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ENGINEERING SCIENCES

PREVENTION OF COAL RAW MATERIALS FREEZING BY MEANS OF ORGANOSILICON COMPOUNDS

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Abstract. *This article authors represents the results of search for new reagents to prevent the freezing of coal in winter. Attention focuses on the physicochemical characteristics of silicone polymer, methods of introduction in coal concentrate and influence this reagent on freezing. The results of studies have shown that the use of organosilicon is more effective use of acetates and chlorides of metals. The high activity of organosilicon substances is explained by their elemental composition and structure of molecules.*
Keywords: *coal freezing, freezing point, degree of freezing, siloxane skeleton, silicone polymer.*

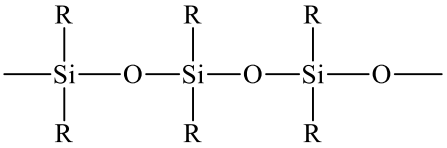
Introduction. The freezing of coal in transit is a serious problem for the coal industry. From November or December on, the wet coal in railroad cars becomes a solid frozen mass. Turnaround times extend, rolling stock is held up at discharge sites, and rail customers complain of lost time. Preventive measures are required to prevent freezing of the coal to the walls of the railroad cars in cold weather.

The most promising preventive method is to reduce the pour point of the moisture's active component and reduce the strength of the bonds in the frozen coal. The materials employed should be harmless to the operating staff and the environment, should not cause corrosion of metal components, should not impair coal quality, should not significantly reduce the capacity of the rail car, should not require special storage conditions, and should mix well with coal.

The choice of a chemical to prevent the freezing of coal during its transportation in winter should be based on its efficiency and environmental friendliness, and should take into account the following aspects: the reagent must be dissolved in the outer moisture of the coal concentrate to form a solution, the concentration of which will ensure the flowability of the coal; preventative means should be inexpensive, affordable and environmentally friendly for service personnel, making their use economically and environmentally sound; must be resistant to changing weather conditions; not to adversely affect technological processes (coking, blast furnace melting) and product quality characteristics.

Results and discussions. In the present work, we continue the search for new reagents to prevent the freezing of coal in winter. The search for the most effective chemical preventive agent to prevent the freezing of coal concentrates in winter at very low temperatures during transportation from the supplier (coal processing plants) to coke plants showed that these requirements are satisfied when using silicone polymer.

Molecules of organosilicon compounds combine in part the structure of polymeric inorganic and organic molecules. The basis of their molecules is the siloxane skeleton - a chain of alternating atoms of silicon and oxygen. Other silicon bonds are compensated by organic radicals or groups of atoms [6].



where R – H^-, CH_3^-, $C_6H_5^-$, and etc.

The peculiarity of the structure is associated with the unusual properties of these polymers, which combine the stability of these compounds to the action of low temperatures. Organosilicone liquid polymers can be obtained with a freezing temperature of minus 130°C or even lower.

A valuable property of silicone liquids is the weak dependence of their viscosity on temperature. Thus, as the temperature decreases, the viscosity of the organosilicon compounds increases to a lesser extent than for petroleum oils. This makes it easier to apply to the surface of a metal wagon and mix with coal [6].

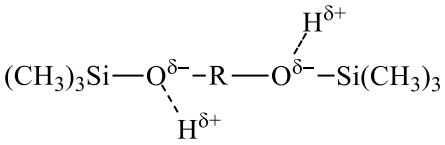
For polysiloxanes, low freezing temperatures and chemical inertness to metals are typical. The flammability of organosilicon liquids is much lower than that of organic compounds. The final

combustion products are carbon dioxide, water and silica as a fine powder. Polysiloxane fluids do not irritate the skin and eyes.

Thus, the most valuable technical properties of organosilicon liquids are determined by their physical and chemical properties: low pour point (minus 70 to minus 140 °C), low viscosity dependence on temperature (multiplicity of viscosity change is 5-10 times in the interval temperature temps from - 50 to + 50 °C) [6].

Emulsions of silicone polymers are stable structures of the type «oil in water». Due to the fact that it is practically more convenient to use aqueous emulsions of silicone liquids instead of their solutions in organic solvents, the industry produces 30-70% silicone emulsions. These emulsions are easily diluted with water and used in 5-10% concentration. In commercial form, the emulsions are a white mass of creamy consistency.

Molecules of organosilicon compounds contain an oxygen atom, so the electron density at oxygen atoms is localized. As a result, the reagents can specifically interact with the sorption-active centers of the coal surface bearing a positive charge (protonated hydrogen atoms of phenolic, carboxyl groups in macromolecules of organic mass of coal) according to the scheme:



where R – alkyl radical.

Molecules of oxygen-containing organosilicon compounds also contain hydrocarbon radicals that can interact with the apolar centers of the coal surface due to Van der Waals intermolecular forces. Therefore, when adsorbed on the coal surface, molecules of organosilicon exhibit both specific (hydrogen bonds) and universal nonspecific intermolecular forces of interaction with positive parts of the coal surface. This determines their high adsorption on the coal surface.

If the solution or emulsion is mixed with coal, these atoms or groups are reacted with the organic mass of the coal and water hydrate. Organosilicone bonds - Si - O - Si - O -, which provide physical and chemical interaction with the coal facing the surface, and organogenic groups framing the silicon atom in the opposite direction - outwards. The orientation of organosilicon bonds and hydrocarbon radicals when applied to the surface can be schematically represented Fig.1.

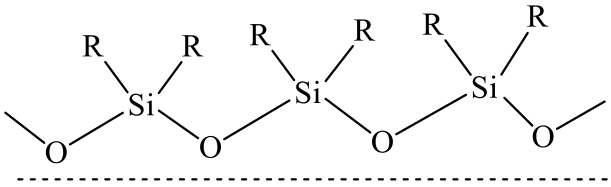


Fig.1. Orientation of organosilicon bonds and hydrocarbon radicals on the coal surface

Organosilicon compounds, when applied to a coal surface, react with water approximately molecule to molecule. The films of organosilicon compounds are very thin. The thickness of the film, which is calculated by the material flow and film weight, assuming that its density is equal to one, is $0.1 \cdot 10^{-6}$-$2.5 \cdot 10^{-5}$. The film on the surface is invisible, does not wear away when rubbed, does not wash off with water, is stable over a wide temperature range (from - 200 to +300 °C). Polymeric silicones on the surface of coal, even in small quantities, provide a great water repellent effect.

For the experiment, a sample of coal weighing 500 g was taken, the moisture content of the coal was 12%, the size class was 0-3 mm. The coals were carefully treated with an emulsion. Next, the processed coal was loaded into a metal tank with a diameter of 50 mm, height 50 mm, without bottom and cover. This metal container was placed in the freezer and kept at a predetermined temperature for 24 hours. Then the tank was turned over, and the coal that was poured was weighed. The degree of freezing was thus determined. The study used an organosilicon fluid GKZh-94, which is a colorless slightly yellow liquid. Density - 0,996-1,003 g/cm^3; freezing temperature -50 °C; pH not less than 6. In water it is insoluble, but well forms an emulsion, corrosion inactive, does not emit harmful vapors and gases, weatherproof.

The organosilicon additive was used as 5 and 10% aqueous emulsions. The emulsion was thoroughly stirred with charcoal for 3-5 minutes. The amount of emulsion was changed from 4 to 40 g per 1 kg of coal. The concentration of the emulsion was 5 and 10%. The results of the experiment are shown in Table 1.

Table 1. The degree of freezing of the treated coal GCZh-94 emulsion at minus 15 °C

Quantity of GCZh-94, g/kg	Mass of spilled coal, g	Variation of mass, g	Degree of freezing, %
5 % emulsion			
4	150	350	70
8	170	330	66
12	190	310	62
16	220	280	56
20	260	240	48
24	290	210	42
28	310	190	38
32	390	110	22
36	450	50	10
40	490	10	2
10 % emulsion			
4	200	300	60
8	220	280	56
12	250	250	50
16	270	230	46
20	290	210	42
24	360	140	28
28	400	100	20
32	420	80	16
36	480	20	4
40	500	0	0

Studies have also been conducted to identify consumption rates of known and claimed prophylactic agents to prevent freezing of coal with a moisture content of 12% (Table 2).

The analysis of these tables shows that the organosilicon emulsions reduce the freezing point well, and when compared with salts it can be seen that the consumption of the organosilicon emulsion in comparison with the consumption of calcium chloride, magnesium and potassium acetate is lower.

Table 2. Dependence of the freezing point of the coal with a moisture content of 12% added of prophylactic agents

Freezing point of sample, °C	Added of prophylactic agents, wt %			
	$CaCl_2$	$MgCl_2$	CH_3COOK	10 % GCZh -94
-15	5,0	4,6	4,0	3,6

Conclusions. Thus, the proposed method not only prevents the concentration of coal concentrates in winter during their transportation from the manufacturer to the coke plant, but also reduces the cost of coke by reducing the cost of defrosting (in greenhouses) and unloading coal, to prevent the corrosion of cars and equipment of coal-preparation shops of coke-chemical plants. Organosilicon compounds are less toxic. The use of organosilicon is more effective than the use of acetates and chlorides of metals. The high activity of organosilicon substances is explained by their elemental composition and structure of molecules.

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ПЕРСПЕКТИВЫ НЕФТЕГАЗОНОСНОСТИ ГЫЗМЕЙДАНСКОЙ ЗОНЫ ПОКРОВА ШАМАХЫ-ГОБУСТАНСКОГО СИНКЛИНОРИЯ

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Abstract. *The Shemakha-Gobustan synclinorium is located on the southwestern slope of the southeastern plunge of the Greater Caucasus and is differed by a complex structural-tectonic structure. The nappes and the linear folds are developed in the Shemakha-Gobustan synclinorium, on other hands, it is accompanied with reverse faults, thrusts, strike-slip faults, as well as mud volcanism that complicate it. These manifestations are indicating the susceptibility of the Shemakha-Gobustan depression sedimentary cover to intense tectonic movements, stimulated mainly by compressive stresses that characteristic of collisional zones. Due to the fact that this structural-tectonic element is located relatively close to the axial zone of the southeastern plunge of the mega-anticlinorium of the Greater Caucasus, which tectonic processes developing within this mountain-fold system are quite intensively manifested in the Shemakha-Gobustan synclinorium. Another cause for the complex structural-tectonic structure in the Shemakha-Gobustan synclinorium lay is the block structure of its crystalline base.*
Keywords: *thickness, sand content, prospects, zone, structure, sediments, amplitude, age, cover, tectonic fault, overthrust, cleavage, oil, gas.*

По мере сокращения структурного фонда нефтегазоносных земель Азербайджана все более актуальным становится ряд принципиально важных нетрадиционных направлений выявления новых месторождений. Например, к таковым относятся тектонически сложнопостроенные участки с покровно-надвиговыми зонами земной коры. В настоящее время открыто достаточно много месторождений, связанных с покровными зонами, развитыми в прибортовых частях седиментационных бассейнов. Так, например, на Северном Кавказе Старогрозненском нефтяном месторождении в поднадвиговой части складки. В надвигах и поднадвиговых зонах промышленные залежи нефти и газа известны также в Предкарпатском и Предуральском передовых прогибах, а на территории США потенциальные извлекаемые ресурсы Кордильерского пояса надвигов на конец 1981 г. составляли 2,1 млрд. тонн нефти и 2,8 млрд. м^3 газа [1, 2].

Плитная тектоника позволяет по-новому рассматривать вопросы перспективности на нефть и газ тех или иных участков земной коры. Регионы, которые с позиции геосинклинальной теории считались неперспективными, с позиции плитной тектоники оказались не только перспективными, но и нефтегазоносными. С этой точки зрения определенный интерес представляет мегантиклинорий Большого Кавказа. Некоторые тектонические особенности его строения при сравнении с подобными регионами в пределах, которых уже установлены скопления углеводородов, позволяют предположить наличие таких скоплений и в пределах мегантиклинория Большого Кавказа. Так, например, по юго-западному склону этого горно-складчатого сооружения в пределах бортовой части Прикуринской межгорной впадины вплоть до его осевой зоны имеют широкое развитие покровы и чешуйчатые структуры, а также в междуречье Куры и Иоры, что является явным свидетельством надвинутости Большого Кавказа на обширный осадочный нефтегазоносный бассейн Прикуринской межгорной впадины. По мнению исследователей, этот процесс продолжается по настоящее время. Следовательно, есть основание полагать, что в процессе надвигания Большого Кавказа на осадочный бассейн, последний будет частично перекрыт и сжат этим горно-складчатым сооружением [3, 4, 5].

Таким образом, на наш взгляд, зона перекрытия, которая, по всей вероятности, простирается вдоль юго-западного подножья горно-складчатых сооружений Большого Кавказа, представляет определенную перспективу на нефть и газ.

В качестве конкретного примера можно указать на Шамахы-Гобустанский синклинорий, с которым связан одноименный нефтегазоносный район мезо-кайнозойской складчатости. В

пределах этого района широко развиты покровы, грязевулканизм и естественные выхода нефти и газа. В 1950-60-ые годы в районе села Астраханка (Гызмейдан) были пробурены поисково-разведочные скважины, которые впоследствии были законсервированы, но, несмотря на это, из их устья происходит периодическое выделение воды с пленкой нефти и газа. С другой стороны, общеизвестным фактом является широкое развитие там грязевулканизма, например, Мыльные родники, близ селения Гызмейдан, что также свидетельствует о перспективах нефтегазоносности этого региона. Эти факты свидетельствуют о том, что площадь перспективных на нефть и газ земель в межгорных осадочных бассейнах, к которым относится и Южно-Каспийская мегавпадина, может быть значительно увеличена и за счет покровно-надвиговых частей горно-складчатых сооружений ограничивающих такие бассейны [6, 7, 8, 9].

Полосу расположения локальных структур Шамахы-Гобустанского района, в плане соответствующем Явандаг-Сангачальскому гравитационному максимуму, следует считать основным участком для проведения параметрического и поисково-разведочного бурения после изучения его глубинного строения современными методами разведочной геофизики.

Практика показывает, что в покровных зонах наибольшие размеры ловушек и промышленные запасы нефти, бывают, связаны с автохтоном, в котором встречаются крупные месторождения нефти и газа. Например, Загросский пояс надвигов, обрамляющих Аравийскую платформу, характеризуется крупными месторождениями нефти и газа, связанными с автохтонными антиклинальными структурами (Пезанан, Ага-Джари, Ахваз и др.). В свою очередь, среди месторождений нефти и газа в аллохтонных комплексах обычно преобладают относительно мелкие скопления, хотя могут содержаться и крупные. Причем они могут сформироваться, как в традиционных антиклинальных ловушках, так и в нетрадиционных зонах дробления, катаклазитах и в других формах залегания пород связанных с динамометаморфизмом. Вместе с тем нефтегазоносность аллохтона является прямым признаком продуктивности одновозрастных пород автохтона, запечатанных аллохтоном [10, 11, 12, 13].

На ранних стадиях образования зон надвигов происходит преимущественно разрушение и переформирование существующих ранее залежей УВ и образование новых в уже вновь сформировавшихся ловушках, причем на раннем этапе развития надвиги и связанные с ними другие виды дизъюнктивов служат преимущественно путями миграции. А на более поздних стадиях их развития формируются главным образом залежи в ловушках, генетически связанных с покровно-надвиговыми структурами. На этом этапе надвиги и ряд других разрывов играют уже роль экранов, а в ловушки поступают УВ, часть которых была дополнительно генерирована в поднадвиговых толщах. Фактически геологические события, после образования надвигов, служат определяющим параметром для поисков месторождений нефти и газа в покровно-надвиговых поясах. В этой связи необходима переоценка границ нефтегазоносных регионов с целью расширения перспективных земель за счет региональных покровно-надвиговых зон. С этой целью следует определить структуры и мощности аллохтонных пластин и автохтонов, выявить в них природные резервуары для нефти и газа, в том числе и нового типа.

По мнению исследователей, покровно-надвиговые окраины складчатых горных сооружений относятся к древним пассивным континентальным окраинам (Скалистые горы Канады, зона Персидского залива, Предкавказье), которые как правило характеризуются весьма благо-приятными условиями для нефтегазообразования и формирования их скоплений [14, 15, 16, 17].

Северный борт Южно-Каспийской мегавпадины (ЮКМВ) до недавнего прошлого представлял собой зону субдукции, переросшую в процессе геодинамического развития в зону коллизии, морфологически и структурно-тектонически выраженную горно-складчатыми сооружениями Большого Кавказа. Это связано с тем, что окраины межгорных впадин, где развиты субдукционные процессы, в нашем случае это Закавказский срединный массив в прошлом, т.е. ЮКМВ в настоящем, в результате коллизионных процессов трансформируются в горноскладчатые сооружения типа Большого Кавказа.

ЮКМВ в настоящее время представляет собой седиментационный бассейн, в процессе развития которого имело место интенсивное наращивание отложений, происходила генерация углеводородов и развитие локальных поднятий (как это имело место на Андаманских и Индонезийских островах аккреционного происхождения). В дальнейшем при трансформации субдукционной зоны в коллизионную еще более активизируются сжимающие напряжения, которые приводят к складкообразованию и формированию покровно-надвиговых структур. Очевидно, на этой же стадии (орогенеза) закладываются основные покровно-надвиговые зоны, в бывших зонах субдукции. Эти процессы, сопровождаемые напряжениями сжатия, активизируют

генерацию углеводородов за счет выработки дополнительной диссипативной тепловой энергии при взаимном трении крыльев покрова [18, 19, 20, 21, 22]. В основном процессы динамометаморфизма и приводят к формированию в покровно-надвиговых зонах нефтяных и газовых месторождений. Это связано с отжимом флюидов к центральной части впадины, т.е. в направлении убывания интенсивности сжимающих напряжений. Таким образом, в прибортовых надвиговых зонах создаются удовлетворительные условия для аккумуляции и сохранения УВ благодаря покровно-надвиговой природе сформированных ловушек.

В конце субдукционного этапа происходит трансформация последнего в коллизионную, т.е. в орогенную стадию. Одновременно продолжает развиваться межгорная впадина в качестве осадочного бассейна, где происходит накопление молассового осадочного комплекса как, например в ЮКМВ. В них же возникают свои ОНГО, с которыми генетически бывают, связаны скопления нефти и газа уже межгорной впадины. В результате формируются бассейны в зонах субдукции, которые затем втягиваются в поднятие и от которых остаются месторождения в надвиговой зоне. Значительная часть этих бассейнов не сохранившиеся в современной структуре Земли, Б.А. Соколовым предлагается именовать фантомными, а нефтегазовые скопления надвиговых поясов рассматривать как элементы фантомных бассейнов.

Согласно Б.А. Соколову фантомные бассейны достаточно распространенная категория. Поэтому перспективы нефтегазоносности периферии горно-складчатых сооружений, таких как Скалистые горы, Кавказ, Урал, Копетдаг и других следует рассматривать как достаточно перспективные и для объективной оценки их перспективности на нефть и газ необходимо более тщательное их изучение [23, 24].

Согласно Ахмедбейли А.С., Т. Кенгерли в пределах Азербайджана покровно-надвиговые структуры развиты по ЮЗ склону Большого Кавказа и они приурочены в основном к двум его подзонам:

1) Шахдаг - Хызинская зона - Мегазона Бокового Хребта
2) Говдаг - Сумгайытская подзона - Закатало-Говдагская зона – Мегазона Южного склона

Вследствие наличия структурно-картировочного и разведочного материала лишь по Гызмейданскому покрову, нами рассмотрена эта структура, относящаяся к Говдаг-Сумгайытской зоне покровов.

Гызмейданский покров входит в состав Пирсаат – Северо-Гобустанского участка. Он вытянут в общекавказском направлении более чем на 20 км при максимальной ширине в 5 км. В подошве покрова залегают породы кемишдагской, кемчинской и юнусдагской свит, а наиболее глубокие скважины вскрыли халчайскую свиту.

В региональном плане фиксируется утонение аллохтонной пластины от центральной части к краям покрова. Лишь в центральной части наблюдаются нижнемеловые (баррем-апт) отложения. Примерно в этом районе структурно-поисковым бурением выявлена крупная антиклиналь в автохтоне, которая осложнена грязевулканизмом. Последний свидетельствует о высокой перспективности данного поднятия. В данном регионе известно порядка 60 потухших и действующих сопок, грифонов и сальз различных размеров, объединенных под общим названием «Мыльные родники» (Большие и Малые). По данным бурения поверхность покрова (волочения) имеет неглубокое залегание (1500м). Возраст покрова предполагается палеоцен-миоценовым.

С целью выявления перспектив нефтегазоносности данной территории был проанализирован фактический материал на предмет битуминозности пород и распределения в них других компонентов ОВ. В результате было установлено, что распределение рассеянных битумов меняется от следов – 0,02% до 0,156%. Низкое количество битума содержится в породах сантон-нижнекампанского возраста. В битумах по всему вскрытому скважинами разрезу преобладает маслянистые и легкие маслянистые разности. Битуминозность не вскрытой бурением части разреза нижнего мела взята из обнажений, находящихся по соседству с Гызмейданом. В них количество битума составляет от 0,02% в известняках до 0,04% в песчано-алевролитовых разностях и мергелях. Встречаемый тут битум относится к легкому маслянистому типу. В целом же закономерность в распределении битуминозного материала в меловых отложениях района Гызмейдан не была выявлена.

В свою очередь, известно, что все элементы покровно-надвиговых структур Большого Кавказа литофациально представлены преимущественно осадочными породами. Как, например, терригенно-карбонатным флишем свидетельствующим о неподверженности их метаморфическим процессам или слабой подверженности за исключением динамометаморфизма. С другой стороны, следует отметить, что мезозойские отложения,

которые составляют основную часть разреза рассматриваемой зоны, формировались здесь в условиях активной окраины океанического бассейна, т.е. благоприятных для накопления в них органического вещества. Наряду с этим развитие грязевулканизма в пределах рассматриваемой покровно-надвиговой зоны Большого Кавказа с естественными нефтегазопроявлениями, свидетельствует о протекании здесь нефтегазогенерационных процессов и миграции флюидов. Эти факты говорят о том, что рассмотренные покровно-надвиговые зоны азербайджанской части южного склона Большого Кавказа представляют несомненный интерес с точки зрения перспектив их нефтегазоносности и требуют детальных геолого-геофизических исследований для более объективной оценки их перспективности на нефть и газ.

По мнению исследователей среднее содержание ОВ в осадках дна океанов не превышает 0,5%. Однако, по расчетам О.Г. Сорохтина потенциальная производительность биогенных веществ из океанических осадков может достигать 30%, т.е. в районе глубоководных желобов перед зоной поддвига за счет апвеллинга глубинных вод океанические осадки обогащаются органикой иногда до 30%. В свою очередь известно, что северная окраина океана Тетис была активной. Здесь, в пределах центрального сегмента Средиземноморского пояса, частью, которой является ЮКМВ, с позднего триаса до позднего миоцена существовал субдукционный режим и связанные с ним палеогеографические условия окраинных морей. Эта совокупность палеогеодинамических и палеогеографических условий была весьма благоприятной как для накопления в осадках ОВ большой концентрации, так и для преобразования его в УВ.

Вследствие этого если учесть, что Шамахы-Гобустанский синклинорий является тектоническим элементом юго-западного склона активной Большекавказской коллизии, то есть основание полагать, что Шамахы-Гобустанский синклинорий на субдукционном этапе развития региона имел достаточно благоприятные палеогеодинамические, палеотектонические, палеогеографические и термобарические условия для накопления, захоронения и преобразования ОВ в УВ с дальнейшим формированием их скоплений промышленного значения. Однако последовавший с конца миоцена коллизионный процесс привел к перестройке и усложнению тектонического плана всего региона в том числе и его Шамахы-Гобустанской части. Последняя не только преобразовалась в синклинорий, но и была осложнена покровной структурой. Коллизионные процессы способствовали разрушению и переформированию имевшихся здесь углеводородных скоплений. В этой связи в современном структурно-тектоническом строении Шамахы-Гобустанского синклинория с точки зрения перспектив нефтегазоносности наиболее перспективным следует считать перекрытую аллохтоном, то есть запечатанную последним автохтонную часть Гызмейданского покрова. Развитие в его пределах грязевулканизма («Мыльные родники»), естественных выходов нефти и газа, а также пленок нефти и газовыделений из устий консервированных скважин являются прямым признаком, а следовательно, и свидетельством нефтегазоносности не только Гызмейданского покрова, но и всего Шамахы-Гобустанского синклинория. Однако, следует учесть, что высокая динамичность аллохтона, связанная с тектонической активностью при формировании Гызмейданского покрова, привели к разрушению, раскрытию, дегерметизации и переформированию скоплений нефти и газа, содержащихся в аллохтонной части покрова, о чем свидетельствуют вышеотмеченные различной формы нефтегазопроявления.

Вследствие этого в пределах Шамахы-Гобустанского прогиба наиболее благоприятные геолого-геохимические условия с точки зрения нефтегазонакопления имеются в его центральной и южной зонах.

Для правильной оценки нефтегазоносности отдельных стратиграфических единиц мезозоя необходимо увеличить объем бурения параметрических и поисковых скважин на перспективных площадях нефтегазоносных районов. Низкая эффективность поисково-разведочных работ на территории суши Азербайджана, в первую очередь, объясняется некачественной подготовкой перспективных структур со сложным геологическим строением сейсмикой под глубокое бурение, ввиду серьезного отставания региональных работ по бурению параметрических скважин и проведения региональных геофизических исследований в районах со сложным геологическим строением, в частности, Шамахы-Гобустанского прогиба.

Верхнемеловые образования с предполагаемой мощностью около 2 км в исследуемом районе представлены трещиноватыми известняками турон-коньяка и терригенными трещиноватыми карбонатными породами кампан-маастрихта, которые могут служить природными резервуарами для нефтегазонакопления. Не исключается наличие литолого-стратиграфических ловушек в зонах выклинивания меловых отложений в погруженных частях

склонов вышеуказанных (особенно центральной и северной) зон. Поэтому для изучения разреза и нефтегазоносности мезо-кайнозоя необходимо пробурить параметрические скважины с глубиной 5000 – 6000 м на площади Гызмейданы и других (Тува, Набур, Шейтануд, Явандаг, Нардаран-Ахтарма) комплексируя их результаты с данными геофизики (в основном сейсморазведки). В Шамахинском районе ввиду незначительного развития плиоцена и олигоцен-миоцена, скважины с указанной глубиной могут вскрыть отложения до юры включительно (на площадях Мадраса, Чархан, Гушчу) [24, 25, 26].

Нижнетурон-коньякский стратиграфический интервал и сеноманский ярус, а также подстилающие их более древние отложения мела и юры в поднадвиговых зонах Гызмейдан и Ени-Гызмейданской структур считаются весьма перспективными на нефть и газ.

Анализ накопленного фактического материала в совокупности позволяет считать обоснованным поиски залежей нефти и газа структурно-поисковыми скважинами в верхнетурон-коньякских отложениях на Гызмейдан, Ени-Гызмейданской и других структурах.

Для поиска крупных скоплений нефти и газа в Шамахы-Гобустанском нефтегазоносном районе наиболее благоприятным объектом является продуктивная толща. При этом важно отметить, что при оценке перспектив поисков нефти в этой толще важное значение приобретает детальное исследование разломной тектоники Шамахы-Гобустанского нефтегазоносного района.

Все вышесказанное позволяет заключить, что сформировавшиеся в пределах Гызмейданского покрова скопления нефти и газа могут быть лучше сохранены в его автохтонной, то есть поднадвиговой части, как это имеет место в пределах Предкарпатского, Предуральского и других передовых прогибах.

Таким образом, на основании вышеизложенного с целью уточнения геологического и в особенности структурно-тектонического строения покрова, и в первую очередь его автохтонного крыла для уточнения возможно и выявления новых перспективных локальных поднятий предлагаем проведение более точных геолого-геофизических исследований с последующим осуществлением поисково-разведочного бурения в пределах наиболее перспективных структур для выявления скоплений нефти и газа.

Выводы и рекомендации.

- Наиболее благоприятными условиями для накопления ОВ в потенциально нефтематеринских толщах обладают отложения средней и верхней юры, среднего и верхнего миоцена, нижнего плиоцена. В меловых и майкопских отложениях количество ОВ может быть в районе его кларкового значения.

- Юрские и меловые отложения согласно глубине залегания и разрезу осадочного чехла находятся в наиболее благоприятных термобарических условиях для преобразования ОВ в УВ.

- В пределах региона структуро- и разрывообразование происходило в условиях интенсивных сжимающих напряжений, обусловивших развитие хорошо выраженных пликативных дислокаций и сдвиговых, взбросо-надвиговых и покровных структур, которые способствовали разрушению и переформированию ранее существовавших углеводородных скоплений, особенно содержащихся в аллохтонном крыле покрова.

- Согласно проведенному анализу, интенсивность сжимающих напряжений по разрезу возрастает с глубиной.

- Развитие грязевулканизма и широкое площадное распространение естественных выходов нефти и газа свидетельствует о высокой перспективности территории, а также о процессе разрушения УВ скоплений в основном по тектоническим причинам.

- Наиболее благоприятными условиями для сохранения УВ скоплений обладает запечатанная аллохтоном, автохтонное крыло Гызмейданского покрова. УВ скопления могут быть связаны в основном с меловыми, майкопскими и нижнеплиоценовыми отложениями автохтона.

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ФИЗИЧЕСКИЕ ХАРАКТЕРИСТИКИ НЕФТЕГАЗОНОСНЫХ ГОРИЗОНТОВ ПТ НА МЕСТОРОЖДЕНИИ КАЛАМАДДИН НИЖНЕКУРИНСКОЙ ВПАДИНЫ

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***Abstract**. Recently, in the Republic has been deploying drilling explorations from the eastern part to less studied central and western areas. In this reason, had a particular importance the generalization of the available geological and geophysical materials related to the new focus territory, the evaluation of the prospects of individual lithologic-stratigraphic complexes and the forecasting of deep-seated oil and gas reservoirs. Studies carried out in this direction are given in this paper, which describes the analysis of different petrophysical data. At the same time were re-interpreted reservoir and petrophysical properties of rocks, meso-Cenozoic deposits taken from the drilled exploratory wells and geological material of the areas of the Kalamaddin oil and gas bearing area, where are widely distributed deposits of the productive strata (PT-lower Pliocene). As a result of analysis and interpretation of geological, geophysical and petrophysical date, it has been established that oil-and-gas-bearing reservoirs are mainly fractured volcanogenic-sedimentary and carbonate rocks. Brief petrophysical characteristics of the sediments of the Kalamiddin oil and gas bearing region are presented. On the basis of the generalized data, a schematic graphs was drawn up, which reflects the change in rock porosity from the section. According to this graph with depth, the porosity of the rocks decreases, and the density and propagation velocity of ultrasonic waves increase. The obtained generalizations allow to conclude that the change in reservoir properties of rocks over a wide range of Kalamaddin areas is associated with the lithological heterogeneity of rock complexes, the variety of depth of their occurrence and, in connection with this, the difference in thermobaric and complexity of tectonic conditions. The results of various petrophysical research methods show that the filtration capacitance properties (FCP), in general, deteriorate with depth. However, in certain cases, in clay and carbonate rocks, reservoir properties can improve, due to the appearance of secondary porosity under relatively stringent thermobaric conditions. In addition, the relationships between physical parameters and material composition for individual groups of rocks have been established.*
***Keywords:** deposits, suit, porosity, deep, well, density, petrophysics, gorizont, drilling, geophysics, oil and gas accumulatios.*

Введение. Наличие богатых запасов углеводородов отличает Азербайджан во всем Закавказском регионе. Надо отметить, что общая площадь перспективно нефтегазоносных земель суши Азербайджана составляет 54% всей территории (47 тыс. км^2). Перспективные территории охватывают равнинные и предгорные районы республики и приурочены к нефтегазоносным бассейнам-прогибам, испытавшим интенсивное погружение в мезозойско-кайнозойское время (Рис. 1).

В последние годы в Республике осуществляется передислокация буровых разведочных работ с восточных районов в менее изученные центральные и западные. При этом особую важность обретает обобщение имеющегося геолого-геофизического материала, оценка перспективности отдельных литолого-стратиграфических комплексов и прогнозирование глубокозалегающих нефтегазовых резервуаров.

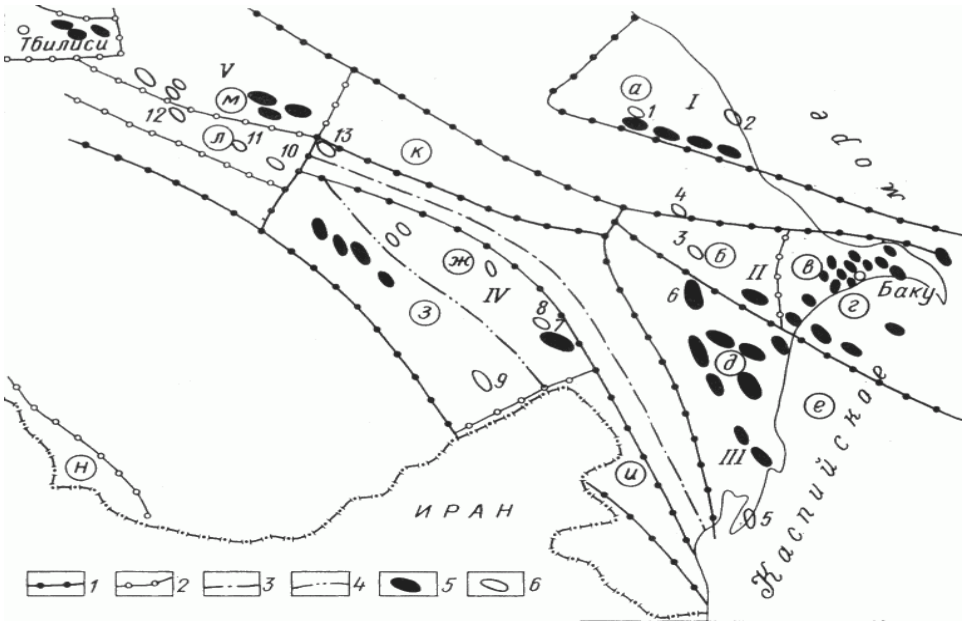

Рис. 1. Схема нефтегазоносных районов.
1 - НГО (I - Северо-Апшеронская, II - Гобустано-Апшеронская, III - Нижнекуринская, IV - Евлах-Агджабединская, V- Иори-Аджиноурская); 2 -НГР (а - Кусаро-Дивичинский, б - Шемахино-Гобустанский, в - Апшеронский, г - Апшеронский архипелаг, д - Нижнекуринский, е - Бакинский архипелаг, ж - Мурадханлинский, Саатлы-Геокчайская зона, з - Кировабадский, и - Ленкоранский, к - Аджиноурский, л - междуречье Куры и Иори, м - Мирзаанский, к - Нахичеванский, возможно нефтегазоносный); осевые линии: 3 - Мингечаур-Саатлы-Талышского межбассейнового поднятия, 4 - Евлах-Агджабединского прогиба; 5 - месторождения нефти и газа; 6 - локальные поднятия: 1 - Талаби, 2 - Агзыбирчала, 3 - Ленинабад, 4 - Астрахановка, 5 - Кызылагач, 6 - Каламадын, 7 - Мурадханлы, 8 - Зардоб, 9 - Советляр, 10 - Тарсдалляр, 11 - Гюрзундаг, 12 - Саждаг, 13 - Аджиноур)

Геологические характеристики площади Каламаддин. В связи с открытием месторождений нефти и газа на площадях Мишовдаг, Галмаз, Кюровдаг и др. в Нижнекуринской впадине, интерес к площади Каламадин возрос и, начиная с 1967 года, на этой площади начали бурить разведочные скважины. В результате был изучен осадочный разрез этой площади от олигоцен-миоценовых (майкопская серия – P_3 –N_1^1) до четвертичных отложений включительно (рис. 2). В нижней части майкопских отложений были вскрыты песчанистые пласты, а в верхней – в основном глины. Надстилающий майкопскую серию чокракский горизонт характеризуется чередованием маломощных песчаников и глин, а вышезалегающая диатомовая свита представлена глинисто-песчаными отложениями.

Отложения продуктивной толщи (нижний плиоцен-N_2^1) на своде размыты и вскрыты в нескольких скважинах. Литологически они представлены чередованием глин и песков. Реже встречаются пласты конгломерата. На площади Каламаддин нижняя часть отложений ПТ, примерно ниже XI - IV горизонтов, в разрезе не присутствует. Здесь в разрезе ПТ выделяется 8 песчаных пластов, а в нижней ее части отмечается глинистая пачка.

Отложения акчагыльского яруса вскрыты в нескольких скважинах, они размыты на севере-восточном крыле складки. Акчагыльские отложения литологически представлены чередованием серых глин, песков и песчаников. В нижней части разреза встречаются пропластки вулканического пепла.

Четвертичные отложения, в основном встречаются в зонах погружения крыльев структуры и представлены чередованием песчано-глинистых пород. Общая мощность акчагыльских отложений составляет 450 м.

Отложения апшеронского яруса представлены тремя подъярусами, литологически выраженными чередованием песков, песчаников и глин. Нижний подъярус имеет минимальную песчанистость, средний апшерон более песчаный, а верхний апшерон относительно глинистый. Общая мощность отложений абшеронского яруса составляет 480 м. Складка Каламаддин представляет собой укороченную брахиантиклиналь, простирающуюся с северо-запада на юго-восток (рис. 2).

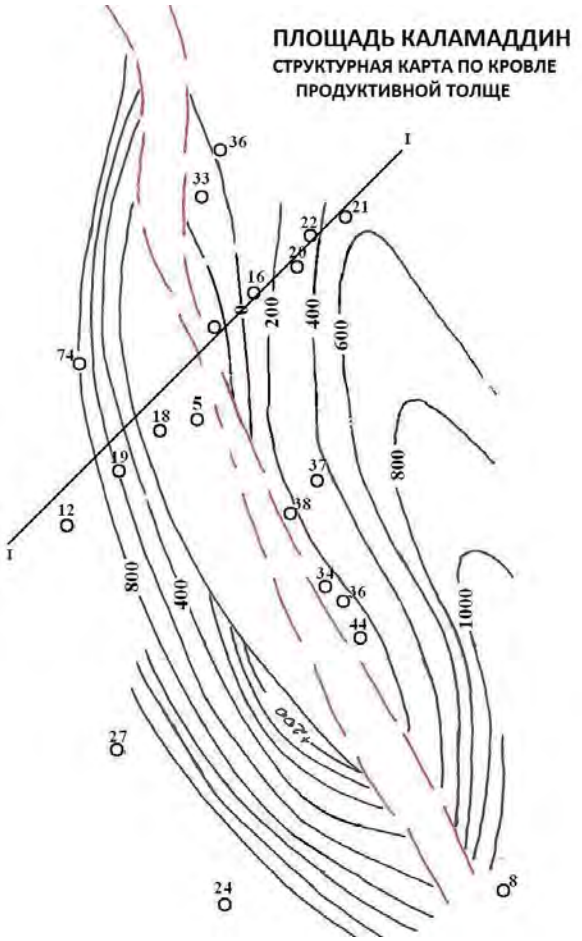

Рис. 2. Пл. Каламаддин.

Как видно из рисунка 3, развитие складки в целом происходило по нарастающей в течение рассматриваемого геологического времени. Очевидно, это связано с близостью ее к очагу сжимающих напряжений, каким является Большекавказская коллизия. Проведенными геофизиками в последние годы исследованиями установлено, что складка состоит из двух самостоятельных куполов, которые разделяются слабовыраженной седловиной. Длина северного купола, в котором расположено нефтяное месторождение, составляет 6 км, ширина 2 км, а высота 1,3 км (Рис. 4).

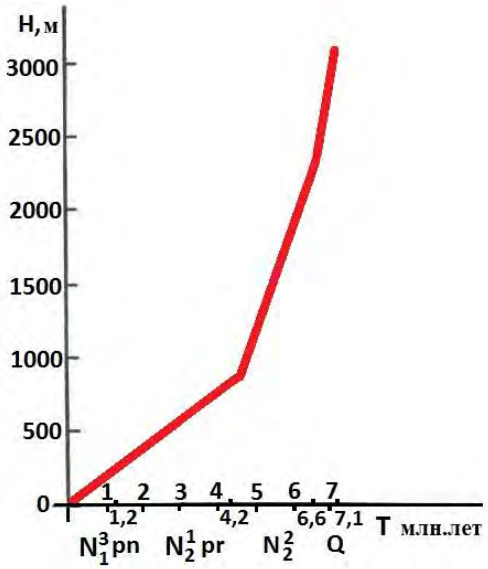

Рис. 3. График интенсивности роста складки Каламаддин

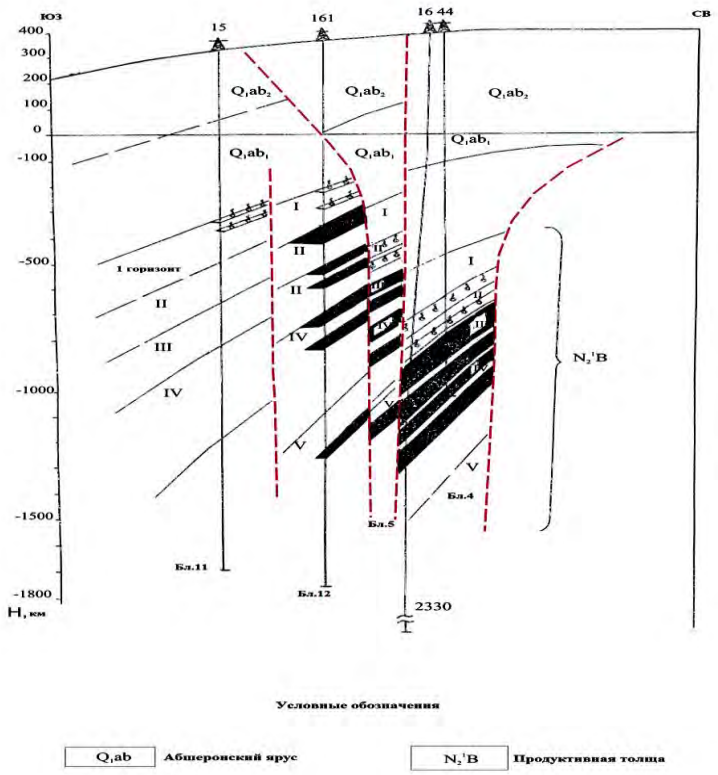

Рис.4. Складка Каламаддин. Геологический профиль по линии I-I

Грязевой вулкан Каламаддин связан с вышеуказанным первым глубинным разломом. Грязевой вулкан, грифоны, сальзы, а также наблюдаемые в структурно-поисковых скважинах нефтегазовые проявления и благоприятные геологические условия дали основание, чтобы начать здесь глубинное поисковое бурение. Определение причин проявления грязевых вулканов, грифонов, сальз, а также нефтесодержания в пределах поднятия Каламаддин, возможно с помощью графика развития складки начиная с понтического века по настоящее время. Складка Каламаддин является самой севере-западной складкой антиклинальной зоны Каламаддин-Хыдырли-Янан Тава-Мугань-дениз северо-запад-юго-восточного простирания. Складка расположена на северо-западе Нижнекуринской впадины и простирается в пределах Бакинского архипелага. Как видно из графика скорости развития складки, скорость развития складки в пределах рассматриваемого геологического времени протекает в целом поступательно. Складка начала свое развитие не позднее понтического века, а скорость развития складки в это время почти идентична скорости развития в раннем плиоцене. В позднем плиоцене скорость развития складки значительно возросла, а в четвертичном периоде увеличилась скорость ее роста. С целью уточнения перспективности нефтяного месторождения Каламаддин, были комплексно проанализированы образцы кернового материала отобранного из поисково-разведочных скважин. Следует отметить, что месторождение Каламаддин, по отношению к другим площадям Нижнекуринской впадины мало изучено. Вследствие этого, для определения перспектив нефтегазоносности, необходимо изучение коллекторских свойств отложений месторождения и прилегающих территорий.

Для решения этой задачи, были изучены такие физические свойства образцов, как гранулометрический состав (%), карбонатность (%), пористость ($К_м$, %), плотность (σ, г/см^3), проницаемость (10^{-15} м^2).

В частности, по результатам изучения гранулометрического состава пород продуктивной толщи для нефтяного месторождения Каламаддин, установлено, что размеры зерен изменяется в пределах 0,1-0,01 мм. Это указывает на преобладание в разрезе алевритов. Некоторая динамика размеров зерен (с постепенным увеличением) объясняется неравномерным распределением литотипов в разрезе. Установлено также закономерное изменение значений физических свойств пород в литостратиграфических единицах, участвующих в геологическом строении месторождения, по площади и разрезу. Для этого был

рассчитан диапазон изменения и средние значения коллекторских свойств пластов. Кроме того, были установлены зависимости проницаемости от пористости, пористости от глубины, а также изменение других физических параметров с глубиной.

Как видно из графиков изображенных на рис. 5, с глубиной происходит ухудшение коллекторских свойств пород. Такое уменьшение пористости с глубиной связано с изменением гранулометрического состава пород. Эта зависимость более явно прослеживается по усредненным значениям петрофизических характеристик пород.

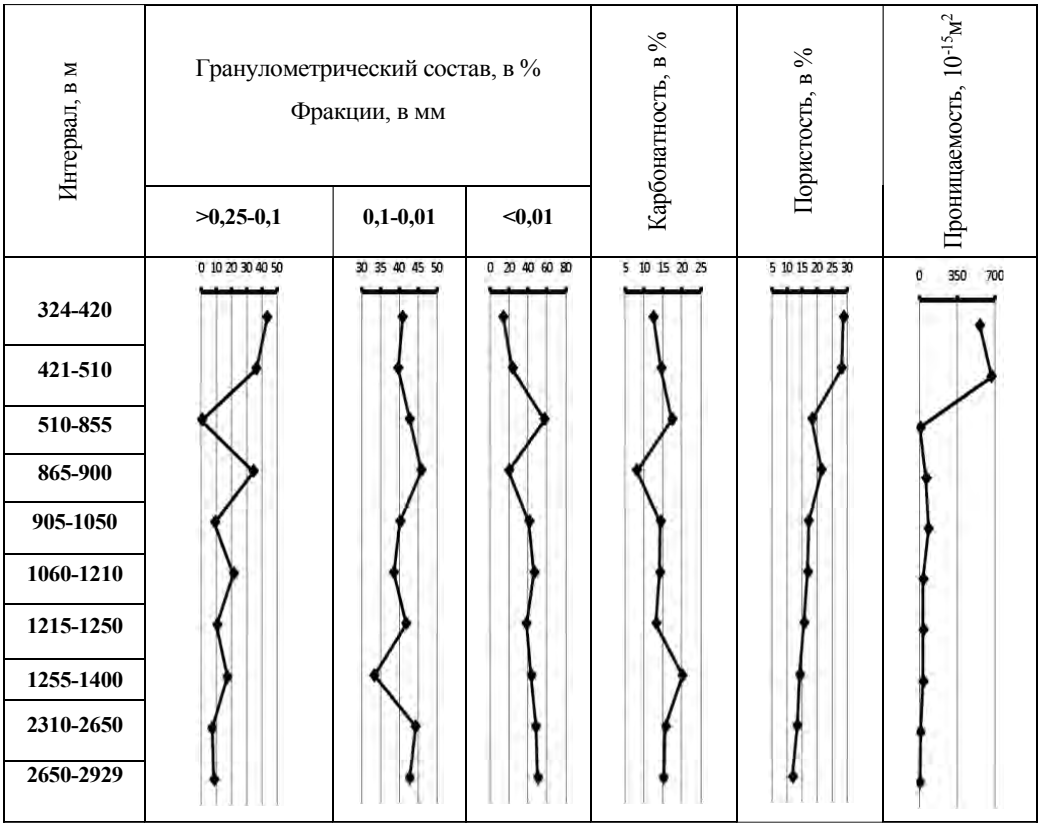

Рис. 5. График изменения петрофизических характеристик пород ПТ с глубиной месторождения Каламаддин

Из рассмотрения глубинных интервалов вариации значений пористости и глинистости (Рис. 5) следует, что пористость пород ПТ с глубиной убывает от 28,8 до 11,8%, а глинистость, наоборот, возрастает от 13,6 до 50,2%. Несомненно, что коллекторские свойства пород оказывает влияние также содержание других фракций, степень отсортированности, кабонатность, уплотненность и т.д. Более того примечательно, что по данным неглубоких и глубоких скважин изменение коллекторских свойств пород имеет место и в отдельных тектонических блоках. Последнее, на наш взгляд, связано с генетической природой самой складки, степенью ее осложненности дизъюнктивами, с их типами, гипсометрическим положением тектонических блоков относительно друг друга и со степенью развитости напряжений сжатия или растяжения в пределах отдельных тектонических блоков, и с целым рядом других факторов. В глубоких зонах также существуют вышеуказанные процессы. Это дает нам возможность прогнозировать, что в нижних глубокозалегающих частях разреза месторождения имеются пористые нефтегазоносные коллекторы.

При анализе петрофизических данных пород и при построении графика изменения их значений, выяснилось, что в некоторых случаях нарушается закономерность изменения петрофизических данных. Для уточнения этого явления, были изучены материалы керна в условиях высокой температуры и давления.

Несомненно, что эти породы в естественных условиях в глубоких слоях земли подвергаются воздействию напряжений, возникающих вследствие механических и физико-химических процессов. Так, в частности, в горных породах в стадии эпигенеза под

воздействием давления и температуры происходит растворение минеральных веществ и изменение порового пространства.

Детальное изучение пористости и плотности пород под высоким давлением показало, что эти параметры подвержены значительному изменению. Все эти показатели учтены при исследовании геологических и геофизических материалов. В диапазоне давлений 0-60 МПа (соответствует глубине в 5-6 км) упругие деформации порового пространства составляют 30-50%.

Выводы. Обобщение проведённых исследований позволяет прийти к выводу, что изменение коллекторских свойств пород в широком диапазоне по площади Каламаддин связано с литологической неоднородностью комплексов пород, разнообразием глубины их залегания и, в связи с этим, с различием термобарических и сложностью тектонических условий. Результаты разных петрофизических методов исследований показывают, что коллекторские свойства пород, в целом, ухудшаются с глубиной. Однако в отдельных случаях в глинистых и карбонатных породах коллекторские свойства могут улучшиться, за счет появления вторичной пористости при относительно жестких термобарических условиях. Для прогнозирования нефтегазоносности глубокозалегающих толщ, наряду с методами разведочной геофизики, следует также использовать данные о фильтрационно-емкостных свойствах (ФЕС) коллекторов.

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TRANSPORT

ABOUT THE CONCEPT FOR THE DEVELOPMENT OF MOTOR TRANSPORT IN GEORGIA BASED ON INTELLIGENT TRANSPORT SYSTEMS

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Abstract. *The growth of motorization is followed by a number of problems, including low speed of communication, congestion of the road network, high accident rate, deterioration of the environmental situation. Improving the quality and safety of road traffic can be achieved through the creation of an intelligent transport system, which, being a global trend, can dramatically improve the quality and safety of road traffic. The long-term concept for the development of Georgia's transport should be based on the advanced achievements of science and technology. The state strategy for the development of an intelligent transport system should reflect the vision of this industry in the long term. The national intelligent transport system must be unified with international intelligent transport systems, therefore it is advisable to create such a system in cooperation with European countries, taking into account local specific features.*
Keywords: *transportation system, intelligent transportation system, innovations, management, development concept.*

Введение. За последние 10 лет число автомобилей в Грузии, с населением 3,7 млн человек, увеличилось в 2 раза, превысило 1,5 млн единиц и продолжает расти. Рост автомобилизации вызвал ряд проблем, связанных с увеличением нагрузки на улично-дорожную сеть, особенно в городах: снизилась скорость сообщения, ухудшились режимы движения, появились перегрузки улично-дорожной сети, увеличились выбросы вредных веществ в атмосферу и уровень транспортного шума, возросло количество аварий.

Дорожное движение содержит аварийную, экологическую, экономическую и социальную угрозы. Для участников движения из всех угроз наиважнейшей является аварийность, поскольку непосредственно касается жизни, здоровья и благополучия граждан, поэтому борьба с аварийностью имеет большую социальную значимость, и ее необходимо рассматривать на государственном уровне. Ежегодно в мире погибает более 1,3 млн человек и около 50 млн получают травмы. В Грузии каждый год происходит более 6 тыс. дорожно-транспортных происшествии, в которых погибают около 500 и получают ранения более 9 тыс. человек. Почти 21 тыс. км автомобильных дорог на территории 69,7 тыс. км^2 имеют стратегическое значение для страны. Они связывают и обеспечивают жизнедеятельность всех городов и населенных пунктов на всей территории государства, во многом определяют возможности развития регионов, реализацию транзитного потенциала страны.

Переходя к интенсивному инновационному развитию, Грузия стремится включится в глобальную экономику, что требует принятия адекватных стратегических решений по усовершенствованию транспортного-дорожного комплекса. Долгосрочная концепция формирования транспорта, должна быть инновационной, т.е. опираться на передовые достижения науки и техники.

Основная часть. Концепция развития транспортной системы Грузии должна ориентироваться как на интенсивное. так и на экстенсивное развитие транспортной системы. Под интенсивным развитием подразумевается более эффективное использование существующих ресурсов, а под экстенсивным развитием - строительство новых дорог, транспортных развязок и т. д.

При разработке долгосрочной концепции развития транспорта основными принципами ее создания являются:

- разработанная концепции должна опираться на системный подход, базирующуюся на современном или перспективном развитии науки и техники;
- основной идеей долгосрочной концепции инновационного развития транспорта эта интеллектуальная транспортная система.

Повышения качества и безопасность дорожного движения можно достичь с помощью создания интеллектуальной транспортной системы (ИТС). Интеллектуальная транспортная система эта интеллектуальная система управления, использующая инновационные разработки в моделировании транспортных систем и регулировании транспортных потоков, интегрирующая современные информационные и телематические технологии и предназначенная для автоматизированного поиска и принятия к реализации максимально эффективных сценариев управления транспортно-дорожным комплексом. Внедрения ИТС, как показывает мировая практика, поможет решить вопросы сокращения аварийности, повышения эффективности общественного транспорта и грузоперевозок, обеспечения общей транспортной безопасности, улучшения экологических показателей. ИТС являясь общемировым трендом, позволяет кардинальным образом улучшить качество и безопасность дорожного движения.

С помощью ИТС можно решить следующие актуальные задачи для страны:

- оптимизация распределения транспортных потоков в улично-дорожной сети во времени и пространстве;
- увеличение пропускной способности существующей улично-дорожной сети;
- предоставление приоритетов для проезда определенному типу транспорта;
- повышение безопасности дорожного движения;
- снижение отрицательного экологического воздействия транспорта;
- предоставление информации о дорожной обстановке участникам транспортного процесса и т.д.

В мире существуют различные концепции уже апробированных ИТС. В зависимости от ряда политических и социальных особенностей той или иной страны, приоритеты в предоставляемых сервисах расставляются по-разному. В одних странах государство обеспечивает развитие ИТС и зарабатывает на предоставляемых сервисах, в других - идет по пути развитию коммерческих ИТС с регулированием в основном социальной сферы и систем безопасности. С учетом различных апробированных систем ИТС многие страны с развитой экономикой имеют свои национальные концепции и приоритетные программы развертывания ИТС, что находит отражение в их программных документах.

Опыт стран Евросоюза, США, Японии, Китая и других государств в продвижении проектов ИТС показывает, что в условиях рыночной экономики только единая государственная политика позволяет объединить усилия государства и его субъектов, бизнеса всех уровней и секторов экономики в решении общенациональных целей в транспортном комплексе. Государство осуществляет стратегически-инновационную функцию – поддерживает базисные технологические и экономические инновации, придавая им начальный импульс. При формировании интеллектуальной транспортной системы. Основная роль государства может быть:

- организующая и координирующая – в создании институциональной основы для разработки национальной архитектуры ИТС и координационных планов развития;
- регулирующая – создание правового поля, стандартизация параметров в сфере безопасности и технической совместимости;
- стимулирующая – поддержка исследований и социально-ориентированных проектов ИТС- сервисов в сфере общественного транспорта и неотложных служб;
- инвестиционная – разработка и реализация ИТС-проектов, решающих задачи безопасности и производительности, которые могут создаваться и эксплуатироваться с привлечением частного капитала на условиях государственно-частного партнерства.

В настоящее время государственная политика Грузии в сфере интеллектуальных транспортных систем не выстроена и действующими стратегическими и программными документами не определена и находятся на зачаточном уровне. Тем не менее разрабатываются отдельные элементы, в наиболее обширной сфере применения ИТС - в обеспечение безопасности дорожного движения. Широко применяются дорожные камеры фиксации нарушений правил дорожного движения. Они детектируют различные нарушения правил, от

превышения скоростного режима, до сложных, комбинированных нарушений на перекрестках, пешеходных переходах, распознают автомобильные номера, создают доказательную базу, передавая ее в центр обработки данных. Применение информационных технологий не обходит стороной и сферу общественного транспорта, где используют видеонаблюдение, детектирующее нарушения общественного порядка. Грузинский технический университет готовит специалистов по курсу «Телематические системы». Предполагается прилагать больше усилий для внедрения интеллектуальной и эффективной транспортной системы за счет современных технологий.

В государственной стратегии развития ИТС должно быть отражено видение данной отрасли в долгосрочной перспективе. Необходимо, чтобы она включала в себя такие цели, как повышение безопасности транспорта, обеспечение предсказуемости транспортных потоков и информированности пользователей, функционирование экологически безопасной транспортной системы, создание комфортных условий проживания в городах. Национальная интеллектуальная транспортная система должна быть унифицирована с международными интеллектуальными транспортными системами, поэтому такую систему целесообразно создавать в сотрудничестве с европейскими странами, учитывая специфические особенности страны. Внедрение ИТС управления дорожным движением позволит снизить аварийные, экономические и экологические, а также социальные потери в сфере дорожного движения несмотря на рост автомобилизации.

Выводы. Долгосрочная концепция развития транспорта Грузии должна опираться на передовые достижения науки и техники. Современные интеллектуальные транспортные систему являются новым типом систем управления, пришедшими на смену автоматизированных и информационным системам управления. Они учитывают такие важные факторы как распределенная информация и пространственные отношения. Интеллектуальные транспортные системы служат инструментом принятия решений в условиях большой сложности и больших объемов данных. При разработке долгосрочной концепции инновационного развития транспорта в Грузии в качестве основной идеи следует использовать интеллектуальные транспортные системы и концепцию долгосрочного инновационного развития транспорта, создавать их на основе современных информационных и телематических технологии.

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AGRICULTURE

THE ROLE OF THE GOVERNMENT AS A PARTICIPANT IN THE INNOVATIVE AGRICULTURE SYSTEM

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Abstract. *Innovation is considered to be the driving force of the whole economy, as well as the development tool of the agrarian sector in particular. Innovation enables us to overcome both local and global challenges. The article presents the innovative capacity in agriculture, models, participants, etc. The main directions of governments' activities in the field of innovation in different countries and the tools with which the governments try to promote innovative development have been studied. Agriculture is one of the most important sectors of the Armenian economy, in which there are many unresolved issues. The best and the most effective way to solve these problems is through innovation. However, the studies show that the process of innovative development of the RA agrarian sphere is very slow, which is partly due to the shortcomings in the field of science. The article presents some indicators of RA science. The conclusion section of the article presents clear recommendations that should be implemented by the RA Government to increase the efficiency and competitiveness of the agricultural sector through innovation.*
Keywords: *agriculture, innovation, government, development, science*

Introduction. Innovation is the driving force behind economic development. There are different views on the definition of innovation. In general, innovation is considered a technology-based process, which, using new approaches, increases productivity, competitiveness, people's incomes and improves the living standards of the population. Innovation is a complex process where multiple actors play different roles. Governments and other key stakeholders, including civil society, farmer organizations, research bodies and the private sector, all have a role to play in creating an environment that enables innovation in agriculture to flourish and generate solutions. Success hinges on connecting the drivers that influence innovation uptake[1].

Purpose of the research. One of the most important actors of agricultural innovation systems is government. In most countries, governments provide strategic guidance for research and innovation, and provide funding to research institutions, private companies, and advisory systems. Government funding can be granted directly to research institutions, or through funding organizations, such as research councils or foundations, which allocate funds to projects. Depending on the country, part or all of agricultural research funding is integrated into the general innovation policy. In several countries, the Ministry in charge of agriculture plays a prominent role in funding and performing agricultural research via agricultural research institutes that are part or under the umbrella of the ministry (e.g. INTA in Argentina, Embrapa in Brazil, Agriculture and Agri-Food Canada's research centers, Corpoica in Colombia, and the USDA Agricultural Research Service). These research institutes include regional offices and laboratories throughout the country, and are often active in knowledge diffusion. Beside government research centers, universities in these countries also perform agricultural research and development (R&D), and have a significant role as in the case of land-grant universities the United States. They often focus their activities on regional agricultural strengths, and receive both federal and regional funds. In the reviewed EU countries, agricultural R&D is funded as part of general R&D mechanisms, but performed mainly in universities with strong specialization in agriculture or life sciences (University of Life Sciences in Estonia, Latvia University of Life Science and Technologies, Wageningen University in the Netherlands, and the University of Agricultural Science in Sweden). In Estonia, Latvia and the Netherlands, the agricultural university includes

[1] FAO's work on agricultural innovation, Sowing the seeds of transformation to achieve the SDGs, FAO, 2018, 20p., p. 6

applied research institutes (e.g. Wageningen Economic Research). In Turkey, 43 universities are engaged in agricultural R&D, as well as two of the TÜBITAK institutes. Diversity is even higher among advisory systems, from competitive ones with a large range of suppliers for farmers to choose from, and minor government involvement, like in the Netherlands, to comprehensive government managed and funded systems like in Korea. In Brazil, the public advisory system focuses on non-commercial, smaller farmers.[1] The Inter-American Institute for Cooperation on Agriculture (IICA), as the specialized agency for agriculture and rural well-being in the Inter-American System, promotes technological and organizational innovation, taking a systemic approach to improve competitiveness, boost production and help improve the functioning of agricultural markets[2].

Taking into account the importance and significance of agriculture, the Government of the Republic of Armenia is trying to work actively for the development of the sector. However, taking into account the existing problems in the RA agriculture (high levels of poverty, underdeveloped infrastructures, imperfections in the irrigation and agricultural risk management systems, small plots of land, old, worn-out agricultural machinery and so on), it can be stated that the work carried out by the government is not very effective. The aim of the research is to present clear proposals on what the RA Government should do for the development of innovative agriculture.

Methodology. Two schools of thought are prominent in the field of innovation support for agricultural or rural development. The first believes in facilitation, which aims to create conditions that are conducive to innovation. The second focuses on strategic management, which involves bringing out and supervising a community of innovating actors, called innovation community, by providing support that is gradually adapted to each phase, starting from the phases for ideation and design to those for deployment and dissemination. With more encompassing approaches being required, the discourse among researchers and development agencies gave rise to two new frameworks of thought: AKIS (Agricultural Knowledge and Information Systems) and AIS (Agricultural Innovation Systems). In both these frameworks, the interactive innovation model contrasts with the linear model. Innovation is thought of as a collective process of creation in which collective learning phenomena play a central role. The farmer is no longer relegated to the role of a mere user, one who simply adopts innovation, but becomes a full actor in innovation in his own right, as a source of knowledge and a co-designer. The AKIS framework focuses on the exchange of knowledge and information to sustain the innovation process. It is the actors of research and development, education, and agricultural advice who are at the heart of mechanisms for providing support to farmers. Participatory research methods involving farmers then followed, such as participatory research and development, participatory technology development, the Farmer First approach, or mechanisms for action research in partnership. The AIS approach is intended to be even more inclusive; it takes into account all the actors who participate, directly or indirectly, in innovation processes (input suppliers, actors of supply chains, banks, policymakers, etc.). Participation, the co-creation of knowledge and value, as well as the facilitation of actor networks become the key principles for designing new mechanisms to accompany and support innovation. The main form of operationalization of this approach is the innovation platform. Its goal is to help different categories of actors – who usually have no connection with each other – interact to share knowledge and to pool resources for innovation. Facilitation is defined as a voluntary intervention to strengthen the interactions between individuals, organizations and their social, cultural and political structures through a process of network building, social learning and negotiation.[3]

It is also clear that capacity building is key for knowledge management, and that cooperation in the countries should be oriented toward making every innovation system more dynamic. Knowledge is thus understood to originate from a diversity of sources: research centers (including NARIs, universities, private institutions, NGOs, international centers and others), extension systems, the know-how of farmers themselves, or a combination of all these. The approach for achieving this vision will be to create internal and external conditions that facilitate innovation in agriculture. Such

[1]Innovation, Productivity and Sustainability in Food and Agriculture, Main Findings from Country Reviews and Policy Lessons, OECD Publishing, Paris, 2019, p. 85,

[2] Innovation in agriculture: a key process for sustainable development, San Jose, May 2014, 20p., p. 1-2

[3] Guy Faure, Yuna Chiffoleau, Frédéric Goulet, Ludovic Temple and Jean-Marc Touzard, Innovation and development in agricultural and food systems, France, 2018, p.108-110

conditions could include, for example, fostering and gaining access to knowledge and new technologies, and strengthening the capacities of private and public stakeholders to generate innovation processes in the agricultural sector.[1]

It has already been mentioned that the basis of innovation is science. The main indicators characterizing the field of science in the Republic of Armenia are presented in Table 1.

Table1. The main indicators characterizing the field of science in the Republic of Armenia, 2018*

Indicator	Amount
Domestic costs for research and development (mln. drams)	10 532.2
Number of organizations engaged in research and development,	63
Number of employees of organizations engaged in scientific researches and developments, persons	4 452
Volume of scientific and technical works, total, (mln. drams)	10 871.3

* The table was compiled by the author based on the data of the RA National Statistical Service

In 2018 the domestic costs for research and development were 10 532,2 mln. drams (0,19% of GDP). There were 63 organizations engaged in research and development. Research institutions and enterprises engaged in research activities include research institutes, design and prospecting organizations, pilot production plants not serving any outside entities, higher education institutions, scientific and technical units of industrial enterprises engaged in research, design and technological work, and also other organizations reporting R&D activities in the period covered by their reports. The number of employees of organizations engaged in scientific researches and developments was 4452 (0,44% of total employed people).

Research results. Studies show that the financial support provided by the Government of the Republic of Armenia in the field of science is very small both in comparison with the leading countries of the world and in comparison with most of its neighbors. The World Bank analyzed the most recent available data on which countries spend the largest proportion of GDP on R&D activities. While the data predates the pandemic, it helps shine a light on how funding research can bolster economic competitiveness. Here is a summary of the top three nations in the World Bank's list. In 2018, Israel spent 4.95% of GDP on R&D, South Korea spent 4.81% of GDP on R&D, Switzerland spent 3.37% of GDP on R&D[2]. Research and development expenditure (% of GDP) in the neighboring countries of Armenia is shown in the table 2.

Table 2. Research and development expenditure (% of GDP), 2018*

Country	% of GDP
Armenia	0,19
Georgia	0,30
Iran	0,83
Turkey	0,96
Azerbaijan	0,18

*The table was compiled by the author based on data from the World Bank

According to the table, Armenia is only 0.01% ahead of Azerbaijan in this index, but it lags far behind the other three neighboring countries.

There are a number of problems in the field of science in the Republic of Armenia, which hinder the development of the field. These problems include the low salaries of researchers, the small share of young scientists in the total number of scientists, the results of scientific research not being applied in practice, etc. The need to ensure close cooperation between the state, production, science and education participants has been discussed many times in Armenia. However, my practical experience in the field of education and science proves that this cooperation has not been formed yet. The different participants operate mainly independently of each other, as a result of which novelties are created, the demand for which is sometimes not in the market. Sometimes research on the same topic is carried out by different scientific organizations, which do not cooperate with each other, that`s why sometimes duplicate work is observed.

[1] Innovation in agriculture: a key process for sustainable development, San Jose, May 2014, 20p., p. 16
[2] https://www.weforum.org/agenda/2020/11/countries-spending-research-development-gdp/

It is widely recognized that innovation requires certain types of public sector support. In developing and emerging countries, public institutions are weaker and generate a number of failures that do not affect developed countries to the same extent. Lack of information – such as, for example, paucity of statistics on the informal sector – lack of co-ordination across agencies and lack of stable human resources reduce the ability of public institutions to play their role as efficiently as possible. Policies which are fine "in theory" might simply not work in that context: for instance, an R&D tax credit has little sense when tax collection is at best partial. It is important that policy messages addressed to developing countries take into account the level of development of their institutions and administrative system – for their success, policies must be "resilient" to weak institutions[1].

Conclusions. The innovation process comes about largely within "innovation systems" made up of organizations and private and public stakeholders interconnected in different ways and possessing the technical, commercial and financial competencies and inputs necessary for innovation. The government plays a fundamental role, supplying the economic, social and institutional conditions that foster innovation in agriculture.

For the development of innovative agriculture in Armenia, the government of RA should

- create a national platform that should unite all participants in the innovative agriculture system,
- develop a strategy for the development of innovative agriculture, which should be an integral part of the strategy for an innovative economy strategy,
- create a website on innovations in agriculture, where innovations in the field of agriculture will be posted,
- develop state support programs aimed at conducting agricultural activities with innovative technologies.
- increase the efficiency of consulting services,
- increase the amount of state funding in the field of science,
- take measures to involve farmers in innovative agriculture not as consumers, but as idea generators.

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GEOGRAPHICAL SCIENCES

ASSESSING HUMAN ACTIVITIES INFLUENCES ON THE VEGETATION COVER USING TRENDS OF NORMALIZED DIFFERENCE VEGETATION INDEX TIME SERIES: CASE STUDY IN DORNOD PROVINCE

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Abstract. *Desertification and land degradation are causing a serious environmental problem in Mongolia, with climate change and human activities being major contributors to the land degradation. This study examines whether MODIS NDVI satellite data time series can be used to detect land degradation and regeneration areas in Eastern province of Mongolia. Time series analysis was applied to a 12-year MODIS NDVI satellite data record, based on the hypothesis that the resulting NDVI residual trend vectors would enable successful detection of changes in photosynthetically active vegetation. GIS and statistical analyses were used to estimate the trend of the annual average NDVI for June, July and August from 2006 to 2017. We also examined land cover development and meteorological data for the same period. MODIS land cover products proved suitable for identifying areas of vegetation cover change. Areas showing positive and negative NDVI trends mostly coincided with areas of land cover class change indicating an increase or a decrease in vegetation, respectively. The Dornod was selected as a study site since the area is vulnerable to desertification. The study results reveal an increasing trend in NDVI values in 89.03% of the total study area and a decreasing trend in NDVI values in 11.07% from 2006 to 2017. Overall, 11.07% of the total area, has been affected by desertification. There was a positive moderate correlation between change in precipitation and the NDVI trend in the study area. The study indicates that the effects of precipitation variance on the changes in the trend of the NDVI resulted from more than human activities in the study area.*
Keywords: *Normalized Difference Vegetation Index (NDVI); Pearson correlation; vegetation cover.*

Introduction. The cause of desertification is all types of soil degradation and loss of vegetation cover (Kosmas C, Tsara M, Moustakas N, et al. 2003). The biological indicators of desertification are changes of vegetation and mammal diversity, which consists of the ecosystem (Dash, Jalbaa, 2003). The NDVI is selected as one of the biophysical indicators of land degradation assessment in arid areas (FAO & LADA 2007). Mongolian and international scientists have agreed that long-term decline of vegetation cover is a sign of desertification (Dash et al. 2003; Lantieri, as cited in FAO & LADA 2007). The NDVI is the estimated result of remote sensing measurements that indicate greenness of the vegetation and patterns of green biomass (Forkel et al. 2013).

The Dornod province is selected as a research site. This research conducted to estimate trends in annual average NDVI from 2006 to 2017 in this area. The NDVI trends and statistical analysis identified in this period.

As above mentioned, a decrease in NDVI is one of the criteria of land degradation and desertification. Thus, aimed to identify the effect of human impacts and climate, to evaluate each of them for spatial analysis.

Research data.

Meteorological data. The distribution of the weather station network is very sparse across Mongolia. These weather stations estimate the monthly precipitation data for the whole area of each soum, which is inadequate to generate a spatial distribution of precipitation monthly with close approximation of scale and accuracy to the NDVI dataset. In order to estimate spatial distribution of

the amount of precipitation densely distributed precipitation data are needed. Therefore, remotely sensed precipitation data derived from TRMM's (Tropical rainfall measuring mission) were acquired to estimate the annual average accumulated precipitation for June, July and August from 2006 to 2017. TRMM's monthly precipitation 3B43 data were collected for this study. The spatial resolution of this product is a 0.25ox0.25o grid and the temporal resolution is monthly (Huffman 2016). It presents the monthly average precipitation in mm/hour per pixel of the 0.25ox0.25o grid.

Normalized Difference Vegetation Index /NDVI/. MODIS satellite data with 1 km resolution (MOD13A3) used in annual average NDVI for June, July and August from 2006 to 2017.

Vector data. The vector data include roads, settlement areas and herders' seasonal location points, wells, rivers and streams within the selected area. The data acquired were from the "National unified land territory registration" data which has been developed by the Agency of Land Administration and Land Management, Geodesy and Cartography.

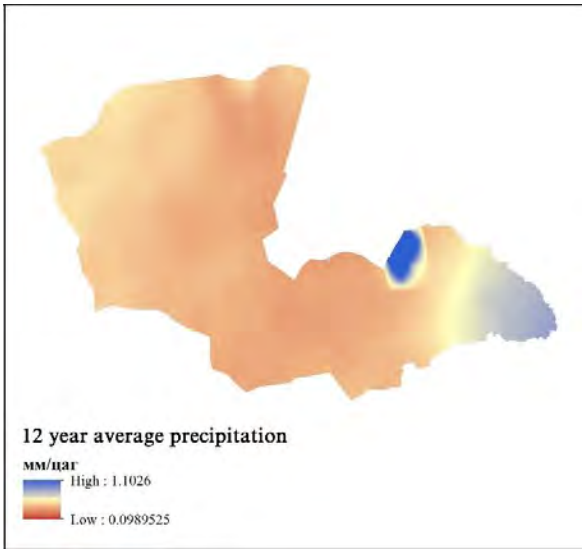

Fig. 1. Spatial distribution of annual precipitation in the Dornod aimag over an average of 12 years

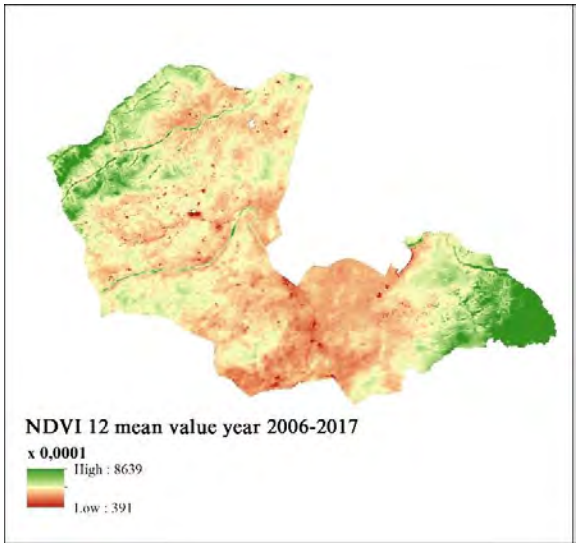

Fig. 2. Spatial distribution of the average NDVI over the 12 years of existence of the Dornod aimag

Data processing. The process was used in ArcGIS 10.3.1 software for spatial analysis and multivariate analysis, transformation.

NDVI. For each year of the study, the values of NDVI/6, 7 and 8 MODIS were superimposed and analyzed according to the average statistical value.

Precipitation. TRMM 3b43 resolution on the surface of the TRMM satellite with a resolution of 0.25° by gradient in netCDF format to build a clip from the border of the Dornod aimag and to form the spatial distribution of each spatial distribution for each year (up to 1 km). The northern end of precipitation is 50 degrees north latitude, no news. In addition, there were no data on the northern sums of sums, such as the sum of Chulluntor from the Dornod aimak. Although the final data were presented in the form of data from meteorological stations, there are few meteorological stations in the area and they are too large and cannot be reconstructed.

Vector data processing. Vector data were converted to 1 km, exactly in 5 districts at a distance of 1 km from each other for each site, population and wells, wells and rivers.

Research methodology.

Pearson's correlation analysis. Pearson's correlation determines the degree of linearity between two numerical values. The value of the correlation coefficient is the strength and direction of the connection (positive and negative). The correlation coefficient is expressed in r or R and varies from [-1: 1]. The Pearson correlation coefficient is measured by linear force (r). When we look at the duration of time and variables, we determine the variables. The correlation coefficient measures the strength of the linear relationship, not just the relationship between variables.

For correlation coefficients (Piao & Fang, 2002), [2] the correlation between NDVI and the given time corresponds to:

$$r_{xt} = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(i - \bar{t})}{\sqrt{\sum_{i=1}^{n}(x_i - \bar{x})^2 \sum_{i=1}^{n}(i - \bar{t})^2}} \quad (1)$$

Here is the n-shaped year, the value of xi-i is the year of NDVI, (x) is the average value of the given time of NDVI. $\bar{t}$ - annual average (n + 1) / 2 consecutive years. This value is calculated at each point within 1 km (x, y) of 142727 points. Estimated positive and negative values reflect a 12-year decline in the growth rate of the NDVI index over the period 2006-2017.

Results.

NDVI and the precipitation approach. The following figure shows that the mean values of precipitation and NDVI change with each other in the same deviation of the linear correlation line. The NDVI is the most commonly used index and has a measurement scale ranging from -1 to +1. Negative values represent non-vegetated surfaces, whereas values close to 1 have very dense vegetation (Ioan et al. 2013).

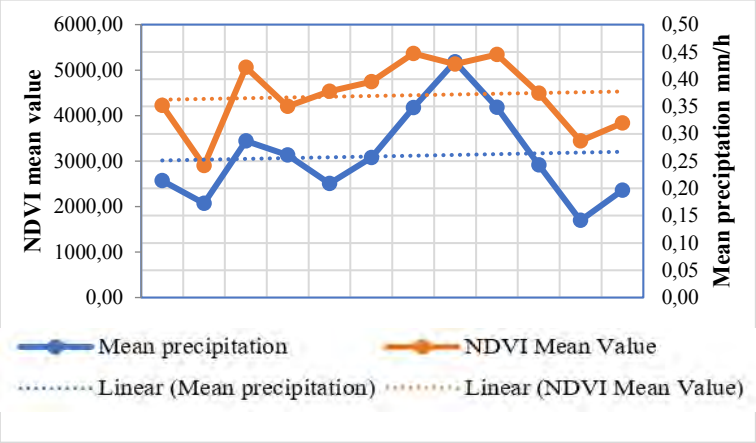

Fig. 3. Comparison of mean 12-year precipitation and mean annual changes in NDVI

The value of the NDVI index and the 12-year significance coefficient or correlation coefficient 1, the linear dependence with a strong increase, indicates the strength up to the value close to -1. In other words, the linear dependence on strong growth represents a long-term trend of NDVI variables and a significant decrease in the long-term decrease of NDVI variables.

Figure 5 shows that most regions of the country tend to grow moderately or weakly. The slightest tendency is observed to the least extent.

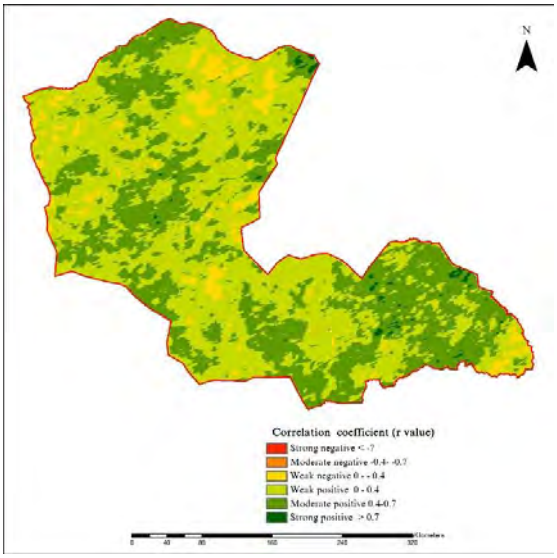

Fig. 4. Value of NDVI and 12-year series of dependences

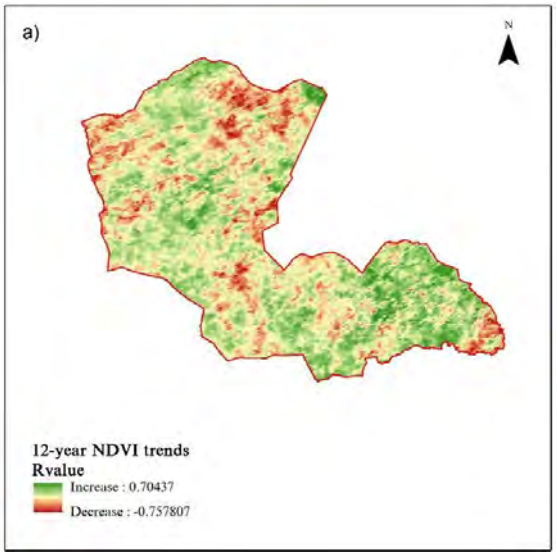

Fig. 5. Comparison of 12-year NDVI trends

(Strength of linear dependence (Value of NDVI and 12-year series of dependences))

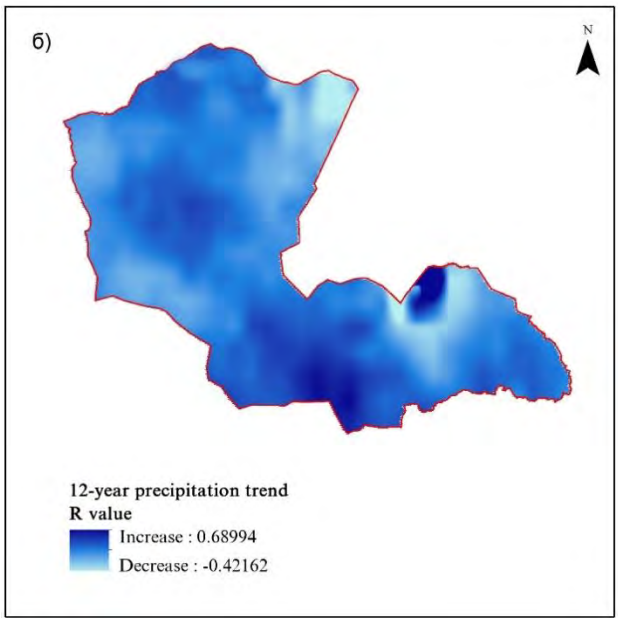

Fig. 6. Trends in precipitation over 12 years

The above graph shows that the amount of precipitation has increased over the past 12 years

Human impacts.

To ensure the spatial distribution of the human factor, five areas have been identified with an accuracy of 1 km for humanitarian activities, infrastructure and natural sites, and areas beyond 5 km are considered less vulnerable to human impact (Figure 7).

Water bodies and their surroundings are the main summer habitat for reindeer herders and represent areas of high intensity. To estimate the anthropogenic impact, the percentage of INR growth within a 5 km radius of the reservoir is calculated as 1 km per capita. As can be seen from Table 1, the maximum reduction of the lake area, or 21% of the total area, has been reduced.

Infrastructure inflow affects the land types in the Dornod aimag category, such as roads, urban and agricultural areas, and Table 2 shows that the greatest impact in the affected area is 1 km in the area of impact, occupying 20 percent of the area.

Depending on the type of impact zone, Figure 11 illustrates how NDVI increases and decreases. In terms of total area, the spatial distribution of IRIS trends is 21% and 17.4% is in close proximity to the areas under crops.

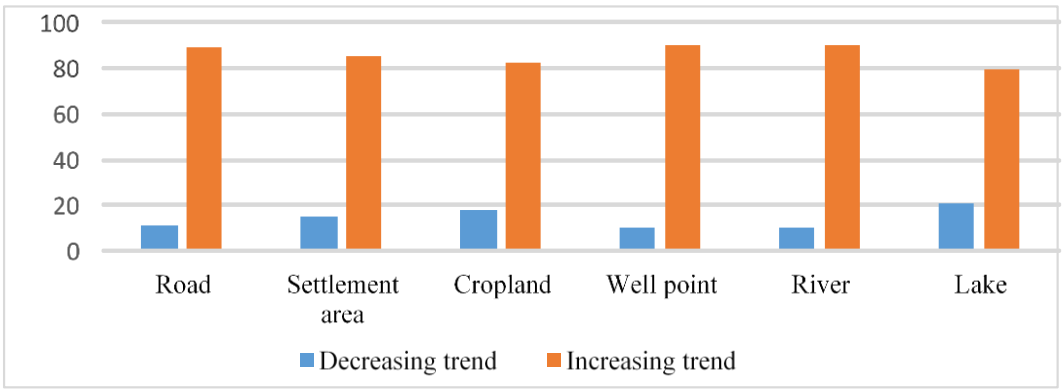

Fig. 7. Ratio of growth rate to NDVI index decrease in the area of influence

Discussion.

1. According to the correlation coefficient, 11.07% of the total study area decreased the value of INRRRR. In other words, 11.07% of the surveyed areas show that vegetation cover is likely to decrease slightly, indicating land degradation and desertification in these areas. Most of the settlement (89.03 percent) is observed, which is directly related to the increase in precipitation over a 12-year period.

Table 1. Percentage of spatial distribution of IRI trends on river pastures, lakes and ponds in the stream impact zone

Land use type	Trend	1 kilometer		2 km		3 km		4km		5km	
		Total value	Percent	Total value	Percent	Total value	Percent	Total value	Percent	Total value	Percent
Well	decrease	730	5.45	1672	11.66	1812	11.30	1685	11.32	1458	11.0
	Increase	12673	94.55	12673	88.34	14223	88.70	13206	88.68	11787	88.9
River	decrease	662	14.63	559	15.34	492	13.96	477	13.80	478	14.3
	Increase	3864	85.37	3085	84.66	3033	86.04	2980	86.20	2852	85.6
Lake	decrease	72	18.09	99	22.81	109	21.25	124	20.63	137	21.0
	Increase	326	81.91	335	77.19	404	78.75	477	79.37	514	78.9

Table 2. Spatial distribution of HDI trends in anthropogenic factors affecting infrastructure

Type	Trend	1 kilometer		2 km		3 km		4km		5km	
		Total value	Percent	Total value	Percent	Total value	Percent	Total value	Percent	Total value	Percent
Roads	decrease	1311	11.4	1251	11.41	1115	10.8	1067	11.1	937	10.5
	Increase	10153	88.5	9716	88.59	9136	89.1	8488	88.8	7942	89.4
Settled area	decrease	71	13	102	14.67	112	13.6	143	15.0	165	15.1
	Increase	475	87	593	85.32	709	86.3	807	84.9	921	84.8
Cropland	decrease	242	20	251	18.24	280	17.96	296	17.09	288	15.11
	Increase	980	80	1125	81.75	1279	82.04	1436	82.91	1618	84.89

2. The trend correlation (> 0.7) and the decrease (<-0.7) are usually very low when estimating the correlation coefficients of correlation coefficients, indicating that over the 12 years between 2007 and 2018 the fluctuations were short.

3. Due to the long-term decrease of the HDI compared to human impact, the impact of aquifers is 20.8% in lake impact zones, 12.1% in water impact zones, 10.2-11.1% in road impact zones, 14.5% in urban areas and 17.4% in crop impact zones. However, depending on the type of activity, changes in vegetation cover occur. In the area affected by the water body, especially in the lake area, it is noted that the intensity of traffic in this area is related to shepherds who drink water in summer.

4. As a result of the conducted studies, changes in vegetation cover depend on the influence of precipitation and anthropogenic factors.

Conclusions. The purpose of this study is to review trends based on spatial distribution of vegetation cover, which allows combining spatial analysis of human and natural forces. In addition, indicators that can be used to describe vegetation biomass more realistically in the future are likely to be used to determine vegetation cover and land degradation using the methodology used in this study.

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TOURISM AND RECREATION

RESULT STUDY OF DESTINATION AND SATISFACTION OF CHINESE TOURISTS, VISITING MONGOLIA

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Abstract. *With the increasing number of foreign tourists visiting Mongolia, new tourist products and regional destinations are emerging. In recent years, the number of foreign tourists visiting Mongolia has increased, with Chinese tourists accounting for one-third of the market, and this growth is expected to continue. Thus, the results of a sample survey of 750 tourists and residents of Chinese tour operators in Mongolia have compiled 74 (18 groups) indicators reflecting the direction and satisfaction of Chinese tourists visiting Mongolia.*
The results of the study identified 9 regions where Chinese tourists are more inclined to travel to Mongolia and summarized 9 factors that are necessary to improve Destination management.
The results of the study were ranked according to the Gray method, and the satisfaction score was assessed by quantitative and qualitative methods. As a result of this assessment, this paper shows that Ulaanbaatar, Gorkhi-Terelj National Park, and border regions are more satisfied.
Keywords*: Destination, competitiveness, Tourists' satisfaction, Destination ranking, Gray method.*

Introduction. One of the main vital concepts of tourism is the comprehension of a tourist *destination*. As described in the tourism study, "Destination" is a place to visit for tourism purposes. The tourist destination was described as follows by author Clare A. Gunn[1]. "A tourist destination" is a place that provides visitors with services and exhibits to enjoy their leisure time", he described. According to this view, tourist destination must include tourist attractions, products, and services that may be required during travel, and infrastructure to ensure the safety and comfort of the tourists.

Determining the competitiveness of a destination is an important part of tourism competitiveness, and calculation attempts have begun in the 1990s. Researchers believe that destinations will be existent in competition and lead through implementing environmental management, providing participation in public-private partnerships, and improving position in the market[1]. Competitiveness of a tourist destination[2] is considered to be a strong and efficient permanent position in the market. The main ways to promote competitiveness are to increase the tourism revenue and the number of tourists in the destination and to introduce and apply new products and services based on the results of the satisfaction survey.

Research purpose. The purpose of this study is to investigate and rank competitiveness and destination resources by reviewing the satisfaction and current situation of Chinese tourists, visiting Mongolia. This will create the basic conditions for updating and increasing the number of travel products and services offered to Chinese tourists under the demand of tourists.

Research methodology. This study is about influence factors on the satisfaction of Chinese tourists, visiting Mongolia, and utilized a rank order survey. Analysis on current situation and satisfaction on Chinese tourists, visiting Mongolia has been made. The survey was developed by random sample of Chinese tourists visiting Mongolia in 2018 - 2019 (a total of 750), 8 groups and 33 indicators of "Factors influencing tourist satisfaction" research model of authors (Li Tian Yuan, 2012),

[1] Beneditti J. "The competitiveness of Brazil as Dutch holiday destination". 2010
[2] Baatartsooj G. "Stable tourism" UB city, 2006

1 group and 4 indicators of Mongolia's main tourist regions and destinations, a total of 9 groups and 37 indicators, and the level of satisfaction of factor is evaluated in 5 steps. The order of factors was determined by the Gray correlation method.

In modern times, the Gray correlation method is widely used to determine rankings. Gray correlation analysis is aimed at determining hierarchies using simple calculations rather than specific statistical distributions, and is generally similar to the World Economic Forum's Competitiveness Index methodology, but is an effective and flexible method used in the multidisciplinary analysis. The advantage of the Gray system is that it can analyze both specific issues and incomplete information. This is an analytical tool, especially in the absence of information. This was proposed by Deng Ju long, a scientist at the Huazhong University of Science and Technology in China, in line with the Gray system theory.

Gray correlation analysis is based on a method of measuring the relationship between factors. Gray correlation is a method aimed at determining the order of things by simple calculations without the need for small amounts of information and specific statistical distributions. Gray correlation analysis consists of 5 basic steps.

Step1. Find the maximum value and the minimum value in the basic order

Step 2. Determine the relationship

a. High to low: Indication to show a list of the distance from China to the destination from high to low.

$$x_i^*(k) = \frac{x_i^{(o)}(k) - min\left\{x_i^{(0)}(k)\right\}}{max\left\{x_i^{(0)}(k)\right\} - min\left\{x_i^{(0)}(k)\right\}}$$

$i - factor$

$k - satisfaction\ level$

$x_i^{(o)} - normal\ coefficient\ or\ basic\ order$

$x_i^*(k) - comparison\ sequence, i\ factor$ ба (k)

$satisfaction\ level$

b. Low to high: Indication to show a list of the distance from China to the destination from low to high.

$$x_i^*(k) = \frac{max\left\{x_i^{(0)}(k)\right\} - x_i^{(0)}(k)}{max\left\{x_i^{(0)}(k)\right\} - min\left\{x_i^{(0)}(k)\right\}}$$

Then find the maximum value of the above coefficient and the maximum value is equal to 1.

Step3. Calculate the absolute value between$x_0^*(k)$ ба $x_0^{*i}(k)$: $\Delta_{oi}(k) = x_0^*(k) - x_i^*(k)$

In other words, subtract each value of the comparison sequence from the maximum value of the comparison sequence.

Step4. Find correlation. $x_0 \in X_0$ Main sequence and $x_{0i} \in X_i$ comparison sequences are sets of X factor. Also, it will represent the correlation of $x_0(k), x_i(k)$.

$$r_k^0\left(x_0(k), x_i(k)\right) = \frac{min_i\, min_k \{x_o(k) - x_i(k)\} + \zeta\, max_i max_k \{x_o(k) x_i(k)\}}{x_o(k) x_i(k)\ \zeta max_i max_k \{x_o(k) - x_i(k)\}}$$

ζ (sort factor) is belong to $\in [0, \infty]$, however, have value between [0; 1]. ζ is high in sort when the number is low, and generally, it should be less than 0.5.

$$\Delta_{min} = \Delta_{oj}(k) = \{x_o - x_k\}$$
$$\Delta_{max} = \Delta_{oj}(k) = \{x_o - x_k\}$$

The main function of the sort factor ζ is to adjust the relationship between the base value and the measured value and the measured value.

Step5. Find the correlation order.

The degree of Gray correlation is calculated by the following formula.

$$r_k^0(x_i, x_i) = \frac{1}{n_k} \sum_{k=1}^{n} r(x_i(k), x_i(k))$$

$r_k^0(x_i, x_i)$ Factor, the aggregate index of k of (0), n_k is the number of variables in k indicator.

Result and discussion. A total of 750 subjects were chosen randomly and questioned according to the question below (Table 1).

Table. 1. General information (frequency, percent)

Basic information		Frequency	Percent
Gender	Male	347	46.3
	Female	403	53.7
Age	Under 20	6	0.8
	21-30	108	14.4
	31-40	198	26.4
	41-50	217	28.9
	51-60	133	17.7
	Below 60	88	11.7
Job	Student	11	1.5
	Self-employed	139	18.5
	Retired	91	12.1
	Worker	21	2.8
	Farmer, herder	95	12.7
	Entrepreneur	79	10.5
	Civil servant	314	41.9
Level of Education	Secondary school	70	9.3
	High and vocational school	89	11.9
	College	151	20.1
	Graduate degree	345	46.0
	Postgraduate degree	95	12.7
Income (month)	Under 2000 yuan	29	3.9
	2001-4000 yuan	157	20.9
	4001-6000	187	24.9
	6001-8000	164	21.9
	8001-10000	122	16.3
	10001-20000	72	9.6
	Below 20001 yuan	19	2.5
Frequency of travel	Once	401	53.5
	Twice	245	32.7
	more than 3	104	13.9
Duration of travel	Under 2	10	1.3
	3-4days	130	17.3
	5-6days	248	33.1
	More than 7 days	362	48.3
The total expense of travel	Under 3000	79	10.5
	3001-5000	244	32.5
	5001-8000	195	26.0
	8001-10000	142	18.9
	10001-15000	67	8.9
	Below 15000	23	3.1

A sample profile indicates that 53,7% were females while 46,3% were males. According to age, 26,4% is between the ages of 31-40, 28,9% is between the ages of 41-50, which is the majority. Whereas only 0,8% is aged under 20, the lowest in the area. Findings indicate that the civil servants are relatively high possibility to travel with 41,9%, yet students and workers are in the opposite. In terms of education level, 58.7 percent of the participants had a post-graduate education or higher education, and 67.7 percent of the participants had a monthly income of 2001-8000 yuan.

In the frequency of travel, 53.5 percent are first-time tourists to Mongolia, and the percentage of tourists who travel for 5-6 days or more than 7 days is high, which is 81.4 percent, and the total cost per tourist is around 3001-10,000 yuan, which is the total of 77.5 percent participants.

According to the frequency of participants destinations (Figure 1), the highest number of participants was in the Ulaanbaatar region (720), and 675 was in the Gorkhi-Terelj National Park, 330

was in the Orkhon Valley, 36.9 percent was in the Khuvsgul region, and 32 percent was in the Eastern region, 9.1 percent was in Bulgan-Selenge region, 6 percent was in Gobi region, 35 percent was High Mountain region, and 4.3 percent was in the border region.

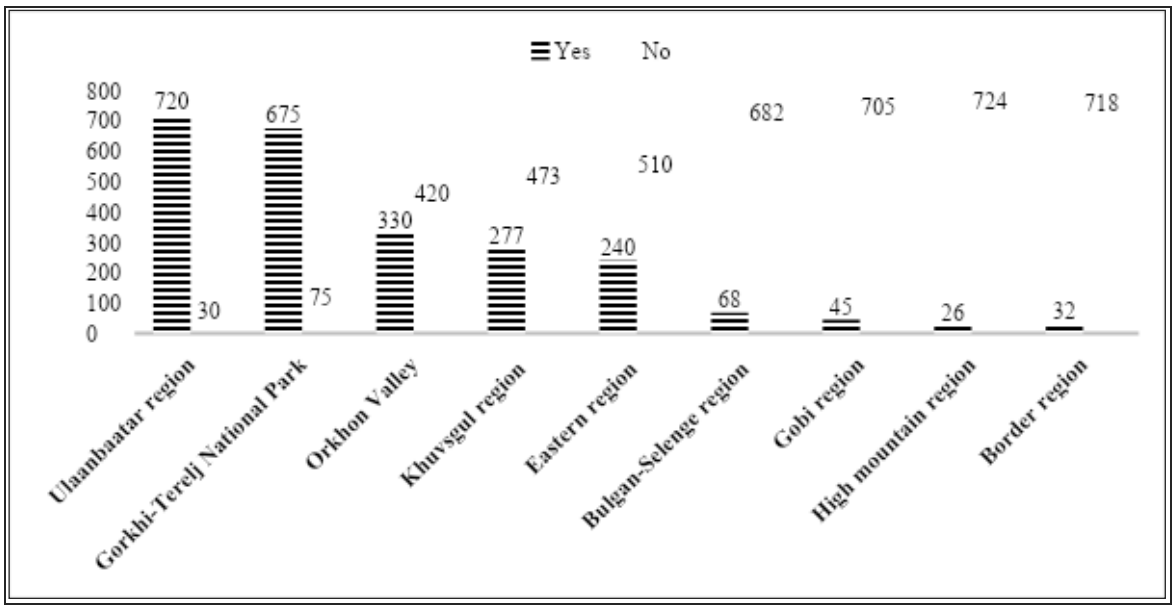

Fig. 1 Frequency and region of destination

The followings are indicators of factors influencing satisfaction. (Table 2)

Table 2. Factors influencing satisfaction

№	Factor	Satisfaction
1	Satisfaction with nature	The value, types, characteristics of nature, cost of a ticket
2	Satisfaction with travel environment, weather, and atmosphere	Urban-rural style, clean environment, pleasant atmosphere, and social safety
3	Satisfaction with accommodation	Accommodation price, comfort, and quality
4	Satisfaction with food service	A specialty of food, price, hygiene
5	Satisfaction with souvenir	Rural areas souvenirs, price, choices, market demand
6	Event	Features, types, prices, and quality of anniversary events
7	Satisfaction with transportation	Transportation, types, communication, high road
8	Satisfaction with travel service	Guide skills, local friendliness, integrated travel information system, signage
9	Destination	Destination selection, historical and cultural exhibits, accessibility, and personal assessment of the destination

Participants rated 1-5 on each of the 37 indicators of 9 groups of the study ("excellent-5, good-4, medium-3, bad-2, very bad-1"). Rates were collected, analyzed and the average was calculated using the SPSS program:

"EXCELLENT"

combined with "excellent + good rating";

"Medium" rating is "PLEASANT"

"UNPLEASANT"

Combined with "bad + very bad"

Based on the number of participants considered the most favorable, Gray calculated the ranking of the factors using the correlation method.

Factors influencing tourist satisfaction (frequency) and "Destination" ranking

Rates were summarized using the "SPSS" program and the average was made as "excellent + good rating"="EXCELLENT", "Medium" ="PLEASANT", and "bad + very bad" ="UNPLEASANT".

The rankings of each indicator (Table 3) were converted to scores, and the scores were aggregated to produce a general ranking.

General Ranking (Table 3) has been made as calculating the overall point of each destination based on the transfer of each satisfaction indicator, such as 9 points for Rank I, 8 points for Rank II, 7 points for Rank III, and so on.

Table 3. Competitiveness ranking (Gray Method)

№	Destination	Nature pleasure		Environment pleasure		Foodservice		Souvenir		accommodation		Events		Transportation		Travel service		Destination		Total	
		Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score
1	Ulaan-baatar	IY	6	II	8	YI	4	IY	6	IY	6	IY	6	YI	4	IY	6	IY	6	II	52
2	Gorkhi-Terelj	III	7	YI	4	Y	5	III	7	Y	5	Y	5	IY	6	IX	1	YII	3	YI	43
3	Orkhon valley	Y	5	YII	3	IY	6	II	8	YI	4	II	8	II	8	YI	4	III	7	I	53
4	Khuvsgul region	YI	4	Y	5	YII	3	YI	4	III	7	YI	4	YII	3	YII	3	Y	5	YIII	38
5	Eastern	YII	3	IY	6	YIII	2	YII	3	YII	3	YII	3	Y	5	Y	5	YI	4	IX	34
6	Bulgan – Selenge region	IX	1	IX	1	IX	1	I	9	I	9	III	7	I	9	III	7	YIII	2	Y	46
7	Gobi	II	8	III	7	III	7	IX	1	II	8	YIII	2	III	7	I	9	IX	1	III	50
8	High mountain region	YIII	2	YIII	2	I	9	Y	5	YIII	2	I	9	IX	1	YIIII	2	II	8	YII	40
9	Border region	I	9	I	9	II	8	YIII	2	IX	1	IX	1	YIII	2	II	8	I	9	IY	49

This general ranking only relates to destinations based on the 9 satisfaction factors assessed according to the survey questionnaire (Figure 2). In other words, the travel regions of Mongolia were ranked based on the results of the survey and the tourist satisfaction survey.

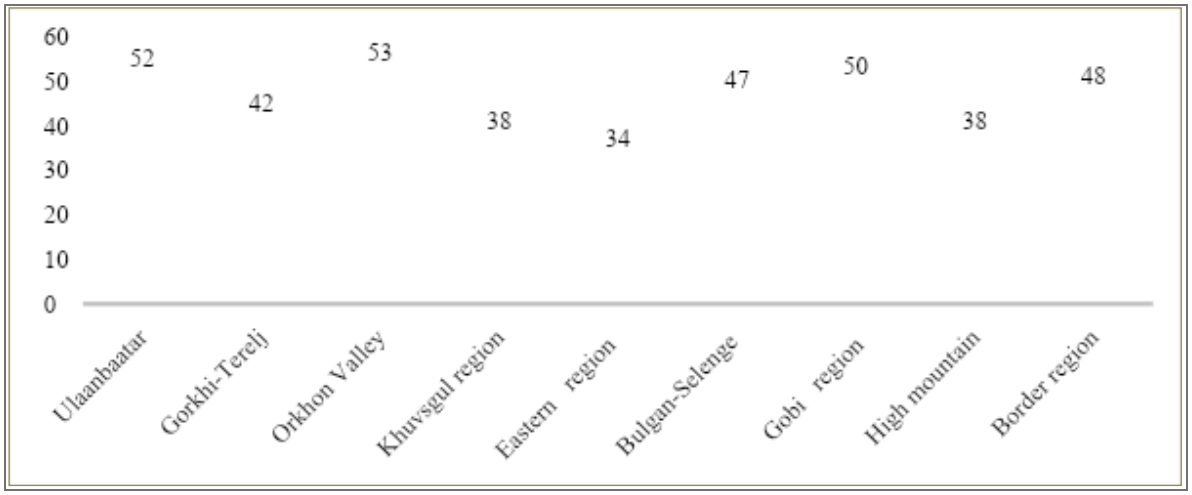

Fig. 2. General ranking assessment of destination (points)

Gray calculated the "destination ranking" using a correlation method, converted it to a numerical value, and determined the ranking of the 9 travel regions. This shows that Chinese tourists visit the Orkhon Valley, Ulaanbaatar, and Gobi regions in terms of competitiveness.

The region's high competitiveness varies on nine factors that affect the destination and it shows the difference in the study. The ranking of satisfaction factor indicators (Fig. 3) were considered for each destination.

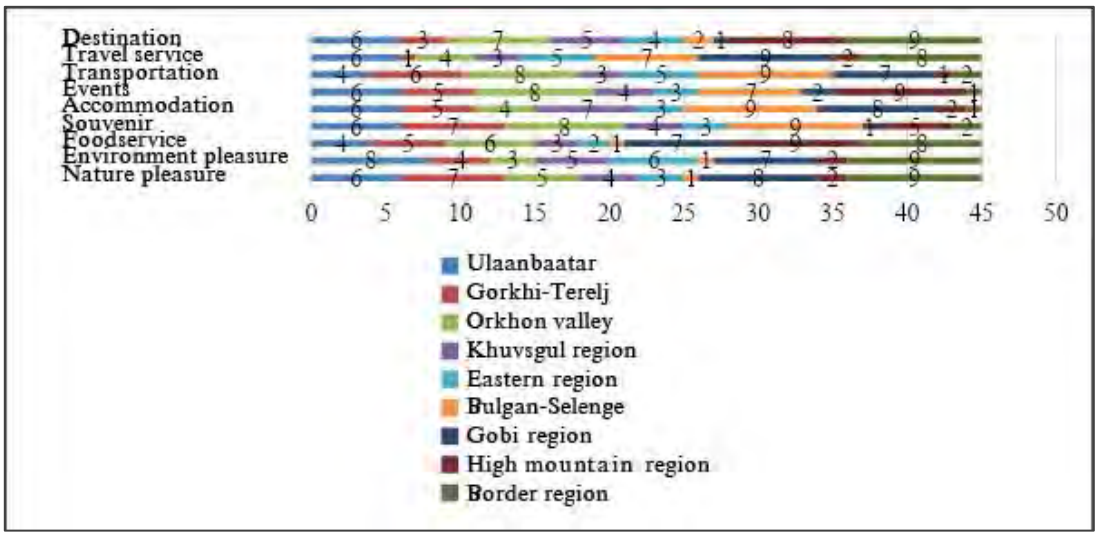

Fig. 3. Factors ranking of destination (point)

Conclusions. To determine the competitiveness of tourism regions is important for strengthening the region's strengths, improving its weaknesses, and developing sustainable development policies. Ulaanbaatar, the Orkhon Valley, the Gobi, and the border areas are the most competitive, as the weak regions include the Eastern region, the western or High Mountain region, and the Khuvsgul region. The weak regions are spatially remote, the exhibit distance is long, and roads and infrastructure are poorly developed, which makes them less competitive. Based on the satisfaction of about 170,000 Chinese tourists visiting Mongolia (MNET report, 2019), destination ranking was made by Gray correlation method and concluded as follows.

- Regardless of the region is close, short-term (5-7 days) and low-cost (about 1,000 yuan) trips are purchased, depending on income level and purpose of the trip;
- Tourists are interested in nature, historical and urban travel, and the number of tourists is not increasing well enough due to poor information access and visa issues.

Finally, this study can be the basis paper for the Government of Mongolia to steadily increase the number of Chinese tourists, to increase the number of products and services to key markets addressing infrastructure issues (Report of the Director of the Ministry of Nature, Environment and Tourism, 2019) and decision making.

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MEDICINE

CLINICAL CASE OF THE MULTIMODAL SCHEME USING FOR LIMBS AND FRONTAL THORAX SOFT TISSUES RECONSTRUCTION

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Abstract. *Gunshot wounds of soft tissues are often accompanied by bulky tissue defects that require reconstructive surgery in order to quickly and maximally restore the anatomical and functional integrity of the anatomical area. In the course of the analysis of wounds and preparation for reconstructive closure of gunshot defects of soft tissues, it is essential to identify areas of damage and preserve the sources of perfusion of areas of "future reconstruction". Current experience and results of treatment of gunshot wounds of soft tissues show that this goal can be achieved by the sequential performance - dynamic infrared spectral thermography in combination with the Doppler method of examination of the vascular network of the damaged anatomical structure.*
Keywords*: soft-tissue defect, reconstruction, Key-Stone, gunshot wound, spectral thermography, Doppler.*

Introduction. During the military conflict in Eastern Ukraine, considerable experience has been gained in providing medical care to the wounded and injured with soft tissue defects. In order to use the full potential of the trophic capabilities of the moving tissues, it is essential to identify and maintain a dominant power supply during the operation. Restoration of the damaged structure, function, maximum cosmetic effect as a result of surgical reconstruction is possible only under the condition of tactically correctly planned and "ideally" [4] performed surgical intervention or staged surgical interventions.

Gunshot wounds of soft tissues are often accompanied by bulky tissue defects that require reconstructive surgery in order to quickly and maximally restore the anatomical and functional integrity of the anatomical area [2]. In the course of the analysis of wounds and preparation for reconstructive closure of gunshot defects of soft tissues, it is essential to identify areas of damage and preserve the sources of perfusion of areas of "future reconstruction" [6]. Current experience and results of treatment of gunshot wounds of soft tissues show that this goal can be achieved by the sequential performance - dynamic infrared spectral thermography in combination with the Doppler method of examination of the vascular network of the damaged anatomical structure [1, 5, 7, 8].

Soft tissue defects of gunshot etiology differ in several signs, which determine the peculiarities of the pathological process. The optimality of the reconstruction method depends on the ability to integrally assess the features of the tissue defect in each case, taking into account systemic disorders and individual characteristics of the human macroorganism, which in turn depends on the experience of the surgeon. Rationalization and simplification of the process of preoperative planning, intra- and postoperative dynamic control are among the tasks that provide the opportunity to "maximally" restore the damaged area [4]. A representative clinical case in the process of surgical reconstruction of gunshot defects of the soft tissues of the extremities and anterior surface of the chest during the use of a multimodal scheme in pre-, intra- and postoperative monitoring is described below.

Clinical case. Wounded X was hospitalized to the Clinic of Reconstructive Surgery and Thermal Injuries of the South Region Military Medical Clinical Center on May 3, 2018, with

complaints of wounds in the chest, right forearm, left hand, left leg, accompanied by severe pain, severe pain, decreased vision in the right eye, lack of vision in the left eye.

During the collection of **anamnesis** it was established that on April 23, 2018, during the execution of a combat mission in the anti-terrorist operation zone for demining the area near the settlement of Granite around 12:00 the patient received an explosive wound due to a mine explosion. First aid was provided on the spot by soldiers of the unit. He was transported by ambulance to the Volnovakha Central Regional Hospital, where he received qualified medical care in the amount of PST of gunshot wounds and correction of hypovolemia. 23.04.18 at 20:00 the patient got evacuated to Dnipro by air, hospitalized in RCH named after I.I. Mechnikov, where repeated staged surgical treatments of gunshot wounds were performed. For further treatment on May 3, 2018 the patient was airlifted to Military Medical Clinical Center of the Southern Region and hospitalized in the department of surgical infections.

Objective status at the time of hospitalization: Body temperature 37.5°C. Height – 180 cm, weight – 110 kg. The patient's condition is moderate, stable. Consciousness is clear, the reaction to the environment is adequate, the orientation in time, space and self is preserved. Meningeal symptoms are negative. The skin, visible mucous membranes are clean, pale pink, moist and warm to the touch. Peripheral lymph nodes are not enlarged. Auscultatory: in the lungs above the entire surface of the lung tissue there is vesicular respiration, no wheezing. RR equals 17 per minute. The activity of the heart is rhythmic, heart tones are clear, without pathological noises. Blood pressure equals 120/80 mm Hg, pulse 72 per minute. The tongue is clean and moist. The abdomen is soft, symmetrical, not enlarged, evenly participates in the act of breathing. Deep palpation is painless throughout. There are no symptoms of peritoneal irritation. Peristalsis is active, uniform. The liver is not enlarged. Kidneys, the spleen is not palpable. The tapping symptom is negative on both sides. The bladder is not reliably determined by palpation and percussion over the womb. Active peristalsis is determined over the entire surface of the abdomen.

St. localis: The transparency of the sclera of the left eye is significantly reduced, there is no vision. The skin of the face is pale pink, above the upper lip on the left there is a sutured postoperative wound measuring 1.5x 0.5 cm without signs of inflammation. In the area of the anterior surface of the thorax in the projection of the xiphoid condyle there is a sluggish wound, measuring 7.0x8.0x -0.7 cm, irregular in shape with uneven, hyperemic, swollen edges, pronounced paravular edema, partially covered with immature gray-white granulations, upon touching the wound surface there is bleeding. Palpation along the contour of the wound is painful. In the area of the 5th intercostal space on the right along the anterior inguinal line there is a granular wound 2.5x3.0x0.6 cm with jagged edges, moderate paravular infiltrative edema, the bottom of the wound is partially covered with gray fibrin, upon touching the wound surface with an instrument the bleeding is absent. In the area of the anterior abdominal wall, multiple wounds 0.3 to 1.5 cm in diameter are identified, the surrounding soft tissues covered with a black scab are infiltrated with a bluish color. Under the navel there is a postoperative wound (paracentesis), the edges of the wound are adapted, without signs of inflammation. The contours of the right forearm are deformed due to interstitial edema of soft tissues and wounds on the flexor surface measuring 10.0x6.0x2.5 cm, irregular in shape with uneven, swollen edges of blue-purple color, pronounced paravular edema, partially covered with a layer of gray fibrin, partially scab black, with moderate serous-mucous secretions from the surface. On the outer surface there is a wound of longitudinal shape measuring 4.0x0.5 cm, the sutures are adapted, without signs of inflammation. The contours of the left hand are deformed due to interstitial edema of soft tissues, the skin is hyperemic, on the palmar surface with the transition to the lateral surface of the hand there is a wound with a soft tissue defect, size 6.0x5.0x0.6 cm sharply painful on palpation, covered with layers of gray fibrin. In the area of the main phalanx of the first finger and tenor there are wounds with a soft tissue defect, covered with a layer of gray-white fibrin, measuring 1.5x1.0x0.5 cm and 3x2x0.5 cm. There is no bleeding on contact with the wound surface. In the area of the right half of the scrotum there is a wound of irregular shape, with uneven edges, size 3.0x1.5x0.4 cm painful on palpation, does not bleed when touched. On the anterior surface of the left leg there is an NPWT system functioning in pulse mode with indicators of -125 mmHg. The vacuum is stable.

Clinical diagnosis: Explosive injury (23.04.18). CTBI. 1st degree concussion. Shrapnel blind injuries to the soft tissues of the face and head. Gunshot shrapnel wounds to both eyes. Contusion, OU subconjunctival hemorrhage, penetrating injury of the left eye. Multiple gunshot wounds to the anterior surface of the chest, the anterior surface of the abdomen. Multiple shrapnel blind injuries to the right

forearm, left hand with a soft tissue defect. Multiple gunshot shrapnel blind injuries of the anterior and inner surface of the right thigh, scrotum, anterior surface of the left leg. Condition after operations (23.04.18): laparocentesis; (24.04.18): removal of foreign bodies of the cornea and conjunctiva, revision of the OS sclera, vitriolectomy and tamponade of the vitral cavity with a gas mixture, sclera wound PTS and removal of foreign bodies of the OD cornea; (28.04.18): necrectomy, debridement of shrapnel wounds of the right forearm, left hand, left leg, right thigh, installation of NPWT system. (02.05.18): repeated surgical treatment of gunshot wounds of both upper extremities, imposition of secondary sutures.

The clinical task for the reconstruction of gunshot defects of soft tissues was available in the wounded soft tissue defects on the anterior surface of the chest, right forearm, shins which according to the proposed classification refers to soft tissue defects of these localizations, simple topographic and anatomical structure, complex histological structure, large in area, medium in volume, divergent relative to the tension lines, geometrically irregular, local, thermostable by IR spectrographic indicators.

As the first stage of reconstruction, stage treatment of wound surfaces of defects of the anterior chest, flexor surface of the right forearm, anterior surface of the middle third of the left leg by physical-chemical and mechanical methods (ultrasonic cavitation, NPWT systems, applications with solutions of betadine and decasanide, repeat wound detritus) was conducted for 5 days.

Photos before the operation.

Fig.1. View of the wounded on admission, day 1 in the department of surgical infections Military Medical Clinical Centre of the Southern Region (10 days after the wound).

Fig.2. View of the flexion surface of the right forearm on admission, day 1 in the department of surgical infections Military Medical Clinical Centre of the Southern Region (10 days after the wound).

Fig.3. View of the postoperative wound of the anterior surface of the left leg, on admission, day 1 in the department of surgical infections Military Medical Clinical Centre of the Southern Region (with NPWT system)

Preoperative dynamic monitoring was performed for 5 days and zones of thermographic stability with Doppler confirmation of satisfactory blood flow were established:

1. On the anterior surface of the chest during the dynamic digital thermography of the wound surface and surrounding tissues the temperature of+32.5°C, blood flow rate of 10 cm/s was measured, the reconstruction by the full-layer flap Keystone method with "power switches" in the form of perforating vessels from *a. thoracica interna (rami intercostales 5-6)* was planned.

Fig.4. View of the anterior surface of the thorax 1 month after discharge from the hospital.

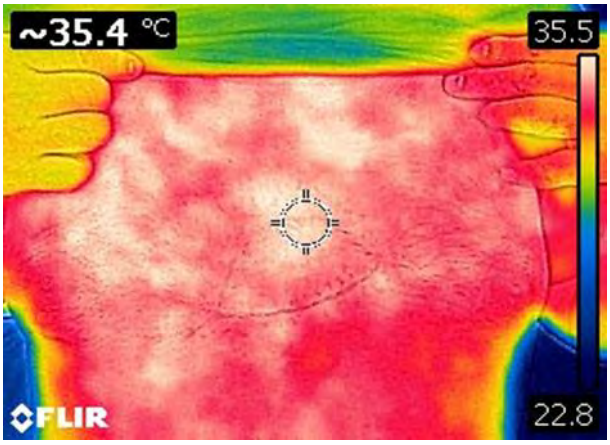

Fig.5. Dynamic digital thermography of the anterior surface of the chest 1 month after discharge from the hospital. The pre-identified 5 perforating vessels of the anterior surface of the chest are shown by dotted arrows.

2. On the flexor surface of the middle third of the right forearm during the dynamic digital thermography of the wound surface and surrounding tissues the temperature of +32.1°C, blood flow rate of 9 cm/s was measured, the reconstruction by the Keystone method of double rotary flaps with "power switches" in the form of *a. radialis dexter (rami medialis)* and *a. ulnaris dexter (rami distalis)* perforating vessels was planned.

Fig.6. View of the flexor surface of the right forearm on admission, day 1 in the department of surgical infections Military Medical Clinical Centre of the South Region.

Fig.7. View of the flexor surface of the right forearm after complex surgical treatment in the department of surgical infections Military Medical Clinical Centre of the South Region (5 days of hospitalization).

Fig.8. View of the flexor surface of the right forearm 14 days after surgery by the double rotary flaps method.

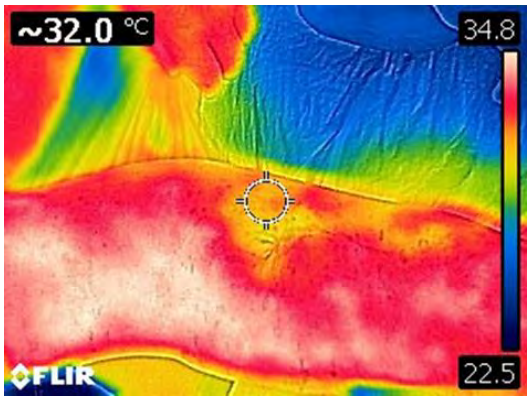

Fig.9. Thermographic view of the flexor surface of the right forearm after reconstruction by the method of double rotary flaps (21 days of hospitalization).

3. On the anterior surface of the middle third of the left leg during the dynamic digital thermography of the wound surface and surrounding tissues the temperature of +31.5°C, blood flow rate of 6 cm/s was measured, the reconstruction by the method of a full-layer flap by the Keystone method with "power switches" in form of *a. tibialis anterior sinister (rami medialis) et a. sinus fibularis (rami medialis)*.

Fig.10. Marking of the future flap on the front surface of the middle third of the left leg by the Keystone method (9 days of inpatient treatment, 19 days from the date of injury).

Fig.11. Type of postoperative wound.

Fig.12. Partial tissue necrosis along the upper pole of the postoperative wound of the anterior surface of the middle third of the left leg (23 days of inpatient treatment, 33 days from the moment of injury).

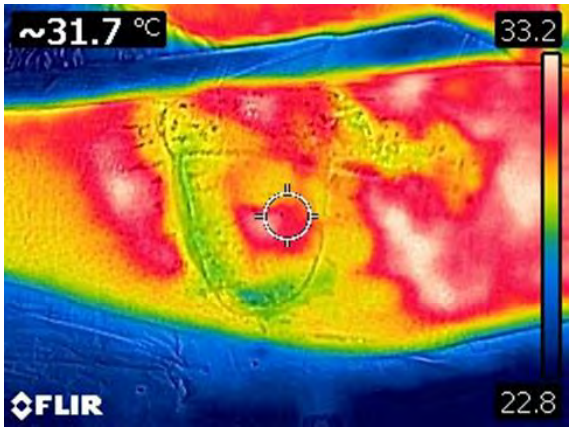

Fig.13. Thermographic view of the postoperative wound of the anterior surface of the middle third of the left leg (23 days of inpatient treatment, 33 days from the time of injury).

Discussion. The use of a multimodal scheme during the surgical reconstruction of gunshot defects of soft tissues allows to provide quality care to the wounded and injured in the area of environmental protection with a clearly formed doctrine at all stages in the Ukrainian Navy.

According to the results of the clinical case, compliance with the proposed multimodal algorithm and monitoring of the victim with a gunshot defect of soft tissues provides high-quality surgical reconstruction. With this result, it is possible to say that most of the wounded with soft tissue defects in the subsequent postoperative period will belong to the category of lightly wounded with the optimal prospect of a rapid return to service [4, 9].

The method of dynamic monitoring can be used at all levels of medical care in the Ukrainian Navy, but taking into account time, conditions, material base, the level of specialists of the medical institution, the multimodal scheme provides maximum anatomical-functional result of surgical reconstruction at the IV level [3].

Conclusions. Consistent application of methods of dynamic digital thermography and Doppler scanning of vessels promotes adequate differentiation of dominant zones and sources of alternative blood supply.

The fundamental factors in the process of preoperative modeling of donor flaps are the indicators of thermographic diagnostics of more than 32°C and the results of audio-examination of perforating vessels ("power switches") with indicators of speed and volume of blood flow (according to the anatomical part of the human body).

The use of affordable and effective techniques in the process of reconstructive surgery allows achieving good anatomical-functional and cosmetic results of reconstructive interventions with high probability.

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ЕОЗИНОФІЛЬНИЙ ГАСТРИТ У ДІТЕЙ: ОСОБЛИВОСТІ МОРФОГЕНЕЗУ

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Abstract. *The article presents characteristics of morphological and immunohistochemical changes of the gastric mucosa in children with eosinophilic gastritis. The course of eosinophilic gastritis in children is characterized by an imbalance of cell regeneration processes.*
It was found that most children were diagnosed with hemorrhage, microthrombosis, stromal fibrosis, proliferation of fibroblasts and collagen fibers. In a process of immunohistochemical examination of gastric biopsies, most children with eosinophilic gastritis revealed uneven expression of the VEGFR 1 receptor in gastric endothelial cells. Type IV collagen expression was determined in the individual fragmented foci in the basement membranes of the superficial epithelium and single glandular structures. Advanced expression of TGFRβ positive cellular elements was diagnosed only in patients with severe gastric mucosal fibrosis. The data that has been collected indicates that the course of eosinophilic gastritis is accompanied by microcirculation disorders and stromal-epithelial change of the gastric mucosa.
Keywords: *children, eosinophilic gastritis, microcirculation of the gastric mucosa, fibrosis, fibrous remodeling.*

Вступ. Еозинофільні захворювання шлунково-кишкового тракту (ШКТ) – хронічні імунопатологічні захворювання, які протікають з переважно еозинофільним запаленням слизової оболонки (СО) різних відділів ШКТ. Недостатньо вивчена патологія, тенденція до зростання якої спостерігається в останні роки [4,12]. Діагностика еозинофільних захворювань ШКТ викликає труднощі у зв'язку з варіабельністю їх клінічних проявів. Морфологічне дослідження біоптатів СО ШКТ є стандарт діагностики еозинофільних захворювань ШКТ і безумовними ознаками еозинофільного запалення є наявність скупчення еозинофілів в поєднанні з фіброзом [2, 5].

Основні патогенетичні механізми, що приводять до виникнення еозинофільного ураження ШКТ, невідомі. Експерти припускають, що за рахунок вивільнення таких цитокінів, як IL-2, IL-4, IL-5, IL-10, IL-12, IL-13, IL-16, IL-18, трансформуючого фактору росту TGFβ, хемокінів (еотоксин), ліпідних медіаторів (фактор активації тромбоцитів і лейкотрієнів С4), еозинофіли можуть опосередковано підтримувати прозапальну реакцію в СО ШКТ [11,14]. На теперішній час доведена провідна роль TGFβ в посиленні фіброзного ремоделювання СО, експресія якого посилена при еозинофільних захворюваннях ШКТ як у дітей, так і у дорослих. TGFβ відноситься до групи цитокінів, які стимулюють регенераторні процеси, ріст сполучної тканини, утворення фібронектину [1, 6]. В процесі фіброзного ремоделювання активну участь приймають і еозинофіли. При активації еозинофіли продукують еозинофільну пероксидазу, еозинофільну колагеназу, хемокіни 2-го типу, які підвищують проникність судин, посилюють проліферацію фібробластів і сприяють формуванню фіброзного ремоделювання. Порушення кровопостачання СО ШКТ призводить до зміни структури, цілісності і функції травної системи. На теперішній час багато уваги приділяється біорегулятору ангіогенезу – васкулярному фактору росту ендотелію судин (VEGF). Первинним тригером, що активує експресію судинних факторів росту та появу рецепторів до VEGF, є гіпоксія. Регенерація СО відбувається під впливом VEGF та ангіопоетинів, які відіграють важливу роль у відновленні сполучної тканини і мікросудин при пошкодженнях СО ШКТ [2, 10]

У сучасній класифікації еозинофільні захворювання ШКТ розрізняють за основним залученим органом [7, 8, 9] і виділяють: еозинофільний езофагіт; еозинофільний гастрит; еозинофільний гастроентерит; еозинофільний коліт. Перші клінічні прояви гастроінтестинальної харчової алергії часто перебігають під маскою функціональних порушень у вигляді колік, зригувань, метеоризму, діареї. При недостатній увазі до гастроінтестинальних проявів харчової алергії в ранньому віці, у дітей формуються різні форми еозинофільних запальних захворювань ШКТ [3, 13].

Еозинофільний гастрит – це хронічне імунопатологічне захворювання з еозинофільною інфільтрацією слизової оболонки шлунка (СОШ). За даними літератури поширеність еозинофільного гастриту становить 3–8 на 100 тисяч жителів [4]. Сучасні уявлення про формування та розвиток еозинофільного гастриту базуються на узагальнюючій концепції еозинофільного запалення і не мають чітких клінічних та морфологічних критеріїв діагностики. Наведені дані є суттєвим аргументом на користь вивчення феномену еозинофільного запалення і фіброзного ремоделювання СОШ у дітей при еозинофільному гастриті.

Мета: вивчити особливості морфологічних та імуногістохімічних змін СОШ при еозинофільному гастриті у дітей.

Методи дослідження. Для верифікації діагнозу всім дітям проводили фіброезофагогастродуоденоскопічне дослідження (ФЕГДС) з прицільною біопсією СО тіла, антрального відділу шлунка для подальшого морфологічного та імуногістохімічного дослідження. Для оцінки гістологічних змін СОШ тканинні зрізи фарбували гематоксиліном та еозином і пікрофуксином по Ван-Гізон. Результати дослідження трактували відповідно Кіотського консенсусу, 2015 року.

Для імуногістохімічного дослідження зрізи завтовшки 4-6 мкм наносили на адгезивні предметні скельця Super Frost Plus і використовували непрямий стрептавидін-пероксидазний метод забарвлення. Апоптоз визначали з мишачими моноклональними антитілами до антиапоптозного білка Bcl – 2 (Clone 124, DAKO, Данія) і проапоптотозного протеїну Bax (Clone 2D2, DAKO, Данія). Для визначення проліферації використовували ядерний антиген проліферуючих клітин (Proliferating Cell Nuclear Antigen – PCNA) (Clone: PC10, DAKO, Данія). Колаген типували з моноклональними антитілами до Collagen Typ IV (Clone COL – 94, DAKO, Данія). Трансформуючий фактор росту TGFβ типували з поліклональними антитілами до TGFβ (DAKO, Данія). Фактор росту клітинних структур і судин VEGFR1 типували з моноклональними антитілами до VEGFR 1(Flt – 11, DAKO, Данія).

Інтерпретацію результатів імуногістохімічного забарвлення проводили відповідно до типу реакції. При використанні моноклональних антитіл до антиапоптозного білку Bcl – 2, проапоптозного протеїну Bax оцінювали кольорові реакції в цитоплазмі клітин, при використанні ядерного антигену проліферуючих клітин враховували ядерне забарвлення. Облік позитивних реакцій проводили за кількістю відредагованих клітин – виражали у відсотках до загальної кількості клітин на площі гістологічного препарату. При інтерпретації імунозабарвлення з використанням моноклональних антитіл до Collagen TypIV, VEGFR – 1 (Flt – 11) та поліклональних антитіл до TGFβ, розповсюдженість та інтенсивність реакції оцінювали напівкількісним методом в балах, від 0 до 3 балів:

а) розповсюдженість:

1) 0 – немає забарвлення;

2) 1 – менше 10% позитивно забарвлених клітин;

3) 2 – більше 10% і менше 50% позитивно забарвлених клітин;

4) 3 – гомогенне забарвлення більше 50% клітин;

б) інтенсивність реакції:

1) 0 – немає видимого забарвлення;

2) 1 – слабке забарвлення;

3) 2 – помірне забарвлення;

4) 3 – виразне забарвлення.

Статистичну обробку результатів проводили за загальноприйнятими методами варіаційної статистики.

Результати дослідження. Під нашим спостереженням було 112 дітей віком від 8 до 16 років з веріфікованим діагнозом хронічний гастрит в періоді загострення, які надійшли на стаціонарне лікування у дитячу лікарню м. Києва.

Всім дітям було проведено ФЕГДС з прицільною біопсією СО тіла, антрального відділу шлунка для подальшого морфологічного та імуногістохімічного дослідження. При морфологічному дослідженні СО фундального і антрального відділів шлунка у 67,9±4,4% пацієнтів діагностували еозинофільний гастрит, у 32,1±4,4% - лімфоцитарний гастрит. При лімфоцитарному гастриті у фундальному і антральному відділах шлунка були відмічені порушення рельєфу СО у вигляді вкорочення ямок і сплощення валиків, явища периваскулярного набряку. Власна пластинка СО

інфільтрована лімфоцитами до 25 в полі зору і поодинокими плазмоцитами, еозинофілами та нейтрофілами, які локалізуються, в основному, у поверхневих відділах СО і у валиках. Відмічали вогнища гіпотрофії СО зі зменшенням кількості залоз, архітектоніка їх була порушена (рис.1).

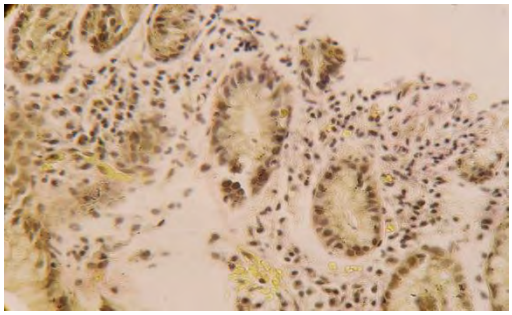


Рис.1. Мікрофото біоптата СОШ. Лімфоцитарний гастрит Х 200.

При еозинофільному гастриті в фундальному і антральному відділах шлунка рельєф СО був порушений, відмічали вкорочення ямок і сплощення валиків у всіх спостереженнях. Поверхневий епітелій з ділянками десквамації і вогнищами сплощення. Власна пластинка СО інфільтрована лімфоцитами до 10 в п/зору і еозинофілами до 25-30 в п/зору, вогнища периваскулярного набряку, ерозії, крововиливи, мікротромбози у всіх біоптатах. У власній пластинці СОШ відмічали вогнища фіброзу різних розмірів від 50-70 мкм до 100-150 мкм, проліферації фібробластів і тонких колагенових волокон у більшості біоптатів, які мають нечіткі контури і перебувають як у базальних, так і поверхневих відділах. Залози у власній пластинці розташовуються нерівномірно, з вогнищами деструкція. В антральному відділі шлунка визначали вогнища ерозій (рис.2)

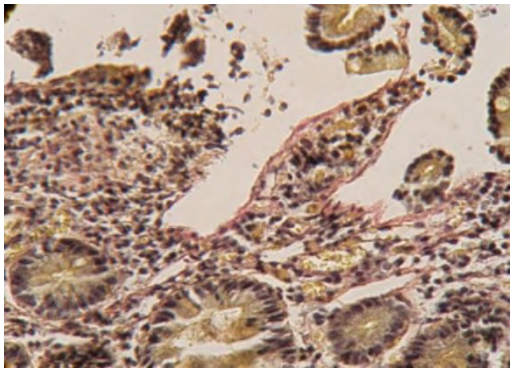
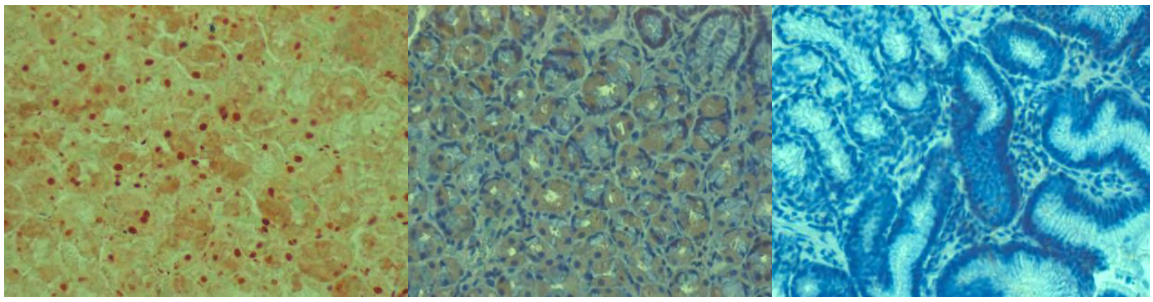


Рис.2. Мікрофото біоптата СОШ. Еозинофільний гастрит. Х200.

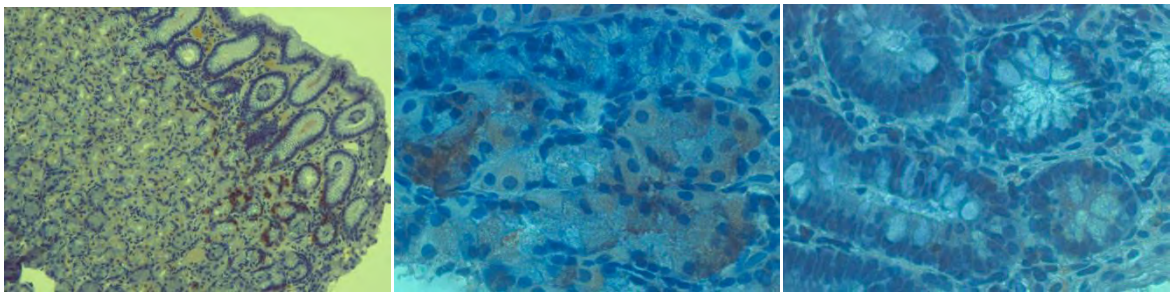
Імунногістохімічні показники клітинного гомеостазу при еозинофільному гастриті характеризувалися збільшенням проліферативної активності: експресії PCNA становила від 10,6% до 42,1% позитивно пофарбованих ядер епітелію залоз, експресія Bax - від 10,3 до 29,1% позитивно пофарбованих клітин і експресія Bcl-2 - менше 10% позитивно пофарбованих клітин (рис.3).



а *б* *в*

Рис.3. Мікрофото біоптата СОШ. Еозинофільний гастрит: а – імуногістохімічна реакція з антитілами до PCNA. Х 200; б – імуногістохімічна реакція з антитілами до Bax. Х 200; в – імуногістохімічна реакція з антитілами до Bcl– 2. Х 200.

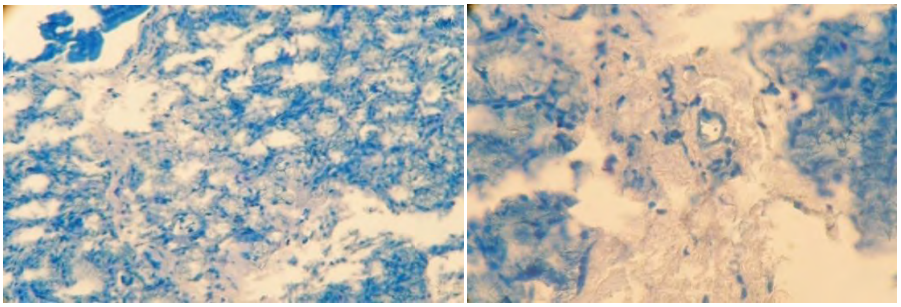
При проведенні аналізу рівня показників клітинного відновлення у пацієнтів при лімфоцитарному гастриті нами була відмічена тенденція до зростання проапоптозного показника Bax від 82,4% до 96,1% позитивно пофарбованих клітин при низькій експресії Bcl – 2 (менше 10% позитивно пофарбованих клітин) і низькій експресії PCNA від 0,9%–2% позитивно пофарбованих клітин (рис. 4.).



а *б* *в*

Рис.4. Мікрофото біоптата СОШ. Хронічний атрофічний гастрит: а – імуногістохімічна реакція з антитілами до PCNA. Х 100; б – імуногістохімічна реакція з антитілами до Bax. Х 200; в – імуногістохімічна реакція з антитілами до Bcl – 2. Х 200.

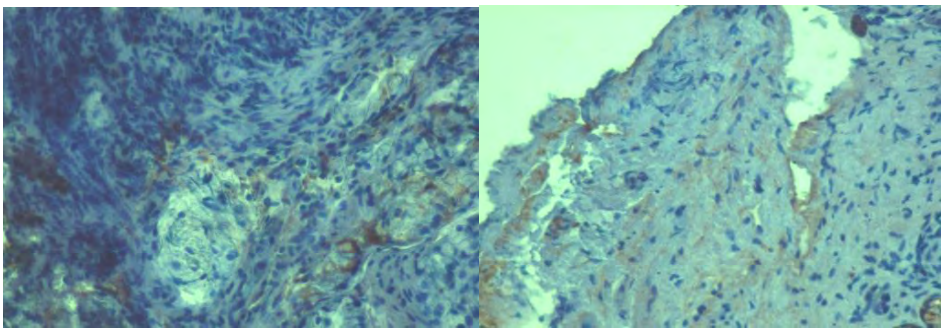
Зважаючи на отримані нами результати морфологічного дослідження, щодо порушень мікроциркуляції СОШ при еозинофільному гастриті, нами було проведено дослідження васкулярно – ендотеліальний фактор росту VEGFR1, який відіграє важливу роль у відтворенні судинної капілярної сітки та відновленні мікроциркуляції в СОШ. При імуногістохімічному дослідженні біоптатів шлунка ми виявили нерівномірну експресію рецептора VEGFR1 в ендотеліальних клітинах шлунка. У 57,9±5,7% пацієнтів при еозинофільному гастриті розповсюдженість реакції імунозабарвлення до VEGFR1 становила більше 10% і менше 50% позитивно забарвлених клітин (рис.5а). У 47,2±8,3% пацієнтів з лімфоцитарним гастритом розповсюдженість реакції VEGFR1 була менше 10% позитивно забарвлених клітин (рис.5 б)



а *б*

Рис.5. Мікрофото біоптата СОШ. Непрямий стрептавидін-пероксидазний метод забарвлення. Експресія з моноклональними антитілами до рецептора VEGFR1 Х 200. а - еозинофільний гастрит; б - лімфоцитарний гастрит

Отримані дані у пацієнтів при еозинофільному гастриті щодо проявів проліферації фібринових і колагенових волокон у власній пластинці СОШ як показників стромально-епітеліальної перебудови СО, вказали на необхідність дослідження колагену IV типу, який характеризує трофічну функцію власної пластинки СО і якість регенераторних процесів. Експресія рецепторів до колагену IV типу була виявлена у вигляді окремих фрагментованих вогнищ в базальних мембранах поверхневого епітелію і поодиноких залозистих структурах. При еозинофільному гастриті розповсюдженість реакції з використанням моноклональних антитіл до Collagen Typ IV у більшості дітей (56,6±5,7%) була менше 10% позитивно забарвлених клітин (рис.6 а), при лімфоцитарному гастриті - більше 10% і менше 50% позитивно забарвлених клітин (рис.6 б)



а *б*

Рис.6. Мікрофото біоптата СОШ. Експресія з моноклональними антитілами до колагену IV типу. Х 200. а - еозинофільний гастрит; б - лімфоцитарний гастрит.

Вище викладене вказує на актуальність вивчення трансформуючого фактору росту (TGFβ), який бере участь в регуляції процесів відновлення епітеліальних структур, сполучної тканини, а також судин і м'язового шару. Експресія рецепторів до TGFβ в цитоплазмі і ядрах епітеліоцитів була нерівномірна. Виражене імунозабарвлення TGFRβ, більше 50% позитивних клітинних елементів, виявили у 40,8±5,6% хворих при еозинофільному гастриті з вираженим фіброзом та проліферацією (рис.7 а). При лімфоцитарному гастриті розповсюдженість реакції з TGFβ визначалася лише 11,1±5,2% пацієнтів і вона становила менше 10 % позитивно забарвлених клітин при слабкому забарвлені реакції (рис.7 б)

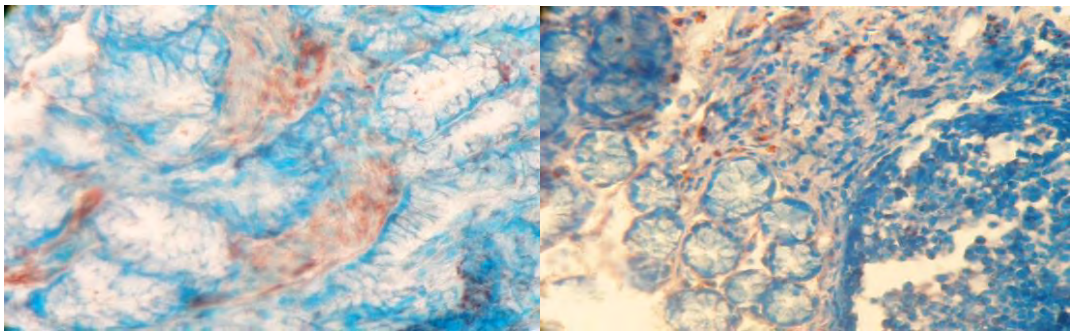


Рис.7. Мікрофото біоптату СОШ. Експресія з поліклональними антитілами до TGFβ. Х 200. а - еозинофільний гастрит; б - лімфоцитарний гастрит.

Висновки. На підставі проведеного дослідження встановлені морфологічні зміни СО, які є патогномонічними для еозинофільного гастриту і проявляються еозинофільною інфільтрацією, фіброзом строми власної пластинки, мікроциркуляторними порушеннями з явища множинних крововиливів, тромбозів, ерозій. На нашу думку, мікроциркуляторні порушення СОШ пов'язані саме з еозинофільною інфільтрацією власної пластинки СО. Еозинофіли, як відомо, містять високі концентрації пероксидази, яка підвищує судинну проникливість і призводить до розвитку васкуліту.

При імуногістохімічному дослідженні біоптатів СО шлунку були виявлені особливості розповсюдженості та інтенсивності реакції імунозабарвлення до VEGFR 1, показник якого був вищим у пацієнтів з еозинофільним гастритом. Так як VEGFR 1 є головним індуктором ангіогенезу, забезпечує відновлення сполучної тканини і мікросудин, тому підвищення рівня експресії рецептора, ймовірно, пояснює раніш отримані нами дані стосовно гемоциркуляторних розладів СОШ саме серед пацієнтів з еозинофільним гастритом.

Розповсюдженість і інтенсивність реакції імунозабарвлення до Collagen Typ IV, як показника стромально-судинного компоненту травного каналу, у пацієнтів при еозинофільному гастриті була слабкою у вигляді окремих фрагментованих вогнищ в базальних мембранах поверхневого епітелію і поодиноких залозистих структурах. Отримані дані, на наш погляд свідчать про те, що при еозинофільному гастриті є порушення трофічної функції власної пластинки СО і зниження регенераторних процесів в СОШ.

При еозинофільному гастриті у дітей були виявлені структурні особливості дисрегенерації, які проявляються дисбалансом процесів клітинного відновлення Виражене

підвищення індексу проліферації епітеліоцитів шлунка при еозинофільному гастриті вказує на можливість порушення фізіологічної регенерації СО. При підвищенні індексу проліферації епітеліоцитів відбувається збільшення не диференційованих клітин, що не спроможні виконувати притаману їм функцію і це призводить до розвитку стромально-епітеліальної перебудови СОШ.

При інтерпретації реакції імунозабарвлення з використанням поліклональних антитіл до TGFβ, встановлено, що при еозинофільному гастриті у більшості пацієнтів розповсюдженість та інтенсивність реакції була вираженою. Нами встановлено, що високий рівень розповсюдженості позитивно забарвлених клітин відмічали саме при фіброзі та проліферації фібробластів, колагенових волокон у базальних і поверхневих відділах власної пластинки СО.

Таким чином, виявлені нами характерні морфологічні та імуногістохімічні зміни СОШ при еозинофільному гастриті, а саме структурні особливості дисрегенерації, дисбаланс процесів клітинного відновлення, мікроциркуляторні порушення і стромально-епітеліальна перебудова СОШ свідчать про формування фіброзного ремоделювання при еозинофільному гастриті у дітей.

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EDUCATIONAL LEVEL AND GENDER-AGE CHARACTERISTICS OF THE EPIDEMIOLOGY OF HOSPITAL ANXIETY IN SURGICAL PATIENTS

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Abstract. *A prospective cohort study was performed in 138 patients aged 48-85 years (68 men and 70 women, mean age 42.0 ± 18.5 years) who were to undergo surgery for diseases of the abdominal cavity. Patients aged 18-33 and 34-49 years are most often subject to an average level of preoperative anxiety, which dictates the need to include adequate doses of tranquilizers in premedication in the preoperative period. Patients in the age range of 50-65 years and 66-81years most often suffer from high preoperative anxiety, which requires special attention of the anesthesiologist-resuscitator and the appointment of adequate doses of anxiolytic drugs in preoperative premedication, especially in female patients. Taking into account the individual psychological characteristics of patients before surgery will help to qualitatively protect the patient from preoperative stress, comfortably carry out surgery, and reduce the frequency of intra- and postoperative complications associated with inadequate premedication and patient preparation for surgery.*

Keywords: *HADS scale, surgical patients, educational level, gender, age*

Introduction. The scale of the prevalence of depression in the world is evidenced by data from the World Health Organization (2017), which reported 300 million cases of depression, of which 77% of respondents associate this psychophysiological disorder with pain syndrome [1]. It is now generally accepted that the patient's preoperative anxiety is not only a risk factor for the development of postoperative pain syndrome, but in many cases affects the reparative processes after surgery [2-5].

In particular, the results of a Norwegian cross-sectional population study, in which 5731 respondents (men and women) took part in two age ranges: 46-49 years old and 70-74 years old, showed that age, education and income, physical activity, smoking, alcohol consumption and a healthy diet are inversely related to the incidence of clinical occurrence of hospital depression [6]. Studies by Periañez et al (2020) showed the presence of preoperative anxiety in 47.7% of patients, and depression was detected in 13.8% of cases. According to the authors, only patients with preoperative anxiety experienced postoperative pain of varying intensity in almost half of the cases, which gave researchers reason to consider depression as a predictor of the development of postoperative pain syndrome, which is due to uncertainty about improving health after surgery and fears about the success of surgery [7].

Along with this, according to systematic reviews and meta-analyzes, it was found that depression is an independent risk factor for the development of chronic non-communicable diseases [8-12]. Thus, the results of a meta-analysis of prospective studies presented by Engum (2007), Rotella and Mannucci (2013) indicate that under conditions of depression, the chance of developing type 2 diabetes mellitus (DM) increases by 60% [10, 13] and the risk of clinical realization of cardiovascular diseases increases [10-12].

However, in 50-80% of cases these neurotic and anxious - phobic disorders are not detected by outpatient doctors, and at the hospital stage of treatment in the preoperative period they are not recognized in 70% of cases, which increases the degree of operational anesthetic risk. complicates the work of anesthesiologists and surgeons at all stages of treatment [14]. Unfortunately, doctors at the hospital stage do not pay due attention to this aspect of the disease, which (in turn) leads to the appointment of preoperative premedication without taking into account the individual psychological characteristics of the patient. According to Stepanova et al (2015), in the routine clinical practice of an anesthesiologist, the psychological portrait of the patient's personality is rarely taken into account when choosing an analgesic strategy at all stages of surgical treatment, including the postoperative period [15]

In the context of the above difficulties and problems, the purpose of our study was to study the gender and age characteristics of the epidemiology of hospital anxiety in patients with a surgical profile.

Material and research methods. A prospective cohort study was performed in 138 patients aged 48–85 years (68 men and 70 women, mean age 42.0±18.5 years) who were to undergo surgery for diseases of the abdominal cavity.

Study design. Inclusion criteria: age not less than 48 years old and not more than 85 years old; the absence of mental illness in the anamnesis and in the immediate family; not taking psychotropic drugs six months before enrollment in the study; no indication of participation in other clinical trials at the time of inclusion in this study; informed consent to participate in this clinical trial. Exclusion criteria: age less than 48 years old and more than 85 years old; a history of mental illness and in the immediate family; an indication of taking psychotropic drugs six months before inclusion in the study; indication of participation in other clinical trials; lack of informed consent to participate in this clinical trial.

Research methods. Psychological diagnostics of the level of anxiety was carried out at the preoperative stage using the hospital scale of anxiety and depression (HADS), which is validated in Russia. The questionnaire includes 14 questions to identify and assess the severity of depression and anxiety in a hospital setting over the past 2 weeks. There are 3 areas of values: normal: 0-7 points, no reliably pronounced symptoms of anxiety and depression; subclinically severe anxiety/depression: 8–10 points; clinically severe anxiety/depression - 10 points or more. The scale allows you to separately assess the presence of signs of anxiety and depression [16].

In this work, we focused on the indicator of anxiety as a more common clinical phenomenon at the preoperative stage.

Statistical Analyses. Statistical processing of the research results was carried out in the environment of the "Statistica 8.0" package. The normal distribution of indicators was checked using the Shapiro-Wilk test (W-test). The Mann-Whitney test (U-test) was used to assess the significance of differences between the samples. Differences were considered significant at a significance level of $p < .05$ [17].

Research results. The analysis of age characteristics of the frequency of distribution of levels of hospital anxiety showed that a low level of anxiety in the age group of 18-33 years was detected in 13.5% of cases, at the age of 34-49 years - in 15.5% of the examined, in patients aged 50-65 years - only 2.5% of respondents and at the age of 66 - 81 - in 6.5% of patients. The average level of anxiety in the age group of 18-33 years was recorded in 54% of the surveyed, at the age of 34-49 years - in 47% of patients, in patients aged 50-65 years, the average level of hospital anxiety was found in 36% of the respondents and at the age of 66 - 81 years - in 26.5% of patients. A high level of anxiety in the age group 18-33 years was revealed in 32.5% of patients, at the age of 34-49 years - in 37.5% of cases, at the age of 50-65 years in 61.5% of respondents and in the age group 66-81 years old, a high level of preoperative anxiety was recorded in 67% of the examined.

An assessment of the gender characteristics of the epidemiology of preoperative hospital anxiety, performed in 68 men and 70 women, showed that a low level of anxiety was found in 14% of male patients and in 4% of women. There were no significant differences in the frequency of distribution of the average level of anxiety in the surveyed men and women in our study. In particular, the average level of anxiety was recorded in 46% of cases in men and in 45% of women surveyed. A high level of preoperative anxiety was recorded in 40% of male patients and in 51% of cases in the examined women.

Analysis of the influence of education level on the frequency and severity of hospital anxiety showed that patients with secondary education had a low level of anxiety in 12% of cases, an average level of anxiety was recorded in 53% of cases, and a high level of anxiety was found in 35% of patients. In those surveyed with secondary specialized education, only in 5% of cases a low level of anxiety was recorded. The average level of hospital anxiety in patients with secondary education was found in 25% of the examined and in 70% of patients a high level of anxiety was revealed. According to our data, patients with higher education are characterized by medium and high levels of anxiety, recorded in 44% and 45%, respectively. At the same time, only 11% of patients with higher education showed a low level of hospital anxiety.

Discussion of research results. In our opinion, the reason for the revealed gender differences in the frequency and severity of preoperative anxiety is associated with the peculiarities of the mentality of women, who (in contrast to men) are characterized by a negative self-assessment of

health [18] and a lower level of emotion control [19], which (in turn) determines their frequent adherence to manifestations of depression, fear and anxiety [20].

Our results of assessing the frequency and severity of hospital anxiety in patients with different levels of education contradict the studies of Feinstein et al. (2006) and Mackenbach et al. (2015), according to which the level of education is a determining factor in lifestyle, medical culture and culture of health, reflects higher life expectancy and lower mortality rates, in comparison with the same indicators of persons with a different educational qualification [21]. Further research is needed to determine the reasons for this contradiction. The high frequency of severe anxiety, revealed in our study in patients of the older age group, is consistent with the opinion of Polishchuk et al. (2008), according to which the main reasons for the high frequency of anxiety, anxiety-phobic and anxiety-hypochondriacal personality disorders are associated with awareness of one's condition, the presence of various comorbidities and a lack of confidence in a favorable outcome of pain relief and surgery [22].

Conclusions. Patients aged 18-33 and 34-49 years are most often subject to an average level of pre-operative anxiety, which dictates the need to include adequate doses of tranquilizers in premedication in the preoperative period. Patients in the age range of 50-65 years and 66-81 years most often suffer from high preoperative anxiety, which requires special attention of the anesthesiologist-resuscitator and the appointment of adequate doses of anxiolytic drugs in preoperative premedication, especially in female patients.

Taking into account the individual psychological characteristics of patients before surgery will help to qualitatively protect the patient from preoperative stress, comfortably carry out surgery, and reduce the frequency of intra- and postoperative complications associated with inadequate premedication and patient preparation for surgery.

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ARTIFICIAL INSEMINATION IN THE CONTEXT OF ISLAMIC BIOETHICS

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Abstract*. In the process of advancing medical science, new concerns have arisen relating to artificial insemination. Artificial insemination, as a subject of both secular and Muslim bioethics, should be investigated from different aspects. It is important to consider whether artificial fertilization is halal from the point of view of Islamic religious ethics, and to compare the decisions made by the Islamic Fiqh Academy regarding artificial insemination with the original sources of Islam. The main conclusion of the article is that the position of the Muslim theological school should be developed and promulgated, since bioethical problems can have serious consequences for the life of a person, family and society. The article is one of the components of the author's research on the theoretical and practical basis of Islamic bioethics. The methodological structure of the article has a theoretical and practical nature for the study of such areas of Islam as ethics, fiqh and bioethics.*
Keywords: *artificial insemination, heterologous and homologous means, intellectual and religious justification, fatwas of the Fiqh Academy.*

Introduction. Bioethics is the field of science that forms a new starting point of philosophical thought. Its formation and development are closely related to the transformation of traditional and medical ethics as a whole. Interest in bioethics is foremost an indication of the global interest across modern societies that creates a number of challenges that require significant spiritual and legal regulation in the area of human rights, as well as testing of new technologies and medicinal products on humans.

It should be noted that with significant achievements made in medical, biological and methodological research during 1965-1980, an unprecedented technological revolution took place in the world of science. Although these achievements were of extraordinary significance to mankind, they raised a number of new moral and ethical issues.

Even as artificial insemination is advancing as a field of modern medicine, human embryos developed in research are terminated. After the egg and sperm cells taken from the mother and father candidate are combined in a laboratory setting to successfully complete the in vitro fertilization, some of these embryos are transferred to the womb of the mother candidate, while others are stored frozen. Only one of the embryos transferred to the mother's womb will develop normally, while the embryos that do not develop are terminated through abortion. Frozen embryos perish if not used within 5 years. Furthermore, live human embryos are used in research and experiments for artificial insemination. Scientists could have never imagined this type of research in the past.

The simplified approach to artificial insemination has resulted in a similarly relaxed approach to human embryos. This method allows parents not only to choose the gender of their child or even identify the most ideal time for birth, but also encourages opportunities for further research in eugenics. Finally, in our developed world, artificial insemination has become a highly lucrative practice for doctors. In truth, with material interests on one end of the scale, the value of human life is undermined on the other.

All medical projects, particularly those that are based on artificial insemination, along with genetic studies are seeking the answer to one important question: should every innovation that has become technically possible be allowed to proceed?

Currently, there are talks of establishing a scientific tribunal that would resolve these disputed issues. Some call for a set of new laws to regulate scientific research, while others avoid publishing in scientific journals in a manner that could cause moral objections. Rising from controversial processes as one of the most popular sciences of the 20th and 21st centuries, bioethics emerges with global questions and answers for society and mankind.

The attitude of the world religions toward the most important issues in bioethics - artificial insemination, cloning, abortion, euthanasia, experiments on patients, etc., has never been simple. It is

important to point out that disagreement on these issues reigns among different religions and sects. The Christian faith, particularly the Catholic and Eastern Orthodox churches, hold broad views on this matter. The church generally keeps all processes in the field of biomedical innovations under control and regularly prepares its recommendations for modern medical innovations.

There are noted similarities in Christianity and Islam's attitudes towards medical and religious ethics. The protection of human dignity - expression of human rights, freedom of choice and will, hold the same meaning in both religions. In this respect, Islam gives utmost preference to human free will. The attitude in Islam towards bioethics is closely related to its attitude towards mankind. What distinguishes Islam from other world religions is that it provides and protects an individual's identity, merit, rights and in particular, women's rights, both on the basis of Shari'ah and secular laws.

The separate interpretation of Islamic jurisprudence in terms of exclusion, opinion, comparison and *ijtihad* of the secular bioethical problems emerging in modern times aims to demonstrate the attitude of different sects and movements towards popular morality. In order to solve the new ethical problems created by biomedical technologies, today's Muslim jurists and fiqh scholars hold regular meetings and prepare certain judgments and decisions. The scope and effect of these provisions and decisions are of great interest to the Muslims of Azerbaijan.

The contemporary period we are in is a period of contradictions and scientific developments that are closely related to each other. As science progresses, as in all areas of life, judicial and legal precedents occur in the religious sphere, which creates discrepancies between science and religion. The only amiable solution to these types of conflicts is in finding answers to these problems.

One of the new subjects that have emerged as a result of increasing success in medicine is artificial insemination. Of course, because rights in Islam are regulated under Shari'ah law, no lawyer or legal expert can legitimize these controversial current issues without consulting Islamic law. To that extent, the faqihs must first consider such matters from the perspective of Shari'ah law, so that legal experts can then ensure that necessary laws are put into effect according to these regulations.

It is important to note that the issue of artificial insemination is very broad, deep and controversial, so we will attempt to review it in a thorough, comprehensive manner. Since this is a topic of interest in secular bioethics, but also particularly in Muslim bioethics, we will examine it in 3 steps.

In the first step, we will review the definition of artificial insemination, as well as its history, including the first country it was performed in and what living creatures were used in the initial experiments. Subsequently, we will review whether this issue is halal in terms of Shari'ah law and the decisions made by the Islamic Fiqh Academy regarding artificial insemination. In the second step, we will consider the various options for artificial insemination and the respective position of the fakihs in regards to each option. In the third step, we will examine the position of Islamic lawyers on artificial insemination and present the conclusion of this issue.

Research Methods. We can define artificial insemination as the fertilization of female and male reproductive cells outside of the body. In other words, the process, without a sexual act between a man and a woman, but with egg cells from the woman who will become the mother combined with the sperm cells of the candidate father in laboratory settings, subsequently placed in the mother's womb again, constitutes artificial insemination.

Artificial insemination was first performed in Russia. This event took place in the first half of the twentieth century, when Russian scientists practiced artificial insemination in sheep, cows, horses and pigs. In 1950, scientists first managed to freeze bull sperm to -79 degrees Celsius using liquid carbon dioxide and then to -196 degrees using liquid nitrogen. The scientists who were able to heat the frozen sperm to normal temperatures found that these sperm samples did not lose their effectiveness. Thus, artificial insemination of animals with donor sperm preserved over long periods of time was possible.

The first person to have applied internal insemination by artificial means and used a substitute mother was M. C. Chang of Boston, USA. He conducted this experiment on rabbits in 1959. The first attempt to conduct artificial insemination on humans was done by Robert Edwards in 1965. In 1978, after many previous failed attempts, Robert Edwards and Patrick Steptoe saw the birth of the first human child conceived by artificial insemination.

This process begins with the removal of the woman's egg cell out of the ovaries. On November 10, 1977, Dr. Patrick Steptoe placed mother candidate Lesley Brown's egg cells into a container prepared by Dr. Robert Edwards. After fertilization took place in the container and the

zygote had developed sufficiently, Dr. Steptoe placed the blastula in Lesley Brown's womb on November 12, 1977 and on July 25, 1978, in news that resonated all across the world, Louise Brown, the first child successfully conceived through artificial insemination, was born.

The actual insemination process is divided into two types: homologous and heterologous. The homologous method is applied when the woman's partner has sperm cells that are healthy, but the woman cannot conceive by natural means for physical or psychological reasons. In this method, sperm cells taken from the man are released into the woman's uterus.

Artificial insemination has been the subject of debate and discussion among Islamic scholars since it was first introduced. Previously, several well-known Shia faqihs had found this practice to be unacceptable. Today, however, the majority of the Shia faqihs state that this is permissible (halal). The reasoning of those who argue that artificial insemination is permissible (halal) is based on both sperm cells and egg cells belonging to the spouses themselves and only the fertilization process being solved by artificial means. There is no evidence that this situation is haram. The intellectual and Shari'ah perspective also find this is permissible. However, haram activities, such as adultery or the transfer of sperm cells into the womb of another woman are not considered.

The position of the Sunni (Hanafi) faqihs regarding homologous fertilization is different. Although the majority of Sunni faqihs stated that this matter was permissible on the condition that certain rules are applied, a small number of faqihs, such as Sheikh Ahmad al-Haji stated that this was haram. The main argument of those that view artificial insemination as permissible is that married couples are able to have children this way and that the birth of the children strengthens the love and bond between them. The argument of the faqihs on the opposing side is that a child can only come into the world as a result of sexual intercourse. If a child cannot be conceived through sexual intercourse, then that is Allah's will, or to put it another way, artificial insemination is to contrary to Allah's will and it eventually leads to *shirk* (idolatry), which is one of the greatest sins. They defend their ideas with this verse of the Qur'an: *"To Allah belongs the dominion of the heavens and the earth. He creates what He wills (and plans). He bestows (children) male or female according to His Will (and Plan), Or He bestows both males and females, and He leaves barren whom He will: for He is full of Knowledge and Power.*" (Surah Ash-Shura, 49-50).

Heterologous fertilization is applied when no issues can be observed in the woman's fertility, while the male partner's sperm cells are not capable of making the woman pregnant. In this case, sperm cells from a third-party male (donor) are taken, prepared and then placed in the woman's uterus. The majority of Shia faqihs said that this type of artificial insemination is haram, while a small number have found it to be halal (permissible).

Those who argue that heterologous fertilization is haram associate it with the commandments given to men and women to protect themselves from haram, by referencing several surahs of the Qur'an (Surah Al-Mu'minun 5-7, Surah An-Nur 30-31, Surah An-Nisa 22-23, Surah Al-Ma'arij 29), as well as relying on the hadiths from the Imams. One of their verses on this subject is as follows: *"Say to the believing men that they should lower their gaze and guard their modesty: that will make for greater purity for them: And Allah is well acquainted with all that they do", "And say to the believing women that they should lower their gaze and guard their modesty."* The relative nature of "lowering the gaze" is highlighted by the use of Arabic preposition *min* in these ayahs. This means that only one aspect of the gaze is considered haram, relative of the situation.

Those who view the heterologous method as unlawful, support their opinion with several hadiths, with the following two in particular:

1. Ali Ibn Salim had narrated the following saying of Imam al-Sadiq (a): "*on the Day of Judgement, the most severe punishment will be given to the man who transfers his own nutfah (the sperm cell that has fertilized the egg cells) into the womb of another (namahram) woman."* It is understood from this hadith that it is a great sin for a man to transfer his own *nutfah* (sperm) into the uterus of a *namahram* woman. The word *nutfah* mentioned in the hadith refers that the sperm cells of the man fertilizing the egg cells of the woman in the process of forming an embryo.

2. Imam al-Sadiq (a) had narrated The Prophet (SAWS) saying: *"there is no greater sin in the presence of Allah than killing the prophet or imam, destroying the Kaaba which Allah has chosen as the Qibla for his servants, and transferring a man's own nutfah into the womb of another woman."*

This hadith also makes it clear that it is a sin for a man to transfer his own sperm cells into another woman's womb. This hadith covers the transfer of sperm to the womb of another woman, regardless of the way that it happens, as absolutely haram and a great sin. Many modern Shia faqihs have submitted other evidence that artificial insemination is haram.

It should be noted that the Sunni faqihs believe that the heterologous method of artificial insemination is haram. The following are two key arguments on this position:

1. This act, beneath the level worthy of humanity, stooped down to the level of animals and plants, is at the same time, a great sin and considered as grave as adultery. Because the goal of both is the deliberate transfer of the male sperm cell into the woman's uterus. This type of artificial insemination would also not be approved from the perspective of child adoption, forbidden in Islam. Just as with adoption, it is at the very least established that a child has biological parents, so in this case the paternity is not firmly established and a third party becomes involved.

2. "*Call them by (the names of) their fathers.*" Referring to this verse, the Sunni faqihs pointed out that children are ascribed to their own fathers. In heterologous insemination, a child conceived from another man's sperm cells is ascribed to the woman's actual partner. However, the wife's partner is aware that the child is not his and cannot accept the child as such.

The Islamic Fiqh Academy has made several resolutions regarding artificial insemination. The Islamic Fiqh Academy, which had been founded by the Organization of the Islamic Conference (currently called the Organization of Islamic Cooperation), was established on the basis of the decisions made at the 3rd Summit of Heads of State and Governments of Islamic Countries, convened in Saudi Arabia on 25-28 January 1981. The aim of this institution, headquartered in the city of Jeddah, is to aid with matters in the field of Islamic law and to find solutions in accordance with Islamic law to problems that arise in modern times.

One of the main issues discussed and deliberated by the Islamic Fiqh Academy is the subject of artificial insemination. Thus, at the VIII Assembly of the World Islamic Unity Center in Mecca (27 Rabi' al-Akhir 1405 - 7 Jumada al-Awwal 1405 / 19-28 January 1985), the following decisions regarding artificial insemination were made:

The methods of artificial insemination currently known are as follows:

1. the sperm cells of the husband are used to fertilize the egg cells of a third-party female and the developed embryo is placed in the womb of the wife.
2. a wife's egg cells are fertilized with a third-party male's sperm cells and the embryo is placed in that woman's own womb.
3. An embryo developed from laboratory-based fertilization of a couple's own egg and sperm cells is placed in the womb of a surrogate mother.
4. An embryo developed from laboratory-based fertilization of third-party female egg cells by third-party male sperm cells is placed in the womb of a woman
5. The husband's sperm cells are used to fertilize his wife's egg cells in a laboratory setting and are subsequently placed in the womb of his second spouse
6. An embryo from fertilization of a woman's own egg cells by her husband's sperm cells is developed in a laboratory setting and subsequently placed back in the woman's womb.
7. The sperm cells of the husband are collected and artificially inserted into the wife's womb, resulting in an internal fertilization of the egg cells

Taking into account the above articles, the Assembly passed the following resolutions:

The first five methods are in contradiction with religious principles, interfering with natural generational development, as well as raising uncertainty with the nature of motherhood, etc. and are by all means considered haram.

At the same time, the Islamic Fiqh Academy, emphasizing the need for action when appropriate, found that, if necessary, the sixth and seventh methods are permissible.

The most recent provisions on artificial insemination were adopted at the second meeting of the Eurasian Fatwa Assembly held in Istanbul in 2017, under the coordination of the presidency of Religious Affairs of the Republic of Turkey. According to a resolution passed by the Assembly, "...in cases of medical necessity, there is no harm in inseminating the egg cells of a woman with the sperm cells of her lawful husband." (3;6) The use of the sperm cells belonging to a man other than the lawful husband, in fertilization of the woman's egg cells and subsequent assurance of her pregnancy, is not

permissible, as it incorporates elements of adultery and is offensive to natural human instincts. This method is only appropriate when breeding animals.

Today, new milestones have been achieved in the field of artificial insemination and for spouses who cannot have children naturally, new methods and techniques have been developed. Among these, the most widely applied method involves inseminating the egg cells with the sperm cells in a laboratory setting and placing the fertilized cell back in the woman's womb. This treatment is essential to women who cannot otherwise get pregnant naturally. There is absolutely no difference between the normal fertilization of the egg cells with sperm cells of spouses and a method where this fertilization occurs externally and the embryo is subsequently placed back in the womb. This is on the condition that the spouses any other way cannot conceive a child.

Outside of the scenario described above, any case where a third-party element is involved, such as use of the sperm cells, egg cells or the uterus of a person who is not one of the spouses, is not permissible. From the perspective of Islam, a legitimate child must have a relation to its parents both through sperm and egg cells, and the womb it grows in.

Legal examination of artificial insemination.

As noted at the outset, issues such as a child's custody, marriage and inheritance are put within the context of the child's lineage. The lexical meaning of the word *nasab* (lineage) implies relationship and dependence and is generally used with reference to ancestral kinship. From a legal standpoint, there are several definitions for the word *nasab*. The late Dr. Imami had defined *nasab* as follows: "Lineage is something that occurs as a result of sexual relationship between a man and a woman. A child born on the account of such a relationship signifies the blood ties between the man and the woman."

None of these definitions fully reveal the essence of *nasab*. That is, according to these definitions, it is not understood whether lineage is natural or relative. Since lineage has not been defined in Shari'ah law, this issue has been left up to the community to adjudicate.

From a medical standpoint, the formation of the embryo is influenced by the father, meaning that it is related to the sperm cells. In society, lineage is formulated by way of physiological fecundation. There are verses and hadiths that also support this. For example, a verse from the Qur'an says: "*It is He Who has created man from water: then has He established relationships of lineage and marriage."*

As we can see from the verse, there are kinship relations between people created from the same seed. The society also adopts this view when referring to family relationships. In reality, this is how an embryo develops and forms. However, unfeasible matters, such as adopting someone, etc. have no ancestral basis to them.

In addition, a number of thoughts were expressed regarding the child's relation to the mother. One of the main thoughts is that at the basis of this relationship is the act of birth. Both in terms of the lexical meaning and the generally accepted opinion, a mother is a woman who has given birth to a child who was conceived of her. Therefore, a newborn's mother is the woman who was pregnant with that child and gave birth to it.

Those who disagree with this have made a number of statements against the aforementioned claim, and we are referring to only one of them. In the following verse, Allah calls the woman who gave birth to a single human a mother, but it is not stated that a woman who did not bear the child cannot be considered his mother as well. For example, although the "milk mother" (a wet nurse, a woman employed to provide suckle to another woman's child) is not the woman who became pregnant and gave birth to the child, she is also defined as a mother in the Qur'an.: *"Prohibited to you (For marriage) are: Your mothers, daughters, sisters; father's sisters, Mother's sisters; brother's daughters, sister's daughters; foster-mothers (Who gave you suck), foster-sisters; your wives' mothers; your step-daughters under your guardianship, born of your wives to whom ye have gone in, no prohibition if ye have not gone in; (Those who have been) wives of your sons proceeding from your loins; and two sisters in wedlock at one and the same time, except for what is past."*

Another criteria in establishing a relationship of a child to its mother involves the egg cells. Those holding this view equate motherhood and fatherhood. That is, the mother of a child is the woman who plays a role in the formation of the embryo, being the source of the egg cells that are combined with the sperm cells to develop the foetus. The nutrients absorbed by the woman serve the development of the child. From a medical point of view, the formation of the embryo is the result of the merger of the sperm cells of the man and the egg cells of the woman. Many verses of the Qur'an confirm this idea: "*Verily We created*

Man from a drop of mingled sperm..." and *"It is He Who has created man from water: then has He established relationships of lineage and marriage: for thy Lord has power (over all things).*"

Another criterion of the child's relationship to the mother is that the mother exclusively provides both the uterus and egg cells. The view on this is that both the woman who is the source of the egg cells responsible for forming the embryo, and the woman whose uterus the embryo is placed in, are considered the mother of the child.

With the subject of artificial insemination, enriched with today's bioethics, framed within the sensitive approach of our society and the permissibility within Shari'ah law, being sufficiently important, it becomes very difficult to accept one of the aforementioned views over others. Both genetically, and from the viewpoint of our society, having an embryo formed from a woman's egg cells be placed in another woman's womb does not deprive the woman who provided the egg cells of being the mother. However, on the other hand, it is not appropriate to dismiss the woman who carries the child in her womb for months and is literally connected in body with it. In particular, many verses of the Qur'an show that Allah sees as separate the stages between the formation of the embryo and the final development of a child. "*Then We made the sperm into a clot of congealed blood; then of that clot We made a (foetus) lump; then we made out of that lump bones and clothed the bones with flesh; then we developed out of it another creature.*"

Allameh Tabataba'i in interpreting this verse, had written: "In this verse, Allah wants to point out that this flesh-and-bone creature is entering a new phase. So much so that this lifeless, ignorant, helpless being transforms into a living being capable of holding knowledge and power."

From various verses and hadiths relating to this subject, we conclude that a child in this situation is connected to both women. Therefore, both the woman who provided the egg cells for the embryo and the woman whose womb the embryo developed in are considered the mother of the child.

Various options for artificial insemination

Here, we will review the various options for artificial insemination, while at the same time, considering the position of the various Islamic scholars on the matter:

I. Fertilization of a woman's egg cells with her husband's sperm cells

In some circumstances, the sperm cells of a husband and the egg cells of his wife are not fertilized naturally, so this may be achieved medically in a laboratory environment, after which the embryo is transferred to the woman's uterus. The foetus continues its development in the woman's womb. It appears that all the faqihs consider this process halal, as there is no evidence to any parts of it being haram. Due to some of its potentially questionable aspects, based on the legal and intellectual deliberation methods within Usul Al-Fiqh, this process is considered halal conditionally, provided the sperm cells are not obtained in a manner considered haram, such as masturbation or external visual or physical stimulation.

This type of artificial insemination has been considered halal as it does not involve any elements of adultery, and there is nothing forbidden in the process of combining the male sperm cells and the egg cells of his wife in a laboratory environment. A child conceived this way will be a full-fledged child of the parents, just as the spouses will be the rightful parents of the child, with issues of lineage and inheritance being naturally addressed.

"The fertilisation of a man's sperm cells with the egg cells of own wife is lawful, but the sperm cells must not be obtained in forbidden ways. If a child is conceived through the artificial insemination process as described, the newborn will be considered a lawful child of the parents. Even if aspects of obtaining sperm cells are haram (for example, by way of masturbation), the child that is conceived as a result will still be considered the legitimate child of the parents. However, the man is guilty because of engaging in masturbation."

The fatwas of the Mujtahideen, such as Mohammad Reza Golpaygani, Sheikh Yousef Saanei, Mohammad Momin, Mohammad Yazdi and Sayyid Mohammad Sadeq Rohani, affirm this idea.

II. Transfer of the embryo from one woman's uterus to another woman's uterus

This option consists of the following elements:

a) Biologically, there are no problems with either of the spouses, that is, there is no obstacle to the fertilization of the sperm cells of the husband and the egg cells of the wife and the forming of the foetus. However, due to medical conditions of the wife, such as diabetes or thalassemia, the foetus cannot be kept viable in the uterus and results in a miscarriage. With the latest advances in medicine, the occurrence of this scenario has been considerably reduced.

b) the sperm cells and the egg cells of the spouses are combined in a laboratory environment and transferred to the womb of a third party female. In Shari'ah point of view, this can be considered rental of the uterus.

Ayatollah Khomeini was asked: "some women, due to health issues and for other reasons, cannot carry the foetus in their wombs and suffer miscarriages. In such a case, if the foetus is developed in the uterus of another woman, can the child be returned to the biological parents, considering the foetus has developed in a rented uterus until the birth". Ayatollah Khomeini replied: "If this example contains no elements of haram, the fact that the embryo developed in the uterus of a third party female does not present a challenge. If the foetus is formed from the spouses' sperm cells and egg cells, the child belongs to them."

c) In some instances, the woman may not have viable egg cells, and so egg cells of another woman are transferred to the woman's uterus, which are then fertilized with the sperm cells of the first woman's husband in the course of sexual intimacy. According to some scholars, based on the hadiths referenced earlier, the fertilization of a third party female's egg cells with the husband's sperm cells is considered haram. However, the scholars who argue that this is not haram have clarified that the issue referenced in the hadiths is with the transmission of the man's sperm into the third party female's uterus. Therefore, these hadiths should not be referenced in relation to a scenario where a husband's sperm cells fertilize a third party female's egg cells in the womb of the lawful wife. It should be noted that as the egg cells of the third party female are transferred to the womb of the wife, these cells integrate with the wife's body and are eventually considered her own.

The process of transferring the embryo into another woman's womb, also known as surrogacy, is one of the issues that have become relevant in recent times. Over the past 20-30 years, several various versions of this process have emerged. We will focus on one.

With both the husband and wife being in adequate health, the husband's sperm and the wife's egg cells being within normal parameters, but due to medical concerns with the wife's body, such as diabetes or thalassemia, the wife may have difficulty carrying the embryo to term. In this case, the transfer of the foetus to another woman's womb can happen in the following two cases:

1. The woman into whose womb the embryo is transplanted can become mahram to the man, there is no harm in being close to him. In this instance, the opinion of all Islamic scholars, there is no legal justification for considering the embryo transplantation to be haram. Because the man wishes to transfer his own sperm cell into the womb of the woman who is privy to him, we can see that this method is not haram.
2. The embryo is placed in the womb of a woman, closeness with whom would be haram for the man. The scholars could not come to a common decision regarding this, some considering this lawful and some say that it is haram.

Those advocating that it is permissible to transplant the embryo into another woman's womb defend their view on the basis that protection and preservation of the embryo is of utmost importance. The embryo should not be allowed to be destroyed under any circumstances. If there is no argument that the transfer of the embryo to another woman's womb is haram, the situation is considered lawful in accordance with the rules of justification within Usul al-Fiqh. In the interests of erring on the side of caution, and since there is some evidence that this is haram in Shari'ah, a further, deeper review of the issue is necessary.

The muftis have expressed their views on the subject. Mohammad Taqi Bahjat answered the question posed to him regarding permissibility of transferring embryos or sperm cells to a third-party woman's womb as follows: "if there are no pre-requisites with haram elements in this matter, then there is no wrong."

Mohammad Yazdi answered this question as follows: "after fertilizing male and female reproductive cells in a laboratory environment, it is lawful to transfer the cell that is formed into another woman's womb regardless of her marital status. This can not be considered haram. Because this is neither adultery, nor the transfer of the male's own sperm cells into the womb of a *namahram* woman."

Those who view this matter as haram have drawn attention to several verses and hadiths, such as: *"And say to the believing women that they should lower their gaze and guard their modesty."* This verse commands believing women to protect their eyes and their honour (private parts) from haram. It appears to suggest that the woman can not leave her private parts at the disposal of her doctor or obstetrician. In this respect, the doctor's actions to transfer embryos into a woman's womb would be considered haram. If

someone views this action involving lawful spouses as haram, it should be noted that some scholars view all forms of artificial insemination as unlawful, labeling them as unnatural and foreign.

Those who object to this claim feel that in protecting private parts of a woman from haram, the aforementioned verse only refers to protecting them from the sight of others. Based on this, the transplantation of a *namahram* man's sperm cells into a woman's womb naturally or through the artification insemination process is not a concern. The need to only protect private parts from being seen by others is also seen in the hadith of Imam al-Sadiq (a) narrated by Abu Basir. In that same hadith, Imam (a) says: "*apart from this verse, in all the other verses in the Qur'an about guarding the private parts, the reference is to guarding against adultery* "; This hadith was narrated in "Tafsir Al-Qummi" and "Tafsir Noor al-Thaqalayn", as well as in "Usul al-Kafi". There is no concern in the execution of the hadith narrated in "Tafsir Al-Qummi".

Yousef Saanei was of the view that transferring the embryo into another woman's womb is haram. He had noted the importance of avoiding these methods of reproduction, which are contrary to moral values. Fazel Lankarani, Hossein Noori-Hamedani and Abdul-Karim Mousavi Ardebili had also stated that this scenario is not allowed under Shari'ah law.

Conclusions. The position of Islamic scholars on artificial insemination.

The views of Islamic faqihs about artificial insemination can be grouped as follows:

1. All forms of artificial insemination by medical means being halal

Ayatollah Sayyid Ali Hosseini Khamenei, as well as Hassan Tabatabaei Qomi, Mohammad Yazdi and Sayyid Mohammad Mousavi are all in support of this view. Their main argument is that no verse in the Holy Qur'an or any hadiths indicate that this situation is prohibited. However, even those supporting this view caution staying away from using a third-party male's sperm cells in artificial insemination, as well as introduction of elements of haram during the process of artificial insemination.

2. All forms of artificial insemination by medical means being haram

Among those holding this view, Sayyid Mohammad Hadi Milani, as well as several prominent Sunni scholars have proclaimed artificial insemination to be absolutely haram, while Shaykh Muhammad Abdul Latif al-Farfour and Bakr Abu Zayd Mohammadsharif Ahmed only considered some aspects of artificial insemination to be unlawful. As the main evidence in support of their view, they reference *"Your wives are as a tilth unto you; so approach your tilth when or how ye will"*, stating that reproduction must occur only as a result of natural sexual intercourse. According to this verse, men should only be intimate with their wives and offspring must only be produced as a result of this intimacy. Bringing a child into this world by other means (artificial insemination) is contrary to this verse of the Qur'an. In addition, verses such as *" He is created from a drop emitted, Proceeding from between the backbone and the ribs"* show that gushing *nutfah* (sperm) must enter the female uterus. This does not occur with artificial insemination. On the other hand, in situations unrelated to artificial insemination, the *namahram* (marriageable) man might see and touch a woman's body, under circumstances that on their own would be considered haram.

3. Artificial insemination by medical means between spouses being absolutely halal, artificial insemination involving a third-party man or woman being halal only under certain circumstances.

Some mujtahideen have ruled that the fertilisation of the husband's sperm cells and his wife's egg cells is absolutely halal. Mohammad Momin Qomi and Mohsen Harampanahi have served as guiding examples to the scholars who are of this view. They support their claim with references to hadiths that forbid a man's own sperm to enter the uterus of a woman who is not his wife, inferring from this that artificial insemination is not strictly forbidden. However, with regards to a third-party man's sperm cells being used to fertilize a woman's egg cells in a laboratory setting being considered haram, since there are basis for finding it unlawful, the provision has been made that it is not halal.

4. Artificial insemination by medical means strictly between spouses being absolutely lawful, while artificial insemination involving a third-party man or woman being absolutely forbidden.

The criteria for determining whether the fertilization process is halal or haram are the composition of the reproductive cells and the involvement of third-party donors. In the process of fertilizing egg cells with sperm cells, the matter of whether artificial insemination is lawful or unlawful has no relevance. Among the chief evidence referenced by the scholars of this opinion are ayahs, hadiths, the intellectual opinions and arguments expressed within Usul al-Fiqh, the philosophy on marriage rules,

etc. Several prominent scholars, as well as Ayatollahs Khomeini, Montazeri and al-Khoei, can be cited for guiding examples on this issue. Among the Sunni scholars, Shaykh Mustafa Al-Zarqa, Abdullah Bassam, Abdusalaam Ibadi, Shaykh Abdelhalim and others are also of this opinion.

5. Artificial insemination by medical means strictly between spouses and only under certain conditions being halal.

Those supporting this view find artificial insemination to be lawful only on the condition that all the steps involved are by the spouses themselves and that this measure is taken out of great necessity. Even so, not all all types of artificial insemination, but only the intrauterine insemination (IUI) method is considered halal. Their reasoning is the same as the reasoning demonstrated in the second group described above. Although Shaykh Mustafa Zarga and Dr. Mohammad Ali Al-Bar referenced Sunni scholars who support this view, they did not disclose their names. It is noteworthy that the fatwa centers of Egypt and Jordan also support this theory.

Ayatollah Borujerdi, a Shia faqih, can also be added to the list of those supporting this view. He considered it permissible for a husband's sperm cells to be introduced to his wife's uterus, but only out of absolute necessity.

6. No opinion being expressed on whether medically conducted artificial insemination is halal or haram.

Shaykh Abd al-Aziz ibn Baz, who presided over the VIII meeting of the Islamic Fiqh Academy (Hijri 1405), and one of the participants, Sheikh Bakr Abu Zayd, were in support of this opinion.

As we come to a close on the subject of artificial insemination, with the intent of obeying the commands Allah has given and the bans Allah has imposed, and in particular, *"To Allah belongs the dominion of the heavens and the earth. He creates what He wills (and plans). He bestows (children) male or female according to His Will (and Plan)", "Or He bestows both males and females, and He leaves barren whom He will: for He is full of Knowledge and Power"*, it is most advisable to accept the will of the Supreme Creator.

Our conclusion is that because biotechnology and bioethics concerns have most serious consequences for the human life, the basis of family and society, the Muslim theological school of thought should be completely reviewed and informed on this subject. We must consider that biomedical concerns become increasinly complex, as they reflect both the complexities of the actual science behind them and the firm interests of some social groups. Therefore, while accounting for the rules of implementation of biological innovations, it is necessary to focus on the arising conflicts in their technological, economic, political and moral aspects and to correctly interpret the theoretical and experimental foundations of religious and ethical propositions.

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NURSING HUMAN RESOURCE DEVELOPMENT IN MONGOLIA

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Abstract. *There is a need for a policy to modernize Mongolia's nursing care in rural areas, and to allocate and retain nurses. Nursing human resource growth is averaging 2.01 percent per year. The number of nurses working in rural areas has decreased by 21.4 percent over the last 19 years. There is a need to reflect cross-sectoral cooperation and the roles, activities and participation of policy stakeholders in the implementation of nursing human resource policy.*
Keywords: *nursing, human resource, allocation, rural area, policy.*

Background. By 2019, 12,773 nurses are working in our country and 46.7 percent of them work in rural areas, and 9,875 are working directly in medical services. In rural hospitals, the workload of nurses is so high and we need to meet the work to international standards based on medical science. The supply of nurses does not meet the required standards, especially in rural areas, nursing services cannot meet the demand of care is limited in terms of quantity and quality, and it depends on a huge amount of transition of nurses.

Purpose. The survey was conducted to analyze the current situation of allocation and migration of nursing human resources in rural areas.

Methods. Evidence-based and descriptive research models identified nursing human resources reports, data, and statistics. The research is provided according to the research ethics committee by permission of the Research Ethics Committee №13-1A meeting of the Research Ethics Committee №13-03 / 1A. The survey was conducted with the approval of the meeting and the card was filled out with the signature of each person. From each stages the list of nurses made required collections by definite selection and collected defined numbers randomly. Research design and scope: A total of 560 nurses working in rural areas, including 10 aimags in 4 economic regions of Mongolia, were selected from two-level hospitals. By the research of documents: The information has been taken from documents, legal acts, orders and rules and information of government organizations. By Quantitative research: Here involved challenges to nursing human resources and its distribution and study ways identification of improvement nursing human resource challenges. In this research involved 134 nurses as representation of total nurses. According to guide lines held 15 times discussions and provided 9 discussions intercom hospitals' nurses and provided 7 discussions in aimag hospitals' nurses. We collected information by purposive sampling and quota sampling and involved in significance level of 5 percent and sampling force is involved 80% and participated totally 170 organizations and 27 hospitals of 1and 2nd stage. Based on the guidelines of the interview questions, the participants were guided by the principle of equal participation in order to reveal the opinions, suggestions and opinions of the participants through discussion. The interview lasted 60 minutes.

Analyses. Focus group discussions were matched with keywords. The sub-headings and guided questions are grouped by region (review of sub headings and guided questions). Identify key aspects from guided questions content, select the quotes and key comments / recommends, and make a report. analytic summary). Analyze and summarize documents Policy documents were analyzed by analyzing and summarizing the documents. In addition, capacity, structure, and management decisions in nursing human resource stratification were compared by comparing health indicators. The future direction of nursing human resources was determined by extrapolation.

Results. Current status of policy implementation.

The analysis of the implementation of the policy paper shows that there is no causal analysis of human resource policies, strategies in the areas of health, education, labor, and social protection, which are slow to implement, whose participation is weak, and whether there is duplication of functions. The parties do not know exactly how to participate in the policy, which creates conditions for weak cross-sectoral cooperation and policy implementation from top to bottom. This is: The policy

to develop human resources in the health sector in 2004-2013 was implemented incompletely by 2941 nurses, “medium-term human resource outlook for the health sector 2005-2015” policy was under-implemented by 2317 nurses, the government's health sector policy for 2012-2016 has not been achieved, the “State Health Policy” aims to make the ratio of doctors and nurses 1: 1.6 by 2021 and 1:2 by 2026, but the reality is 1: 1.1, according to the standard approved in 2017, there will be 2.0-2.5 nurses per doctor and 0.5-1 assistant nurses per 4 nurses, which shows that there is a shortage of 2434.5 nurses in rural areas, out of 1623.

Comparing the distribution of nurses working in rural hospitals with the lower limit of the standard, the average number of nurses in the aimags is 315.3 and the number of nurses is understaffed from 1623 to 2434.5. The number of nurses will be 12,773 in 2019, and a dynamic analysis of the population shows that the human resources for nursing have increased by 3.4 percent over the past year.

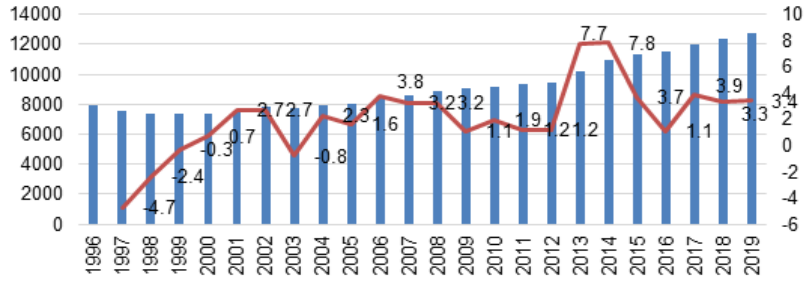

Fig.1. Current supply and growth trends of nurses

Overall, the consolidated trend analysis shows that the number of nurses increases by an average of 2.01 percent per year, which is very low. The highest increase in the number of nurses was in 2014, when it increased by 7.8 percent, and the lowest in 1997, when it decreased by 4.7 percent. The average of the last 5 years is estimated to be 12772.9 nurses in 2019, indicating that the current (12773 nurses) can be used to extrapolate future human resource trends. In 2020, there will be 13,041.07 nurses, and in 2030, there will be 16,156.6 nurses.

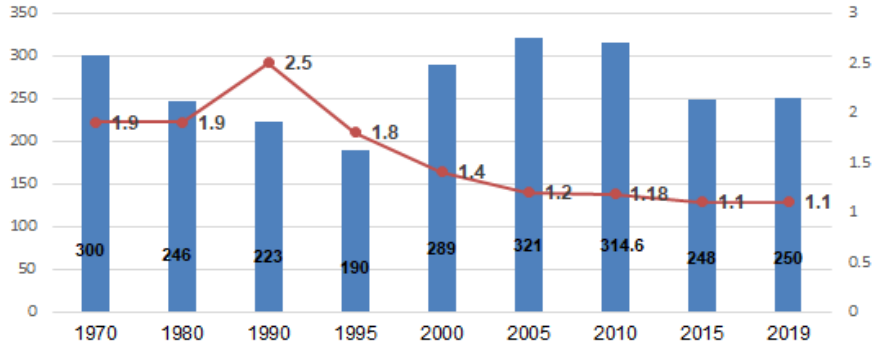

Fig.2. Population per nurse and doctor-nurse ratio

In 1985, there were 2.5 nurses per doctor, compared to 1.1 nurses per doctor in 2015, and the situation will remain the same in 2019. The highest number of nurses per 10,000 population was 52.6 in 1990, while the lowest was 31.1 in 2000, and the number of nurses decreased by 21.4.

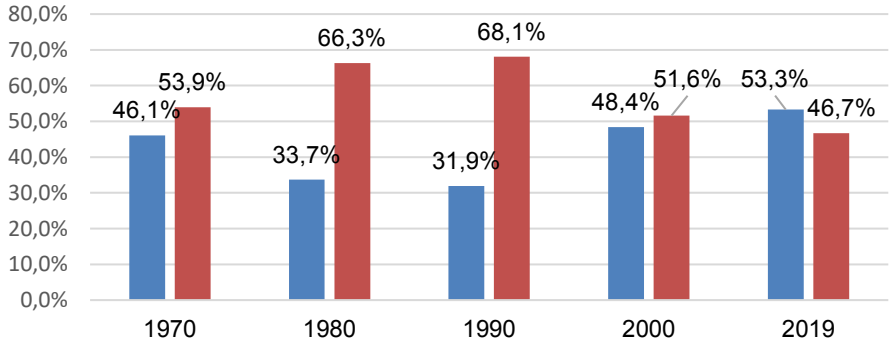

Fig.3. Trend of nurses decrease in rural area.

Summary of group discussion. In rural areas, nursing is influenced by many factors. These include: Increased wages and benefits in remote rural areas, adequate human resources to reduce workload and streamline job descriptions**,** focus on retraining, nurse training, program optimization at the local level, professional degrees and specialization, supply of tools and equipment**,** Improving the legal environment. In summarizing the findings of the study, there is a similar result of study, and the most pressing issues for nurses in the regions are salaries, workload, ABT, and improving the legal environment.

Table 2. Nurses' views on ways to address the issues:

№	Scope of the problem	Challenges	Proposed action
1	Work load	The workload of nurses working in rural areas is high	– Balancing workload, reducing nurse workload – Optimizing the nurse's work schedule – Reduce workload – Improving public perceptions and attitudes about nursing – Provide supportive management, understand and support nurses at the management level
2	Working conditions	The working environment and conditions of nurses working in rural areas are poor	– Improving the supply of modern tools and equipment – To ensure safe working conditions for nurses supply of disposable nursing equipment, – Addressing nursing social issues.
3	Training	Retraining of nurses working in rural areas is insufficient	– Systematic improvement of nursing education – Skills training, – Continuous development of nursing professionals – To train a large number of specialized nurses, – Stable operation
4	Human resources	Insufficient human resources	– Define human resource policy correctly, monitor implementation – Plan, develop and sustain human resources based on STD standards, – Increase the number of nurses at the local level, – Hiring nurses and paramedics. – Optimize the nurse-patient ratio. – Distribute and place newly graduated nurses in rural areas
5	Care standards	The implementation of STD standards is insufficient and the quality of STDs is poor in rural areas	– The nursing care system needs to be changed to ensure equal access – Improving compliance with STD standards – Need to develop home nursing – Training in teamwork skills – Improve monitoring of nurse performance – Ensuring the quality of STD refinement and development
6	Job evaluation	The evaluation of the work of nurses working in rural areas is unrealistic	– Optimize job descriptions – Change the salary chain, increase salaries, pay by education gap – Providing regional allowances – Provide real incentives – Improvement of job evaluation objectively optimize allocation

According to our survey, 40.7 percent of nurses working in rural areas are dissatisfied. 44.0 percent said that the workload of nurses working in rural areas was very high and 39.3 percent said that they were overworked. Underemployment, overwork, and increased overtime contribute to

dissatisfaction among nurses, and the survey found that most of their working hours (over 80.0 percent) were spent on injections. In rural areas, 49 percent of nurses said that their productivity was not realistically assessed, and 83.1 percent said that it was not enough.

Employee dissatisfaction and suicidal ideation are directly related to high turnover, and the lower the employee's level of satisfaction, the higher the risk of dismissal.

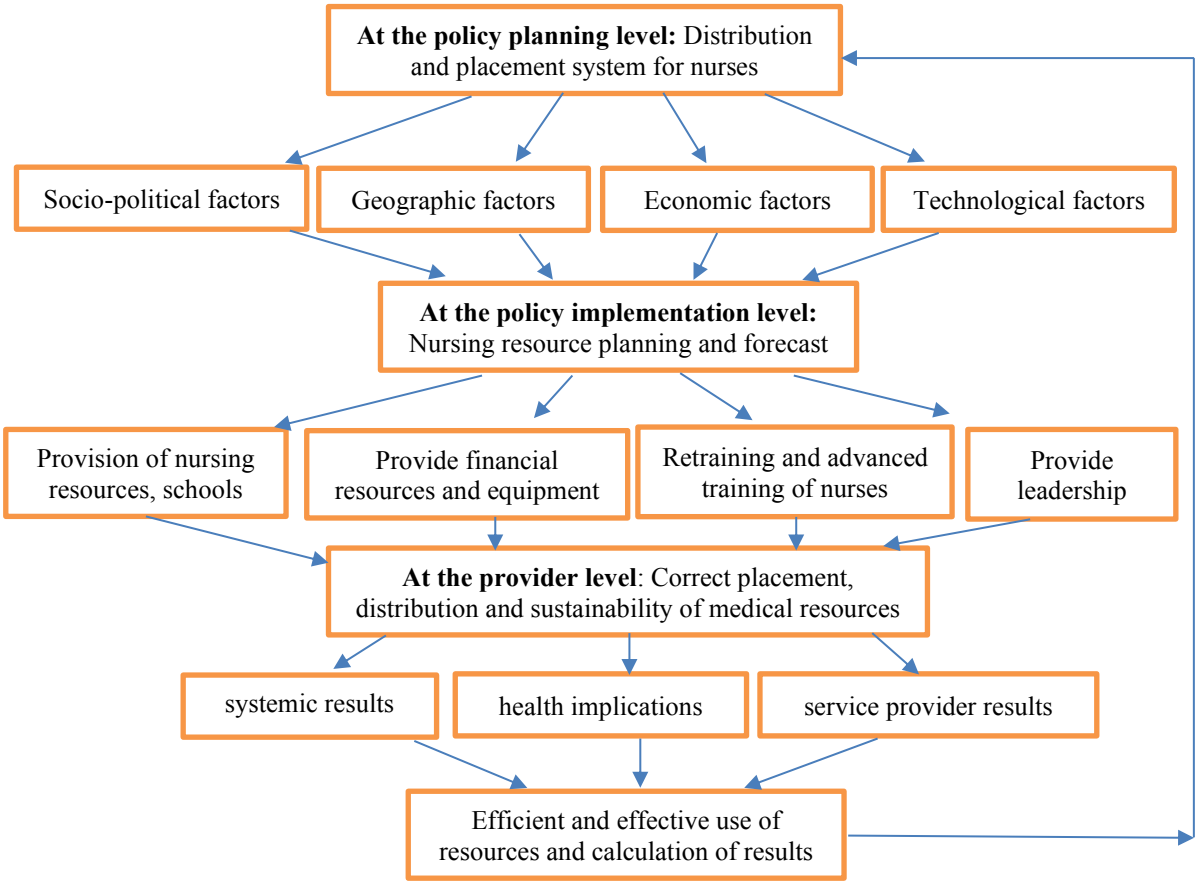

Fig.4. Types of nursing human resource placement systems

Based on the factual research, we have developed a system for allocating and allocating nursing resources, how political, socio-economic and technological factors affect it, forecasting the future of human resources, training a sufficient number of nurses, how to place and allocate them, stable employment and nursing care. A unified model has been developed to take into account the results of quality service delivery. The analysis of the implementation of the policy document shows that human resource policies and strategies are slow to be implemented, there is no analysis of the causes and effects to determine who is weak, there is no duplication of functions, and the parties do not know how to participate in cross-sectoral policy. Cooperation is weak and policies are not implemented from the top down.

Conclusions. There is a need for a policy to modernize Mongolia's nursing care in rural areas, and to allocate and retain nurses. Although the legal environment is in place, implementation has been slow and needs to be further improved. Nursing human resource growth is averaging 2.01 percent per year. The number of nurses working in rural areas has decreased by 21.4 percent over the last 19 years. There is a need to reflect cross-sectoral cooperation and the roles, activities and participation of policy stakeholders in the implementation of nursing human resource policy.

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PHARMACY

АНАЛІЗ ЕФЕКТИВНОСТІ ВИКОНАННЯ ЦЕНТРАЛІЗОВАНИХ ДЕРЖАВНИХ ПРОГРАМ ЗІ ЗАБЕЗПЕЧЕННЯ ХВОРИХ НА ЦУКРОВИЙ ДІАБЕТ ПРЕПАРАТАМИ В УКРАЇНІ

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Abstract. *В статті представлені результати аналізу рівня виконання держаних цільових програм зі забезпечення хворих на цукровий діабет необхідними ліками, а також оновленої редакції Реєстру лікарських засобів, що підлягають реімбурсації у відповідності до наказу МОЗ України від 11.08.2020 р. № 1851. Встановлено, що у 1998 р. була запроваджена в Україні перша цільова програм «Цукровий діабет» на 1998-2001 рр.. У подальшому, було розроблено та прийнято ще дві програми на 2002-2007 рр. та на 2009-2013 рр. Доведено, що рівень їх виконання за фінансовими показниками коливався у діапазоні значень від 81,6% (1999 р.) до 104,1% за даними 1998 р., а з 2004 р. (з 94,3% до 98,1%) до 2013 р. спостерігався відносно стабільний характер змін зазначеного показника.*
нання зазначених цільових програм. За результатами аналізу Реєстру лікарських засобів за асортиментом ліків, що відпускаються хворим на цукровий діабет за програмою «Доступні ліки» встановлено, що зазначений перелік містить 48 асортиментних позицій, серед яких 79,17% припадає на препарати А10ВА02-Метформіну, 14,58% на препарати А10ВВ09-Гліклазиду, а всього 6,25% на ліки із групи А10ВВ01-Глібенкламіду. Встановлено, що домінуючи позиції у зазначеному асортименті займають імпортні ліки (Глібенкламід –100,0%, Гліклазид – 57,14%,Метформін – 78,95%).Найбільш доступними є препарати Глібенкламіду. Лише дві асортиментні позиції препаратів можуть бути відпущені без доплати з боку пацієнта
Keywords: *цукровий діабет, централізовані державні програми, цукрознижуючи препарати, фармацевтичне забезпечення.*

Вступ. Цукровий діабет (ЦД) постає як тяжка патологія, що відноситься до значущих медико-соціальних проблем. Забезпечення хворих на ЦД ліками визнана у багатьох країнах як питання державного рівня виконання, а також воно є пріоритетом для різних національних систем охорони здоров'я [1, 2, 3]. Так, за даними Міжнародної діабетичної федерації (International Diabetes Federation – IDF) нині в світі налічується близько 250 млн хворих на ЦД, а у 2030 р. їх буде близько 320 млн, а за іншими даними –понад 530 млн [4, 5]. Якщо ж враховувати пацієнтів із порушеною толерантністю до глюкози, то зараз таких хворих у всьому світі налічується 480 млн, тобто кожен 8–10-й чоловік має порушену інкреторну функцію підшлункової залози [6-8]. Керуючих твердженням, що ЦД є поліморфною патологією, можна відповідальне стверджувати, що лікування цих хворих є високозатратним процесом у будь-якої із національних систем охорони здоров'я.

У 2007 р. Організація Об'єднаних Націй звернулася до усіх глав держав із закликом створювати державні програми та вирішувати цілу низку проблем, пов'язаних із поширенням ЦД. За даними Всесвітньої організації охорони здоров'я (ВООЗ), ЦД є одним із найбільш поширених серед неінфекційних захворювань, кількість хворих зростає у геометричній прогресії, а сама патологія характеризується високим ризиком виникнення ускладнень, таких як діабетична ретинопатія, нефропатія, діабетична стопа [4, 6, 8]. Крім того, кількість випадків інфаркту міокарда та інсульту у хворих на ЦД значно вища, ніж у середньому в популяції [9-11]. Все це призводить до інвалідізації та передчасної смертності таких хворих. У більшості країн світу

витрати, що пов'язані зі забезпечення хворих на ЦД ефективними препаратами та інсуліном бере на себе держава. Не виключенням із цього переліку країн є й Україна. З метою вирішення проблемі забезпечення хворих на ЦД ІІ типу в Україні з 01.04.2017 р. запрацювала урядова програма «Доступні ліки» [17, 18]. При цьому слід зазначити, що реалізація цієї програми була високо оцінені міжнародною спільнотою, а саме ВООЗ [19-20]. Це була не перша спроба держави вирішити питання підвищення рівня доступності препаратів, які використовуються хворими на ЦД. Враховуючи вже існуючий досвід реалізації комплексу заходів, які спрямовані на підвищення рівня ефективності фармацевтичного забезпечення хворих на ЦД актуальним є проведення аналізу рівня виконання фінансових зобов'язань, які бере на держава у напрямку забезпечення хворих на ЦД доступними та ефективними препаратами.

Мета дослідження – аналіз ефективності виконання централізованих державних заходів із забезпечення хворих на цукровий діабет необхідними препаратами у ретроспективі років.

Матеріали та методи дослідження. Для досягнення окресленої мети нами були розроблені наступні завдання досліджень: проаналізувати епідеміологічну ситуацію з ЦД у світі та в Україні; здійснити аналіз комплекс заходів, що спрямовані на забезпечення хворих на ЦД необхідними препаратами у ретроспективі років в Україні; оцінити рівень виконання зазначених програм за обсягами фінансування по рокам дослідження; окреслити основні характеристики процесу фінансового забезпечення у виконанні державних програм зі забезпечення хворих на ЦД необхідними препаратами; визначити проблеми у реалізації державних гарантій з надання хворим на цукровий діабет ефективної фармацевтичної допомоги.

Об'єктом досліджень став процес надання хворим на ЦД ефективної медичної допомоги та фармацевтичного їх забезпечення у рамках виконання відповідних державних гарантій за централізованими цільовими програмами.

Предметам досліджень були обрані: показники поширеності та захворюваності населення від ЦД в світі та в Україні; дані вітчизняної законодавчої та нормативно-правової бази, що регулює питання організації надання хворим на ЦД ефективної медичної та фармацевтичної допомоги, паспорти державних цільових програм по ЦД (програми за 1998-2001 рр., 2002-2007 рр., 2009-2013 рр.) за обсягами фінансування та рівням виконання державних гарантів зі забезпечення хворих на ЦД препаратами інсуліну та цукрознижуючими ЛП. Крім цього, у дослідженнях використовувалися дані аналітичної системи дослідження фармацевтичного ринку (ФР) «PharmXplorer»/«Фармстандарт» (компанія «Proxima Research») [17,18].

Всі необхідні показники оброблялись за допомогою стандартного пакету статистичного аналізу Statistica *(*version 12.0*,* StatSoft*,* Tulsa, USA). В статистичних розрахунках значення $p < 0,05$ вважалось статистично значущим.

У дослідженнях використовувалися системний підхід, а також історичний, логічний, порівняльний, графічний та математико-статистичні методи прикладних досліджень.

Результати та обговорення. За даними ВООЗ, в економічно розвинутих країнах світу до 4,0%-6,0% населення хворіє на ЦД [12-14]. В Європі питома вага (%) таких хворих становить близько 4,0% [5, 12]. Визначаючи загрозу, яку становить для людства ЦД, Генеральна Асамблея ООН прийняла 20 грудня 2006 р. «Резолюцію про цукровий діабет», відповідно до якої витрати, пов'язані з наданням медичної допомоги хворим, оцінюються більш, як у 2,0%-3,0% від загальних видатків з охорони здоров'я. Майже 80,0% припадає на лікування ускладнень, а 20,0% – на закупівлю цукрознижувальних препаратів і засобів контролю за рівням цукро в крові пацієнта [6, 9, 15, 16]. В Україні зареєстровано близько 1 млн 300 тисяч хворих на ЦД і щорічно реєструють більше 100 тисяч нових випадків. Фахівці відмічають, що з кожним зареєстрованим існує 2-2,5 недіагностованих хворих [6,7].

Україна займається вирішенням проблем організації ефективної медичної та фармацевтичної допомоги хворим на ЦД ще з 1999 р. Так, у зазначеному році указом Президента України була започаткована перша програма заходів по боротьбі із ЦД в Україні. Одним із ключових питань, яке було у цій програмі, це організація безкоштовного забезпечення хворих високоякісними інсулінами вітчизняного виробництва. На даний час в України зазначене питання вирішено, працюють два заводи – «Індар» і «Фармак», а держава щороку виділяє близько 500 млн грн. на закупівлю інсулінів.

Для хворих ЦД з квітня 2017 р. запрацювала урядова програма «Доступні ліки», яка передбачає реімбурсацію вартості споживання цукрознижуючих препаратів Метформін (Metformin), Гліклазид (Gliclazide), Глібенкламід (Glibenclamidum) [17, 18]. Держава компенсує вартість найдешевшого лікарського засобу (ЛЗ), який подав заявку на участь у зазначеній

програмі. Такий препарат пацієнт матиме змогу отримати в аптеках безоплатно. Дорожчий препарат, ціна на який не перевищує граничну референтну, хворих на ЦД може отримати, доплативши різницю між мінімальною ціною та роздрібною ціною обраного найменування препарату. Ліки, ціна на які перевищує референтну ціну в 5 сусідніх країнах, не підпадають під програму відшкодування [17-20]. Також наявність препарату у програмі залежить від рішення про його участь від виробника – він має подати заявку для включення свого препарату до Реєстру ЛЗ, що підлягають реімбурсації.

Аналізуючи зміст усіх зазначених державних програм по боротьбі із ЦД в Україні можна стверджувати, що всі вони були розроблені та впроваджувалися з метою створення дієвої системи доступної медичної та фармацевтичної допомоги пацієнтам з ЦД та його ускладненнями.

Використовуючи дані, які представлені на офіційних сайтах МОЗ України нами було проаналізовано стан виконання державних гарантій з організації забезпечення хворих на цукровий діабет ЛЗ. Так, нами були досліджені дані паспортів комплексних програм «Цукровий діабет» за 1998-2001 рр. (Указ Президента від 21.05.99 р. № 545/99), державної цільової програми «Цукровий діабет» на 2002-2007 рр. та 2009-2013 рр. (постанова КМУ від 19.08.2009 р. №877). Результати аналізу рівня (%) виконання фінансових зобов'язань за означеними державними цільовими програмами у ретроспективі років наведені на рис.1 та 2.

Фінансування державних гарантій за програмою «Цукровий діабет» здійснюється у переважній більшості за рахунок місцевих бюджетів адміністративно-територіальної одиниць країни [19, 20]. Особливо це стосується фінансування фармацевтичної складової у вигляді організації та проведення тендерів на закупівлю інсулінів на рівні адміністративно-територіальних одиниць країни.

Рис.1. Аналіз рівня виконання державних гарантій зі забезпечення хворих на ЦД інсуліном та цукрознижуючими препаратами за цільовими програмами (центральний та місцевий бюджет) упродовж 1998-2013 рр.

Як бачимо за даними рисунків рівень (%) виконання програм, які досліджуються коливався у діапазоні значень від 81,6% (1999 р.) до 104, 1% за даними 1998 р.. Звертає на себе увагу наявність більш стабільного характеру зміни показників рівня (%) виконання державних гарантій з 2004 р. (з 94,3% до 98,1%) до 2013 р. Таким чином, можна констатувати, що упродовж 1998-2013 рр. держава на досить високому фінансовому рівні виконували взяті на себе зобов'язання стосовно забезпечення хворих на ЦД як інсулінами, так й препаратами цукрознижуючої дії.

Важливим напрямком вирішення питань підвищення рівня ефективності медичного та фармацевтичного забезпечення зазначеної групи хворих стало впровадження урядової програми «Доступні ліки». Так, спочатку до складу Реєстру ЛЗ, які підлягають реімбурсації за рахунок держаних коштів було віднесено два препарату за міжнародними непатентованими назвами (МНН). Це A10BA02-Метформін (Metformin), та A10BB09-Гліклазид (Gliclazide). У подальшому був також включений A10BB01-Глібенкламід (Glibenclamide). Як свідчать дані системи дослідження вітчизняного фармацевтичного ринку (ФР) «PharmXplorer»/«Фармстандарт» компанії «Proxima Research» споживання торгових найменувань (ТН) препаратів цих 3-х ліків за МНН в останні роки збільшилось [17, 18]. Зазначений факт є важливою позитивною характеристикою процесу підвищення рівня економічної доступності ЛЗ для хронічних хворих, насамперед тих, хто страждає від ЦД II типу.

12.08.2020 р. на офіційному сайті МОЗ був оприлюднений наказ від 11.08.2020 р. № 1851 [21]. У відповідності до цього наказу була затверджена нова редакція Реєстр ЛЗ, які підлягають реімбурсації, станом на 07.08.2020 р. (у подальшому Реєстр ЛЗ). Нормою, яка була прописана у зазначеному документі було встановлено факт втрати чинності наказу МОЗ від 01.06.2020 р. № 1284, яким затверджувався попередній Реєстр ЛЗ. За результатами аналізу

оновленої редакції Реєстру ЛЗ за асортиментом ліків, що відпускаються хворим на ЦД за програмою «Доступні ліки» встановлено, що зазначений перелік містить 48 асортиментних позицій, серед яких 79,17% припадає на препарати А10ВА02-Метформіну, 14,58% на препарати А10ВВ09-Гліклазиду, а всього 6,25% на ліки із групи А10ВВ01-Глібенкламіду.

Рис.2. Аналіз динаміки фінансування та використання коштів центрального та місцевих бюджетів за відповідними заходами за програмою «Цукровий діабет» у 2005-2009 рр.

Встановлено, що співвідношення (%) між вітчизняними та імпортними ліками у сукупності препаратів А10ВВ01-Глібенкламіду дорівнює 100,0%:0% (компанії ПрАТ «Технолог», ТОВ «Фармацевтична компанія «Здоров'я АТ «Фармак»), по групі А10ВВ09 Гліклазиду – 57,14%:42,86%, а по препаратах А10ВА02 Метформіну – 78,95%:21,05%. За даними аналізу рівня доплати за переліком ліків, що досліджується встановлено, що найбільш доступними, з економічної точки зору для вітчизняних хворих на ЦД II типу є препарати А10ВВ01Глібенкламіду, на другій позиції представлені препарати А10ВВ09 Гліклазиду, а на третій А10ВА02 Метформіну. Співвідношення (%) між кількістю ТН які можуть бути відпущені без доплати та з доплатою з боку хворого дорівнює 100,0%:0,0%, 57,14%:42,86%, 78,95%:21,05% відповідно.

Доведено, що із асортименту імпортних ліків лише 2 асортименті позиції препаратів можуть бути відпущені без доплати з боку пацієнта. Це Метформін САНДОЗ® 500 мг (оптова-відпускна ціна 48,26 грн, а роздрібна – 65,32 грн) та 850 мг (оптова-відпускна ціна 82,04 грн, а роздрібна – 111,04 грн) №120 компанії Лек С. А. (Республіка Польща).

Підсумовуючи результати проведених досліджень можна стверджувати, що за умов підвищення показників захворюваності та поширеності ЦД серед населення країни та враховуючи обмежений характер ресурсного забезпечення національної системи охорони здоров'я важливим напрямком підвищення ефективності медичного та фармацевтичного забезпечення зазначених груп хворих повинно стати впровадження раціональних моделей використання коштів державного та місцевого бюджету.

Висновки.

1. Доведено, що реалізація централізованих та цільових програм забезпечення хворих на ЦД необхідними ліками значена програмам є важливою складової процесу реформування всієї національної системи охорони здоров'я в Україні. У 2019 р. ВООЗ високо оцінила ефективність реалізації урядової програми «Доступні ліки», особливо у напрямку підвищення рівня економічної доступності ЛЗ для хворих на серцево-судинні патології та ЦД II типу.
2. За даними ретроспективного аналізу встановлено, що Україна розпочала боротьбу з ЦД ще с моменту проголошення своєї незалежності, а у 1998 р. була запроваджена перша цільова програм «Цукровий діабет» на 1998-2001 рр.. У подальшому, було розроблено та прийнято ще дві програми на 2002-2007 рр. та на 2009-2013 рр.. За означеними програмами хворі на ЦД забезпечувалися безкоштовно препаратами інсуліну та цукрознижуючими ліками.
3. За результатами дослідження вищезазначених цільових програм встановлено, що рівень їх виконання за фінансовими показниками коливався у діапазоні значень від 81,6% (1999 р.) до 104,1% за даними 1998 р.. Крім цього нами доведено, що з 2004 р. (з 94,3% до 98,1%) до 2013 р. спостерігався відносно стабільний характер змін показника рівня (%) виконання цільових програм по «Цукровому діабету» в Україні.
4. За результатами аналізу Реєстру ЛЗ за асортиментом ліків, що відпускаються хворим на ЦД за програмою «Доступні ліки» встановлено, що зазначений перелік містить 48 асортиментних позицій, серед яких 79,17% припадає на препарати А10ВА02-Метформіну, 14,58% на препарати А10ВВ09-Гліклазиду, а всього 6,25% на ліки із групи А10ВВ01-Глібенкламіду.

5. Встановлено, що співвідношення (%) між вітчизняними та імпортними ліками у сукупності препаратів A10BB01-Глібенкламіду дорівнює 100,0%:0% (компанії ПрАТ «Технолог», ТОВ «Фармацевтична компанія «Здоров'я АТ «Фармак»), по групі A10BB09 Гліклазиду – 57,14%:42,86%, а по препаратах A10BA02 Метформіну – 78,95%:21,05%.

6. За даними аналізу рівня доплати за переліком ліків, що досліджується встановлено, що найбільш доступними, з економічної точки зору для вітчизняних хворих на ЦД II типу є препарати A10BB01Глібенкламіду, на другій позиції представлені препарати A10BB09 Гліклазиду, а на третій A10BA02 Метформіну. Співвідношення (%) між кількістю ТН які можуть бути відпущені без доплати та з доплатою з боку хворого дорівнює 100,0%:0,0%, 57,14%:42,86%, 78,95%:21,05% відповідно. Доведено, що із асортименту імпортних ліків лише 2 асортименті позиції препаратів можуть бути відпущені без доплати з боку пацієнта.

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