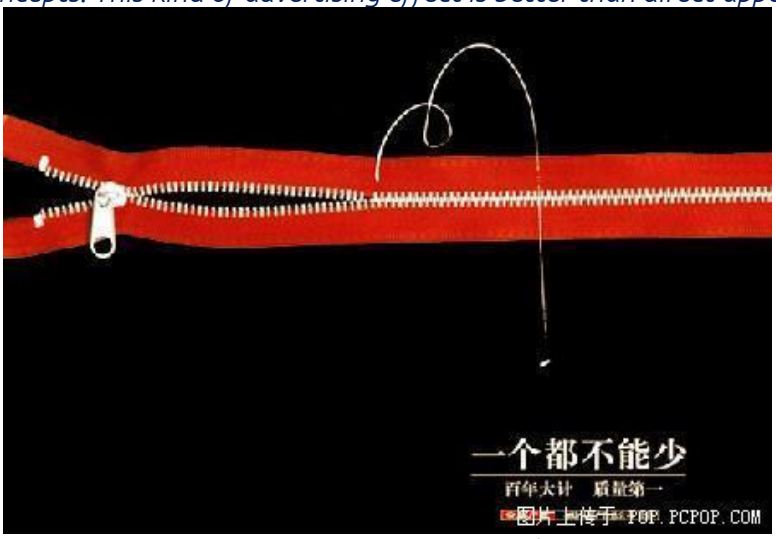

Figure 3 – Chinese print public service advertising, 2007s.

4. Inspiration from Traditional Chinese Culture

Chinese culture has a long history, and its religious beliefs and customs are deeply rooted in the hearts of the Chinese people, which have a profound impact on people's thinking and behavior. So there are countless creative elements that can be explored in traditional ethnic culture. The cultural traditions and aesthetic psychology of the nation are the foundation of public service advertising production. To evoke national emotions and resonate with the audience in this form. Integrating behavior, moral values, and national characteristics enriches the cultural essence of advertising, thereby increasing the appeal of public service advertising. (Zhao, 2007)

Chinese characters are the only type of block font in the world, which has undergone a thousand years of cultural accumulation. It includes pictographs, phonetic characters, and semantic characters. Using the meaning and shape of the font itself to do some disassembly will give a unique sense of originality.

Figure 4 is a print public service advertisement created by the Hong Kong Lingzhi Advertising Company. The inspiration for this public service advertisement is derived from the Chinese pictogram "森" (in Chinese "Forest"), which consists of three pictograms "木" (in Chinese "tree"). The author then decomposes it into many "木", and below them, it is decomposed into many crosses representing tombstones of death. Another cleverness is that the form of the genealogy branch used from the "森" to the "木" is very consistent with the copy: "The previous generation abused wood, and the next generation is waiting to be victimized."

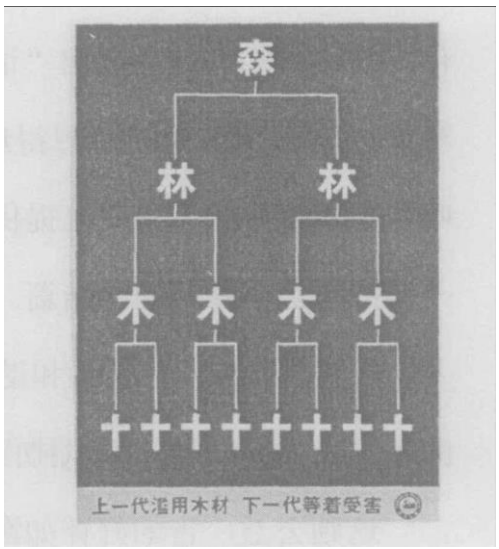

Figure 2 – Chinese print public service advertising, 1990s.

Although modern public service advertising in China started relatively late, with the development and progress of society, on the one hand, more and more social problems require public education through public service advertising. The demand for public service advertising in society is constantly increasing, which will inevitably promote the rapid growth of public service advertising; On the other hand, with the progress of social technology, people's attention to public service advertising has increased, especially the increase in investment in research on public service advertising, which has led to more artistic forms of expression and a significant improvement in overall creativity. As the longest existing and most representative form in the history of public service advertising, print public service advertising has high research significance. In the process of developing print public service advertising, the role of creativity in public service advertising has become increasingly prominent, transforming Chinese print public service advertising from propaganda to a modern style. If creative awareness is regarded as an important milestone in the development of Chinese graphic public service advertising, the 1990s was the most important stage, from which creativity in graphic public service advertising was valued and became a regulator of public behavior and moral standards.

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Medical sciences

METHODS OF TREATMENT OF ZOOANTHROPONOTIC TRICHOPHYTOSIS

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Relevance. *In recent years, many observations have noted changes in clinical pictures of zooanthroponotic dermatophytosis, the appearance of their erased and atypical forms. In isolated cases, there were observed asymptomatic, erased, sluggish forms of microsporia of smooth skin, when focal lesions are detected do not have clear boundaries, pronounced inflammatory phenomena, significant peeling. They are usually mistaken for manifestations of seborrheic dermatitis, seborrhea, streptoderma, chronic trichophytosis. A characteristic feature of all dermatophytosis is a modification microflora. If earlier the most common pathogens of dermatophytosis were anthropophilic fungi, now they account for no more than 1% flora. The main causative agents of microsporia and trichophytosis are zoophilic fungi. For microsporia, this is M. canis, trichophytosis - T. verrucosum and T. mentagrophytis var. gypseum. In Uzbekistan, trichophytia is more common, caused by zoophilic fungi, the role of which increases during periods of epidemiological outbreaks of mycoses. Zoophilic trichophytia, caused by pathogenic fungi of the genus Trichophyton, is one of the mycotic diseases of the skin and appendages, common mainly in rural areas and affecting both children and adults. In the etiological structure of zooanthroponous trichophytia, there are two pathogens-Trichophyton verrucosum, Trichophyton mentagrofites, var.gypseum, having different natural reservoirs, which determines the features of the epidemiology of trichophytia. When infected with T. verrucosum, the source of infection is most often cattle, when infected with T. verrucosum. mentagrophytes - mouse-like rodents. Seasonality is expressed, but there are differences related to the peculiarities of agricultural activities.*

Purpose of the study. *Study of the features of the concomitant microflora in the foci of infiltrative-suppurative trichophytia complex treatment of complicated forms of zooanthroponous trichophytia.*

Material and research methods. *Microbiological studies on concomitant microflora were carried out in the bacteriological laboratory of the Tashkent regional dispensary. For the qualitative and quantitative analysis of the skin microflora, the methods of flushing according to Willamsonet Kligman were used using sterile cotton swabs soaked in nutritious broth. Highly selective culture media were used for sowing: blood agar, yolk - salt agar, Saburo, Endo, etc. Washes were made from 1 cm2 of the skin surface.*

Research results. *The age structure was dominated by children of preschool and primary school age 46 (47.92%), teenagers were 23(23.96%), adults – 27(28.13%). Microscopic examination of the hair from the lesion foci revealed Tr. Ectotrix in all cases. The growth of fungi in bacteriological culture was obtained in 46 (47.92%) patients with this form, of which Tr. verrucosum (syn. Tr. faviforme) was determined in 32 patients, and Tr. Mentagrophytes var. gypseum – in 14 patients. There were 92 rural residents. Sources of infection were identified in 76 (30.4%); the infection occurred from cattle kept in a private farmstead, as well as due to domestic contact with sick family members, acquaintances. In 5(5.2%%) patients with localization of the lesion in the pubic region, infection occurred during sexual contact with partners. The majority of patients - 29(30.2%), were involved in treatment in the first 7-14 days after the detection of signs of the disease in the period from 15 to 30 days – 41(42.7%), after 1-2 months – 8(8.3%), over 2 months-8(8.3%).*

Conclusion. *The infiltrative-suppurative form of zooanthroponous trichophytia is often complicated by intoxication, lymphadenitis, a violation of the general condition of patients and has a progressive course against the background of traditional therapy with systemic and topical antimycotic drugs. In most cases, patients have secondary infection of the foci due to the activation of the skin microflora, increased colonization by staphylococci and opportunistic microorganisms of the intestinal group. The use of the combined antibacterial drug mupiroban in combination with systemic and topical fungicidal therapy contributes to a more successful dynamics of the inflammatory process and is not inferior in effectiveness to standard treatment methods.*

DIETARY FORECASTING TO CORRECT THE SELENIUM STATUS OF A PERSON

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Abstract

Balanced micronutrient composition of the population's diets makes it possible to eliminate the source of problems of deficient conditions of the body, including selenium deficiency. The relationship between the level of selenium (Se) and the risk of disease is U-shaped, that is, insufficient or excessive intake of this trace element contributes to the occurrence of non-infectious alimentary-dependent diseases (NCDs) in humans. Insufficient provision of Se leads to an acceleration of oxidative processes, which contributes to a violation of metabolic homeostasis in the adult population. The deficiency of antioxidant minerals in the body increases with age, which may be a significant cause of premature aging. The main sources of Se are food products. In this article, the authors present a comparative analysis of the average daily set of products in the diet of volunteers of women (n=76) and men (n=67) aged 25-50 years, with the Se content in the body below and within the physiologically optimal level (POL). The analysis of the diet revealed insufficient meat consumption 45,2% and 66,6% of the recommended level of consumption (RLC), fish 53,5% and 86%, milk and fermented milk products 48% and 45,3%, fresh fruit 23,5% and 51,6%, respectively, the first recorded their consumption is lower by 2 times or more, than the second, which contributes to the violation of the microbiota and the assimilation of Se. Despite the excess of the RLC in both groups for cereals: wheat flour (due to the oven) by 34.6% and 30.9%, cereals and legumes by 2.3% and 33%, pasta by 9% and 55.5%, respectively, at the same time, a significant excess of sugar and confectionery products by 11.4% and 42.3%, respectively, which also contributes to the violation of microbiota and the assimilation of Se. The coefficient of a one-factor model for predicting the level of selenium in the boy with a quantitative change in potential predictors are presented for the first time. A statistically significant direct relationship was established between the consumption of fish ($p < 0.001$), meat ($p=0.013$) and fruit ($p=0.023$) with the concentration of Se, as well as a tendency to have a direct association with the consumption of fermented dairy products ($p<0.05$). The level of sugar and confectionery consumption was statistically significantly negatively associated with the concentration of Se ($p=0.017$). According to mathematical forecasting, the greatest risk of selenium deficiency conditions exists with an increase in sugar and confectionery products in the diet, with a decrease in cereals, fish, meat, fruits and dairy products.

Keywords: selenium; hair; daily diet; women; men; forecasting; food products.

Relevance. *Currently, the proportion of the population with the incidence of obesity and type 2 diabetes mellitus, along with other dysmetabolic disorders, is steadily increasing worldwide: hypertension, hyperinsulinemia, insulin resistance and dyslipidemia [1].*

The States that are Members of the United Nations (UN) are faced with the issues of nutrition and noncommunicable diseases (NCDs) in two tasks out of 17 (SDGs 2.2 u SDGs 3.414). It is believed that their solution can also greatly contribute to the solution of many other tasks [2].

In the report of the UN System Standing Committee on Nutrition in 2018, much attention is paid not only to options for correcting the current situation, but also to the need to find opportunities to eliminate, first of all, the sources of problems - improving the quality of diets and reducing malnutrition. This strategy is also the most effective and efficient, since the relief and treatment of overweight, obesity and NCDs are very expensive, and the success rates of treatment of these diseases are low [2].

Of great interest is the level of actual consumption by the population of such an important trace element as selenium. Inadequate intake of this trace element contributes to the emergence of non-communicable alimentary-dependent diseases (NCDs) in humans [3, 4]. Insufficient intake of selenium in

the body contributes to the weakening of antioxidant protection, slowing down metabolism, leading to metabolic disorders [5, 6].

The recommended daily requirement of selenium for the adult population worldwide is low [7, 8], however, the usual daily diet does not provide adequate intake of selenium into the body [9], besides, this trace element can be poorly absorbed [10, 11].

The main sources of selenium intake are food products of plant and animal origin, in which selenium is in bioavailable organic form: selenocysteine (SeCys) and selenomethionine (SeMet) [37, 10].

Fat-soluble vitamins (A, E), riboflavin, beta-carotene, vitamin C, contribute to increasing the bioavailability of selenium (up to 80%), and factors that reduce the body's selenium content include the presence of heavy metals in food, a low-protein diet [12].

Prevents the assimilation of trace elements in the body, including selenium, violation of the intestinal microbiota. At the same time, the intestinal microflora is negatively affected by the addition of preservatives and simple sugars to the diet, which contribute to the occurrence of the inflammatory process, which is accompanied by a violation of the permeability of the intestinal epithelial barrier, and positively by the intake of probiotics (lactic acid and bifidobacteria) [13, 14].

WHO also recognizes the insufficiency of essential trace elements that are necessary for the proper functioning of the body, including Se [9, 15].

Thus, timely correction of the diets of the population, taking into account the receipt of the necessary trace elements, will prevent the occurrence of deficient conditions of the body and reduce the risk of developing many NCDs.

Goal– *based on the study of a set of food products of daily diets, to assess the risks of selenium deficiency conditions in the adult population. The results obtained will be used to develop a relevant model for the prevention of selenium deficiency conditions in the provision of primary health care.*

Material and methods*. The actual nutrition of volunteers among adults aged 25-50 years (n=143, 47% of them men) with a selenium content in the body below and within the physiologically optimal level was studied (POL) [16]. A laboratory study of the daily rations (n=1960) of the 7-day menu (separately breakfast, lunch and dinner), including weekends (7 randomly selected days), was conducted on the actual content of Se in the diet. The selenium content in individual daily rations (1960 samples) was determined by atomic absorption spectrometry with the generation of hydrides with preliminary mineralization of the sample under pressure" using the atomic absorption spectrometer "Analyst 400" (testing center of the Federal State Budgetary Institution "Tatar Interregional Vet. laboratory", Kazan). The content of vitamins A, E, B2, C, and iodine in foods and dishes was calculated based on reference materials [17]. The comparison of Se intake with the daily diet of the surveyed population was carried out with Rational norms of food consumption that meet modern requirements of healthy nutrition, approved by the order of the Ministry of Health of the Russian Federation from 19.08.2016 г. № 614 (in the editorial office of 01.12.2020 N 1276).*

Single-factor linear regression models were used to assess the association of selenium concentration with potential predictors.

Results and discussion. *According to the results of the data obtained from the 7-day menu, the average daily actual intake of selenium with the diet in the adult population was <30 mcg (the consumption rate for women is 55 mcg / day, for men — 75 mcg / day). The proportion of diets with a lack of nutritive selenium in the autumn-winter period was 40-46% of diets among men (n=67) and 54-61% among women (n=76).*

The results of calculations of the average daily food set of diets of the examined adult population with the Se content in the body below the POL and within the POL are presented in the table 1.

Table 1.

Characteristics of the food set of the daily diet of the adult population aged 25-50 years, g / day per person.

Name of food products	Recommended level of consumption	A grocery set of the daily diet of the adult population	
		In people with a lower Se content in the body POL (n=840)	In people with Se content in the body within POL (n=1120)
		% from the RLC	% from the RLC
Rye flour	55	36,9	40,9
Wheat flour	55	134,8	130,9
Cereals, legumes	65	102,1	133
Pasta	22	48,1	75,4
Potato	246	53,7	60,3
Vegetables, greens	342	53	62,5
Fresh fruit	274	23,5	51,6
Meat, offal	115	45,2	66,6
Poultry, offal	85	42,2	43
Fish (fillet), including weakly or lightly salted fillets	60	53,5	86
Milk	296	30,4	20
Fermented milk food products		17,6	25,3
Cottage cheese	52	35,5	80
Cheese	19	35,2	34,2
Sour cream	8	133,7	131,2
Butter	5	150	160
Vegetable oil	33	30	40
Egg	28	107,1	117,8
Sugar	65	111,4	142,3
Confectionery products			

POL - physiologically optimal level; n=840 – number of rations; Se – selenium; RLC – recommended level of consumption.

A comparative analysis of the average daily food set of diets of the surveyed adult population with a Se content in the body below the POL and within the POL showed that with insufficient consumption of meat 45,2% and 66,6% of the recommended level of consumption (RLC), fish 53,5% and 86%, milk and dairy products 48% and 45.3%, fresh fruits 23.5% and 51.6%, respectively, the first noted their consumption is 2 times lower or more than the second, which contributes to the violation of the microbiota and the assimilation of Se. Despite the excess of the RLC in both groups for cereals: wheat flour (due to the oven) by 34.6% and 30.9%, cereals and legumes by 2.3% and 33%, pasta by 9% and 55.5%, respectively, at the same time, a significant excess of sugar and confectionery products by 11.4% and 42.3%, respectively, which also contributes to the violation of microbiota and the assimilation of Se. It is necessary to pay attention to the structure of the protein component in the diet of the population: protein provided 13-15% of the daily energy intake, which is within the recommended values of 10-15%. However, the proportion of animal protein in people with a selenium content in the body below the POL was 34.4%, in people with a selenium content in the body within the POL - 43.1% at a rate of at least 50%.

The micronutrient composition of the average daily diet of the adult population affecting the bioavailability of Se is characterized by a significant deficiency of vitamin A both in people with selenium content in the body within the POL and below the POL (89.7% and 84.9%, respectively), vitamin B2 (91.2% and 92.4%, respectively), vitamin C (87.2% and 78.9%, respectively, p=0.001). The content of vitamin E in the studied diets of the population corresponds to the norms.

On the basis of a one-factor linear regression analysis, potential predictors of a prognostic model for the prevention of selenium-deficient conditions in the adult population were determined,

demonstrating quantitative changes in the concentration of selenium in the body with changes in food intake from among those that confirmed statistical significance (Table 2).

Table 2.

Prognostic model of prevention of selenium deficiency conditions in the adult population aged 25-50 years with a Se content below FOU (below 0.290 mg/kg).

Predictors of selenium deficiency states	Average value of food consumption (g/day)	Change in food intake (mg/day)	Regression coefficient for every 10 micrograms/g of selenium in the adult population		
			β	lower bound 95% CI	upper bound 95% CI
The use of cereals	66,4	↑ 10	0,08	0,01	0,88
Eating meat	52	↑ 10	0,27	0,06	0,47
Eating fish	32,15	↑ 10	0,88	0,42	1,34
Eating fruit	64,3	↑ 10	0,18	0,07	0,28
Milk consumption	90	↑ 10	0,24	0,03	0,45
The use of cottage cheese	18,5	↑ 10	0,12	0,01	0,31
Consumption of fermented milk products	52,1	↑ 10	0,24	0,01	0,5
Sugar consumption	49,6	↑ 10	- 1,41	- 2,55	- 0,26
The use of confectionery	22,8	↑ 10	- 0,33	- 0,4	- 0,03

↓ - decline; ↑ - raising; POL - physiologically optimal level; β – regression coefficient; CI – confidence interval.

A statistically significant direct relationship was established between the consumption of fish (p <0.001), meat (p=0.013) and fruit (p=0.023) with the concentration of Se, as well as a tendency to have a direct association with the consumption of fermented dairy products (p<0.05). The level of sugar and confectionery consumption was statistically significantly negatively associated with the concentration of Se (p=0.017).

Conclusion. *The data obtained allow us to conclude that despite the small daily need for selenium 55 (Women) – 70 (Husband) mcg / day, the usual diet does not provide sufficient intake of selenium into the body. According to mathematical forecasting, the greatest risk of selenium deficiency conditions exists with an increase in sugar and confectionery products in the diet, with a decrease in cereals, fish, meat, fruits and dairy products.*

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THE ROLE OF TRANSFERRIN IN THE FORMATION OF CHRONIC HEART FAILURE IN PATIENTS WITH HIV INFECTION AND ANEMIA

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Anemia, as the most common hematological complication of HIV infection, is one of the key indicators of its severity and a predictor of death from its complications [1]. The aim of this work was to study the role of transferrin in the course of chronic heart failure (CHF) against the background of anemia in persons infected with the human immunodeficiency virus (HIV). According to the literature, up to 80-90% of patients with HIV infection suffer from anemia of varying severity caused by iron deficiency, taking antiretroviral therapy (ART), or developed as anemia of chronic diseases [2,3].

This study was conducted in accordance with the principles of the Declaration of Helsinki and GCP (Good Clinical Practice) standards. For four years, 240 people with HIV infection were examined in a multidisciplinary hospital, among which 160 (66.6%) patients had CHF, and 94 of them (58.75%) had anemia of varying severity. The author personally examined patients in the volume of transthoracic echocardiography using the VIVID T8 device (GE Healthcare, USA), and also collected and sent blood and urine samples to the laboratory. Criteria for inclusion in the study: the presence of CHF, the presence of HIV infection, the signing of a voluntary consent to participate in the study, stabilization of the condition for the disease that required hospitalization. Exclusion criteria were acute heart failure; acute decompensation of CHF; oncology; acute conditions requiring surgical intervention; social deprivation, refusal to sign informed voluntary consent. All patients underwent the determination of the concentration of the N-terminal fragment of the brain natriuretic propeptide (NT-proBNP) in the blood plasma using reagent kits "Vector Best" (Russia) for enzyme immunoassay using an Immulite 1000 analyzer (DPC, USA) Determination of the concentration of transferrin was carried out with reagent kits from RANDOX (Great Britain) on a semi-automatic biochemical analyzer "Clima MC-15". There were formatted 2 groups of patients with CHF and HIV infection. In the first group (94 people) there were patients with anemia, in the second - without anemia (66 people). The obtained data were statistically processed using the licensed software product Statistica 13.0 (StatSoft, Russia).

According to the data obtained, males predominate among patients with anemia, these individuals are more likely to smoke, take drugs, and have a lower body weight. In anamnesis, patients with anemia were more likely to experience coronary artery disease with exertional angina, pulmonary arterial hypertension, ventricular arrhythmias, and chronic kidney disease (CKD) stage 3A and above. Hydrothorax, hydropericardium and ascites were also more common in the group of CHF patients with anemia. It is noteworthy that there was no significant difference between the groups in terms of receiving antiretroviral therapy (ART). In patients with anemia, the concentration of NT-proBNP in plasma is higher, the value of C-reactive protein (CRP) in blood serum and the erythrocyte sedimentation rate (ESR) are higher.

The ROC-curve of the dependence of the level of NT-proBNP in the blood plasma of patients with CHF and HIV infection on anemia is presented. According to the ROC-curve of NT-proBNP, AUC value was 0.879±0.057, 95% CI was 0.609-0.790. The resulting model was statistically significant ($p<0.001$). The threshold value of NT-proBNP at the cut-off point was 170 pg/ml. Thus, in individuals with CHF and HIV infection, determining the concentration of NT-proBNP ≥ 170 pg/ml is associated with the development of anemia. The sensitivity of the method was 71.7%, the specificity was 61.7%, respectively.

After analyzing the OR and RR between the indicators "CHF" and "Anemia", the following relationship was obtained: the presence of CHF 2.75 times increases the chances of developing anemia in HIV-infected people (95% CI 1.818-4.164). The RR was 1.66 with a 95% CI of 1.35-2.046. Sensitivity and specificity 62.9% and 61.9% respectively. In addition, a significant relationship was found between the development of severe CHF with NT-proBNP >1500 pg/ml and decreased serum transferrin less than 200 mg/dl. Thus, low transferrin less than 200 mg/dl 10.99 times increases the chances of developing severe CHF with NT-proBNP≥1500 pg/ml (OR=10.99; 95% CI 2.99-7.77; RR=2.07 , 95% CI 1.56-2.33, sensitivity 26.6%, specificity 96.8%, respectively.

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Pedagogical sciences

FORMATION OF MATHEMATICAL KNOWLEDGE AND SKILLS IN THE TASKS -SOLVING PROCESS OF PRİMARY SCHOOLCHILDREN

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KİÇİKYAŞLI MƏKTƏBLİLƏRİN MƏSƏLƏ HƏLLİ PROSESİNDƏ RİYAZİ BİLİK VƏ BACARIQLARININ FORMALAŞDIRILMASI

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Abstract

The article is devoted to the problem of forming students' mathematical knowledge and skills in the process of problem solving in primary classes. In the article, the author commented on the ways of forming students' mathematical knowledge and skills. She notes that in order to achieve a high level of assimilation of problem-solving training in the elementary course of mathematics, it is necessary to investigate the psychological-pedagogical basis of this training process and to study their impact on the student's development. As it is quite complicated to investigate the role of problem solving in the mental development of students, it is necessary to use different methods.

By using various psychological and pedagogical methods, it is possible to educate the development of the ability to judge in a purposeful way in students. These skills and abilities can be developed more vividly through problem solving. Thus, the associations formed in the process of problem solving become strong and fundamental, leading to the development of students' thinking.

Author states that knowledge is the theoretical and practical information that students acquire about the surrounding world and forms the basis of the intellectual activity, behavior and actions of schoolchildren. It is a universally accepted fact that the knowledge of a student who does not master theory and practice in unity cannot be of high quality. Therefore, in the training of problem solving, problem solving must be manifested in the form of skills and habits in a practical way, and should not be limited only to theoretical knowledge. Because practical skills and habits are primarily considered to be knowledge in action, applied in everyday real life. The key difference here is that skills are the dynamic, automated component of conscious action, while habits are the automated component.

Xülasə

Məqalə ibtidai siniflərdə məsələ həlli prosesində şagirdlərin riyazi bilik və bacarıqlarının formalaşdırılması probleminə həsr edilmişdir. Məqalədə müəllif şagirdlərin riyazi bilik və bacarıqlarının formalaşdırılması yollarını şərh etmişdir.

O, qeyd edir ki, riyaziyyatın ibtidai kursunda məsələ həlli təliminin yüksək səviyyədə mənimsənilməsinə nail olmaq üçün bu təlim prosesinin psixoloji - pedaqoji əsaslarını araşdırmaq və onların şagirdin inkişafına təsirini tədqiq etmək lazımdır. Məsələ həllinin şagirdlərin əqli inkişafında oynadığı rolu araşdırmaq kifayət qədər mürəkkəb olduğu üçün, müxtəlif metodikalardan istifadə edilməsi də zəruridir.

Müxtəlif psixoloji və pedaqoji üsullardan istifadə etməklə, şagirdlərdə məqsədyönlü surətdə mühakimə aparmaq qabiliyyətinin inkişafını tərbiyə etmək olar. Məsələ həlli vasitəsilə bu bacarıq və qabiliyyətlərin inkişafı daha canlı formada aparıla bilər. Belə ki, məsələ həlli prosesində formalaşan assosiasiyalar möhkəm və əsaslı olur, şagirdlərin təfəkküründün inkişafına gətirib çıxarır.

Müəllif bildirir ki, bilik şagirdlərin ətraf aləm haqqında əldə etdikləri nəzəri və praktik məlumat olub məktəblilərin intellektual fəaliyyətinin, davranış və hərəkətlərinin əsasını təşkil edir. Nəzəriyyə ilə praktikanı vəhdət halında mənimsəməyən şagirdin biliyinin keyfiyyətli ola bilməməsi hamı tərəfindən qəbul edilən həqiqətdir. Ona görə də məsələ həlli təliminde məsələ həlli hökmən praktik şəkildə bacarıq və vərdişlər halında təzahür etməli, yalnız nəzəri biliklərlə məhdudlaşmamalıdır. Çünki praktik bacarıq və vərdişlər, ilk növbədə fəaliyyətdə olan, gündəlik real həyatda tətbiq edilən bilik hesab edilir. Burada əsas fərq ondan ibarətdir ki, bacarıqlar şüurlu fəaliyyətin dinamik, avtomatlaşdırılmış komponenti olduğu halda, vərdişlər avtomatlaşdırılmış komponentdir.

Keywords: *primary school, student, training, tasks solving, mathematical knowledge.*
Açar sözlər: *ibtidai sinif, şagird, təlim, məsələ həlli, riyazi bilik.*

Məsələ həlli riyaziyyat fənninin tədrisi zamanı artıq mövcud olan problemlərin inkişafına kömək etməklə bərabər, yeni ideyaların meydana çıxmasına da şərait yaratması baxımından təhsildə əhəmiyyət daşıyır. Məsələ həlli vasitəsilə riyaziyyat təliminin müxtəlif komponentlərinin, metod və vasitələrinin təkmilləşdirilməsi probleminin həlli məqsədilə, əvvəlki illərin riyaziyyat proqramları və həmin proqramlar əsasında hazırlanmış keçmiş dərsliklər də əsaslı şəkildə tədqiq olunmuşdur. Bundan əlavə müasir kurikulum islahatı yeni məzmun standartları, təlimin strategiyaları, yeni məzmun xətləri üzrə bəzən nöqsanlı hazırlanmış dərsliklərin məzmununda olan problemli məqamları işləməyi, məsələ həlli təliminə yeni yanaşmaların qoyulmasını tələb edir [1].

Riyaziyyatın ibtidai kursunda məsələyə aşağıdakı kimi yanaşmalar olmuşdur:

1. Kəmiyyətlərin verilmiş qiymətlərinə və onlar arasındakı sözlərlə ifadə olunmuş asılılığa görə kəmiyyətin məchul qiymətini tapmaq tələbinə hesab məsələsi deyilir;

2. Verilmiş ədədlərə və bunlarla məchullar arasında verilmiş münasibətlərə görə bir və ya bir neçə məchulu tapmaq tələbinə hesab məsələsi deyilir;

3. Bizi əhatə edən aləmdə sonsuz sayda elə həyati situasiyalar (vəziyyətlər) baş verir ki, bunlar ədədlərlə bağlıdır. Həmin ədədlər üzərində hesab əməllərinin yerinə yetirilməsi tələb olunur – bu məsələdir və ya Məsələ - sözlərlə formalaşdırılmış sualdır və bunun cavabı hesab əməllərinin köməyi ilə alınır[2, s. 8].

Yuxarıda qeyd edilən fikirlərdən də göründüyü kimi, verilən izahların hamısı məzmunca eyni, formaca müxtəlif olduğundan, biz belə qənaətə gəlirik ki, məsələ elə tapşırıqdır ki, burada verilən ilə axtarılan arasında hansı əməlin tətbiq olunmasının tapılmasından söhbət gedir. Daha dəqiq ifadə etsək, təlim prosesində əslində şagirdlər nəzərdən keçirilən məsələnin növünün həlli üsulu ilə tanış olurlar. Yəni məsələ həllinin axtarılması – məsələyə daxil olan kəmiyyətlər arasındakı əlaqəni inkar etmək və bunun əsasında zəruri olan hesab əməllərinin seçilməsindən ibarətdir. Başqa sözlə, Riyazi məsələni həll etmək o deməkdir ki, riyaziyyatın elə ümumi əsaslarının ardıcıllığını tapmaq lazımdır ki, onu məsələnin şərtinə uyğun tətbiq etməklə məsələdə tələb olunanı – yəni cavabı tapasan [3, s. 81].

Riyaziyyatın ibtidai kursunda məsələ həlli təliminin yüksək səviyyədə mənimsənilməsinə nail olmaq üçün bu təlim prosesinin psixoloji - pedaqoji əsaslarını araşdırmaq və onların şagirdin inkişafına təsirini tədqiq etmək lazımdır. Məsələ həllinin şagirdlərin əqli inkişafında oynadığı rolu araşdırmaq kifayət qədər mürəkkəb olduğu üçün, müxtəlif metodikalardan istifadə edilməsi də zəruridir.

Müxtəlif psixoloji və pedaqoji üsullardan istifadə etməklə, şagirdlərdə məqsədyönlü surətdə mühakimə aparmaq qabiliyyətinin inkişafını tərbiyə etmək

olar. Məsələ həlli vasitəsilə bu bacarıq və qabiliyyətlərin inkişafı daha canlı formada aparıla bilər. Belə ki, məsələ həlli prosesində formalaşan assosiasiyalar möhkəm və əsaslı olur, şagirdlərin təfəkküründün inkişafına gətirib çıxarır. Lakin təcrübə göstərir ki, bir sıra hallarda şagird verilən məsələni ya həll edə bilmir və yaxud da həll etməkdə çətinlik çəkir. Bu hal əsas etibarilə iki səbəbdən meydana çıxa bilər:

1. *İbtidai sinif şagirdi məsələnin həlli üçün lazım olan nəzəri biliyə malik deyil.*
2. *Şagird məsələnin həlli üçün zəruri olan təklifləri bilir, lakin həmin təkliflərin məhz bu məsələdə zəruri olduğunu bilmir.*

Şagirddən həmin təklifi (qaydanı) soruşduqda düzgün cavab verir, lakin onu məsələyə tətbiq edə, məsələni düzgün həll edə bilmir. Bu isə belə nəticəyə gəlməyə əsas verir ki, şagirdin biliyi formal xarakter daşıyır, konkret situasiyada bu bilikdən istifadə etməyi bacarmır.

Məsələ: Elə bir ən kiçik ədəd tapılmalıdır ki, həmin ədədi 3-ə, 4-ə, 5-ə, 6- ya bölsək qalıqda uyğun olaraq 1,2,3,4 ədədləri alınsın.

Məsələnin həlli: Verilən rəqəmi 2 vahid artıranda həmin ədəd 3,4,5 və 6-ya bölünər. Burada göstərilən ədədlərə bölünən ən kiçik ədəd 60 olduğunu nəzərə alsaq, bizə lazım olan ədəd 60 – 2 = 58-dir.

Şagird məsələ həllində ümumi riyazi hazırlıqdakı biliklərdən istifadə etməlidir. Şagirdlərin verilmiş məsələnin həllində istifadə etdikləri biliklər stimullaşdırıcı elementlərdir. Təcrübə göstərir ki, bu elementlərdən bəzilərinin unudulması həll prosesini ləngidə bilər. İbtidai siniflərdə (xüsusilə IV sinifdə) təcrübə göstərir ki, məsələ həlli prosesində stimullaşdırıcı elementlərin müəyyən edilməsi və onlardan istifadə edilməsi şagirdlərin biliklərini sistemə salır, təkrar edir, onun tətbiqi zərurətini göstərir və bununla da formalizm aradan qalxır. Lakin təcrübədə başqa bir halın şahidi oluruq: Məsələ həllində şagirdlərin ayrı - ayrı mərhələlərin əsaslandırılması, izahı tələb olunmur. Məsələ həll olunarkən onun xarici və daxili tələbləri izah olunmalıdır.

Məsələ: Kitabı səhifələmək məqsədilə cəmisi 1392 rəqəm istifadə edilib. Kitab neçə səhifədən ibarətdir?

Həlli: Kitabın ilk 9 səhifəsi bir rəqəmli ədəddir, burada 9 rəqəmdən istifadə olunub, 90 səhifəsi iki rəqəmli ədəddir. Odur ki, burada 90·2=180 rəqəmdən istifadə olunmuşdur. Kitabın qalan 3 rəqəmli ədədlərdən olan səhifəsində 1392- (180+9)=1203 rəqəmdən istifadə olunmuşdur. Hər səhifədə 3 rəqəm işlədildiyindən 1203:3= 401 səhifə nəticəsi əldə edilir.

Belə nəticəyə gəlmək olar ki, kitab 401+90+9=500 səhifədən ibarərdir.

İbtidai məktəbdə məsələ həlli təlimi yalnız şagirdlərə sadə bilik, bacarıq və vərdişlər verməklə məhdudlaşmır, eyni zamanda öyrənməyi öyrətmək vəzifəsi kimi olduqca vacib bir problem də həll etmək lazım gəlir. Bu vəzifə təlimin öyrədici, tərbiyəedici və inkişafetdirici rolunu daha yaxşı təmin etməyə imkan verir.

Təcrübə göstərir ki, öyrənmənin səmərəli yollarına yaxşı yiyələnən kiçik yaşlı şagirdlər yaxşı da oxuyur, daha az enerji və vaxt sərf etməklə öz təlim vəzifələrini asanlıqla yerinə yetirirlər. Bu isə öz növbəsində şagirdlərin psixoloji baxımdan daha sağlam olmalarına, təhsildə daha böyük uğurlar qazanmalarına gətirib çıxarır.

Məlum olduğu kimi, bilik şagirdlərin ətraf aləm haqqında əldə etdikləri nəzəri və praktik məlumat olub məktəblilərin intellektual fəaliyyətinin, davranış və hərəkətlərinin əsasını təşkil edir. Nəzəriyyə ilə praktikanı vəhdət halında mənimsəməyən şagirdin biliyinin keyfiyyətli ola bilməməsi hamı tərəfindən qəbul edilən həqiqətdir. Ona görə də məsələ həlli təliminde məsələ həlli hökmən praktik şəkildə bacarıq və vərdişlər halında təzahür etməli, yalnız nəzəri biliklərlə məhdudlaşmamalıdır. Çünki praktik bacarıq və vərdişlər, ilk növbədə fəaliyyətdə olan, gündəlik real həyatda tətbiq edilən bilik hesab edilir. Burada əsas fərq ondan ibarətdir ki, bacarıqlar şüurlu fəaliyyətin dinamik, avtomatlaşdırılmış komponenti olduğu halda, vərdişlər avtomatlaşdırılmış komponentdir.

Tədqiqatlar göstərir ki, yadda saxlama zamanı həll prosesi və əməllər şüurda saxlanılır, inkişaf edir, daim hərəkətdə olur və dəyişmək xüsusiyyətlərini nümayiş etdirir. Odur ki, məsələ həllində təlim fəaliyyətinin hafizə ilə daha sıx əlaqədar olduğunu əminliklə söyləmək mümkündür [4, s. 31-32]. Təsadüfi deyildir ki, şagirdlərin təlimdə əldə etdikləri nailiyyətlər çox vaxt onların hafizəsinin keyfiyyəti ilə izah olunur. Məsələ həlli təlim fəaliyyətinin səmərəliliyinin artırılması, ilk növbədə şagirdlərin hafizəsindən optimal istifadə etməklə mümkündür.

Beləliklə, belə nəticəyə gəlirik ki, ibtidai sinif şagirdlərdə məsələ həlli prosesində formalaşan bilk və bacarıqlar daha möhkəm və dayanıqlı olur. Məsələ həlli prosesində stimullaşdırıcı elementlərdən istifadə edilməsi, ibtidai sinif şagirdlərinin təfəkkür fəaliyyətini formalaşdırır və bununla da möhkəm biliklərin formalaşmasını təmin edir. Burada stimullaşdırıcı elementlər dedikdə izahlar, tərifler və digər mühakimə formaları nəzərdə tutulur və bütün bunlar məsələ həllini başa düşməyə və əsaslandırmağa kömək edir. Məsələ həlli prosesində stimullaşdırıcı elementlərdən istifadə edilməsi müsbət nəticələrə gətirib çıxarır.

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Pharmaceutical sciences

ANTIMONOAMINOXIDASE ACTIVITY OF THE SUBSTITUTED PYRIMIDINES

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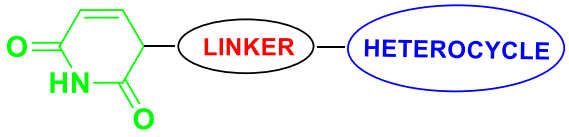
Background. *It is known that depressive states are characterized not only by the depression of the psycho-emotional sphere of the individual, but are also often the etiological cause of a number of somatic diseases, primarily cardiovascular diseases, metabolic disorders, vegetative-vascular and neurological dysfunctions and disorders [1]. Taking into account the increasing impact of adverse external factors on a person and the associated increase in the background of depressive diseases, the treatment of depressive disorders and diseases is of great importance. For this purpose, antidepressants of various pharmacological groups are widely used in modern practice, in particular, monoamine oxidase (MAO) inhibitors, such as ipraniazid, nialamide, pyrazidol, indopan, etc. The pharmacological effect of the latter is due to inhibition of the metabolism of endogenous and exogenous monoamines by inhibiting MAO, which leads to to increase their concentrations in the blood and improve psycho-emotional states.*

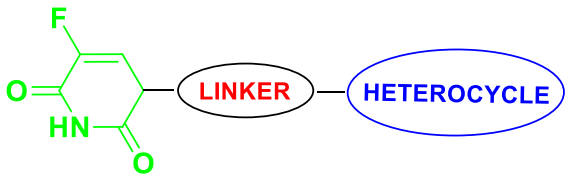
However, although these drugs and similar drugs show a pronounced clinical effect, nevertheless, many of them have side effects, are not always effective enough and cause drug resistance. In light of this, studies on the search for new antidepressants in the series of monoamine oxidase inhibitors with improved pharmacotherapeutic and toxicological properties are relevant.

Purpose of the study. *In the present investigation, we studied the antimonoamine oxidase activity of hybrid compounds based on uracil, 5-fluorouracil with a nitrogen-containing heterocycle, connected via a linker and a number of 6-methylpyrimidines with unsaturated groups in position 5 of the ring.*

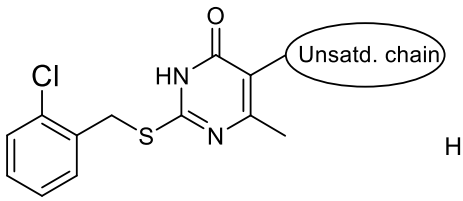
Materials and methods. *The structural formulas of the studied compounds are presented below. The source of monoamine oxidase (MAO) was 50 % rat brain homogenate, which was obtained by homogenizing the brain in a glass homogenizer with an equal by weight volume of 2.5 % Arcopal solution; in the obtained 50% homogenate, the MAO activity was determined by the described method [2]. Each compound was tested in 3-4 experiments, from which the average data were derived, the control drug – indopane.*



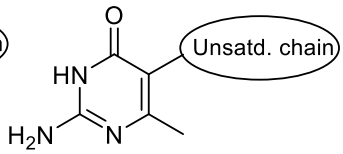
1-152 URACIL



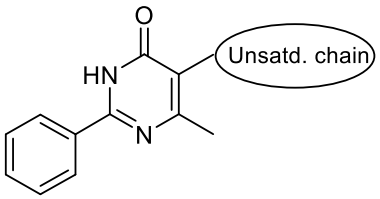
2-154 5-FLUOROURACIL



3-268



4-271



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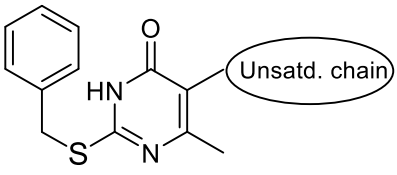
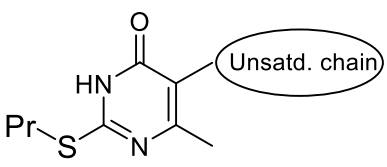
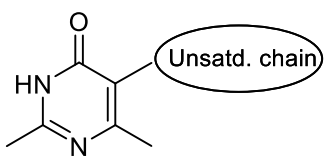


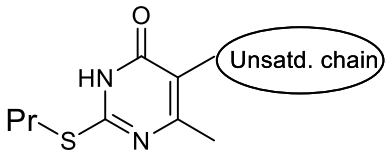
6 -276



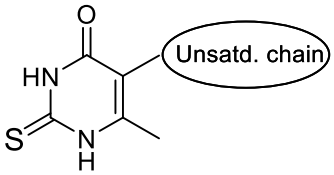
7-278



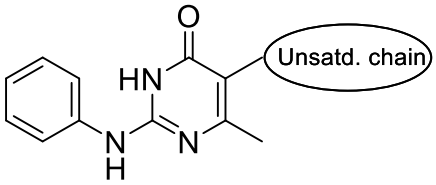
8-280



9-281



10-283



11-284

Data on antiMAO activity are presented in the table.

Table. Effect of new pyrimidine derivatives on serotonin (5-OT) deamination in bovine brain.

Comp. NN	*Inhibition of MAO activity $1 \cdot 10^{-6}$ mkmol/ml*	*Inhibition of MAO activity $5 \cdot 10^{-6}$ mkmol/ml*	*P*
1 (152)	*72±3,2*	*80±3,8*	*<0,05*
2 (154)	*54±2,6*	*68±3.4*	*<0,05*
3 (268)	*66±3,0*	*72±3,6*	*<0,05*
4 (271)	*54±2,8*	*62±2,8*	*<0,05*
5 (272)	*52±2,4*	*70±2,6*	*<0,05*
6 (276)	*35**	*-*	*-*
7 (278)	*50±2,6*	*74±3,0*	*<0,05*
8 (280)	*46±2,2*	*62±2,4*	*<0,05*
9 (281)	*22**	*-*	*-*
10 (283)	*48±2,4*	*68±2,6*	*<0,05*
11 (284)	*52±2,6*	*72±3,2*	*<0,05*
Indopane	*86±6,0*	*-*	*<0,05*

**reliability not calculated due to low activity*

*It was shown that only compound **1(152)** at doses of 1.0 µmol/ml and 5.0 µmol/ml inhibits serotonin deamination, showing moderate activity - 72 and 80%, respectively. The rest of the compounds at a concentration of 1.0 µmol/ml show a weak anti-MAO activity. It should be noted that at a concentration of 5.0 µmol/ml, the same compounds exhibit moderate activity, except for compound **1(152)**, which at a concentration of 5.0 µmol/ml exhibits a pronounced 80% antiMAO activity. (Table). The rest of the compounds exhibit weak anti-MAO activity.*

***Conclusions**. Thus, the data obtained allow us to conclude that it is possible to create new drugs - monoamine oxidase inhibitor antidepressants based on hybrid compounds of uracil and 5-fluorouracil and pyrimidines with unsaturated groups in position 5 of the ring. 5-on uracils and azaheterocycles.*

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Philological sciences

ANALYSIS OF SOME LEXEMES OF PUBLIC ADMINISTRATION AT THE STAGE OF THE HISTORICAL DEVELOPMENT OF SOCIETY

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АНАЛИЗ НЕКОТОРЫХ ЛЕКСЕМ ГОСУДАРСТВЕННОГО УПРАВЛЕНИЯ НА ЭТАПЕ ИСТОРИЧЕСКОГО РАЗВИТИЯ ОБЩЕСТВА

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Abstract

In this article, the author considers the transformation of some terms denoting the first persons, the rulers of the state. The article deals with the term's prince, grand duke, khan. The author dwells in detail on the origin of these terms, on the semantic interpretation reflected in historical documents and lexicographic dictionaries. This article is of interest to specialists, teachers of historical and philological disciplines, as well as to a wide range of readers interested in issues and problems of the history of the Russian language, linguoculturology.

Аннотация

В данной статье автор рассматривает трансформацию некоторых терминов, обозначающих первых лиц, правителей государства. В статье рассматриваются термины князь, великий князь, хан. Автор подробно останавливается на происхождении данных терминов, на смысловой интерпретации, отражённых в исторических документах и лексикографических словарях. Данная статья представляет интерес для специалистов, преподавателей историко-филологических дисциплин, а также широкому кругу читателей, интересующихся вопросами и проблемами истории русского языка, лингвокультурологии.

Keywords: *public administration, ruler of the state, Ancient Rus', Central Asia, XVII century, term, prince, khan.*

Ключевые слова: *государственное управление, правитель государства, Древняя Русь, Средняя Азия, XVII век, термин, князь, хан.*

Данная научная статья посвящается исследованию лексического фонда языков, в частности русского, и исторических источников. Анализ показывает, что в возникновении каких-либо терминов относительно государственного управления большая роль принадлежала процессам, связанным с развитием общества, как на Западе, так и на Востоке.

Обозначение первого лица – правителя государства было символом власти, авторитета и полномочий, которыми он обладал.

Наименования первых лиц на Руси прошли своеобразный путь развития и трансформации.

С момента образования государства в Древней Руси (IX в.) по отношению к правителю страны вошли в обиход термины ***князь*** *и* ***великий князь****. Термин* ***князь*** *имел широкую смысловую интерпретацию, которая отражена в различных исторических документах и лексикографических источниках. «Словарь русского языка XI–XVII вв.» (СлРЯ XI–XVII вв.)* ***князь*** *в значении «3. Правитель княжества (удела, земли); государь, монархический правитель в древней Руси зарубежных государствах» впервые отмечает в Ипатьевской летописи (список первой четверти XV в.) под 862 г.: «Поищемъ сами в собе князя, иже бы володелъ нами ирядилъ по ряду по праву» [5, с. 11]. В этой словарной статье приводятся и другие значения данного термина: «1. Глава, старейшина; владыка. … 2. Господин, хозяин, владелец. … 4. Лицо, имеющее титул князя (родовой или пожалованный). … 5. О женихе (в русском свадебном обряде) …» [5, с. 11].*

*Происхождение термина **князь** привлекало к себе внимание многих исследователей. А.С. Львов полагает, что он заимствован восточными славянами «у восточных болгар в XI в.» [3, с. 190]. Согласно данным «Этимологического словаря русского языка» под редакцией Н.М. Шанского, **князь** считается общеславянским заимствованием из германского языка: «Прагерм. *kuning "вождь, глава рода"» [7, с. 300].*

*Если первоначально термин **князь** обозначал «главу племени, рода», то с момента образования государственного строя в Древней Руси – «первого лица, правителя, главу территориального правления» (Новогородская республика, Киевская Русь, Московская Русь).*

*Как отмечает О.Г. Порохова, «слово **князь** относится также к татарским князьям, вельможам Сибирского царства (что связано, видимо, со старым значением слова **князь** "правитель княжества", которое переносится и на татарских феодалов), и русским князьям. Московский государь всегда называется **великий князь**, а другие князья – без этого определения» [4, с.75].*

*Д.С. Кулмаматов Д.С. в своей работе «Среднеазиатские дипломатические документы и их русские переводы XVII в.» отмечает, что даже главы и послы иностранных государств в своих официальных посланиях, направленных к российским правителям, всегда обращались к ним, используя термин **великий князь**. В частности, среднеазиатские послы в своих челобитных XVII в., написанных на «среднеазиатском тюрки» арабской графикой, обращались к российским правителям, употребляя «своеобразный двусловный титул УЛУҒ БиЙ», т.е. **великий князь** [2, с.13].*

*Термин **великий князь** до конца XVII в. был одним из обязательных элементов титулов российских правителей.*

*Данные письменных памятников русского языка свидетельствуют, что иногда по отношению к русским князьям вместо термина **великий князь** применялся термин **великий каган,** являющийся **титулом** правителей у хазар, болгар, аваров, тюрков, монголов. «Словарь русского языка XI–XVII вв.» отмечает его в «Слове о законе и благодати» Иллариона (XI в.): «Похвалимъ же и мы … нашего учителя и наставника, великого кагана нашея земля, Владимера, внука стараго Игоря» [5, с.11].*

*Анализ разного рода исторических источников показывает, что с момента образования государств в Восточных странах по отношению к правителям употреблялись и другие термины: **хан, шах, эмир** и т.д. Наиболее употребительным в Средней Азии был, конечно, термин **хан.***

*Словарь древнерусского языка И.И. Срезневского термин **хан** впервые фиксирует в «Хожении за три моря» Афанасия Никитина в 1466–1472 г. (по Троицкому списку XVI в.) в значении «азиатский владетель; вельможа»: «Хан же ездитъ на людехъ, а слоновъ у него и кони много добрыхъ» [6, Стлб. 1360].*

Н.А. Баскаков, исследуя титулы и звания представителей верховной и административной власти восточных стран, по поводу данного термина пишет: «Хан – традиционный титул в большом родоплеменном объединении или государстве тюркских и монгольских народов; у тюрков впервые отмечен у гуннов в форме хан и каган, а также у булгар – в форме хан. Титулы хан и каган происходят из китайского: хап <кит. kuan "хан"; qaγan <кит. ke-kuan "великий хан"» [1, с. 64].

*Как показывает вышеизложенный материал, термины **князь** (**великий князь**) и **хан** (**каган, великий каган**) в истории двух языков имели активное употребление, что отражено в памятниках древнерусской и среднеазиатской письменности. Примечательно, что проанализированные нами термины были относительны к правителям и Древней Руси, и Восточных стран.*

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Technical sciences

SEGMENTATION OF HISTOPATHOLOGICAL IMAGES FOR THE DIAGNOSIS OF BREAST CANCER

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There are several research groups working towards the use of artificial intelligence in medical diagnostics. In February 2017, Stanford published an article in the journal Nature on the diagnosis of skin cancer. By utilizing deep learning algorithms, their model achieved an accuracy of 91%, which is comparable to that of human experts. They were able to identify general visual indicators of the disease using deep neural networks. Other leading universities are also investing in the use of deep learning algorithms for diagnosing various diseases, including nodules and breast cancer. Accurate diagnosis. However, the increasing number of patients and the limited availability of experienced pathologists pose several challenges in accurately diagnosing breast cancer. The imbalance in the distribution of medical resources also contributes to misdiagnosis [1].

Therefore, we are striving to develop a reliable computer program that will assist pathologists in diagnosing breast cancer more quickly and easily. While there are various approaches to automated medical diagnostics, many of them are designed for pathologists with limited experience in artificial intelligence. Pathologists may not understand the terminology associated with artificial intelligence or may not comprehend the statistical inference produced by artificial intelligence [2].

It is possible that the pathologist may not accurately interpret the report generated by the computer. Such limitations may delay the acceptance of collaboration with artificial intelligence. Therefore, we are striving to implement a fully automated system for the diagnosis of breast cancer. In this system, even if pathologists have no knowledge of artificial intelligence, we will provide them with a user-friendly deep learning program that can assist them in providing advice. It will be designed for mammography or pathological analysis, as well as for identifying potential locations for abnormalities. Ultimately, a well-structured report will be prepared regarding the diagnosis and location of abnormalities, aiding in making more precise diagnostic decisions. The system will handle tasks such as image classification, object detection, and image annotation [3].

The examination of biological specimens by pathologists is considered the conventional method for diagnosing many diseases, especially cancers such as breast cancer. However, reviewing specimens requires manual effort and a significant amount of time, which may delay decision-making.

Viewing pathology slides can be a challenging task. In some cases, agreement on the diagnosis of certain forms of breast cancer can be as low as 48% [1]. Pathologists face difficulties in diagnosing diseases because they need to review all slides for each patient, and each slide can generate 10 gigapixels of data when digitized at 40x magnification.

On the other hand, the current approaches to automated medical diagnosis do not target pathologists with limited experience in artificial intelligence. Pathologists may not understand the terminologies used to describe AI or comprehend the statistical inference generated by AI [4].

It is possible that the pathologist may not accurately interpret the report generated by the computer. Such limitations may delay the acceptance of collaboration with AI.

Therefore, we are taking steps towards implementing a fully automated system for the diagnosis of breast cancer. The entire system will have the following functionalities:

1. *Begin with mammography. To determine if there is a presence of abnormalities or not, the first step requires an enhanced mammogram of the patient. The deep learning program performs an initial classification: whether it is suspicious, non-suspicious, or inconclusive. Further detailed diagnosis is carried out subsequently.*
2. *If classified as positive, locate potential areas of abnormality. If the program classifies the image as positive, it identifies the potential locations of abnormalities in an additional manner. This provides pathologists with specific regions to focus their attention on.*

3. Provide more confident conclusions with pathological analysis. If the program does not reach the predefined confidence threshold, it suggests a pathological analysis. As analyzing pathology can provide more information, the program refines its conclusions.

4. Generate an easily interpretable report. Finally, the program presents its findings in a concise and understandable manner. The report encapsulates all the conclusions. Initially, our primary goal was to create a precise model for classifying histopathological images of breast cancer, which is the first step in the diagnostic process. The first stage involved pre-processing, as the original images were of lower quality and contained a significant amount of noise. Gaussian filtering was applied to smoothen and reduce noise in the image. Then, they expanded the histogram to enhance contrast. The second stage involved nucleus segmentation since classifying abnormalities requires identifying nuclei in each region of interest. They implemented four clustering algorithms: competitive neural network, fuzzy C-means, K-means, and an adaptive Gaussian model.

Among the topics discussed, histopathological interpretation, pathophysiology, and current methods of diagnosing breast cancer are present. Let's focus on histopathological interpretation. Microscopic visualization of biopsies serves as a standard tool for pathologists in diagnosing breast cancer. Pathologists examine the size, shape, and structure of cells and tissues, searching for specific features in the image. Certain signals used in this procedure capture the appearance of each cell, the appearance of each nucleus, and the appearance of each tissue [1]. Pre-processing is an essential part of image classification, especially in the classification of histopathological images. Based on the previous section, we have implemented various preprocessing methods and presented the code. In this section, we will explore different preprocessing methods without altering other parameters.

*Let's consider a task whose main objective is automatic segmentation based on k-means clustering of color images represented in the L*a*b color space.*

• Step 1: Image reading.

*Step 2: Transform the image from the RGB color system to the L*a*b color system.*

• Step 3: Color classification in the 'ab' space using k-means clustering.

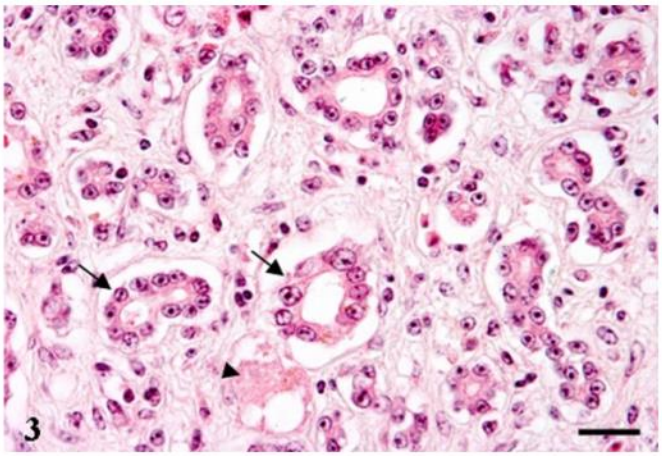
• Step 4: Assign labels to each pixel of the image based on the k-means method.

• Step 5: Create a segmented image based on the colored clusters.

• Step 6: Kernel segmentation based on an individual image.

Step 1: Image reading.

Let's read the file "hestain.png," which contains a Hematoxylin and Eosin (H&E) stained image. This staining method is commonly used for detailed pathological analysis.



Step 2: Converting the image from the RGB color system to the L*a*b* color system.

*In the RGB color system, when not considering the possibility of brightness combinations, three colors are visible in the image: white, blue, and pink. It is important to note the differences between these colors. The L*a*b color space (also known as CIELAB or CIE L*a*b) allows us to perceive and distinguish these visual differences.*

Step 3: Color classification in the 'ab' space using k-means clustering.

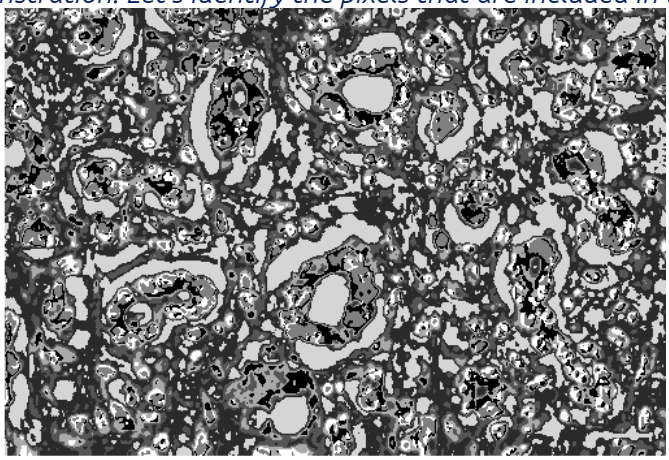
Clustering leads to the grouping of objects, and k-means clustering also results in the localization of objects in space. The determination of which object belongs to which class, or the search for division, is based on the analysis of the metric distance between objects.

Based on the color information in the 'ab' space, each pixel of the object is assigned values for 'a' and 'b*'. We will use k-means clustering to separate the objects into 7 clusters. To achieve this, we will employ the Euclidean distance metric.*

Step 4: Assigning labels to each pixel of the image based on the k-means method.

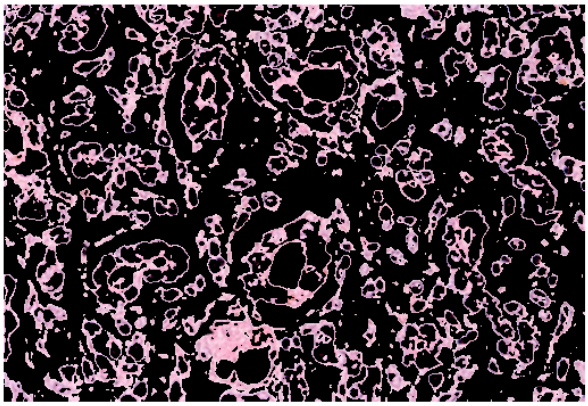
Step 4: Assigning labels to each pixel of the image based on the k-means method.

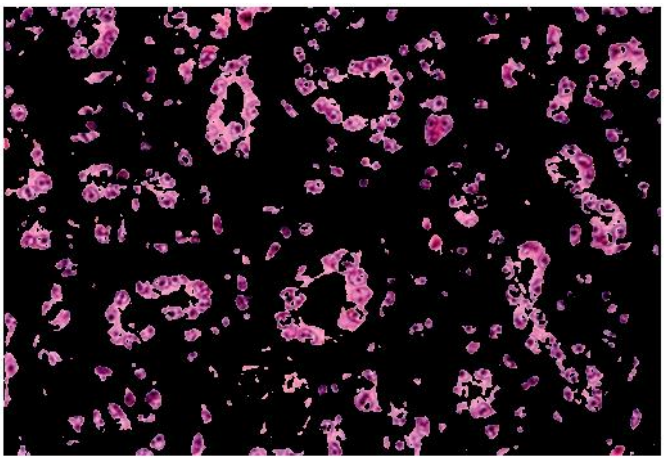
For each object in the original image, the k-means method returns the index of the corresponding cluster. The value of the 'cluster_center' parameter obtained from the application of the k-means method will be used for further demonstration. Let's identify the pixels that are included in the 'cluster_index'.

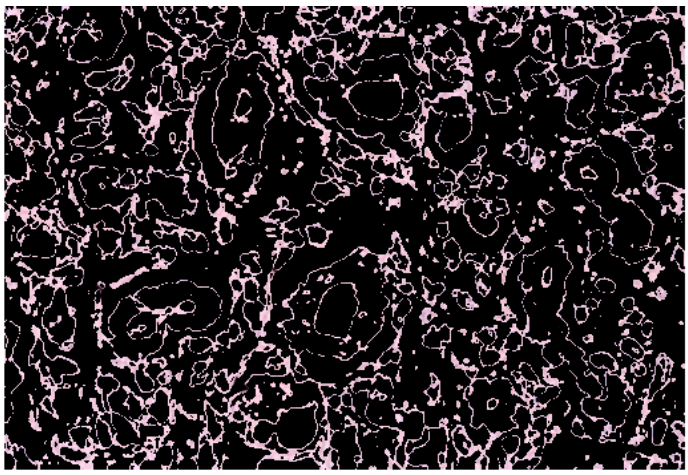


Step 5: Creating a segmented image based on the colored clusters.

By utilizing the 'pixel_labels' parameter, we can separate the objects in the image based on their colors.



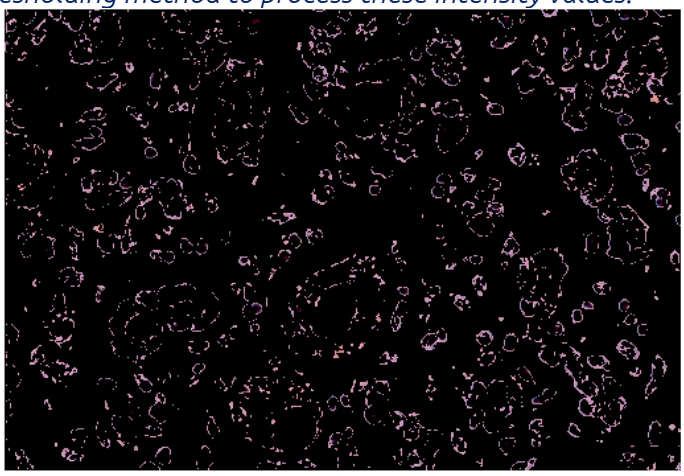




Step 6: Segmentation of nuclei based on an individual image

Let's consider an image that contains blue objects. We observe that they vary in shades of dark blue and light blue. By utilizing the 'L' value in the Lab* color space, we can distinguish between dark blue and light blue objects.*

As a reminder, the 'L' parameter contains intensity values for each color. We will identify the clusters that contain blue objects and extract the intensity values of the objects within those clusters. We can then apply a thresholding method to process these intensity values.*



Different preprocessing methods have a significant impact on the results, typically showing improved performance with higher magnification. It is estimated that with proper input, our system can achieve approximately 5% higher accuracy.

Our main goal is to create a diagnostic system that assists doctors in making accurate and prompt decisions. Therefore, our program aims to not only classify histopathological images but also explore other methods that can contribute to the diagnosis process in the future.

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FORMATION AND PROCESSING OF BIOMEDICAL IMAGES

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Image serves as a means of representing information in visual form. The effectiveness of perceiving this information by humans depends on various factors. The maximum consideration of these factors can be achieved by studying a range of issues related to image acquisition, visual perception properties, and image processing.

In the modern era, the development of technical and medical diagnostics is closely related to the visualization of internal structures [1]. There are many different types of visualization methods. New methods emerge, but they do not replace existing ones; they complement them. Different visualization methods are based on various physical interactions of electromagnetic radiation with materials, media, biological tissues, and, as a result, provide measurements of different physical properties of these objects. Let's consider several main methods of image acquisition that are of interest to technical and medical diagnostics [2].

It has been established that the contrast of X-ray images sharply decreases with increasing quantum energy. Therefore, to achieve high contrast, it is necessary to use low-energy radiation. However, this entails a high radiation dose, and thus, a compromise must be found between sufficient contrast and the lowest radiation dose [3].

Even if an imaging system has high contrast and good spatial resolution, high levels of noise pose serious problems for radiologists in identifying large structures. The level of noise can be reduced by increasing the number of quanta that form the image. However, this also increases the radiation dose, so the relationship between these two quantities must be taken into account [4].

Standard analog systems perform the formation and display of information in an analog manner. However, analog systems have very strict limitations on exposure due to a small dynamic range and relatively limited image processing capabilities. In contrast to analog systems, digital radiographic systems allow image acquisition at any desired dose and provide extensive image processing capabilities.

One of the most important characteristics is the histogram of pixel intensity distribution in the image [5-6].

Obtaining Images Using Radiotracers

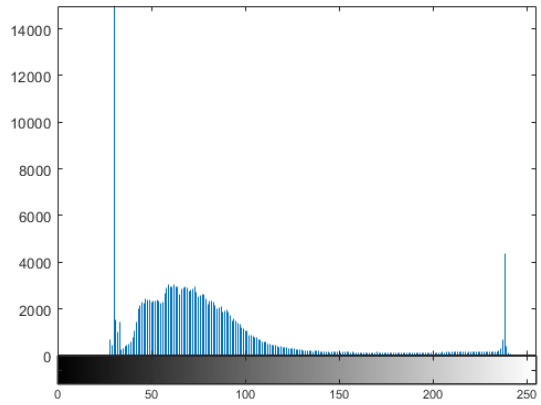
The method discussed below has found wide application in medicine. In recent decades, clinical diagnosis of human diseases using the introduction of radiotracers into the body has significantly advanced. Radiotracer imaging involves a range of imaging techniques that reflect the distribution of radiolabeled substances in the body. These substances, known as radiopharmaceuticals, are designed for the observation and evaluation of the physiological functions of specific internal organs. The distribution pattern of radiopharmaceuticals in the body is determined by the methods of administration, as well as factors such as blood flow rate, circulating blood volume, and the presence of various metabolic processes.

Radiotracer imaging provides valuable diagnostic information. The most common method in this class is static isotope imaging in a plane, known as planar scintigraphy. Planar scintigrams are two-dimensional representations, specifically projections of the three-dimensional distribution of isotope activity within the detector's field of view. Tomographic studies using multi-view data acquisition systems overcome most of the problems associated with information overlap in single-view data collection. The progress of computer technology has led to the application of computers in radiotracer studies, where tomographic and dynamic information plays a crucial role. The use of computer technology enhances image quality and enables quantitative information about the studied objects to be obtained in radiotracer imaging.

Using Nuclear Magnetic Resonance (NMR) Imaging

Despite being an important diagnostic tool in many major research centers, NMR imaging is still in a relatively early stage of development. The phenomenon of nuclear magnetic resonance was independently discovered by Bloch and Purcell with Pound in 1946. This method, through slight changes in resonance frequency (via the presence of an electron cloud in the vicinity of the molecule), allows the

identification of nuclei in different chemical environments. Initially, NMR methods with high resolution were developed as a universal means of studying the chemical composition and structure of solids and liquids, and later found applications in other fields, including medicine. Alongside the development of NMR spectroscopy, imaging methods were also developed, including point methods, fast imaging methods, and others. In modern NMR systems, the central processing unit is a powerful mini-computer that provides communication with the operator and controls the functions of the system's components. The computer also facilitates data storage and archiving, displays the results of investigations, and in many cases, is connected to fast processing devices such as matrix processors.



Quite often, when conducting image analysis, there is a need to determine the intensity values of certain pixels. The histogram of an image is one of the most informative characteristics. By analyzing the histogram, we can assess the brightness distortions of the image, i.e., determine whether the image is underexposed or overexposed. Ideally, a digital image should have an equal distribution of pixels with all brightness values, resulting in a uniform histogram. The process of redistributing the pixel intensities in an image to achieve a uniform histogram is called histogram equalization.

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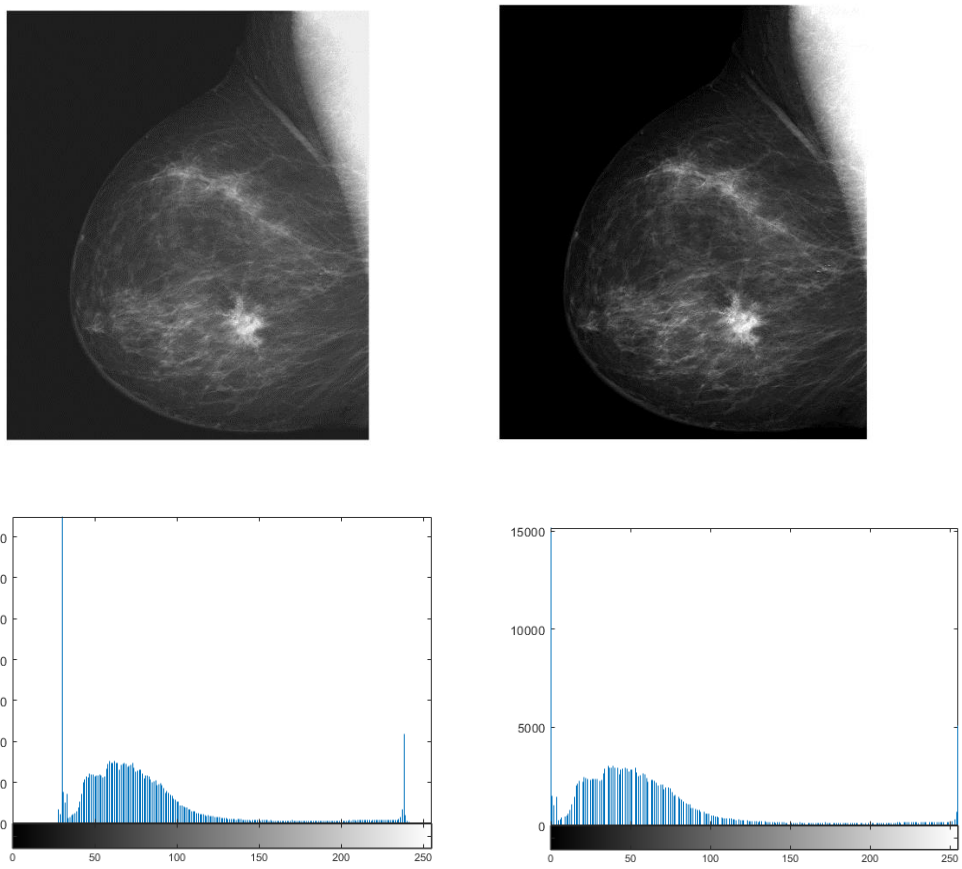
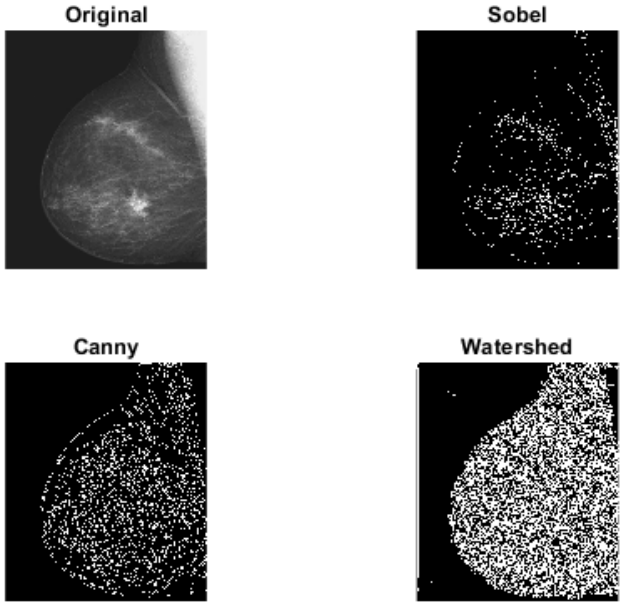
Original Image *Image after Histogram Equalization*

Quite often, when generating images, not the entire range of intensity values is used, which negatively affects the quality of visual data.



One of the most commonly used techniques for edge detection is the edge detection function, which implements various built-in methods such as Sobel, Prewitt, Roberts, Laplacian of Gaussian, Canny, and others. Here are some examples of implementing the function using different filters:



Quite often, X-ray biomedical images do not meet the quality criteria necessary for accurate analysis. Additionally, it is not always possible to retake the image. This necessitates digital processing of such information [2, 3].

The main drawbacks of X-ray images, in most cases, are distorted brightness characteristics and low contrast. Let's consider an example of processing one such image.

The drawback of the original biomedical image (Fig. 3a) is that it is low contrast, which hinders the analysis of fine details. Therefore, the first step is to perform a histogram stretching operation to expand the image's histogram to the maximum allowable range (Fig. 3b). Next, contrast enhancement of the investigated image is carried out (Fig. 3c). This leads to an improvement in the visual quality of X-ray images. In practice, more complex methods and algorithms for processing such images are also applied.



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CHARACTERISTICS OF HEAT EXCHANGE WITH TRAPEZOIDAL BAFFLES HEAT EXCHANGER

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Abstract

Periodic whole cross-section computation models are established for segmental baffle heat exchanger, shutter baffle heat exchanger, and trapezoid-like tilted baffle heat exchanger. The reliability of models is verified by comparing the simulated results to the results obtained from the Bell-Delaware method. Due to the orthogonal assembly of the baffles, the shell side fluid shows the twisty flow of trapezoid-like tilted baffle heat exchanger. The essential mechanism on disturbing flow and heat transfer enhancement is revealed by defining the non-dimensional factor η of the shell side fluid flow direction of heat exchanger and the field synergy principle. The results show that at the same Reynolds number, the shell side fluid convection heat transfer coefficient of trapezoid-like tilted baffle heat exchanger is 12.43%-24.33% and 6.71%-11.51% higher than those of segmental baffle heat exchanger and shutter baffle heat exchanger, respectively. The shell side fluid flow velocity field and the pressure gradient field of trapezoid-like tilted baffle heat exchanger and shutter baffle heat exchanger decreases compared with that of segmental baffle heat exchanger, so the shell side fluid flow resistance and pressure drop is increased; the shell side comprehensive performance of trapezoid-like tilted baffle heat exchanger is 5.85%-9.06% higher than that of segmental baffle heat exchanger, and 15.27%-23.28% higher than that of shutter baffle heat exchanger. In this study, a baffle structure with higher efficiency of the energy utilization for the heat exchanger is provided.

Keywords: *shell-and-tube heat exchanger, trapezoid-like tilted baffle, twisty flow, field synergy principle*

1. Introduction

As one of the most widely used heat transfer equipment, the shell-and-tube heat exchanger plays an important role in energy conservation. When the fluid flows in the shell side of the traditional segmental baffle heat exchanger, the flow and heat transfer dead zones come into being from the eddy current stagnation areas near the baffle incision and nozzles, which leads to fouling corrosion easily around heat exchange tubes and reduction of heat transfer efficiency. Fluid-induced vibration can damage heat exchange tubes and reduce the service life of the heat exchanger [1, 3]. Therefore, the development of a new type of energy-saving with high-efficiency heat exchanger and the optimal design of the structure are very important. In recent years, new tube support structures have been continuously developed, such as a full circle with hole baffle [4, 6], ladder-type fold baffle rod baffle, and shutter baffle the shell-side fluid flow into lateral flow, longitudinal flow, spiral flow, and oblique flow. Gu combined the advantages of the lateral and longitudinal flow of the heat exchanger shell side fluid, proposed and developed a shutter baffle tube bundle support structure. With the developed structure, fluid flows in an oblique pattern in the shell side of the heat exchanger. In the heat exchanger, the dead zones of the fluid flow are reduced leading to the enhancement of the heat transfer in the shell side.

According to the characteristics of oblique flow, a trapezoid-like tilted baffle was used as the support structure of the tube bundles. The adjacent two sets of baffle plates were arranged orthogonally to make the fluid flow twisted in the shell-side. The characteristics of fluid flow and heat transfer performance in shell side were studied, combining with the field synergy principle to reveal the heat transfer enhancement mechanism.

2. Numerical simulation methods

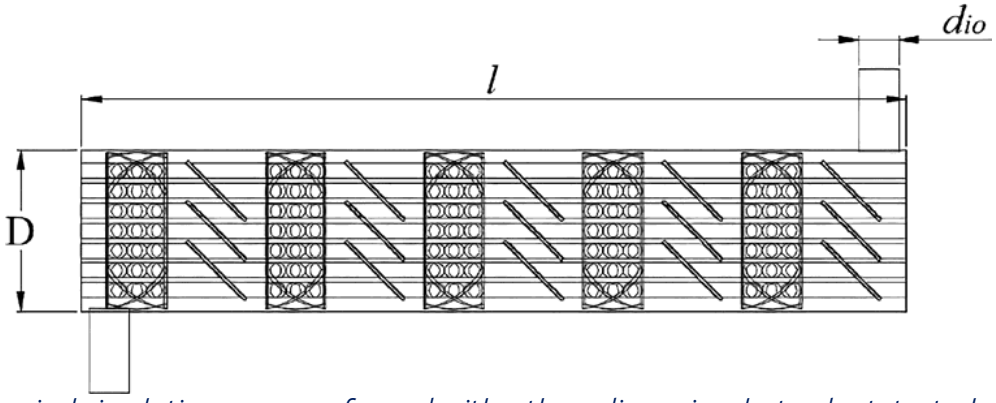
The core component of a shell-and-tube heat exchanger (STHX) is composed of tube bundle and tube supports or baffles. Because of the difference in tube bundle support structures, thermodynamics performances in shell sides vary greatly [1, 2].

To study characteristics of fluid flow and heat transfer in the shell side of the trapezoidal-like tilted baffles heat exchanger, two types of STHXs with traditional segmental baffle and shutter baffle were selected as comparisons.

3. GEOMETRIC MODEL

In numerical investigations, according to the characteristics of fluid flow and heat transfer in the shell side of heat exchanger [1,3], the inlet and outlet sections of heat exchanger account for only a small part of thewhole shell side fluid field of the heat exchanger, andmost of them is in the fully developed section. In thefully developed mainstream region, the shell sidestructure of heat exchanger is periodic, so the averagecross-section flow velocity, pressure drop anddimensionless temperature are periodic in the mainstreamregion. The periodic computer model was developed withsuch reasonable simplifications of the geometric structure. Numerical models were built up including traditional segmental baffle, shutter baffle, and trapezoid-like tilted baffle heat exchangers. A schematic diagram of the overall structure of trapezoid-like tilted baffle heatexchanger is shown in Fig. 1.

Fig. 1 The overall structure of trapezoid-like tilted baffle



The numerical simulations were performed with a three-dimensional, steady-state, turbulent flow system. Inthis paper, the Reynolds number of shell side fluid is varied between 5000 and 20000, so the shell side fluid is in the state of completely turbulent flow.

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APPLICATION OF ARTIFICIAL INTELLIGENCE TECHNOLOGIES IN FORECASTING THE MARKET NEEDS FOR MEDICINES

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In the early stages of drug discovery, machine learning can perform many tasks, from initial observations of drug compounds to predicting drug success. Artificial intelligence can play a role in drug identification and validation tasks, such as drug repurposing and biomarker detection. Applying artificial intelligence to drug testing can shorten the time it takes to get a drug approved and on the market, thereby reducing overall costs. An artificial intelligence system for the production of drugs should take into account the following characteristics of slow processes [1-3]:

- *They are multifactorial and multidimensional.*
- *Extensive use of modern mathematical models, digital methods and information technologies based on artificial intelligence methods.*

From the drug development process to the purchase of the drug by the patient at the pharmacy, the pharmaceutical industry has to work with a huge amount of data. Laboratory diagnostics, monitoring of patients' condition, messages about the drug's effectiveness on forums and social networks - all this is useful information for a pharmaceutical company. However, given their quantity and fragmentation, the manufacturer does not have time to process and absorb this knowledge, much less apply it. Artificial intelligence helps to solve these and other problems [1,2].

The desire of pharmaceutical companies to collect, systematize and analyze large data has forced them to turn to artificial intelligence technologies. The neural network created by scientists can easily cope with collecting the necessary information both in the creation of the drug and in obtaining feedback from patients [3].

Another task where artificial intelligence can be useful is to reduce drug development time [4-9].

The optimal planning model for the sale and production of pharmaceutical products was developed.

$$f_1 = \sum\sum \mu_{ij} x_{ij} \to \max$$
$$f_2 = \sum\sum r_{ij} x_{ij} \to \min \quad (1)$$
$$f_3 = \sum\sum \upsilon_{ij} x_{ij} \to \min$$

subject to

$$0 \le \mu(x), r(x), \upsilon(x) \le 1,$$
$$\sum_j x_{ij} = S_i\,, \quad (2)$$

where S_i denotes the sentence of source i,

$$\sum_j x_{ij} = D_i\,, \quad (3)$$

where D_i denotes the demand of destination j,

$$x_{ij} \ge 0\ .$$

Here:

μ_{ij} *- i - the selling price of product*

$x_{i,j}$ *- the amount of i-type manufactured products in the j-stage*

r_{ij} *- production costs of i-type product*

v_{ij} *- costs of certification of the same type of products*

Solving this problem can be done using the fuzzy programming method, which allows to find the optimal solution of multi-level problems.

Solution algorithm.

Step 1: Solve a multiobjective optimization problem.

Step 2: Based on the results of step 1, determine the appropriate values for each goal in each resulting solution. Then find the lower and upper bounds of f_k^L, *and* f_k^U $(k=1,2,3,....,K)$.

Step 3: The membership function $\mu_{k(x)}$ *corresponding to the kth goal of the minimization problem is defined as*

$$\mu_k(x)=\begin{cases}1 & if \quad f_k \le f_k^L,\\ 1-\dfrac{f_k-f_k^L}{f_k^U-f_k^L} & if \quad f_k^L < f_k < f_k^U,\\ 0 & if \quad f_k \ge f_k^U\end{cases}$$

The membership function can be defined for the maximization problem as

$$\mu_k(x)=\begin{cases}0 & if \quad f_k \le f_k^L,\\ 1-\dfrac{f_k-f_k^U}{f_k^U-f_k^L} & if \quad f_k^L < f_k < f_k^U,\\ 1 & if \quad f_k \ge f_k^U\end{cases}$$

The linear programming problem can be further simplified as follows.

$$\lambda \to \max$$
$$f_k+\lambda(f_k^U-f_k^L)\le f_k^U$$

for the minimization problem and

$$f_k+\lambda(f_k^U-f_k^L)\le f_k^L$$

for a maximization problem with given constraints and

$$\lambda \ge 0.$$

Step 3 gives the values of the three objective functions f_1, f_2 *and* f_3.

Step 4:

$$f = f_1 - f_2 - f_3$$

1. Results.

Consider the fuzzy optimization problem

$\mu_{ij} =$

0.6	0.7	0.3	0.8
0.5	0.4	0.5	0.3
0.4	0.3	0.6	0.7

$r_{ij} =$

0.1	0.2	0.3	0.1
0.2	0.1	0.3	0.3
0.3	0.2	0.3	0.3

$v_{ij} =$

0.2	0.1	0.1	0.1
0.3	0.1	0.1	0.2
0.2	0.2	0.1	0.2

The solution is obtained as

$$\lambda = 0.91,$$
$$f_1 = 513.27,$$
$$f_2 = 137.32,$$
$$f_3 = 111.57$$

$$\mu_o = 0.71, r_o = 0.0032, \upsilon_0 = 0.139$$

The main advantage of fuzzy goal programming is that it can be transformed into a traditional linear programming model. Another advantage is that setting goals is symmetric with setting constraints. Finally, the concept of allowable degraded aspiration level is compatible with real decision making.

In the article, the task of developing optimal planning methods and models for the production and sale of pharmaceutical products, as well as creating software tools supporting these models and methods, was set and solved. A fuzzy mathematical model of the optimal planning of the production and sale of pharmaceutical products has been developed, which takes into account the unique characteristics of the industry and maximizes the company's profit; A heuristic algorithm for planning the production and sale of pharmaceutical products has been developed, which is characterized by high speed and planning efficiency.

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ASSESSMENT OF THE RISK OF CROP DECLINE

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Artificial intelligence technologies (hereinafter referred to as AI; automated processes and phenomena occurring under conditions close to optimal, and having the ability to improve upon the accumulation of a critical mass of statistical data) [1, 2] in large volumes and with greater speed they penetrate into various sectors of the national economy (types of economic activity) [3-5]. This is due to the exponential development of computing power of computer technology and the continuous search by people for the best solutions that are able to solve the current problems [6]. Artificial intelligence has established itself as a more effective and efficient way in matters of accurate and reliable assessment and diagnosis (assessment of financial risks, natural and climatic phenomena, diagnosis of diseases) [4, 7]. This technology shows better predictive results in comparison with classical methods of data processing and analysis. At the moment, the introduction of artificial intelligence systems is in its infancy, but the success of such programs, despite the shortcomings in the technology (determination of the optimal architecture of simulated artificial neural networks, the need for expensive computer equipment that can cope with labor-intensive computational algorithms, the lack of necessary information libraries and databases), shows the best results relative to the previously used methods [8- 10]. AI-assisted computing systems deliver more accurate, reliable and efficient results.

Artificial intelligence technologies used in agriculture have a number of significant features. First of all, these are software and hardware. Artificial intelligence technologies perform an intellectual function when carrying out work in agriculture, which consists in the implementation of abstract inferences, pattern recognition, action in conditions of incomplete information, the manifestation of creativity, the ability to self-study.

The forecast yield for the forecasted year, taking into account water availability, weather conditions and the difference of mineral fertilizers is determined [10-12]:

$y^{T} = y^{П} + \Delta y$.

When modeling the yield forecast of cotton in a fuzzy environment, we take the following notation.

P_{kij} *- area under cotton;*

Y_{kij} *- cotton yield;*

μY_{kij} *- membership function for cotton yield;*

C_{kij} *- breeding variety;*

N_{kij} *- input of nitrogen to cotton;*

μN_{kij} *- the membership function for the added amount of nitrogen for cotton;*

BO_{ki} *- water availability;*

μBO_{ki} *- membership function for water availability;*

$П_{ki}$ *- weather conditions of the planting season;*

$\mu П_{ki}$ *- membership function for weather conditions, the sowing period;*

B_{ki} *- weather conditions of the vegetation period;*

μB_{ki} *- membership function for the weather conditions of the vegetation period;*

$УБ_{ki}$ *- weather conditions for harvesting period;*

$\mu УБ_{ki}$ *- the function of the attribution of the weather conditions of the harvest period;*

k- years preceding the projected;

$i = \overline{1,n}$ *- number of the object;*

j - index of the selection grade of cotton.

The forecast of cotton yield is carried out by the method of restoring a potentially possible crop that is not received due to the influence of unfavorable weather conditions and water availability during the sowing season, growing and harvesting, the introduction of recovery factors.

It is advisable to use the methods of fuzzy mathematics, as weather conditions, yield, water availability are fuzzy numbers [11].

Potentially possible yields, corrected under normal weather conditions and water availability, are determined by the formula

$$\bar{Y}_{kij} = (\sum_{s=1}^{m} \mu^s Y_{kij} Y_{kij}^s / \sum_{r=1}^{m} \mu^r Y_{kij})(1+w_{ki}),$$

where w_{ki} *- the recovery factor of the under-received crop due to unfavorable weather conditions and water availability.*

The recovery ratio is expressed in this way[12]

$$w_{ki} = 0,01\rho_1(1-\sum_{s=1}^{m} \mu П_{ki}^s П_{ki}^s / \sum_{r=1}^{m} \mu П_{ki}^r) * *(1-0,3\sum_{s=1}^{m} \mu BO_{ki}^s BO_{ki}^s / \sum_{r=1}^{m} \mu BO_{ki}^r - 0,7\sum_{s=1}^{m} \mu B_{ki}^s B_{ki}^s / \sum_{r=1}^{m} \mu B_{ki}^r) +$$

$$+0,01\rho_2(1-\sum \mu B_{ki}^s B_{ki}^s / \sum_{r=1}^{m} \mu B_{ki}^r) + 0,01\rho_4(1-\sum_{s=1}^{m} \mu BO_{ki}^s BO_{ki}^s / \sum_{r=1}^{m} \mu BO_{ki}^r) *$$

$$*(1-0,4\sum_{s=1}^{m} \mu B_{ki}^s B_{ki}^s / \sum_{r=1}^{m} \mu B_{ki}^r - 0,2\sum_{s=1}^{m} \mu П_{ki}^s П_{ki}^s / \sum_{r=1}^{m} \mu П_{ki}^r) +$$

$$+0,01\rho_3(1-\sum_{s=1}^{m} \mu УБ_{ki}^s / \sum_{r=1}^{m} \mu УБ_{ki}^r).$$

Here, the influence of factors of influence on yield reduction is due to weather conditions in sowing by ρ_1 *%, in vegetation by* ρ_2 *%, by harvesting by* ρ_3 *% and by water insecurity by* ρ_4 *%.*

The degree of influence of weather conditions is determined on the basis of long-term observations and takes on value

$$\rho_i = \sum_{s=1}^{m} \rho_i^s \mu\rho_i^s / \sum_{r=1}^{m} \mu\rho_i^r, \; i = \overline{1,4};$$

$$\mu\rho_1^s = 1/(1+|\rho-4|); \qquad \mu\rho_3^s = 1/(1+|\rho-10|);$$

$$\mu\rho_2^s = 1/(1+|\rho-7|); \qquad \mu\rho_4^s = 1/(1+|\rho-12|).$$

Suppose given:

- A sets of alternatives (selection varieties of the cotton depending on the type of soil and the application of fertilizers);

- feature sets (biological and technological characteristics, which are used to select an acceptable sort);

acceptable variety.

The experiment was carried out for the selection problem of four selection sorts: C-4727, Tashkent 1, 159-F, 108-F cotton ($X = \{x_1, x_2, ..., x_4\}$*) better in the following characteristics (*$P = \{p_1, p_2, ..., p_4\}$*): yield, fiber length, fiber strength, seed oil [7-9].*

The importance of each feature is given and expressed through fuzzy densities

$$g_1 = 0,66, \quad \mathbf{g_2 = 0,89,} \quad \mathbf{g_3} = 0,96, \quad g_4 = 0,93$$

$$h_1 = 0,19, \quad h_2 = 0,21, \; h_3 = 0,22, \; h_4 = 0,24$$

$$g_\lambda(x_1, x_2, x_3, x_4) = 1.$$

$$g_1g_2g_3g_4\lambda^3 + (g_1g_2g_3 + g_1g_2g_4 + g_1g_3g_4 + g_2g_3g_4)\lambda^2 +$$

$$(g_1g_2 + g_1g_3 + g_1g_4 + g_2g_3 + g_2g_4 + g_3g_4)\lambda + g_1 + g_2 + g_3 + g_4 = 1.$$

$$0,524\lambda^3 + 2,49\lambda^2 + 4,409\lambda + 2,44 = 0.$$

$$\lambda^3 + 4,75\lambda^2 + 8,41\lambda + 4,66 = 0.$$

$$\lambda = -0,96.$$

$$g_\lambda(x_1, x_2, x_3) = g_1g_2g_3\lambda^2 + (g_1g_2 + g_1g_3 + g_2g_3)\lambda + g_1 + g_2 + g_3 =$$

$$-0,96^2 \times 0,66 \times 0,89 \times 0,96 - (0,66 \times 0,89 + 0,66 \times 0,96 + 0,89 \times 0,96) \times 0,96$$

$$+0,66 + 0,89 + 0,96 = 1,03$$

$$g_\lambda(x_1,x_2,x_4)=g_1g_2g_4\lambda^2+(g_1g_2+g_1g_4+g_2g_4)\lambda+g_1+g_2+g_4=$$
$$-0,96^2\times0,66\times0,89\times0,93-(0,66\times0,89+0,66\times0,93+0,89\times0,93)\times0,96$$
$$+0,66+0,89+0,93=1,04$$

$$g_\lambda(x_1,x_3,x_4)=g_1g_3g_4\lambda^2+(g_1g_3+g_1g_4+g_3g_4)\lambda+g_1+g_3+g_4=$$
$$-0,96^2\times0,66\times0,96\times0,93-(0,66\times0,96+0,66\times0,93+0,96\times0,93)\times0,96$$
$$+0,66+0,96+0,93=1,05$$

$$g_\lambda(x_2,x_3,x_4)=g_2g_3g_4\lambda^2+(g_2g_3+g_2g_4+g_3g_4)\lambda+g_2+g_3+g_4=$$
$$-0,96^2\times0,89\times0,96\times0,93-(0,89\times0,96+0,89\times0,93+0,96\times0,93)\times0,96$$
$$+0,89+0,96+0,93=1,042$$

$g_\lambda(x_1,x_2)=g_1g_2\lambda+g_1+g_2=-0,96\times0,66\times0,89+0,66+0,89=0,99$,

$g_\lambda(x_1,x_3)=g_1g_3\lambda+g_1+g_3=-0,96\times0,66\times0,96+0,66+0,96=1,02$,

$g_\lambda(x_1,x_4)=g_1g_4\lambda+g_1+g_4=-0,96\times0,66\times0,93+0,66+0,93=1,01$,

$g_\lambda(x_2,x_3)=g_2g_3\lambda+g_2+g_3=-0,96\times0,89\times0,96+0,89+0,96=1,03$,

$g_\lambda(x_2,x_4)=g_2g_4\lambda+g_2+g_4=-0,96\times0,89\times0,93+0,89+0,93=1,02$,

$g_\lambda(x_3,x_4)=g_3g_4\lambda+g_3+g_4=-0,96\times0,96\times0,93+0,96+0,93=1,05$,

$h_1=0,19,\quad h_2=0,21,\ h_3=0,22,\quad h_4=0,24$.

i=1: $h(x_1)\wedge g(x_1,x_2,x_3,x_4)=0,19\wedge1.0=0,19$,

i=2: $h(x_2)\wedge g(x_2,x_3,x_4)=0,21\wedge1,042=0,21$,

i=3: $h(x_3)\wedge g(x_3,x_4)=0,22\wedge1,05=0,22$,

i=4: $h(x_4)\wedge g(x_4)=0,24\wedge0,93=0,24$,

$$\int h\circ g=\bigcup_{i=1}^{4}(h(x_i)\wedge g(E_i))=\max(0,19;\ 0,21;\ 0,22;\ 0,24)=0,24\ \ x_4=0,24$$

Thus, the results of the ranking of all selection sorts showed that variety 108-F is the best among the offered selection sorts of cotton, because the resulting value of the degree of belonging of this variety to the fuzzy set is the largest (0.24).

Artificial intelligence technology has significant potential to optimize food production by analyzing working conditions in specific regions and determining what needs to be done to increase yields in each region.

Progress in the development of artificial intelligence technologies in agriculture has been made possible by various technological breakthroughs. Often these technologies are based on machine learning and the use of big data, neural networks, etc. The use of these technologies allows discovering new patterns in the animal and plant world, which can lead to various technological breakthroughs in agriculture. The weaknesses of these technologies are the need to concentrate significant financial and human resources on research in these areas. Countries with a high level of economic development, primarily China, the USA, and the EU countries, are aware of the importance of researching these issues and are investing heavily in them.

The use of artificial intelligence technologies in agriculture and in the economy as a whole will have a decisive impact on the development of various social institutions. Experts believe that most of them, primarily all institutions of private property, market, production, family, education, state and law, will undergo cardinal changes.

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FORECASTING THE YIELD OF AGRICULTURAL PRODUCTS

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Agriculture and the agro-industrial complex is an important branch of the national economy, providing people with food products necessary for any life. In conditions of population growth and limited territories, there is a growing shortage of finished agricultural products, as well as the problem of ensuring its high quality for all consumers. Soil salinity is a big problem today. More than 80% of the irrigated land is saline. It is not recommended to apply mineral fertilizers to saline soils. Fertilizers are also salty, they also cause salinization - soil mineralization. In addition, in saline soils, mineral fertilizers not only absorb the plant, but also increase the stress effect. The use of modern revolutionary artificial intelligence technologies in solving this problem is one of the urgent problems [1].

Artificial intelligence has proven to be the most accurate and effective method in accurate and reliable assessment and diagnostics (assessment of financial risks, natural and climatic phenomena, forecasting the yield of agricultural products) [2].

The physical basis for the interpretation of the soil cover is the idea of the spectral properties of the soil. Only those fertility indicators that affect its spectral reflectivity can be remotely assessed. This determines the potential (maximum list) of fertility indicators controlled by remote sensing methods.

The composition of the real list of remotely determined indicators is associated with the current level of progress in remote sensing, which is determined by the following factors [3]:

- development of technologies for space imaging of the earth's surface;

- development of computer technology and software for processing space images;

- accumulation and generalization of experience in remote research of the soil cover.

To date, various publications describe methods for the remote determination of the following indicators: soil genetic affiliation, humus content, particle size distribution, salinity, degree of erosion, carbonate content, content of iron compounds, content of various minerals, danger of soil crusts formation [4].

The soil index takes negative values for soils: for typical chernozems from -0.5 to -0.8, for podzolized and leached chernozems - from -0.8 to -1.0, for dark gray forest soils - from -1, 0 to -1.25, for gray forest soils - from -1.25 to -1.7, for light gray forest soils - from -1.7 to -2.2.

The process of deciphering the soil cover using the index includes three stages. At the first stage, the spatial limitation of the decoded territory is carried out by identifying areas with a soil cover devoid of vegetation. Other areas are excluded from processing using the masking operation. At the second stage, the index is calculated directly, the result of which is a gradient image. Gradient imaging is the best way to convey soil continuity and the gradual transition between soils. Smoothing with a median filter is performed before the selection by the gradient image of soil areas. This eliminates the errors associated with "noise" in the image. The third step is to transform the gradient image into a discrete one using quantization. At this stage, the boundaries of the areas of soil subtypes are delineated and their identification occurs [5-7].

At present, various formulas have been created that link the humus content and the spectral properties of the soil. They are intended for the quantitative determination of the humus content. Their common disadvantage is their non-universal character. Each existing formula works with the greatest efficiency only in the territory for which it was created.

On the basis of experimental data, it is possible to obtain a quantitative expression of the relationship of soil fertility [8-10]

$$y = a_0 + a_1 x_1 + a_2 x_2 + ... + a_7 x_7 + a_8 x_8 .$$

In this task, the state of the system is the content of humus in the soil, %;

x_1 *- volumetric mass of soil,* g / sm^3 *;*

x_2 *- depth of plowing, sm;*

x_3 *- dosage of phosphorus, kg/ha;*

x_4 *- dose of potassium, kg/ha;*

x_5 - nitrogen content in soil, %;

x_6 - soil organic carbon content, %;

x_7 - average daily temperature, %;

x_8 - soil moisture, %;

For the first phase of development of agricultural crops, one can obtain the equation

$$z_1 = b_0 + b_1 x_{11} + b_2 x_{12} + ... + b_7 x_{17} + b_8 x_{18}$$

where x_{11} - dose of added phosphorus, kg/ha;

x_{12} - dose of nitrogen application, kg/ha;

x_{13} - irrigation norm, m^3 / ha ;

x_{14} - sum of effective temperatures, C^0 ;

x_{15} - soil surface temperature, C^0 ;

x_{16} - relative humidity, %;

x_{17} - soil moisture, %;

x_{18} - density of plant standing, thousand/ha;

z_1 - number of fruits on a bush.

The second phase is described by equation

$$z_2 = c_0 + c_1 x_{21} + c_2 x_{22} + c_3 x_{23} + ... + c_7 x_{27}$$

where z_2 - number of fruits per bush;

x_{21} - dose of introduced nitrogen, kg/ha;

x_{22} - dosage of phosphorus, kg/ha;

x_{23} - irrigation norm, m^3 / ha ;

x_{24} - sum of effective temperatures, C^0 ;

x_{25} - soil surface temperature, C^0 ;

x_{26} - relative humidity, %;

x_{27} - density of plant standing, thousand/ha;

The state of agricultural crops during maturation corresponds to the expression

$$z_3 = d_0 + d_1 x_{31} + d_2 x_{32} + ... + d_7 x_{37}$$

where z_3 - number of ripe fruits on the bush;

x_{31} - plant density, thousand/ha;

x_{32} - dose of nitrogen added, kg/ha;

x_{33} - dosage of phosphorus, kg/ha;

x_{34} - irrigation norm, m^3 / ha ;

x_{35} - sum of effective temperatures, C^0 ;

x_{36} - soil surface temperature, C^0 ;

x_{37} - relative humidity, %;

The crop as the final state of the plant, which depends on the states in the previous stages, is described by equation

$$z_4 = f_0 + f_1 y + f_2 z_1 + f_3 z_2 + f_4 z_3 .$$

Thus, agriculture and the agro-industrial complex are an important part of any socio-economic system. This is due to the fact that this set of industries and areas of management provides people with food, which, in turn, is a vital condition for human existence and provide his primary needs [1]. In addition, it should be noted that higher quality agricultural products have a direct relationship with the current health of people and its duration, since the result of the activity of the agro-industrial complex is food, which, in turn, is a building material for the human body [2,3]. With the growth of the planet's population and the general striving for legal justice, the problem of food shortages will become more acute, and, no less important, the need for an increase in their quality will increase [4]. Technologies will largely help to cope with these tasks. artificial intelligence that will automate the economic and management process, including the optimization of sowing, harvesting, monitoring the condition of the soil on which the crop

grows, the correct composition of feed mixtures, elimination of pests, automation of animal feeding and much more. The foregoing is the purpose of this article. It consists in the generalization and systematization of knowledge about promising artificial intelligence technologies in agriculture, which can be successfully used both for the basic tasks of the agro-industrial complex (providing the population with high-quality food), and for obtaining new competitive advantages by agricultural organizations in the short-term. perspective in relation to their opponents in the market.

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APPLICATION OF ARTIFICIAL INTELLIGENCE TECHNOLOGIES IN CROP MONITORING

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Analysis of images allows you to determine the time of harvesting (the first mowing in July). The image shows vegetation development in June (yellow-green area). The image in July shows that mowing was carried out, the vegetation cover was removed, and the soil surface was partially exposed. The soils in this case are marked in dark color, closer to brown. In August, intensive regrowth of vegetation was noted, which can be seen in the image in light green tones. Thus, the data of the images makes it possible to estimate the timing of harvesting and the timing of the growth of perennial grasses after mowing. The Healthy Vegetation combination renders objects in shades of red, brown, orange, and green. Soils can appear green or brown, urbanized areas appear whitish, gray and blue-green, bright blue indicates freshly cleared areas, and reddish indicates regrowth or sparse vegetation. Clear deep water will appear dark blue (almost black), while shallow or suspended water will appear in lighter blue hues. The addition of the mid-infrared channel makes it possible to achieve good discrimination of the vegetation age [1-2].

RGB images were used for research. The crop dataset contains over 50 images of each crop (corn, wheat, jute, rice, cotton, and sugarcane). The dataset contains over 179 augmented Crop Images of each class. Zoom contains horizontal flip, rotation, horizontal offset, vertical offset.

To assess the quality of seedlings, a procedure was used that includes the following sequence of actions [3,4]:

1. *Building a vegetation map using the modified TGI index.*
2. *Splitting the image into intersecting fragments and counting the number of pixels in each of them occupied by vegetation (that is, those for which the index value is above a certain threshold). The ratio of the area occupied by vegetation to the area of the fragment is considered the density of vegetation in this fragment.*
3. *Determination of the number of fragments with a satisfactory density of vegetation (i.e., more than a given threshold). The ratio of the number of such fragments to the total number of fragments is considered the final indicator of the quality of seedlings in the image.*

The blurred and noisy image is restored in an iterative way [5].

Step 1. Image reading. we read the RGB image and cut out a part of it.

Step 2. Simulation of blurs and noise. Simulation of a realistic image containing motion blur or poor camera focus and noise. Blurring is simulated by convolving a Gaussian filter with an image. The Gaussian filter is represented as a function of the extent of a point. To simulate a noisy image, Gaussian noise with deviation V is added to the blurry image. Next, the deviation value V will be used as the damping parameter.

Step 3. Restoring a blurry and noisy image. The blurred and noisy image will be restored using the iteration point extension function. The resulting array has the same data format as the original array.

Step 4. Interactive recovery analysis. The resulting image changes with each iteration. To study the process of image restoration, a function is implemented in a step-by-step mode, i.e. the result is analyzed at each iteration. In this case, the resulting array contains four numeric arrays, the first of which represents the blurred image, the second - the same image in double format, the third - the result of the penultimate operation, and the fourth - some processing parameters.

A neural network architecture for image recognition is proposed. Results are expected depending on the loss program error. The loss function Loss does not work very well on a limited database. This is because some of the fuzzy sets may perform well at values that are too small and others that are too large. We use fuzzy membership functions to reduce the value of the loss function. The essence of training is to select weights that minimize the difference between the result of the following neuro-fuzzy approximations and the real properties of the object [7-12]:

$$y = f_j(x_1, x_2, ..., x_n). \quad (1)$$

$$E = \frac{1}{2}\sum_{j=1}^{M}\left(y_j - \hat{y}_j\right)^2 \to \min$$

The prediction results for the trained model by neural networks are shown in Figure 1.

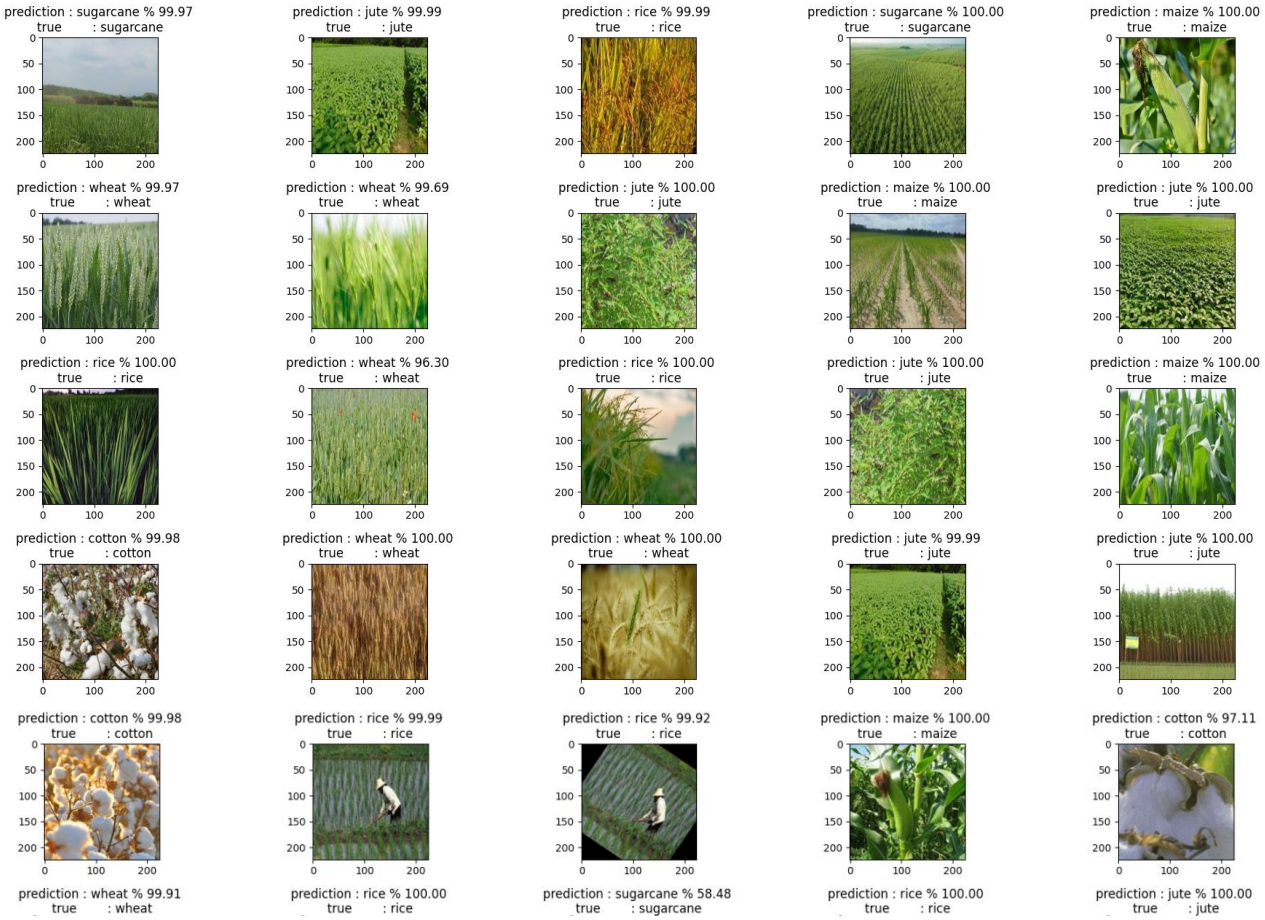

Fig. 1. Prediction results for the trained model by neural networks

To evaluate the efficiency of using the index, we created a labeled image of a small size (400×300 pixels) for training and a test image (400×300 pixels). The training and test images are fragments of full-size crop images. The accuracy of division of the training image using the TGI index with a threshold of 0.07 (the optimal value, selected empirically) was 94.19%, and that of the test image was 83.88%. Since the task under consideration differs from the one for which the TGI index was developed, it seems appropriate to modify the index for a specific sensor and specific shooting conditions.

The paper proposes a method for isolating vegetation, which makes it possible to carry out a quantitative and qualitative assessment of seedlings of agricultural crops. The method is based on the use of the TGI index, which has been modified to solve this problem. Unlike other common methods, the proposed method does not use data in the IR range, so it can be used to work with RGB images obtained using consumer cameras and video cameras. This makes it possible to use modern compact and affordable means of remote sensing of the Earth, including UAVs, for shooting. The method allows to allocate with sufficient accuracy the areas occupied by agricultural crops in the absence of weeds. Further research will be aimed at solving the problems of separating plantings from weeds and separating rows of crops.

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CONSTRUCTION OF SELF-SIMILAR SOLUTIONS OF THE SYSTEM OF NONLINEAR DIFFERENTIAL EQUATIONS OF CROSS-DIFFUSION

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Abstract

In this article, we study the problem of constructing self-similar solutions to a system of nonlinear differential equations that describe cross-diffusion processes. The main attention is paid to the analysis of the long-term behavior of the system, including its stability, convergence or divergence under various initial and boundary conditions. The paper uses both theoretical methods of analysis and numerical methods for constructing self-similar solutions. This study contributes to a deeper understanding of the interaction of diffusion and can serve as a basis for the development of effective methods for modeling and controlling diffusion processes in various systems.

Keywords: model, algorithm, parabolic differential equation, nonlinear system, self-similar solution, cross-diffusion.

1. Introduction. The study of a class of nonlinear differential equations and systems of equations in which the desired function and its derivative are represented in a power form is an important area of research in the field of modeling real physical processes. This class of nonlinearities is widely used in various fields, including biological populations, reaction-diffusion, and cross-diffusion [1]. Solving nonlinear boundary value problems is difficult, since analytical methods are rarely applicable, and obtaining new properties of solutions requires a long study. In the works of various authors, such as A. A. Samarskii, V. A. Galaktionov, A. P. Mikhailov, M. M. Aripov, A.T. Khaidarov, Sh. A. Sadullaeva, A. S. Matyakubov and others, special attention is paid to self-similar solutions of nonlinear parabolic boundary value problems describing various processes. Therefore, self-simulation and approximate self-similar approach are actively researched methods for studying such problems [2-9]. Self-similar approach of nonlinear differential equations with cross-diffusion is an important area of research. Self-similar approach methods offer approximate solutions to complex systems of equations, taking into account interactions between components and diffusion conditions. This makes it possible to effectively model and analyze systems with nonlinear interactions and inhomogeneous conditions. Self-similar solutions find application in various fields of science and technology, including biology, ecology, chemistry, and physics, where cross-diffusion plays an important role.

2. Methodology. Consider the following problem, which represents the process of cross-diffusion:

$$\begin{cases} \dfrac{\partial u}{\partial t} = \dfrac{\partial}{\partial x}\left(v^{\sigma_1} \dfrac{\partial u}{\partial x} \right) - v^{\beta_1} \left| \dfrac{\partial u}{\partial x} \right|^{P_1}, \\ \dfrac{\partial v}{\partial t} = \dfrac{\partial}{\partial x}\left(u^{\sigma_2} \dfrac{\partial v}{\partial x} \right) - u^{\beta_2} \left| \dfrac{\partial v}{\partial x} \right|^{P_2}, \end{cases} \tag{1}$$

$$\begin{cases} u(x,0) = u_0(x), \\ v(x,0) = v_0(x), \ x \in R, \end{cases} \tag{2}$$

$$u(0,t) = u_1(t), \qquad u(1,t) = u_2(t),$$
$$v(0,t) = v_1(t), \qquad v(1,t) = v_2(t), \ 0 \le t \le T, \tag{3}$$

here $\Omega = \{(x,t) : -\infty < x < +\infty, 0 < t < T, T > 0\}$ *and* $\sigma_1, \sigma_2, \beta_1, \beta_2, p_1, p_2$ *there are given real numbers, which are the parameters of the environment and the front.*

The presented form of solving the system of equations (1) is used:

$$u(t,x) = V_1(t) w_1(\tau, x), \tag{4}$$

$$v(t,x)=V_2(t)w_2(\tau,x), \qquad (5)$$

τ(t) - time function and

$$V_1(t)=(T+t)^{n_1}, \qquad V_2(t)=(T+t)^{n_2}. \qquad (6)$$

For self-similar solutions, we find n_1 *and* n_2 *:*

$$n_1=\frac{2(p_1-2)(p_2-1)-(p_2-2)(2\beta_1-p_1\sigma_1)}{4(p_1-1)(p_2-1)-(2\beta_1-p_1\sigma_1)(2\beta_2-p_2\sigma_2)},$$

$$n_2=\frac{2(p_1-1)(p_2-2)-(p_1-2)(2\beta_2-p_2\sigma_2)}{4(p_1-1)(p_2-1)-(2\beta_1-p_1\sigma_1)(2\beta_2-p_2\sigma_2)}.$$

$w_1(x,\tau)=f_1(\xi)$, $w_2(x,\tau)=f_2(\xi)$, *here* $\xi=\frac{x}{\tau^{\frac{1}{2}}}$, *ξ- self-similar variable,*

Functions f_1 *and* f_2 *choose in the form:*

$$f_1=(a+\xi)^{\gamma_1}, \qquad (7)$$

$$f_2=(a+\xi)^{\gamma_2}.$$

Finding γ_1 *and* γ_2 *for self-similar solutions:*

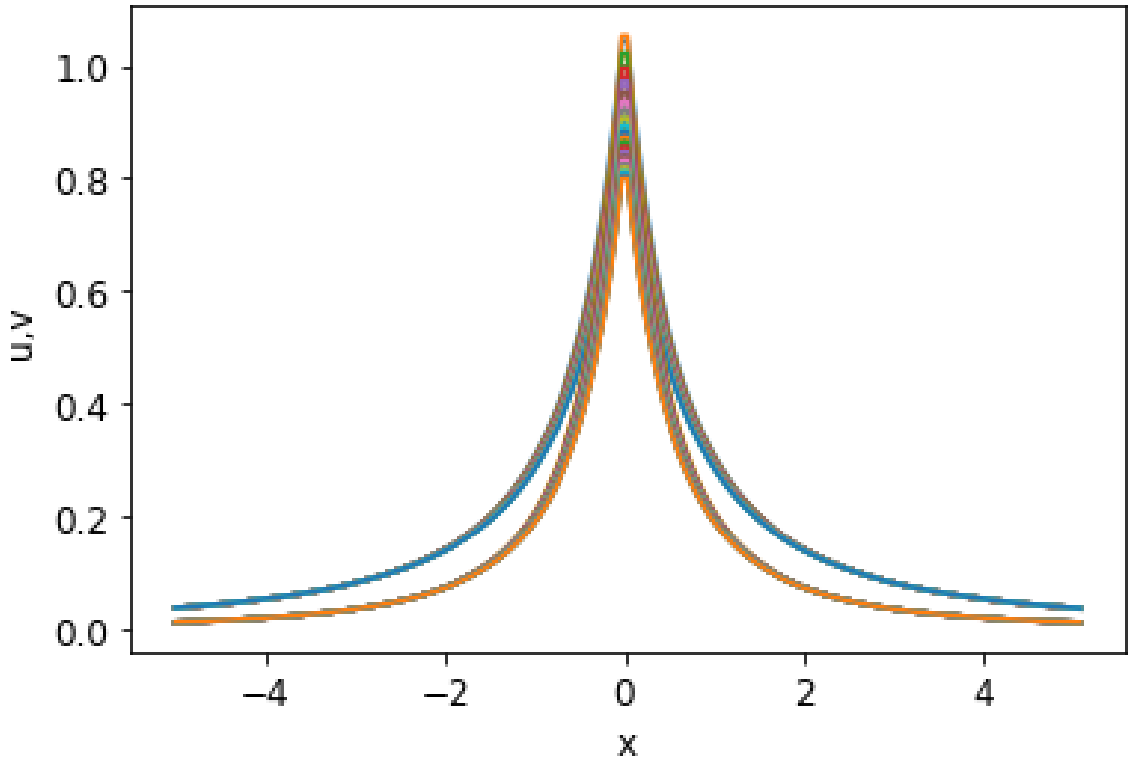
$$\gamma_1=\frac{(2-p_2)(\delta_1-\beta_1)+(2-p_1)(1-p_2)}{(\delta_1-\beta_1)(\delta_2-\beta_2)-(1-p_1)(1-p_2)}, \quad \gamma_2=\frac{(2-p_1)(\delta_2-\beta_2)+(1-p_1)(2-p_2)}{(\delta_1-\beta_1)(\delta_2-\beta_2)-(1-p_1)(1-p_2)};$$

Based on the values found above, we obtain the following self-similar solutions:

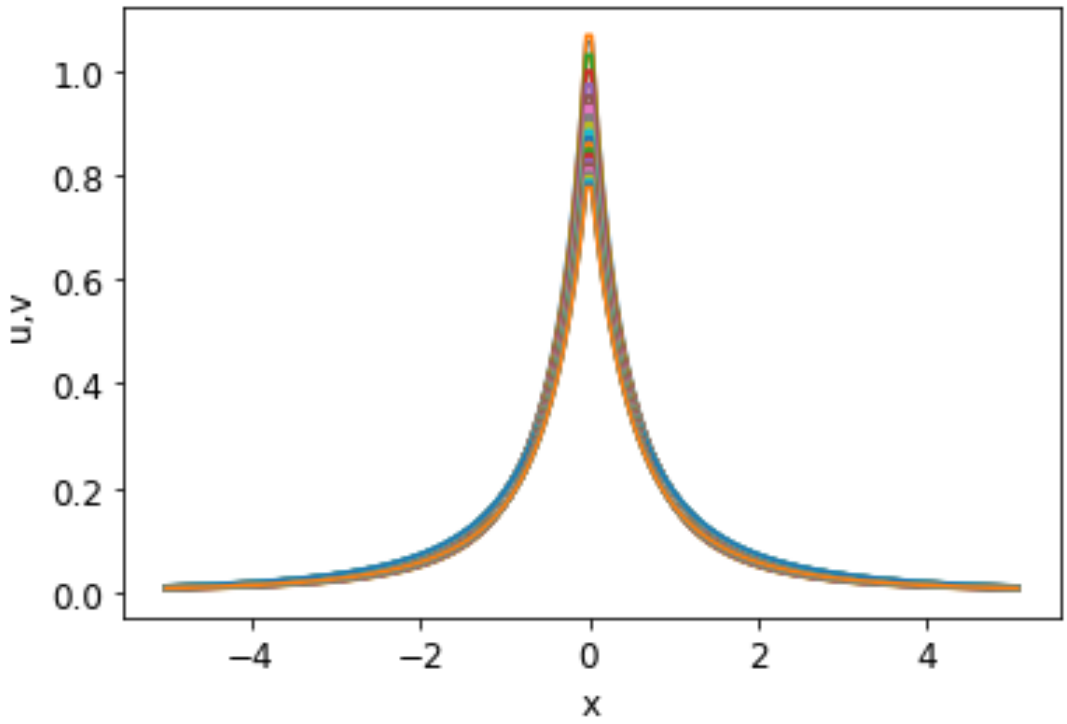
$$u(x,t)=(T+t)^{n_1}\cdot f_1(\xi)=(T+t)^{n_1}\cdot(a+\xi)^{\gamma_1}, \qquad (8)$$

$$v(x,t)=(T+t)^{n_2}\cdot f_2(\xi)=(T+t)^{n_2}\cdot(a+\xi)^{\gamma_2}.$$

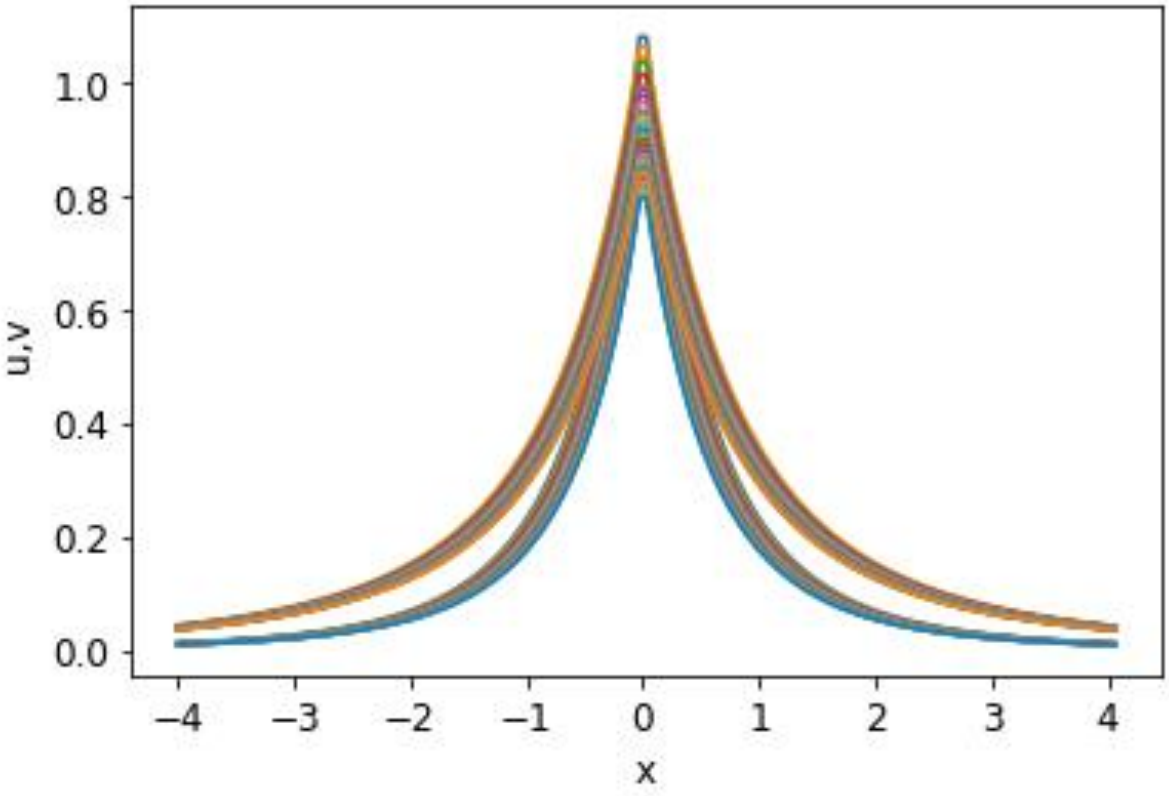
3. Results: *Using self-similar solutions (8) of system (1)-(3), numerical solutions were obtained, the graphs of which are given below.*



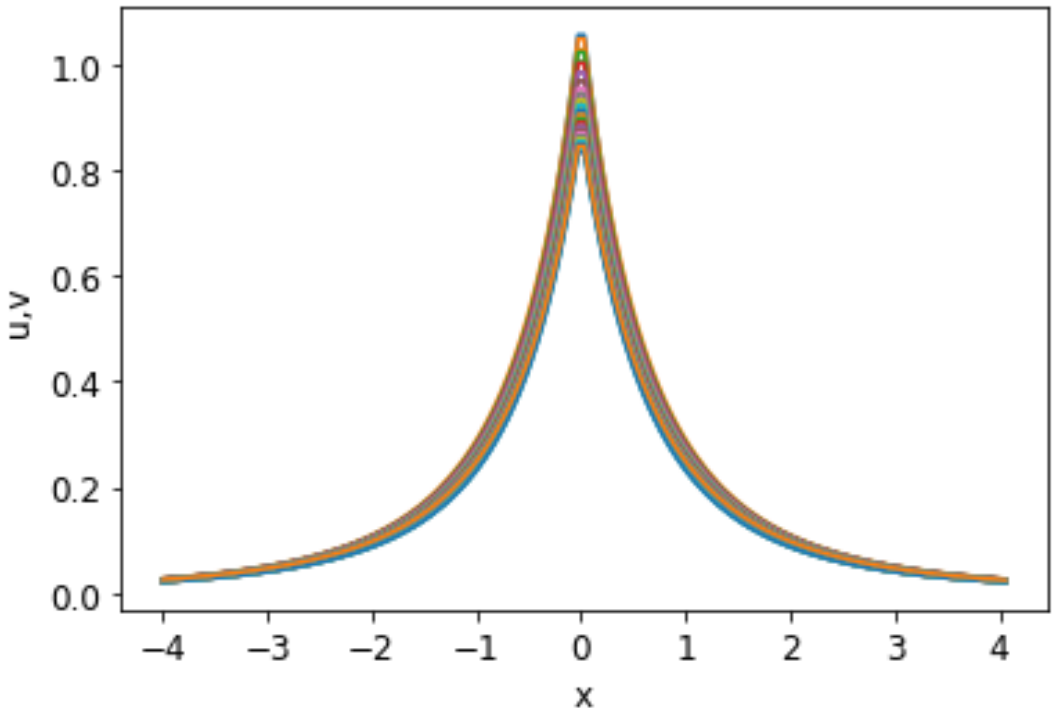
$\sigma_1=5,\ \sigma_2=6,\ \beta_1=3.25,\ \beta_2=3.19,\ \ p_1=2.88,\ p_2=2.81,\ a=1$



$\sigma_1 = 4,\ \sigma_2 = 3,\ \beta_1 = 1.33,\ \beta_2 = 1.47,\ \ p_1 = 3.42, p_2 = 3.71,\ a = 1$



$\sigma_1 = 6,\ \sigma_2 = 5,\ \beta_1 = 2.41,\ \beta_2 = 2.73,\ \ p_1 = 3.28, p_2 = 3.73,\ a = 1$



$\sigma_1 = 7, \sigma_2 = 6, \beta_1 = 3.97, \beta_2 = 3.71, \ p_1 = 3.5, p_2 = 3.1, a = 1$

4. Conclusion. The paper investigates the construction of a self-similar solution to a system of nonlinear differential equations that describe cross-diffusion problems depending on a spatial variable. Cauchy problems for an equation with variable coefficients are also considered. A method for obtaining an estimate for a solution corresponding to a second-order nonlinear equation is proposed and justified. These results make it possible to iteratively solve the problem of initial approximation in the numerical solution of this problem.

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