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BOTANY

ANTIOXIDANT, ANTIMICROBIAL AND ANTIVIRAL PROPERTIES OF SOME PLANTS USED IN TRADITIONAL MEDICINE

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Abstract

In recent years, there has been a growing trend towards the increased utilization of herbal materials over synthetic or chemical drugs due to the comparatively milder side effects associated with past antibiotics. The application of herbs can take the form of plant extracts or their active constituents. Moreover, a significant portion of the global population has historically relied on herbal materials, owing to their potent antimicrobial properties and fundamental advantages for primary healthcare. The focus of this paper is to underscore the antibacterial, antiviral, and antioxidant attributes inherent in herbal materials. Various herbal antimicrobial agents are delineated in this review, encompassing clove, portulaca, cinnamon, turmeric, ginger, thyme, pennyroyal, mint, fennel, chamomile, burdock, lemon balm, mallow, and garlic, all of which are succinctly summarized.

Keywords: antioxidant, antimicrobial, antiviral, medicinal plants, traditional medicine.

The utilization of botanical substances as therapeutic botanicals encompasses various botanical species. Numerous botanical substances exhibit medicinal properties, including antioxidant, anticancer, anti-inflammatory, antimicrobial, and antiviral effects. While antimicrobial agents serve as antibiotics to manage infections within the human body, they may induce adverse reactions, particularly by augmenting reactive oxygen species levels [1]. Botanical remedies play a fundamental role in addressing infections in certain developing nations. Diverse investigations have highlighted the role of various botanical remedies as reservoirs of multiple compounds, many of which demonstrate radical scavenging abilities and antimicrobial characteristics, thereby fortifying the human body against pathogens and oxidative processes. Consequently, these substances play a crucial role in formulating various botanical treatments due to their antimicrobial, antiviral, and antioxidant capabilities [2, 3, 4]. An antimicrobial agent or medicine is defined as a substance that can eradicate microorganisms or impede their proliferation. The classification of antimicrobial medications is based on their target microorganisms, such as bacteria and viruses.

Botanical antimicrobial agents, for instance, clove, portulaca, cinnamon, turmeric, ginger, thyme, pennyroyal, mint, fennel, chamomile, burdock, lemon balm, mallows, and garlic, possess the ability to function as scavengers of free radicals, thereby obstructing reactive oxygen species generation. The list of vital botanical substances with their primary components is presented in ***Table 1.***

Table 1.

The list of herbal medicinal herbs

Medicinal plants	Main compounds
Clove	Eugenol, eugenyl acetate,α-humulene, 2-heptanone, and β-caryophyllene
Portulaca	Ascorbic acid, a-tocopherols, omega-3 fatty acids, apigenin, gallotannins, quercetin, and kaempferol
Cinnamon	Cinnamaldehyde and eugenol
Turmeric	Vitamin-C, cineole, tumerone, borneol, zingiberene, d-sabinene and d-phellandrene
Ginger	Phenolic acids, gingerols, paradols and shogaols
Thyme	Carvacrol, thymol and phenols
Fennel	Phenolic compounds
Pennyrile	Neo-menthol, pulegone and menthone
Chamomile	Flavonoids, terpenoids, phenolic compounds, apigenin and matricin
Mint	Phenolic compounds
Burdock	Caffeic acid, rutin, o-hydrobenzoic acid, chlorogenic acid and p-coumaric acid
Lemon balm	Phenolic componds such as thymol and carvacrol
Garlic	Organosulfur such as allicin, phenolic and polysaccharides compounds
Malva	β-carotene, flavonoids, vitamin E, polyphenols and vitamin C

Clove or *Syzygium aromaticum*, belonging to the Myrtaceae family, is renowned for its notable antimicrobial and antioxidant characteristics. By virtue of its bioactive constituents such as eugenol, eugenyl acetate, α-humulene, 2-heptanone, and β-caryophyllene, clove exhibits a wide array of pharmacological properties encompassing antimicrobial, antioxidant, anti-inflammatory, antimutagenic, anticancer, and anti-allergic effects. The presence of these bioactive elements endows clove with a remarkable antioxidant capacity, surpassing that of many other herbal remedies. Previous research has highlighted the substantial antibacterial efficacy of clove oil and extract against various bacterial strains, including both Gram-positive and Gram-negative types. Particularly, clove, through the action of eugenol, exerts antimicrobial effects. Furthermore, a study has demonstrated the antioxidant prowess of eugenol in clove extract against DPPH, ABTS, and superoxide radicals [6].

Portulaca oleracea is a traditional herb renowned for its remarkable antimicrobial and antioxidant properties. The predominant biomedicine activity of this plant stems from its potent antioxidant effects. These effects are predominantly attributed to various components found in portulaca, such as ascorbic acid, a-tocopherols, omega-3 fatty acids, apigenin, gallotannins, quercetin, and kaempferol. Omega-3 fatty acids, in particular, play a key role in the antioxidant activity of portulaca. Numerous studies have demonstrated the efficacy of this plant in combating various bacteria and fungi, underscoring its antimicrobial effects. The antioxidant and antimicrobial prowess of this medicinal herb can be attributed to its chemical composition, which includes phenolic compounds [5, 7].

Cinnamomum verum and *Cinnamomum zeylanicum*, is a member of the *Lauraceae* family. Due to its antioxidant, antimicrobial, and anticarcinogenic properties, it finds extensive application in pharmaceutical sectors. The traditional usage of cinnamon revolves around its antiseptic, antioxidant, and antimicrobial characteristics. The presence of phenolic compounds in cinnamon contributes to its potential antioxidant, antimutagenic, antidiabetic, anticancer, and anti-inflammatory attributes. The essential oil derived from this plant has demonstrated notable antioxidant properties. Furthermore, investigations have highlighted the antioxidant potentials of water, methanol, and ethanolic extracts of cinnamon. Notably, this plant exhibits significant anti-influenza virus activity [8, 9].

Curcuma longa is a botanical remedy traditionally utilized, belonging to the *Zingiberaceae* family. The presence of curcumin, a polyphenolic compound, in turmeric extracts has exhibited both antimicrobial and antioxidant properties. As a result, the antioxidant capabilities of turmeric can be attributed to the phenolic compound curcumin. Turmeric contains various phytochemical structures such as vitamin C, cineole, tumerone, borneol, zingiberene, d-sabinene, and d-phellandrene. Within turmeric, a variety of chemical compounds are identified, including sesquiterpene ketones, monoterpenes, and sesquiterpene alcohols. Zingiberene is found in fresh turmeric, with curcumin being the most prominent curcuminoid in this plant. Past studies have documented the antimicrobial effects of turmeric. Research indicates the antiviral potential of turmeric against the HIV virus [10].

Ginger, which is the underground rhizome of *Zingiber officinale* roscoe and herbaceous perennial plants, is considered a fundamental herbal medicinal plant within the Zingiberaceae family. Originating in Asia, ginger has been utilized for medicinal purposes for over two millennia globally. It boasts polyphenol components, such as phenolic acids, gingerols, paradols, and shogaols, which play a crucial role in various biological activities including antioxidant, antidiabetic, antimicrobial, renoprotective, antihypertensive, antiulcer, anti-inflammatory, cardiovascular, analgesic, and gastrointestinal effects. The antioxidant properties of ginger are attributed to its chemical compounds like zingiberene, zingerone, shogaols, and gingerols. Numerous in vivo and in vitro laboratory experiments have investigated the antioxidant activities of ginger and its constituents, with some studies highlighting the potential antioxidant effects of ginger extract. Research on rats has specifically shown the antioxidant impact of ginger extract. Furthermore, studies have evidenced the antiviral efficacy of ginger against the influenza virus [11, 12].

Thymus vulgaris is considered one of the active antimicrobial herbal medicinal plants within the Lamiaceae family. This robust antimicrobial potency can be attributed to the substantial concentrations of carvacrol, thymol, and phenols present in thyme extracts and essential oils. Thyme extracts and essential oil exhibit a wide array of medicinal properties, encompassing antibacterial, antioxidant, antitussive, spasmolytic, anticancer and anti-inflammatory attributes. Traditionally, the extract from this plant has been utilized as an antitumor remedy due to its antioxidative characteristics [13].

Mentha pulegium represents one of the fragrant botanicals affiliated with the Lamiaceae family. The herb has been traditionally utilized in medicine for various purposes including skincare, aromatherapy and cosmetic applications due to its notable antioxidant and antimicrobial properties. Recent studies have shed light on the antioxidant characteristics of pennyroyal extracts and essential oils, emphasizing the chemical composition of this botanical specimen. The key bioactive elements found in pennyroyal extracts and essential oils are phenols, while its antimicrobial efficacy can be attributed to the presence of neo-menthol, pulegone, and menthone. Notably, this herbal remedy exhibits potent inhibitory effects against herpes virus and influenza virus [14].

Foeniculum vulgare is a member of the Apiaceae family. Various research endeavors have been conducted to investigate the radical scavenging capabilities of fennel, shedding light on its antioxidant properties. These investigations have elucidated that the high phenolic content present in fennel extracts contributes significantly to its antioxidant capacity. The efficacy of fennel in terms of antioxidant activity has been well-documented, with its extract being attributed to a multitude of antioxidant mechanisms including free radical scavenging, superoxide anion radical scavenging, total antioxidant, and hydrogen peroxide scavenging. As a result, fennel extracts and essential oils have the potential to serve as valuable natural sources for the development of innovative antimicrobial agents. Notably, fennel has exhibited inhibitory effects against the influenza A virus, further highlighting its pharmacological potential [15].

Chamomile, scientifically known as *Matricaria chamomilla*, represents a conventional form of botanical remedies. Belonging to the plant family Asteraceae, Chamomile continues to find applications in diverse sectors of the medical field, including pharmaceutical and cosmetic industries. The potent antimicrobial and antioxidant capabilities attributed to Chamomile can be primarily linked to the presence of flavonoids within its extract. Various pharmacological activities have been observed in Chamomile, encompassing antioxidative, antibacterial, anti-inflammatory, antifungal, analgesic, anticancer, anti-hypoglycemic, anti-stress, antihypertensive, and hepatoprotective properties [16].

Mentha piperitha, is a perennial herb from the Lamiaceae family that is renowned for its aromatic properties. Its diverse uses encompass pharmaceuticals and cosmetics applications. Studies have demonstrated that mint essential oil can serve as a valuable short-term remedy for irritable bowel syndrome in individuals, attributed to its anti-inflammatory properties. Furthermore, this natural remedy exhibits inhibitory effects against HSV-1 and HIV viruses [17, 18].

Arctium lappa or budrock is a widely used traditional medicinal plant belonging to the Asteraceae family. Due to its phenolic rich compounds, burdock exhibits antimicrobial and antioxidant properties, along with other biochemical activities such as antipyresis and detoxification. Consequently, this plant can serve as an antioxidant, antimicrobial, and anti-inflammatory agent. Research has highlighted the antioxidant potential of burdock. Generally, burdock extracts have shown significant antimicrobial and antioxidant activities. These properties are attributed to the combined effects of caffeic acid, rutin, o-hydroxybenzoic acid, chlorogenic acid, and p-coumaric acid found in the extracts. Burdock leaves, in particular, display strong antimicrobial activity [19].

Lemon balm or *Melissa officinalis* is a traditional herbal medicine from the Laminaceae family. The extracts and essential oils of lemon balm possess various pharmacological effects, including antimicrobial, anticancer, antibacterial, cardiovascular protection, antioxidant, anti-inflammatory, antispasmodic, and antiviral properties. Rich in phenolic compounds such as thymol and carvacrol, lemon balm's antibacterial and antioxidant activities are notable [20].

Malva sylvestris a medicinal herb belonging to the Malvaceae family. This plant's extract is rich in phenolic content and has notable antimicrobial properties. Over the past decade, mallow extract has been applied medicinally due to its beneficial effects on various bodily systems, including the skin, muscular and skeletal systems, and respiratory and digestive systems. Mallow exhibits spasmolytic, lenitive, laxative, diuretic, demulcent, anti-diarrheal, bronchodilator, expectorant, and antitussive properties. Its high antimicrobial and antioxidant activities make it particularly recommended for skincare. These properties are linked to its chemical constituents, such as β-carotene, flavonoids, vitamin E, polyphenols, and vitamin C. The primary reason for mallow's excellent antioxidant and antimicrobial capabilities is its polyphenol content. Consequently, both alcoholic and aqueous extracts of mallow exhibit pharmacological effects, including antiviral, anti-inflammatory, antibacterial, and anti-carcinogenic properties [21].

Allium sativum an herbal medicine from the *Amaryllidaceae* family. Garlic is known for its biological activities, including antioxidant, immunomodulatory, antidiabetic, anticancer, antibacterial, cardioprotective, and anti-inflammatory effects. Its major components include phenolic compounds, polysaccharides, and organosulfur compounds, along with saponins, amino acids, flavonoids, vitamins A and C, B-complex vitamins, and minerals. As a natural antioxidant, garlic helps inhibit the harmful effects of free radicals in cells. It is recognized for its antimicrobial and antioxidant characteristics in traditional medicine. The antioxidant properties of garlic are attributed to its chemical components, including organosulfur and phenolic compounds. Amino acids like alliin are significant components of garlic. The enzyme alliinase converts alliin into allicin, a key component responsible for garlic's antimicrobial activity [22].

Numerous researchers have highlighted the biomedical uses of herbal medicines. While antibiotics and other chemical antimicrobial agents, including metal oxides and nanoparticles, can inhibit bacterial growth, they often generate reactive oxygen species and other side effects. In contrast, herbal medicines like clove, portulaca, cinnamon, turmeric, ginger, thyme, pennyroyal, mint, fennel, chamomile, burdock, lemon balm, mallow, and garlic can eliminate bacteria by acting as free radical scavengers. The antibacterial efficacy of these herbs varies across different bacteria and depends on the type of extract or essential oil used. Some studies have explored the advantages and limitations of nanofibrous dressings, which have a large surface area and can locally release antibiotics, herbal medicines, and antibacterial agents to treat infections. The phenolic compounds in the extracts or essential oils of these herbs typically exhibit strong antioxidant and antimicrobial properties. Therefore, herbal medicines are often preferred over synthetic antimicrobial agents due to their lower toxicity and fewer side effects. Given their potent antimicrobial and antioxidant properties, these herbs can aid in healing various types of wounds.

Bioavailability is a crucial factor in assessing the health benefits of herbal medicines for humans. This paper thoroughly discusses the antioxidant, antimicrobial, and antiviral properties of individual herbs. The use of herb combinations is also common in traditional medicine. Future research should focus on identifying active components and studying the effects of herb-herb combinations for therapeutic advancements and pharmaceutical development.

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CHEMISTRY

NEW RECYCLING AND UTILIZATION ROUTE FOR NYLON 6,6 WASTE PLASTIC THROUGH THERMOCHEMICAL CdS NANOPARTICLE DEPOSITION

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Abstract

Nylon 6,6 is a thermoplastic material that is used in the production of a wide variety of useful things from synthetic fibers and packaging substances to cable ties and films, etc. Due to the high amount of production and application it causes danger to the environment with accumulation in nature. The solution to the problem is the utilization of its wastes. Nylon 6,6 based plastic waste materials were used in this work as the matrix for the synthesis of the CdS nanoparticles in order to get a new advanced polymer nanocomposite with unique properties and to find novel utilization for the waste plastics. Cadmium chloride and sodium sulfide were used as the raw materials to synthesize the CdS nanoparticles through the thermochemical method. The obtained nanocomposite was characterized using FTIR, UV-vis., X-ray diffraction, and SEM techniques to get information about the formation of nanoparticles within the polymer matrix. The obtained results confirm the formation of nanoparticles and give information about their mean size. UV-Vis spectroscopy revealed that the obtained nanostructures are appropriate base materials for making optical and semiconductor devices. The novelty of this work is the introduction of the new approach for the recycling and utilization of the Nylon 6,6 based plastic wastes and their first-time use as a matrix for CdS nanoparticle synthesis through the thermochemical method.

Keywords: Nylon, cadmium sulfide, recycling, utilization, polymer nanocomposites.

Introduction

The semiconductor nanoparticles have received considerable attention from the scientific community due to their interesting size effects and a wide range of potential applications. CdS is a semiconductor with a band gap of 2.42 eV and it finds applications in the production of phosphors, solar cells, sensors, light-emitting diodes, photocatalyst materials, and lasers. They can be synthesized by different methods like the sol-gel process, gamma-irradiation method, electrochemical method, hydrothermal or solvothermal method, microemulsion, microwave, thermal evaporation, and the ultrasonic method [1-3].

The large surface-to-volume ratio of nanomaterials often results in aggregation, which can prevent their application. Various polymers, glasses, ceramics, and organic capping agents are used to overcome this problem by improving the stability of nanocrystals and reducing the surface defects [2,3].

Nylon 6,6 is polyamide that is used in the production of strong and stiff synthetic fibers, packaging substances, cable ties, as well as films, etc. This polymer material is thermoplastic which makes it available for recycling, but the high amount of production and application cause danger to the environment. The incineration process decreases the amount of natural raw material and needs high energy. The minimization of the Nylon wastes can reduce their environmental impacts. The solution to the problem can be found through the utilization of the Nylon wastes.

In this paper, we introduce using the Nylon 6,6 based plastic wastes as the matrices for the synthesis of the CdS nanoparticles and obtaining new polymer nanocomposites with useful properties. The origin of the used polymer is Nylon 6,6 cable tie waste. The Naylon 6,6 based polymer powders obtained from the cable tie wastes were used as the matrix in order to synthesize CdS nanoparticles. Then the obtained Nylon/CdS polymer nanocomposite was investigated by different investigation techniques.

The novelty of this work is the introduction of the new approach for the recycling and utilization of the Nylon 6,6 based plastic wastes and their first-time use as a matrix for CdS nanoparticle synthesis through the thermochemical method. We aim (a) to explore the applicability of this new polymer matrix for CdS nanoparticle synthesis through the thermochemical method and (b) to investigate the influence of the CdS nanocrystals on the properties of the polymer matrix. The anticipated benefit of the Nylon 6,6/CdS nanocomposite is its applicability in solar cell and semiconductor fabrication.

Materials and methods

Preparation of matrix from nylon 6,6 based waste

The polymer matrix was prepared using Nylon 6,6 based pigment-free cable tie wastes. The cable ties were first washed, dried, mechanically ground with kitchen grinder and passed through a sieve to obtain the uniform polymer powders. Then, the polymer powder was sonicated under 35 kHz condition for 15 minutes to reduce its grain size, and also to get the pores and active parts inside the polymer grains. The obtained finer polymer powder was washed several times, filtered through a membrane filter (pore size=0.45μm), and dried under atmospheric conditions.

Thermochemical synthesis of the CdS nanoparticles within the nylon 6,6 matrix

0.1 M aqueous solution of $CdCl_2 \cdot 2.5H_2O$ was prepared using double-distilled water in a 50 ml volumetric flask. Then this solution was transferred to a 250 ml three-neck round-bottom flask and 2 grams of previously prepared Nylon 6,6 fine powder was added to it. The flask was connected to a reflux condenser and placed in a water bath. The temperature was gradually raised to 90ºC and the process was continued with stirring for 4 hours. After the completion, the mixture was gradually cooled in air, filtered through a membrane filter (pore size=0.45μm) in a Büchner funnel, washed several times with double-distilled water to remove the unreacted chemicals, transferred to a Petri dish, and dried under atmospheric conditions.

Then 0.1 M aqueous solution of $Na_2S \cdot 9H_2O$ was prepared using double-distilled water in a 50 ml volumetric flask and transferred to a 250 ml three-neck round-bottom flask. The previously prepared Nylon6,6/Cd_2^+ intermediate structure was added to the as-prepared solution of the sulfuration agent in the flask. The flask was connected to a reflux condenser and placed in a water bath again. The temperature was gradually raised to 90ºC and the process was continued with stirring for 2 hours. After the completion, the mixture was gradually cooled in air, filtered through a membrane filter (pore size=0.45μm) in a Büchner funnel, washed several times with double-distilled water to remove the unreacted chemicals, transferred to a Petri dish, and dried under atmospheric conditions.

The obtained polymer nanocomposite (Nylon 6,6/CdS) was prepared for an investigation by various instrumental techniques.

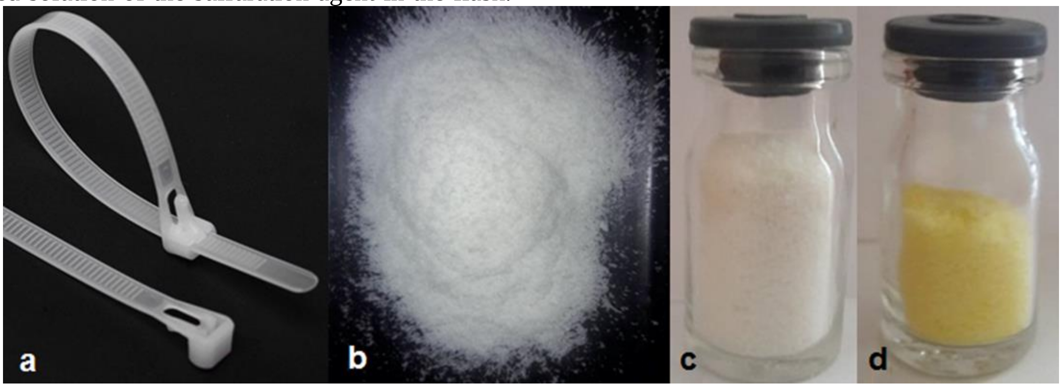

Figure 1. The image of the Nylon 6,6 based waste cable tie (a), the powder obtained from that (b,c), and the Nylon 6,6/CdS nanocomposite.

As shown in Figure 1, the white color turns yellow through the process which is the proof of the formation of CdS nanoparticles within the Nylon 6,6 polymer matrix.

Characterization

All the chemicals used in the synthesis of the CdS nanoparticles were of analytical reagent grades. The raw materials were purified before use by recrystallization. Double-distilled water was used as the solvent in all stages of the process. All experiments were conducted under an air atmosphere. The SEM, FTIR, XRD, and UV-vis. spectroscopy techniques were used to characterize the obtained nanostructures. VARIAN 3600 spectrophotometer was used to get the FTIR spectra of the samples ground in the KBr pellet. UV-vis. results for fine powder samples were taken using an integrating sphere by SPECORD 250 PLUS device. Powder XRD studies were carried out on a Rigaku MiniFlex Desktop X-ray diffractometer using CuK_α radiation with a 1.5418 Å wavelength. Scanning Electron Microscopy (SEM) images were taken by means of a JEOL JSM-6510LV device at 10 kV accelerating voltage.

Results and Discussion

Figure 2 shows the comparative FTIR spectra of the Nylon 6,6 based polymer matrix (a) and Nylon 6,6/CdS nanocomposite (b) samples. The macromolecular chain of the Nylon 6.6 polymer contains the functionalities that possess carbon, hydrogen, nitrogen, and oxygen atoms. These functionalities are highly active to infrared irradiation, causing the corresponding characteristic peaks in the spectrum. The peaks corresponding to the C-C vibrations are clearly observed at 677 cm^{-1}, 929 cm^{-1}, 1029 cm^{-1}, 1043 cm^{-1} in the spectrum of the pristine-Nylon 6.6 polymer (figure 2a). The peaks corresponding to the carbonyl (C = O) groups derived from adipic acid residues are at 1627 cm^{-1}, 1635 cm^{-1}, 1647 cm^{-1}, 1668 cm^{-1}, 1701 cm^{-1}, 1718 cm^{-1}, and 1735 cm^{-1}. Peaks at 584 cm^{-1}, 1130 cm^{-1}, 1172 cm^{-1}, 1192 cm^{-1}, and 1259 cm^{-1} correspond to the C-N amide group. N-H deformation corresponding to the amide group shows itself with numerous peaks at 1361 cm^{-1}, 1458-1544 cm^{-1} interval, 1668-1851 cm^{-1} interval (N-H bending), and 3500-3900 cm^{-1} interval (asymmetric and symmetrical N-H deformation). The weak peaks for symmetrical and asymmetrical CH_2 deformation and symmetrical C-H deformation vibrations are observed at 2839 cm^{-1}, 2910 cm^{-1}, and 3053 cm^{-1}. The peaks around the wave numbers 1411 cm^{-1}, 1431 cm^{-1}, and 1475 cm^{-1} also correspond to the methylene groups (CH_2). In the process of making a matrix from Nylon 6.6-based plastic waste material, the mechanical grinding and ultrasonic treatment cause destruction in the polymer chain, which manifests itself in numerous peaks corresponding to the OH deformation in the region of 3500-3900 cm^{-1} interval [4-8].

The same peaks can also be seen in the FTIR spectrum of the Nylon 6,6/CdS nanocomposite (figure 2b). It can be seen from the spectrum that the thermochemical synthesis of the CdS nanoparticles within the Nylon 6.6 polymer matrix changes the intensities of the peaks of the functionalities of the polymer. It can be explained by the formation of nanoparticles on these functional groups and the consequent change in their vibrational capacity under the influence of infrared radiation. The peaks for Cd-S deformation are also observed in the spectrum for Nylon 6,6/CdS nanocomposite at 534 cm^{-1}, 580 cm^{-1}, 582 cm^{-1}, 638 cm^{-1}, and 717 cm^{-1} [1-3].

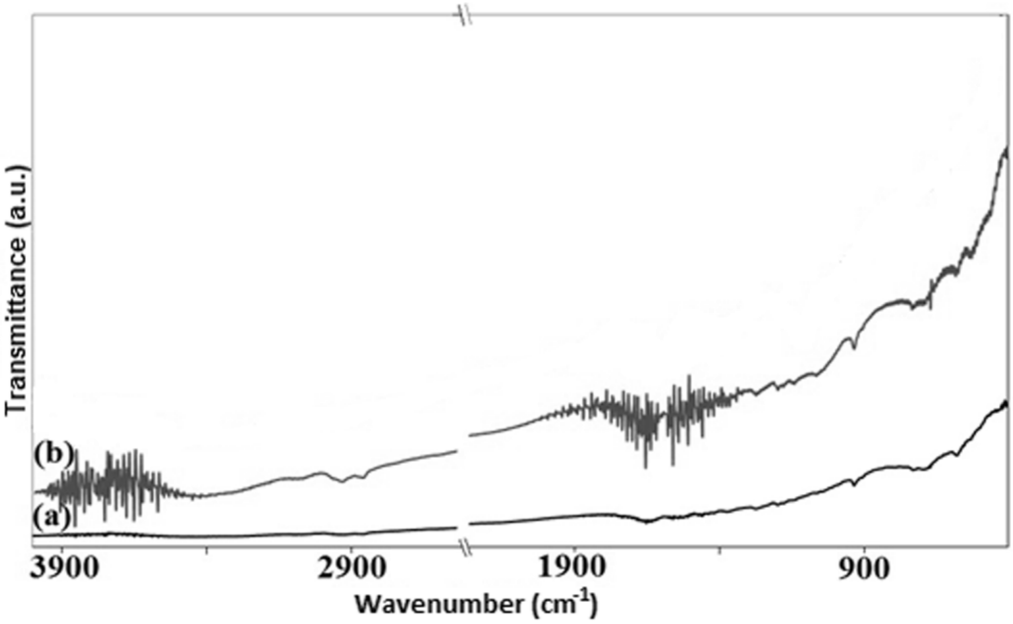

Figure 2. FTIR spectra of the Nylon 6,6 based polymer matrix (a) and Nylon 6,6/CdS nanocomposite (b) samples.

The optical properties and the band gap of the synthesized materials were characterized by UV-vis spectroscopy. Figure 3 shows the transmittance spectra (A) and dependence of $[F(R)h\nu]^{1/2}$ on hν (B) for Nylon 6,6 based polymer matrix (1) and Nylon 6,6/CdS (2) samples. The Kubelka-Munk approach is applied in order to characterize the optical properties using the result from optical reflectance. The Kubelka-Munk equation is expressed as follows [3]:

$$F(R)=(1-R)^2/2R=k/s$$

where R is the absolute reflectance, k is the molar absorption coefficient and s is the scattering coefficient. The band gap energies (Eg) of the samples can be calculated by plotting the dependence of $[F(R)h\nu]^{1/2}$ on hν and extrapolating the linear parts of the curves to the abscissa energy axis.

UV-vis spectra were recorded in the 190-1100 nm range and the band gap obtained from the dependence of the $[F(R)h\nu]^{1/2}$ on hν for the Nylon 6,6/CdS nanocomposite was 4.2 eV. This result is higher than that of bulk CdS (2.42 eV) and shows the blue shifting due to the crystalline size [9]. This rather broad band gap suggests that the nanocomposite could find applications in photovoltaic devices.

The average diameters of the CdS nanocrystals in Nylon 6,6/CdS nanocomposite were calculated as 5.9 nm using the Brus equation [10].

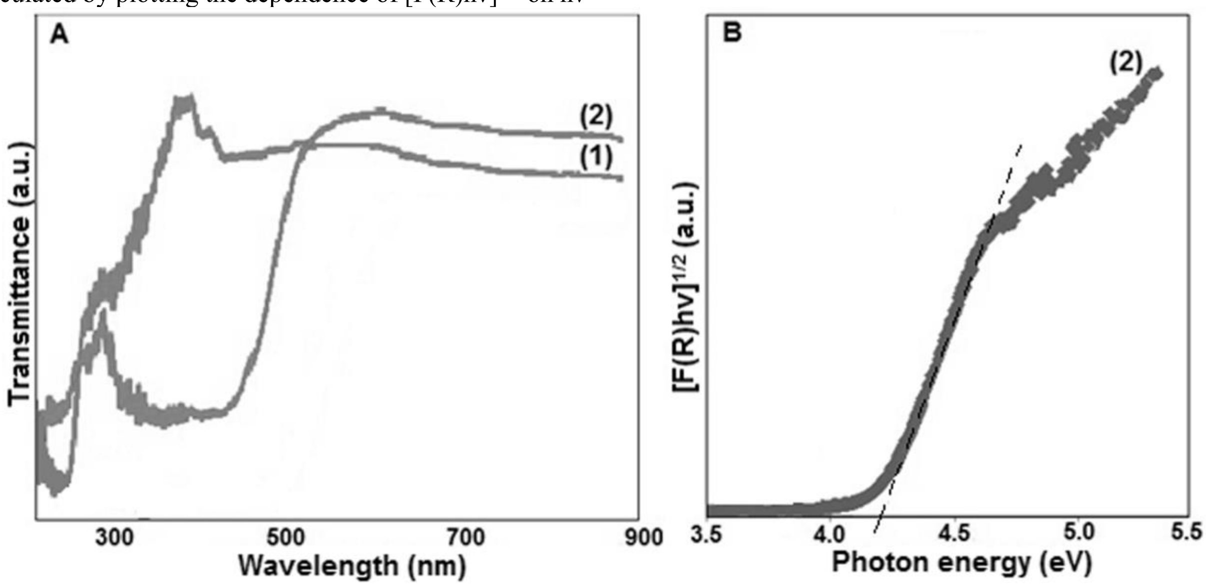

Figure 3. UV-vis transmittance spectra (A) and dependence of $[F(R)h\nu]^{1/2}$ on hν (B) for Nylon 6,6 based polymer matrix (1) and Nylon 6,6/CdS (2) samples.

Figure 4 shows the X-ray diffraction pattern of Nylon 6,6/CdS nanocomposite obtained by the thermochemical method. The peaks observed at 2θ angles of 20.54º, 23.63º, 38.18º, and 40.72º can be assigned to reflections from the characteristic (011), (021), (113), and (013) crystallographic planes of CdS nanoparticles, respectively. The results were studied based on the 04-006-0809 and 04-004-1000 standard diffraction files of CdS and the obtained nanoparticles were proved to have two mixed phases like hexagonal and cubic crystal structures [1-3].

Scherrer's formula was used to calculate the average size of CdS nanoparticles synthesized by the thermochemical method within the Nylon 6,6 polymer matrix [3,11,12]. Calculations were made for each peak and the average value was taken. It was found that the average diameter of the synthesized nanoparticles is 2.76 nm.

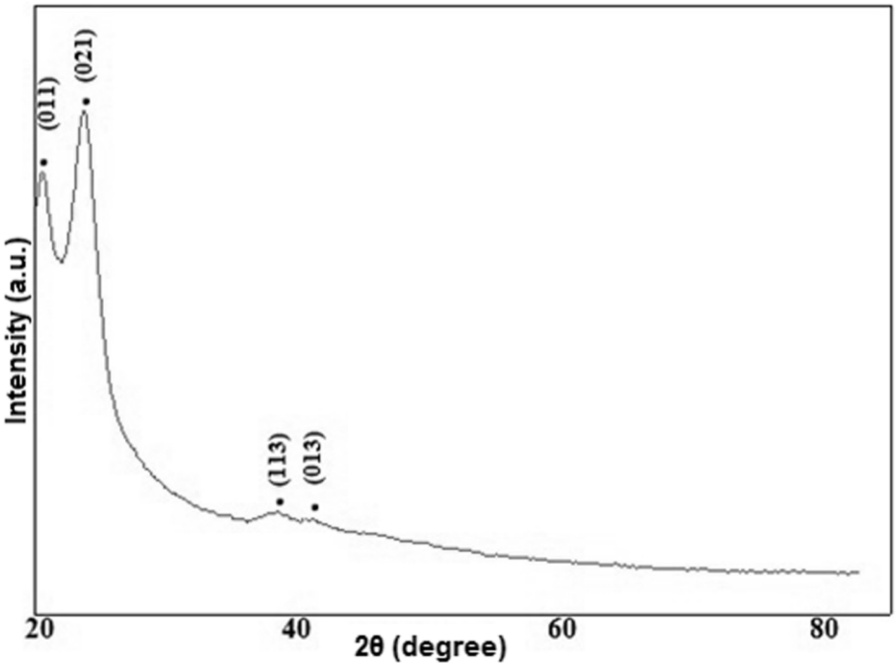

Figure 4. X-ray diffraction pattern of Nylon 6,6/CdS nanocomposite obtained by the thermochemical method.

SEM micrographs of the initial Nylon 6,6-based matrix and the Nylon 6,6/CdS nanocomposite samples, as well as Elemental mapping images of C, O, Cd, and S elements in the Nylon 6,6/CdS nanocomposite sample are depicted in figure 5. It can be seen from the images that the pristine Nylon 6,6 polymer exhibits a relatively smooth surface morphology. By synthesizing CdS nanoparticles, this smooth surface morphology changes to a correspondingly rough form. From the image of the nanocomposite, the average sizes of CdS nanoparticles were visually determined and found to be consistent with those obtained by other methods.

The elemental mapping images show that the synthesized nanoparticles are uniformly distributed within the polymer. This proves that the synthesis is effective, including that the matrix and synthesis conditions are optimal for the synthesis of CdS nanoparticles.

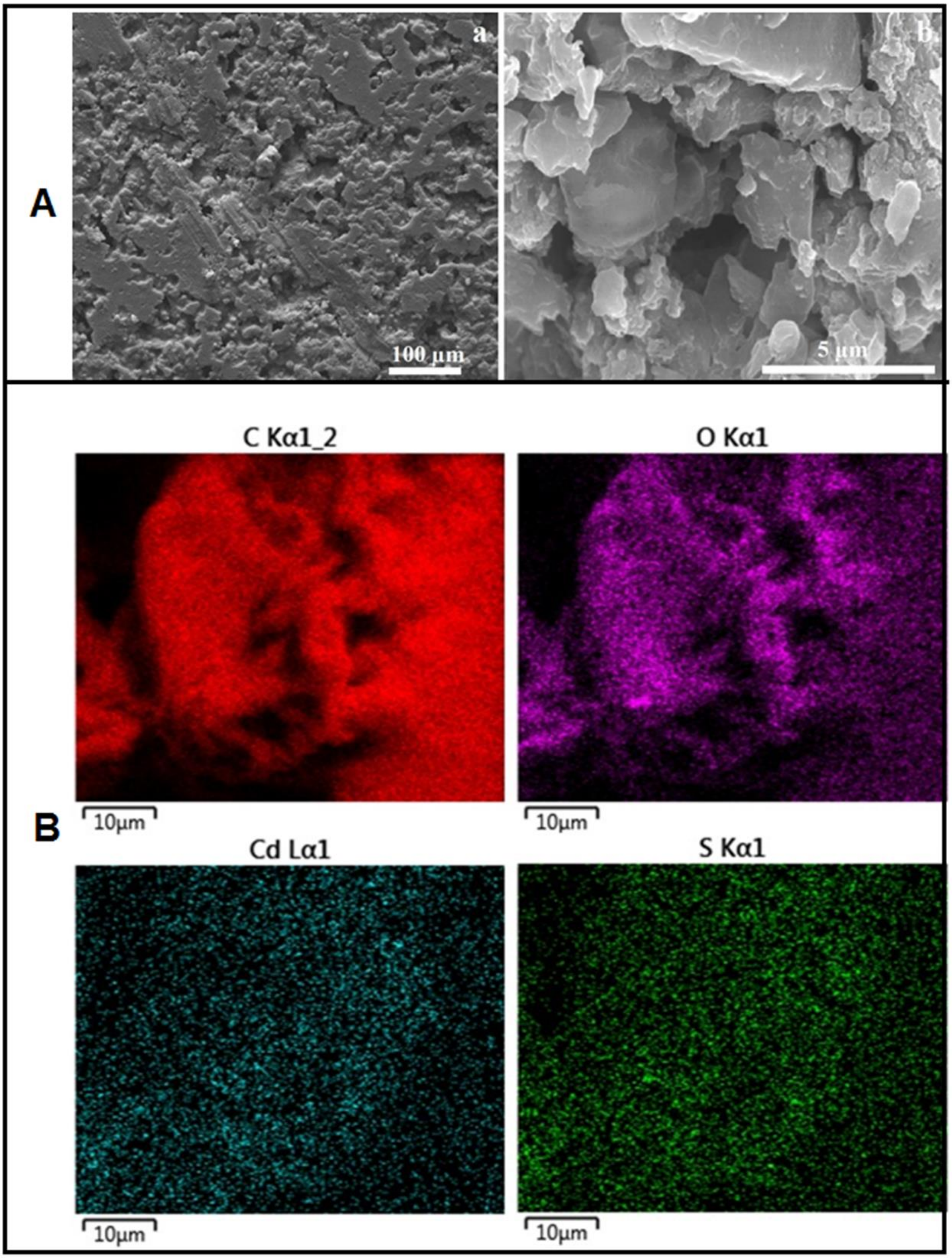

Figure 5. SEM images of the initial Nylon 6,6-based matrix (a) and the Nylon 6,6/CdS nanocomposite (b) samples (A); Elemental mapping images of C, O, Cd, and S elements in the Nylon 6,6/CdS nanocomposite sample (B).

Conclusion

CdS nanoparticles were synthesized via the thermochemical technique. Nylon 6,6 based plastic waste materials were used as the matrix in order to get new polymer nanocomposite with unique properties and to find new utilization for the waste plastics. The success of formation of the polymer nanocomposite was confirmed by different characterization techniques like FTIR, UV-vis., XRD, and SEM. The FTIR results show the anticipated bands related to the functionalities of the Nylon 6,6. The formation of the CdS nanoparticles within the matrix changes the intensities of the peaks and adds new peaks related to Cd-S deformation to the spectrum. The UV-vis results show 4.2 eV band gap which is higher than that of bulk CdS (2.42 eV). This shifting to the higher energy state is evidence of the formation of CdS nanoparticles with 5.9 nm average diameter. The rather broad band gap suggests that the nanocomposite could find applications in photovoltaic devices. The XRD results revealed that the obtained nanoparticles are in 2.76 nm mean size and mixed hexagonal and cubic structure. The average sizes of CdS nanoparticles were visually determined also from SEM micrographs and found to be consistent with those obtained by other methods. The elemental mapping images show that the synthesized nanoparticles are uniformly distributed within the polymer which proves that the synthesis is effective, including that the matrix and synthesis conditions are optimal for the synthesis of CdS nanoparticles. All the obtained results show that the nylon 6,6 based plastic waste materials are suitable for application as the matrices for the CdS nanoparticle synthesis.

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ECONOMY

INVESTMENT REGULATION MECHANISMS: BALANCING RISK AND OPPORTUNITY

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Abstract

Investment regulation mechanisms play a pivotal role in shaping the landscape of global investments, where the delicate balance between risk and opportunity is crucial. This article delves into the intricate mechanisms of investment regulation, exploring how different regulatory frameworks influence investment decisions, mitigate risks, and create opportunities. The study examines the effectiveness of various regulatory approaches, from stringent controls to more liberalized environments, and their impact on both domestic and foreign investments. By analyzing case studies from diverse economic contexts, the article highlights how well-designed regulations can foster a stable investment climate, protect investors' interests, and encourage sustainable economic growth.

Furthermore, it addresses the challenges regulators face in adapting to the dynamic global market, including technological advancements and geopolitical shifts. The discussion extends to the role of international regulatory bodies and agreements in harmonizing investment regulations across borders. Emphasizing the need for a balanced approach, the article argues that overly restrictive regulations can stifle innovation and economic development, while insufficient regulation can lead to financial instability and investor insecurity. Ultimately, the article advocates for a nuanced regulatory strategy that aligns with the evolving needs of the global economy, ensuring that investment regulation mechanisms not only manage risks effectively but also unlock opportunities for growth and development. This comprehensive analysis provides valuable insights for policymakers, investors, and academics, contributing to the ongoing discourse on optimizing investment regulation in a rapidly changing world.

Keywords: Investment regulation, risk management, economic opportunity, financial stability, regulatory frameworks, investor protection.

İntroduction

In the dynamic world of global finance, investment regulation mechanisms serve as the cornerstone for ensuring a balanced interplay between risk and opportunity. As markets evolve and new financial instruments emerge, the need for effective regulation becomes increasingly critical. Investment regulation encompasses a wide array of policies and rules designed to safeguard investors, maintain market integrity, and promote economic stability. However, striking the right balance is a complex endeavor. Overly stringent regulations can hinder innovation and restrict capital flow, while overly lenient approaches can expose markets to volatility and systemic risks. This article seeks to explore the intricate landscape of investment regulation mechanisms, examining how they are crafted, implemented, and their broader implications on both local and international scales. By delving into case studies from various economies, we will uncover how different regulatory frameworks have succeeded or faltered in balancing these critical elements.

Additionally, the article will address the emerging challenges faced by regulators in the context of technological advancements and shifting geopolitical landscapes. In an era where financial markets are more interconnected than ever, understanding the nuances of investment regulation is essential for policymakers, investors, and stakeholders alike. Through a comprehensive analysis, this article aims to shed light on the strategies that can effectively mitigate risks while harnessing opportunities for sustainable growth and development.

In the ever-evolving realm of global finance, the interplay between risk and opportunity is a constant challenge. Investment regulation mechanisms are essential tools that policymakers use to navigate this delicate balance. These mechanisms, designed to protect investors and ensure market integrity, must also foster innovation and economic growth. Striking this balance is a complex and dynamic task, requiring a nuanced understanding of both local and international financial landscapes.

The Need for Investment Regulation

Investment regulations serve multiple purposes. Primarily, they aim to safeguard investors from fraud and market manipulation, ensuring that financial markets operate in a fair and transparent manner. Regulations also seek to maintain systemic stability, preventing financial crises that can arise from excessive risk-taking and speculative bubbles. By setting standards for disclosure, governance, and financial practices, regulatory frameworks help build investor confidence, which is crucial for the smooth functioning of capital markets.

Protecting Investors

One of the primary objectives of investment regulation is to safeguard investors from fraud, manipulation, and malpractice. Individual investors, particularly retail investors, may lack the resources and expertise to thoroughly vet financial products and the entities offering them. Regulatory frameworks impose strict disclosure requirements, ensuring that investors receive comprehensive and accurate information about investment opportunities. This transparency helps investors make informed decisions, reducing the likelihood of falling victim to deceptive schemes [1].

Ensuring Market Transparency

Transparency is essential for the efficient functioning of financial markets. Regulations mandate regular and detailed disclosures from companies regarding their financial health, governance practices, and potential risks. These disclosures enable market participants to assess the true value and performance of investments. By enforcing standards of honesty and openness, regulations help build trust in the financial system, which is crucial for market liquidity and stability.

Preventing Financial Crises

Regulatory mechanisms are designed to mitigate systemic risks that can lead to financial crises. Excessive risk-taking and speculative bubbles, if left unchecked, can destabilize the entire financial system. Regulations set limits on leverage, establish capital requirements for financial institutions, and impose stringent oversight on risky financial products and practices. These measures are intended to prevent the kind of unchecked risk-taking that precipitated the 2008 global financial crisis. By curbing excessive speculation and ensuring that financial institutions maintain adequate buffers, regulators aim to protect the broader economy from financial shocks [2].

Promoting Sustainable Economic Growth

Effective investment regulation also plays a crucial role in promoting sustainable economic growth. A stable and transparent financial system attracts both domestic and foreign investment, which is essential for funding innovation, infrastructure, and business expansion. Regulatory frameworks that support investor confidence contribute to a favorable investment climate, encouraging long-term investments that drive economic development. Moreover, regulations can be tailored to support specific policy goals, such as environmental sustainability or social equity, by promoting investments in green technologies or socially responsible enterprises.

Adapting to Technological Advancements

The rapid pace of technological change presents new challenges and opportunities for investment regulation. Innovations such as digital currencies, blockchain technology, and fintech platforms have the potential to transform financial markets but also introduce new risks. Regulators must adapt quickly to these developments, crafting rules that protect investors and maintain market integrity without stifling innovation. For instance, the regulatory approach to cryptocurrencies varies widely across jurisdictions, reflecting different assessments of the risks and benefits associated with these digital assets [3].

Responding to Geopolitical Shifts

Geopolitical shifts also underscore the need for adaptive regulatory frameworks. Trade tensions, political changes, and international agreements can significantly impact investment flows and market stability. Regulatory bodies must be able to respond to these changes, ensuring that their frameworks remain relevant and effective. For example, the regulatory adjustments necessitated by Brexit have had far-reaching implications for cross-border investments and financial services within the UK and the European Union.

The need for investment regulation is multifaceted, encompassing the protection of investors, the maintenance of market transparency, the prevention of financial crises, and the promotion of sustainable economic growth. As financial markets continue to evolve, the role of regulation becomes increasingly critical. Policymakers must remain vigilant and adaptable, continuously refining regulatory frameworks to address emerging challenges and seize new opportunities. By doing so, they can ensure that investment regulation mechanisms effectively balance risk and opportunity, supporting a resilient and thriving global financial system [4].

Case Studies in Regulatory Balance

Different economies offer varied examples of how regulatory frameworks can balance risk and opportunity. For instance, the United States, with its relatively robust regulatory environment, has managed to create a conducive atmosphere for innovation while maintaining market stability. The Sarbanes-Oxley Act, enacted in response to corporate scandals in the early 2000s, significantly strengthened financial reporting and corporate governance standards. This regulatory tightening restored investor confidence and underscored the importance of transparency and accountability.

In contrast, emerging markets often grapple with different challenges. In countries like India and Brazil, regulatory frameworks are continually evolving to address issues of market manipulation, insider trading, and corporate governance. These economies demonstrate that while stringent regulations can initially seem to stifle growth, they ultimately create a more stable and attractive investment environment. For example, India's recent efforts to overhaul its bankruptcy laws have improved the country's ease of doing business, thereby attracting more foreign investment.

Balancing risk and opportunity through investment regulation mechanisms is a delicate task that varies significantly across different economic landscapes. Examining case studies from various countries provides valuable insights into how different regulatory frameworks address this balance, highlighting both successes and challenges. The experiences of the United States, India, and Japan offer a diverse perspective on how regulatory approaches can create stable, transparent, and growth-conducive investment environments [5].

United States: The Sarbanes-Oxley Act

The United States provides a notable example of how stringent regulations can restore market confidence and stability. In response to the corporate scandals of the early 2000s, such as the Enron and WorldCom debacles, the U.S. government enacted the Sarbanes-Oxley Act (SOX) in 2002. This legislation significantly tightened financial reporting and corporate governance standards.

SOX mandated rigorous internal controls and increased the accountability of corporate executives for the accuracy of financial statements. It also enhanced the independence of auditors and imposed stricter penalties for fraudulent financial activity. These measures restored investor confidence by ensuring greater transparency and reliability in corporate reporting. Despite initial concerns that SOX might stifle business growth due to increased compliance costs, the act has been instrumental in preventing corporate fraud and fostering a more transparent investment climate, thereby balancing risk and opportunity.

India: Overhauling Bankruptcy Laws

India's journey towards balancing investment regulation is exemplified by its recent overhaul of bankruptcy laws. Before 2016, India faced significant challenges with its insolvency resolution process, which was lengthy and inefficient, deterring investment. The introduction of the Insolvency and Bankruptcy Code (IBC) in 2016 marked a significant regulatory reform aimed at addressing these issues.

The IBC streamlined the process of insolvency resolution, reducing the time taken to resolve bankruptcy cases and improving the recovery rates for creditors. This reform enhanced the ease of doing business in India and attracted more foreign investment by creating a more predictable and investor-friendly environment. While initially stringent, the IBC has been continuously refined to address emerging challenges and balance the interests of creditors and debtors. This dynamic approach to regulation has bolstered India's investment climate, showcasing the importance of adaptive regulatory frameworks [6].

Japan: Embracing Fintech Innovation

Japan's approach to regulating financial technology (fintech) demonstrates a forward-thinking balance between fostering innovation and ensuring market stability. Recognizing the transformative potential of fintech, Japan has implemented regulatory measures that encourage innovation while protecting consumers and maintaining market integrity.

In 2017, Japan became one of the first major economies to regulate cryptocurrencies, introducing a licensing system for cryptocurrency exchanges. This regulation required exchanges to comply with anti-money laundering (AML) and know-your-customer (KYC) norms, enhancing the security and transparency of cryptocurrency transactions. By providing a clear regulatory framework, Japan has created a stable environment for fintech innovation, attracting numerous fintech startups and investments.

Furthermore, Japan's Financial Services Agency (FSA) has adopted a flexible and responsive regulatory approach, engaging in continuous dialogue with fintech companies to understand their needs and challenges. This collaborative approach has enabled Japan to adapt its regulations in a way that balances the promotion of fintech innovation with the mitigation of associated risks [7].

The case studies of the United States, India, and Japan illustrate the diverse strategies that can be employed to balance risk and opportunity through investment regulation mechanisms. The U.S. experience with SOX highlights the importance of stringent regulations in restoring market confidence and transparency. India's overhaul of its bankruptcy laws underscores the need for dynamic regulatory frameworks that evolve to meet emerging challenges. Japan's regulation of fintech innovation demonstrates the benefits of a collaborative and adaptive regulatory approach.

These examples underscore that there is no one-size-fits-all solution to investment regulation. Effective regulatory frameworks must be tailored to the specific economic context and continuously refined to address new developments. By learning from these varied experiences, policymakers can design robust regulatory mechanisms that not only protect investors and ensure market stability but also foster innovation and sustainable economic growth [8].

Challenges and Adaptations

The global financial landscape is constantly evolving, presenting regulators with a myriad of challenges that require continuous adaptation. As new technologies emerge and geopolitical dynamics shift, investment regulation mechanisms must be flexible and forward-thinking. This section explores the key challenges faced by regulators and the innovative adaptations being implemented to balance risk and opportunity in an increasingly complex environment.

Technological Advancements

Technological innovation is reshaping financial markets at an unprecedented pace. Digital currencies, blockchain technology, and fintech platforms are transforming how financial transactions are conducted, posing both opportunities and risks.

Cryptocurrencies and Blockchain: The rise of cryptocurrencies presents significant regulatory challenges. These digital assets operate on decentralized networks, often beyond the reach of traditional regulatory frameworks. Regulators must balance the need to prevent illicit activities, such as money laundering and fraud, with the potential benefits of blockchain technology in enhancing transparency and efficiency in financial transactions. Countries like Japan and Switzerland have implemented progressive regulatory frameworks that allow for the growth of cryptocurrency markets while imposing necessary safeguards.

Fintech Innovations: Fintech startups are revolutionizing financial services, offering new products and services that improve accessibility and convenience for consumers. However, the rapid pace of innovation can outstrip the ability of regulators to keep up. Regulators are adopting sandbox approaches, as seen in the UK and Singapore, where fintech companies can test new products in a controlled environment under regulatory supervision. This allows regulators to understand emerging risks better and adapt regulations accordingly [9].

Geopolitical Shifts

Geopolitical changes can have profound impacts on financial markets, necessitating adaptive regulatory responses.

Trade Tensions: Ongoing trade tensions, such as those between the United States and China, create uncertainty in global markets. Regulatory bodies must be prepared to address the potential impacts on investment flows and market stability. This may involve tightening or loosening regulations to stabilize markets and protect domestic interests.

Brexit: The UK's departure from the European Union has required significant regulatory adjustments. The UK must now establish its regulatory framework independent of the EU, impacting cross-border investments and financial services. Regulators have had to create new agreements and adapt existing regulations to ensure continued market access and stability.

Globalization and Cross-Border Investments

The globalization of financial markets means that regulatory actions in one country can have far-reaching implications. Coordinating regulations across borders is essential to manage systemic risks effectively.

International Cooperation: Organizations such as the International Organization of Securities Commissions (IOSCO) and the Financial Stability Board (FSB) play a crucial role in fostering international regulatory cooperation. By harmonizing standards and facilitating information sharing, these bodies help mitigate risks associated with cross-border investments and ensure a level playing field for all market participants [10].

Regulatory Arbitrage: Differences in regulatory frameworks across countries can lead to regulatory arbitrage, where firms exploit gaps between jurisdictions to evade stricter regulations. To address this, countries are increasingly collaborating to harmonize their regulatory standards, reducing the incentives for regulatory arbitrage and ensuring more consistent oversight.

Environmental, Social, and Governance (ESG) Considerations

The growing emphasis on ESG factors in investment decisions poses new regulatory challenges and opportunities.

Sustainable Finance: Regulators are increasingly focusing on sustainable finance to address climate change and promote responsible investment practices. The European Union's Sustainable Finance Disclosure Regulation (SFDR) is an example of efforts to enhance transparency and ensure that investors have access to information on the sustainability of their investments.

Social Equity: Regulators are also considering social equity in their frameworks, encouraging investments that promote social well-being and economic inclusion. This includes supporting initiatives that enhance access to financial services for underserved populations and addressing issues related to income inequality.

Adapting to Emerging Risks

Regulators must remain vigilant and proactive in identifying and addressing emerging risks.

Cybersecurity: As financial transactions become increasingly digital, cybersecurity threats pose a significant risk to market stability. Regulators are enhancing their focus on cybersecurity standards, requiring financial institutions to implement robust measures to protect against cyberattacks.

Pandemic Preparedness: The COVID-19 pandemic highlighted the need for regulatory frameworks that can quickly adapt to unforeseen global events. Regulators have had to implement emergency measures to stabilize markets, support financial institutions, and protect investors during periods of extreme volatility.

The challenges faced by regulators in balancing risk and opportunity are multifaceted and continuously evolving. By adopting innovative approaches and fostering international cooperation, regulators can effectively adapt to technological advancements, geopolitical shifts, and emerging risks. This dynamic and proactive regulatory stance is essential to maintaining market stability, protecting investors, and promoting sustainable economic growth in an increasingly interconnected and complex global financial landscape [11].

The Role of International Cooperation

Harmonizing investment regulations across borders is essential in an increasingly interconnected global economy. International regulatory bodies, such as the International Organization of Securities Commissions (IOSCO) and the Financial Stability Board (FSB), play a pivotal role in promoting global regulatory standards. By fostering cooperation and information sharing among national regulators, these organizations help mitigate systemic risks and ensure a level playing field for investors worldwide.

Conclusion

Balancing risk and opportunity through investment regulation mechanisms is a dynamic and ongoing process. Effective regulations are crucial for protecting investors, maintaining market stability, and fostering economic growth. As financial markets evolve, regulators must remain vigilant and adaptable, continuously refining their frameworks to address new challenges. By learning from diverse regulatory experiences and promoting international cooperation, policymakers can craft robust regulatory mechanisms that support a resilient and thriving global financial system. In this way, investment regulation can serve as a pillar of economic stability and a catalyst for sustainable development.

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FOREST ECOLOGY

AGROCHEMICAL, PHYSICO-CHEMICAL AND MECHANICAL PROPERTIES OF SOILS DISTURBED BY ANTHROPOGENIC-TECHNICAL EFFECTS IN THE TERRITORY OF GARADAGH DISTRICT

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Abstract

The research works were carried out in the contaminated soils in the oil and gas production area of Garadagh district. Soil samples were taken from the area based on the coordinates. Analyzes were carried out in the laboratory to determine the mechanical, physico-chemical and agrochemical properties of the collected soil samples.

Keywords: anthropogenic-technical effects, granulometric composition, physical-chemical properties of soil, agrochemical properties of soil, sand, silt, clay

One of the global problems of the modern era is environmental protection. In this regard, oil pollution of the biosphere is of particular importance. Despite the observance of safety rules in the process of oil extraction, transportation and processing, soil pollution is inevitable. This, in turn, affects the disturbance of the ecological balance, changes in the structure of biocenoses, and the intensity of soil cultivation processes.

The experience in the field of elimination of environmental pollution with petroleum products shows that an objective assessment of the polluted ecosystem is an important condition.

Absheron Peninsula is one of the regions in our republic where the soil cover is more exposed to anthropogenic pressures. the Absheron Peninsula is at the forefront of the development of the oil industry apart from being the most developed economic region of our country. The crude oil produced here is a valuable raw material for obtaining various types of high-quality oil products [1, 2].

For the first time, many scientists were engaged in research on the fertility of oil-contaminated soils in Azerbaijan [2, 3, 4, 5, 7].

Effective use of existing land resources, protection of fertility, preparation of a system of necessary measures for the return to use of lands that are conventionally considered unsuitable today, in particular, determination of ways to eliminate the limiting factors that lead to the degradation of soil cover are carried out in the world, including in the Republic of Azerbaijan (ecological, agrotechnical, reclamation, agrochemical, microbiological, etc.) is one of the prospective directions of research.

Restoration of oil-contaminated areas by the method of phytomelioration, that is, a system of measures applied to radically change the natural conditions of the area by the vegetation.

As a phytoremediation measure in oil-polluted areas, it is recommended to plant perennial grasses that are resistant to oil to adapt the vegetation to the conditions due to the agrotechnical and meliorative measures implemented in the area [6].

In this context, reclamation measures are applied in Canada, Russia, Norway and other countries.

It is considered appropriate to use perennial plantings for phytomelioration of soils in oil-contaminated areas in the conditions of Absheron in Azerbaijan.

Research methodology. The research works were carried out in the contaminated soils in the oil and gas production area of Garadagh district. Soil samples were taken from the area based on the coordinates. Analyzes were carried out in the laboratory to determine the mechanical, physico-chemical and agrochemical properties of the collected soil samples. All laboratory analyzes were performed by the following methods, which are currently the most widely used: granulometric composition - N.A. Kachinsky; absorbed Ca and Mg – D.V. Ivanov; absorbed Na – Hedroys; common humus I.V. Tyurin; pH-potentiometer (pH-meter); absorbed ammonia – D.P. Konev; activated phosphorus - B.P. Machigin; exchangeable potassium –was determined by the P.B. Protasov method.

Analysis and discussion. The result of the analysis of the mechanical composition of the soil in the samples taken from the layers of 0-30, 30-60, 60-90 cm in the soil samples is reflected in the table below.

Table 1

Granulometric composition of soils

Sample №	Depth, cm	1-0,25	0,25-0,05	0,05-0,01	0,01-0,005	0,005-0,001	< 0,001	< 0,01
1	0-30 sm	0.06	19.14	22.00	12.80	29.20	16.80	58.80
2	30-60 sm	0.32	44.48	49.60	2.80	2.00	0.80	5.60
3	60-90 sm	0.35	24.05	30.00	12.40	21.20	12.00	45.60
		Sand		**Silt**			**Clay**	

As can be seen from table 1, the soils of the area belong to the type of mechanically light granular soils. Water permeability is average.

Table 2

Absorbed bases in irrigated light grey-brown soils

Depth, cm	Ca	Mg	Na	Sum of absorbed bases, (SAB), mg-eq	Ca	Mg	Na
	mg-eq				Percentage from SAB		
0-25	12.2	18.0	2.4	32.6	37.43	55.21	7.36
25-50	14.0	13.0	2.2	29.2	47.95	44.52	7.53
50-75	12.9	9.2	3.2	25.3	50.99	35.4	12.60
75-100	16.5	14.5	2.6	33.6	49.11	43.15	7.74

As can be seen from table 2 the SAB is 32.6-33.6 mg.eq in the irrigated light grey-brown soils of the Garadagh district. 12.2-16.5 mg-eq Ca, 14.5-18.0 mg-eq Mg, 2.4-2.6 mg-eq Na fall on 100 g of soil in the crop and sub-crop layers in these soils. The percentages occupied by Ca, Mg and Na are, respectively, 37.43-49.11; 35.4-55.21; 7.36-12.60%.

Table 3

Agrochemical properties of soils

Depth, cm	pH	Humus %	Absorbed NH_3 mg/kg	Activated phosphorus, mg/kg	Exchangeable potassium, mg/kg
0-20	7.6	1.86	19.4	23.3	190.4
20-40	7.7	1.47	15.9	21.9	175.0
40-60	7.75	1.20	14.1	16.6	135.0
60-80	7.89	0.67	12.3	10.7	113.3
80-100	8.3	0.53	10.6	5.7	113.3

As a result of the research, it was found that the pH is 7.6-8.3, as can be seen from the analyzes of the agrochemical characteristics of the irrigated light grey-brown soils of the Garadag district. Humus is 1.86% in the 0-20 cm layer of the soil, and it decreases to 0.53% in the depth of 80-100 cm in the soils of the research area. According to the profile, absorbed ammonia in these soils is 10.6-19.4 mg/kg; activated phosphorus 5.7-23.3 mg/kg; exchangeable potassium varies between 113.3-190.4 mg/kg. (Table 3).

Figure

Conclusion

1. The irrigated light grey-brown soils of the Garadagh district mechanically belong to the type of light granular soils. Water permeability is average.

2. In the irrigated light grey-brown soils of the Garadagh district, the SAB is 32.6-33.6 mg.eq. in these soils, 12.2-16.5 mg-eq Ca, 14.5-18.0 mg-eq Mg, 2.4-2.6 mg-eq Na fall on 100 g of soil in the crop and subcrop layers. The percentages occupied by Ca, Mg and Na are, respectively, 37.43-49.11; 35.4-55.21; 7.36-12.60%.

3. As a result of the research, it was found that the pH is 7.6-8.3, as can be seen from the analysis of the agrochemical characteristics of the irrigated light grey-brown soils of the Garadag district. Humus is 1.86% in the 0-20 cm layer of the soil, and it decreases to 0.53% in the depth of 80-100 cm in the soils of the research area. According to the profile, absorbed ammonia in these soils is 10.6-19.4 mg/kg; water-soluble phosphorus 5.7-23.3 mg/kg; exchangeable potassium varies between 113.3-190.4 mg/kg.

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HISTORY OF ART

THE DAWN OF MUSIC: HOW THE FIRST SOUNDS SHAPED HUMAN CULTURE AND COMMUNICATION

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Abstract

The article "The Dawn of Music: How the First Sounds Shaped Human Culture and Communication" delves into the origins of music, exploring how early auditory expressions transformed human societies. By examining archaeological findings, such as ancient instruments and cave art, alongside anthropological studies of early human communities, this article traces the evolution of music from its rudimentary beginnings. It highlights how the first musical sounds were not merely forms of entertainment but essential tools for communication, ritual, and social cohesion. The study reveals how these early sonic practices laid the groundwork for complex cultural expressions and collective identity, illustrating music's fundamental role in the development of human civilization. Through a multidisciplinary approach, this research provides a comprehensive understanding of how the nascent art of music influenced and shaped the early fabric of human life and society.

Keywords: Origins of music, prehistoric sound practices, early musical instruments, ancient rhythmic patterns, music and communication.

Introduction:

Music is a universal language that transcends time and culture, yet its origins remain shrouded in mystery. The article "The Dawn of Music: How the First Sounds Shaped Human Culture and Communication" seeks to unravel this enigmatic beginning by exploring how early humans first engaged with sound and rhythm. As far back as the prehistoric era, our ancestors used music not only as a form of expression but also as a vital component of their social and cultural practices. This introduction sets the stage for a comprehensive examination of how the earliest musical activities—evidenced by rudimentary instruments, ancient vocalizations, and early rhythmic patterns—were integral to the formation of communal bonds and the development of complex societal structures. By investigating the interplay between these primitive sonic practices and the evolution of human interaction, this article aims to illuminate the profound impact that early music had on shaping the ways in which early humans communicated, formed communities, and constructed their cultural identities.

The origins of music are as elusive as they are fascinating, presenting a compelling narrative of how early sounds and rhythms became a cornerstone of human culture and communication. As one of the most fundamental aspects of human experience, music's roots extend far beyond the sophistication of modern compositions, tracing back to the nascent sounds created by our prehistoric ancestors. This essay explores the profound impact of these early auditory expressions, examining how the first sounds shaped human society, communication, and culture.

The Birth of Music: Early Evidence and Instruments

Archaeological evidence provides invaluable insights into the early development of music. The discovery of ancient musical instruments, such as flutes made from bone and early drums, reveals that prehistoric humans were crafting and using sound-making tools as far back as 40,000 years ago. These artifacts, often found in burial sites or ceremonial contexts, suggest that music was integral to early human rituals and social practices. The use of bone flutes, for example, indicates an understanding of pitch and rhythm that suggests music's role in more than just entertainment— it was a sophisticated form of communication and expression. The emergence of music in human history is a subject that intertwines archaeology, anthropology, and musicology, offering a fascinating glimpse into the lives of our prehistoric ancestors. The study of early musical instruments and evidence of their use reveals not only the sophistication of early sound-making but also the integral role that music played in the development of human culture and communication.

Ancient Instruments: A Window into Prehistoric Sound

The earliest known musical instruments provide tangible evidence of humanity's initial forays into music. Among the most significant discoveries are bone flutes, found in various archaeological sites across Europe and Asia. These flutes, made from bird bones or mammoth ivory, date back to the Upper Paleolithic period, approximately 40,000 years ago. For instance, the Divje Babe flute, discovered in Slovenia, and the Aurignacian flutes found in Germany, suggest that early humans had a sophisticated understanding of musical pitch and rhythm. The deliberate creation of these instruments, including the precise placement of finger holes, indicates that music was not only an incidental aspect of daily life but a practiced and valued art form.

In addition to flutes, ancient percussion instruments, such as drums and rattles, have been uncovered in various archaeological contexts. These instruments, often constructed from natural materials like animal skins and bones, provide evidence of rhythm and beat in early musical practices. The use of drums in prehistoric rituals and ceremonies underscores the communal and ceremonial aspects of early music, highlighting its role in social and spiritual life [1].

Musical Contexts and Uses

The presence of early musical instruments in burial sites and ceremonial locations points to music's significant role in ritualistic and social practices. For instance, the discovery of musical artifacts alongside human remains in gravesites suggests that music was intertwined with burial rites and beliefs about the afterlife. These findings imply that music was used to accompany and enhance important life events, reinforcing its role in ceremonial contexts. Furthermore, the use of music in prehistoric communities likely extended beyond ritualistic purposes to include everyday activities. Early humans may have used music to coordinate group efforts, such as hunting or gathering, and to facilitate social interactions. The rhythmic sounds of drums and the melodic tunes of flutes would have helped synchronize group activities and foster a sense of unity and cooperation.

Technological Innovations and Musical Development

The development of early musical instruments reflects a remarkable level of technological innovation. The craftsmanship involved in creating bone flutes, for example, required not only an understanding of material properties but also precise engineering to achieve desired musical tones. The evolution of these instruments over time, from simple bone flutes to more complex constructions, illustrates the ongoing refinement of musical technology and the growing sophistication of musical practices.

The transition from rudimentary sound-making tools to more advanced instruments also highlights the role of music in cultural and cognitive development. As early humans experimented with different materials and designs, they not only expanded their musical repertoire but also engaged in a process of cultural transmission, passing down musical knowledge and skills through generations.

Implications for Understanding Early Music

The study of early musical instruments and their contexts provides valuable insights into the role of music in prehistoric societies. These instruments serve as a testament to the creativity and ingenuity of early humans, revealing how music was used to express emotions, communicate, and participate in social and cultural practices. The evidence of early music underscores its significance as a universal aspect of human experience, transcending time and place to connect us with our distant ancestors [2].

In conclusion, the birth of music is marked by the emergence of early instruments and sound-making practices that played a crucial role in shaping human culture and communication. The discovery of ancient flutes, drums, and other musical artifacts offers a window into the lives of our prehistoric ancestors, illustrating how music was woven into the fabric of their daily lives and ceremonial practices. As we continue to explore and understand these early musical traditions, we gain a deeper appreciation for the enduring power of music to connect, express, and unify across the ages.

Music as a Communicative Tool

The earliest forms of music were deeply entwined with communication. Before the advent of complex language, sound played a crucial role in conveying messages and emotions. Early humans likely used rhythmic drumming, melodic chanting, and vocalizations to coordinate activities, express feelings, and strengthen social bonds. Music provided a non-verbal means of interaction that could unify groups and facilitate collective action, whether in hunting, ritualistic ceremonies, or communal gatherings. The rhythmic patterns and tonal qualities of early music would have allowed for nuanced communication, serving as a bridge between primitive language and more developed forms of speech.

Music's role as a tool for communication predates written language, serving as a fundamental means by which early humans conveyed messages, emotions, and social norms. The evolution of music from its nascent forms to more complex structures highlights its significance beyond mere entertainment. Early sound-making practices were deeply intertwined with the development of social interaction and collective identity, revealing music's essential function in shaping human communication and societal organization.

Pre-Linguistic Communication

Before the advent of sophisticated spoken language, early humans relied on non-verbal methods to communicate. Music, with its ability to convey complex emotions and intentions, served as a vital pre-linguistic tool. Early musical practices, such as rhythmic drumming and melodic chanting, provided a means of expression that transcended the limitations of verbal communication. These early sound forms could convey urgency, comfort, or cohesion, facilitating interactions within groups and aiding in the coordination of collective activities.

Rhythmic patterns, for instance, likely played a crucial role in organizing group actions such as hunting or rituals. The synchronization of movements through rhythmic sounds helped to coordinate efforts, maintain group unity, and enhance efficiency. Similarly, melodic vocalizations and chants could serve as a form of emotional expression, allowing individuals to communicate feelings of joy, sorrow, or reverence in a manner that words alone might not fully capture [3].

Facilitating Social Interaction

Music also functioned as a social lubricant, fostering interactions and building relationships within early human communities. In communal settings, such as gatherings or celebrations, music provided a shared experience that helped to strengthen social bonds and reinforce group identity. Participating in musical activities allowed individuals to connect with one another on an emotional level, creating a sense of belonging and unity.

The communal aspect of early music can be seen in archaeological evidence of collective rituals and ceremonies where music played a central role. These events were not merely social gatherings but significant occasions for reinforcing cultural norms and values. Music facilitated social cohesion by providing a common framework for communal experiences, helping to integrate individuals into the larger social fabric.

Music as Emotional Expression

One of the most powerful aspects of music as a communicative tool is its ability to express and evoke emotions. Early humans used music to articulate feelings and experiences that might have been difficult to convey through words alone. The emotional resonance of music, whether through the plaintive notes of a flute or the driving beat of a drum, allowed individuals to connect with others on a deep, emotional level.

In ritualistic contexts, music often served to heighten emotional experiences and create a shared sense of purpose. For example, the use of drumming in ceremonies could amplify feelings of unity and transcendence, while melodic chants might evoke a sense of spiritual connection. This emotional dimension of music not only enhanced individual experiences but also contributed to the collective emotional landscape of early human societies.

Music and Social Organization

The use of music as a communicative tool also extended to social organization and governance. In many early societies, music played a role in reinforcing social hierarchies and cultural norms. For instance, certain musical practices or instruments might be reserved for specific social classes or roles, reflecting and reinforcing social structures. Music could also be employed in rituals and ceremonies that established or maintained authority, providing a means of legitimizing leadership and social order.

Moreover, music's role in marking significant life events, such as births, marriages, and deaths, highlights its function in structuring social life and cultural practices. By framing these events within musical contexts, early societies were able to create meaningful rituals that reinforced social bonds and cultural continuity [4].

Rituals and Social Cohesion

In prehistoric societies, music was not merely a backdrop but an active participant in ritualistic and social practices. Early ceremonies, often tied to religious or cultural rites, utilized music to enhance the spiritual experience and to mark significant events. The rhythmic beats of drums and the melodic strains of early flutes would have created an atmosphere conducive to communal participation and emotional expression. Music in these contexts helped to reinforce group identity, foster cohesion, and solidify social structures. By participating in music-making, individuals could align themselves with the group, creating a shared sense of purpose and belonging.

The intersection of music with ritualistic practices highlights its profound role in fostering social cohesion and reinforcing cultural identity in early human societies. From prehistoric times, music has been an integral component of rituals, ceremonies, and communal gatherings, serving not only as an expression of spiritual beliefs but also as a mechanism for strengthening social bonds and reinforcing collective identity.

Music in Ritualistic Contexts

Early human societies often employed music in ritualistic settings to mark significant life events, such as births, marriages, and deaths, as well as seasonal changes and religious ceremonies. These rituals, accompanied by music, were more than mere customs; they were essential for maintaining the social fabric and cultural continuity of the community.

For instance, the use of drums, flutes, and vocal chants in rituals served to enhance the ceremonial experience, creating a shared sense of purpose and transcendence among participants. The rhythmic and melodic elements of ritual music helped to focus collective attention and induce states of heightened emotional and spiritual awareness. This shared experience was crucial for reinforcing group cohesion and affirming cultural values.

Rituals as Social Glue

Rituals, supported by music, functioned as a form of social glue, binding individuals together and fostering a sense of community. The act of participating in ritualistic music-making provided a common experience that transcended individual differences, promoting unity and collective identity. Through synchronized actions, shared rhythms, and communal singing or drumming, individuals were able to experience a sense of belonging and mutual support.

In many early societies, rituals were central to social life, providing opportunities for individuals to come together, reinforce social bonds, and participate in collective decision-making. Music played a crucial role in these gatherings, facilitating communication, enhancing group solidarity, and ensuring that social norms and traditions were upheld [5].

Music as a Reflection of Social Hierarchies

The role of music in rituals also extended to the reinforcement of social hierarchies and power structures. In some early societies, certain musical practices or instruments were reserved for specific social classes or roles, reflecting and reinforcing existing social hierarchies. For example, the use of elaborate instruments or complex musical compositions might be restricted to leaders or religious figures, while more basic forms of music were accessible to the general populace.

Music thus served not only as a means of communal expression but also as a tool for maintaining social order and legitimacy. Rituals involving music could legitimize authority, reinforce social roles, and perpetuate cultural norms, contributing to the overall stability and cohesion of the community.

The Role of Music in Cultural Continuity

Music’s involvement in rituals also played a crucial role in preserving and transmitting cultural traditions. Through ritualistic music, early societies were able to pass down stories, myths, and historical narratives from generation to generation. Songs and chants, often performed during rituals, served as oral records of cultural heritage, ensuring that important traditions and values were preserved and perpetuated.

By embedding cultural narratives within musical practices, early societies could maintain a sense of continuity and identity, even as they evolved over time. Music thus became a vehicle for cultural transmission, linking past, present, and future generations through shared ritualistic experiences.

Music and Cultural Development

The influence of early music on cultural development cannot be overstated. As societies evolved, so did their musical practices, which began to reflect and shape their cultural values and social norms. Music became a vessel for storytelling, preserving oral histories and traditions that were vital to cultural continuity. Early musical forms laid the groundwork for more complex musical systems and genres, influencing subsequent generations and contributing to the rich tapestry of human cultural heritage.

The Legacy of Early Music

The legacy of early music is evident in the diverse musical traditions that have emerged across different cultures and epochs. While the specific sounds and instruments of early music may have varied, the fundamental role of music as a means of communication and cultural expression has remained constant. The study of early music offers valuable insights into how humans have used sound to connect with one another, to express their innermost feelings, and to navigate the complexities of social life. In conclusion, the dawn of music marks a pivotal moment in human history, one that profoundly shaped how early humans communicated and formed cultural identities. From the rudimentary sounds of ancient instruments to the intricate rhythms and melodies of early rituals, music served as a crucial medium for expression and social cohesion. Understanding these origins not only enriches our appreciation of music's role in our ancestors' lives but also highlights the enduring power of music to unite, communicate, and inspire across generations. The first sounds, in their simplicity and profundity, laid the foundation for the vast and varied musical traditions that continue to shape human culture today [6].

The legacy of early music extends far beyond the ancient artifacts and rudimentary instruments discovered by archaeologists; it embodies the profound and lasting impact that primitive musical practices have had on the evolution of human culture and society. Early music, with its rudimentary instruments and simple forms, laid the foundational structures upon which the complex musical traditions of later cultures would be built. Understanding this legacy offers valuable insights into the enduring influence of early music on contemporary practices and cultural identities.

Foundations of Musical Traditions

Early music represents the genesis of musical traditions that have evolved over millennia. The basic principles of rhythm, melody, and harmony established by early humans form the cornerstone of modern musical systems. From the earliest bone flutes and drums to the sophisticated instruments of subsequent eras, the evolution of music can be traced through the incremental development of these fundamental elements. Early musical practices provided the first frameworks for creating and organizing sound, influencing the development of more complex musical forms and genres.

Cultural Continuity and Evolution

One of the most significant aspects of the legacy of early music is its role in cultural continuity. Early musical practices were deeply embedded in the social and ceremonial life of prehistoric societies, and many of these practices were preserved and adapted by subsequent generations. Through oral transmission and ritualistic performances, early music became a vessel for preserving cultural traditions, beliefs, and stories. As societies evolved, they built upon the musical foundations laid by their ancestors. The transition from early sound-making to more sophisticated musical forms reflects both the continuity and adaptation of cultural practices. For example, the rhythmic patterns used in ancient drumming are echoed in contemporary drumming traditions, while melodic structures from early music can be seen in various folk and classical music forms.

Influence on Artistic Expression

The artistic and emotional power of early music has had a lasting impact on subsequent musical expressions. The simplicity and directness of early musical forms—whether through the repetitive rhythms of drums or the haunting melodies of bone flutes—continue to inspire and influence contemporary composers and musicians. Modern music often draws on these early elements to create new and innovative sounds, demonstrating how ancient musical practices still resonate in contemporary artistic expression. Additionally, the use of music in early rituals and ceremonies has influenced how music is employed in modern religious and cultural practices. The ceremonial aspects of early music, including its role in marking significant life events and reinforcing social cohesion, have been adapted and maintained in various forms of contemporary music and performance.

Educational and Scholarly Insights

The study of early music provides valuable insights into the cognitive and social development of early humans. By examining the evolution of musical instruments, patterns, and practices, scholars gain a deeper understanding of how music influenced and was influenced by human cognitive processes and social structures. This research contributes to broader fields such as anthropology, archaeology, and musicology, offering a richer understanding of how music has shaped human history and culture. Educationally, the exploration of early music helps to contextualize contemporary musical practices within a historical framework. Understanding the origins and development of musical traditions can enhance appreciation for the diversity and complexity of modern music, fostering a deeper connection between past and present musical experiences [7].

Enduring Universal Appeal

The universal appeal of music, rooted in its earliest forms, is a testament to its enduring power to connect and inspire. The legacy of early music underscores its fundamental role in human life, transcending cultural and temporal boundaries. Music's ability to evoke emotions, foster social bonds, and express cultural identity is as relevant today as it was in prehistoric times. In conclusion, the legacy of early music is a rich tapestry woven from the threads of primitive sound-making, cultural continuity, and artistic evolution. The foundational principles established by early musical practices have influenced the development of complex musical traditions and continue to inspire contemporary artists and scholars. By exploring the legacy of early music, we gain a deeper appreciation for its role in shaping human culture and its enduring significance in the tapestry of human experience.

Conclusion:

In examining the dawn of music, we uncover a profound narrative of how the earliest sounds and rhythms were more than mere auditory experiences—they were pivotal in shaping the very fabric of early human society. The exploration of ancient musical artifacts and practices reveals that music served as a fundamental tool for communication, ritual, and social cohesion. These primitive musical expressions were not isolated phenomena but integral elements that influenced the development of collective identities and cultural structures. By understanding how early humans used sound to forge connections and convey meaning, we gain valuable insights into the origins of complex societal behaviors and cultural evolution. Music, in its nascent form, was instrumental in crafting the social and cultural landscapes of our ancestors, setting the stage for the rich and diverse musical traditions that would follow. This exploration underscores the timeless and universal role of music in human life, highlighting its enduring impact on our cultural heritage and communal bonds.

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ТОКАЙ МАМЕДОВ – НЕПРЕВЗОДЁННЫЙ МАСТЕР ПОРТРЕТА И МОНУМЕНТАЛЬНОЙ СКУЛЬПТУРЫ

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TOKAY MAMEDOV - THE UNRIVALED MASTER OF PORTRAIT AND MONUMENTAL SCULPTURE

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Аннотация

В начале XX века в Азербайджане сложилось большая национальная школа скульптуры со своими традициями, своей тематикой. Широкие и многогранные творческие поиски скульпторов не только способствовали рождению этих традиций, но и создали предпосылки для развития новых черт и качеств современной азербайджанской пластики. Это прежде всего острое чувство современности и стремление к монументальности. Одним из выдающихся ваятелей Азербайджана является Токай Мамедов. Среди азербайджанских скульпторов работы выдающегося художника Токая Мамедова привлекают внимание своей высокой техникой и богатством использованных материалов. В творчестве Токая Мамедова всегда шли рядом два жанра, требующих самого пристального внимания к человеку – портрет и монументальная скульптура. Скульптурный портрет – область, в которой наиболее полно раскрывается дарование и мастерство Токая Мамедова, выражаются его художественные принципы. Выдающийся ваятель глубоко проникал в душевный мир своей модели, средствами пластики передавал главное, характерное в человеке.

Abstract

The article discusses the work of outstanding Azerbaijan sculptor Tokay Mamedov, as well as an analysis of the artist's sculptural works. At the beginning of the 20th century, a large national school of sculpture was formed in Azerbaijan with its own traditions and themes. The wide and multifaceted creative search of sculptors not only contributed to the birth of these traditions but also created the preconditions for the development of new characteristics and qualities of modern Azerbaijani plastic art. This is the most acute sense of modernity and aspiration to monumentality. Among the works of Azerbaijan sculptors, the work of the outstanding artist Tokay Mamedov attracts attention to its high technique and richness of materials used. In the work of Tokay Mammadov, two genres have always been side by side, requiring the closest attention to a person - a portrait and a monumental sculpture. Sculptural portrait is an area in which the gift of Tokay Mamedov is most fully revealed, its artistic principles are expressed. The outstanding sculptor deeply penetrated his model's soul, conveying a person's main characteristic through plastic materials.

Ключевые слова: Токай Мамедов, скульптор, композиция, скульптурный портрет, пластика, скульптурные формы, памятник, искусство XX века, монументальность.

Keywords: Tokay Mamedov, sculptor, composition, statue portrait, plastic art, sculptural forms, monument, 20th-century art, monumentality.

Токай Мамедов выдающийся азербайджанский скульптор-монументалист XX века, которому свойственно стремление к героически-возвышенным образам, ярким и самобытным характером. Величие и безмерная красота человека на протяжении веков и даже тысячелетий – тема, постоянно манящая к себе скульпторов. В XXI веке эта тема осталась негасимым маяком для скульпторов реалистического течения. Мысли и чувства о человеке, выраженные безмолвным языком скульптуры, понятны и близки всем, реалистический язык искусства не нуждается в переводе (1). Нужно отметить, что постановка фигуры в пространстве, передача её движения, позы, жеста, светотеневая моделировка, усиливающая рельефность формы, фактура лепки или обработка материала, архитектонические организации объёма, зрительный эффект его массы, весовых отношений, выбор пропорций, специфический в каждом случае характер силуэта являются главными выразительными средствами скульптуры (5). Объёмная скульптурная форма строится в реальном пространстве по законам гармонии, ритма, равновесия, взаимодействия с окружающей архитектурной или природной средой и на основе анатомических (структурных) особенностей той или иной модели. Монументальная и монументально-декоративная скульптура рассчитана на конкретное архитектурно-пространственное или природное окружение. Она призвана конкретизировать архитектурный образ, дополнять выразительность архитектурных форм новыми оттенками, способна решать большие идейно-образные задачи, что с особой полностью раскрывается в городских памятников, монументальных, мемориальных сооружениях, которым обычно присуща величавость форм и долговечность материала, приподнятость образного строя, широта обобщения.

В портретах Лятифа Керимова и Мирза Кязим бека, созданные ещё в пору учёбы в институте, он умело воспел единства внутреннего содержания изобразительных искусств, особенности натуры. В портрете Лятифа Керимова присутствует это ощущение индивидуальности, многогранности натуры. Работа с натуры несомненно помогали Токаю Мамедову в передаче характерных особенностей модели. Скульптор вживался в образ, прочувствовав его, изучал живую натуру, видел и запечатлел самую суть характера изображаемого. Создавая фигуры, он прежде всего стремился увидеть её «изнутри». Детали существовали для него лишь как части единого целого. В своих портретах скульптора нет детализации, есть свежесть восприятия натуры. Большая наблюдательность, широкий кругозор, знание жизни своего народа, его национальных традиций позволило ему найти средства воплощения сложных человеческих характеров, глубокое образное видение. От одной работы к другой прослеживается пластическое мастерство скульптора. В его работах мы видим большую пластичность, цельность, при которой содержание не приходит в противоречие с манерой исполнения. Например, в фигуре нефтяника Асафа Зейналова скульптор обобщённо передал формы: он раскрыл образ человека в многообразии его деятельности в связи с окружающим миром. Он умело передал естественность позы, разнообразие фактур. Благодаря чётко найденному пластическому ритму, скульптор убедительно раскрыл внутренний духовный мир модели. Токай Мамедов добился художественной выразительности, разрешил сложный идейно-образный замысел, напряжённой лепки, сложной игрой светотени.

Он сам нажимал на «нужные клавиши» своего таланта, и под его чуткими пальцами бесформенный камень оживал, превращаясь в бессмертные произведения искусства.

Следует отметить произведение Токая Мамедова – памятник Узеиру Гаджибейли, основоположнику современного профессионального музыкального искусства Азербайджана и нового жанра камерной вокальной музыки – романса-газели, создателю первой национальной оперы «Лейли и Меджнун» (мугамная опера), установленный в 1960 году перед Азербайджанской Государственной Консерваторией, ныне Бакинская Музыкальная Академия имени Узеира Гаджибекова. В 1957 году Токай Мамедов начинает первые подготовительные эскизы для памятника. К работе над этим памятником скульптор подошёл в какой-то мере внутренне подготовленным. Он как бы продолжил ту работу, которую начала его мать Зивар ханум Мамедова. Большое количество портретов в числе погрудной бюст композитора, созданных ею, являются большим вкладом в создание иконографии великого азербайджанского композитора. В 1957 году Токай Мамедов создаёт портрет композитора. Индивидуальная выразительность портрета достигнута благодаря живым, точным деталям. Черты лица проработаны энергично, главное в портретной характеристике – выражение внутренней душевной силы. Весь процесс дальнейшей работы над образом композитора – это поиски выражения сложного внутреннего мира человека-творца, автора лучших азербайджанских опер. Нельзя не отметить серьёзности замысла и тщательности, с которой были выполнены подготовительные работы. Это и многочисленные варианты портретных решений, и проект будущего монумента, который должен был быть установлен перед сложившимся ансамблем: зданием консерватории (2). Этот памятник занимает особое место среди монументальных памятников Азербайджана, где возрождается образ гения. Глядя на памятник, неизбежно чувствуешь звуки музыки Узеир бека и величие увертюры «Кёроглы». Это чувство пронизывает всю композицию. Памятник великому Узеир беку огромен. Однако критерий этого гиганта не в размерах статуи, а в величии гения. Фигура Узеир бея, в сидячем положении, симметрия его черт лица и его многозначительный внешний вид, говорящий о его гении, очень красивы. Эта красота умело подчеркнута в скульптуре художником (3). Находясь перед памятником, зритель может в полной мере оценить мастерство скульптора. Оно в умелой компоновке объёмов, и в ритме, и в пропорциях статуи относительно постамента, и, наконец, в выразительности решения. Памятник Токая Мамедова новое слово в монументальной пластике. Памятник Узеиру Гаджибейли – это монумент, превозмогающий привычное для жанра камерное звучание. По устремлённости он близок к остальным памятникам скульптора: в каждом из них сконцентрирован прожитый человеком душевный и жизненный опыт. Они словно подталкивают зрителя к философскому размышлению о его нравственной сущности, о его характере. Пластическая завершённость сидящей в кресле фигуры, замкнутая и почти статичная её компоновка вносят в памятник черты величавого спокойствия (2). Этому отвечает уравновешенность пластического ритма, который раскрывается постепенно, по мере обхода памятника. Характерно и выявление психологического состояния композитора, как бы вслушивающегося в звуки музыки. Как всегда для Токая Мамедова большую роль играет жест: левая рука поднесена к подбородку и подчёркивает состояние глубокой задумчивости, правая рука с зажатым карандашом опирается на ноты, лежащие на коленях (рис.1).

Особое место в творчестве Токая Мамедова занимает так называемый «героический портрет», моделями для которого скульптору служили сильные и возвышенные: Низами Гянджеви, Самед Вургун, Мехти Гусейнзаде, Мирза Фатали Ахундов, Сулейман Рагимов, Фархад, Бюль-Бюль, Ниязи, Мирза Алекпер Сабир, Фредерик Шопен и другие. Его очень привлекала тема героического начала человеческой личности (4).

Рис.1. Памятник Узеир Гаджибейли

Рис.2. Портрет Ваджии Самедовой

Ясностью, чистотой форм, тонкой пластичностью исполнения привлекает портреты скульптора. Токаю Мамедову присуще долгое кропотливое вынашивание замысла. «Вживание в образ» длится иногда очень долго. Характерным для скульпторов явились и поиски новых материалов. Он одним из первых азербайджанских скульпторов Токай Мамедов сделал своим излюбленным материалом дерево (2). В мощном творческом порыве скульптор создаёт небывалую композицию. Умение скульптора с мастерством выбрать композицию, найти выразительную силу жеста, раскрыть сложность психологического состояния, национальный характер азербайджанского народа особенно отчётливо сказались в портрете великого азербайджанского поэта Низами Гянджеви. Ясно понимая место поэта в мировой культуре и назначение его наследия для современности, скульптор передал своё восприятие образа, раскрывая высокий интеллект, сложность глубокого духовного мира поэта. Используя свойства дерева, скульптор добился строгой красоты скульптурных форм. Пластическая выразительность лица достигнута плавной моделировкой объёмом, игрой бликов и светотени. Поднятая к лицу рука, придают скульптуре завершённость и величие. Компактная композиция выявляет самые главные черты характера. Глубоко сдержанное, необычайно благородное лицо поэта поражает богатством и сложностью внутренней жизни. В правильных, мужественных его чертах, в глазах, устало прикрытых веками, в чуть нахмуренных бровях читается мудрость человека, прожившего большую жизнь. Пластика портрета, особенности его композиционного решения неразрывно связаны с смысловой насыщенностью образа и неотделимы от него. Казалось, Токай Мамедов выразил в скульптуре всю – мыслимую – красоту. Проникнув во внутренний мир изображаемого, скульптор передал в портрете великого Низами романтику, глубокую поэтичность и мужественную гордость в личности любимого народного поэта. Сын своего народа, великолепный портретист и психолог, Токай Мамедов грандиозным произведением «Низами» дал характеристику этой скульптуре, характеристику исторически верную.

В 1966 году скульптор создал портрет талантливой художницы Азербайджана, безвременно ушедшей из жизни Ваджии Самедовой. Создавая портрет по памяти, Токай Мамедов передал во внешних, остроиндивидуальных чертах то душевное состояние, ту бесконечно милую улыбчивость и жизнерадостность, которые присущи Ваджии Самедовой. И это скульптору удалось, он достиг жизненности и пластической цельности образа. Послушный резцу мастера, кусок мрамора зажил неповторимой духовной жизнью, запечатлев характерный облик Ваджии Самедовой, неповторимый склад её мыслей, её чувств и стремлений. Отметим, что пластика экспрессивна (2). Эта экспрессивность помогает выразить активность образа. Перед нами лицо молодой, полной сил и энергии женщины, исполненной действенного начала. Обобщённое пластическое решение привело к внутренней монументальности и значительности портрета (рис.2). Известный польский скульптор Ксаверий Дуниковский говорил: «Форма меняется в связи с идеей. Если мы попробуем внимательно приглядеться к нашему времени, то увидим, какие необыкновенной мощности стимулы заложены в нём. Они заставляют художника искать новые формы. Эмоции нашего времени немыслимо выразить ни старыми категориями, ни слепками с форм разных исторических эпох».

Токай Мамедов подлинно национальный скульптор. В своих произведениях он воссоздал образы лучших людей, героических людей Азербайджана. Его работы широко известны как в Азербайджане, так и за её пределами.

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MATERIALS SCIENCE AND MECHANICS OF MACHINES

DETERMINATION OF THE IMPACT OF THE TECHNOLOGICAL PROCESS ON THE PERFORMANCE OF SAFETY DEVICES USED IN PRESSURE FACILITIES

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Abstract

The publication describes the influence of the technological process on certain parameters of safety devices used in pressure equipment. The defining technological parameters are shown and their influence on the reliability of manufactured safety devices used in pressure equipment is investigated.

Keywords: reliability in the production of safety devices for pressure equipment; safety devices; pressure equipment; pressure vessels; reliability of protective devices.

1. Introduction

The modern level of technological development provides great opportunities for achieving high levels of reliability of machines, mechanisms and devices. This, however, is associated with the incurrence of certain costs, which in certain cases may prove ineffective for the results that would be achieved. As a result, the cost-effectiveness of implementing a certain type of reliability improvement measures in the production of safety devices in pressure equipment should be assessed.

There are various options for increasing the reliability of safety devices. These possibilities can be related to improving the design, optimizing the production and technological processes in their manufacture and carrying out certain optimization measures during their operation. The application of these various options is acceptable only if the economic cumulative economic effect is evaluated and it is established that its value is positive and the final result will be achieved by guaranteeing a high degree of reliability with a proven low value of the applied optimization actions.

2. Impact Assessment Indicators (P_i)

2.1 Indicators in the manufacture of safety devices (P_m)

The indicators that are applicable for a sufficiently correct assessment at the production stage are design (p_d), manufacturing (p_p), testing (p_c), transport to the final destination (p_t), as well as other costs related to the realization of the final product (p_o). The value of the Pm indicator will be equal to the sum of all the constituent indicators, i.e.

$$P_m = p_d + p_p + p_c + p_t + p_o$$

$$P_i = P_m + P_u$$

If we assume that the influence of each of the constituent indicators can vary in the range from 0 to 1, it will mean that the maximum value of P_m can be 5, which will determine a range of changes in this parameter from 0 to 5, i.e.

$$0 \le P_m \ge 5$$

2.2 Indicators influencing during the operation of safety devices (P_u)

The performance indicators that have a significant impact on the costs during the normal operation of safety devices in pressure equipment are related to all activities to ensure their normal operation and restore their operability when it has been disrupted.

These indicators are:

- Maintenance (m_t),
- Repair (m_r) and
- Prevention (m_p).

The value of the Pu indicator will be equal to the sum of all composite indicators, i.e.

$$P_u = m_t + m_r + m_p$$

If we assume that the influence of each of the constituent indicators can vary in the range from 0 to 1, it will mean that the maximum value of P_u can be 3, which will determine a range of changes in this parameter from 0 to 3, i.e.

$$0 \le Pu \ge 3$$

As a result of what has been said so far, it can be concluded that the indicator for assessing the impact P_i is the sum of P_m and P_u

$$P_i = P_m + P_u$$

3. Influence of technological process parameters on operational parameters of safety devices

There is a connection between the operational and technological parameters, which is a function of various influences. Such influences can be the properties of the material from which the safety devices are made, the achieved accuracy of the final parameters of the device as a result of the process of its manufacture, the sufficient degree of reliability of the elements included in the device (springs, nozzles, etc.). This relationship can be described by the functional dependence, which is a function of a random argument

$$Q = f(X)$$

where,

X is a parameter of the safety device formed by the technological process

Q is the operational parameter of the safety device

The parameter ***Q*** may be, for example, the wear resistance determined by the rate of wear of the safety device, and may also include composite parameters for the wear resistance of the individual elements constituting the safety device.

Figure 1 shows the functional relationship between the parameter of the the safety device formed by the technological process "***X***" and the operational parameter of the safety device "***Q***".

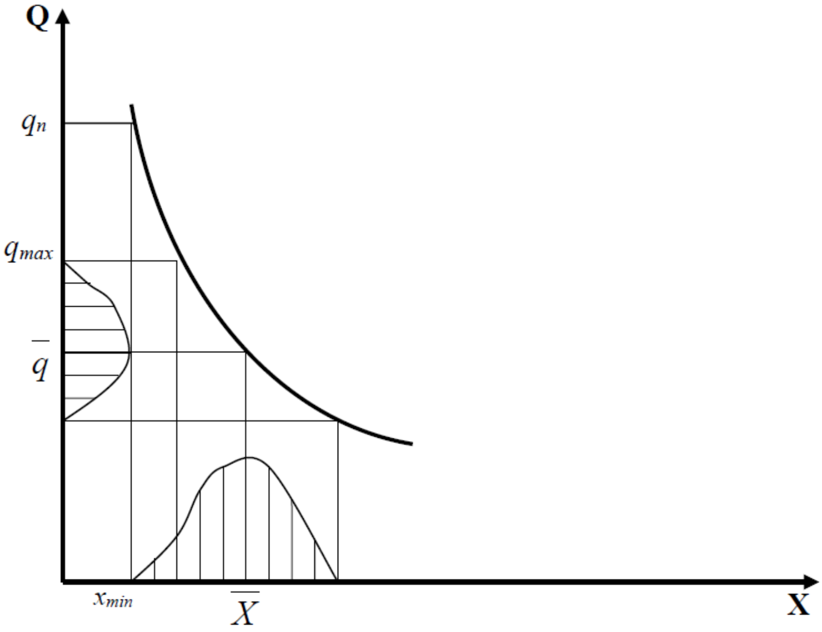

Figure 1

From the process shown in Figure 1, it is found that if sustainable control over the influence of the technological process is carried out and the production of a safety device with parameters lower than x_{min} is not allowed, it can be expected that the manufactured device will have a sufficient degree of reliability. Since the parameters ***Q*** and ***X*** are located in a complex stochastic relationship, this result cannot be achieved very easily. In addition, ***X*** is dependent not only on one, but also on more technological parameters. This means that their change will have a direct impact on the change in ***X***. As a result of these influences, it can be expected that there is an increasing likelihood that the safety device of the pressure facility will produce an unacceptable ***Q*** value. In practice, this probability turns out to be of a high degree of real occurrence, since most often a smaller number of parameters of the manufactured safety device are subjected to control than the number of factors that affect its performance, which has a direct impact on its reliability.

4. Influence of the technological process on the reliability of safety devices in pressure equipment

The technological process of manufacturing a safety device is a complex and responsible complex cycle of activities. In its essence, it is a complex dynamic system that includes materials, production equipment, measuring instruments, control instruments, transport systems in the production process, working tools, production environment, personnel engaged in production and management of the entire process. Obviously, if any of these components is not sufficiently reliable, this will also affect the reliability of the safety device being manufactured.

The technological process has many characteristics that create difficulties in ensuring its reliability, while at the same time this process has sufficient capabilities that, if used and combined, could have a significant and beneficial impact on ensuring the necessary degree of reliability of the manufactured safety device for pressure equipment. These difficulties arise as a result of the great complexity of the process itself, as well as as as a result of the numerous stochastic relationships.

Along with this, the technological process also has a lot of opportunities to ensure sufficient reliability of the manufactured safety device. These possibilities are: changing the structure, by introducing additional controls and defining the operations of smaller ones, ensuring stable transitions between them, and designing technological systems in such a way that they become more adaptable and provide them with the possibility of changing their properties automatically or through self-regulation, by adapting to the specifics of the production process.

The main feature of the technological process is the interaction between its qualitative and quantitative indicators, i.e. a sufficient degree of reliability is guaranteed in achieving the corresponding high productivity. These indicators are in constant dynamic variability, and very often they enter into a contradiction mode.

The technological process considered as a system from the point of view of reliability must function stably in terms of both reliability and performance.

The reliability of the technological process is its property to ensure the production of the safety devices of the pressure equipment in the quantity for which it is designed while guaranteeing and ensuring the requirements for quality and safety of the manufactured product. It is a mistake to confuse the reliability of the technological process with its accuracy and stability. The accuracy of this process is its ability to ensure the correspondence between the scattering field of the value of the quality indicator of the manufactured safety device and the tolerance field set in accordance with the requirements and its location. Process stability is its ability to keep the quality indicators of the manufactured safety device within specified limits for a certain period of time.

The reliability of a technological process characterizes the dynamics of change in its indicators, and accuracy is the statics of this behavior for a given moment. As a result, accuracy should be considered as an integral part of process reliability. On the other hand, stability characterizes the process only in terms of maintaining quality indicators and does not affect the change in productivity. It is important to note that a technological process can be defined as stable, even if it produces safety devices with deviations from the requirements, i.e. the process can be stable, not without guaranteeing the necessary reliability. The reliability of the technological process should be evaluated only by those parameters that depend on the manufacturing technology of safety devices. This means that the technological process can be reliable, but the manufactured safety device must have a relatively low degree of reliability.

The aspiration in creating the optimal conditions for achieving a successful final product of production should be, through the creation of a reliable production process, to achieve the guarantee of the established criteria for reliability of the finished product, which in this case is a safety device for pressure equipment.

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MUSICOLOGY

THE VOCAL ART OF YASHAR GURBANOV

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Abstract

Azerbaijani vocal art stands, as a testament to the country's profound cultural heritage, intertwining centuries of tradition, emotion, and artistic expression. Central to this rich vocal tradition is **Mugham** - a sophisticated and emotive form of music that integrates poetry, instrumental mastery, and vocal improvisation. Alongside Mugham, **Ashiq** music, performed by the storytelling musicians known as Ashiq, adds another layer of depth with its narrative songs and rich folklore. These vocal forms are not only pivotal to Azerbaijan's cultural identity but have also garnered global recognition. As we delve deeper into the intricacies and contemporary relevance of Azerbaijani vocal art, we uncover a world where ancient traditions meet modern influences, creating a unique fusion that continues to captivate and inspire. Yashar Gurbanov is a name that resonates deeply within Azerbaijani vocal art. Known for his talent and dedication to preserving and promoting the rich musical traditions of his homeland, Gurbanov has become a leading figure in classical and folk music. His contributions span across performances, recordings, and educational efforts, making him one of the pivotal characters in the cultural landscape of Azerbaijan. This article examines the work of Yashar Gurbanov, who has a special role in the promotion of Azerbaijani vocal art, which resonates far beyond the borders of Azerbaijan with its historical roots and artistic nuances.

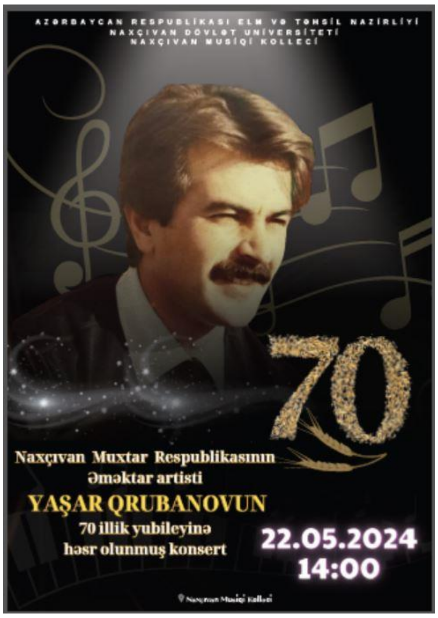
Keywords: art, vocal art, Yashar Gurbanov, Estrada, concerto, voice, classic music.

Throughout history, Azerbaijani vocal art experienced significant transformation and development, shaped by the socio-political changes of the time. While mugham remained a cornerstone of the national musical identity, other vocal art forms flourished too, reflecting the ideological and cultural shifts.

In the Soviet period, state-sponsored initiatives aimed at preserving and promoting folk traditions led to the establishment of folk music ensembles and choirs. These groups often performed re-arranged traditional songs to align with Soviet artistic principles, emphasizing harmony and collective performance over individual expression. The influence of Soviet culture brought about the rise of **Estrada**, a genre of Soviet popular music that combined elements of folk, classical, and contemporary styles. Azerbaijani singers like Rashid Behbudov and Muslim Magomayev became prominent figures in this genre. Their performances, characterized by powerful vocals and theatrical presentations, gained widespread popularity within Azerbaijan and abroad.

This period saw the incorporation of Azerbaijani language, themes, and motifs into Soviet-style compositions, creating a unique hybrid that reflected both local traditions and Soviet modernity. The Soviet era also brought about significant advancements in music education and professionalization. Conservatories and music schools were established, providing systematic training for aspiring vocalists and musicians. These institutions played a vital role in nurturing a new generation of artists who would carry Azerbaijani vocal traditions into the future. Beyond the enduring tradition of Mugham, other vocal forms evolved, influenced by both local heritage and Soviet cultural policies. The legacy of this era is a rich tapestry of classical, folk, and popular music that continues to shape Azerbaijan's musical landscape today.

Born in a region steeped in musical heritage, Yashar Gurbanov was exposed to the sounds and rhythms of Azerbaijani music from an early age. His journey into the world of vocal art began with traditional folk songs, which are deeply ingrained in the culture of Azerbaijan. These early experiences shaped his understanding of music and laid the foundation for his future endeavors. Azerbaijani vocal performance has become an independent art of performing precisely by benefiting from the art of ashiq and mugham. The essence of the Azerbaijani national classical vocal art is based on the creativity of Uzeyir Hajibeyov. On January 21, 1908, the vocal parts in the opera "Leyli and Majnun" by U. Hajibeyov - arias, ariosos, duets, and choral scenes - performed by the opera troupe in Baku had a great impact on the development of mass vocal performance art in Azerbaijan. As in all regions of Azerbaijan, in Nakhchivan, it is necessary to mention the great service of local ashiq and singing masters in the creation of a vocal school. The cultural environment in Baku played a special role in the development of Azerbaijani vocal art. It is here that the formation of the school of composition, formed by Ü. Hajibeyli, which includes features characteristic of classical European music, also influenced the development of vocal art. Since the first decades of the 20th century, a vocal school, which is the bearer of new principles has been established in Baku. Among the students of this school are Nakhchivan vocalists.



Poster of the concert dedicated to 70-year jubilee of Yashar Gurbanov.

Yashar Gurbanov is one of the first vocalists of the Nakhchivan vocal performance school, who received vocal education in Baku and worked there in Sumgayit. Yashar Gurbanov was born on May 22, 1954, in Sumgait city. He received his first education at secondary school No. 4 in Sumgait city.

Gurbanov's formal training in music began at a prestigious institution where he honed his skills under the tutelage of renowned masters. His education encompassed a broad spectrum of musical styles, from classical folk songs - a traditional Azerbaijani genre characterized by complex improvisation and deep emotional expression - to contemporary compositions. This diverse training allowed Gurbanov to develop a versatile and nuanced vocal style.

In the years 1961-1971, when he was studying, he was one of the active members of the school's self-activity collective, he was a participant in many concerts, not only in Azerbaijan but also in Ukraine and Russia. Here, he was an active member of many pop groups. Among them, we can mention the popular pop collectives of N. Narimanov club "Romashka", "Rovesnik" of BTZ club, "Shakhmat" club, "Stroitel", Vishnyakov, and "Ashiqlar". Yashar Gurbanov started his musical career at the age of 14. His close relationships with artists such as Elbrus Mehdiyev, Yashar Safarov, and Novruz Mammadov greatly influenced and benefited his musical development. His influences are varied, drawing inspiration from both historical figures in Azerbaijani music and contemporary artists. The rich tapestry of sounds that defines Gurbanov's music is a testament to his ability to blend tradition with innovation seamlessly.

In 1971, he moved to Nakhchivan city with his family and continued his activities there. Here he was invited to work as a soloist in the Nakhchivan State Song and Dance Ensemble. In the years 1973-1976, he was in active military service and did not stop his musical activities. He created a variety group on the ship he served and performed in many concerts, even in Tunisia, Egypt, and Algeria with extensive concert programs. The main place in his repertoire is our folk song "Sari Gelin". Yashar Gurbanov performed this song in almost all his concerts. After completing his military service, Yashar Gurbanov returned to Nakhchivan, where he continued his musical career in the Nakhchivan State Song and Dance Ensemble. In 1978, to continue his education, he was admitted to the Nakhchivan Secondary Music School, majoring in vocal. He studied vocal at a professional level in the class of Olga Ivanovna, a specialist pedagogue from St. Petersburg, and also took master classes from her. He graduated from that school in 1982. In 1987, he was admitted to the Azerbaijan State Art University, and in 1992 he successfully graduated. During his studies, he performed in many concert programs and acquired a rich repertoire. Here, T. Guliyev, R. Hajiyev, P. Bulbuloglu, M. Magomayev, R. Mirishli, and Pakhmutova performed popular Russian pop works and arias, romances, and songs of many foreign composers and continues to teach students. He was invited by R. Babayev, head of the Azerbaijan TV variety symphony orchestra, to the Song Theater created by Rashid Behbudov, but he could not go due to his family situation. In 1981, he was invited to a concert program organized by the Nakhchivan Komsomol Organization, to be held in Moscow. The tour does not end only in Moscow, but also in Krasnoyarsk, Novosibirsk, and other cities. A month-long musical tour ends very successfully. Although Yashar Gurbanov occasionally stopped his stage activities, he did not stop his teaching activities from 1978 until today. As a result of his activities, he was awarded the medal "Otlichnik kulturnogo pevstva nad selom" by the Ministry of Culture of the USSR, I degree diplomas at many festivals ("Golden Autumn" festivals held in Khankendi (1980-1983)). The music schools of the Babek region of the Nakhchivan Autonomous Republic have achieved great achievements in the training of personnel, as their students were awarded 1st-degree diplomas in the competitions dedicated to the birthday of Azerbaijani National Leader Heydar Aliyev. Among them, Habib Huseynov, Samir Farajov and others can be mentioned. He is currently working as a teacher at the Nakhchivan Music College, teaching vocal art and the secrets of his art to the young generation, training future vocal performers, and at the same time working as a soloist of the Nakhchivan State Philharmonic. The personnel trained by him continued their musical activities in various concert halls and were awarded honorary titles. He performed concert programs at state events held in the Nakhchivan Autonomous Republic and was awarded many times. On September 18, 2016, Yashar Gurbanov was awarded the title of Honored Artist of the Nakhchivan Autonomous Republic.

Yashar Gurbanov's vocal technique is marked by its clarity, emotional depth, and technical precision. His ability to convey the subtleties of Azerbaijani folk songs has earned him widespread acclaim. Gurbanov's mastery of this art form is evident in his performances, where his voice effortlessly navigates complex melodic patterns, creating a captivating auditory experience. These pieces, often characterized by their lyrical beauty and rhythmic diversity, showcase his ability to adapt his vocal technique to different styles while maintaining the integrity of the music. Gurbanov's contributions to Azerbaijani music extend beyond his performances. He is actively involved in efforts to preserve and promote the country's musical heritage. Through recordings, he has created a valuable archive of traditional songs, ensuring that they are accessible to future generations. His educational initiatives, including workshops and masterclasses, have inspired and nurtured a new generation of musicians, fostering a renewed interest in Azerbaijani vocal art.

Yashar Gurbanov's music has transcended national boundaries, earning him recognition on the international stage. His performances at global music festivals and collaborations with artists from different cultural backgrounds have introduced Azerbaijani music to a broader audience. Through these endeavors, Gurbanov has showcased the beauty of his homeland's musical traditions and highlighted the universal language of music.

As a custodian of Azerbaijani vocal art, Yashar Gurbanov continues to explore new horizons while remaining deeply rooted in tradition. His work embodies the spirit of Azerbaijani music - rich, diverse, and ever-evolving. With each performance and project, he contributes to a living legacy that celebrates the past, embraces the present, and inspires the future.

In the world of music, few artists manage to achieve the delicate balance between honoring tradition and embracing innovation. Yashar Gurbanov is one such artist, and his vocal art is a testament to the enduring power and beauty of Azerbaijani music. As he continues to share his gift with the world, Yashar Gurbanov remains a beacon of cultural pride and artistic excellence.

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NEUROIMMUNOLOGY

OPTIMIZATION OF SURGICAL REHABILITATION AND QUALITY OF LIFE OF PATIENTS WITH INTESTINAL STOMA

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Abstract

The article describes in detail the history of the development of surgical proctology, from the time of the appearance of colostomy, the imposition of anastomoses, the stages of the surgery of fatigued patients. Methods and results of rehabilitation of fatigued patients, principles of imposition and closure of single-double colostomy, treatment of post-operative complications. The impact of a surgical treatment method on social adaptation and quality of life of patients.

Keywords: Rehabilitation, surgery, proctology, colostomy, social adaptation, quality of life.

Relevance

In recent years in the Republic of Uzbekistan the number of stomatitis patients have a tendency to increase. This is due to not high-quality nutrition at the choice of people themselves, frequent use of fast food and the growth of colon diseases, in the treatment of which often ends with surgery of the imposition of colostrum.

In today's society, due to rapid urbanization, the number of stomatitis patients is increasing and can be observed between 120 and 150 per 100,000 people, which is consistent with the data of the World Health Organization (WHO), but there is no accurate accounting of stomiosis patients. [3,14,15,18,20,21,22,28].

In the emergency medical service, the most frequently applied colostomy preventively, colostomy is unnatural anus, which is formed during various surgical interventions on the colon and rectum, performed and carrying a rescue character in no-response situations. [1,2,6,16,18].

The history of the development of the trigger mechanism for the application of colostomy preventively, as an operation of choice in emergency situations, is a forced measure, protocolling adopted in many medical institutions around the world. If you look back at the times of ancient doctors with penetrating wound in the abdomen with the opening of the lumen of the intestine could count only on the delimitation of the wound from the free abdominal cavity and the natural formation of intestinal stoma [3,5,6,14,15,18,20].

Natural colostomies sometimes closed themselves, often caused the painful death of patients [3,14,15,20]. Scientists now know more than 200 methods and modifications of colostrum, it has advantages and disadvantages and therefore none of them can be considered ideal [3,4,5,6,7,8,9,10,11,12,13].

Currently, restoration of impaired intestinal function during rehabilitation is of paramount importance. Traditionally, operational accesses pose a significant problem. The surgeon during the operation due to the pronounced adhesive process does not always the desired result. As a result of the emergence of post-operative complications, the patient spends more time in the hospital, resulting in increased financial costs all this contributes to the deterioration of social adaptation and quality of life of patients [13,23,25,26,27].

At the present stage of the development of medicine among scientists' proctologists there is no consensus on the choice of method of formation of colostrum in emergency cases, the search for new ways of fatigue continues. Intestinal stoma is known to seriously affect the quality of life of the patient regardless of the underlying diagnosis [18,24,29].

Currently, the quality of life (QL) of the patient is an important and, in some situations, the main criterion for assessing the effectiveness of treatment in clinical trials. Quality of life reflects the impact of illness and treatment on the well-being of the patient and characterizes his physical, emotional and social wellbeing, which changes under the influence of the illness or his treatment.

The objective is to improve the results of surgical rehabilitation, by optimizing the methods of reconstructive and rehabilitation operations and to study the dynamics of the quality of life of patients with intestinal stoma.

Material and methods

We analyzed the results of observations of 397 patients with intestinal stasis during the period 2012-2019, who were on hospital treatment at Republican Clinical Hospital No. 1 of the Republic of Uzbekistan. All patients were examined according to the standard scheme, including clinical examination data of specialists and instrumental methods of study: ECG; Ultrasound; X-ray; Esophagogastroduodenoscopy; fibrocolonoscopy; rectoromanoscope; digital sphincterometry; proctography; irrigography; colonoscopy; diagnostic laparoscopy; pauschography as needed.

Magnetic resonance imaging (MRI) and other necessary instrumental methods of examination were used to exclude tumors of the abdominal cavity and to identify other pathologies.

In order to assess the quality of life, respondents used the European Quality of Life questionnaire EuroQol-5D and the visual-analogue scale (VAS) to determine the intensity of pain syndrome, who had passed the standard procedure of validation. After the diagnosis, all patients were subjected to surgery – colostomy, various anastomoses and other reconstructive methods of surgery.

Results and discussions

A total of 397 patients with intestinal stoma were studied during the period 2012-2019, who were on hospital treatment at Republican Clinical Hospital No. 1 of the Republic of Uzbekistan.

Patients were classified by age according to the WHO classification.

An analysis of the age aspect showed that, with the majority of subjects being of young age (18–44 years; 74%), male patients were predominantly women by 10% (Table 1).

Table 1

Distribution of patients by gender and age (n=397)

Age	Gender				Number of patients	
	Men		Woman			
	abs.	%	abs.	%	abs.	%
18-44*	160	54,79	132	45,21	292	73,55
45-59	47	60,26	31	39,74	78	19,65
60-74	14	56,00	11	44,00	25	6,30
75-90	2	100,00	0	0,00	2	0,50
Всего	223	56,17	174	43,83	397	100,00
Note: * 16 years old - 2 males. and 1 female, 17 years old - 1 male. Patients over 90 years of age were not observed in our study.						

Patients aged 18-44 years were observed 73%, 55% of men and 45% of women, this is due to lifestyle and other factors leading to intestinal dysfunction.

The analysis of the observation showed that, the disease of patients comes mainly at the working age of 18-59 years about 93% which makes the problem very urgent.

All 397 patients were divided into 3 groups according to the severity of the disease. The first group included 131 (33%) recovered patients who had undergone colostomy, anastomosis and other various types of surgery, their condition was assessed as a milder degree. The second group included 133 (33.5%) patients who had undergone various types of surgery early, their condition was assessed as moderate severity. The third group included 133 (33.5%) patients whose condition was assessed as severe, had repeatedly undergone various surgical interventions and continuing to be ill.

In our study, in 397 patients, the reasons for ostomy placement were as follows: nonspecific ulcerative colitis 140 (35.3%), intestinal bleeding for various reasons 98 (24.7%), intestinal stricture 30 (7.6%), purulent-inflammatory diseases. intestines and peritonitis 19 (4.8%), ulcerative proctitis 19 (4.8%), abdominal pain syndrome 15 (3.8%), adhesive intestinal disease 14 (3.5%), colon diverticulosis 12 (3 %), Crohn's disease 11 (2.5%), ulcerative proctitis 10 (2.5%), volvulus 9 (2.3%), Hirschsprung's disease 5 (1.3%), abdominal trauma 3, duodenal ulcer intestines with perforation 3 and intestinal amebiasis 2 cases, depending on the cause, various stomas or surgical methods were used (Table 2).

Table 2

Nosologically forms of diseases for which ileostomy or colostomy were performed (n= 397)

№	Nosologically form	Quantity	%
1	Nonspecific ulcerative colitis	140	35.3
2	Amebiasis of the colon	2	0.5
3	Volvulus of the sigmoid colon	9	2.3
4	Abdominal injury	3	0.8
5	Diverticulosis of the colon	12	3.0
6	Crohn's disease	11	2.8
7	Diffuse polyposis of the colon	3	0.8
8	Hirschsprung's disease	5	1.3
9	Intestinal bleeding	98	24.7
10	Intestinal stricture	30	7.6
11	Ulcerative proctitis	10	2.5
12	Peritonitis, purulent-inflammatory diseases	19	4.8
13	Duodenal ulcer	3	0.8
14	Intestinal obstruction	19	4.8
15	Adhesive bowel disease	14	3.5

16	Abdominal pain syndrome	15	3.8
17	Uterine fibroids	4	1.0
Total:		397	100%

All 397 patients underwent various surgical interventions depending on the location and origin of the intestinal pathology, with a total of 500 interventions performed, this is explained by the fact that some patients underwent several operations at once (Table 3).

Table 3

Methods of primary surgical interventions (n=397).

№	**Methods of operations**	**Quantity**	**%**
1	Ileo- or colostomy	243	48.6
2	Ascendostomy	2	0.4
3	Descendostomy	26	5.2
4	Ileostomy	177	35.4
5	Colostomy	8	1.6
6	Hartmann operation	3	0.6
7	Sigmostomy	23	4.6
8	Transversostomy	14	2.8
9	Cecostomy	4	0.8
Total:		500	100%

Analysis of the data obtained from 397 patients according to the types of treatment carried out showed the following results: Patients in the first group received the highest number of anastomoses: 78 (60%); in the second group, 35 (27%); 8 (6%); reconstructive operations: 6 (5%); conservative treatment: 4 (3%). In this group of patients, the application of anastomoses is the preferred method of choosing surgery that allows for early recovery (table 4).

Table 4

Indicators of types of treatment for patients of the first group (n=131)

№	**Types of treatment**	**Number abs.**	**%**
1.	Single-barrel stoma placement	8	6,1
2.	Double-barreled stoma	35	26,7
3.	Overlay anastomosis	78	59,5
4.	Reconstructive surgeries	6	4,6
5.	Conservative treatment	4	3,1
Total:		131	100

Patients in the second group received the most surgeries: double stoma closure 35 (26%); second anastomosis 28 (21%); monosomy closing 15 (11%); reconstructive surgery 15 (11%); conservative treatment 40 (30%). In this group of patients, the imposition of anastomoses compared to the first group is three times less, but remains the method of choice of surgical treatment. Many patients (30%) in this group received conservative treatment and rehabilitation therapy (Table 5).

Table 5

Indicators of types of treatment for patients of the second group (n=133)

№	**Types of treatment**	**Number abs.**	**%**
1.	Closure of a single stoma	15	11,3
2.	Closing a double-barreled stoma	35	26,3
3.	Overlay anastomosis	28	21,1
4.	Reconstructive surgeries	15	11,3
5.	Conservative treatment	40	30,1
Total:		133	100

Patients in the third group had the highest number of surgeries: double stoma closure 38 (29%); closure of single stoma 26 (19%); imposition of anastomosis 24 (18%); reconstructive surgery 15 (11%); conservative treatment 30 (23%). In this group of patients, anastomosis was less frequently performed than in the first and second groups, but it remains the method of choice for surgical treatment. Conservative treatment was given to 22% of patients in this group, continuing to be ill and receiving rehabilitation therapy. (Table 6).

Table 6

Indicators of types of treatment for patients in the third group (n=133)

№	Types of treatment	Number abs.	%
1.	Single-barrel stoma placement	26	19,5
2.	Double-barreled stoma	38	28,6
3.	Overlay anastomosis	24	18,0
4.	Reconstructive surgeries	15	11,3
5.	Conservative treatment	30	22,6
Total:		133	100

Of the 397 patients, 74 (18%) received conservative treatment. In the first group 4 (3%) after surgery, additional conservative treatment was performed, signs of intestinal obstruction were resolved and no additional surgery was required, in the second group 40 (30%) patients who had previously undergone surgery after a conservative therapy, the symptoms of Dynamic Intestinal Obstruction had been resolved, and no surgery was needed, and in the third group 30 (23%) in the history of repeated surgical interventions during conservative treatments, signees of dynamic intestinal obstruction had been solved (Table 7).

Table 7

Patients who received conservative treatment (n=397)

Groups	Number of patients	%	Number abs.	%	Percentage of the total number of patients in the group, %
1	131	33,0	4	5,4	3,1
2	133	33,5	40	54,1	30,1
3	133	33,5	30	40,5	22,6
Total:	397	100	74	100	18,6

A comparative analysis of the surgical treatment of 397 patients showed the following results. The preferred method of surgical treatment is the application of anastomoses 130 (40%) in all examined groups, the ratio to the total number of patients 33%, the second place is the imposition and closure of bipolar stoma 108 (33%) out of the total of 27%, the impositions and closures of single stoma 49 (15%) out of a total of 12% and reconstructive operations 36 (11%), out of 9%, it will be as follows (Table 8).

Table 8

Indicators of patients after surgical treatment (n=397)

<table>
<tr><td colspan="2" rowspan="3">Operation name</td><td colspan="6">Groups</td><td colspan="2">Total in groups</td><td>Total n=397</td></tr>
<tr><td colspan="2">Group1</td><td colspan="2">Group 2</td><td colspan="2">Group 3</td><td colspan="2"></td><td></td></tr>
<tr><td>n</td><td>%</td><td>n</td><td>%</td><td>n</td><td>%</td><td>n</td><td>%</td><td>%</td></tr>
<tr><td>1</td><td>Closure of a single stoma</td><td>8</td><td>6,3</td><td>15</td><td>16,1</td><td>26</td><td>25,2</td><td>49</td><td>15,2</td><td>12,3</td></tr>
<tr><td>2</td><td>Closure a double-barreled stoma</td><td>35</td><td>27,6</td><td>35</td><td>37,6</td><td>38</td><td>36,9</td><td>108</td><td>33,4</td><td>27,2</td></tr>
<tr><td>3</td><td>Overlay anastomosis</td><td>78</td><td>61,4</td><td>28</td><td>30,1</td><td>24</td><td>23,3</td><td>130</td><td>40,2</td><td>32,7</td></tr>
<tr><td>4</td><td>Reconstructive surgery</td><td>6</td><td>4,7</td><td>15</td><td>16,1</td><td>15</td><td>14,6</td><td>36</td><td>11,1</td><td>9,1</td></tr>
<tr><td colspan="2">Total:</td><td>127</td><td>100</td><td>93</td><td>100</td><td>103</td><td>100</td><td>323</td><td>100</td><td>81,4</td></tr>
</table>

In our study, the timing of reconstructive operations was developed taking into account the disease for which the stoma was performed, the volume of surgical intervention performed and the general condition of the patient; abdominal trauma - 2.5-4 months, ulcerative-inflammatory diseases - 8-10 months.

A comparative treatment analysis of 397 patients showed the following results. The predominant method of surgical treatment is the application of anastomoses 130 (40%) in all examined groups, the ratio to the total number of patients 33%, in the second place the application and closure of bipolar stoma 108 (33%) out of the total 27%, the imposition and closing of single stoma 49 (15%) out of all 12% and reconstructive surgeries 36 (11%) from the total 9%, the conservative treatment was carried out in the first group 4 (3%), the second group 40 (30%), the third group 30 (23%), that is, 74 (19%) to patients from all studied (table 9).

Table 9

General indicators of treatment of patient groups (n=397)

Group 1 n=131				**Group 2 n=133**		**Group 3 n=133**		**Total:**	
Name of treatment	**n**	**%**	**Name of treatment**	**n**	**%**	**n**	**%**	**n**	**%**
Overlays Single-barreled stoma	8	6,1	Closing single-barrel stoma	15	11,3	26	19,5	49	12,3
Overlays double-barreled stoma	35	26,7	Closing double-barreled stoma	35	26,3	38	28,6	108	27,2
Overlays anastomosis	78	59,5	Overlays anastomosis	28	21,1	24	18,0	130	32,7
Reconstructive operation	6	4,6	Reconstructive operation	15	11,3	15	11,3	36	9,1
Conservative treatment	4	3,1	Conservative treatment	40	30,1	30	22,6	74	18,6
Total:	131	100	Total:	133	100	133	100	397	100

The type of anastomosis formed largely depends on the topographic-anatomical relationships that currently exist in the abdominal cavity. To select a rational method of operation, the type of ileum or colostomy formed, the volume of resection performed, and the length of the proximal and distal parts of the intestinal tube to the stoma are also of no small importance.

The quality of life, study of 397 patients was achieved using the European Quality of Life questionnaire EuroQol-5D and the visual-analogous scale (VAS) to determine the intensity of pain syndrome, having undergone the standard validation procedure.

Analysis of the results of the quality of life, study (QL) of 397 patients showed that the data received in all three groups were different, the deterioration of the QL indicators of the first group did not differ greatly from the normal, in the second group it was found that the patients' PC indicators deteriorated moderately, and in the third group this QL indicator of the patients significantly worsened and slowly recovered.

The most deteriorating parameters of the Euro Qol-5D questionnaire were pain/discomfort and anxiety/depression. QL studies of patients in all groups were conducted before and after surgical treatment (Table 10-11).

Table 10

Indicators of the Euro Qul-5D questionnaire before treatment (n=397)

Groups	**Numbner of patients**	**M (mobility)**	**S (Self-service)**	**BA (Household activity)**	**P/D (Pain/Discomfort)**	**A/D (Anxiety/Depression)**	**EQ health score**
1	131	1	1	0,39658	0,123	0,08611	0,66271
2	133	1	1	0,3404	0,123	0,08465	0,6645
3	133	1	1	0,34767	0,123	0,08727	0,65795
Total:	397	1	1	0,36138	0,123	0,08601	0,661705

Pain/discomfort and anxiety/depression descriptors were largely abnormal in the second and third groups and slowly recovered, with QL rates returning to normal in the first group immediately after surgical treatment.

Table 11

Indicators of the Euro Qul-5D questionnaire after treatment (n=397)

Groups	**Numbner of patients**	**M (mobility)**	**S (Self-service)**	**BA (Household activity)**	**P/D (Pain/Discomfort)**	**A/D (Anxiety/Depression)**	**EQ health score**
1	131	1	1	0,38922	0,4979	0,95208	-0,57638
2	133	1	1	0,3259	0,5244	1,025	-0,6124
3	133	1	1	0,3501	0,3727	0,9483	-0,4421
Total:	397	1	1	0,354912	0,464848	0,975237	-0,54345

A study of 397 patients showed that the most affected parameters of QL pain/discomfort and anxiety/depression contributed to this was the emotional state of the patients.

Pain syndrome as a strong stimulus primarily acts on the emotional state of patients being a provocative factor for the deterioration of QL patients.

To fully evaluate the quality of life of patients, two or more questionnaires covering the most disturbed descriptors and indicators are required. To study the parameters of pain syndrome we used the scale (VAS) for the completeness of the study used its modified form.

The indicators of VAS prior to surgical treatment revealed in the first group light pain (1-3 points) in 113 (86%), moderate pain (4-6 points) for 18 (14%), in the second group mild pain in 51 (38%), moderated in 80 (60%), very severe pain (7-9 points) at one patient, unbearable pain (10 points) on a patient, in the third group slight pain in 15 (11%), moderate in 96 (72%), very strong 184% (14%), intolerable pain in 3 (2%) patients (table 12).

Table 12

VAS scale indicators before treatment (n=397)

Groups	**Number of patients**	1-no pain (0)	2-mild pain (1-3)	3-moderate pain (4-6)	4-very severe pain (7-9)	5-unbearable pain (10)
1	131	0	113	18	0	0
2	133	0	51	80	1	1
3	133	0	15	96	18	3
Total:	397	0	179	194	19	4

After surgical treatment in all three groups, the pain syndrome regressed to disappear, and only one patient in the second group and four patients in the third group sustained mild pain, which proves the effectiveness of the treatment. The modified version of VAS and its five parameters allow for more detailed examination of pain syndrome, absence of pain (0 points), weak pain (1-3 points), moderate pain (4-6 points), very severe pain (7-9 points), intolerable pain (10 points) which means the maximum possible sensation of the pain syndrome. The postoperative parameters of pain sensation in patients are given in the following table (Table 13).

Table 13

VAS scale indicators after treatment (n=397)

Groups	**Number of patients**	1-no pain (0)	2-mild pain (1-3)	3-moderate pain (4-6)	4-very severe pain (7-9)	5-unbearable pain (10)
1	131	131	0	0	0	0
2	133	132	1	0	0	0
3	133	129	4	0	0	0
Total:	397	392	5	0	0	0

The modified version of the VAS and its five parameters allow a more detailed examination of pain syndrome, no pain (0 points), mild pain (1-3 points), moderate pain (4-6 points), very severe pain (7-9 points), unbearable pain (10 points) which means the maximum possible sensation of pain.

Conclusion

Thus, patients aged 18-59 observed 93%, for the proportion of men 55% and women 45%, the disease came mainly in the working age which makes the problem very urgent.

Postoperative follow-up of patients in the first group showed that the highest number of anastomoses were 78 (60%), the second number was 35 (27%), 8 (6%), reconstructive surgeries 6 (5%), conservative treatment 4 (3%). For patients in this group, the application of anastomoses is the preferred method of choosing surgery that allowed early recovery.

A comparative analysis of surgical treatment of 397 patients showed the following results. The predominant method of surgical treatment is anastomosis 130 (40%) in all examined groups, the ratio to the total number of patients 33%, the second place is the imposition and closure of bipolar stoma 108 (33%) out of the total 27%, the impositions and closures of single stoma 49 (15%) out of a total of 12% and reconstructive surgery 36 (11%) from the total of 9%.

Analysis of the results of the quality of life, study (QL) of 397 patients showed that the data received in all three groups were different, the deterioration of the QL indicators of the first group did not differ greatly from the normal, in the second group it was found that the patients' PC indicators deteriorated moderately, and in the third group this PC indicator of the patients significantly worsened and slowly recovered.

The most deteriorating parameters of the Euro Qol-5D questionnaire were pain/discomfort and anxiety/depression.

The Visual Analogous Scale (VAS) and its five parameters allow more detailed examination of pain syndrome, absence of pain (0 points), weak pain (1-3 points), moderate pain (4-6 points), very severe pain (7-9 points), intolerable pain (10 points) which means the maximum possible version of pain.

Conclusion

1. Analysis of observations showed that, the disease of patients comes mainly at the working age of 18-59 years about 93% which makes the problem very regent.

2. The predominant method of surgical treatment is the application of anastomoses 130 (40%) in all studied groups, the ratio to the total number of patients 33%, in the second place the application and closure of bipolar stoma 108 (33%) out of a total of 27%.

3. A study of 397 patients showed that the most affected parameters of QL pain/discomfort and anxiety/depression were the emotional state of the patients.

4. The visual-analogous scale and its five parameters allow more detailed examination of pain syndrome, absence of pain (0 points), weak pain (1-3 points), moderate pain (4-6 points), very severe pain (7-9 points), unbearable pain (10 points) which means the maximum possible feeling of pain.

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MODERN DIAGNOSTICS, ASSESSMENT OF QUALITY OF LIFE AND DIFFERENTIATED TREATMENT OF PATIENTS WITH TRIGEMINAL NEURALGIA

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Abstract

The article describes in detail the historical aspects of such a serious disease as trigeminal neuralgia, the dynamic development of methods and techniques of conservative and surgical treatment. In connection with the development of medicine and the emergence of modern diagnostic methods, an analysis and importance for determining the severity of trigeminal neuralgia are given. The advantages of methods for treating trigeminal neuralgia, the validity of a differentiated approach taking into account the severity of the disease is given. Studies of the quality of life of patients using questionnaires, based on the analysis of the data obtained, the choice of a method for treating trigeminal neuralgia and improving the results.

Keywords: trigeminal neuralgia, diagnostics, quality of life, differentiated approach, severity of neuralgia.

Relevance

Trigeminal neuralgia (TN) is a syndrome characterized by sudden, short-term, intense, recurring pain in the innervation zone of one or more branches of the trigeminal nerve. This definition of TN is confirmed by the International Association for the Study of Pain [1,4,12,19]. Pain syndrome in long-term recurrent courses of neuralgia can change - it can become constant, diffuse, acquire a "burning", "pressing", "aching" character [5,11,16,18].

Trigeminal neuralgia is quite common and makes up from thirty to fifty patients per hundred thousand inhabitants in most countries of the world, and the incidence according to the World Health Organization (WHO) reaches three to five cases per hundred thousand inhabitants during the year. At present, it is not possible to accurately estimate the incidence and morbidity, since patients are most often treated by various specialists at their place of residence [6,7,11,13,15,19].

At the current stage of development of medicine, a more valuable method for diagnosing trigeminal neuralgia is Magnetic resonance imaging (MRI) from 1.5 to 3.0 Tesla, according to T2 (3D-FIESTA, DRIVE or CISS), time-of-flight magnetic resonance angiography (MRA) (3D-TOF), as well as contrast-enhanced weighted according to T1 mode [2,5,14,16,17].

A more modern and very important method in diagnosing trigeminal neuralgia is electroneuromyography (ENMG), which determines the level of damage to the branches of the nerve, i.e., central or peripheral irritation. ENMG allows us to choose the tactics of surgical or conservative treatment of trigeminal neuralgia taking into account the level of damage [1,2,5,14,16].

Currently, quality of life (QOL), based on the patient's subjective feelings, is an important, and in some situations one of the main criteria for assessing the effectiveness of treatment in clinical trials. Quality of life reflects the impact of the disease and treatment on the patient's well-being and characterizes his physical, emotional and social well-being, which changes under the influence of the disease or its treatment, so scientists around the world have increasingly begun to study [3,8,9,10].

Purpose of the study: Improving the treatment results of patients with trigeminal neuralgia through a differentiated approach taking into account the severity of the course and assessing the quality of life.

Material and methods

The study is based on the results of observations of 171 patients with trigeminal neuralgia who were treated in the inpatient department of the Tashkent Medical Academy, a multidisciplinary clinic, and the neurosurgery department in the period from 2019 to 2023.

To establish a diagnosis and choose a treatment method, all patients underwent a comprehensive examination, including clinical, neurological and instrumental research methods.

During the initial examination of patients, as the main criteria for trigeminal neuralgia (TN), attention was paid to the presence of the following symptoms - unilateral paroxysmal facial pain; the presence of a trigger zone; soreness of the Vale points (pressure on which causes an attack), increased pain when eating and talking; a positive effect from treatment with Finley psinom at the initial stages of the disease. The presence of such symptoms as hypertonicity of the masticatory muscles, autonomic disorders, hypesthesia of the innervation zones of individual branches or the entire half of the face were also checked. NTN is characterized by the presence of short attacks (2-15 min), which can be repeated frequently (up to 30 times a day).

We give an important place in establishing the diagnosis and determining further treatment tactics to magnetic resonance imaging (MRI) data from 1.5 to 3.0 Tesla, according to T2 (3D-FIESTA, DRIVE or CISS), time of flight magnetic resonance angiography (MRA)

(3D-TOF), as well as contrast-enhanced weighted according to T1 mode to determine neurovascular conflict.

In our studies, we used electroneuromyography (ENMG), which determines the level of damage to the nerve branches, i.e., central or peripheral irritation with a reliability of 75%, giving us the opportunity, taking into account the level of damage, to choose the tactics of surgical or conservative treatment of trigeminal neuralgia.

The quality of life of patients was assessed using the questionnaires "Assessment of the quality of life in trigeminal neuralgia" and "Assessment of pain syndrome in trigeminal neuralgia" developed by the Republican Specialized Scientific and Practical Medical Center for Neurosurgery.

Results and discussion

The results of observations of 171 patients with trigeminal neuralgia who were treated in the inpatient department of the Tashkent Medical Academy, a multidisciplinary clinic, and the neurosurgery department in the period from 2019 to 2023 were studied.

All patients were divided into three groups according to treatment methods, severity of trigeminal neuralgia and somatic status.

The first group included 55 (32.2%) patients who underwent conservative treatment, blockade of the peripheral branches of the trigeminal nerve. The second group included 57 (33.3%) patients who underwent Gasser's node blockade, exeresis of the branches of the trigeminal nerve. The third group consisted of 59 (34.5%) patients who underwent microvascular decompression of the trigeminal nerve root.

By age, patients were distributed according to the WHO classification, which provides for the identification of age groups: young age 14-19 years; younger middle age 20-44 years; older middle age 45-59 years; elderly age 60-74 years; old age 75-89 years.

Distribution of patients by age and gender showed that among the patients, women prevailed - 103 (60.2%), there were 68 (39.8%) men, which is 1.5 times less than women. Most patients 71 (41.5%) were of middle and old age, the maximum number of patients was in the age group of 60-74 years, 52 (30.4%), which is consistent with the data of world scientists.

When examining the somatic status, it was revealed that among 171 patients, 69 (40.5%) patients had somatic pathology, manifested in the form of arterial hypertension in 53 (31.0%) patients, ischemic heart disease in 13 patients (7.8%). In 19 (11.2%) observations, diabetes mellitus was noted, in 4 (2.6%) patients, liver pathology, and in 1 (0.9%), renal failure. It should be noted that the same patient had a combination of two or more somatic diseases, especially cardiovascular diseases.

Analysis of provoking factors based on the results of the study showed that almost all patients had: provoking factors such as chewing and talking in more than 93% of cases, the second place is taken by the factor of touch - up to 8% of observations, the rest are cold, brushing teeth, washing, shaving and opening the mouth in less than 5% of cases.

Before admission to the clinic, all patients received complex conservative treatment, patients were treated by dentists, neurologists, maxillofacial surgeons.

During examination of patients, the following symptoms were identified as the main criteria of trigeminal neuralgia: unilateral paroxysmal facial pain, the presence of a trigger zone in 171 patients examined; localization of trigger zones gave the following results, with a total of 33 (19.3%) observations; among 33 patients with trigger points, the nasolabial triangle ranks first in localization 16 (48.5), the mental region ranks second 8 (24.3%), the frontal-zygomatic region ranks third 3 (9.1%), and the remaining zones are the oral cavity, cheek, parotid region, Vale points, neck in the area of the spinous processes of the III-IV cervical vertebrae from 3% to 6% of cases.

We also checked for symptoms of hypertonicity of the masticatory muscles, autonomic disorders, and hypoesthesia of the innervation zones of individual branches or the entire half of the face. At the same time, it was confirmed that trigeminal neuralgia is characterized by the presence of short attacks (2-15 min), which can be repeated frequently (up to 30 times a day). The study of sensitivity disorders in the innervation zone of the trigeminal nerve branches yielded the following results.

In our study, out of a total of 171 patients, 92 (54%) had impaired sensitivity in the innervation zone of the trigeminal nerve branches: 52.2% of cases of hypoesthesia, 40.2% of cases of paresthesia, 6.5% of cases of hyperesthesia, and 1 case of anesthesia as a result of previous surgical interventions. This case was observed among patients in the third group. As a result of multiple exeresis operations, sensitivity in the innervation zone was completely lost, and trophic changes in the facial muscles of the face on the side of the lesion of the trigeminal nerve branches occurred.

Vegetative disorders in our patients were observed in 18 (10.5%) cases, of which 50.1% were hyperemia, 33.3% were lacrimation, 16.6% were salivation, if we consider by groups 55.6% were in the third group, 27.7% were in the second group, and the least were 16.7% in the first group. After treatment, vegetative disorders were restored.

Analysis of the 171 patients examined, by the location of the affected branches of the trigeminal nerve, showed the following results.

134 (78.4%) patients had trigeminal neuralgia on the right, 34 (19.8%) on the left, and in 3 (1.8%) observations on both sides.

In our observations, the second (33.3%) and second + third branches (4.6%) were most often affected in the patients under study, and, as noted above, right-sided neuralgia was noted in most cases, which proves its typicality.

Thus, in our observations, 2 branches were most often affected simultaneously in 50.9% of patients. Damage to all three branches was observed in 31.9% and one branch in 17.2%. Most often, the pain syndrome was on the right in 78.4%, on the left in 19.8% and on both sides in 1.8% of cases. The data we obtained from the study of patients are consistent with the literature data of world authors.

Positive results among the 171 patients under study were noted in 163 (95.0%), without changes in 8 (5.0%). The best indicators were in group 3, all patients in this group received positive results. This proves the effectiveness of the surgical intervention method with a differentiated approach to the treatment of trigeminal neuralgia, taking into account the somatic status of the patient.

The analysis of the obtained data showed that 87% of patients in the third group showed significant improvement, 13% showed improvement, no change, in the second group 25.5% showed significant improvement, 66.7% showed improvement, in the first group only 9.2% showed significant improvement, 83.3% showed improvement, in the first and second groups no change in almost equal proportions more than 7% of cases.

In our studies, microvascular decompression of the trigeminal nerve root at the brainstem turned out to be a more effective surgical intervention method, since 87% of the total number of patients treated in this group showed significant improvement. In our studies, questionnaires from the Republican Specialized Scientific and Practical Medical Center of Neurosurgery were used to assess the quality of life and pain syndrome in patients with trigeminal neuralgia.

The use of the questionnaire "Assessment of the quality of life in trigeminal neuralgia" showed that the quality of life in all the studied groups was similar: that is, before the operation, the quality of life, indicators in all groups were low.

After the treatment, the quality of life, indicators immediately began to improve in patients with trigeminal neuralgia, this was especially noticeable in the third group, and positive results were also shown by patients in the second and first groups.

The use of the questionnaire "Assessment of pain syndrome in trigeminal neuralgia" in the third period showed that the parameters of pain syndrome in the preoperative period in the studied patients in all groups differed from each other with a difference in points.

High indicators were recorded in the first group before the operation, which corresponded to a severe degree of severity of the pain syndrome, and after the treatment in all groups, a decrease in it to an average degree was observed in both the first and second groups, which was noted by the data obtained as a result of using the questionnaires.

Analyzing the anamnestic data of these patients, I would like to draw attention to the following points indicating the complexity of diagnosing the disease and, accordingly, incorrect treatment of patients. Thus, out of 5 patients with neuralgia of the first branch, 3 had previously been diagnosed with migraine, and appropriate therapy was carried out. However, the most difficult and causing certain damage to health are neuralgias of the 3rd or third branch. Almost all patients of the second group (57) consulted dentists about toothache.

Almost all patients underwent therapy at the dentist, including tooth extraction. Further progression of pain allowed to correctly establish the diagnosis and conduct further therapy of the underlying disease.

Thus, comparative assessment data on all used questionnaires of quality of life and pain syndrome in patients with TN before and after microvascular decompression of the trigeminal nerve root correlated with each other.

According to the questionnaire "Assessment of pain syndrome in trigeminal neuralgia": a sum of up to 10 points - mild severity of trigeminal neuralgia, 11-21 points - moderate severity of trigeminal neuralgia, 22-32 points - severe severity of trigeminal neuralgia. Assessment of pain syndrome in trigeminal neuralgia according to the questionnaire made it possible to determine in 171 patients mild pain syndrome in 41 (24.4%), moderate pain in 121 (71.3%), severe pain in 9 (5.2%), and in the postoperative period - a complete absence of pain was noted in 166 (97.3%) and in 5 (2.9%) - mild pain syndrome.

According to the questionnaire "Assessment of the quality of life in trigeminal neuralgia": a sum of up to 10 points is a slight deterioration in the quality of life, 11-21 points is a moderate deterioration in the quality of life, 22-33 points is a significant deterioration in the quality of life. Assessment of the quality of life according to the questionnaire in 171 patients with trigeminal neuralgia showed a significant deterioration in the quality of life in the preoperative period in 130 (76.5%) patients, and a deterioration in the quality of life in 41 (24.4%). And in the postoperative period, patients with a significant improvement in the quality of life amounted to 18 (10.4%) and with improvement - 146 (85.4%), a slight improvement in the quality of life was noted in 7 (4.3%) patients.

Conclusions

1. Distribution of patients by age and gender showed that among the patients, women prevailed - 103 (60.2%), men were 68 (39.8%), which is 1.5 times less than women. Most patients 71 (41.5%) were of middle and old age, the maximum number of patients was in the age group of 60-74 years, 52 (30.4%), which is consistent with the data of world scientists.

2. Provoking factors such as chewing and talking more than 93% of cases, the second place is taken by the factor of touch - up to 8% of observations, the rest are cold, brushing teeth, washing, shaving and opening the mouth less than 5% of cases.

3. When examining the somatic status, it was revealed that among 171 patients, 69 (40.5%) had concomitant pathology, such as arterial hypertension in 53 (31.0%), ischemic heart disease in 13 (7.8%) cases, diabetes mellitus was noted in 19 (11.2%) observations, liver pathology in 4 (2.6%) and renal failure in 1 (0.9%).

4. Trigger zones in 171 patients in a total of 33 cases (19.3%) of observations, among 33 the following were revealed: nasolabial triangle 16 (48.5), mental region 8 (24.3%), frontal-zygomatic region 3 (9.1%), other zones such as the oral cavity, cheek, parotid region, Vale points, neck in the area of the spinous processes of the III-IV cervical vertebrae from 3% to 6% of cases. 5. In our study, out of 171 patients, 92 (54%) had impaired sensitivity in the innervation zone of the trigeminal nerve branches (52.2% of cases of hypoesthesia, 40.2% of cases of paresthesia, 6.5% of cases of hyperesthesia, and 1 case of anesthesia as a result of previous surgical interventions.

6. Autonomic disorders were observed in our patients in 18 (10.5%) cases, of which the most common were 50.1% hyperemia, 33.3% lacrimation, and 16.6% of cases of salivation.

7. Positive results after treatment of 171 patients were noted in 163 (95.0%), and unchanged in 8 (5.0%), which proves that all methods of treating neuralgia are quite effective when used in a differentiated manner.

8. Assessment of pain syndrome in trigeminal neuralgia using a questionnaire allowed us to determine mild pain syndrome in 41 (24.4%) patients, moderate pain syndrome in 121 (71.3%), severe pain syndrome in 9 (5.2%), and in the postoperative period, a complete absence of pain was noted in 166 (97.3%) and mild pain syndrome in 5 (2.9%). 9. Assessment of quality of life using a questionnaire in 171 patients with trigeminal neuralgia showed a significant deterioration in quality of life in the preoperative period in 130 (76.5%) patients, and a deterioration in quality of life in 41 (24.4%). In the postoperative period, patients with a significant improvement in quality of life amounted to 18 (10.4%) and with improvement – 146 (85.4%), a slight improvement in quality of life was noted in 7 (4.3%) patients.

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DIAGNOSTIC CRITERIA AND ASSESSMENT OF QUALITY OF LIFE IN THE DIFFERENTIATED TREATMENT OF PATIENTS WITH TRIGEMINAL NEURALGIA

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Abstract

The article describes in detail the historical aspects of such a serious disease as trigeminal neuralgia, the dynamic development of methods and techniques of conservative and surgical treatment. In connection with the development of medicine and the emergence of modern diagnostic methods, an analysis and importance for determining the severity of trigeminal neuralgia are given. The advantages of methods for treating trigeminal neuralgia, the validity of a differentiated approach taking into account the severity of the disease is given. Studies of the quality of life of patients using questionnaires, based on the analysis of the data obtained, the choice of a method for treating trigeminal neuralgia and improving the results.

Keywords: trigeminal neuralgia, diagnostics, quality of life, differentiated approach, severity of neuralgia.

Relevance

Trigeminal neuralgia is quite common and accounts for thirty to fifty patients per hundred thousand inhabitants in most countries of the world, and the incidence according to the World Health Organization (WHO) reaches three to five cases per hundred thousand inhabitants during the year. Currently, it is not possible to accurately estimate the incidence and incidence, since patients are most often treated by various specialists at their place of residence [7,10,12,13,16].

Symptoms of trigeminal neuralgia were first described in more detail and its treatment was proposed by John Locke, an English philosopher, a philosopher of consciousness, who studied Plato and Aristotle during the English ambassador's wife in 1677 with paroxysmal pain in the right side of the face. To treat this disease, he prescribed laxatives, after using them for several weeks, he observed a significant reduction in neuralgia attacks. Then, about a century later, Nicholas Andre in 1756 described the pain syndrome in trigeminal neuralgia and called it "tic doloreux". Andre thought that the occurrence of pain syndrome was associated with facial muscle contractions as a result of irritation of the branches of the trigeminal nerve, due to the production of fluids. Based on his hypothesis, he used an alkali solution for local application in order to destroy the second branch through the suborbital opening for several days until the root was completely destroyed [1,3,4,9,11,12,13,14,16].

At the current stage of development of medicine, a more valuable method for diagnosing trigeminal neuralgia is Magnetic resonance imaging (MRI) from 1.5 to 3.0 Tesla, according to T2 (3D-FIESTA, DRIVE or CISS), time-of-flight magnetic resonance angiography (MRA) (3D-TOF), as well as contrast-enhanced weighted according to T1 mode [1,3,4,9,11,12,13,14,16].

The disadvantages of MTR include low resolution in the diagnosis of small arterial branches and veins, as well as the inability to determine thickening of the arachnoid membrane and distal root compression. Thus, most authors indicated that this protocol is not effective enough to accurately determine neurovascular conflict in trigeminal neuralgia [1,3,4,9,11,12,13,14,16].

A more modern and very important method in the diagnosis of trigeminal neuralgia is electroneuromyography (ENMG), which determines the level of damage to the nerve branches, i.e., central or peripheral irritation. ENMG gives us the opportunity, taking into account the level of damage, to choose the tactics of surgical or conservative treatment of trigeminal neuralgia [5,6,12,15].

Currently, quality of life (QOL), based on the patient's subjective feelings, is an important, and in some situations one of the main criteria for assessing the effectiveness of treatment in clinical trials [2,8,12].

It should be noted that the analysis of the literature shows the creation of a single registry of patients with trigeminal neuralgia receiving treatment from family doctors, dentists, ophthalmologists, neurologists and other specialists. A differentiated approach to the treatment of patients, taking into account the severity of trigeminal neuralgia, gives us the opportunity to improve treatment outcomes and quality of life.

Purpose of the study: Improving the treatment outcomes of patients with trigeminal neuralgia through a differentiated approach, taking into account the severity of the course and assessing the quality of life.

Material and methods

The study is based on the results of observations of 171 patients with trigeminal neuralgia who were treated in the inpatient department of the Tashkent Medical Academy, a multidisciplinary clinic, and the neurosurgery department in the period from 2019 to 2023.

To establish a diagnosis and select a treatment method, all patients underwent a comprehensive examination, including clinical, neurological and instrumental research methods.

During the initial examination of patients, the following symptoms were taken into account as the main criteria for trigeminal neuralgia (TN): unilateral paroxysmal facial pain; the presence of a trigger zone; soreness of the Vale points (pressure on which causes an attack), increased pain when eating and talking; a positive effect from treatment with Finley Psin in the initial stages of the disease. The presence of symptoms such as hypertonicity of the masticatory muscles, autonomic disorders, and hypoesthesia of the innervation zones of individual branches or the entire half of the face were also checked. TN is characterized by the presence of short attacks (2-15 minutes), which can be repeated frequently (up to 30 times a day).

An important place in establishing a diagnosis and determining further treatment tactics is given to magnetic resonance imaging (MRI) data from 1.5 to 3.0 Tesla, by T2 (3D-FIESTA, DRIVE or CISS), time of flight magnetic resonance angiography (MRA) (3D-TOF), as well as contrast enhanced weighted by T1 mode to determine neurovascular conflict.

In our studies, we used electroneuromyography (ENMG), which determines the level of damage to the nerve branches, i.e., central or peripheral type irritation with a reliability of 75%, giving us the opportunity, taking into account the level of damage, to choose the tactics of surgical or conservative treatment of trigeminal neuralgia.

The quality of life of patients was assessed using the questionnaires "Assessment of the quality of life in trigeminal neuralgia" and "Assessment of pain syndrome in trigeminal neuralgia" developed by the Republican Specialized Scientific and Practical Medical Center for Neurosurgery.

Results and discussion

The results of observations of 171 patients with trigeminal neuralgia who were treated in the inpatient department of the Tashkent Medical Academy, a multidisciplinary clinic, and the neurosurgery department from 2019 to 2023 were studied.

All patients were divided into three groups according to treatment methods, the severity of trigeminal neuralgia, and the state of their somatic status.

The first group included 55 (32.2%) patients who underwent conservative treatment, blockade of the peripheral branches of the trigeminal nerve.

The second group included 57 patients (33.3%) who underwent Gasserian ganglion block and trigeminal nerve branch exeresis. The third group consisted of 59 patients (34.5%) who underwent microvascular decompression of the trigeminal nerve root.

By age, the patients were distributed according to the WHO classification, which provides for the identification of age groups: young age 14-19 years; younger middle age 20-44 years; older middle age 45-59 years; elderly age 60-74 years; old age 75-89 years.

The distribution of patients by age and gender showed that among the patients, women predominated - 103 (60.2%), there were 68 men (39.8%), which is 1.5 times less than women. The majority of patients 71 (41.5%) were of middle and old age, the maximum number of patients was in the age group of 60-74 years, 52 (30.4%), which is consistent with the data of world scientists.

When examining the somatic status, it was revealed that among 171 patients, 69 (40.5%) patients had somatic pathology, manifested in the form of arterial hypertension in 53 (31.0%) patients, ischemic heart disease in 13 patients (7.8%). In 19 (11.2%) observations, diabetes mellitus was noted, in 4 (2.6%) patients liver pathology and in 1 (0.9%) renal failure.

It should be noted that in one and the same patient, a combination of two or more somatic diseases was noted, this was especially characteristic of cardiovascular diseases.

Analysis of provoking factors based on the results of the study showed that almost all patients had: provoking factors such as chewing and talking in more than 93% of cases, the second place is taken by the factor of touch - up to 8% of observations, the rest are cold, brushing teeth, washing, shaving and opening the mouth in less than 5% of cases.

During examination of patients, the following symptoms were identified as the main criteria of trigeminal neuralgia: unilateral paroxysmal facial pain, the presence of a trigger zone in 171 patients examined; localization of trigger zones gave the following results, with a total of 33 (19.3%) observations; among 33 patients with trigger points, the nasolabial triangle ranks first in localization 16 (48.5), the mental region ranks second 8 (24.3%), the frontal-zygomatic region ranks third 3 (9.1%), and the remaining zones are the oral cavity, cheek, parotid region, Vale points, neck in the area of the spinous processes of the III-IV cervical vertebrae from 3% to 6% of cases.

We also checked for symptoms of hypertonicity of the masticatory muscles, autonomic disorders, and hypoesthesia of the innervation zones of individual branches or the entire half of the face. In this case, we were convinced that trigeminal neuralgia is characterized by the presence of short attacks (2-15 min), which can be repeated frequently (up to 30 times a day).

The study of sensitivity disorders in the innervation zone of the trigeminal nerve branches gave the following results. In our study, out of 171 total, 92 (54%) patients had sensitivity disorders in the innervation zone of the trigeminal nerve branches: 52.2% of cases of hypesthesia, 40.2% of cases of paresthesia, 6.5% of cases of hyperesthesia, and 1 case of anesthesia as a result of previous surgical interventions. This case was observed among patients in the third group. As a result of multiple exeresis operations, sensitivity in the innervation zone was completely lost, and trophic changes in the facial muscles of the face on the side of the lesion of the trigeminal nerve branches occurred.

Vegetative disorders in our patients were observed in 18 (10.5%) cases, of which 50.1% were hyperemia, 33.3% were lacrimation, 16.6% were salivation, if we consider by groups 55.6% were in the third group, 27.7% were in the second group, and the least were 16.7% in the first group. After treatment, vegetative disorders were restored.

An analysis of the 171 patients examined, by the location of the affected branches of the trigeminal nerve, showed the following results.

In 134 (78.4%) patients, trigeminal neuralgia was noted on the right, in 34 (19.8%) on the left, and in 3 (1.8%) observations on both sides.

In our observations, the second (33.3%) and second + third branches (4.6%) were most often affected in the patients under study, and, as noted above, right-sided neuralgia was noted in most cases, which proves its typicality.

Thus, in our observations, 2 branches were most often affected simultaneously in 50.9% of patients. Damage to all three branches was observed in 31.9% and one branch in 17.2%. Most often, the pain syndrome was on the right in 78.4%, on the left in 19.8% and on both sides in 1.8% of cases. The data we obtained from the study of patients are consistent with the literature data of world authors.

Positive results among the 171 patients under study were noted in 163 (95.0%), without changes in 8 (5.0%). The best indicators were in group 3, all patients in this group received positive results.

This proves the effectiveness of the surgical intervention method with a differentiated approach to the treatment of trigeminal neuralgia, taking into account the somatic status of the patient.

Analysis of the obtained data showed that 87% of patients in the third group showed significant improvement, 13% showed improvement, no change, in the second group 25.5% showed significant improvement, 66.7% showed improvement, in the first group only 9.2% showed significant improvement, 83.3% showed improvement, in the first and second groups no change in almost equal proportions in more than 7% of cases.

In our studies, microvascular decompression of the trigeminal nerve root at the brainstem turned out to be a more effective surgical intervention method, since 87% of the total number of patients treated in this group showed significant improvement. In our studies, questionnaires from the Republican Specialized Scientific and Practical Medical Center of Neurosurgery were used to assess the quality of life and pain syndrome in patients with trigeminal neuralgia.

The use of the questionnaire “Assessment of the quality of life in trigeminal neuralgia” showed that the quality of life in all study groups was similar: that is, before the operation, the quality of life, indicators in all groups were low.

After the treatment, patients with trigeminal neuralgia immediately began to improve their quality of life, indicators, this was especially noticeable in the third group, and positive results were also shown by patients in the second and first groups.

The use of the questionnaire "Assessment of pain syndrome in trigeminal neuralgia" in the third period showed that the parameters of pain syndrome in the preoperative period in the studied patients in all groups differed from each other with a difference in scores.

High indicators were recorded in the first group before the operation, which corresponded to a severe degree of severity of pain syndrome, and after the treatment in all groups, its decrease to an average degree was observed in both the first and second groups, which was noted by the data obtained as a result of using questionnaires.

Analyzing the anamnestic data of these patients, I would like to draw attention to the following points indicating the complexity of diagnosing the disease and, accordingly, improper treatment of patients. So, out of 5 patients with neuralgia of the first branch, 3 were previously diagnosed with migraine, and appropriate therapy was carried out. However, the most difficult and causing certain damage to health are neuralgias of the 3rd or third branch. Almost all patients of the second group (57) consulted dentists about toothache.

Almost all patients underwent therapy at dentists, including tooth extraction. Further progression of pain allowed to establish a correct diagnosis and conduct further therapy of the underlying disease.

According to the questionnaire "Assessment of pain syndrome in trigeminal neuralgia": the sum of up to 10 points is a mild degree of severity of NTN, 11-21 points is an average degree of severity of NTN, 22-32 points is a severe degree of severity of NTN. Assessment of pain syndrome in trigeminal neuralgia using the questionnaire allowed us to determine mild pain syndrome in 171 patients (41 (24.4%), moderate pain syndrome in 121 (71.3%), severe pain syndrome in 9 (5.2%), and in the postoperative period, complete absence of pain was noted in 166 (97.3%) and mild pain syndrome in 5 (2.9%).

According to the questionnaire "Assessment of the quality of life in trigeminal neuralgia": a sum of up to 10 points means a slight deterioration in the quality of life, 11-21 points means a moderate deterioration in the quality of life, 22-33 points means a significant deterioration in the quality of life. Assessment of quality of life by questionnaire in 171 patients with trigeminal neuralgia showed significant deterioration of quality of life in 130 (76.5%) patients in the preoperative period, and deterioration of quality of life in 41 (24.4%). And in the postoperative period, patients with significant improvement of quality of life amounted to 18 (10.4%) and with improvement – 146 (85.4%), slight improvement of quality of life was noted in 7 (4.3%) patients.

Conclusions:

1. Trigger zones in 171 patients in only 33 cases (19.3%) of observations, among 33 the following were revealed: nasolabial triangle 16 (48.5), mental region 8 (24.3%), frontal-zygomatic region 3 (9.1%), other zones such as oral cavity, cheek, parotid region, Vale points, neck in the area of spinous processes of III-IV cervical vertebrae from 3% to 6% of cases.

2. In our study, out of 171 total, 92 (54%) patients had impaired sensitivity in the innervation zone of the trigeminal nerve branches 52.2% of cases of hypesthesia, 40.2% of paresthesia, hyperesthesia 6.5% and 1 observation of anesthesia as a result of previous surgical interventions.

3. Vegetative disorders were observed in 18 (10.5%) cases in our patients, of which 50.1% were hyperemia, 33.3% were lacrimation, 16.6% were salivation.

4. Positive results after treatment of 171 patients were noted in 163 (95.0%), no changes in 8 (5.0%),

which proves that all methods of treating neuralgia are quite effective when used in a differentiated manner.

5. Assessment of pain syndrome in trigeminal neuralgia using a questionnaire allowed us to determine mild pain syndrome in 171 patients in 41 (24.4%), moderate pain in 121 (71.3%), severe pain in 9 (5.2%), and in the postoperative period, a complete absence of pain was noted in 166 (97.3%) and 5 (2.9%) had mild pain syndrome.

6. Assessment of the quality of life using a questionnaire in 171 patients with trigeminal neuralgia showed a significant deterioration in the quality of life in 130 (76.5%) patients in the preoperative period, and a deterioration in the quality of life in 41 (24.4%). And in the postoperative period, patients with a significant improvement in the quality of life amounted to 18 (10.4%) and with an improvement - 146 (85.4%), a slight improvement in the quality of life was noted in 7 (4.3%) patients.

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NORMAL AND PATHOLOGICAL PHYSIOLOGY

INVESTIGATION OF THIOL/DISULFIDE HOMEOSTASIS AS AN OXIDATIVE STRESS PATHWAY IN DEVELOPMENTAL DYSPLASIA OF THE HIP

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Abstract

Objectives: The present study sought to investigate the role of thiol–disulfide homeostasis (TDH) acting as a specific biochemical pathway of oxidative stress in the etiology of Developmental Dysplasia of the Hip (DDH).

Study Design: Randomised control trial.

Place and Duration of the Study: Department of Orthopedics and Traumatology, Harran University Faculty of Medicine, Şanlıurfa, Türkiye. From April 2020 to May 2023.

Methodology: Venous blood samples were collected from children with DDH and the control group. Participants were assessed for oxidative stress status including TDH and systemic oxidative stress parameters. Clinical outcomes were assessed using Tönnis grading and acetabular index measurements.

Results: After treatment, clinical scores in patients improved significantly than the pretreatment scores. In DDH patients, systemic oxidative parameters were significantly higher than in the control group, while TDH values did not show a statistical difference. TDH metabolism in the patient group showed a significant improvement after treatment.

Discussion: This is the first study to investigate the potential role of dynamic TDH metabolism in DDH. There is no difference in TDH parameters between patients before treatment and the control group. However, TDH improved significantly in DDH patients after treatment. This can be attributed to the decrease in overall oxidative stress.

Keywords: developmental dysplasia of the hip, thiol-disulfide, oxidative stress.

Introduction

The hip joint is stabilized by the acetabulum, joint capsule, and surrounding connective tissues. During embryogenesis normal hip joint development may be disrupted by various precipitating factors such as ligamentous laxity, breech presentation, and postnatal posture under the influence of hormonal and genetic factors. Based on this etiology that also includes postnatal factors, Davies and Walker coined the term "Developmental Dysplasia of the Hip (DDH)" in 1984. This term has expanded the spectrum of the disease to cover acetabular dysplasia, subluxation, and dislocation resulting from capsular laxity and abnormal development of the hip.[1]

Energy production is achieved by oxidative phosphorylation reactions at the cellular level, resulting in endogenous formation of reactive oxygen species (ROS). However, ROS may also result from exposure to exogenous conditions such as aging, infection, xenobiotics, ischemia-reperfusion injury, high oxygen pressure, and radiation.[2] ROS reportedly can damage biological structures and cause tissue damage, but these effects can be counterbalanced by antioxidant defense systems. Under physiological conditions, ROS and antioxidants are in equilibrium.[3] The condition when this balance shifts in favor of ROS is called "oxidative stress". Oxidative stress has been shown to trigger the etiopathogenesis of numerous diseases.[4]

Thiol-based antioxidant compounds containing sulfhydryl (-SH) groups (albumin, cysteine, γ-glutamyl cysteine, cysteinyl glycine, glutathione, and homocysteine) act as a defense mechanism against oxidative stress by reducing oxygen in ROS and oxidizing themselves.[5] This leads to covalent bonds of disulfide-based (-S-S) compounds between ROS and oxidized thiol groups. Such a decrease in the amount of native thiol- (NT) and total thiol- (TT) based compounds and increase in the amount of disulfide- (DS) based compounds indicate oxidative stress. Conversely, an increase in NT and TT indicates reduced oxidative stress. This state is called thiol–disulfide homeostasis (TDH).

Ability of DS-based compounds to be reduced back to thiol-based compounds via reversible reactions allows the maintenance of TDH. Studies have implicated dysregulated TDH in the pathogenesis of numerous diseases such as chronic renal failure, liver diseases, cardiovascular diseases, diabetes, cancer, AIDS, rheumatoid arthritis, and neurodegenerative diseases.[4]

The relationship between oxidative stress and DDH has already been demonstrated.[6] Based on the hypothesis that normal or abnormal results of TDH, as an oxidative stress mechanism, can provide useful information about patients with DDH, this study sought to investigate the relationship between DDH and dynamic TDH.

Methodology

In this prospective study, patients who were diagnosed with and treated for DDH were assessed between April 2020 and May 2023 at Harran University Faculty of Medicine, Department of Orthopedics and Traumatology. The study received local ethics committee approval (decision no: HRU/20.07.16-16987). The families of all participants were informed about the study procedure and provided written informed consent. The study was conducted in accordance with the World Medical Association's Declaration of Helsinki and included children aged 1.5–60 months who were diagnosed with primary DDH based on standardized clinical criteria and radiographic examinations and had no comorbidities. Patients with secondary diseases and five patients diagnosed with cerebral palsy during follow-up were excluded, and two patients were could not be followed up.

The study involved the analysis and comparison of oxidative stress values in 95 patients with DDH (Group 1) at initial presentation and at the end of the follow-up period and those of 98 healthy controls (Group 2). Patients and controls had no significant difference in terms of age ($p < 0.05$). Patients were followed up for 2–23 months. Group I consisted of 95 patients (18 males and 77 females), age range: 1.5–60 months (10.32 ± 8.95), and Group II consisted of 98 healthy controls (32 males and 66 females), age range: 2–28 months (11.82 ± 4.79). The demographic characteristics of the participants are presented in Table-1.

Table-1

Demographic characteristics of controls and patients

Demographics	Patients	Controls	P-value
Number of patients (n)	95	98	
Age (month) (mean ± SD)	10.32 ± 8.95	11.82 ± 4.79	0.146
Sex			
Female (n, %)	77 (81.05%)	66 (67.3%)	*0.024
Male (n, %)	18 (18.95%)	32 (32.7%)	
*Significant at p < 0.05; Wilcoxon test; SD, standard deviation; n, number of patients			

Patients with DDH were assessed for Tönnis grading and acetabular index (AI) values immediately after the diagnosis, and venous blood was collected from them to assess oxidative stress values. When the Tönnis clinical score of the patients reached grade 1 during follow-up, venous blood was drawn a second time. Thus, the length of follow-up varied between 2 months and 23 months. For patients with bilateral DDH, a grade of 1 on one side was considered sufficient and assessments were made based on that side.

Serum oxidative stress was assessed using parameters native thiol (NT), total thiol (TT), disulfide (DS), NT/TT ratio, DS/NT ratio, and DS/TT ratio and total antioxidant status (TAS), total oxidant status (TOS), and oxidative stress index (OSI). Diagnosis, follow-up, and interventions were performed by the same orthopedist (Baki Volkan Çetin,MD). Patients received different procedures including follow-up only (9.5%), Pavlik harness (30.5%), closed reduction (40.0%), and open reduction (7.4%). Closed reduction was used when Pavlik harness therapy failed (6.3%), and open reduction was used when closed reduction failed (6.3%). All surgical procedures were followed by the application of a pelvipedal cast.

Venous blood was collected from the antecubital veins of patients with DDH and healthy controls after 8 h of fasting, and samples were placed into blood collection tubes. The blood samples were centrifuged at 1500 ×g for 10 min for the separation of cells. The separated serum samples were transferred into sterile Eppendorf tubes and stored at −86 °C. Serum TDH parameters were analyzed using an automated measurement technique developed by Erel and Neselioğlu.[7] Serum NT and TT levels were determined spectrophotometrically using a Varioskan Lux Multimode microplate reader (Thermo Fisher Scientific, USA). DS levels were obtained by calculating half of the difference between NT and TT content. Other calculated parameters included oxidized thiol ratio (DS/TT), reduced thiol ratio (NT/TT), and thiol oxidation–reduction (DS/NT) ratio. NT, TT, and DS levels were expressed in µmol/L. Serum oxidative stress parameters, including TAS and TOS, were examined based on an automated measurement technique developed by Erel.[8] Serum TAS and TOS levels were determined spectrophotometrically using a Varioskan Lux Multimode microplate reader (Thermo Fisher Scientific, USA). Calculation of OSI, an important indicator of oxidative stress, started with the calculation of TOS and TAS units. OSI was calculated according to the following formula:[9]

OSI (arbitrary unit) = TOS (µmol H_2O_2 equivalent/L)/TAS (µmol Trolox equivalent/L) × 100.

Statistical methods

Statistical analysis was performed using IBM SPSS Statistics version 25.0. Data sets were assessed for normality of distribution using Shapiro–Wilk test, which helped determine the appropriate statistical techniques for further processing. Normally distributed continuous variables were presented as mean ± standard deviation, whereas those that were non-normally distributed were described using median and interquartile range. Categorical variables were expressed as number (n) and percentage (%). For comparing two independent samples, the independent samples t-test was used for normally distributed data and Mann–Whitney U test for non-normally distributed data. Data within groups were analyzed using the dependent samples t-test or Wilcoxon signed-rank test depending on distribution. Relationships between continuous variables were analyzed using Pearson's correlation coefficient, and categorical data were analyzed using Pearson's chi-square test. The results were analyzed at 95% confidence interval, and a p-value <0.05 was considered statistically significant.

Results

Post-treatment Tönnis scores and AI measurements in the patient group were observed significant improvement than their pretreatment values ($p < 0.001$) (Table-2).

Table-2

Tönnis and acetabular index scores before treatment and after treatment

Scoring	Pretreatment	Post-treatment	P-value
Tönnis			
Right hip (n=79)	2.07 ± 0.75	1.15 ± 0.51	**<0.001***
Left hip (n=78)	2.03 ± 0.78	1.11 ± 0.45	**<0.001***
Acetabular index			
Right hip (n=79)	34.60 ± 6.48	26.49 ± 5.42	**<0.001***
Left hip (n=78)	34.43 ± 6.49	25.83 ± 5.43	**<0.001***
*Significant at p < 0.05; nonparametric test (Wilcoxon signed-rank test); n, number of hips			

In the patient group, statistically significant improvement of post-treatment values of NT, TT, compared to pretreatment (p value 0.003; 0.026 respectively). Compared with the values in the control group, patients' pretreatment NT, TT, and DS values were lower and NT/TT ratio was higher. After treatment, however, patients had higher NT and TT values and lower DS values compared with the values in the control group.

While pretreatment TOS and OSI were significantly higher than post treatment (p value 0.001; 0.003, respectively), TAS value was lower. Compared to the control group, the TOS values of the patient group pretreatment were significantly higher (p=0.015), while the OSI value was higher and the TAS was lower. After the treatment, while a significant improvement was achieved in TOS and OSI values compared to the control group (p value 0.001; 0.018, respectively), TAS values were also similar to the control group (Table-3).

Table-3

Analysis of oxidative stress parameters in controls and patients

	Pretreatment	Post-treatment	Controls	P1	P2	P3
NT (µmol/L)	485.01 (122.96)	515.75 (112.71)	491.84 (145.16)	0.170	**0.003***	0.189
TT (µmol/L)	686.40 (281.91)	743.60 (379.97)	731.75 (242.69)	0.432	**0.026***	0.068
DS (µmol/L)	104.24 (103.81)	113.79 (162.36)	121.39 (98.53)	0.541	0.340	0.105
DS/TT (%)	15.94 (7.83)	14.93 (11.82)	16.21 (7.99)	0.314	0.863	0.356
NT/TT (%)	68.12 (15.64)	70.15 (23.64)	67.56 (15.99)	0.312	0.862	0.353
DS/NT (%)	23.40 (17.59)	21.28 (27.11)	24.00 (17.09)	0.312	0.926	0.355
TAS (mmol Trolox equiv./l)	0.66 (0.31)	0.68 (0.33)	0.71 (0.44)	0.667	0.966	0.761
TOS (µmol H2O2 equiv./l)	11.50 (5.61)	9.19 (5.80)	11.09 (5.94)	**0.015***	**<0.001***	**0.001***
OSI (arbitrary unit)	1.84 (1.23)	1.43 (1.01)	1.77 (1.78)	0.396	**0.003***	**0.018***

*Significant at p < 0.05; Wilcoxon test; intragroup comparisons were made via Wilcoxon test, and intergroup comparisons were made via Mann–Whitney U test. Median [25%–75%].

P1, P-value of the comparison between patients before treatment and controls; P2, P-value of the comparison between preoperative and postoperative scores in patients; and P3, P-value of the comparison between patients after treatment and controls.

NT (µmol/L), native thiol; TT (µmol/L), total thiol; DS (µmol/L), disulfide; DS/TT (%), disulfide/total thiol (oxidized thiol); NT/TT (%), native thiol/total thiol (reduced thiol); DS/NT (%), disulfide/native thiol (thiol oxidation/reduction); TAS (mmol Trolox equiv./l), total antioxidant status; TOS (µmol H2O2 equiv./l), total oxidant status; OSI (arbitrary unit), oxidative stress index

Patients with more severe disease according to the Tönnis grading system before treatment had higher NT and TT values (NT: $r = 0.252$, $p = 0.014$; TT: $r = 0.260$; $p = 0.001$).

The relationship between the applied treatment method and TDH parameters was examined. There was no correlation between the type of treatment and TDH parameters.

Discussion

Although it is not fully understood which factors contribute to the etiology of DDH, a number of predisposing factors are known to be involved. The present study was prompted by the idea that increased body oxidative stress may be a precipitating factor in DDH. Departing from this hypothesis, the study sought to investigate the relationship between DDH and oxidative stress parameters of TDH. Thus, patients with DDH and healthy controls were compared in terms of systemic oxidative stress parameters and TDH. We also compared pretreatment and post-treatment levels of these parameters in patients. Although DDH has been previously investigated in relation to oxidative stress, to our knowledge, no study has yet investigated the relationship between TDH with DDH.[6,10,11] This study is the first study to investigate the contribution of TDH to the etiology of DDH. The potential implications of this new knowledge are worth being considered for both screening and treatment strategies.

Dynamic TDH status is critical in antioxidant protection mechanisms. Yazar et al. reported that free oxygen radicals can disrupt dynamic TDH and cause oxidative stress.[12] Further, TDH dysregulation has been implicated in increased oxidative stress in several diseases such as hypertension, atopic dermatitis, bipolar disorder, rotator cuff tears, acute pancreatitis, breast cancer, fibromyalgia.[12-19] In the present study, Our results suggest that free oxygen radicals may be causing oxidative stress not through TDH but via another antioxidant pathway.

All the patients included in this study achieved a satisfactory change in their clinical Tönnis and AI scores after treatment compared with pretreatment values ($p < 0.001$). These significant results suggest that the treatment delivered for each patient with DDH was clinically appropriate and correct. Comparison of the post-treatment levels with the pretreatment results in terms of oxidative biochemical parameters showed a statistically significant increase in NT and TT levels ($p = 0.003$ and $p = 0.026$, respectively). This result demonstrated that TDH improved positively with treatment. Considering that it is challenging to perform a high-quality physical examination on patients with DDH during follow-up checks because of the pelvipedal cast or orthopedic appliances and, positive biochemical NT and TT results may provide a useful guidance for the surgeon. Thus, recording NT and TT values during each visit can provide additional information for facilitating follow-up.

This study showed no correlation between any of the six treatment modalities that were used in patients with DDH and that resulted in clinical and radiologic improvement compared to the pretreatment period and TDH. This could mean that it is not the treatment modality but achieving Tönnis grade 1 that allows a reduction in oxidative stress.

Although previous studies have reported higher oxidative stress values in patients with DDH compared with healthy children, to our knowledge, no study has yet investigated TDH levels in these patients. The present study compared TDH levels in patients with DDH with those in healthy children. Although there was a significant improvement in NT and TT values in DDH patients with treatment, they did not differ significantly from the control group. For oxidative stress parameters, significant improvement was achieved, especially in TOS and OSI, when compared to the control group before and after treatment. In 2017, Altay et al. reported that oxidative stress parameters in patients with DDH had a statistically negative relationship but noted that the origin of this causality was unclear.[6] Levels of NT, TT, and DS as well as DS/TT and DS/NT ratios in patients with DDH were lower than the control group. Thus, TDH, as part of oxidative stress metabolism, does not have a direct causal link to the development of DDH. We reviewed the literature for similar abnormal TDH results and found that Balta et al. attributed all these decreased levels to the conversion of DS to S-nitrosothiol, sulfenic acid, sulfinic acid, and sulfonic acid.[20] However, this hypothesis needs to be supported by detailed studies examining reversible and irreversible reactions including S-nitrosothiol, sulfenate, sulfinate, and sulfonate. Similarly, Ducrocq et al. noted that thiols can also promote oxidative stress through nitrosative stress by reacting with nitric oxide (NO) to form nitrosothiols.[21] This evidence shows that the decrease in NT and TT, as well as the lack of increase in DS, may represent nitrosative stress rather than TDH-induced oxidative stress in DDH.

In patients with DDH, post-treatment NT and TT values were higher and DS values were lower than those in healthy children. Low DS values in the presence of systemic oxidative stress was an unexpected result and prompted us to search for similar reports in the literature. In one of those studies, Fidan et al. investigated TDH levels in fibromyalgia and found similar unexpected results.[19] According to the authors, this was linked to proliferative changes, explaining the higher NT and lower DS levels. Fass found similar abnormal change in patients with angina pectoris and concluded that low DS levels may be caused by the protective power of extracellular cysteine pairs in DSs, which protect reactive thiol groups and support protein stability and functioning.[22] Uysal et al. reported the presence of oxidative stress and decreased DS levels in atopic dermatitis.[15] They suggested that the decreased DS level may be caused by the rebound phenomenon that works to maintain the protective effect by facilitating the neutralization of the oxidative state. We suggest that the reason why DS values are low despite the presence of systemic oxidative stress is due to oxidative stress that is not caused by TDH. That may be interpreted that oxidative stress is attempted to be corrected by other antioxidant pathways that are not caused by TDH.

Patients with more severe disease before treatment according to the Tönnis grading system had higher NT and TT values. NT and TT increase as the severity of the disease increases. Based on these results, it appears that as DDH becomes more severe, TDH attempts to compensate this situation. Therefore, it could be the body's attempt to correct the oxidative stress caused by DDH.

The fact that the male-female ratio of control group patients is not statistically the same can be seen as a limitation. Due to the high female predominance in DDH, we could not achieve the same rate in the control group. Instead of DDH patients with different severities and different treatment methods, similar patient profiles and the same treatment methods may make the study more homogeneous. However, it was observed that the success of the treatment, not the type of treatment, was effective on the results. The strength of this study may be that a high number of DDH patients were analyzed in comparison with the control group prospectively.

Previous studies have reported that DDH is associated with torticollis and metatarsus adductus. In our study, however, none of the 95 patients with DDH had torticollis or metatarsus adductus; further studies are necessary to investigate this information. In the existing literature, the link between pathologies and oxidative stress has been investigated increasingly more frequently. However, although DDH is the most common dysplasia of the musculoskeletal system, there is a scarcity of evidence regarding with specific oxidative stress pathways.

Conclusion

Oxidative stress increases in DDH, but it is not directly related to TDH. Further, in addition to the improvement in oxidative stress parameters, treatment of DDH leads to a positive change in TDH.

Declarations

Conflicts of interest/Competing interests: Authors declare no conflict of interests.

Ethical Approval

The study received local ethics committee approval (decision no: HRU/20.07.16-16987). The families of all participants were informed about the study procedure and provided written informed consent. The study was conducted in accordance with the ethical of the standards 1964 World Medical Association's Declaration of Helsinki.

The location of the study

This prospective comparative study was conducted at Harran University Faculty of Medicine, Department of Orthopaedics and Traumatology between April 2020 and May 2023.

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Contributions of the Study Group Members

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All authors approved the final version of the manuscript to be published.

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МЕНСТРУАЛЬНА ФУНКЦІЯ У ЖІНОК З ДІАГНОСТОВАНОЮ ПАТОЛОГІЄЮ ЩИТОВИДНОЇ ЗАЛОБИ ПІСЛЯ COVID-19

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MENSTRUAL FUNCTION IN WOMEN WITH DIAGNOSED THYROID PATHOLOGY AFTER COVID-19

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Анотація

Мета. Вивчити особливості менструальної функції у жінок репродуктивного віку серед яких після перенесеного COVID-19 виявлено різні патології щитоподібної залози. Матеріали та методи. Було проведено дослідження за участю 60 жінок із порушенням менструальної функції та діагностованою патологією щитоподібної залози після інфікування COVID-19 протягом останнього року. Середній вік становив 27,1±0,7 року. Проведено загальноклінічне, лабораторне та гінекологічне обстеження, у тому числі УЗД щитоподібної залози, визначення рівня ТТГ, вільного Т4, вільного Т3, антитіл до ТПО, естрадіолу та прогестерону. Результати. Патологія щитоподібної залози виявлена у 43 жінок (71,7%): підгострий тиреоідит у 16 (11,6%), автоімунний тиреоідит у 38 (88,4%). Менструальна дисфункція серед цих пацієнток (n=43) включала опсоменорею (25,6%), вторинну аменорею (23,3%), метрорагію (16,3%), гіперменорею (11,6%), альгодисменорею (10%) та менорагію (14%). Гормональний профіль щитоподібної залози показав 23,3% з еутиреозом, 69,7% з субклінічним гіпотиреозом і 7% з субклінічним гіпертиреозом. При субклінічному гіпотиреозі (n=30) опсоменорея спостерігалася у 33,3%, вторинна аменорея — у 26,7%, метрорагія — у 13,3%, гіперменорея — у 6,7%, альгодисменорея — у 6,7% і менорагія — у 13,3%. Для еутиреоїдного статусу (n=10) опсоменорея була присутня у 10%, вторинна аменорея у 20%, метрорагія у 10%, гіперменорея у 30%, альгодисменорея у 10% та менорагія у 20%. Гіпертиреоз на фоні автоімунного тиреоідиту виявлено у 3 жінок, метрорагія — у 2, альгодисменорея — у 1. Висновки. Порушення менструальної функції у жінок після перенесеного COVID-19 є наслідком патології щитоподібної залози, викликаної вірусом. Основними видами порушень менструального циклу є опсоменорея (25,6%), вторинна аменорея (23,3%), метрорагія (16,3%), гіперменорея (16,3%), альгоменорея (16,3%), менорагії (16,3%). Клінічний перебіг змінювався залежно від функції щитоподібної залози: субклінічний гіпотиреоз призвів до опсоменореї (33,3%) і вторинної аменореї (26,7%); еутиреоїдний стан призвів до гіперменореї (30%) та вторинної аменореї (20%); гіпертиреоз, викликаний метрорагіями. Раннє виявлення та лікування захворювань щитоподібної залози може покращити репродуктивне здоров'я жінки.

Abstract

The aim. To study the peculiarities of menstrual function in women of reproductive age, in whom various pathologies of the thyroid gland were detected after suffering from COVID-19. Materials and Methods. A study was conducted on 60 women with menstrual dysfunction and diagnosed thyroid pathology following COVID-19 infection within the last year. The average age was 27.1±0.7 years. General clinical, laboratory, and gynecological examinations were performed, including thyroid ultrasound, and measurements of TSH, free T4, free T3, anti-TPO antibodies, estradiol, and progesterone levels. Results. Thyroid pathology was detected in 43 women (71.7%): subacute thyroiditis in 16 (11.6%), AIT in 38 (88.4%). Menstrual dysfunction in these patients (n=43) included opsomenorrhoea (25.6%), secondary amenorrhea (23.3%), metrorrhagia (16.3%), hypermenorrhea (11.6%), algodismenorrhea (10%), and menorrhagia (14%). Hormonal thyroid profile showed 23.3% with euthyroidism, 69.7% with subclinical hypothyroidism, and 7% with subclinical hyperthyroidism. For subclinical hypothyroidism (n=30), opsomenorrhoea was present in 33.3%, secondary amenorrhea in 26.7%, metrorrhagia in 13.3%, hypermenorrhea in 6.7%, algodismenorrhea in 6.7%, and menorrhagia in 13.3%. For euthyroid status (n=10), opsomenorrhoea was present in 10%, secondary amenorrhea in 20%, metrorrhagia in 10%, hypermenorrhea in 30%, algodismenorrhea in 10%, and menorrhagia in 20%. Hyperthyroidism on the background of AIT was found in 3 women, with metrorrhagia in 2 and algodysmenorrhea in 1. Conclusions. Menstrual dysfunction in women after COVID-19 is a result of thyroid pathology caused by the virus. The main types of menstrual disorders are opsomenorrhoea (25.6%), secondary amenorrhoea (23.3%), metrorrhagia (16.3%), hypermenorrhoea (16.3%), algomenorrhoea (16.3%), and menorrhagia (16.3%). The clinical course varied with thyroid function: subclinical hypothyroidism led to opsomenorrhoea (33.3%) and secondary amenorrhoea (26.7%); euthyroid state resulted in hypermenorrhoea (30%) and secondary amenorrhoea (20%); hyperthyroidism caused metrorrhagia. Early detection and treatment of thyroid disorders can improve women's reproductive health.

Ключові слова: захворюваніcть на COVID-19, менструальний цикл, репродуктивне здоров'я, ендокринна патологія, організація гінекологічної допомоги.

Keywords: COVID-19 incidence**,** menstrual cycle, reproductive health, endocrine pathology, organization of gynecological care.

It is widely known that the female reproductive system is one of the most sensitive and reactive systems to various external factors [1]. Therefore, it is logical that during the COVID-19 pandemic, under the viral load on the female body, the reproductive system is primarily affected: menstrual function is disrupted, fertility decreases, the incidence of gynecological pathology increases, and the risk of complicated pregnancies, spontaneous abortions, and stillbirths rises [2].

COVID-19 is a severe immunosuppressive disease that has a multifaceted impact on the entire body and can exacerbate pre-existing autoimmune (chronic) diseases. One of the most vulnerable organs remains the thyroid gland. The most common thyroid pathology is the emergence or exacerbation of autoimmune thyroiditis, which in turn can lead not only to structural changes in the thyroid tissue but also to various functional disorders of the gland [3, 4]. Due to the presence of angiotensin-converting enzyme 2 (ACE2) receptors in the thyroid gland, through which SARS-CoV-2 enters the cells, and the action of integrins, there is a high likelihood of developing thyrotoxicosis, subacute, and chronic thyroiditis following a COVID-19 infection [5, 6].

It should be noted that in the literature dedicated to the functional relationship between the thyroid gland and the female reproductive system, there is a lack of data on the correlation between changes in the ovaries and uterus against the background of COVID-19 and thyroid function, and vice versa. Additionally, we have not found scientific works that justify the principles of early diagnosis of menstrual dysfunctions developing against the background of viral thyroiditis.

THE AIM. To study the peculiarities of menstrual function in women of reproductive age who were diagnosed with various thyroid gland pathologies after suffering from COVID-19, in order to improve the quality of diagnosis and treatment of these disorders.

MATERIALS AND METHODS. To achieve this goal, a study was conducted on 60 women with menstrual dysfunction and detected pathological changes in the thyroid gland after suffering from COVID-19 during the year. There were no pathological changes in the anamnesis of both the thyroid gland and the reproductive system in the patients who participated in the study.

The average age of patients included in the study was 27.1±0.7 years.

The set of diagnostic studies included:

• general clinical, laboratory and gynecological examination,

• ultrasound of the thyroid gland,

• determination of pituitary hormones (TSH), thyroid gland (free T4 and free T3, AT-TPO) and sex hormones (estradiol and progesterone).

RESULTS. Analyzing the main features of the clinical characteristics of the patients, it should be noted that half of the women (50%) had a different number of pregnancies and deliveries in their anamnesis.

According to the results of the diagnosis of the thyroid gland, pathology was detected in 43 women (71.7%).

The structure of thyroid pathologies was distributed as follows: subacute thyroiditis – in 16 (11.6%), AIT – in 38 (88.4%).

In 17 women (39.5%) – pathology was detected using ultrasound signs; in 14 (32.5%) – it was detected by testing thyroid hormones, thyroid-stimulating hormone and antibodies to thyroid peroxidase in blood serum; in 12 (27.9%) – only an uninformative and subjective palpation method was used to diagnose thyroid gland pathology.

According to ultrasound data, the increase in the thyroid gland in the examined women was accompanied by a homogeneous echo structure of the organ. The echogenicity of the gland tissue was normal in 11 patients (64.7%); slightly increased in 4 women (23.5%) and in 2 women (11.7%) diffuse hypoechoic areas without clear borders were detected.

During a comprehensive study of the features of menstrual dysfunction against the background of thyroid gland pathology, detected in female patients (n=43(100%)), we obtained the following data, which make it possible to determine the main types of menstrual dysfunction:

- 11 (25,6%) – opsomenorrhoea,
- 10 (23,3%) – secondary amenorrhea,
- 7 (16,3%) – metrorrhagia,
- 5 (11,6%) – hypermenorrhea,
- 4 (10%) – algodismenorrhea,
- 6(14%) – menorrhagia.

In patients with thyroid pathology, the study of the hormonal thyroid profile (n=43 (71.7%)) revealed functional disorders. It turned out that among these patients, 23.3% had euthyroidism, 69.7% had subclinical hypothyroidism, and 7% had signs of subclinical hyperthyroidism.

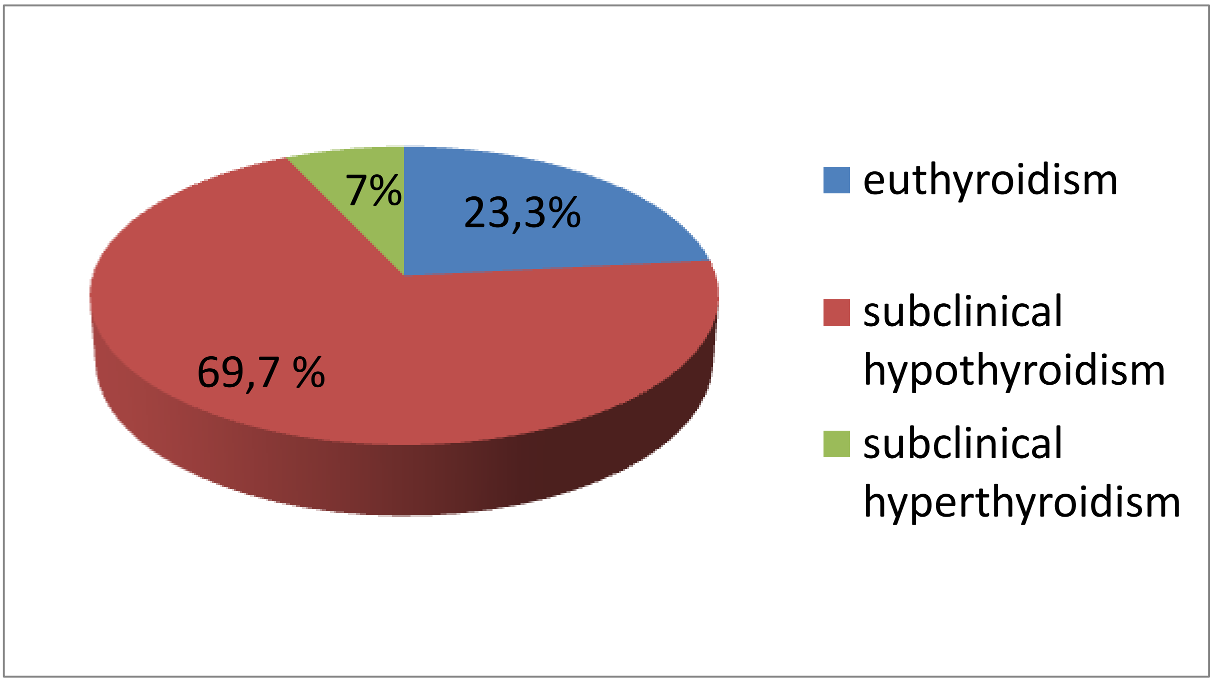

Fig. 1 Hormonal thyroid profile

Taking into account the obtained results, we decided to establish the interdependence between the violation of the menstrual cycle and the type of functional disorder of the thyroid gland. Thus, it was investigated that in the presence of subclinical hypothyroidism (n = 30 (100%)), the following clinical types of menstrual dysfunction were determined:

- 10 (33,3%) – opsomenorrhoea,
- 8 (26,7%) – secondary amenorrhea,
- 4 (13,3%) – metrorrhagia,
- 2 (6,7%) – hypermenorrhea,
- 2 (6,7%) – algodismenorrhea,
- 4 (13,3%) – menorrhagia.

In the case of euthyroid status (n=10 (23.3%)), menstrual cycle disorders were as follows:

- 1 (10%) – opsomenorrhoea,
- 2 (20%) – secondary amenorrhea,
- 1 (10%) – metrorrhagia,
- 3 (30%) – hypermenorrhea,
- 1 (10%) – algodismenorrhea,
- 2 (20%) – menorrhagia.

With detected hyperthyroidism on the background of AIT, which was detected by us in only 3 examined, menstrual function was characterized by: metrorrhagia in 2 persons and aldodysmenorrhea in 1 woman.

DISCUSSION. The results of our study confirm that COVID-19 significantly affects the function of the thyroid gland, which, in turn, leads to menstrual cycle disorders in women of childbearing age. The detected disorders are characteristic of patients with various forms of thyroid pathologies after suffering from COVID-19 and are mainly manifested in the form of opsomenorrhoea (25.6%) and secondary amenorrhoea (23.3%), which coincides with the results of numerous domestic and foreign studies. and indicate both a direct effect of transferred COVID-19 on the thyroid gland through ACE2 receptors, and an indirect one, through immune mechanisms, causing autoimmune processes and inflammatory reactions [4, 7, 8].

Taking into account the data obtained on the detection of thyroid pathology in 71.7% of women after suffering from COVID-19, the importance of early diagnosis and monitoring of thyroid gland function in patients suffering from COVID-19 should be emphasized.

In view of the above, further research for a deeper understanding of the mechanisms of the impact of COVID-19 on the thyroid gland and the reproductive system of a woman, which will allow the development of an effective treatment-diagnostic-prophylactic algorithm for these disorders. This will help not only in identifying and treating thyroid disorders, but also in reducing the frequency and severity of menstrual disorders, improving the overall reproductive health of women.

CONCLUSIONS. Disruption of menstrual function in women after suffering from COVID-19 is a consequence of thyroid gland pathology caused by the effect of the virus on the gland.

The main types of menstrual disorders in women after suffering from COVID-19: opsomenorrhoea (25.6%), secondary amenorrhoea (23.3%), metrorrhagia (16.3%), hypermenorrhoea (16.3%), algomenorrhoea (16, 3%), menorrhagia (16.3%).

The clinical course of menstrual cycle disorders in women after suffering from COVID-19 depended on the functional changes of the thyroid gland. Against the background of subclinical hypothyroidism, opsomenorrhoea (33.3%) and secondary amenorrhoea (26.7%) prevailed in patients; on the background of euthyroid state – hypermenorrhea (30%) and secondary amenorrhea (20%); with hyperthyroidism - metrorrhagia.

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PARASITOLOGICAL SCIENCES

EFFECT OF EUSTRONGYLIDES EXCISUS ON BIOCHEMICAL PARAMETERS OF BLOOD SERUM OF COMMON CARP

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Abstract

Most parasitic organisms are opportunistic and can be present in small numbers in a water body or on fish at all times and cause disease only when the fish is stressed. Eustrongylides spp. is considered a zoonotic nematode of freshwater and predatory fish. In the waters of Odesa region, the larvae of the nematode E. excisus were first diagnosed in common carp (Cyprinus carpio). In the pathological examination of carps of 3 years of age, the larvae of the nematode E. excisus were found on the serous membrane of the abdominal cavity and liver. In the biochemical parameters of the blood serum of carps in the spontaneous course of eustrongylidiosis, a decrease in the content of total protein by 24.7 %, albumin by 38.9 %, an increase in the content of ß-globulins by 39.1 %, the activity of AlAt enzymes by 112.2 % and a decrease in urea by 40.6 % were recorded, indicating an allergic reaction to E. excisus larvae and liver damage and renal failure.

Keywords: carp, eustorgylidosis, biochemistry, blood serum.

Parasites affect the health of fish both in the wild and in aquaculture. They can weaken the fish's immune system, making them more susceptible to secondary infections caused by bacteria, viruses and other harmful microorganisms [1].

Many fish diseases cause huge mortality in aquaculture and some also cause disease in humans. Most parasitic organisms are opportunistic and can be present in small numbers in the water or on the fish at all times and cause disease only when the fish are stressed [2]. Outbreaks of parasitic diseases are also caused by poor water quality and malnutrition [3].

Nematodes are common parasites of freshwater and marine fish [4]. Most adult nematodes that parasitize fish live in their intestinal tract. Larval nematodes of fish can be found in almost every organ, but are most commonly found in the mesentery, liver, and muscle [5, 6].

The main parasite species that affect different fish species are the trematodes Clinostomum and Euclinostomum, the nematodes Contracaecum and Eustrongylides, and the cestodes Ligula intestinalis and Proteocephalus, which are the most commonly affected: *Clarias gariepinus*, *Oreochromis niloticus*, *Barbus* and *Cyprinus carpio* [7].

Eustrongylides spp. is considered to be a zoonotic nematode of freshwater fish and has been recorded in six edible fish from Lake Trasimeno: European perch (Perca fluviatilis), goldfish (Carassius auratus), large-mouth bass (Micropterus salmoides), tench (Tinca tinca), carp (Cyprinus carpio) and smelt (Atherina boyeri). [8, 9].

In the waters of Odesa region, the larvae of the nematode Eustrongylides excisus were first diagnosed in common carp (Cyprinus carpio). The places of their localization were the liver, kidneys and walls of the digestive tract. In the case of perforation of the intestinal wall, edema, hyperemia and hemorrhage with mechanical tissue damage were recorded [10].

Certain blood-feeding parasites can cause anemia in fish by depleting their blood, leading to weakness and reduced viability [11].

Hematological tests have two main purposes: firstly, they help to establish the normal state of health of the body and secondly, they help to diagnose diseases caused by a number of factors, including parasitic infections, nutritional imbalances, pollution, genotoxicity, exposure to pollutants, environmental stress and heavy metal exposure [12].

By studying changes in biochemical parameters associated with exposure to various parasites registered in the database, these tests can help diagnose diseases and apply appropriate treatments or preventive measures [13].

Parasites cause a decrease in red blood cells, hemoglobin, and an increase in the number of leukocytes, which is associated with a defense mechanism and an immunological reaction against them [14]. In the blood serum of fish with mixed infection caused by Lernea cyprinacea and Dactylogyrus vastator, a decrease in total protein content by 18.4 %, an increase in ß- and γ-globulin fractions by 19.5 % and 27.2 % was found [15].

The study of immunological parameters is important for the detection of immunodeficiency and immunopathological conditions, the initial assessment of the immune status of the body, as well as for the diagnosis, treatment and prognosis of diseases.

Purpose of the work. To determine the effect of E. excisus nematode larvae on the biochemical parameters of blood serum of common carp.

Materials and methods. In the fish farms of Aquarest LLC and Aquacity LLC in Odesa region, during 2022-2023, studies were conducted on the effect of Eustrongylides excisus on the biochemical parameters of blood serum of common carp. The fish were taken during the planned control catch, and also purchased from fishermen at the place of catch. A total of 20 carps of 3 years old were studied. The first experimental group of fish was spontaneously infected carps, the control group of fish was not infected. The diagnosis of eustrongylidosis was made by careful examination of carp scales and internal organs and serous membranes of the abdominal cavity during the dissection of the fish from the anus to the head. Nematode larvae were collected in Petri dishes and fixed with 70% ethyl alcohol.

Blood was drawn from the heart using a disposable syringe. The blood tubes were settled to obtain serum. The obtained blood serum without hemolysis was used for biochemical studies, which were performed on an automatic biochemical analyzer IDEXX VestTest (IDEXX Laboratories, USA) with appropriate reagent kits (Diagnosticum Zrt, Hungary). The content of total protein was determined by the biuretophore reaction and its fractions, the activity of the enzymes ALT and ACAT was determined by the Reitman-Frenkel method, and the content of urea and glucose was determined [16]. The study was conducted at the Department of Physiology, Pathophysiology and Biochemistry of Odesa State Agrarian University.

Research results. During the pathological examination of 3-year-old carps, larvae of the nematode Eustrongylides excisus were recorded on the serous membrane of the abdominal cavity and liver. The intensity of the lesion ranged from 6 to 15 specimens per fish. (Fig. 1).

Fig. 1 Larvae of the nematode Eustrongylides excisus removed from the abdominal cavity of a 3-year-old common carp

Parasitization of larvae of the nematode E. excisus in carp leads to general allergic reactions in the fish body and to significant changes in biochemical parameters of blood serum.

The content of total protein in the blood serum of carps infected with E. excisus was significantly ($p<0.001$) 24.7% lower than in non-infected fish and amounted to 49.94±1.01 g/l versus 66.31±0.75 g/l (Table 1).

Table 1

Biochemical parameters of blood serum of common carp, affected *Eustrongylides excisus* (M±m, n=10)

Indicators	Groups of fish		% to control
	experimental	control	
Total protein, g/l	49,94±1,01***	66,31±0,75	-24,7
Albumin, g/l	20,59±0,52***	32,10±1,01	-38,9
Total globulins, g/l	29,35±1,12**	34,21±0,98	-14,2
Albumin, %	38,16±0,98***	46,51±1,05	-17,9
α-globulins, %	17,40±1,02*	20,88±1,01	-16,7
ß-globulins, %	21,01±0,55***	15,10±0,35	+39,1
γ-globulins, %	23,43±1,01***	17,51±1,02	+34,2
A/G ratio	0,70	0,94	-25,5
AsAT, U/l	73,61±0,92***	54,9±1,01	+34,1
AlAT, U/l	90,21±1,03***	42,52±0,96	+112,2
De Ritis coefficient	0,82	1,29	-36,4
Urea, mmol/l	4,10±0,02***	6,91±0,05	-40,6
Glucose, mmol/l	8,92±0,65**	10,95±0,12	-18,5

Note: * – p<0,05; ** – p<0,01; *** – p<0,001 compared to the control

A significant decrease in albumin content by 38.9 % ($p<0.001$) indicates a slowdown in fish growth and weight loss. In the infected carps, the index was 20.59±0.52 g/l, compared to 32.10±1.01 g/l in the control group.

The content of total globulins significantly ($p<0.01$) decreased by 14.2 % and amounted to 29.35±1.12 g/l, compared to the control - 34.21±0.98 g/l. A significant ($p<0.001$) increase in the content of ß-globulins by 39.1 % in infected carp compared to the control indicates liver damage and hemorrhage due to infection by the larvae of the nematode E. excisus.

Also, in the experimental group of carps, hypergamaglobulinemia was recorded by 34.2%, which occurs due to activation of immune reactions and increased secretion of globulins and indicates liver damage.

The albumin-globulin coefficient in the control group of carps that were clinically healthy was 0.94, while in the infected carps it was 0.70, that is 25.5% less.

In the study of the enzyme AlAt, which is an indicator of liver damage, a significant ($p<0.001$) increase in the experimental group of carps by 112.2 % (73.61±0.92 U/l) was recorded compared to the control group of fish (54.9±1.01 U/l) and an increase in the enzyme AsAT by 34.1 %. Thus, the de Ritis coefficient in the experimental group of carps was 0.82, and in the control group - 1.29, which is 36.4 % less.

In the experimental group of carps, a significant ($p<0.001$) decrease in urea level by 40.6 % (4.10±0.02 mmol/l) was found compared to the control group, where this indicator was 6.91±0.05 mmol/l, indicating the presence of renal failure.

Glucose level is used as an indicator of stress and is a universal bioenergy substrate that is rapidly transferred through plasma to tissues. In infected carps, the glucose content was 18.5% lower ($p<0.05$) and amounted to 8.92±0.65 mmol/l, while in clinically healthy carps the index was 10.95±0.12 mmol/l.

Conclusion.

In 3-year-old carps affected by the larvae of the nematode Eustrongylides excisus, changes in the biochemical parameters of blood serum were recorded. The spontaneous course of eustrongylidosis in carps is accompanied by an increase in the content of ß-globulins by 39.1 %, the activity of AlAt enzymes by 112.2 % and a decrease in urea level by 40.6 %, indicating an allergic reaction to the parasite and liver damage and renal failure.

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PEDAGOGY

EFFECTIVE READING STRATEGIES FOR ESP UKRAINIAN STUDENTS

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Abstract

Reading proficiency is a critical skill for professional performance. It enables effective communication, continuous learning, and problem-solving, while also enhancing productivity, career advancement, writing skills, adaptability, and expertise. The necessity for students to develop strong reading skills has motivated Ukrainian educators to implement various techniques in teaching ESP reading and examine the impact of these techniques on enhancing the reading abilities of Ukrainian students. This article discusses recent developments and current issues in acquiring reading skills through strategies that affect teachers and learners and suggests reading strategies needed to develop reading proficiency.

Keywords: reading proficiency, reading strategies, English for Specific Purposes (ESP), Theme-Based Learning (TBL), Task-Based Language Learning.

Introduction

In today's world, proficiency in English is increasingly seen as essential for success in many professional areas, including Information Technology (IT). As modern universities strive to equip their students for the fast-changing IT sector, language teaching within IT programs has become more important than ever.

Today Professionally Oriented English Language Teaching for IT students (POELT) contributes significantly to modern university education by addressing the specific language and communication needs of students pursuing careers in the IT sector POELT combines elements of ESP and EAP, focusing on the language needs of learners within a specific professional context, such as business, healthcare, engineering, or IT. It integrates both ESP and EAP approaches to address the language needs of professionals to enhance their communication skills, such as reading and writing technical reports, presenting findings, and participating in meetings.

Reading proficiency is an indispensable part of academic and professional success. It goes beyond the ability to decode words on a page; it encompasses comprehension, critical thinking, and the ability to engage with and reflect on complex ideas. Nunung Mardianti (2020) stated that standard reading proficiency requires students to analyze, relate, and critique information within a single source and across multiple sources. Reading at a higher level involves more than just basic comprehension; it requires advanced skills and strategies that enable readers to engage deeply with complex texts.

The study aims to examine context-specific, task-based strategies to improve the language and reading proficiency levels of undergraduate university students at the Computer Science and Cybernetics Faculty of the Taras Shevchenko National University of Kyiv in Ukraine.

Research Questions

The specific questions to be answered in this study are:

What are the primary concerns and difficulties in the acquisition of reading skills in teaching ESP?

What strategies should educators implement in their classrooms to improve learners' reading proficiency?

Method

This research is descriptive and focuses on the analysis and classification of cognitive strategies used by the students in reading.

Literature review

Reading strategies have been investigated in a variety of studies by (Oxford & Nyikos, 1989; Anderson, 2003; Mokhtari and Reichard, 2002; Kolic-Vehovec, Bajsankiand Zubkovic, 2011; Aydinbek, 2021; Sheorey and Mokhtari (2001), etc.). Sheorey and Mokhtari (2001) divided reading strategies into three primary categories: metacognitive strategies, cognitive strategies, and support strategies. Metacognitive strategies involve techniques that readers use to oversee or regulate their reading. Cognitive strategies encompass actions or procedures, such as reading aloud, adjusting reading speed, and re-reading for improved comprehension used directly with the text. On the other hand, support strategies include tools like using a dictionary, taking notes, and underlining information to better understand a specific text. O'Malley & Chamot (1990) defined cognitive strategies as those that are closely linked to specific learning tasks and are used in the learning process, including repetition, translation, grouping, resourcing, note-taking, deduction, elaboration, imagination, and inference. Ghafournia (2014) states that learning strategy holds a significant role in enhancing students' ability to comprehend text, perform specified tests, and solve specific problems.

According to Cahyono and Widiati (2006), reading at a higher level requires the students to read a considerable amount of English text sources beyond the instruction process. To make the reading process effective, higher-level learners should develop several reading skills. Firstly, it's the ability to analyze and evaluate the content critically. Next, readers must assess the credibility of sources, understand the author's perspective, and identify biases or assumptions. This involves questioning the text, distinguishing between main ideas and supporting details, seeking evidence, and drawing well-founded conclusions. Secondly, a broad and sophisticated vocabulary should be learned to understand complex texts. Higher-level readers must be acknowledged with technical terms, scientific language, and varied writing styles. What is more, language learners are to integrate information from multiple sources and perspectives. This skill is crucial for forming a comprehensive understanding of a topic, identifying connections between ideas, and constructing new insights.

Most studies indicate that students employ a variety of cognitive strategies to enhance their reading skills. Techniques such as skimming for a general overview, scanning for specific information, and re-reading for deeper understanding are commonly carried out in our university language lessons. Additionally, predicting, note-taking, identifying main ideas, recognizing synonyms and word families, annotating, and summarizing are valuable strategies for retaining and organizing information. Almasi and Susan (2003) focus attention on such reading strategies as evaluating content, connecting the text to prior knowledge or experiences, asking and answering relevant questions, identifying keywords, using grammatical analysis to understand sentence components, re-reading, paraphrasing, and summarizing. These reading strategies are particularly practiced by ESP students of cybernetics science studies. Thus, improving reading comprehension can be increased through suitable teaching methods and understanding the insight of reading skills and reading strategies.

Discussion and Results

In our ESP reading lessons, we observed that higher-level reading involves using specific strategies tailored to the text and purpose. What is more, higher-level reading requires a high level of engagement and intrinsic motivation. Students must be willing to invest the time and effort needed to research complex texts. A genuine interest in the subject matter and a desire to learn and grow intellectually can drive this engagement. Deci and Ryan (1991) highlighted the significance of learners' self-determination in the educational process. They mentioned that it has become increasingly evident that self-determination, through intrinsic motivation and autonomous internalization, leads to outcomes that are advantageous for both individuals and society.

In our classroom, we suggested students choose from the latest topics for research in technology and computer science one of their greatest concerns, and read special articles completing different language tasks. Among various 100 topics, they picked out the most attractive to them ones: *AI and Robotics; Networking and security, High-performance computing, Programming languages, and software systems, Machine learning and neuron networks, How AI and deep learning are changing the healthcare industry, Role of the blockchain, How is open source competing with paid software?, Distributed Data Clustering, How successful is computer-aided learning? Hazards of computer viruses, Ethical hacking: white hat techniques, Is scrum methodology the best of best?* As a result, making their own choice, the undergraduates enjoyed reading more, seeking out new knowledge in authentic, sophisticated texts, and staying curious about the researched subject. That is to say, learners should be given greater freedom to choose what suits best their interests and needs including academic reading and professional-oriented texts.

The provided Professionally-Oriented Reading involved conducting the following Theme-Based tasks: identifying key terms, and main ideas, putting comprehension, discussion questions, and predicting future investigations and results in the topic. It is important to mention that Theme-Based Learning (TBL) is a model of Content-Based Instruction (CBI), which has been a prominent trend around the world in the past two decades showing the advantages of "emphasizing learning about something rather than learning about language", thus "the goal is to assist learners in developing general academic language skills through interesting and relevant content", Jasone Cenoze stated in 2015. This model is definitely very suitable to use in English for Specific Purposes lessons as a need for training learners for particular contexts and events according to the academic matter and students' interests.

The most challenging task appeared to be writing a summary. Summarizing is a strategy that is often perceived as arduous. One of the biggest challenges in summary writing is distinguishing relevant knowledge from irrelevant information and identifying the main ideas of a text. Students often struggle to tell apart between crucial points and minor details, leading to summaries that are either too detailed or lacking essential information. They find it difficult to rephrase content concisely while maintaining the original message. Many students stumble with finding the right words to rephrase sentences while avoiding plagiarism. Students also often face difficulties in structuring their summaries logically, leading to disjointed and confusing narratives. Writing a clear and accurate summary requires a good command of grammar and syntax. Errors in sentence structure, punctuation, or word choice undermine the summary's clarity and effectiveness. Addressing these difficulties through targeted instruction and practice can help students develop their summarizing skills effectively. Reading extensively and proficiently contributes to better writing skills. Exposure to diverse writing styles and vocabulary through reading helps learners improve their own writing, making it more clear, concise, and impactful. Sufficient practice will build the required skill improvement, making students feel encouraged and motivated.

Conclusion

In today's fast-paced and ever-changing work environment, continuous learning is a necessity. Proficient readers can quickly assimilate new information from books, articles, and industry publications. This ability to stay updated with the latest trends, technologies, and best practices is crucial for professional growth and maintaining a competitive edge in one's field.

Reading proficiency improves critical thinking and analytical skills. By implementing context-specific, task-based strategies, coupled with a focus on student autonomy and interest, educators can significantly enhance students' reading comprehension and overall academic performance. Theme-based learning has proven to be an effective approach for developing both language skills and subject matter knowledge. By providing students with opportunities to explore topics of interest within their field, we can foster intrinsic motivation and deeper engagement with the reading material. The main challenges students face are distinguishing between main ideas and details, rephrasing content, and maintaining coherence.

The ESP teacher needs to investigate the IT genre, the language, and the skills concerning computer science communication. It is also essential to design an updated course, renovate teaching materials, obtain more recent and modern context materials, be aware of the latest developments in the world of science and technology, discover the IT students' specific interests, and conduct a needs analysis.

While this study sheds light on the importance of these strategies, further research is needed to investigate their long-term impact on students' professional careers. Additionally, exploring the effectiveness of these approaches in different cultural and educational contexts would be beneficial.

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WEBSITES AND PAGES FOR CREATING VIRTUAL BIOLOGY LABORATORIES

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Abstract

The article presents information about the role of information technology (IT) in the teaching of biological science using the example of virtual laboratories. The integration of information technology (IT) in modern education has revolutionized pedagogical approaches, especially in the field of science education. Through a mixed-methods research design that includes both quantitative evaluation and qualitative research, this study aims to shed light on the effectiveness and implications of virtual laboratories in biology education. The use of virtual laboratories in various educational settings leads to a comprehensive development of the impact on students' learning outcomes, activity and perception. The integration of virtual laboratories in the field of biological sciences has allowed students to learn and engage with complex concepts.

Keywords: information technology (IT), biology, education, web pages, virtual laboratory, online, pedagogy, Front-End.

Traditionally, the study of biology has relied heavily on hands-on laboratory experiences to reinforce theoretical knowledge and develop practical skills. However, logistical constraints, limited resources, and safety issues often present significant challenges in providing comprehensive laboratory experiences for all students. In such situations, the use of virtual laboratories gives high results.

According to N. Azizah, S. Aloysius[7], the relationship between the level of education and virtual laboratory tools in the study of biology, the suitability of virtual laboratory tools used by students to achieve maximum educational goals is very important because R.A. According to Desharnais and P. Narguizian [8], another advantage of virtual laboratories is that they can be used to overcome the limitations associated with the high resource requirements of conventional laboratories. In addition, A. A. N. Alshaikh [1] in his scientific works on virtual laboratories put forward ideas that the student's laboratory skills can be improved by using a virtual teaching and learning environment called "virtual laboratory".

One of the most important advantages of virtual laboratories is their ability to democratize access to high-quality educational resources. Using digital platforms, students from diverse backgrounds and geographic locations can simultaneously engage in immersive learning experiences reserved for privileged institutions. Virtual labs facilitate active learning by providing students with opportunities to explore, experiment, and solve problems in a risk-free environment. Through interactive simulations and multimedia resources, students can manipulate variables, observe results in real time, and deepen their understanding of biological concepts. This practical approach not only strengthens theoretical knowledge, but also develops critical thinking and scientific inquiry. In addition, virtual labs offer unprecedented flexibility and scalability, allowing educators to tailor the learning experience to meet the diverse needs and learning styles of students. Whether integrated into traditional classrooms, blended learning environments, or fully online courses, virtual labs can fit a wide range of learning approaches and learning objectives. Additionally, the asynchronous nature of virtual labs allows students to engage with course material at their own pace, which promotes self-direction and autonomy. Beyond the classroom, virtual labs also hold promise for research and innovation. By providing researchers with virtual platforms to model biological phenomena, test hypotheses, and analyze data, virtual laboratories accelerate the pace of discovery and facilitate interdisciplinary collaboration. According to T.Lynch, I.Ghergulescular[9], from a technological point of view, the inclusion of virtual laboratories in the educational process often requires adjustment or expansion of existing resources available in laboratories.

Methodology. Virtual experiments, that is, interactive laboratory work, can be carried out on online resources or through a number of special disks. Our research is based on the creation of virtual laboratories conducted in secondary schools based on online resources, in which the selection of virtual laboratory platforms and activity design methods were used to create laboratories.

In the selection of virtual laboratory platforms, criteria such as simulation realism, interactivity, usability and compatibility with different devices were taken into account to ensure the suitability of the platforms for various educational conditions and general education school students. Activity design involves designing learning activities and experiences that take advantage of these platforms to increase student engagement and understanding of biological concepts. Based on pedagogical principles and instructional design best practices, a series of interactive simulations, virtual dissections, data analysis exercises, and collaborative projects were developed to address various topics within the biological sciences curriculum.

Research results and discussion. To create virtual laboratories, the Front-End field of programming in computer technologies was taken as a basis. That is, this field is focused on creating web pages, and we learned to create virtual laboratories that are conducted online. One of the most convenient programs for working in the field of Fornt-End is Visual Studio Code, which includes 3 different programming languages:

a) HTML (hypertext markup language) is the basis of web pages and is used to create the content of web pages. HTML is a type of programming that mainly uses tags. These tags make it possible to place texts, tables, various information, pictures, songs, videos, audios, which are the basis of the web page (Fig. 1).

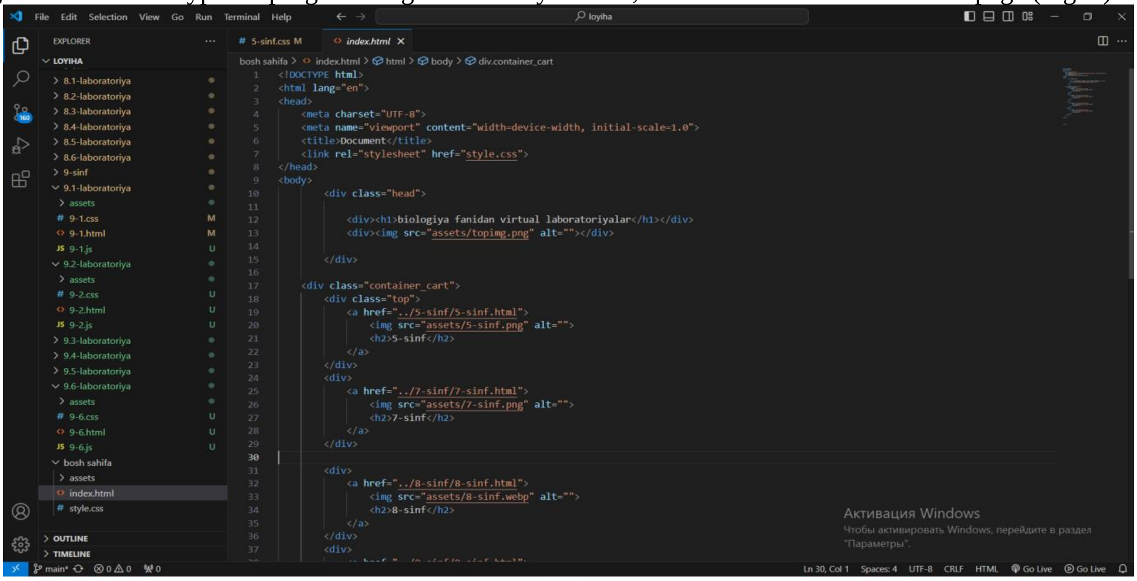

Figure 1. A window of Visual Studio Code in HTML.

b) CSS- (Cascading style sheets) is used to control the layout and visual presentation of web pages. Using CSS, you can design the information written in HTML, change their color, shape, and type (Fig. 2).

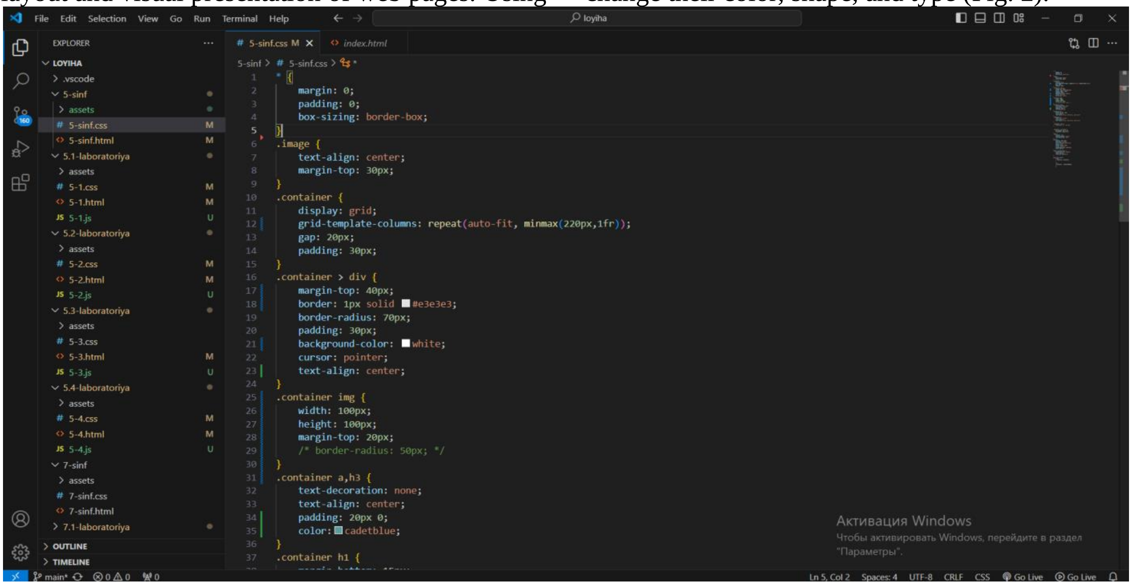

Figure 2. Visual Studio Code CSS window.

c) JavaScript is a versatile programming language used to add interactivity and functionality to web pages (Figure 3).

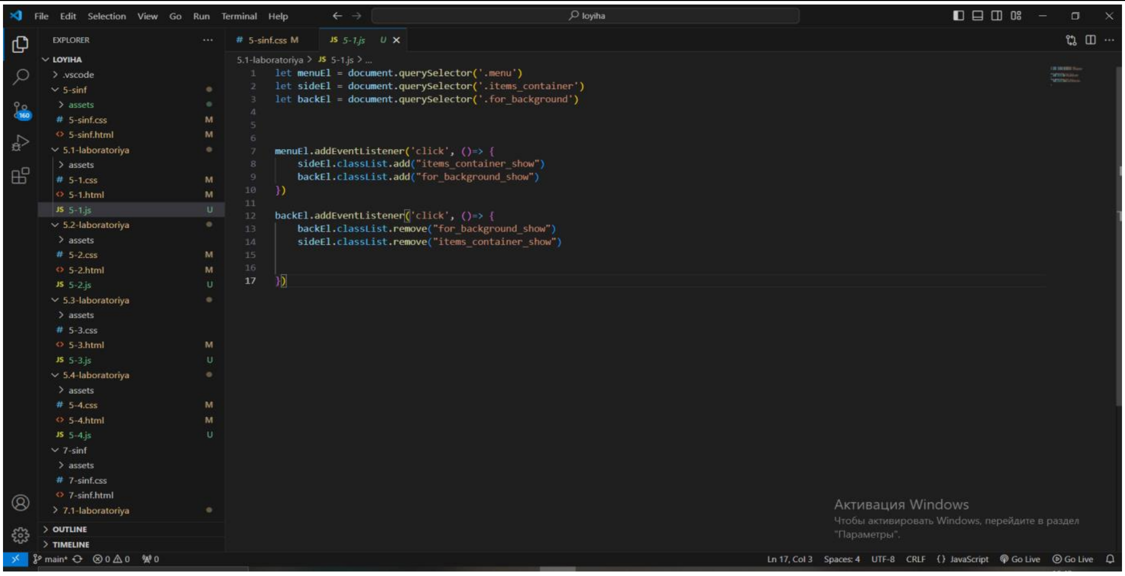

Figure 3. A JavaScript popup in Visual Studio Code.

Virtual labs offer unprecedented flexibility and scalability, allowing educators to tailor the learning experience to meet the diverse needs and learning styles of students. Whether integrated into traditional classrooms, blended learning environments, or fully online courses, virtual labs can fit a wide range of learning approaches and learning objectives. Additionally, the asynchronous nature of virtual labs allows students to engage with course material at their own pace, which promotes self-direction and autonomy. Based on the following methodology, a virtual project of laboratories for biology of general education schools was partially created. According to it, the biology textbooks created for the 5th, 7th, 8th and 9th grades of secondary schools were taken as a basis (pictures 4-5-6-7-8).

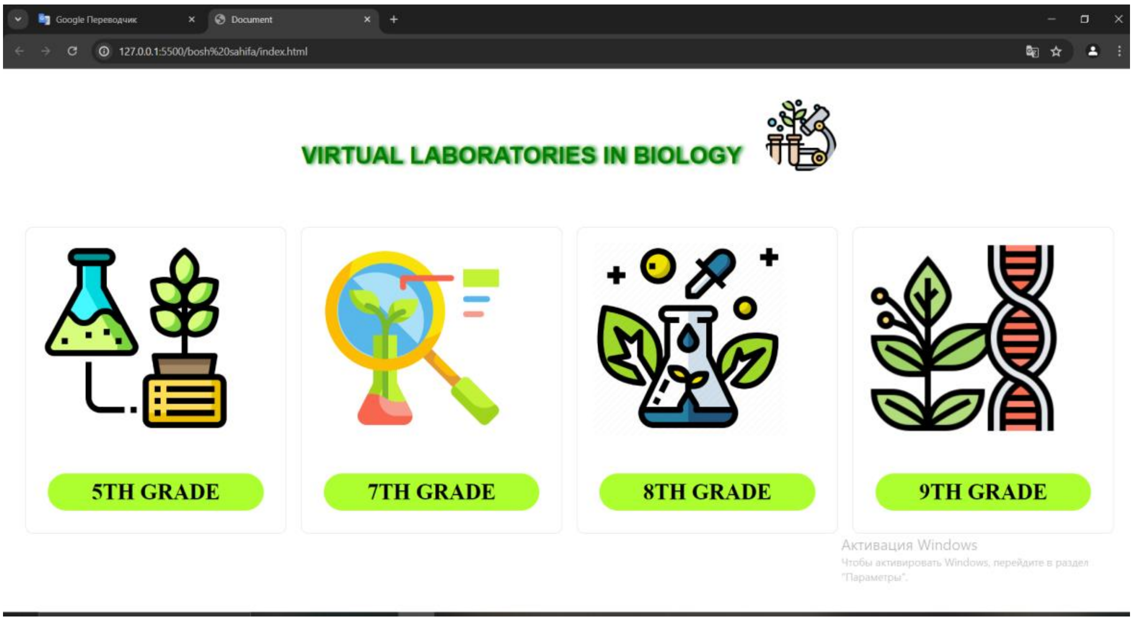

Figure 4. Homepage of the website.

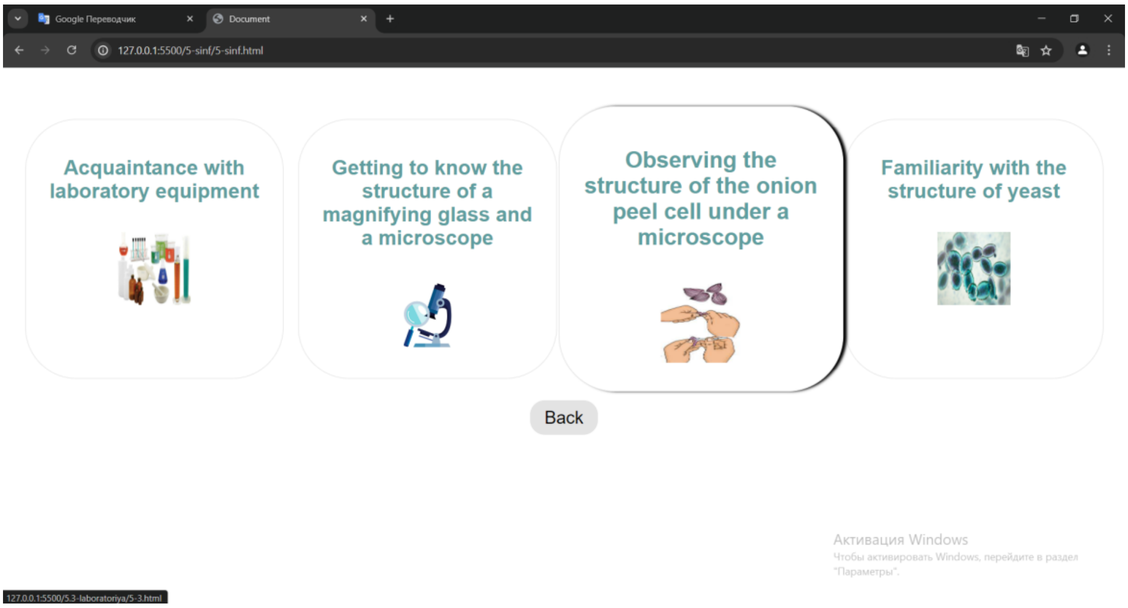

Figure 5. The page of the website with the name of the topics of the labs in 5th grade biology.

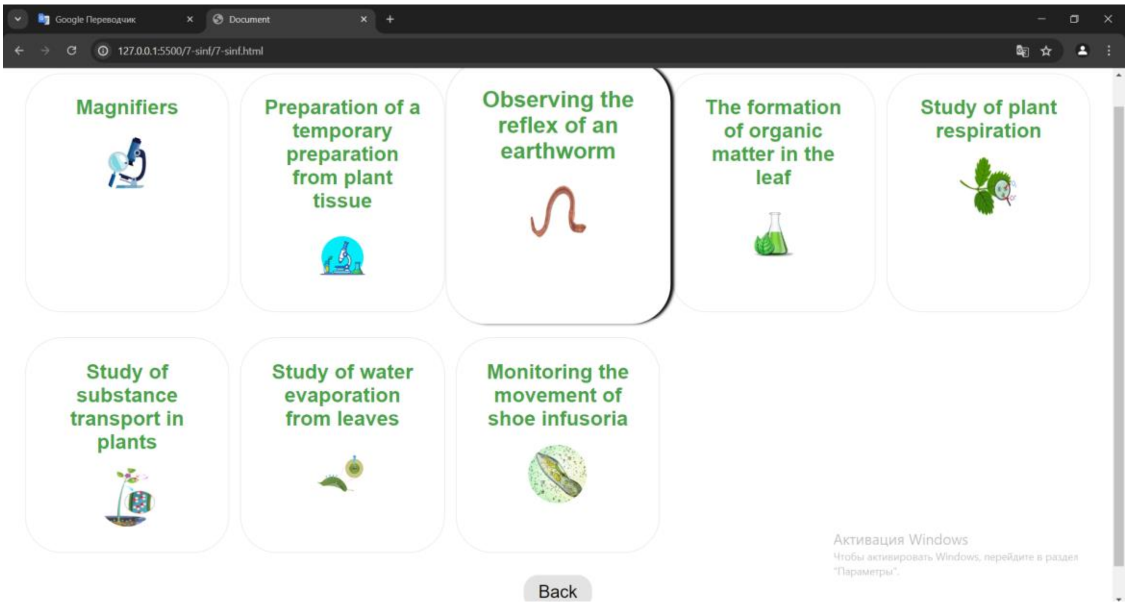

Figure 6. The page of the website with the name of the topics of laboratories in 7th grade biology.

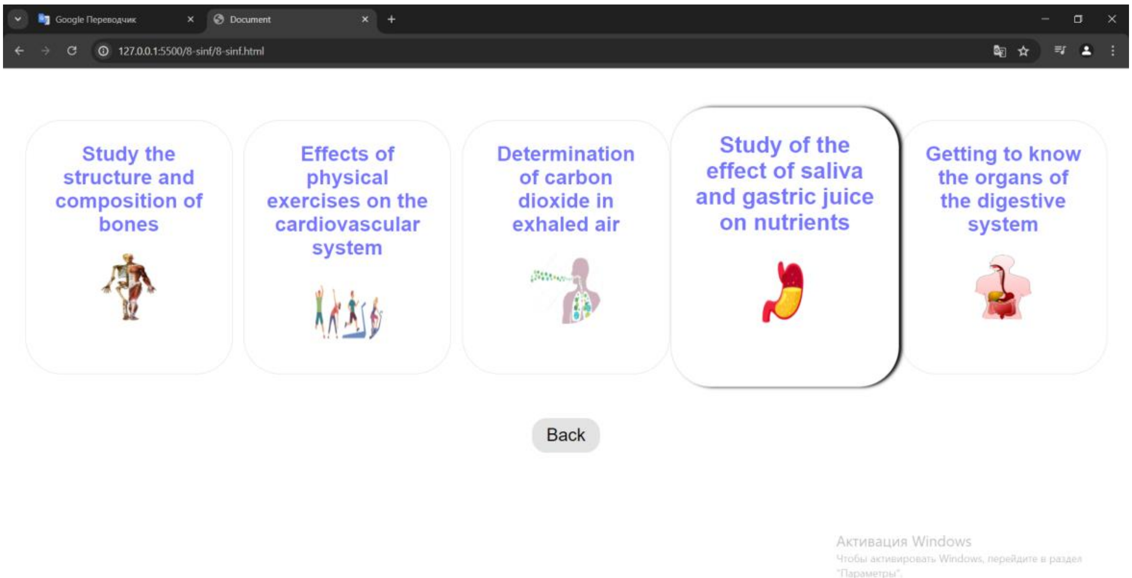

Figure 7. The page of the website with the name of the topics of the labs in 8th grade biology

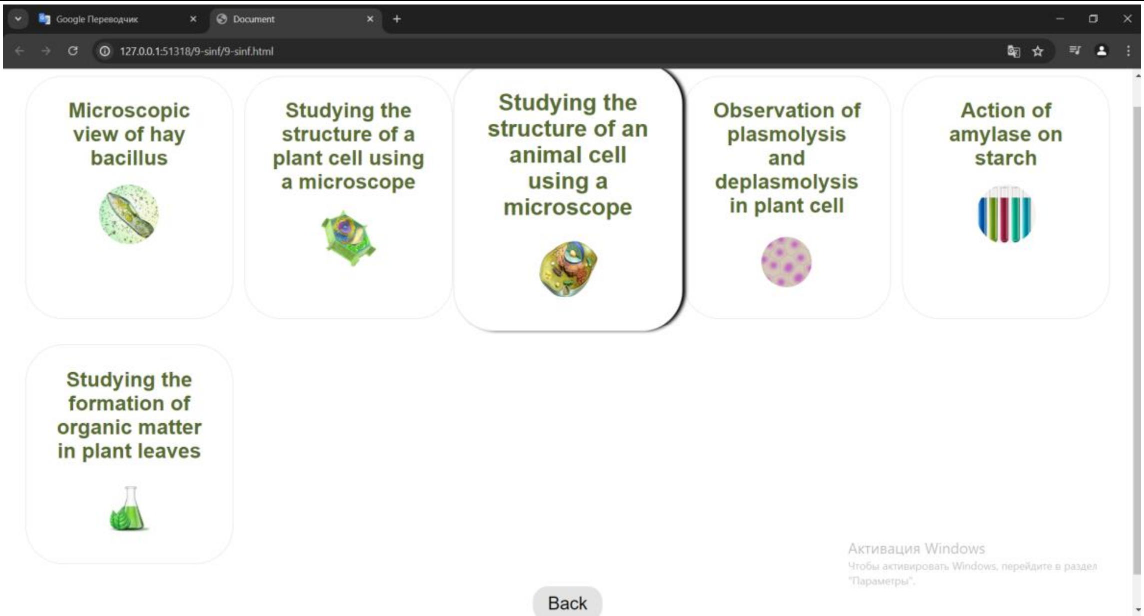

Figure 8. The page of the website with the name of the topics of laboratories in biology of the 9th grade.

Virtual laboratories, despite their advantages, present a number of challenges. The reliability of processes compared to real experiments is one of the main problems. Although virtual environments strive to replicate real laboratory experiences, tactile interaction and self-problem solving may be lacking, which may limit the development of hands-on skills. In addition, the initial investment required to develop high-quality virtual labs and ensure the compatibility of technological infrastructure can present some challenges for educational institutions, especially those with limited financial resources. Also, the integration of virtual laboratories into biology curricula requires adequate training and support of teachers. Teachers must be proficient in managing these digital tools to effectively guide student learning and facilitate meaningful interactions. In addition, it is important to constantly update and maintain virtual laboratories to ensure that they are in line with current scientific advances and educational standards.

Virtual labs are a transformative tool in biology education, leveraging IT to improve accessibility, flexibility, and experiential learning. While challenges remain, ongoing progress and collaborative efforts will evolve to further optimize these digital resources and expand their impact on student learning and engagement.

In conclusion, it can be said that the integration of virtual laboratories represents a revolutionary paradigm shift in biology education, improves educational outcomes, promotes inclusiveness, and enables the development of scientific research. Virtual labs offer students an immersive and interactive learning environment, demonstrating the ability to simulate real science experiments. By harnessing the power of digital platforms, educators can create immersive learning experiences that allow students to explore the wonders of biology and prepare them for the challenges of the 21st century.

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FROM VICTORIAN SOCIETY TO LITERARY REALISM: THE EVOLUTION OF CRITICAL REALISM IN ENGLISH LITERATURE

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Abstract

Victorian literature is defined by the period of time in which it was written, not a central philosophy or style. However, a lot of Victorian literature does have particular themes or showcases similar forms and styles. This was caused by changing trends in thinking and taste. Following the Romantic period, writers of the Victorian age turned away from the abstract expressionism of the former period and focused on realism, with an attention towards social issues and the sciences.

Both poetry and fictional prose were popular throughout the Victorian Age, producing some of the greatest writers in English. And during this time, the novel became the leading literary genre in English. A lot of prominent writers became aware of the social injustices around them and tried to depict them in their works. Thus this period was mirrored in literature by the appearance of a new trend, the Critical Realism.

Victorian writers used the novel as a means to protest against the evils in contemporary social and economic life and to picture the world in a realistic way. Their greatness also lies in their profound humanism. Their sympathy lies with the ordinary people. They believed in the good qualities of the human heart.

The novel's ubiquity today can be traced back to its popularity in Victorian England; the greatest Victorian novelists are remembered for their overall artistry and their social observations and critiques.

Keywords: Victorian literature, social injustice, critical realism, democratic viewpoint.

The history of English literature may well be thought too large a venture for one volume, let alone one historian. Literary contents have obviously changed over the centuries. It is less obvious how far the means of representing life have gradually changed through the history of literary forms. Sometimes these have social or economic causes, but more often they are developments to literature- shifts of fashion, deeper movements.

English Literature has had a long and trying way of evolution, reflecting the history of the country and nation. It has undergone effects of historical periods that raced the literature to its pick. Amidst them was "The Victorian Era" (1832-1901), a period of Queen Victoria's reign.

Queen Victoria had the longest reign in British history, and the cultural, political, economic, industrial and scientific changes that occurred during her reign were quite remarkable.

The Victorian age, the great period of rapid changes and contradictions is subdivided into three phases:

1. Early Victorian (1832- 48)
2. Mid- Victorian (1848- 70)
3. Late- Victorian (1870- 1901)

The early Period (1832- 1848) - A Time of Troubles

The early phase has been characterized as the Time of Troubles. In 1832 the passing of a Reform Bill had seemed to satisfy many of the demands of the middle classes who were gradually taking over control of England's economy. The bill extended the right to vote to all men owning property. In the early 1840's a severe depression with wider spread unemployment conditions in the new industrial and coal- mining areas were sufficiently inflammatory to create revolution. Workers and their families in the slums of such cities as Manchester lived like packs of rats in a sewer and the conditions under which women and children toiled in mines and factories were unimaginably brutal. Elizabeth Barrett's poem "The cry of the children" (1843) tells us about children of fire years of age who dragged heavy tubs of coal through low- ceiling mine- passages for sixteen hours a day. Although the owners of mines and factories are blamed for such conditions these owners regarded themselves as innocent. There was an immense and continually increasing population, no adequate demand for labor, no confidence, but a universal alarm. The country was drawn in a deep sea of sorrows that seemed to be away of any possible way outs. To crown it all, nobody pretended to be able to point out any remedy.

This Time of Troubles left its mark on some early Victorian literature. In his novel "Sybil" (1854) Benjamin Disraeli chose an appropriate subtitle, "The two nations"- a phrase that pointed up the line dividing the England nation into the rich and the poor. The author showed off the real life of England, its social strata - the life the poor led in brutality, rudeness and how confidently the rich dwelled without tasting the poor life

Mid-Victorian Period (1848- 1870). Economic Prosperity and Controversy.

This second phase of the Victorian Age had many harassing problems, but it was a time of prosperity. Great development was noticed in science as well. Darwin's great treatise, "The Origin of Species" (1859) brought new views on humanity. Most readers recognized that Darwin's theory of natural selection conflicted with the concept of creation derived from the Quran, Bible, and other sacred books; thus they didn't accept his theory at all.

The Late Period (1870- 1901). Decay of Victorian Value.

This final phase of the century was a time of serenity and security, the age of house parties and long weekends in the country. Life in London was for many an exhilarating heyday. In 1867, Under Prime Minister Disraeli's guidance, a second reform Bill had been passed which extended the right to vote to sections of the working classes and this made labor a political force.

In poetry, prose fiction essays, history, philosophy and scientific treatises, the Victorian age has done good work. The most eminent writers of the period are Browning and Tennyson in poetry Thackeray, Dickens and George Elliot in prose fiction; Carlyle, Ruskin and Mathew Arnold in essay writing; Herbert Spencer, Cardinal Newman and Sir William Hamilton in various types of philosophy; Tyndell and Huxley in science. Prose takes higher rank in the Victorian than in the preceding age. [1, 93]

In Victorian period appeared a new literary trend—Critical Realism. English critical realism of the 19th century flourished in the 1840s and early. It found its expression mainly in the writing of novels. The critical realists, most of whom were novelists, described with much vividness and artistic skill the chief traits of the English society and criticised the capitalist system from a democratic viewpoint. [1, 52]Eminent representatives of Critical Reslism were writer- realists Dickens, Thackeray, Thomas Hardy, Bronte, Cornel, Samuel Battler, Bernard Show, poet-chartists Johns and Linton.

The writers of this period putting social ideas in the focus of views led the reader to the idea of inhumanity and injustice society. Dickens and Thackeray since the early years of their creativity had defended the honest social Proceeding with the best traditions of realistic literature they were approving democratic principles of art. Putting Social ideas in the focus of views, those writers - realists led the reader to the idea of inhumanity and injustice society. English realists addressed significant problem of their epoch - the conflict of proletariat and bourgeoisie; since Dickens in his "Hard Times", Bronte in "Sherley", Gasckel in "Mary Barton" strictly depicted the problem of interrelation, conflicts and controversies between capitalists and workers. As a result, creation of the English writer - realists has a bright tendency of anti - bourgeoisie. Marks were writing: "The bright group of cotemporary English writers whose expressive and significant notes exposed. The world with its political and social reality rather than professional politics, publicists or moralists did. It was the writers who revealed all stratums of bourgeoisie, starting from "respected" tenants and valuable paper holders, and finishing with small shopkeepers and clerks in advocate offices. There is a question: "How did Dickens and Thackeray, Mrs. Bronte and Mrs.Gasckel depict those respected men of respected society?" [5]They depicted them as vividly as they are - self confident, pompous, ignorant and low leveled tyranits. Characteristic peculiarity of English realists is a craft of satirical exposure. Satire, for its diversity and richness - is the sharpest implement of Dickens and Thackeray. [6]By criticizing rotten society with its all deficiencies and contradictions, they also revealed moral innocence, diligence, disinterestedness and firmness of simple people. In depiction of people one can see a deep sense of humanism in English writers' work, especially in Dickens. His positive ideals, Dickens could see in disinterest and honest toilers. According to Dickens, those poor, simple people are the sole real happy ones despite the all injustice and cruelty of society. However, English critical realists were far away of the conception of historical valuation regularity. They had no direct relation to "worker Movements" surrounding the country.

Depicting people's strive to a better life writers were also revealing the ways for solutions of these problems. In the second part of XIX century struggle of the classes didn 't cease yet; worker movements were still observed. In 50-60s at the same time with Dickens there known other literary men like Thackeray, Emily Bronte, Elizabeth Gaskell and George Elliot. Philosophy of Positivism has brightly displayed the characteristic creation of them. Main characters of their books are common people with their hard and trying life. Bourgeois men of letters devoted to the interests of own class, not only by amusing and flattering since a great number of them frankly praised and supported military aggression and colonial invasions of British Empire. Alfred Tennyson who never exposed knighthood of Middle Ages now was glorifying prospering Victorian England. Though in such a hard opportunity best custom and principles of the art of critical realism were developing in the creation of outstanding writer- Ch. Dickens. [7]

Ch. Dickens was the greatest critical realist in XIX century English literature. K. Marx in an article published in The New York Tribune in 1854 gave the following characterization of the English critical realists.The present brilliant school of novelists in England, whose descriptions have revealed more political and social truth to the world than have all the politicians, publicists and moralists added together, has pictured all sections of the middle class, beginning with the "respectable" owner of government stocks, and finishing with the small shopkeeper. [3, 124] How have they been described by Dickens, Thackeray, Charlotte Bronte and Mrs. Gaskell, as full of self conceit, petty tyranny and ignorance? And the civilized world confirmed their verdict in a damning epigram which it has pinned on that class, that it was servile to its social superiors and despotic to its social inferiors, Of the writers named by Marx, Dickens, and Thackeray were the most outstanding. Creativity of Charles Dickens opens a new bright page in the history of Critical Realism of England. The whole epoch of Evolution of the English literature is concerned with his name. Dickens belongs to that group of great writers that has bees pride of the national English Culture .

With striking force and truthfulness, he pictured bourgeois civilization, showing the misery and sufferings of the common people. In his novels, Dickens pulls out the masks of English Bourgeoisie. [4, 559] He directs his stroke against infinite hypocrisy and egoism. By depicting main characters of his novels, (Oliver Twist, Nicholas Nikleby) the author reveals painful life of thousands of unfortunate people. In Oliver Twist Dickens tells the story of an orphan boy of unknown parentage. Born in a workhouse, brought up under cruel conditions, the hero runs away from the workhouse to London where he falls into the hands of a gang of thieves. He is rescued from them by the benevolent rich Mr. Brownlow, but thieves make him join them once again and partake in their foul dealings.[8] The novel ends with Oliver's adoption by Mr. Brownlow. The adventures of the boy-hero were used by Dickens to describe the lower depths of London. He makes his reader aware of the inhumanity of city life under the conditions of capitalism. Dickens describes here the awful conditions under which the children of the poor were brought up, and exposes the cruelty of the bourgeois philanthropists.[2, 480]

Another critical realist, William Makepeace Thackeray, was a severe critic of the English society. Thackeray’s novels are mainly a satirical portrayal of the upper stratum of society. The writer made his way to popularity much more slowly than Dickens. These two men, who became friends and generous rivals, were very different in character and disposition. Among his novels "Vanity Fair" (1847-48) is Thackeray's masterpiece For the lifelikeness of its characters, it is one of the most remarkable creations in fiction. In "Vanity Fair" certain classes of society satirized. Their intrigues, frivolities and caprices, flippant characters are dealt with. Thackeray probes almost every weakness, vanity and ambition which leads humanity to strive for a place in society In "Henry Esmond" (1852) Thackeray gives an enduring picture of high life in the 18h century. "The History of Pendennis" (1849) and "The Virginians" (1857-1859) are both popular novels. "The English Humorists of the 18th century" (1853) and "The Four Georges" (1860) are among his essays.Thackeray is an uncompromising realist and satirist. He doesn't label his characters with external marks, but enters into communion with their souls. His method of lying bares their motives and an action is strictly modern.

The other representative of the Great Victorian Period was Mary Ann Evans, known to her family as Marian and to her reader as George Eliot (1857-1876) George Eliot does not regard the novel as a vehicle for entertainment alone, but rather as a means of revealing the human condition. Like George Meredith, "she is the embodiment of philosophy in fiction,"' as Oscar Wilde remarked in 1897. Examining her central characters in depth, Eliot often abandons conventional plot-formulae by failing to provide an entirely happy ending. Her stories usually end somberly, without a real hero or heroine emerging. Eliot began her greatest work, Middlemarch, in 1867 and completed it in 1872; it was published in Blackwood's Magazine in eight monthly installments, although she had finished only three when the serial run began in 1871. She envisioned the Vincey part of the story as complete in itself in 1869 the story's realism she carefully investigated provincial hospitals, medical practices, and physicians, rather than accept conventional thinking and stereotypes. Although she was to write one final lengthy novel (Daniel Deronda) before her death in 1880, it is for Middlemarch that she is still remembered as "The Victorian Sage," a remarkable achievement for a woman in nineteenth-century Britain. Adam Bede (1859) was her first full-length novel. It was an immediate success, but attracted fervent public gossip as to who the real author was. When it was discovered that Eliot was Mrs. Marian Evans Lewes, many castigated her but she was also lauded by friends, fellow authors, and feminists. The Lifted Veil (1859) reflects the personal struggles Eliot went through as a woman and author in the spotlight since the success of Adam Bede. She still felt self-doubt at times and had bouts of depression--this sensitive inner-life reflected in many of the portraits. painted of her.

Other novelists who adhere to critical realism were Charlotte Brontë, Emily Brontë, Elizabeth Gaskell, and Thomas Hardy.

The Brontës were the world's most famous literary family. Charlotte, Emily and Anne Brontë were the authors of some of the best-loved books in the English language Charlotte's novel Jane Eyre (1847), Emily's Wuthering Heights (1847), and Anne's The Tenant of Wildfell Hall (1848) were written in this house over a hundred and fifty years ago, yet their power still moves readers today. To find two writers of genius in one family would be rare, but to find several writers in one household is unique in the history of literature. Charlotte and Emily are ranked among the world's greatest novelists; Anne is a powerful underrated author, and both their father, the Revd. Patrick Brontë, and brother Branwell also saw their own works in print.

Surprisingly, the enduring myth of the Brontës living a life of unrelieved isolation and tragedy was, to some extent, created unintentionally by the Brontës themselves In choosing to write under pseudonyms, the sisters drew an immediate veil of mystery around them.

Like most authors, the Brontës drew upon their imaginations, on their personal experiences and the landscape and characters around them, but their mature poems and novels are also rooted in the themes of the early writings of their childhood and adolescence. The following works were written by the Brontë Family: "Jane Eyre" (1846), "Villette* (1853), "Shirley"(1849), "The Professor" (1857) (Charlotte Bronte); "Wuthering heights "(1847) (Emily Bronte); "Agnes Grey" (1847), "The Tenant of Wildfell Hall"(1848) (Anne Bronte); "The Works of Patrick Branwell Bronte" : An Edition (Vol I).

Elizabeth Gaskell’s name is definetelly among the realists as well. (1810-1865) Gaskell's first novel, Mary Barton, was published anonymously in 1848. The best known of her remaining novels are Cranford (1853), North and South (1854), and onfcul Wives and Daughters (1865). She became popular for her writing, especially her ghost story writing, aided by her friend Charles Dickens, who published her work in his magazine Household Words Her ghost stories are quite distinct in style from her industrial fiction and belong to the Gothic fiction genre. Even though her writing conforms to Victorian conventions (including signing her "Mrs. Gaskell"), name Gaskell usually frames her stories as critiques of contemporary attitudes, particularly those toward women, with complex narratives and dynamic female characters. [10]In addition to her fiction, Gaskell also wrote the first biography of Charlotte Bronte, which played a significant role in developing her fellow writer's reputation. Gaskell was well-known for her following novels: "Mary Barton" (1848), " Cranford" (1851- 1853), "Ruth" (1853), "North and South" (1854-1855), "Sylvia's Lovers" (1863), "Cousin Phillis" (1864), "Wives and Daughters: An Everyday Story " (1865). She was the author of short stories like "Libbie Marsh's Three Ears" (1847), "Christmas Storms and Sunshine" (1848), "The Squire's Story" (1853), "Half a Life-time Ago" (1855), "An Accursed Race" (1855), "The Poor Clare (1856) ", "The Manchester Marriage" (1858) a chapter of A House to Let, co-written with Charles Dickens, Wilkie Collins, and Adelaide Anne Procter, The Half-brothers (1859), The Grey Woman (1861). [9]As a Unitarian dissenter living in the industrial town of Manchester, Gaskell wrote with compassion but at-times bold frankness about controversial issues of the day including the general poverty of the working classes, the hardships of men working in mines and factories, and women working in mills, After enjoying an idyllic middle childhood in the country, she was shocked and saddened to see families living in slums eking out a miserable existence. Time and again she would cause controversy among her privileged Victorian readership with her characters and themes. While trying to balance her domestic duties with burgeoning literary pursuits, Gaskell inevitably drew upon her own experiences with various charitable organısations in assisting the poor to create her now famous fictitious works.

All in all, today the greatest Victorian novelists are remembered for their overall artistry and their social observations and critiques. The English critical realists of the 19th century not only gave a satirical portrayal of the bourgeoisie and all the ruling classes, but also showed profound sympathy for the common people. In their best works, the greed and hypocrisy of the upper classes are contrasted with the honesty and good-hearted-ness of the obscure “simple people” of the lower classes. Hence humor and satire abound in the English realistic novels of the 19th Critical realism reveals the corrupting influence of the rule of cash upon human nature. Here lies the essentially democratic and humanistic character of critical realism.

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PSYCHOLOGY

СИНДРОМ НА ПРЕГАРЯНЕТО И ФАКТОРИ НА РАБОТНАТА СРЕДА – ПИЛОТНО ДЕСКРИПТИВНО КРОС-СЕКЦИОННО ПРОУЧВАНЕ СРЕД ДЕНТАЛНИТЕ ЛЕКАРИ В БЪЛГАРИЯ (ЧАСТ I)

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BURNOUT SYNDROME AND RELATED WORK ENGAGEMENT FACTORS - A PILOT DESCRIPTIVE CROSS-SECTIONAL STUDY AMONG DENTISTS IN BULGARIA (PART I)

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Абстракт

Целта на настоящото проучване е да се изследва и оцени разпространението и степента на проява на бърнаут синдрома сред лекарите по дентална медицина, имайки предвид конкретни фактори на работната среда - вид на денталната практика, собственост на денталния кабинет и вид на извършваните клинични дейности. Проведено е анонимно анкетно проучване сред 156 дентални лекари (степен на респондентност=90.6%, n=136). Анкетната карта се състои от две части – социо-демографски профил и характеристики на работното място; стандартна методика за изследване на бърнаут, чрез Maslach Burnout Inventory (MBI-HSS). Според получените резултати работещите в индивидуални дентални практики, в дентален кабинет под наем и тези, които избягват някои клинични дейности (хирургия или лечение на пациенти с тежки хронични заболявания) имат по-висок риск от бърнаут, показвайки високи нива на емоционално изтощение, деперсонализация и намалени персонални постижения, в сравнение с тези, които работят в групови практики, в собствен дентален кабинет и приемат всички пациенти, без значение от клиничния казус. Следователно, избягването на професионалната изолация, еднообразните и монотонни клинични дейности, внасянето на разнообразие в работата, както и практикуването в собствен дентален кабинет, носещо достатъчно сигурност и независимост, биха съдействали в много голяма степен за превенцията на бърнаут синдрома.

Abstract

The purpose of the present study was to investigate and assess the prevalence and levels of burnout syndrome among dentists, taking into account specific factors of the work environment - type of dental practice, ownership of the dental office and type of clinical activities performed. An anonymous survey was conducted among 156 dentists (response rate=90.6%, n=136). The questionnaire consisted of two parts – socio-demographic profile and workplace characteristics; standard burnout research methodology, through the Maslach Burnout Inventory (MBI-HSS). According to the results obtained, dentists working in individual (single) dental practices, in a rented dental office and those who avoided certain clinical activities (surgery or treatment of patients with severe chronic diseases) had a higher risk of burnout, showing high levels of emotional exhaustion, depersonalization and reduced personal accomplishment, compared to dentists who worked in group practices, in their own dental office and accepted all patients, regardless of the clinical case. Therefore, avoiding professional isolation, monotonous clinical activities, bringing variety to work, as well as practicing in one's own dental office, bringing sufficient security and independence, would contribute to a very large extent to the prevention and mitigation of burnout syndrome.

Ключови думи: синдром на „прегаряне“, дентални лекари, фактори на работната среда, MBI-HSS, превенция на бърнаут синдром.

Keywords: burnout syndrome, dental practitioners, work environment factors, MBI-HSS, burnout prevention.

Въведение

Терминът „прегаряне“ е въведен през 1974г. от Хърбърт Фройденбергер (1926-1999), американски психиатър и психоаналитик, като характеристика на психологичното състояние на здрави хора, осъществяващи интензивен и тесен контакт с клиенти, пациенти в емоционално-напрегната трудова атмосфера. Той е един от първите, които описват симптомите на професионалното изтощение в своя труд “Burn Out: The High Cost of Success - and How to Cope with It” (Freudenberger & Richelson, 1980). Съгласно съвременните данни под „прегаряне“ се разбира състояние на физическо, емоционално и умствено изтощение у професионалисти, работещи в социалната сфера [1,2,3].

Досега бърнаутът се наричаше стресов синдром. Световната здравна организация (СЗО) обаче наскоро актуализира своята дефиниция. Понастоящем прегарянето се приема като „синдром, концептуализиран като резултат от хроничен стрес на работното място, който не е бил успешно управляван“ [4].

От практическа гледна точка, синдромът на „прегарянето“ се характеризира с три основни аспекта: физическо и емоционално изтощение; деперсонализация - повишена раздразнителност, арогантност, цинизъм, неглижиращо, безчувствено, „предметно“, нехуманно отношение; тенденция за отрицателна самооценка - чувство на неудовлетвореност и понижени персонални постижения по отношение на способностите и продуктивността [2,4,5].

Денталната професия се реализира под влиянието на множество професионални рискови фактори (вредности). Някои от тях са: биологични фактори – различните микроорганизми (вируси, бактерии, гъби) с тяхното разпространение и цикличност; химични фактори – всички медикаменти и материали с алергизиращо и токсично въздействие; физични фактори - шум, вибрации, неправилно аранжирано осветление и др.; ергономични фактори - неправилна и неергономична работна стойка, специфика на денталните манипулации и др. [6-9]. Значително влияние върху практикуващите могат да имат и нервно-психологичните фактори – всички източници на остър и хроничен дистрес на работното място. Комбинацията от действието на тези хронични, пролонгирани, негативни източници на стрес (дистрес) на работното място и липсата на ресурси на личността за справяне стоят в основата на етиологията на бърнаут синдрома [10,11].

В този смисъл, идентифицирането на основните рискове в професионален аспект, би имало ключово значение за предотвратяване на негативните последици от “прегарянето”. Известно е, че съвременната практико-теоретична рамка на синдрома бърнаут интегрира индивидуални и ситуационни фактори (Ценова, 2005): персонални особености (възраст, пол, образование, семейно положение), личностови черти (невротизъм, екстраверсия, локус на контрол, самоотверженост, идеализъм, перфекционизъм и др.) и фактори на работната среда (липса на възможност за самостоятелно вземане на решения, ролева неопределеност, несъобразен работен график, претовареност в работата, работно напрежение, междуличностни конфликти, липса на благодарност, липса на нужната подготовка за осъществяване на професионалните задължения, недостатъчно ресурси и много други) [12].

Целта на настоящото изследване е да се проучи състоянието на бърнаут синдрома сред лекарите по дентална медицина в контекста на професионалната им дейност, както и да се предложат ефективни стратегии за справяне с него. За постигане на горепосочената цел бяха формулирани следните задачи:

1. Да се изследва и оцени разпространението и степента на проява на бърнаут синдрома сред лекарите по дентална медицина, имайки предвид конкретни фактори на работната среда.

2. Да се предложат стратегии за справяне с проблема с цел ефективна превенция на негативните последици от него.

За целите на настоящото проучване интерес представляват следните фактори на работната среда: вид на денталната практика, собственост на денталния кабинет, вид на извършваните клинични дейности, продължителност на работното време, работа с помощен персонал, условия на труд – дентална апаратура и оборудване, планиране на работния график. Настоящата статия поставя акцент върху първите три характеристики на условията, при които денталните лекари практикуват професията си. Формулирана е работна хипотеза, която се асоциира със становището, че трите компонента на бърнаут (емоционално изтощение, деперсонализация и персонални постижения) са изявени в различна степен при изследваната група лица, поради особеностите в социо-демографския им статус и тъй като професионалната им дейност се извършва при конкретни условия и организация на работата, които са обусловени от индивидуалните особености на всяка дентална практика.

Материал и методи

Настоящото проучване е пилотен проект с дескриптивен крос-секционен дизайн, проведено в периода септември-ноември 2018 г. в София, България. За изпълнение на поставената цел е проведено анонимно анкетно проучване. Бяха раздадени общо 156 въпросника, 5 от които бяха изключени от проучването, тъй като бяха неправилно попълнени. Един зъболекар отказа да участва в проучването. Общо 136 зъболекари са отговорили на проучването (степен на респондентност=90.6%), практикуващи в индивидуални или групови дентални практики за първична или специализирана дентална помощ, както и работещи в дентални или медико-дентални центрове. За целите на изследването респондентите са разделени в три възрастови групи – 25-40 г. – 32 (23.5%), 41-55 г. – 72 (53%) и над 56 г. – 32 (23.5%); разпределението по пол е 56 (41.2%) мъже и 80 (58.8%) жени. Критерии за включване, касаещи единиците на наблюдение, бяха: да бъдат лекари по дентална медицина, дали доброволно съгласие за участие в проучването, с трудов стаж не по-малък от 1 година.

Преди попълването на въпросника, на всеки дентален лекар бе предоставена кратка вербална информация относно целите на проучването и по какъв начин резултатите от него биха допринесли за денталната практика като цяло. Анкетните карти бяха раздадени в денталните кабинети на респондентите, които бяха помолени да отговорят на въпросите анонимно. Попълването на въпросника бе прието като форма на индивидуално съгласие от страна на денталните лекари да вземат участие в проучването. Тъй като последното не включва пациенти или опитни животни, анонимността на участниците беше гарантирана и те имаха право да откажат да участват в проучването, не беше необходимо да се търси одобрение от Етична комисия относно етичните стандарти на проучването.

Проведеното проучване се базира на комплексна методика от собствено изработени и стандартизирани инструменти. Анкетната карта се състои от две части – социо-демографски профил и характеристики на работното място; методика за изследване на бърнаут, чрез Maslach Burnout Inventory (MBI; Maslach & Jackson, 1996). Първата част на анкетната карта съдържа 20 въпроса, обединени в три подгрупи, свързани с установяването на: социо-демографските характеристики на денталните лекари (възраст, пол, трудов стаж, семейно положение). Втората група въпроси са свързани с особеностите на работното място – собственост на денталния кабинет (под наем, собствен или и двете), вид на денталната практика (индивидуална, групова или дентален център), продължителност на работното време, вид на извършваните клинични дейности, работа с помощен персонал, условия на труд в денталния кабинет (дентална апаратура и обзавеждане), планиране на работния график. Въпросите са затворени, някои от тях имат опция за посочване на повече от един отговор. Третата група въпроси са свързани със самооценката на денталните лекари относно получаваните доходи от денталната им практика, както и касаещи наличието да дейности, несвързани с денталната практика (хоби или странични интереси); наличие на вредни за здравето стереотипи, свързани с начина на живот (тютюнопушене, злоупотреба с алкохол, успокоителни медикаменти, антидепресанти или сънотворни, както и безсъние) и въпроси, свързани с професионалното планиране и желанието за работа след пенсиониране.

Втората част на анкетната карта се състои от въпросникът на Маслач за изследване на бърнаут (Maslach Burnout Inventory - MBI), който включва три подскали: емоционално изтощение, деперсонализация и персонални постижения (работоспособност). MBI-HSS се състои от 22 айтема, за измерване на емоционалното изтощение (девет айтема - 1, 2, 3, 6, 8, 13, 14, 16, 20); деперсонализация (пет айтема- 5, 10, 11, 15, 22) и персонални постижения (осем айтема- 4, 7, 9, 12, 17, 18, 19, 21). Българският превод на въпросника е валидиран и използван при медицински персонал в България от Б. Ценова (1991,2002,2004) [13].

Честотата, с която респондентът преживява всяка една позиция се оценява по седем точкова Ликерт - скала с кодове от 0 до 6 със следното значение: 0 – не, никога; 1 – много рядко; 2 – рядко; 3 – понякога; 4 – често; 5 – много често; 6 – винаги. По този начин резултатите варират 0-54 т. за подскалата - емоционално изтощение, 0-30 за подскала – деперсонализация и 0-48 на подскала - лично постижение. По-високите средни резултати за субскалите емоционално изтощение и деперсонализация отговарят на по-високи нива на бърнаут, от друга страна по-високите средни резултати от субскалата - лично постижение отговарят на по-високи нива на „персонална ефективност“, респ. по- ниски нива на прегаряне (Maslach & Jackson, 1986) [14].

Надеждността на вътрешната съгласуваност на целия въпросник и подскалата деперсонализация (ДП) е в интервала „добра за практически цели“, съответно 0.757 и 0.726. Най-висока стойност (0.926, отлична) коефициентът на надеждност Alpha Cronbach има при подскалата емоционално изтощение (ЕИ), докато на подскалата персонални постижения (ПП) е в интервала „Много добра“ – 0.816. [15].

Получените данни бяха въведени и обработени с помощта на статистическия пакет IBM SPSS Statistics v.25.0. Използвана е стандартна дескриптивна статистика (брой, %), за да се изчисли разпространението и степента на проява на бърнаут синдрома сред лекарите по дентална медицина, както и да се представят резултатите, касаещи конкретните характеристики на работните условия.

Резултати

Според получените резултати повече от половината от анкетираните денталните лекари работят в индивидуални практики – 80(58.8%), а останалите – в групови – 56(41.2%). Също така, повече от половината от респондентите - 80(58.8%) работят в собствен дентален кабинет, а 40(29.4%) – в кабинет под наем. Шестнадесет от денталните лекари (11.8%) имат собствен дентален кабинет и работят в такъв под наем.

По отношение на клиничните дейности, денталните лекари бяха помолени да посочат дали приемат всички пациенти, без значение от клиничния казус или в дейността им има специфика при подбора на пациентите, които трябва да лекуват. Последният визира избягването на пациенти с хронични системни заболявания, рядко извършване на хирургична дейност или практикуване на дейности, свързани само със специалността на денталните лекари (ако имат такава). Подробно, получените отговори са представени на табл. 1.

Таблица 1

Честотно разпределение на участниците в проучването по вид на извършваните клинични дейности в денталната практика

Клинични дейности в денталната практика	Брой	Относителен дял (%)
Приемам всички пациенти, без значение от клиничния казус	56	41.2%
Избягвам пациенти с тежки системни нарушения	56	41.2%
Рядко извършвам хирургична дейност	48	35.3%
Практикувам дейности, свързани само със специалността ми	0	0%

Забележка: сборът от процентите надвишава 100, тъй като някои от анкетираните са посочили повече от една дейност

След проведения анализ беше установено, че от денталните лекари, демонстриращи умерено и високо ниво на емоционално изтощение, ¾ са работещи в индивидуални практики (табл. 2). По отношение на деперсонализацията, работещите в индивидуални практики показват много високи нива, докато при работещите в групова практика преобладава относителният дял на високото ниво на деперсонализация (табл.3). При персоналните постижения се наблюдава сходна тенденция. При работещите в индивидуални практики преобладава относителният дял на много високото ниво на намалените персонални постижения, а при работещите в групови практики – умереното ниво (табл.4).

При денталните лекари, работещи в кабинет под наем се наблюдава най-висок относителен дял на високо ниво на емоционално изтощение и деперсонализация и много високо ниво на намалени персонални постижения. При работещите едновременно в собствен дентален кабинет и такъв под наем се регистрират ниски нива на емоционално изтощение, деперсонализация и намалени персонални постижения. Работещите само в собствен дентален кабинет демонстрират много високо ниво на емоционално изтощение, умерена деперсонализация и високо ниво на намалени персонални постижения (табл.2,3,4).

Денталните лекари, които приемат всички пациенти демонстрират най-висок относителен дял на ниските нива на емоционално изтощение и деперсонализация и много високо ниво на намалени персонални постижения (табл. 2,3,4). При лекарите, избягващи пациенти с тежки системни заболявания преобладава относителния дял на умерено и високо ниво на емоционално изтощение, както и високи нива на деперсонализация и персонални постижения. Денталните лекари, които по-рядко извършват хирургична дейност имат най-висок дял на много високо ниво на емоционално изтощение и високи нива на деперсонализация и намалени персонални постижения.

Таблица 2

Честотно разпределение на денталните лекари по вид на денталната практика/ собственост на денталния кабинет/ вид на извършваните клинични дейности и емоционално изтощение

Емоционално изтощение / Вариабилни	Ниско ниво (брой,%)	Умерено ниво (брой,%)	Високо ниво (брой,%)	Много високо ниво (брой,%)	Общо (брой,%)
Вид дентална практика					
Индивидуална	32(57,2%)	24(75%)	24(75%)	0	80(58.8%)
Групова	24(42,8%)	8(25%)	8(25%)	16(100%)	56(41.2%)
Общо (брой,%)	56(100%)	32(100%)	32(100%)	16(100%)	136(100%)
Собственост на денталния кабинет					
Собствен дентален кабинет (1)	24(42.8%)	24(75%)	16(50%)	16(100%)	80(58.8%)
Дентален кабинет под наем (2)	16(28.6%)	8(25%)	16(50%)	0(0%)	40(29.4%)
(1) + (2)	16(28.6%)	0(0%)	0(0%)	0(0%)	16(11.8%)
Общо (брой,%)	56(100%)	32(100%)	32(100%)	16(100%)	136(100%)
Вид клинични дейности					
Приемам всички пациенти	32(50%)	8(16.7%)	8(25%)	8(50%)	56(41.2%)
Избягвам пациенти с тежки системни нарушения	16(25%)	24(50%)	16(50%)	0(0%)	56(41.2%)
Рядко извършвам хирургична дейност	16(25%)	16(33.3%)	8(25%)	8(50%)	48(35.3%)
Общо (брой,%)	64(100%)	48(100%)	32(100%)	16(100%)	160(>100%)

Таблица 3

Честотно разпределение на денталните лекари по вид на денталната практика/ собственост на денталния кабинет/ вид на извършваните клинични дейности и деперсонализация

Деперсонализация / Вариабилни	Ниско ниво (брой,%)	Умерено ниво (брой,%)	Високо ниво (брой,%)	Много високо ниво (брой,%)	Общо (брой,%)
Вид дентална практика					
Индивидуална	24(100%)	24(50%)	8(33.3%)	24(60%)	80(58.8%)
Групова	0(0%)	24(50%)	16(66.7%)	16(40%)	56(41.2%)
Общо (брой,%)	24(100%)	48(100%)	24(100%)	40(100%)	136(100%)
Собственост на денталния кабинет					
Собствен дентален кабинет (1)	8(33.3%)	40(83.3%)	8(33.3%)	24(60%)	80(58.8%)
Дентален кабинет под наем (2)	0(0%)	8(16.7%)	16(66.7%)	16(40%)	40(29.4%)
(1) + (2)	16(66.7%)	0(0%)	0(0%)	0(0%)	16(11.8%)
Общо (брой,%)	24(100%)	48(100%)	24(100%)	40(100%)	136(100%)
Вид клинични дейности					
Приемам всички пациенти	24(100%)	8(12.5%)	0(0%)	24(60%)	56(41.2%)
Избягвам пациенти с тежки системни нарушения	0(0%)	24(37.5%)	16(50%)	16(40%)	56(41.2%)
Рядко извършвам хирургична дейност	0(0%)	32(50%)	16(50%)	0(%)	48(35.3%)
Общо (брой,%)	24(100%)	64(100%)	32(100%)	40(100%)	160(>100%)

Таблица 4

Честотно разпределение на денталните лекари по вид на денталната практика/ собственост на денталния кабинет/ вид на извършваните клинични дейности и персонални постижения

Намалени персонални постижения / Вариабилни	Ниско ниво (брой,%)	Умерено ниво (брой,%)	Високо ниво (брой,%)	Много високо ниво (брой,%)	Общо (брой,%)
Вид дентална практика					
Индивидуална	24(75%)	16(28.6%)	24(75%)	16(100%)	80(58.8%)
Групова	8(25%)	40(71.4%)	8(25%)	0(0%)	56(41.2%)
Общо (брой,%)	32(100%)	56(100%)	32(100%)	16(100%)	136(100%)
Собственост на денталния кабинет					
Собствен дентален кабинет (1)	8(25%)	40(71,4%)	24(75%)	8(50%)	80(58.8%)
Дентален кабинет под наем (2)	8(25%)	16(28.6%)	8(25%)	8(50%)	40(29.4%)
(1) + (2)	16(50%)	0(0%)	0(0%)	0(0%)	16(11.8%)
Общо (брой,%)	32(100%)	56(100%)	32(100%)	16(100%)	136(100%)
Вид клинични дейности					
Приемам всички пациенти	24(75%)	16(22.2%)	0(0%)	16(100%)	56(41.2%)
Избягвам пациенти с тежки системни нарушения	0(0%)	32(44.4%)	24(60%)	0(0%)	56(41.2%)
Рядко извършвам хирургична дейност	8(25%)	24(33.4%)	16(40%)	0(0%)	48(35.3%)
Общо (брой,%)	32(100%)	72(100%)	40(100%)	16(100%)	160(>100%)

Заключение

В резултат от проведеното проучване могат да се направят следните изводи:

1. Работещите в индивидуални дентални практики имат високи нива на емоционално изтощение и деперсонализация, в сравнение с лекарите, работещи в групови практики. Аналогичен е изводът и по отношение на персоналните постижения.

2. Денталните лекари, които работят под наем демонстрират по - високи нива на емоционално из-

тощение, деперсонализация и намалени персонални постижения спрямо, колегите им, работещи в собствен дентален кабинет.

3. Денталните лекари, които избягват някои клинични дейности (хирургия или лечение на пациенти с тежки хронични заболявания) имат по-висок риск от бърнаут, показвайки високи нива на емоционално изтощение, деперсонализация и намалени персонални постижения, в сравнение с тези, приемащи всички пациенти и имащи ниски нива на емоционално изтощение и деперсонализация.

Повишено внимание би следвало да се отдели на ситуационните фактори и характеристиките на работната среда, в контекста на изготвянето на организационно-ориентираните стратегии, които целят подбор и оптимизиране на условията на труд и отстраняване на неблагоприятното влияние на факторите, водещи до бърнаут. В този смисъл, избягването на професионалната изолация, еднообразните и монотонни клинични дейности, внасянето на разнообразие в работата, както и практикуването в собствен дентален кабинет, носещо достатъчна сигурност и спокойствие, биха съдействали в много голяма степен за превенцията на бърнаут синдрома.

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СИНДРОМ НА ПРЕГАРЯНЕТО И ФАКТОРИ НА РАБОТНАТА СРЕДА – ПИЛОТНО ДЕСКРИПТИВНО КРОС-СЕКЦИОННО ПРОУЧВАНЕ СРЕД ДЕНТАЛНИТЕ ЛЕКАРИ В БЪЛГАРИЯ (ЧАСТ II)

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PREVALENCE OF BURNOUT DIMENSIONS AND RELATED WORK ENVIRONMENT FACTORS - A PILOT DESCRIPTIVE CROSS-SECTIONAL STUDY AMONG DENTISTS IN BULGARIA (PART II)

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Абстракт

Целта на настоящото изследване е да се проучат нивата на разпространение на трите аспекта на бърнаут – ЕЕ, ДП и ПП в контекста на определени характеристики на работната среда: работно време (продължителност и планиране на работния график), работа с помощен персонал и условия на труд в денталния кабинет – дентална апаратура и оборудване. Проведен е пилотен проект с дескриптивен крос-секционен дизайн, който се базира на анонимно анкетно проучване сред 156 дентални лекари (степен на респондентност=90.6%, n=136), работещи в столицата на Р България, гр. София. Използваният въпросник се състои от две части: социо-демографски профил и характеристики на работното място; стандартна методика за изследване на бърнаут, чрез Maslach Burnout Inventory (MBI-HSS). Резултатите показват, че при денталните лекари, които работят повече от 8 часа на ден, трите измерения на бърнаут имат високи или много високи нива. Правилното планиране на работния график се свързва с ниски нива на ЕЕ, ДП и намалени ПП, докато липсата му води до много високи такива. Високите и много високи нива на деперсонализация преобладават при денталните лекари, които не работят с помощен персонал. Тези, използващи много добра апаратура и оборудване имат по-малък рискът от бърнаут в сравнение с работещите при по-лоши условия, тъй като при тях се наблюдават и по-ниски нива на деперсонализация и намалени персонални постижения. Ето защо, препоръките относно избягването на свръхнатоварване, правилното и ефективно планиране на работния график, използването на помощен персонал в практиката, както и съвременна много добра дентална апаратура и оборудване, биха могли да играят ключова роля за превенцията, намаляването на риска и изготвянето на ефективни стратегии за справяне със синдрома на „прегарянето“.

Abstract

The aim of the present study was to investigate the prevalence of burnout dimensions - EE, DP and PA in the context of certain characteristics of the work environment: working hours (duration and planning of the work schedule), working with support staff and working conditions in the dental office - dental apparatus and equipment. A pilot project with a descriptive cross-sectional design was conducted, which was based on an anonymous survey among 156 dentists (response rate=90.6%, n=136) working in the capital of the Republic of Bulgaria, Sofia. The questionnaire consisted of two parts: socio-demographic profile and workplace characteristics; standard burnout research methodology, through the Maslach Burnout Inventory (MBI-HSS). The results suggested that among dentists who work more than 8 hours a day, the three dimensions of burnout had high or very high levels. Proper planning of the work schedule was associated with low levels of EE, DP and reduced PA, while its absence lead to very high ones. High and very high levels of depersonalization prevailed among dentists who did not work with support staff. Dentists using very good equipment had a lower risk of burnout than those working under worse conditions, as they also experienced lower levels of depersonalization and reduced personal accomplishment. Therefore, recommendations on avoiding overload, proper and efficient planning of the work schedule, the use of support staff in the practice, as well as modern very good dental equipment, could play a key role in prevention, risk reduction and effective coping with "burnout" syndrome.

Ключови думи: дентални лекари, синдром на „прегаряне, MBI-HSS, работно време, планиране на работния график, помощен персонал, дентална апаратура, превенция на бърнаут.

Keywords: dentists, burnout syndrome, MBI-HSS, working time, time management, dental auxiliaries, dental equipment, burnout prevention.

Въведение

Бърнаут или синдром на „прегарянето“ е термин, който добива популярност през 70-те години на XX век, благодарение на труда на американския психиатър и психоаналитик Хърбърт Фройденбергер [1]. Според него бърнаут е: “някой в състояние на умора или изтощение, причинено от отдаденост към определена цел, начин на живот или взаимоотношение, които не дават очаквания резултат“ [1].

В началото на своите изследвания Фройденбергер различава два стадия – ранен, при който чувствата на засегнатия са запазени, и късен, който е свързан с пълна липса на емоции. След това той описва 12 стадия. В началото е обсесивното желание за доказване на самия себе си. Впоследствие собствените нужди се неглижират, ценностите се преосмислят, а важните проблеми се отричат.

Накрая настъпва апатия, деперсонализация и пълно емоционално и физическо изчерпване [2].

Според Maslach & Jackson (1996) "Бърнаут е синдром на емоционално изтощение, деперсонализация и чувство на неудовлетвореност от себереализацията" [3,4]. Авторите разработват въпросник за измерване на бърнаут – Maslach Burnout Inventory (MBI), който е свързан с оценка на трите основни компонента (аспекти, измерения) на този феномен и които съответно представят динамиката на процеса на „прегарянето": емоционално изтощение, деперсонализация и редуцирани персонални постижения [5,6].

Съвременните позиции относно етиологията на бърнаут синдрома се свързват със схващанията, че той е многостранен психо-социален феномен с полиетиологична генеза [7,8]. Доказано е влиянието на множество рискови фактори, свързани с индивидуалните особености (възраст, пол, семейно положение) [9-12], черти на личността – екстраверсия, невротизъм, локус на контрола и др. [12,13], както и специфични особености на работната среда, от които с подчертано значение са стресовите характеристики на трудовия процес [9-12,14]. От когнитивна гледна точка, ако в последния присъстват хронични, негативни, пролонгирани стресори, за които личността не разполага с достатъчно ресурс за справяне, резултатът е бърнаут [6,15].

Известно е, че денталните лекари осъществяват дейността си под влиянието на множество ежедневни стресори – работата със страхливи и некооперативни пациенти, борба с болката, наличие на усложнения в хода на лечението или спешни животозастрашаващи случаи, проверки от контролиращи органи, неефективна комуникация с пациента и/или екипа, възникнали конфликти и много други [16]. От практическа гледна точка, интерес представлява изясняването на конкретните фактори на работната среда в денталната практика, които съдействат за повишаване нивата на стрес и съответно са предпоставка за възникване на бърнаут симптоми. В този смисъл, целта на настоящото изследване е да се проучат нивата на разпространение на трите аспекта на бърнаут в контекста на определени характеристики на работната среда. В повече детайли са разгледани следните вариабилни: работно време (продължителност и планиране на работния график), работа с помощен персонал и условия на труд в денталния кабинет – дентална апаратура и оборудване.

Материал и методи

За изпълнение на горепосочената цел е проведено анонимно анкетно проучване сред 156 лекари по дентална медицина, практикуващи в столицата на Р България, гр. София, в периода септември-ноември 2018 г. За всички единици на наблюдение бяха формулирани следните критерии за включване: да са лекари по дентална медицина, дали доброволно информирано съгласие за участие в проучването, с трудов стаж не по-малък от 1 година и практикуващи в индивидуални или групови дентални практики за първична или специализирана дентална помощ или работещи в дентални или медико-дентални центрове.

Въпросниците бяха раздадени в денталните кабинети на участниците, като на последните не бяха предложени никакви допълнителни стимули за участие в това проучване. Респондентите бяха информирани относно целите на проучването, използваната методика и значението на евентуалните резултати за денталната практика преди попълването на анкетната карта. Освен това, бяха инструктирани да отговорят анонимно и честно на поставените въпроси. Те бяха уверени, че тяхната анонимност и конфиденциалност на данните ще бъдат запазени. Доброволното попълване на въпросника бе прието като форма на индивидуално писмено информирано съгласие за участие в проучването. Тъй като последното не включва пациенти или опитни животни, анонимността на участниците беше гарантирана и те имаха право да откажат да участват в проучването, не беше необходимо да се търси одобрение от Етична комисия относно етичните стандарти на проучването.

Основният инструмент на изследването е анкетна карта, която се състои от две части: 1. социодемографски профил и характеристики на работното място; 2. стандартна методика за изследване на бърнаут, чрез Maslach Burnout Inventory (MBI-HSS; Maslach & Jackson, 1996). Първата част съдържа 20 въпроса, групирани в три секции, свързани със събиране на информация относно социодемографските характеристики на денталните лекари, особеностите на факторите на работната среда, самооценката им относно получаваните доходи от денталната практика, наличието да дейности, несвързани с работата (хоби или странични интереси); наличие на вредни за здравето стереотипи, свързани с начина на живот (тютюнопушене, злоупотреба с алкохол, успокоителни медикаменти, антидепресанти или сънотворни, както и безсъние) и въпроси, свързани с професионалното планиране и желанието за работа след пенсиониране. Въпросите са затворени, някои от тях имат опция за посочване на повече от един отговор. Втората част на въпросника съдържа 22 становища за измерване на трите аспекта на бърнаут - емоционалното изтощение (девет айтема); деперсонализация (пет айтема) и персонални постижения (осем айтема). Отговорите на въпросите в трите подскали на MBI-HSS се оценяват по седем точкова Ликерт - скала с кодове от 0 до 6: 0 – не, никога; 1 – много рядко; 2 – рядко; 3 – понякога; 4 – често; 5 – много често; 6 – винаги (Maslach & Jackson, 1986) [4]. Българският превод на въпросника е валидиран и използван при медицински персонал в България от Б. Ценова (1991,2002,2004) [17]. Надеждността на вътрешната съгласуваност на целия въпросник е добра - 0.757. За подскалите ЕЕ, ДП и ПП тя е 0.926, 0.726 и 0.816, съответно [6].

Данните бяха обработени със статистическия пакет IBM SPSS Statistics v.25.0. За установяване нивата на ЕЕ, ДП и ПП, както и съответните особености на факторите на работната среда, които представляват интерес за настоящото проучване, е използвана дескриптивна статистика. Резултатите са представени като честотни разпределения (брой, процент).

Резултати

Общо 136 дентални лекари са предоставили правилно попълнени анкетни карти. Пет въпросника бяха изключени от проучването поради непълното им попълване, а един дентален лекар отказа участие (степен на възвращаемост = 90.6%). Респондентите са разделени в три възрастови групи – 25-40 г. – 32 (23.5%), 41-55 г. – 72 (53%) и над 56 г. – 32 (23.5%). От тях 56 (41.2%) са мъже и 80 (58.8%) са жени.

За целите на проучването продължителността на работното време на денталните лекари бе разпределена в три групи – до 6 часа, от 6 до 8 часа и повече от 8 часа на ден. След обработката на получените отговори получихме следните резултати: наймалък е броят на зъболекарите, работещи повече от 8 часа – 24 (17.6%), като 2/3 от тях са представители на възрастовата група 41-55 години, а останалите са в първата възрастова група – 25-40 години. Всички дентални лекари от възрастовата група 56+ години работят по 3 часа дневно. Еднакъв брой лекари имат работно време с продължителност до 6 часа и между 6 и 8 часа – 56 (41.2%).

Денталните лекари, които работят по-малко от 6 часа на ден показват най-висок относителен дял на ниски нива на емоционално изтощение, деперсонализация и персонални постижения. При работещите от 6 до 8 часа е налице най-висок дял на високо ниво на емоционално изтощение и деперсонализация и много високо ниво на намалени персонални постижения. Сходни са и резултатите при работещите повече от 8 часа дневно. При тях най-висок относителен дял се пада на много високите нива на емоционално изтощение и деперсонализация и умерено ниво на персонални постижения (табл.1,2,3).

Таблица 1

Честотно разпределение на денталните лекари по изследвани фактори на работната среда и нива на емоционално изтощение

Емоционално изтощение / Вариабилни	Ниско ниво (брой,%)	Умерено ниво (брой,%)	Високо ниво (брой,%)	Много високо ниво (брой,%)	Общо (брой,%)
Работно време					
До 6 часа	32(57.1%)	8(25%)	8(25%)	8(50%)	56(41,2%)
6-8 часа	16(28.6%)	16(50%)	24(75%)	0(0%)	56 (41,2%)
Повече от 8 часа	8(14,3%)	8(25%)	0(0%)	8(50%)	24(17,6%)
Общо (брой,%)	56(100%)	32(100%)	32(100%)	16(100%)	136(100%)
Работен график – планиране					
Да	48(85.7%)	16(50%)	16(50%)	8(50%)	88(64.7%)
Не	0(0%)	0(0%)	8(25%)	0(0%)	8(5,9%)
Понякога	8(14.3%)	16(50%)	8(25%)	8(50%)	40(29,4%)
Общо (брой,%)	56(100%)	32(100%)	32(100%)	16(100%)	136(100%)
Помощен персонал					
Да	16(28.6%)	8(25%)	16(50%)	8(50%)	48(35.3%)
Не	40(71.4%)	24(75%)	16(50%)	8(50%)	88(64.7%)
Общо (брой,%)	56(100%)	32(100%)	32(100%)	16(100%)	136(100%)
Дентална апаратура и обзавеждане					
Добри	24(42.8%)	24(75%)	24(75%)	0(0%)	72(53%)
Отлични	32(57.2%)	8(25%)	8(25%)	16(100%)	64(47%)
Общо (брой,%)	56(100%)	32(100%)	32(100%)	16(100%)	136(100%)

Адекватното планиране на работния график (съобразено с индивидуалните качества и способности на практикуващите и естеството на извършваната манипулация) е съществена характеристика на ефективната организация в денталната практика. С цел изясняване на особеностите при изготвянето на работния им график, на денталните лекари бяха зададени два въпроса – *"Планирате ли добре работния си график"* и *"Често ли се случва да има струпване на пациенти в чакалнята или принудителни престои?"*. Почти 2/3 от респондентите – 88 (64.7%) - отговарят, че планират добре работния си график. Само осем (5.9%) съобщават за наличие на струпване на пациенти или принудителни престои.

При денталните лекари, които планират добре работния си график, преобладава относителният дял на ниските нива на емоционално изтощение, деперсонализация и намалени персонални постижения. При лекарите, които съобщават, че не планират добре графика си, се наблюдава обратна тенденция – високо ниво на емоционално изтощение и много високи нива на деперсонализация и намалени персонални постижения (табл. 1,2,3).

По отношение на работата с помощен персонал, според получените резултати почти 2/3 от денталните лекари не работят с помощен персонал – 88 (64.7%), а останалите – 48 (35.3%) използват такъв в практиката си. След анализа на резултатите беше установено, че при денталните лекари, които не работят с помощен персонал преобладава делът на ниско и умерено ниво на емоционално изтощение и редуцирани персонални постижения, но в същото време преобладават и високите и много високи нива на деперсонализация (табл.1,2,3).

Таблица 2

Честотно разпределение на денталните лекари по изследвани фактори на работната среда и нива на деперсонализация

Деперсонализация / Вариабилни	Ниско ниво (брой,%)	Умерено ниво (брой,%)	Високо ниво (брой,%)	Много високо ниво (брой,%)	Общо (брой,%)
Работно време					
До 6 часа	24(100%)	24(50%)	0(0%)	8(20%)	56(41.2%)
6-8 часа	0(0%)	16(33,3%)	24(100%)	16(40%)	56(41.2%)
Повече от 8 часа	0(0%)	8(16,7%)	0(0%)	16(40%)	24(17,6%)
Общо (брой,%)	24(100%)	48(100%)	24(100%)	40(100%)	136(100%)
Работен график – планиране					
Да	24(100%)	24(50%)	16(66.7%)	24(60%)	88(64.7%)
Не	0(0%)	0(0%)	0(0%)	8(20%)	8(5.9%)
Понякога	0(0%)	24(50%)	8(33,3%)	8(20%)	40(29.4%)
Общо (брой,%)	24(100%)	46(100%)	24(100%)	40(100%)	136(100%)
Помощен персонал					
Да	8(33.3%)	16(33.3%)	8(33.3%)	16(40%)	48(35.3%)
Не	16(66.7%)	32(66.7%)	16(66.7%)	24(60%)	88(64.7%)
Общо (брой,%)	24(100%)	48(100%)	24(100%)	40(100%)	136(100%)
Дентална апаратура и обзавеждане					
Добри	8(33.3%)	32(66.7%)	16(66.7%)	16(40%)	72(53%)
Отлични	16(66.7%)	16(33.3%)	8(33.3%)	24(60%)	64(47%)
Общо (брой,%)	24(100%)	48(100%)	24(100%)	40(100%)	136(100%)

В проучването е анализирана и самооценката на денталните лекари относно условията на труд, при които практикуват професията си – дентална апаратура и обзавеждане, за което е използвана тристепенна скала – отлични, добри и незадоволителни. Резултатите показват, че почти половината от участниците в проучването – 64 (47%) - са определили тези условия като отлични, а останалите – 72 (53%) като добри. Никой от респондентите не е отговорил, че работи при незадоволителни условия на труд. При денталните лекари, които работят при добри условия на труд, преобладава относителният дял на умерено и високо ниво на емоционално изтощение, а при работещите при отлични условия – много високото ниво (табл. 1). По отношение на деперсонализацията и намалените персонални постижения се забелязва обратна тенденция. Работещите при добри условия демонстрират високи нива, а тези при отлични – ниски нива на деперсонализация и намалени персонални постижения (табл. 2,3).

Таблица 3

Честотно разпределение на денталните лекари по изследвани фактори на работната среда и нива на персонални постижения

Намалени персонални постижения / Вариабилни	Ниско ниво (брой,%)	Умерено ниво (брой,%)	Високо ниво (брой,%)	Много високо ниво (брой,%)	Общо (брой,%)
Работно време					
До 6 часа	24(75%)	8(14.2%)	16(50%)	8(50%)	56(41.2%)
6-8 часа	8(25%)	24(42.9%)	16(50%)	8(50%)	56(41.2%)
Повече от 8 часа	0(0%)	24(42.9%)	0(0%)	0(0%)	24(17.6%)
Общо (брой,%)	32(100%)	56(100%)	32(100%)	16(100%)	136(100%)
Работен график – планиране					
Да	24(75%)	40(71.4%)	16(50%)	8(50%)	88(64.7%)
Не	0(0%)	0(0%)	0(0%)	8(50%)	8(5.9%)
Понякога	8(25%)	16(28.6%)	16(50%)	0(0%)	40(29.4%)
Общо (брой,%)	32(100%)	56(100%)	32(100%)	16(100%)	136(100%)
Помощен персонал					
Да	8(25%)	16(28.6%)	16(50%)	8(50%)	48(35.3%)
Не	24(75%)	40(71.4%)	16(50%)	8(50%)	88(64.7%)
Общо (брой,%)	32(100%)	56(100%)	32(100%)	16(100%)	136(100%)
Дентална апаратура и обзавеждане					
Добри	8(25%)	32(57.2%)	24(75%)	8(50%)	72(53%)
Отлични	24(75%)	24(42.8%)	8(25%)	8(50%)	64(47%)
Общо (брой,%)	32(100%)	56(100%)	32(100%)	16(100%)	136(100%)

Заключение

Проведеното изследване дава основания са се направят следните изводи:

1. При денталните лекари, работещи до 6 часа дневно, се налице ниски стойности на емоционално изтощение, деперсонализация и намалени персонални постижения, докато при тези с продължителност на работното време 6-8 и повече от 8 часа на ден, трите измерения на бърнаут имат високи или много високи нива.
2. Правилното планиране на работния график се свързва с ниски нива на емоционално изтощение, деперсонализация и намалени персонални постижения, докато липсата му води до много високи такива.
3. Високите и много високи нива на деперсонализация преобладават при денталните лекари, които не работят с помощен персонал, за разлика от тези, които използват такъв в практиката си, което значително повишава риска от бърнаут при първата група.
4. При денталните лекари, използващи много добра апаратура и оборудване, рискът от бърнаут е по-малък в сравнение с работещите при добри условия. При тях се наблюдават ниски нива на деперсонализация и намалени персонални постижения, докато при вторите емоционалното изтощение, деперсонализация и намалени персонални постижения са с високи нива.

На базата на тези заключения препоръките относно избягването на свръхнатоварване, правилното и ефективно планиране на работния график, използването на помощен персонал в практиката, както и съвременна много добра дентална апаратура и оборудване, биха могли да играят ключова роля за превенцията, намаляването на риска и изготвянето на ефективни стратегии за справяне със синдрома на „прегарянето“.

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SOCIAL COMMUNICATION STUDIES

IMPACT OF ONLINE SHOPPING WEBSITE DESIGN AND LAYOUT ON CONSUMER TRUST AND ONLINE SHOPPING EXPERIENCE: STUDY ON UNIVERSITY STUDENTS IN AZERBAIJAN

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Abstract

In the modern world, with the development and progress of the world wide web and internet technology, people are now having more convenience in terms of shopping. Especially with the creation of online selling platforms (e-commerce) and shopping websites, consumers can purchase products and services without even moving out of their houses. Thereby, such growth of online shoppers affected the e-marketing as well as its strategies and tactics. As, online stores and e-commerce websites are now trying to reach their consumers through the most effective ways and approaches. However, since online shopping stores are only limited to their websites/apps, the aim of this study is to find out whether the design and layout of online shopping websites are essential in establishing consumer e-trust and shopping experience. The findings of this study suggest that the website design and layout of online shopping website indeed have an impact on consumer e-trust and online shopping experience.

Keywords: E-Commerce, E-Trust, E-Shopping, Online Shopping, Shopping Experience.

Introduction & Background. The benefit of online shopping websites was mostly seen during the COVID-19 pandemic. As, almost 26% of world population was shopping online just in 2020 [6]. Moreover, according to the study done in US, almost 18% of adult population is shopping online minimum four times a month [6]. One of the most interesting studies done by Nasdaq (National Association of Securities Dealers Automated Quotations) indicates that by the year 2040, 95% of people's purchases in the world will be online, which once again specifies the global prevalence of online shopping among people. Consequently, almost 94% percent of internet users do shop online.

Objectives. Earlier on, in store shopping used to be the most preferred type of shopping by almost everyone. The reason behind this was the availability of staff members that would assist the consumer, give personalized recommendations or help when needed. Moreover, traditional shopping even let people test out or try on products and services. However, with unstoppable progress in technology, the era of online shopping is starting to rise. The underlying cause is the convenience of online shopping with its prices, variety of products, and time saving nature. In addition, with the launch of chatbots and consumer reviews people can easily get information about the products and ask any type of questions. Despite all that, majority of world population still avoids shopping online, the most well-known reasons for it are the payment security concerns and e-trust in e-shops [1]. Another reason is the irritating and poor website structure which makes consumers leave the website and feel aversion towards the specific e-store [8]. On account of mentioned consumer obstacles in online shopping, the objectives and central point of the research are to:

1. Examine if the design and layout of online shopping websites have an impact on consumer e-trust.
2. Analyse if online shopping website design and layout affect consumers' shopping experience.
3. Find out the impact of online shopping website design and layout on consumer shopping experience and on consumer e-trust.

Research questions and hypotheses based on the research objectives are specified below, thus, this study has below mentioned hypotheses and research questions that will be examined.

Research Questions:

RQ1: Do the design and layout of online shopping websites have an influence on consumer e-trust?

RQ2: Do online shopping website design and layout influence consumers' shopping experience?

Hypotheses:

H1: Design/Layout of online shopping websites have an impact on consumer e-trust.

H2: Design/Layout of online shopping websites have an impact on consumers' shopping experience.

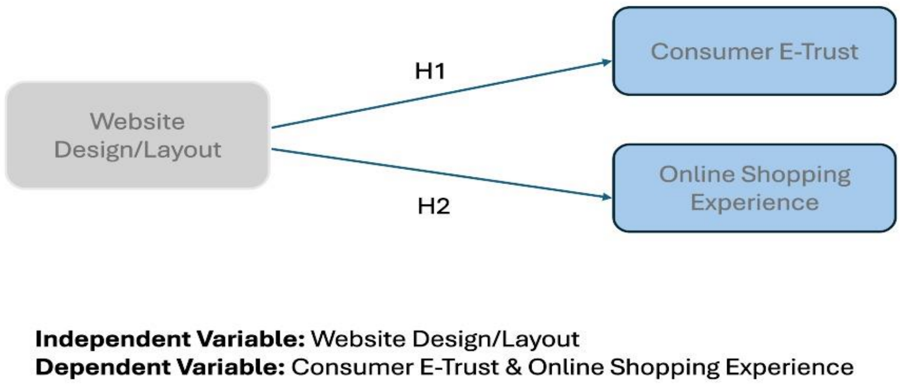

Figure. 1 Conceptual Model of Research

Impact of online shopping website design/layout on consumer e-trust. It has long been a subject of discussion whether design of shopping websites have an essential impact on consumers' e-trust in company or brand. Several studies were done on this case and found a link between web design and consumer trust. Consumer trust has also been an issue in the advancement of online shopping websites, for this reason, consumer trust in online shopping websites, is called "e-trust", as, it is associated with website layout, its parameters, as well as with the quality of distributed information [9].

One of the recent studies shows that the colour of online shopping websites is playing a crucial role in building consumer e-trust [2]. Various researches indicate that consumers usually doubt the reliability of the company if the design as well as the layout of website is not welcoming or straightforward. In addition, the first impression of users is very important, as, the maximum time for the website visitors to get impressed by the website is just between 3 to 6 seconds [11]. For these reasons, companies, especially e-commerce businesses, must work carefully while designing their websites. Interestingly, there are more than 26 million e-commerce and online shopping websites in the world, and each day a new one is being created. However, the failure rate of these businesses is between 80% to 90% [5] and most of them fail in the first 120 days [10] with the one of the major reasons being the design of their website due to which consumers avoid shopping with the specific company.

Furthermore, in accordance with many studies, most users state that poor website design and layout of online shopping websites makes them stay away immediately due to the uncertainty and doubt in the security and privacy of financial information at the same time personal data [7]. Some internet marketers state that what website design should own is the simplicity and professionalism. Moreover, as previously mentioned, colour is very essential; especially blue and red colours are proved to increase the conversion rate of online shopping websites. In addition, several studies concluded that consumers feel safe and trust the company when they see high quality pictures of what they are purchasing, for this reason, high quality graphics and photos are very crucial. Otherwise, consumers easily become tentative about the reliability of the website and behave with uncertainty.

Not just this, according to Annexcloud, "Enabling consumer reviews on online shopping website makes users have trust and even loyalty" as, users are prone to immediately leaving the website if it is dishonest by avoiding review section. Other very key parts of online shopping websites for creating consumer e-trust are responsiveness, easy checkout, smooth navigation, as well as strong branding, because these are the details that create the feeling of trust in consumers towards the company. Hence, from what is claimed by these studies, design of online shopping websites is a crucial key factor in building consumer e-trust, therefore this correlation is brought out and accentuated in this research.

Impact of online shopping website design/layout on consumers' shopping experience. The design and layout of any kind of website have always played a crucial role for visitors of those websites. One of the reasons for such affirmation is because web design always says a lot about the business, it is the face of the company which consumers see first. Moreover, because of technological advancement, almost every person visits the company web page before visiting the actual store or firm. According to a recent study, web design gives the company brand personality and first impression to website visitors [4]. Another study reveals that the convenience of website usage is directly linked with the consumer satisfaction and company success [8].

Several studies indicate that, consumers enjoy their shopping more when the layout and representation of the website is simple and easy to use. For example, almost 50% of online consumer say that website design is important for company's brand. Not just this, many other studies show that consumers want short, correct, and detailed information about the product or service they are purchasing, also, 42% of consumers stated that they would leave the website if the overall design and layout was poor [3].

In addition, one of the world-known marketers Neil Patel clearly stated how online shopping websites can positively affect consumers' shopping experience. Firstly, Patel asserted that consumers care about the overall website design, and they want to see professionalism, effort and brand image. Secondly, the speed plays a significant role as previously mentioned, as well as product selection. For example, consumers do not want to spend infinite amount of time on describing what they are looking for, for this reason, the product selection part should be simple and clear. Besides, consumers expect to see product page for each specific product, intending to read reviews, ask questions about the product, read description and details, and get informed about the brand. Lastly, Patel mentioned the importance of accessible transaction and payment. In other words, consumers do not expect to have trouble with payment and are looking forward to being able to pay with any kind of modern methods, especially fast and securely.

Moreover, American entrepreneur Matthew Toren says that consumers love exceptions and opportunities such as personalized recommendations. Toren's study showed that consumers expect the online shopping companies to know what each consumer wants and design their account pages based on each one's needs and wants. As, these are some of the ways consumer shopping experience is linked with the website design according to some researchers and professionals. Therefore, this study examines the vitalness of online shopping web design on consumer shopping experience and the connection between.

Research Design, Target Population & Data Analysis. This study is a quantitative study with a descriptive research design. The questionnaire is administered via Google Forms, as it is more convenient in terms of preparing and distributing to respondents. The scales measuring Consumer E-Trust, Online Shopping Experience as well as Website Design/Layout Satisfaction are used in the survey. The respondents choose the mostly used online shopping website/platform first then proceed with answering the questions while bearing in mind their mostly used e-commerce website. The survey also includes several introductory and general questions as well as consumer demographics questions. Furthermore, all the scales have Likert Scale answer options and snowball sampling technique is utilized. In addition, all the scales used in this study were highly reliable and valid and were taken from previous studies. The estimated questionnaire length (time to finish the questionnaire) was calculated to be between 6 to 10 minutes. On the other hand, data was analysed on SPSS statistical package. The target population for this study were university students studying in Azerbaijan. As there are almost 30.000 students studying in Azerbaijan, the needed sample size for this research was 380 to have a confidence level of 95% and the margin of error of 5%. However, in order to have more generelizable results with more statistical power and mitigated effect of any potential errors, 410 surveys were administered to students, out of which 403 were valid for analysis.

Findings. The findings of this study suggest that the website design/layout of online shopping website indeed has an impact on consumer e-trust and online shopping experience. As, when measuring the impact of the independent variable of website design/layout on dependent variables of consumer e-trust and online shopping experience, the impact was statistically significant for both dependent variables. Therefore, the findings of this study indicate the importance of website design/layout of online shopping websites when it is about creating pleasant online shopping experience and consumer trust. Thus, this study's findings demonstrate the crucial role of the website appearance and arrangement on consumers during the e-commerce shopping process. Hence, all the two hypotheses of this study were supported according to which the design/layout of online shopping websites have an impact on consumer e-trust and that the design/layout of online shopping websites have an impact on consumers' shopping experience.

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ZOOLOGY

FURTHER SURVIVAL OF WHITE STORKS *CICONIA CICONIA* L. UNDER ENVIRONMENTAL POLLUTION OF ARARAT PLAIN OF ARMENIA

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Abstract

Monitoring of the White Storks *Ciconia ciconia* in Ararat Plain of Armenia was continued in 2022-2023 after the implementation of the mitigation measures against the novelty threat, which was discovered in 2019-2021. The storks were becoming contaminated with the undetermined agent of plant oil and/or fish fat nature, which was impeding their flying abilities. The average percentage of contaminated storks (monitored in 35 villages) grew from 5% in 2019 to 21% in 2020 and then to 58% in 2021. The joint strategy developed and implemented by the state and non-governmental organizations was aimed at the improvement of waste management of over 300 producers of fish, chips, and canned food. As a result, the average percentage of the contaminated nestlings declined from 55% in 2021 to 34% in 2022 (t = -4.36, d.f. = 34, $p < 0.00$), and then to 22% in 2023 (t = -2.52, d.f. = 34, $p < 0.0164$). The number of strongly polluted nestlings, which were in critical condition, showed some decline but not at a significant level. Further short-term and long-term measures are recommended.

Keywords: White Stork, Ciconia ciconia, Contamination, Wetland, Armenia.

Introduction

In Armenia the wetlands are of high conservation importance, hosting a high number of breeding and migratory waterbirds of global and national conservation concern, such as White-headed Duck *Oxyura leucocephala*, Ferruginous Pochard *Aythya nyroca*, Common Pochard *Aythya ferina*, Northern Lapwing *Vanellus vanellus*, and White-tailed Lapwing *Vanellus leucurus*. Despite that, the wetlands of Ararat Plain have declined during the last 70 years from 31,000 ha down to about 20,000 ha (Aghababyan 2011). Also, the wetlands of Ararat Plain are potentially susceptible to pollution, being located in the region of intensive agriculture and high-level urbanization (Aghababyan 2011; Aghababyan *et al*. 2013; 2020). Following European experience of using the White Storks *Ciconia ciconia* L. (hereafter storks) as an indicator of wetland ecosystems (Hornberger 1967; Ilichev 1990; Hötker & Thomsen 2013), we developed similar citizen science around storks in Armenia – a long-term effort that has been initiated in 2005 and continues until now (Aghababyan 2011; Aghababyan *et al*. 2020). Among other things, the effort is dedicated to (1) the identification of the stork population size and dynamics, (2) the measurement of trends in stork breeding success in Armenia, (3) justification of the conservation status of the species in Armenia and development of conservation measures, if necessary.

The recently emerged environmental pollution became detrimental to the populations of the storks of the Ararat Plain of Armenia. The storks were becoming contaminated with the undetermined agent of plant oil and/or fish fat nature, which was impeding their flying abilities, and increasing their mortality (Aghababyan *et al*. 2022). The issue emerged in 2019, while the joint strategy for mitigating the issue was developed at the end of 2021, during a series of seminars implemented between the Ministry of Environment, Environmental Protection and Mining Inspection Body (hereinafter Environmental Inspection), and CSOs. The strategy was aimed at enforcing all producers (which can possibly have fat or oil-containing waste) to deal with the waste according to the prescribed protocols.

This paper summarizes the results of the continued monitoring of the situation with the storks and the pollution during 2022-2023, trying to identify – whether the joint strategy had a positive effect on the storks and the wetland ecosystems.

Study Area

The study area is located in the Ararat Plain of Armenia (Figure 1) and is represented by a combination of settlements, orchards, vineyards, gardens, wetlands, semideserts, and abandoned salinized arable lands.

Figure 1. Study area.

Methods

We conducted an annual monitoring program of the storks starting in 2006 covering the Ararat, Armavir, Aragatsotn, Yerevan, Lori, Shirak, and Vayots Dzor provinces. Additional studies of the contaminated storks were conducted in 2019-2023 and covered only the Ararat Plain. Data collection involved 18 expeditions lasting a total of 21 days and covering 42 locations. Results of the survey of 2019-2021 were already published (Aghababyan *et al*. 2022) and now are supplemented with some additional data, which are repeated here for comparison with the data of 2022-2023.

Monitoring included counts of breeding pairs and nest success from 485 stork nests. The data were collected via direct observations by our team and with the assistance of villagers who served as citizen scientists. The nests were labeled with individual numbers, and villagers provided quick feedback on every unusual occasion—e.g., construction of new nests in the village, storks' injury cases, and, starting from 2019 forward, storks with contaminated plumage.

At each nest, we also recorded the number of contaminated storks, categorized into three levels based on how much smearing each had. Storks were "slightly contaminated" when the lower part of the neck and belly was smeared, having a pale greyish-buff color, "medium contaminated" when the neck, belly, and part of wings were smeared, having a dark greyish-buff, and "strongly contaminated," when smearing covered almost the entire stork.

Villagers were provided with wall calendars to collect data on stork nests. In addition, to try to understand the possible source of pollution, we conducted open-ended interviews with villagers.

The collected data were stored in a Microsoft Access 2003 database (later transferred into Microsoft Office 2010) for further data analysis. Statistical analyses were carried out with Excel 2010 (MS Office 2010) and

R program package. The analyses include the measurement of central tendencies and the calculation of statistically significant differences between variables. The paired samples t-test and/or Wilcoxon test were used to determine whether there is statistical evidence that the average differences between observations for different years are significantly different from zero (Daniel & Cross 2013). Mapping was conducted with QGIS Desktop 3.30.2.

In parallel to the research works, the rescue works have been implemented, and although they do not have a direct relation to the conducted study, they have decreased the mortality of the storks.

Results

Distribution and scale of the storks' pollution before the intervention, in 2019-2021, most of which was published in Aghababyan et al. (2022)

In 2019, contaminated storks were found in five villages, mainly in Hovtashen village, in 42 nests (Table 1, Figure 2a). The total number of contaminated storks included 125 nestlings and 84 adult storks, with most being contaminated at a medium level, and several at strong levels.

In the 35 villages observed, on average, 5% (± 0.03% SE) of the nestlings were contaminated.

In 2020 contaminated storks were found in 15 villages, in 95 nests (Table 2, Figure 2b). The total number of contaminated nestlings was 285, and the number of contaminated adult storks was 192, with all the adults showing some smearing.

On average, 20% (± 4% SE) of the nestlings were contaminated in the monitored villages.

In 2021, contaminated storks were found in 28 villages, in 178 nests (Table 3, Figure 2c). The total number of contaminated nestlings was 534, along with 356 contaminated adults, all of whom were slightly contaminated.

On average, 55% (± 6%) of the nestlings were contaminated.

Table 1.

Distribution of contaminated white storks among 35 surveyed villages in 2019.

#	Village	Number of nests	Conditional level of contamination of white storks in the nests				Number of nestlings	Number and % of contaminated storks	
			Clean	Slightly	Medium	Strong			
1	Geghanist	2	6	0	0	0	6	0	0%
2	Azatashen	2	5	0	0	0	5	0	0%
3	Khachpar	18	52	2	0	0	54	2	4%
4	Hayanist	9	24	3	0	0	27	3	11%
5	Howtashat	25	77	0	0	0	77	0	0%
6	Nizami	6	18	2	0	0	20	2	10%
7	Zorak	5	15	0	0	0	15	0	0%
8	Dashtavan	18	51	0	0	0	51	0	0%
9	Darakert	11	34	0	0	0	34	0	0%
10	Norabats	2	4	0	0	0	4	0	0%
11	Darbnik	4	11	0	0	0	11	0	0%
12	Ghukasavan	2	6	0	0	0	6	0	0%
13	Hovtashen	36	0	21	71	22	114	114	100%
14	Noramarg	4	8	4	0	0	12	4	33%
15	Yeraskhahun	41	118	0	0	0	118	0	0%
16	Yeghegnut	40	115	0	0	0	115	0	0%
17	Jrarat	8	22	0	0	0	22	0	0%
18	Metsamor	2	7	0	0	0	7	0	0%
19	Haykashen	4	11	0	0	0	11	0	0%
20	Gay	8	26	0	0	0	26	0	0%
21	Lusagyugh	4	13	0	0	0	13	0	0%
22	Aknashen	3	9	0	0	0	9	0	0%
23	Griboyedov	8	22	0	0	0	22	0	0%
24	Aratashen	3	8	0	0	0	8	0	0%
25	Khoronk	2	7	0	0	0	7	0	0%
26	Artimet	3	10	0	0	0	10	0	0%
27	Haytagh	2	8	0	0	0	8	0	0%
28	Mkhchyan	2	7	0	0	0	7	0	0%
29	Dimitrov	4	14	0	0	0	14	0	0%
30	Sipanik	10	28	0	0	0	28	0	0%
31	Araksavan	16	48	0	0	0	48	0	0%
32	Pokr Vedi	12	37	0	0	0	37	0	0%
33	Lusarat	6	19	0	0	0	19	0	0%
34	Surenavan	24	74	0	0	0	74	0	0%
35	Armash	22	67	0	0	0	67	0	0%
	Totals	368	981	32	71	22	1106	125	

Table 2.

Distribution of contaminated white storks among 35 surveyed villages in 2020.

#	Village	Number of nests	Conditional level of contamination of white storks in the nests				Number of nestlings	Number and % of contaminated storks	
			Clean	Slightly	Medium	Strong			
1	Geghanist	2	6	0	0	0	6	0	0%
2	Azatashen	2	5	0	0	0	5	0	0%
3	Khachpar	18	32	22	0	0	54	22	41%
4	Hayanist	9	20	11	0	0	31	11	35%
5	Howtashat	25	45	35	0	0	80	35	44%
6	Nizami	6	5	6	5	3	19	14	74%
7	Zorak	5	8	6	2	0	16	8	50%
8	Dashtavan	18	18	29	7	2	56	38	68%
9	Darakert	11	11	16	7	2	36	25	69%
10	Norabats	2	3	3	0	0	6	3	50%
11	Darbnik	4	9	5	0	0	14	5	36%
12	Ghukasavan	2	7	0	0	0	7	0	0%
13	Hovtashen	35	59	40	5	7	111	52	47%
14	Noramarg	4	5	4	3	0	12	7	58%
15	Yeraskhahun	41	78	46	3	0	127	49	39%
16	Yeghegnut	40	121	0	0	0	121	0	0%
17	Jrarat	8	13	11	0	0	24	11	46%
18	Metsamor	2	7	0	0	0	7	0	0%
19	Haykashen	4	11	0	0	0	11	0	0%
20	Gay	8	23	0	0	0	23	0	0%
21	Lusagyugh	4	8	3	0	0	11	3	27%
22	Aknashen	3	9	0	0	0	9	0	0%
23	Griboyedov	8	25	0	0	0	25	0	0%
24	Aratashen	3	10	0	0	0	10	0	0%
25	Khoronk	2	4	2	0	0	6	2	33%
26	Artimet	3	10	0	0	0	10	0	0%
27	Haytagh	2	7	0	0	0	7	0	0%
28	Mkhchyan	2	7	0	0	0	7	0	0%
29	Dimitrov	4	14	0	0	0	14	0	0%
30	Sipanik	10	29	0	0	0	29	0	0%
31	Araksavan	16	47	0	0	0	47	0	0%
32	Pokr Vedi	12	34	0	0	0	34	0	0%
33	Lusarat	6	22	0	0	0	22	0	0%
34	Surenavan	24	73	0	0	0	73	0	0%
35	Armash	22	68	0	0	0	68	0	0%
	Totals	367	853	239	32	14	1138	285	

Table 3

Distribution of contaminated white storks among 35 surveyed villages in 2021.

#	Village	Number of nests	Conditional level of contamination of white storks in the nests				Number of nestlings	Number and % of contaminated Storks	
			Clean	Slightly	Medium	Strong			
1	Geghanist	2	3	0	2	0	5	2	40%
2	Azatashen	2	0	6	0	0	6	6	100%
3	Khachpar	18	6	12	17	21	56	50	89%
4	Hayanist	9	9	7	2	11	29	20	69%
5	Howtashat	25	23	28	25	0	76	53	70%
6	Nizami	6	0	8	6	4	18	18	100%
7	Zorak	5	0	2	4	9	15	15	100%
8	Dashtavan	18	0	9	19	26	54	54	100%
9	Darakert	11	0	12	8	13	33	33	100%
10	Norabats	2	0	4	2	0	6	6	100%
11	Darbnik	4	0	6	3	4	13	13	100%
12	Ghukasavan	2	2	4	0	0	6	4	67%
13	Hovtashen	36	32	39	21	16	108	76	70%
14	Noramarg	4	4	4	2	0	10	6	60%
15	Yeraskhahun	41	59	24	26	14	123	64	52%
16	Yeghegnut	40	118	0	0	0	118	0	0%
17	Jrarat	8	0	16	5	2	23	23	100%
18	Metsamor	2	4	3	0	0	7	3	43%
19	Haykashen	4	10	2	0	0	12	2	17%
20	Gay	8	15	7	3	0	25	10	40%
21	Lusagyugh	4	8	3	0	0	11	3	27%
22	Aknashen	3	7	2	1	0	10	3	30%
23	Griboyedov	8	18	5	0	0	27	5	22%
24	Aratashen	3	2	2	5	0	9	7	78%
25	Khoronk	2	4	3	0	0	7	3	43%
26	Artimet	3	2	5	2	0	9	7	78%
27	Haytagh	2	0	2	4	2	8	8	100%
28	Mkhchyan	2	7	0	0	0	7	0	0%
29	Dimitrov	4	5	0	6	4	15	10	67%
30	Sipanik	10	31	0	0	0	31	0	0%
31	Araksavan	16	19	18	12	0	49	30	61%
32	Pokr Vedi	12	35	0	0	0	35	0	0%
33	Lusarat	6	20	0	0	0	20	0	0%
34	Surenavan	24	75	0	0	0	75	0	0%
35	Armash	22	69	0	0	0	69	0	0%
	Totals	368	587	233	175	126	1125	534	

Concluding the intermediary results we can state that, the average percent of the polluted nestlings in 35 observed villages grew from 5% in 2019 to 20% in 2020 (t = 3.585, d.f. = 34, p = 0.001), and then to 55% in 2021 (t = 6.903, d.f. = 34, p < 0.001) (Figure 3). The number of strongly polluted nestlings (out of the total number of polluted nestlings), that were in critical condition, didn't change significantly from 2019 to 2020 (t = 1.18, d.f. = 34, p = 0.2448), although their percentage from the total number of polluted nestlings, declined from 18% in 2019 to 5% in 2020. The number and percentage of strongly polluted nestlings again increased to 24% in 2021 (t = 3.42, d.f. = 34, p = 0.002).

Distribution and scale of the storks' pollution after the intervention, in 2022-2023

In 2022 contaminated storks were found in 29 villages, in 128 nests (Table 4, Figure 2d). The total number of contaminated nestlings was 383, along with 223 slightly contaminated adults. On average, 34% (± 4% SE) of the nestlings were contaminated.

In 2023 contaminated storks were found in 26 villages, in 145 nests (Table 5, Figure 2e). The total number of contaminated nestlings was 435, along with 208 slightly contaminated adults. On average, 22 (± 3% SE) of the nestlings were contaminated.

Table 4.

Distribution of contaminated white storks among 35 surveyed villages in 2022.

#	Village	Number of nests	Conditional level of contamination of white storks in the nests				Number of nestlings	Number and % of contaminated storks	
			Clean	Slightly	Medium	Strong			
1	Geghanist	2	4	0	2	0	6	2	33%
2	Azatashen	2	3	4	0	0	7	4	57%
3	Khachpar	18	28	10	14	8	60	32	53%
4	Hayanist	12	31	0	3	0	34	3	9%
5	Howtashat	25	52	7	10	4	73	21	29%
6	Nizami	15	18	20	4	0	42	24	57%
7	Zorak	11	34	0	6	0	40	6	15%
8	Dashtavan	23	68	6	8	0	82	14	17%
9	Darakert	11	7	10	9	4	30	23	77%
10	Norabats	2	2	2	3	0	7	5	71%
11	Darbnik	6	22	0	0	0	22	0	0%
12	Ghukasavan	2	3	2	0	0	5	2	40%
13	Hovtashen	36	44	28	24	8	104	60	58%
14	Noramarg	4	5	3	2	0	10	5	50%
15	Yeraskhahun	60	154	0	22	18	194	40	21%
16	Yeghegnut	40	72	0	30	12	114	42	37%
17	Jrarat	8	4	10	4	5	23	19	83%
18	Metsamor	2	5	3	0	0	8	3	38%
19	Haykashen	4	8	3	0	0	11	3	27%
20	Gay	8	17	0	4	2	23	6	26%
21	Lusagyugh	4	9	1	0	0	10	1	10%
22	Aknashen	3	8	2	0	0	10	2	20%
23	Griboyedov	16	48	4	8	0	60	12	20%
24	Aratashen	3	3	2	4	0	9	6	67%
25	Khoronk	2	3	3	0	0	6	3	50%
26	Artimet	3	4	4	2	0	10	6	60%
27	Haytagh	2	2	2	2	2	8	6	75%
28	Mkhchyan	2	6	0	0	0	6	0	0%
29	Dimitrov	4	7	2	4	2	15	8	53%
30	Sipanik	10	28	0	4	0	32	4	13%
31	Araksavan	16	29	12	9	0	50	21	42%
32	Pokr Vedi	12	33	0	0	0	33	0	0%
33	Lusarat	6	18	0	0	0	18	0	0%
34	Surenavan	24	73	0	0	0	73	0	0%
35	Armash	22	66	0	0	0	66	0	0%
	Totals	420	918	140	178	65	1301	383	

Table 5.

Distribution of contaminated white storks among 35 surveyed villages in 2023.

#	Village	Number of nests	Conditional level of contamination of white storks in the nests				Number of nestlings	Number and % of contaminated storks	
			Clean	Slightly	Medium	Strong			
1	Geghanist	9	14	0	1	0	15	1	7%
2	Azatashen	2	7	0	0	0	7	0	0%
3	Khachpar	12	28	2	4	0	34	6	18%
4	Hayanist	16	8	10	12	11	41	33	80%
5	Howtashat	25	58	10	8	0	76	18	24%
6	Nizami	24	37	5	11	9	62	25	40%
7	Zorak	12	18	0	6	9	33	15	45%
8	Dashtavan	36	33	5	37	17	92	59	64%
9	Darakert	9	16	8	2	0	26	10	38%
10	Norabats	2	7	0	0	0	7	0	0%
11	Darbnik	13	22	1	2	9	34	12	35%
12	Ghukasavan	2	6	0	0	0	6	0	0%
13	Hovtashen	28	49	26	4	2	81	32	40%
14	Noramarg	4	9	2	0	0	11	2	18%
15	Yeraskhahun	39	65	9	10	1	85	20	24%
16	Yeghegnut	36	77	18	5	4	104	27	26%
17	Jrarat	8	15	4	2	0	21	6	29%
18	Metsamor	2	5	2	0	0	7	2	29%
19	Haykashen	4	8	2	0	0	10	2	20%
20	Gay	8	19	3	2	0	24	5	21%
21	Lusagyugh	15	37	2	0	0	39	2	5%
22	Aknashen	3	9	0	0	0	9	0	0%
23	Griboyedov	31	47	14	15	1	27	30	39%
24	Aratashen	10	21	0	5	1	27	6	22%
25	Khoronk	17	47	0	0	0	47	0	0%
26	Artimet	21	251	52	42	7	352	101	29%
27	Haytagh	2	5	2	0	0	7	2	29%
28	Mkhchyan	2	7	0	0	0	7	0	0%
29	Dimitrov	4	10	2	2	0	14	4	29%
30	Sipanik	9	20	5	0	0	25	5	20%
31	Araksavan	15	28	8	0	0	36	8	22%
32	Pokr Vedi	12	36	0	0	0	36	0	0%
33	Lusarat	6	18	0	0	0	18	0	0%
34	Surenavan	24	71	0	0	0	71	0	0%
35	Armash	23	67	2	0	0	69	2	3%
	Totals	485	1175	194	170	71	1560	435	

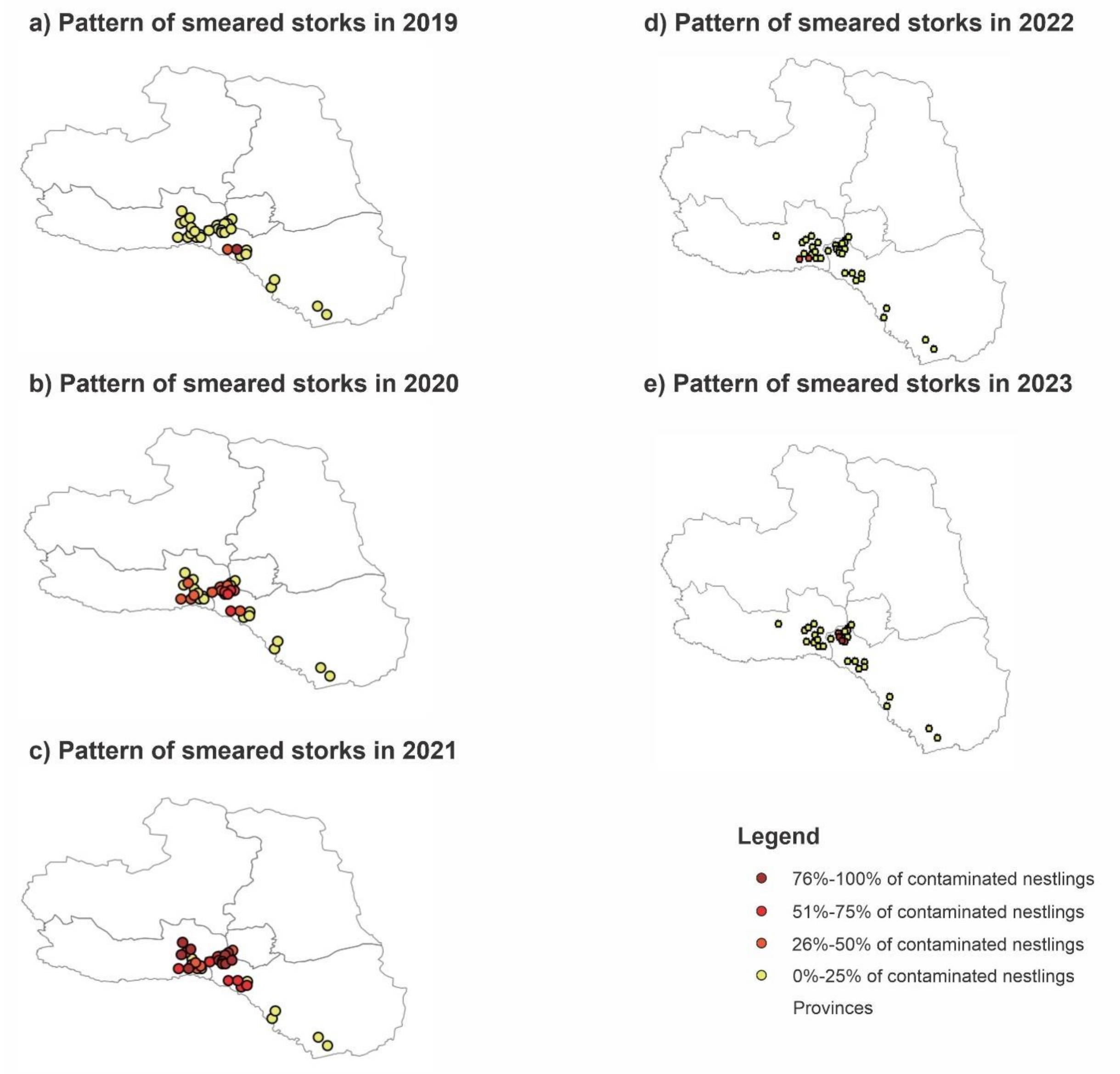

Figure 2. Pattern of white storks' contamination in 2019-2023.

Thus, the average percent of the polluted nestlings in 35 observed villages declined from 55% in 2021 to 34% in 2022 (t = -4.36, d.f. = 34, p < 0.001), and then to 22% in 2023 (t = -2.52, d.f. = 34, p = 0.0164) (Figure 3). The number of strongly polluted nestlings, which were in critical condition, showed some decline from 24% in 2021 to 17% in 2022, which is not statistically significant though (t = -1.24, d.f. = 34, p = 0.2226), and then didn't change significantly in 2023 making 16% (t = 0.14, d.f. = 34, p < 0.8827).

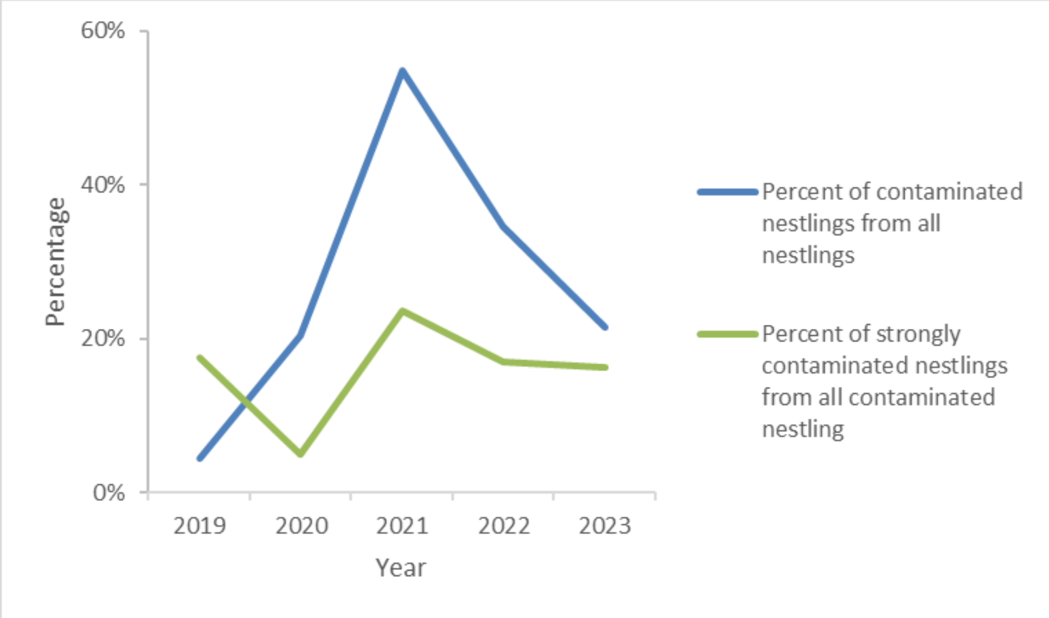

Figure 3. Change of the percent of polluted nestlings in 35 observed villages in 2019-2023.

White storks' mortality and rescue

In 2022, over 40 storks died, but 132 were rescued, cleaned, and released. In 2023, none of the dead storks were recorded, though 26 were rescued. Most of the birds that died in 2022 were fledglings that had been severely contaminated at their nests. The smearing disallowed them from flying, and nestlings that attempted their first flight dropped from the nests, breaking their legs and wings.

Discussion

The storks' contamination declined statistically significantly and consistently from 2022 to 2023. However, the number of strongly contaminated storks declined somewhat in 2022 (although not significantly) and then remained almost the same in 2023.

The possible explanation of the observed decline of contaminated storks can be related to the strategy, jointly developed and implemented by the Ministry of Environment, Environmental Inspection, BirdLinks Armenia NGO, and Protection of Endemic and Endangered Species NGO. One of the conclusions made in the previous period (2019-2021) was that several short-term measures should be implemented urgently (Aghababyan *et al*. 2022). Those include (1) inventory by the Environmental Inspection of all the producers of fish, canned food, chips, etc., which can possibly have a fat or oil-containing waste; (2) enforcing all producers to provide annual reports on their waste, according to the legislation; (3) development of the annual cycle of comparison of the volume of the waste recorded in the annual report with the production volume to find possible violations (Aghababyan *et al*. 2022). The Environmental Inspection identified over 300 such producers within the region of contaminated storks and implemented the planned inspections during 2022-2023, meanwhile broadcasting these steps among producers through its own Public Relations unit and with the help of the NGOs. At the same time, the Hazardous Substances and Waste Policy Department and Public Relations Division of the Ministry of Environment developed and distributed educational materials to popularize the waste-related issues, obligations, and solutions for fish farmers and producers. Therefore, the observed decline of the storks' contamination can be related to the improvement of waste-related behavior of the fish farmers and producers of chips and canned food.

The fact that the average number of strongly contaminated storks didn't decline significantly, most probably means that there are several spots where contamination still remains very intensive. Specifically, there are several villages, where the number of strongly contaminated storks is still enormously high: Darbnik – 9 strongly contaminated out of 12 contaminated (75%), Zorak – 9/15 (60%), Nizami – 9/25 (36%), Hayanist – 11/33 (33%), and Dashtavan – 17/59 (29%). Extraction of these five villages from the sample of 2023 decreases the average percentage of strongly contaminated storks down to 4%. These five villages are located within a single circle and thus, it is essential now to intensify the inspection and education efforts on this circle.

The agents smearing the storks have not yet been identified. However, the fact that the storks' contamination declined after the beginning of the inspections indirectly proves the hypothesis (Aghababyan et al. 2022) that the contamination comes from the fish producers (internal organs of the fish full of fish fat, which are thrown after the fish gutting) and chips and/or canned oil producers (wasted plant oil improperly disposed of).

As concluded in previous research (Aghababyan et al. 2022), the country's existing legislation is sufficient for food producers to have an annual report on waste, which must describe the volume of the waste and the method and terms of its disposal. However, a tracking system and enforcement of the regulation were needed.

With that consideration, in 2022 the Ministry of Environment issued a new decree N 262-L on approval of the Fish-farms' Waste Management Guide. The decree was broadcast through the regular channels by the Public Relations Division of the Ministry, but also through the educational brochure "Fish-farms' Waste Management Guide" developed by the Hazardous Substances and Waste Policy Department of the Ministry and distributed through the series of seminars with the fish-farmers and canned food producers, as well as through the Association of Fish-farmers of Armenia.

The Environmental Inspection examined all the producers of fish, chips, and canned food, forcing them to provide annual reports on the waste. BirdLinks Armenia NGO and Protection of Endemic and Endangered Species NGO broadcasted the issue and the law enforcement through TV interviews and social media.

Considering the described issues, the Ministry of Environment and the Ministry of Territorial Administration and Infrastructure have made legislative changes, proposing those for the relevant legal acts. Specifically, in the Law "On Waste Removal and Sanitation", the regulations related to the management of biodegradable waste have been defined. Also, for the placement of other biological waste, the RA Code on Administrative Offenses (which will come into force on January 1, 2025) has established appropriate measures of responsibility for dumping waste outside of designated places and in unauthorized ways.

The joint efforts of the Ministry of Environment, Environmental Inspection, BirdLinks Armenia NGO, and Protection of Endemic and Endangered Species NGO, directed at enforcing legislation, can be considered successful, taking the decline of storks' contamination, as an indirect indication. It is necessary, therefore, to continue the consistent inspections of these producers and monitoring of the storks' populations, in order to track the efficiency of the efforts for biodiversity and ecosystems.

Conclusion

It appears that the joint strategy that was developed and implemented by the state organizations and CSOs was the right one and it already started giving positive feedback, as evidenced by the decline in the number of contaminated storks. At the moment, it is very important to continue consistent inspections of the producers of fish, chips, and canned food, and to transfer those inspections into the regular annual procedure.

Also, it is important to begin working on increasing punishments for violations of waste disposal rules, as this will motivate the producers further.

In addition, it is very important to begin the development of recycling the remains of gutted fish and used plant oil, which has significant business potential.

Eventually, it is important to protect the storks, not through the Red Data Book, but through its consideration as one of the national symbols of Armenia, and thus through increasing punishments for harming the white storks and their wetland habitats.

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