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მედიცინისა და მენეჯმენტის თანამედროვე პრობლემები

საერთაშორისო, რეცენზირებადი, რეფერირებადი სამეცნიერო ჟურნალი

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მთავარი რედაქტორისაგან
From the Editor-in-Chief

ძვირფასო კოლეგებო!

შემოთავაზებული სამეცნიერო ნაშრომთა ჟურნალი განკუთვნილია მედიცინის, ეკონომიკის, მენეჯმენტის, ფიზიკური მედიცინისა და რეაბილიტაციის დარგის სპეციალისტებისათვის.

ჩვენ ვიმედოვნებთ, რომ ავტორთა მიერ წარმოდგენილი ნაშრომები ხელს შეუწყობს სამეცნიერო პოტენციალის გაძლიერებას.

მარინა ფირცხალავა
ბიოლოგიურ მეცნიერებათა დოქტორი,
პროფესორი, აკადემიკოსი,
უნივერსიტეტ გეომედის რექტორი

Dear colleagues!

The proposed scientific journal is intended for specialists in medicine, management, physical medicine and rehabilitation, economics.
We hope that the works presented by the authors will help to strengthen the scientific potential.

Marina Pirtskhalava
Doctor of Biological Sciences,
Professor, Academician,
Rector of University Geomedi

შინაარსი Contents

Original Research

Study of hepatoprotective properties of protein fractions obtained from leaves of *Tagetes erecta* L. and *Salvia aethiopis* L. plants by gel filtration chromatography on tetrachloromethane (CCl_4) damaged hepatocytes of mice

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Article History

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Abstract

The study presents data on the action of protein fractions obtained from *Tagetes erecta* L. and *Salvia aethiopis* L. plants by gel filtration chromatography on the hepatocytes of mice damaged by a 10% tetrachloromethane solution. Protein fractions of the third and fourth peaks have weak hepatoprotective properties. Each peak was also separated into several fractions by the method of ion exchange chromatography. The SDS-PAGE revealed fractions, including those with a molecular weight of 23-47 kDa, which probably participate in the protection of hepatocytes.

Keywords: Tagetes erecta L., Salvia Aethiopis L., Imeretian saffron, proteins, gel filtration chromatography, ion exchange chromatography, tetrachloromethane, CCl_4, gel electrophoresis, histomorphology, hepatocytes.

Introduction

The homeland of representatives of the genus Tagetes is the American continent, they distributed in the wild from the USA to Argentina. In Europe and Georgia, the plants of this genus were artificially distributed in the 16th century. In Georgia *T. electra* L (large-flowered form) and *T. patula* L. (small-flowered form). Quite often these forms are considered as synonym species [1;2]. In the Caucasus and Russia they are known as Imeretian saffron (the name is related to the Georgian region Imereti, a region of Georgia situated in the central-western part of the country) [3].

Representatives of the genus Tagetes contain various biologically active compounds, including phenol, topene, benzophene derivatives, triterpenes, alkaloids, flavonoids, carotenoids and others. They are used in folk medicine and cooking [4].

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According to the data of the scientific literature, the compounds present in the species of the genus Tagetes are distinguished by their action against various pathogenic agents of humans and other organisms, including negative effects on the growth of bacteria and fungi [5].

The extract of *T. minuta* leaves suppressed the growth of Gram-negative bacteria and did not affect microorganisms of normal human microflora (*Lactobacillus, Zymomonas, Saccharomyces*). The quercetagenin-7-arabinosyl-galactoside isolated from this plant was shown to be active against pathogenic bacteria [6].

Flavonoid patuletin isolated from the methanolic extract of the *T. patula*, was demonstrated to suppress cervical tumor cells, having a similar action to glycoside patulitrin and phenolic acid. According to the authors, the cytotoxic effect is related to the antioxidant activity. It should be noted that in folk medicine *T. patula* flowers are used as an antitumor [7].

Biologically active compounds present in species of the genus Tagetes are effective against parasites of plants important for agriculture, for example, essential oils obtained from *T. minuta* leaf [8].

Methanolic extract of *T. patula* at concentrations of 5 and 10 mg/mL adversely affected the growth and development of the causal agents of plant diseases *Botrytis cinerea, Fusarium moniliforme* and *Pythium ultimum*. Probably, due to the free radical formation, the extract initiated changes in the cell membranes of fungi, leading to premature ageing of fungal mycelium [9].

Plants of the genus Salvia also contain biologically active compounds. Sage is widespread throughout Europe, and on the North American continent, 13 species of this genus are found in Georgia [10].

Triterpenes isolated from *S. argentea* leaves are characterized by antibacterial action, their effects were similar to those caused by antibiotics [11].

In addition to antibacterial properties, secondary metabolites of *S. argentea* have a wide spectrum of antioxidant, anti-inflammatory, and cytotoxic activities [12].

Triterpenes isolated from *Salvia grossheimii in vitro* inhibited the growth of human cancer cells [13].

Essential oils isolated from the stem of *Salvia microphylla* inhibited the growth and development of bacteria, especially strongly suppressing *Enterobacter cloacae*. In addition, they were characterized by anti-fungal properties, suppressing the growth of *Candida albicans* [14].

The extracts of *Salvia microphylla* Kunth, prevented the development of scopolamine-induced histopathological changes in the prefrontal cortex and hippocampus of the rats, and inhibited the deposition of β-amyloid in brain areas [15]. However, information on the protein composition of these species is absent.

The aim of this study was the identification of biologically active proteins of *Tagetes erecta* L. and *Salvia aethiopis* L. and the investigation of hepatoprotective properties of protein fractions obtained from the leaves of these plants.

Materials and Methods

Plant Material and Extraction

Tagetes erecta L. and *Salvia aethiopis* L. samples were obtained in the eastern region of Georgia (coordinates: 41° 47' 11" N, 45° 1' 20" E and 41°43′21″N 44°47′33″E).

The leaves were washed in distilled water and homogenized with 40% PBS solution in

DOI: 10.56580/GEOMEDI47

a ratio of 1:5. The extract was filtrated and the total protein concentration in the extract was determined using the Lowry method. After, the extract was centrifuged at 3000 rpm for 30 min.

Protein purification

The protein from *Tagetes erecta* L. and *Salvia aethiopis* L. extract was concentrated using precipitation with 90% ammonium sulfate solution. The total protein concentration was determined using the Lowry method [16]. The protein solution was subjected to gel filtration on a Sephadex G75 column equilibrated with 5 mM KH_2PO_4. 150 mM NaCl pH 7.4. Fractions were collected at a flow rate of 1 ml/min.

Next, the protein was purified by ion exchange chromatography on DEAE–Sephadex. The protein was eluted by gradient by 10 mM Tris-HCl pH 8.0/10 mM Tris-HCl, NaCl 0.25 M pH 8. Fractions were collected at a flow rate of 2 ml/min.

Animals

White mice, 4–6 months (average weight of 30 ± 0.05 g), were used in the study. The mice were housed under normal light-dark conditions (12 hours light followed by 12 hours dark) for the entire experiment and had access to food and water, *ad libitum*. The animals were randomly assigned to one of 4 groups:

The first group: control animals, intraperitoneally injected with 5%PBS solution for 30 days.

The second group of animals was intraperitoneally injected with 10% oil CCl_4 solution.

The third group of animals was intraperitoneally injected with 10% oil CCl_4 solution and protein fractions of *Tagetes erecta* L. and *Salvia aethiopis* L., obtained by gel filtration chromatography at a concentration of 0.0537 mg/ml (0.00179 mg protein/g of animal weight).

In the fourth group, we administered intraperitoneally protein fractions of *Tagetes erecta* L. and *Salvia aethiopis* L., obtained by gel filtration chromatography at a concentration of 0.0537 mg/ml.

Histological staining

Van Gieson's Stain of liver extracted from 6 mice was performed for each group. Mice were anesthetized with chloroform; livers were removed and placed in 15% formalin solution. Liver tissues were sliced into coronal sections using a rotary microtome. Images were obtained using AmScope microscope.

Results and discussion

Combined protein fractions of the third and fourth peaks of *Tagetes erecta* L. and *Salvia aethiopis* L. retain their initial concentration for 30 days after the start of the experiment at +4°C within 0.0537 mg/ml, which allows their use in experiments for a long time (Figure 1 A and B).

DOI: 10.56580/GEOMEDI47

Figure 1 A and B. Third and fourth peaks of *Tagetes erecta* L. and *Salvia aethiopis* L. protein fractions: A. Before the start of the experiment and B. After the end of the experiment.

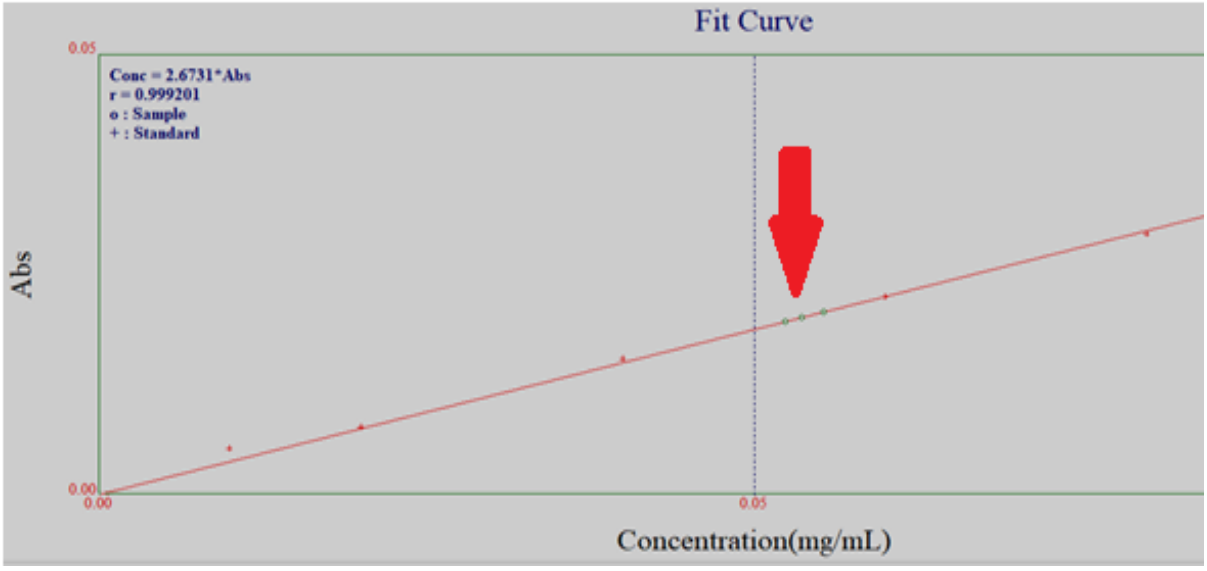


Figure 1 A

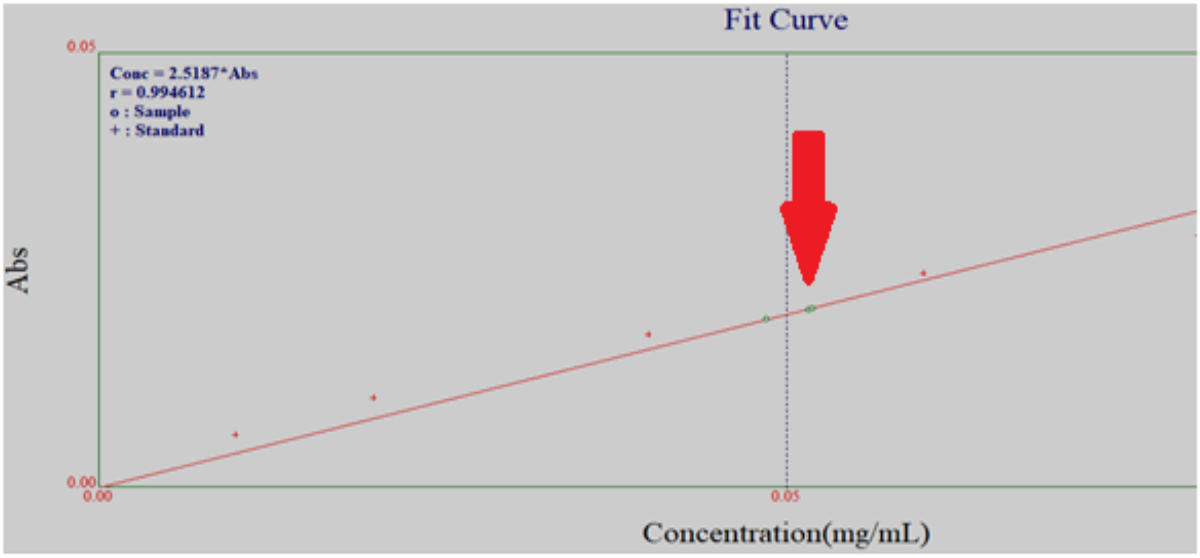


Figure 1 B

The purification of the дeaf protein extract by gel filtration chromatography revealed 4 fractions. Also, 4 fractions were obtained from the extract of *Salvia aethiopis* L. Third and fourth peaks of *Tagetes erecta* L and *Salvia aethiopis* L. were combined and injected in mice (Figure 2 A and B).

DOI: 10.56580/GEOMEDI47

Figure 2 A and B. Chromatogram of fractions obtained by gel filtration chromatography of protein extracts of *Tagetes erecta* L.(A) and *Salvia aethiopis* L. leaves (B).

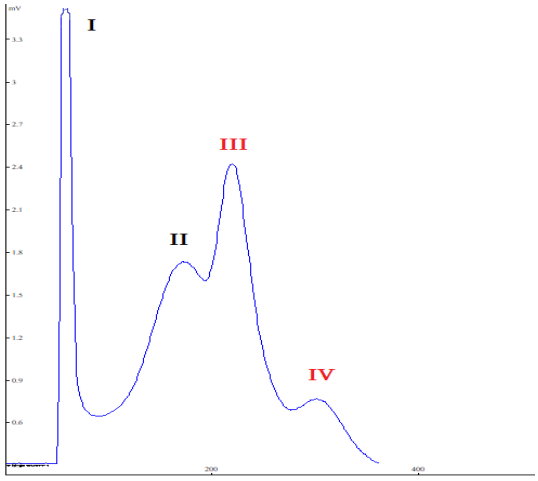


Fig. 2A. Protein fractions of *Tagetes erecta* L. obtained by gel filtration chromatography.

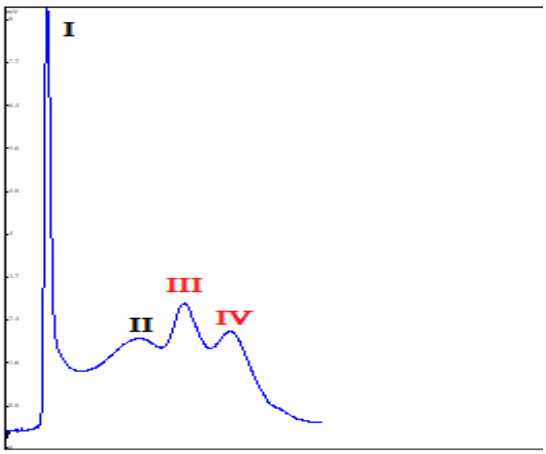


Fig. 2B. Protein fractions of *Salvia aethiopis* L. obtained by gel filtration chromatography

In the next stage of experiments, the third and fourth peaks of *Tagetes erecta* L. and *Salvia aethiopis* L. obtained by gel filtration chromatography were subjected to ion exchange chromatography. The third peak of *Tagetes erecta* L obtained by gel filtration chromatography was separated into three fractions by ion exchange chromatography, and the fourth peak of *Tagetes erecta* L was separated into two fractions (Figure 3).

Figure 3. Ion-exchange chromatography of peaks 3 and 4 of *Tagetes erecta* L. obtained by gel filtration chromatography.

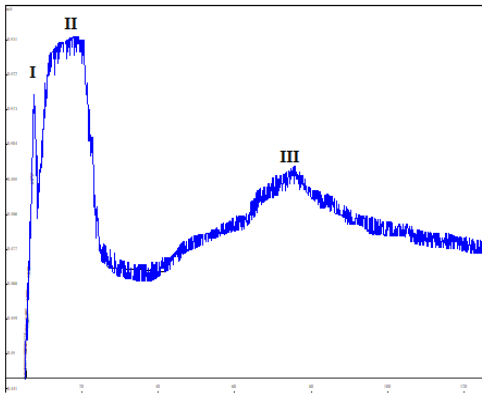


Fig. 3A. The ion-exchange chromatography Of the third by gel filtration chromatography Tagetes erecta L.

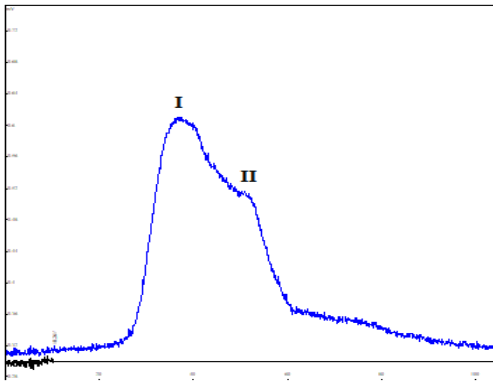


Fig. 3B. The ion-exchange chromatography Of the fourth peak obtained by del filtrtion of chromatography of Tagetes erecta L.

The third peak obtained by gel filtration chromatography from *Salvia aethiopis* L. Leaf extract was separated into two fractions by the ion-exchange chromatography and the fourth peak was separated into 5 fractions (Figure 4).

DOI: 10.56580/GEOMEDI47

Figure 4. Ion-exchange chromatography of peaks 3 and 4 of *Salvia aethiopis* L. obtained by gel filtration chromatography.

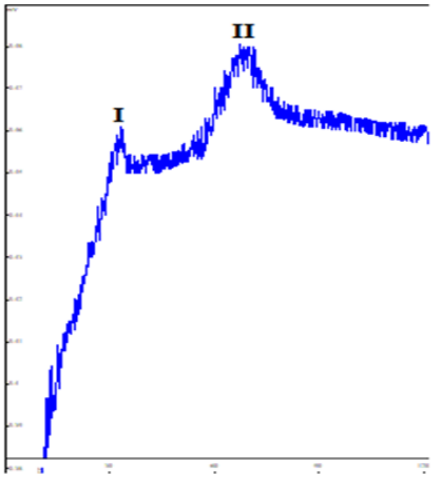


Fig. 4 A. The ion-exchange chromatography of the third peak, obtained by gel filtration chromatography of ***Salvia aethiopis* L**

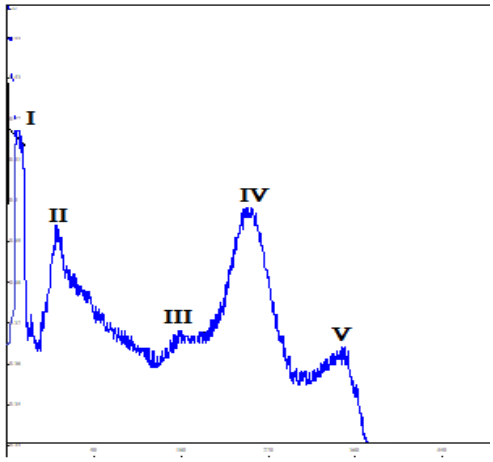


Fig. 4 B.The ion-exchange chromatography of the fourth peak, obtained by gel filtration chromatography **of *Salvia aethiopis* L**

At the next stage of the experiment proteins of *Tagetes erecta* L. and *Salvia aethiopis* L. leaves were subjected to SDS-electrophoresis in 12% polyacrylamide gel.

In both cases, several fractions were identified including proteins with a weight of 23-47 kDa, which most likely act as hepatoprotectors (Figure 5 A and B).

Fig. 5. SDS-PAGE of *Tagetes erecta* L. and *Salvia aethiopis* L. leaf extract in 12% polyacrylamide gel.

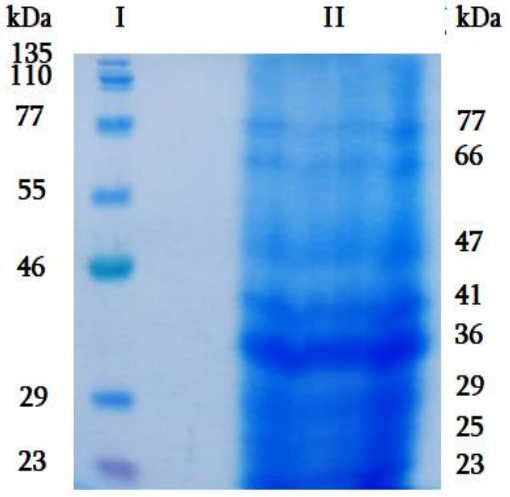


Fig. 5A. SDS-PAGE of ***Tagetes erecta* L**.

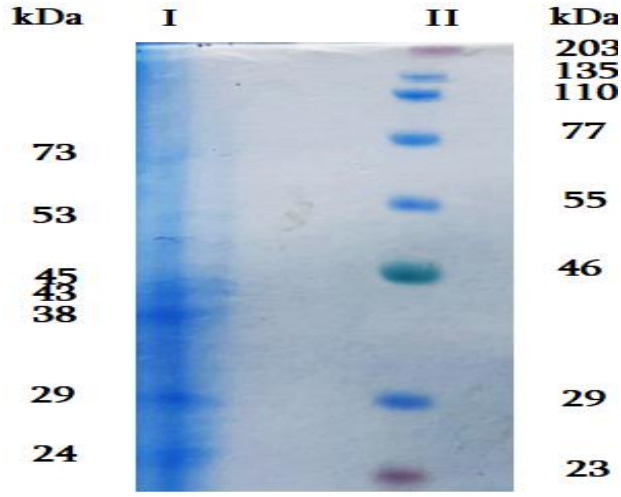


Fig. 5A. SDS-PAGE of ***Salvia aethiopis* L**

A histomorphological pattern of liver tissue showed that intraperitoneal injections of experimental mice with protein fractions obtained from ***Tagetes erecta* L**.

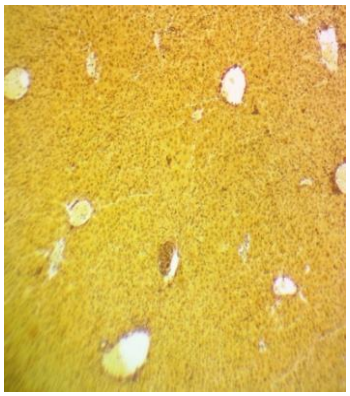
and ***Salvia aethiopis* L**. Leaves during 30 days did not have any pathological effect on the hepatocytes (Figure 6 A, B,C, D,E,F).

DOI: 10.56580/GEOMEDI47

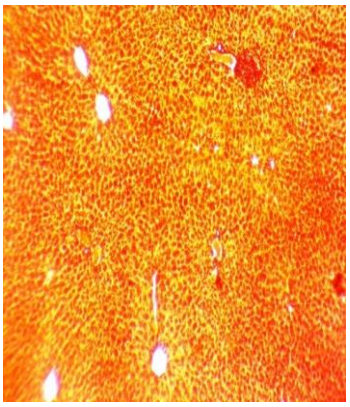
Fig. 6. Effect of 5 mM PBS (A, B, C), *Tagetes erecta* L. and *Salvia aethiopis* L. protein fractions (D,E,F) on mouse hepatocytes.

Fig. 6. A, B, C. Liver tissue of mice injected 30 days with PBS (5mM)

A



B



C

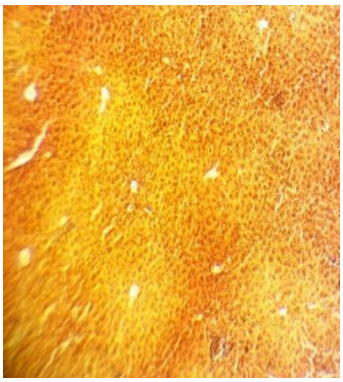
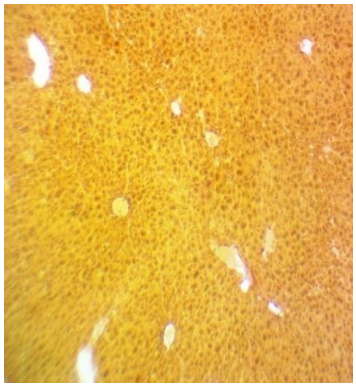
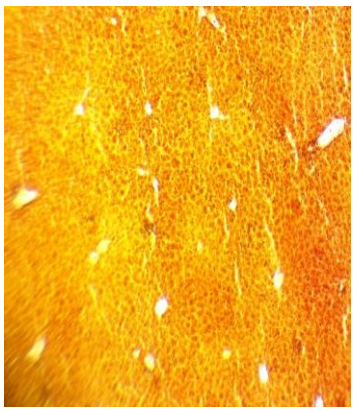


Fig. 6. D, E, F. Liver tissue of mice injected 30 days with *Tagetes erecta* L. and *Salvia aethiopis* L.protein fractions in PBS (5mM)

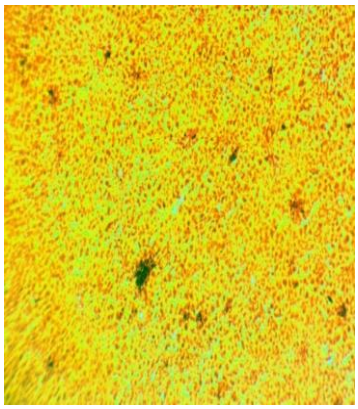
D



E



F



The simultaneous administration of CCl_4 and extract lead to lower development of connective tissue than administration of CCl_4 alone (Figures 7.1-7.2). In the second couple of samples the degree of development of connective tissue was practically the same for administration of CCl_4 and extract and administration of CCl_4 alone (Figures 7.3-7.4).

In the third and fourth samples where CCl_4 And protein fractions were used, the

In the third and fourth samples where CCl_4

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and protein fractions were used, the interlobular connective tissue was visible, although, in CCl_4 and protein fractions variant, a lower degree of damage was observed (Figures 7.5-7.6; 7.7-7.8).

In addition, fuchsinophilic hepatocytes in the samples are less pronounced in joint samples of plant fractions and carbon tetrachloride (10%). It is known from the literature that fucinophilia indicates tissue damage, which was first detected in myocardial cells damaged by coronary heart disease [17].

Therefore, we can conclude that joint injection of *Tagetes erecta* L. and *Salvia aethiopis* L. protein fractions with a concentration of 0.00179 mg/g had weak hepatoprotective action against hepatocyte damage by CCl_4 (Figure 7).

Figure 7. Effect of *Tagetes erecta* L. and *Salvia aethiopis* L. protein fractions on hepatocytes of mice damaged by CCl_4.

The combined effect of CCl_4(10%) and Protein fractions of the extract Tagetes erecta L. and and Salvia aethiopis L on mouse hepatocytes	Damaged mouse hepatocytes 10% tetrachloromethane (CCl_4)

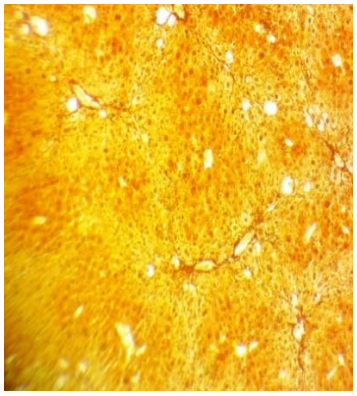

Fig. 7.1. The interlobular borders of the liver are not expressed. Small numbers of numbers of fuchinophilic hepatocytes and steatores are observed in the lobules.

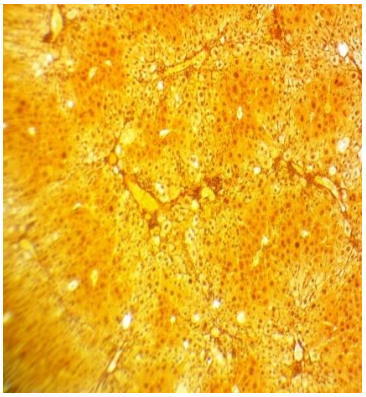

Fig. 7.2. The interlobular borders of the liver are expressed. Fuchinophilic hepatocytes and steatores are observed in the lobules.

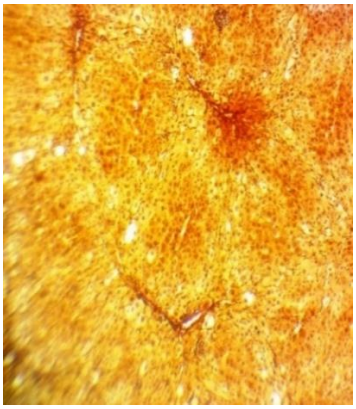

Fig.7.3. Small amount of connective tissue between the liver lobules. Low degree of hepatic steatosis is observed.

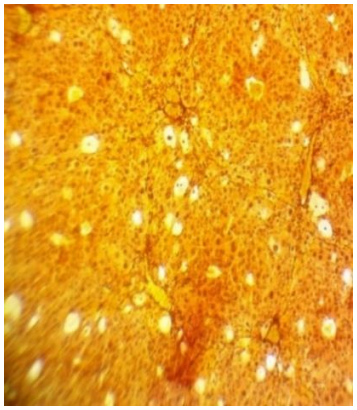

Fig.7.4. Small amount of connective tissue between the liver lobules. More pronounced hepatic steatosis was observed.

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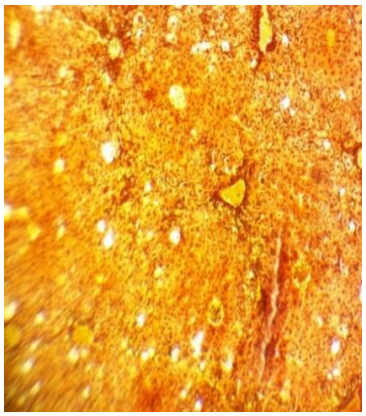

Fig. 7.5. Small amount of connective tissue between the liver lobules. Minor groups of fuchinophilic hepatocytes and steatosis were observed in the lobes.

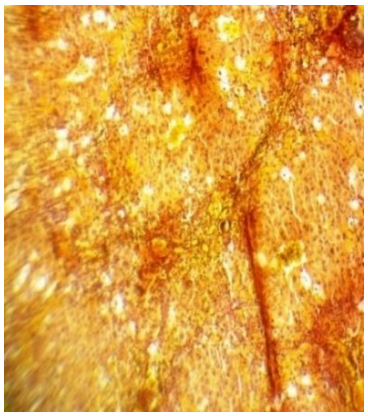

Fig. 7.6. Connective tissue between the liver lobules was expressed. Hepatic steatosis Was observed observed in the liver lobules

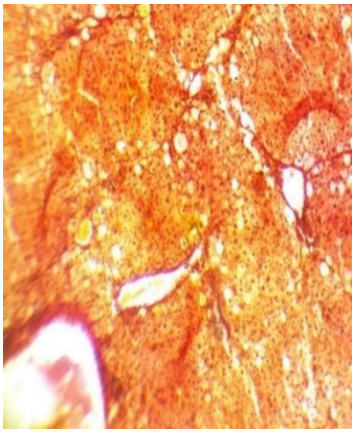

Fig. 7.7. Small amount of connective tissue between the liver lobules. Minor groups of hepatic steatosis Were. Oobserved in the lobules

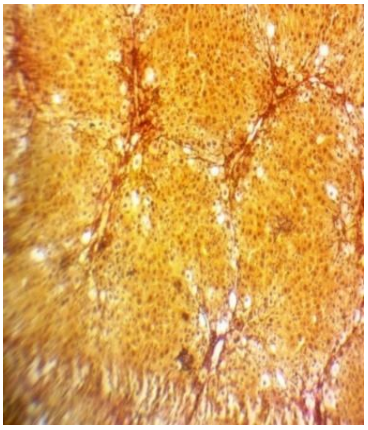

Fig. 7.8. Connective tissue between the liver lobules was well expressed. Hepatic steatosis is observed.

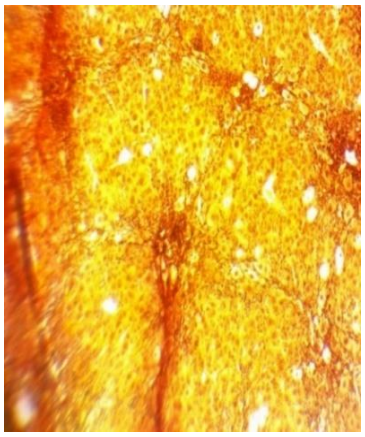

Fig. 7.9. The liver lobules are enlarged. Connective tissue is slightly expressed. Minor groups of fuchinophilic hepatocytes and hepatic steatosis were. Observed in the lobules.

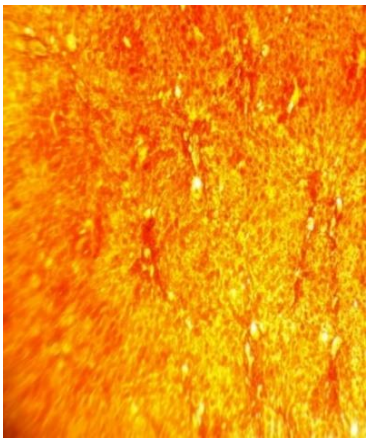

Fig. 7.10. The liver lobules were enlarged. Connective tissue was not expressed. A large number of ofuchinophilic hepatocytes. was observed. Hepatic steatosis was not. Observed in the lobules.

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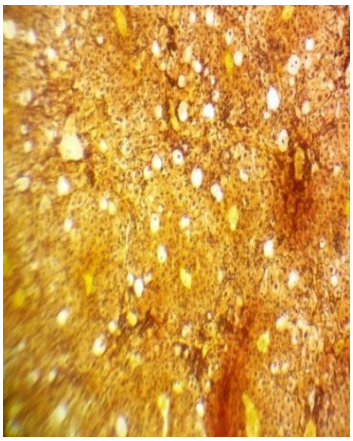

Fig. 7.11. The interlobular borders of the liver with expressed connective tissue. Pronounced hepatic steatosis was observed in the lobules.

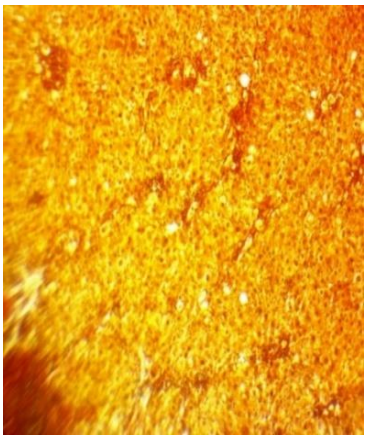

Fig. 7.12. The interlobular borders of the liver with expressed connective tissue. Hepatic steatosis was less expressed.

In addition, in histomorphological images, both in the samples obtained after the treatment with protein fractions and tetrachloromethane and in the samples of the treatments with tetrachloromethane alone, fat clusters were well expressed. Such fat clusters were not observed in the control sample obtained after the treatment with 5% PBS (Figure 6). It is known that tetrachloromethane causes steatosis and fatty dystrophy of the liver [18;19].

In our case, the protein fractions of Tagetes erecta L. And Salvia aethiopis L. reduced the development of steatosis in three of the six samples. In particular, in the second, third and fourth samples. In the first and sixth samples, steatosis is expressed almost identically, both in samples containing an extractive substance and tetrachloromethane (10%), and only in samples exposed to tetrachloromethane (10%). However, steatosis was absent in the fifth sample containing tetrachloromethan. (Fig. 7 – 10).

Conclusions

1. Four protein fractions were obtained from *Tagetes erecta* L. and *Salvia aethiopis* L. by gel filtration chromatography.
2. The obtained fractions were separated by ion-exchange chromatography into several fractions, the third fraction obtained from *Tagetes erecta* L. was separated into three fractions and a fourth fraction of this plant was separated into two fractions. The third fraction of *Salvia aethiopis* L. was separated into two factions, and the fourth fraction was separated into 5 factions.
3. The third fraction of *Tagetes erecta* L. and the fourth fraction of *Salvia aethiopis* L. obtained by gel filtration chromatography at concentrations of 0.0537 mg/ml (by recalculation per animal weight the concentration comprised 0.00179 mg/g) provided weak hepatoprotective effect in mice treated with 10% tetrachloromethane.
4. The third fraction of *Tagetes erecta* L. and the fourth fraction of *Salvia aethiopis* L. obtained by gel filtration chromatography at concentrations of 0.0537 mg/ml (by recalculation per animal weight the concentration comprised 0.00179 mg/g) reduced the development of hepatic steatosis in three of the six samples.
5. The SDS-PAGE of *Tagetes erecta* L. and

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Salvia aethiopis L. proteins in a 12% gel revealed several fractions, including proteins with a molecular weight of 23-47 kDa, which are most likely involved in protecting hepatocytes damaged from 10% tetrachloromethane.

მცენარეების *Tagetes erecta L. და Salvia aethiopis* L. ფოთლების გელ-ფილტრაციული ქრომატოგრაფიით მიღებული ცილოვანი ფრაქციების ჰეპატოპროტექტული თვისებების შესწავლა თაგვების ტეტრაქლორმეთანით (CCl_4) დაზიანებულ ჰეპატოციტებზე

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აბსტრაქტი

სტატიაში მოცემულია მცენარეების *Tagetes erecta L.* და *Salvia aethiopis L*-ს ცილოვანი ექსტრაქტების გელ-ფილტრაციული ქრომატოგრაფიის მეთოდით დაყოფილი ფრაქციების მოქმედება 10%-იანი ტეტრაქლორმეთანით დაზიანებულ თაგვების ჰეპატოციტებზე. აღნიშნული მცენარეების მესამე და მეოთხე პიკების ცილოვან ფრაქციებს გააჩნიათ სუსტი ჰეპატოპროტექტული თვისებები. თითოეული პიკი იონცვლადი ქრომატოგრაფიის მეთოდით ასევე იყოფა რამდენიმე ფრაქციად.

SDS-გელ-ელექტროფორეზის მიხედვით გამოვლინდა ფრაქციები, მათ შორის მოლეკულური მასით 23-47 kDa, რომლებიც დიდი ალბათობით უნდა მონაწილეობდნენ ჰეპატოციტების დაცვაში.

საკვანძო სიტყვები: *Tagetes erecta* L., Salvia aethiopis L., იმერული ზაფრანა, სალბი, ცილები, გელ-ფილტრაციული ქრომატოგრაფია, იონცვლადი ქრომატოგრაფია, ტეტრაქლორმეთანი CCl_4, გელ-ელექტროფორეზი, ჰისტომორფოლოგია, ჰეპატოციტები.

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Original Research

Antioxidant and antibacterial activity of root extracts of Georgian medicinal plants obtained using different extraction methods

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Abstract

This study was designed to investigate the impact of different extracting solvents (methanol and DMSO) on the biological activities of root extract of *Paeonia daurica* subsp. *mlokosewitschii* (Lomakin) D. Y. Hong and *Sempervivum transcaucasicum* Muirhead. *In vitro* assessment of the antioxidant activity of extracts was performed using 2,2-diphenyl-1-picrylhydrazyl (DPPH assays), while their antibacterial activity was tested against *Escherichia coli* ATCC 25922 strain. The analysis of the obtained results revealed that the highest anti-DPPH potential and the highest antibacterial activity were achieved in the methanolic root extracts of both plants. The methanolic root extracts of *Paeonia daurica* subsp. *mlokosewitschii* exhibited significantly higher antioxidant and antibacterial activities in comparison with *Sempervivum transcaucasicum* root extracts. The results of the study indicated the possible use of root extracts of *Paeonia daurica* subsp. *mlokosewitschii* in pharmacy.

Keywords: *Paeonia daurica* subsp. *mlokosewitschii* (Lomakin) D. Y. Hong, *Sempervivum transcaucasicum* Muirhead, extraction methods, antioxidant activity, DPPH assay, antibacterial activity, *E. coli*.

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Introduction

The chemical compounds found in medicinal plants are readily accessible and powerful sources of antibacterial and antioxidant substances. These compounds can work alone or in combination to treat illness and enhance well-being. Tannins with antibacterial and antifungal properties, phenolic compounds with antioxidant and other pharmacological effects, and other phytochemicals are typically found in a single plant. [1]. Georgia's diverse temperature zones and landscapes make it a "hot spot" for biodiversity and a unique home for several hundred species of medicinal plants (discussed in [2]). Around 700 plant species are used in Georgian traditional medicine, and the country's official pharmacopoeia includes 200 taxa. [3]. However, despite the centuries-long history of Georgian folk medicine, the chemical composition and the effects of the extracts of traditional medicinal plants remain poorly investigated. The high concentration of various antioxidant compounds and the significant antimicrobial and antifungal potential were documented in many species of Georgian medicinal plants (discussed in [2] and [4]). In the present study, we investigated the antioxidant and antibacterial effect of representatives of two families of Georgian medicinal plants - *Paeonia daurica* subsp. *mlokosewitschii* (Lomakin) D. Y. Hong and *Sempervivum transcaucasicum* Muirhead.

The genus Paeonia includes 52 accepted members (36 species, 15 subspecies, and 1 variety) and 10 species of the genus distributed in Georgia: *Paeonia macrophylla* (Albov) Lomak., *P. steveniana* Kem.-Nath., *P. wittmanniana* Hartwiss ex Lindl., *P. mlokosewitschii* Lomak., *P. ruprechtiana* Kem.-Nath., *P. caucasica* (Schipcz.) Schipcz., *P. lagodechiana* Kem.-Nath., *P. majko* Ketzch., *P. carthalinica* Ketzch., *P. tenuifolia* L. Nine of them are endemic species of narrow distribution of the Georgian flora and *Paeonia tenuifolia* L. is a cosmopolitan plant [5].

The traditional uses of plants of the genus Paeonia are medicinal. In the folk medicine of many cultures, the different Paeonia parts (roots, root bark, flowers, leaves, seeds) of these species are used to treat neurological and infectious diseases, urinary system diseases, inflammation and trauma [6]. The study of the effect of different solvents on the antioxidant and antibacterial potential of leaf extracts of three *Paeonia* species revealed that the ethyl acetate extract of *Paeonia officinalis* L. had the highest levels of phenolic content and antioxidant potential [7]. The antioxidant activity was also demonstrated for essential oil obtained from the roots of 12 Paeonia species and the highest activity was revealed for *Paeonia lactiflora* Pall. [8]. High antioxidant activity was demonstrated for extracts of *Paeonia daurica* ssp. *macrophylla (*Albov) D. Y. Hong roots [9]. The results of our previous study of different drying and extraction methods and solvent polarity on the antioxidant properties of *Paeonia daurica* subsp. *mlokosewitschii* leaves demonstrated the highest antioxidant activity of *Paeonia daurica* subsp. *mlokosewitschii* leaves

DOI: 10.56580/GEOMED53

freeze-dried and extracted for 24 h with 80% methanol. [10].

The ethyl acetate extract of *Paeonia officinalis* L. leaves was effective against two Gram-positive bacteria *Listeria monocytogenes* and *Staphylococcus aureus*; two Gram-negative bacteria *Pseudomonas aeruginosa* and *Escherichia coli*, and a fungus *Candida albicans* [7]. The extract of *Paeonia peregrina* L. petals obtained using 2,2-difenil-1-pixil-hidrazil inhibited the growth of *Klebsiella pneumoniae* 3 times more effectively compared to Erythromycin. [11]. The 95% methanol extract of *Paeonia officinalis* L. roots exhibited significant antibacterial efficacy against methicillin-resistant *Staphylococcus aureus* [12]. The essential oil obtained from the entire *Paeonia mascula* (L) Miller plant showed moderate activity against *Yersinia pseudotuberculosis* and *Bacillus cereus.* [13].

The genus *Sempervivum* unites over 40 species native to the mountains of Europe, Africa, and Asia. [14] . The name "Sempervivum" has its basis in the Latin Semper ("always") and vivus ("living") due to the ability of the plant to store water in leaves allowing them to inhabit rocks in the mountain, alpine and subalpine belts. [14], [15], [16]. The *Sempervivum* plants are used in traditional medicine for the treatment of ear inflammation and wounds, sores, burns, and abscesses [15], [17]. The 80% ethanol extract of the aboveground part of *Sempervivum davisii* Muirhead had potent antioxidant activity, and kaempferol and quercetin derivatives were shown to be sources of potent antioxidant properties of the extract [18]. Water-ethanolic extracts (50%) of *Sempervivum tectorum* L. leaves also exhibited significant antioxidant activity [19]. Methanol extract of *Sempervivum armenum* Boiss.& A.Huet leaves exhibited strong antioxidative and antigenotoxic effects [15]. The study of 50% ethanol leaf extracts of 22 *Sempervivum* species demonstrated that these extracts are excellent sources of trace elements, antioxidants, and phenolic components [20].

Antibacterial activity of the 50% ethanol extract of *Sempervivum tectorum* L. leaves against *Staphylococcus aureus* and *Pseudomonas aeruginosa* was demonstrated [21]. The investigation of antibacterial activity of *Sempervivum tectorum* leaf extracts on four Gram-positive (*Bacillus subtilis, Micrococcus lysodeikticus*, methicillin-resistant *Staphylococcus aureus* and *Staphylococcus aureus*) and two Gram-negative bacteria (*Escherichia coli* and *Klebsiella pneumoniae*) demonstrated that Gram-negative bacterial strains showed higher sensitivity to extract of this plant [22].

Despite multiple reports on the antioxidant and antibacterial activities of plants of *Paeonia* and *Sempervivum* genera, the properties of representatives of these genera, native to the Caucasus, *Paeonia daurica* subsp. *mlokosewitschii* (Lomakin) D. Y. Hong and *Sempervivum transcaucasicum* Muirhead were not investigated. Herein, we aimed to examine

DOI: 10.56580/GEOMED53

The effect of different extraction methods and extraction solvents on the antioxidant and antibacterial activity of root extracts of *Paeonia daurica* subsp. *mlokosewitschii* (Lomakin) D. Y. Hong and *Sempervivum transcaucasicum* Muirhead.

Materials and methods

Plant material

Paeonia daurica subsp. *mlokosewitschii* and *Sempervivum transcaucasicum* plants were collected in July 2024 in the National Botanical Garden of Georgia (Tbilisi). Samples were placed in paper bags and transported to the laboratory within 1 h. Once in the laboratory, roots were detached from the plants. Samples of fresh plant material were frozen in liquid nitrogen and stored at –80 °C.

Drying processes

Roots of both plant species (5 g) were freeze-dried using a DW-10N freeze dryer in a vacuum flask of 500 mL at 10 Pa and a final condenser temperature of -55 °C until the plant material reached a constant weight, determined by measuring dry weight (DW). The drying process took 6 hours on average.

Sample extraction

The extraction efficiencies of different solvents were tested (Fig. 1). Roots of each plant species were extracted in a ratio of 1:10 with either 80% methanol (Fig. 1, A) or 80% DMSO (Fig. 1, B), followed by continuous stirring for 24 h at room temperature using an orbital shaker at 270 rpm. The extracts were centrifuged at 5000g for 15 min. Then DMSO extracts were stored at -80 °C for further analysis. Extracts obtained using 80% methanol were rotary evaporated at 50 °C and residue was dissolved in 80% DMSO and stored at -80 °C for further analysis.

DPPH free radical scavenging activity assay

The free radical scavenging activity was measured using by 2,2′-diphenyl-1-picrylhydrazyl (DPPH) assay according to the method described earlier [10].

The stock solution was prepared by dissolving 24 mg DPPH with 100 ml methanol. The working solution was obtained by diluting the DPPH solution with methanol to attain an absorbance of about 0.98±0.02 at 517 nm using the spectrophotometer. A 3 ml aliquot of the working solution was mixed with 100 µl of the sample at various concentrations (10 - 500 µg/ml). The reaction mixture was shaken well and incubated in the dark for 30 min at room temperature. Then the absorbance was taken at 517 nm. A typical blank contained 3 ml of the working solution and the appropriate volume of the corresponding solvent and was incubated under the same conditions. Ascorbic acid was used as standard. The scavenging activity was estimated based on the percentage of DPPH radical scavenged as the following equation:

Scavenging effect (%) = [(control absorbance–sample absorbance)/(control absorbance)]×100

The concentrations of the sample required for 50 % inhibition (IC_{50}) were calculated to determine the concentration of the sample required to inhibit 50% of radical. The lower the IC_{50} value, the higher the antioxidant activity of the samples. IC_{50} was

DOI: 10.56580/GEOMED53

calculated by plotting the concentration of extract versus inhibition of DPPH (%) and data were fit with a straight line (linear regression). IC_{50} value was estimated using the fitted line, i.e.:

$Y = a * X + b,$

$IC_{50} = (50 - b)/a.$

Antibacterial assay

The agar-disc diffusion method was employed for antibacterial activity screening. The *Escherichia coli* ATCC 25922 strain was used in the study. The bacteria were grown in LB medium for 16-18 h at 37 °C (10^9-10^{10} CFU/ml). Sterile blank discs with 6 mm diameter were individually placed on a nutrient agar plate covered with 300 µl of the bacteria strain. Different concentrations of plant extract extracted with either 80% methanol or 80% DMSO were put into the sterile blank disc. These plates were incubated at 37 °C for 24 h. The antimicrobial activity was determined in triplicate by measuring the diameter of the inhibition zone (mm). Amoxicillin (20 and 30 µg/disk) was used as the positive control. Dimethyl sulfoxide (80 %) was used as negative control.

Statistical analysis

All the procedures for extraction and antioxidant studies were repeated in triplicate. The results were expressed as means± standard deviation of three parallel replicates. All data of the DPPH assay were analyzed statistically by one-way analysis of variance (ANOVA) using Microsoft Excel. A *p-value* of less than 0.05 was considered statistically significant.

Results and discussion

Solvent screening

The most critical steps of the extraction of bioactive compounds in phytochemical research are the drying temperature of plant material and solvent selection [23]. The effect of different factors, such as solvent polarity, temperature, and time on the extraction efficiency can be independent or coupled [24]. For different drying methods, our previous studies [10] and research made by other authors demonstrated that freeze-drying may avoid the loss of valuable chemical components when compared to other conventional methods [25]. In this study, the effect of different solvents, methanol and DMSO, used for the extraction in the same concentration of 80%, on antioxidant activity and antibacterial activity of plant root extract was assessed (see Fig. 1).

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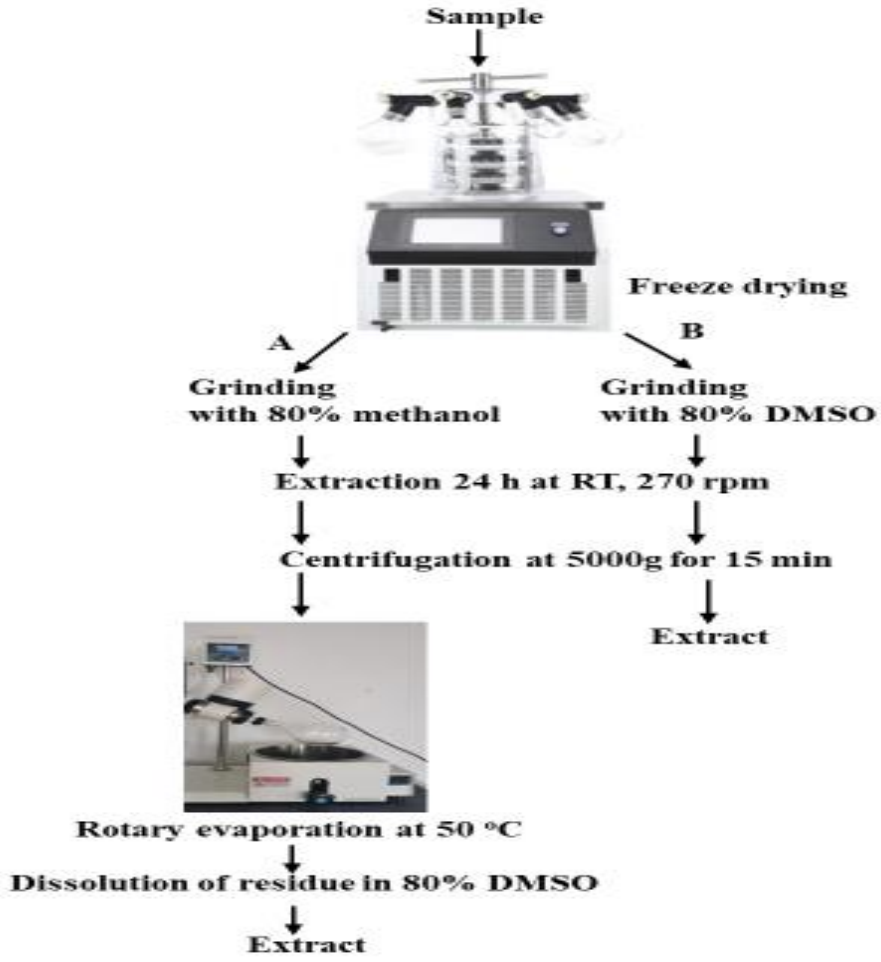

Fig. 1. Two extraction schemes, used in the study. A – extraction of plant material with 80% methanol, B - extraction of plant material with 80% DMSO.

Antioxidant assay -DPPH free radicals scavenging effect.

In the study for the determination of the antioxidant activity of root extracts DPPH assay, which is a rapid and efficient method used for the evaluation of the free radical scavenging activity of medicinal plants [26] was used. Analysis of plant samples against DPPH free radicals revealed that the polarity of the extracting solvent affects DPPH scavenging activity in *Paeonia daurica* subsp. *mlokosewitschii* and *Sempervivum transcaucasicum* roots extract. The comparison of DPPH scavenging activity demonstrated that DPPH scavenging activity was higher in roots of both species, extracted with 80% methanol in comparison with samples extracted with DMSO (Fig. 2 A and B). The *Paeonia daurica* subsp. *mlokosewitschii* roots extracted with 80% methanol were most effective causing 40.01 ± 1.8 % scavenging at 10 mg/ml concentration (Fig. 2 A). At the same concentration *Paeonia daurica* subsp. *mlokosewitschii* roots extracted with 80% DMSO caused 18.50 ± 0.92 % scavenging (Fig. 2 A). The DPPH scavenging ability of *Sempervivum*

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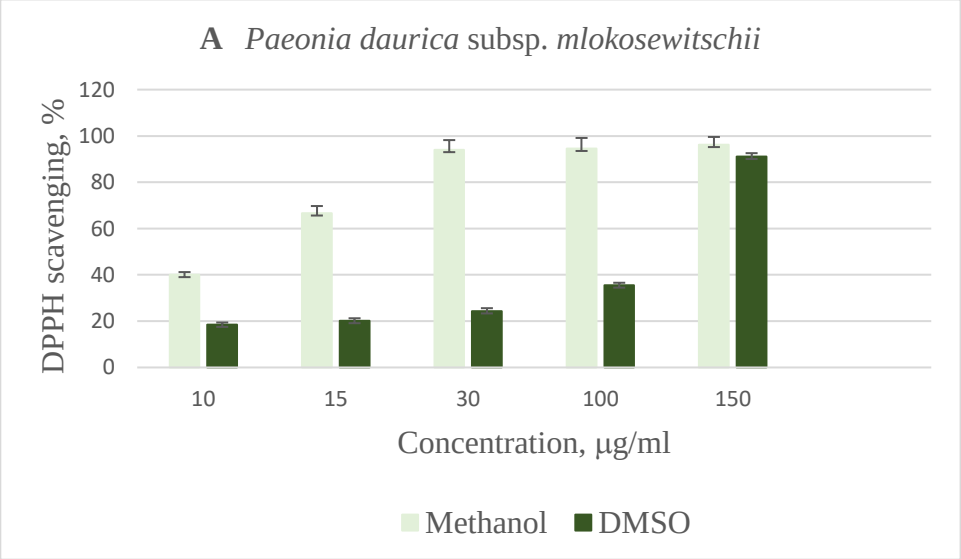
transcaucasicum roots was significantly lower: 5.10 ± 0.44 % scavenging at 15 mg/ml concentration for roots extracted with 80% methanol and 2.11 ± 0.01 % scavenging at 15 mg/ml concentration for roots extracted with 80% DMSO (Fig. 2 B). Median inhibitory concentrations (IC_{50}) were 10.34 ± 0.75 and 30.14 ± 1.37 µg/ml for *Paeonia daurica* subsp. *mlokosewitschii* roots extracted with 80% methanol and 80% DMSO, respectively (Fig. 3C). The IC_{50} values were significantly higher for *Sempervivum transcaucasicum* roots extracted with 80% methanol and 80% DMSO and comprised 161.71 ± 2.58 and 367.21 ± 35.86 µg/ml, respectively.

One-way analysis of variance (ANOVA) of the results obtained for the methanol and ethanol extracts showed that DPPH scavenging activity of *Paeonia daurica* subsp. *mlokosewitschii* and *Sempervivum transcaucasicum* roots were significantly influenced ($p<0.05$) by increasing the polarity of extracting solvent.

Our findings are consistent with previously published results, demonstrating that high-polarity solvents such as ethanol, water, acetone, and methanol are extensively used to extract antioxidant compounds [23], [27], providing a high yield of polar molecules like phenolic and flavonoid components in plant extracts [28]. The abundance of phenolic compounds and their exact positions also have a considerable impact on antioxidant activity [29]. The concentration of phenolic compounds was correlated with the DPPH and the ferric-reducing antioxidant power (FRAP) assay [30], [31]. Based on the results of our study, it can be suggested that extraction with methanol provides efficient recovery of phenolic compounds, contributing to the high antioxidant activity of extracts.



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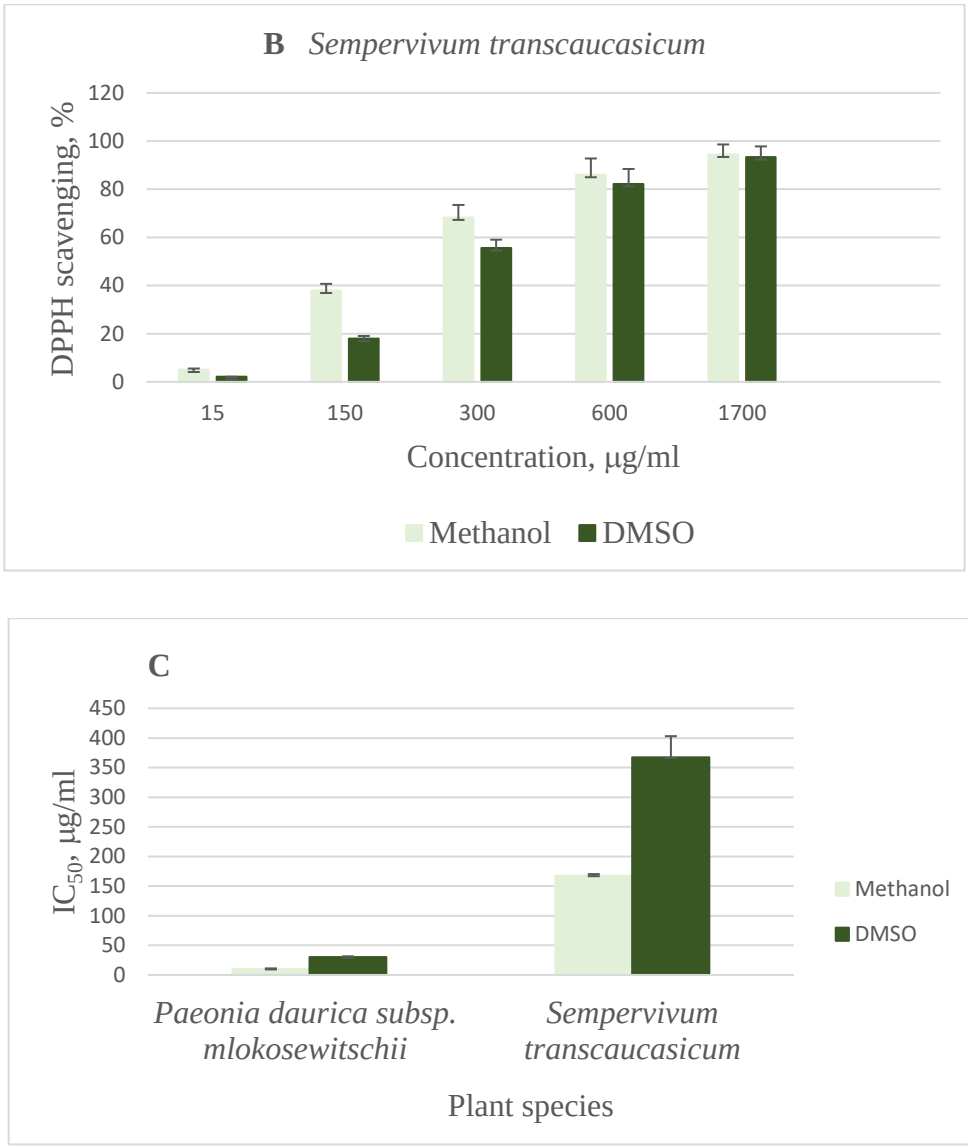

Fig. 2. Antioxidant potential of *Paeonia daurica* subsp. *mlokosewitschii* and *Sempervivum transcaucasicum* root extracts using DPPH assay.

A. *Paeonia daurica* subsp. *mlokosewitschii* roots extracted with 80% methanol or 80% DMSO. **B.** *Sempervivum transcaucasicum* roots extracted with 80% methanol or 80% DMSO. **C.** IC_{50} values of *Paeonia daurica* subsp. *mlokosewitschii* and *Sempervivum transcaucasicum* roots extracted with 80% methanol or 80% DMSO. Values represent % radical scavenging (mean ± SD) from three independent experiments.

Antibacterial activity. The *in vitro* antibacterial activity of the studied *Paeonia daurica* subsp. *mlokosewitschii* and *Sempervivum transcaucasicum* root extracts against *E. coli* ATCC 25922 were determined using disk diffusion assay (Fig. 3, Table 1). At the lowest concentration (100 mg/disk) of extracts used, the highest mean of inhibition zone was recorded for *Paeonia daurica* subsp. *mlokosewitschii* root samples, extracted using 80% methanol (15.66 ± 0.58 mm), followed by *Paeonia*

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daurica subsp. *mlokosewitschii* root samples, extracted using 80% DMSO (12.33 ± 0.58 mm) (Fig. 3A, Table 1). At a concentration of 100 mg/disk, the same lowest mean diameter inhibition zones were recorded for *Sempervivum transcaucasicum* root extracts obtained using 80% methanol or DMSO (6.66 ± 0.58 mm) (Fig. 3B, Table 1).

The same pattern of antibacterial effect was observed for a concentration of 150 mg/disk, the highest mean of inhibition zone was recorded for *Paeonia daurica* subsp. *mlokosewitschii* root samples, extracted using 80% methanol (16.66 ± 0.58 mm), followed by *Paeonia daurica* subsp. *mlokosewitschii* root samples, extracted using 80% DMSO (15.33 ± 0.58 mm). Simila Similarly with a concentration of 100 mg/ disk, the concentration of 150 mg/disk resulted in the lowest mean diameter inhibition zone revealed for *Sempervivum transcaucasicum* root extracts obtained using 80% methanol or DMSO (6.66 ± 0.58 mm).

At the highest extract concentration of 200 mg/disk, the highest mean diameter was recorded for *Paeonia daurica* subsp. *mlokosewitschii* root samples, extracted using 80% methanol (17.33 ± 0.58 mm), followed by *Paeonia daurica* subsp. *mlokosewitschii* root samples, extracted using 80% DMSO (16.33 ± 1.53 mm) and *Sempervivum transcaucasicum* root extracts obtained using 80% methanol (16.00 ± 1.00 mm) and DMSO (11.66 ± 0.58 mm). The antimicrobial activity of studied root extracts against *Escherichia coli* ATCC 25922 was significant in all experimental groups compared to 0 mg/mL ($p < 0.05$).

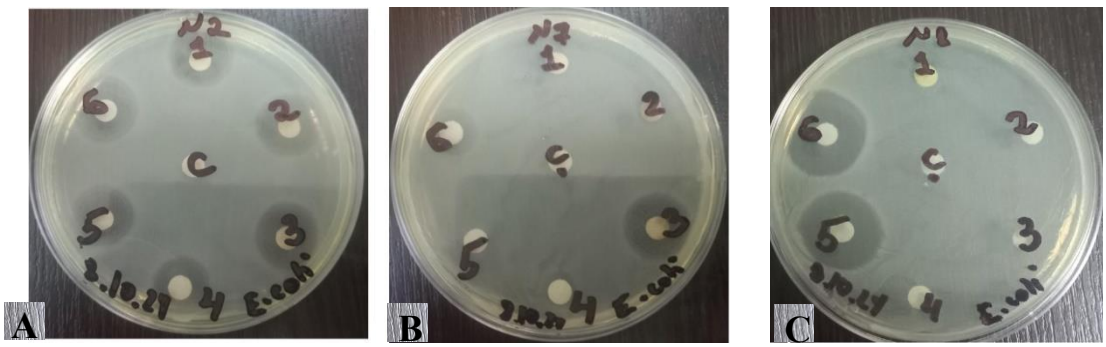

Fig. 3. Inhibition zone test results

A. Extracts of *Paeonia daurica* subsp. *mlokosewitschii* roots, 1 - 100 mg/disk extract in 80% methanol, 2 - 150 mg/disk extract in 80% methanol, 3 - 200 mg/disk extract in 80% methanol, 4 - 100 mg/disk extract in 80% DMSO, 5 - 150 mg/disk 6 - 100 mg/disk extract in 80% DMSO, c - control, 5 ml of 80% DMSO.

B. Extracts of *Sempervivum transcaucasicum* roots, 1- 100 mg/disk extract in 80% methanol, 2 - 150 mg/disk extract in 80% methanol, 3 - 200 mg/disk extract in 80% methanol, 4 - 100 mg/disk extract in 80% DMSO, 5 - 150 mg/disk

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extract in 80% DMSO, 6 - 100 mg/disk extract in 80% DMSO, c – control, 5 ml of 80% DMSO.

C. Control, 1- 10 ml of 80% DMSO, 2- 15 ml of 80% DMSO, 3- 17.5 ml of 80%DMSO, 4 - 20 ml of 80% DMSO, 5 -20 mg/ mg/disk Amoxicillin, 6 - 30 mg/disk Amoxicillin, c – control, 5 ml of 80% DMSO.

Table 1. Antibacterial efficiency of extracts of *Paeonia daurica* subsp. *mlokosewitschii* and *Sempervivum transcaucasicum* roots against *Escherichia coli* ATCC 25922.

Plant species/controls	Extraction solvent	Concentration	IZ diameter, mm
Paeonia daurica subsp. *mlokosewitschii*	80 % methanol	100 mg/disk	15.66 ± 0.58
		150 mg/disk	16.66 ± 0.58
		200 mg/disk	17.33 ± 0.58
	80% DMSO	100 mg/disk	12.33 ± 0.58
		150 mg/disk	15.33 ± 0.58
		200 mg/disk	16.33 ± 1.53
Sempervivum transcaucasicum	80 % methanol	100 mg/disk	6.66 ± 0.58
		150 mg/disk	6.66 ± 0.58
		200 mg/disk	16.00 ± 1.00
	80% DMSO	100 mg/disk	6.66 ± 0.58
		150 mg/disk	6.66 ± 0.58
		200 mg/disk	11.66 ± 0.58
Positive control	Amoxicillin	10 mg/disk	20.67 ± 0.57
		20 mg/disk	25.17 ± 0.29
Negative control	80% DMSO		0

The obtained results for the first time demonstrate the antibacterial activity of DMSO and methanol extracts of *Paeonia daurica* subsp. *mlokosewitschii* and *Sempervivum transcaucasicum* roots. It should be noted that the results are consistent with findings, demonstrating significant antibacterial activity of other *Paeonia* species. Thus, *Paeonia emodi* whole plant extracts prepared using different extraction solvents (hexane, ethyl acetate, chlorophorm) inhibited the growth of *E. coli* [32]. The extracts of *Paeonia wendlboi* roots obtained by Soxhlet extraction method also exhibited significant activity against *E. coli* [33]. The information on the antibacterial activity of *Sempervivum transcaucasicum* is not available in the literature. The methanolic root extracts of both plants exhibited higher antibacterial activity, than DMSO extracts.

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Conclusions

This study for the first time evaluated the biological activities of root extracts of Georgian medicinal plants *Paeonia daurica* subsp. *mlokosewitschii* and *Sempervivum transcaucasicum* obtained by different extraction methods. According to the obtained results, the activities of the extracts varied depending on the employed methods of extraction. The highest antioxidant activity accessed based on anti-DPPH potential was achieved in the methanolic root extracts of both plants, which were rotary evaporated and dissolved in 80% DMSO. The analysis of antibacterial activity against *E. coli* revealed that the highest potential to inhibit bacterial growth was also achieved in the methanolic root extracts of both plants. The methanolic root extracts of *Paeonia daurica* subsp. *mlokosewitschii* exhibited significantly higher antioxidant and antibacterial activities in comparison with *Sempervivum transcaucasicum* root extracts. The results of the study suggest that root extracts of *Paeonia daurica* subsp. *mlokosewitschii* could be used as effective functional ingredients of pharmaceutical products, as they possess prominent antioxidant and antibacterial activities.

სხვადასხვა ექსტრაქციის მეთოდით მიღებული ქართული სამკურნალო მცენარეების ფესვის ექსტრაქტების ანტიოქსიდანტური და ანტიბაქტერიული მოქმედება

ვალენტინა მიტოვა[1,2*], ზურაბ რ. ცეცხლაძე[1,2], ხათუნა მაკალათია[1], როზა ბიძინაშვილი[3], თორნიკე მინდიაშვილი[1,2], მარიამ კობიაშვილი[1,2], ჯოვანი ნ. როვიელო[1,4].

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[4] ბიოსტრუქტურებისა და ბიოგამოსახულების ინსტიტუტი, იტალიის კვლევის ეროვნული საბჭო (IBB-CNR), რიცერკას ტერიტორია და სათაო ოფისი, ვია პიეტრო კასტელინო 111, 80131, ნეაპოლი, იტალია.

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აბსტრაქტი

კვლევა ჩატარებულია სხვადასხვა ექსტრაქციის გამხსნელების (მეთანოლი და DMSO) გავლენის შესასწავლად *Paeonia daurica subsp*-ის ფესვის ექსტრაქტის ბიოლოგიურ აქტივობაზე. *mlokosewitschii (Lomakin) D. Y. Hong* და *Sempervivum transcaucasicum Muirhead.* ექსტრაქტების ანტიოქსიდანტური აქტივობის *In vitro*

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შეფასება განხორციელდა 2,2-დიფენილ-1-პიკრილჰიდრაზილის გამოყენებით (DPPH ანალიზები), ხოლო მათი ანტიბაქტერიული აქტივობა შემოწმდა Escherichia coli ATCC 25922 შტამის წინააღმდეგ. მიღებული შედეგების ანალიზმა აჩვენა, რომ ყველაზე მაღალი ანტი-DPPH პოტენციალი და უმაღლესი ანტიბაქტერიული აქტივობა მიღწეულია ორივე მცენარის მეთანოლის ფესვის *ექსტრაქტებში. Paeonia daurica subsp-*ის მეთანოლის ფესვების ექსტრაქტები. *mlokosewitschii*-მ აჩვენა, რომ მათში მნიშვნელოვნად მაღალია ანტიოქსიდანტური და ანტიბაქტერიული აქტივობა *Sempervivum transcaucasicum* ფესვის ექსტრაქტებთან შედარებით. კვლევის შედეგებმა მიუთითა *Paeonia daurica subsp.mlokosewitschii*-ის ფესვის ექსტრაქტების მიზანშეწონილ გამოყენებაზე ფარმაციაში.

საკვანძო სიტყვები: *Paeonia daurica subsp. mlokosewitschii (Lomakin) D. Y. Hong, Sempervivum transcaucasicum* Muirhead, ექსტრაქციის მეთოდები, ანტიოქსიდანტური აქტივობა, DPPH ანალიზი, ანტიბაქტერიული აქტივობა, E. coli.

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Original Research

Simulation in Medicine: A Boone or a Bane?

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Abstract

Living through the pandemic years has enlarged our perspective on significance of technology and technologically driven services such as Artificial Intelligence, Virtual Reality, Augmented Reality, and the rest of the Internet of Things (IoT). Advances in AI and its employment in healthcare especially in the form of simulation technology, has made revolutionary changes in rendering effective medical training with many educational institutions modifying their conventional approaches in order to impart better clinical knowledge and practice to students in their pre-clinical years. The purpose of this study was to gain an insight into the student's viewpoints and preferences with respect to simulation technology over real-time clinical training. An online survey was conducted in February 2023 and data on perception towards simulation technology was collected using a self-administered questionnaire with responses in a 5-point Likert's scale. A reliability test was performed between the items of various variables using the SPSS program version 29.0.0.0 A poll from 200 participants was received and evaluated, and it demonstrated a favorable attitude towards the use of simulation in medical training, particularly in terms of practicing clinical skills, gaining confidence, and learning comfort. The effectiveness of this technology in dealing with infectious, urgent, or atypical patients however, remains unclear and disputed. Although simulation technology is seen as a beneficial supplementary aid for medical training, its advantages over traditional training remain debatable due to the limitations posed by it; thereby, emphasizing the importance of a multimodal approach in training.

Keywords: Artificial Intelligence, medical training, multidisciplinary approach, simulation technology, clinical experience, learning comfort.

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Introduction

Medicine is an ever-evolving field that demands up-to-the-minute interventions, ranging from laboratory work, diagnostics to surgical procedures. Despite the fact that all professional competencies have recently undergone a huge technological revolution, the application of technology, notably in medicine, has been exemplary. The pandemic years have helped us solidify our understanding of the importance of internet and its related services particularly, in accomplishing routine tasks in the most ingenious ways such as attending universities, hosting medical conferences, initiating research studies, and providing patient consultations, amongst many other things. The soaring potential of certain technologies like Virtual reality (VR), Augmented Reality (AR); Extended Reality (ER) and many more in medical science has compelled us to inculcate a bimodal mode of learning who aims at tackling certain inconveniences that are otherwise faced during conventional learning.[1] There is no clear demarcation of specific-technology associated advantages in educational settings as they can be interchangeably used with each other to aid in the training process.[2-3] Of all these technologies as for example, growing ethical concerns especially with respect to students and residents practicing on real patients as part of their training has lately prompted a call for an alternative that would fill the educational gap produced by these blunders.[4] Moreover, for elucidating the "Medical educators dilemma," a solution aimed not only at addressing ethical concerns of clinical

Practice but also at providing adequate clinical skills and precision was required, thereby introducing the use of simulators for not only undergraduate medical studies but also post-graduate specialty courses.[5]

Medical simulators strive to replicate real patients, physiological processes, or typical clinical events in pre-programmed environments to improve learning quality and comfort.[6] Its main accomplishment lies in overcoming general and ethical concerns about cadaveric dissections, patient safety and availability, recurring medical errors, exhaustive clinical trainings and so on. A simulator exposes professionals/students to pre-programmed clinical scenarios, allowing them to reflect on their theoretical knowledge and utilize it through means of practical demonstration, allowing them to make mistakes without endangering any patients or their professional identity.[7] It allows for the teaching of invasive procedures like intravenous drip placement, intubation, bronchoscopy, suturing, biopsies, and much more with ease, which in contrast; are exceedingly difficult, unrepeatable, and unpleasant if and when performed on real patients. It also exposes and familiarises the students/resident doctors to rare clinical scenarios which would be otherwise difficult to encounter on routine practice.[8-9] Furthermore, it ensures the provision of a risk-free

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environment for both; the patient as well as the physician thereby promoting maximum learning opportunities.[10] According to a recent study, residents practicing laparoscopic and resuscitation procedures on simulation dummies had greater surgical proficiency skills and were greatly benefitted in contrast to those educated through observational learning.[11-13] Simulation has widened our training scopes and has demonstrated a good, pragmatic impact in a multitude of medical training domains ranging from complex surgical competencies to nursing programs.[8] Their precision in delivering technical and practical skills has been appreciated in various field of medicine including internal medicine, Family medicine, critical care, rehabilitation and so on.[14] With further advancements, simulation is expected to be a reliable tool in the future for improving communication, teamwork, and other intrapersonal and interpersonal skills.

Currently, a wide range of simulators Have been developed, including a) Part-task trainers, b) Computer-enhanced mannequins (CEMs), c) Virtual reality (VR) simulators, and d) CAVE simulators (cave automatic virtual environment), with the former being relatively inexpensive and widely employed for the undergraduate training courses.[9,15] Regardless of their differences, the aforementioned tech-savvy interventions play an important part in developing students' capacities to deal with real-life emergency circumstances and aids in competency assessment.[16] Given the complexity and uncertainty of this profession, ofcourse, the experience provided by a simulator solely cannot and should not be considered sufficient in training future doctors;[17] however, other factors such as engineering limitations, cost, time constraints, and variable psychometric requirements also play a critical role in marking its limitations.[18]

Variables impacting the use of simulators

One of the clearest examples of the value of technology driven education is the use of simulation in aviation training. Flight simulators are critical for educating the next generation of pilots and familiarizing them with their sophisticated gear.[19] Utilizing a similar concept, medicine too has modified its approach from "Conventional mentor/observational training" to "AI supported clinical training." Pre-programmed clinical setups, according to a survey, considerably aid in student learning and, on a broader scale, Improve physicians' accuracy, confidence, management, and analytical skills when contrasted to chaotic unplanned conditions experienced in clinics.[20] As of now, the following are some of the pressing factors motivating us to advocate for simulation technology: a) a lack of physician availability (due to their own occupational commitments); b) significant time constraints, particularly when it comes

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to educating in emergency situations; c) patient safety; d) cost; e) unbefitting hospital affiliations; f) an increased likelihood of encountering medical errors and g) Certain ethical concerns as previously indica concerns as previously indicated.

Benefits and Flaws of Incorporating Simulation Technology

Simulation supports medical training in a variety of ways, with (Figure 1) illustrating some of the key benefits and drawbacks of this technology. Aside from ensuring patient safety, one of the most significant benefits is 3D visualization of the body's organ systems, which allows for better anatomical understanding and the development of newer surgical approaches when dealing with patients. Simulators can also be used to address patients' anxieties about surgeries or surgical procedures by allowing them to pre-witness the surgical experience using virtual technology.[21-22] Surgeons, particularly those who practice microsurgery, such as neurosurgeons, ophthalmic surgeons, orthopaedic susurgeons oncologists, laparoscopic laparos surgeons, and others, benefit greatly from simulators in terms of developing practice, estimating location, evaluating the content, and developing patient-centered treatment/surgical approaches.

In terms of students and medical and medical institutions, simulation effectively addresses challenges such as extended clinical training hours, lecturer unavailability, and handling extensive patient data, ethical concerns regarding repeated learning of clinical skills.[23-24]

Some institutions have also viewed this This technology as a "One-time heavy investment" due to the high set-up costs associated with implementation.[24]

However, as we move toward a bimoda learning trend, the future prospects offered by this technology appear profitable and convincing.[22]

DOI: 10.56580/GEOMEDI49

Figure 1: Discusses the advantages and disadvantages of simulation in medicine.

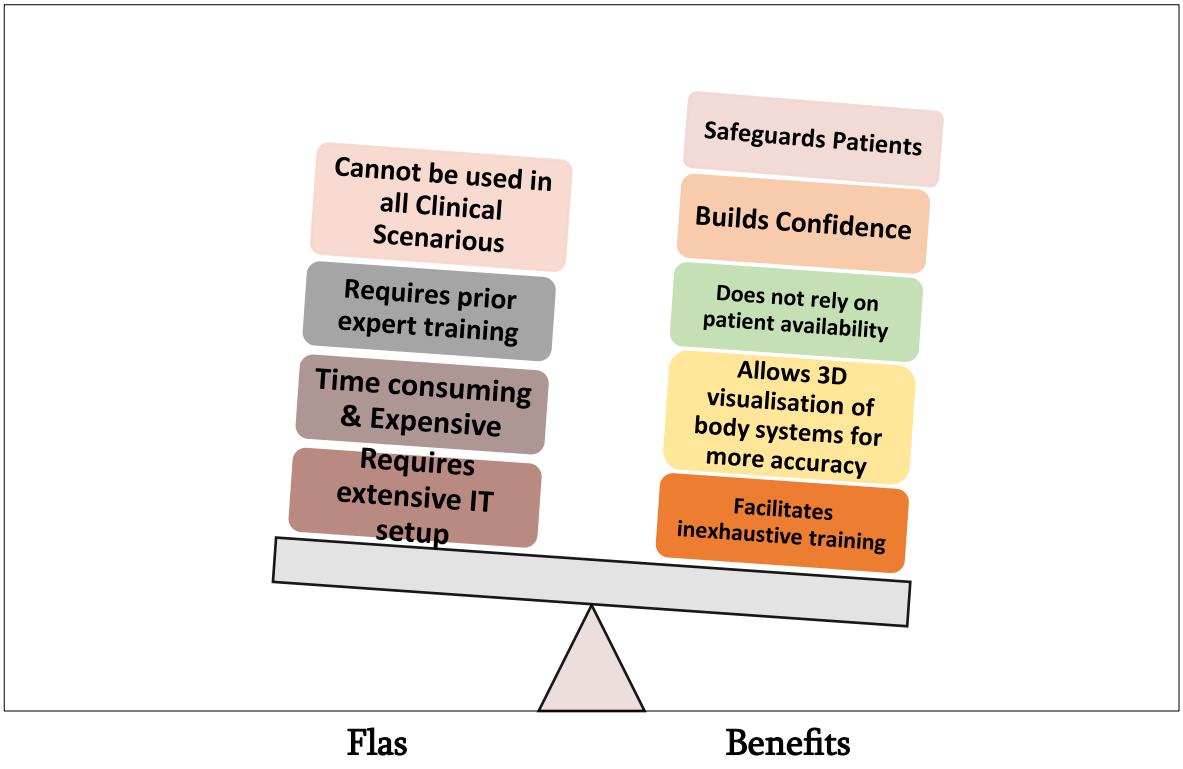

Figure 1: The following figure compares the benefits and flaws of implementing simulation technology in medical training. The benefits offered however, outweigh the flaws making it a reliable tool for educational training.

Materials and Methods

Assessing students' viewpoints and evaluating their acceptability of simulation technology was the primary purpose of our research. An online questionnaire-based survey supplemented our study. Our questionnaire included fifteen closed-ended items, where five each measured one of three variables: a) Students' Perceptions b) Perceived advantages of technology and c) Students' Preferences. The questionnaire was created using Google forms and distributed to students via email and other social networking sites. A four-point Likert scale was used to score responses to the questions, which varied from strongly agree, agree, disagree, to strongly disagree, with strongly agree assessed with a maximum of 4 points and strongly disagree graded with a minimum of point 1. A total of 200 responses were received from participants studying across various countries. The data was collected and a reliability test was performed between the variables using the SPSS program version 29.0.0.0; the rest of the analysis was carried out by reviewing the graphs obtained through the survey. The outcomes were produced, and conclusions were expressed.

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Table 1. Research Questions for the Study

Variable 1: Assessing Students' Perception

RQ1 Do you believe that training in real-world scenarios provides a professional/clinical benefit over training in controlled conditions (simulation labs)?

RQ2 The use of simulation models in certain medical specialties like infectious diseases is highly questionable

RQ3 Physicians trained in simulation clinics might not be able to handle stressful situations that regularly arise in the hospital settings

RQ4 You would rather trust in a physician who has completed the most of his physical OPD visits over one who has been training on simulation dummies

RQ5 One of the major drawbacks of employing AI over real-time exposure is the lack of development of interpersonal and communication skills

Variable 2: Assessing the perceived advantages of Simulation

RQ1 Practicing on simulation dummies gives same level of accuracy as practicing on a real patient

RQ2 Physicians establish confidence and sense of control over their practice when they perform clinical procedures using simulation models

RQ3 AI clinics facilitate better learning comfort and customization in contrast to real-time training

RQ4 Working with simulators offers you the ability to make mistakes without endangering patient safety

RQ5 A doctor trained in simulated clinics can possess comparable clinical judgement skills as those trained in hospitals

Variable 3: Assessing Students' Preferences

RQ1 Simulation clinics are an essential part of medical training

RQ2 Adding a dual teaching method (RT exposure + simulation) would improve academic performance in medical training

RQ3 The usage of cutting-edge 3D tables is substantially preferable over traditional dissection for learning fundamental courses like anatomy and surgery?

RQ4 Mark best suited preference for following scenarios - Symptom based learning

RQ5 Mark best suited preference for the following scenario – Developing interpersonal skills

DOI: 10.56580/GEOMEDI49

Results

Realibility is a measure of internal consistency of the constructs in the study. A construct is reliable if the Alpha (α) value is greater than 0.70. Construct reliability was asessed using Cronbach's Alpha. The results revealed that the Students' Perceptions scale with five items (α = .721) and Perceived Benefits of Technology with five items (α = .749) were found reliable. Similarly, student's preferences scale with five items was also found reliable (α = .756). Reliability tests are summarised in table below.

Table 2: Shows the Cronbach's Alpha of the items in various constructs. Items with α values of .70 or higher are considered reliable. The items in the aforementioned structures have an alpha value greater than 0.70 and are hence reliable.

Constructs	No. of Items	Alpha (α)
Student Perceptions' (SP)	5	.721
Perceived Benefits (PB)	5	.749
Students' Preferences	5	.756

Graphical Analysis

For Variable 1

The results obtained in this section revealed opposing views on real-time training versus simulation training. Numerous responses were seen supporting RT training for its effectiveness in handling emergency Situations, atypical clinical scenarios, and infectious outbreaks, underlining the importance of a physical approach in clinics. However, participants were also seen upvoting the usage of simulation, stressing the need for a blended training strategy.

Table 3a: Highlights the results obtained by graphical analysis for Variable 1.

Questions	Strongly Agree (%)	Agree (%)	Disagree (%)	Strongly Disagree (%)
RQ1	56.3	39.7	4	-
RQ2	25.6	58.3	14.6	1.5
RQ3	39.7	44.2	15.6	.5
RQ4	37.2	52.3	10.6	-
RQ5	39.2	50.8	8.5	1.5

DOI: 10.56580/GEOMEDI49

For Variable 2

The perceived advantages of employing simulation technology were examined by variable 2. When it came to learning on simulators, students overwhelmingly preferred aspects like building confidence, learning comfort, customization, and patient safety. However, there were some differences regarding having equal clinical judgement skills when comparing the two modalities, considering the practical experience aspect when it came to clinical decision-making.

Table 3b: Highlights the results obtained by graphical analysis for Variable 2.

Questions	Strongly Agree (%)	Agree (%)	Disagree (%)	Strongly Disagree (%)
RQ1	7	20.6	49.7	22.6
RQ2	17.1	51.8	23.1	8
RQ3	16.6	46.2	28.6	8.5
RQ4	33.2	57.3	8.5	1
RQ5	12.6	46.7	30.7	10.1

For Variable 3

This component evaluated students' learning preferences, with the majority of Participants preferring a dual mode of education that comprised both modalities (RT training+ simulation technologies).

Table 3c: Highlights the results obtained by graphical analysis for Variable 1.

Questions	Strongly Agree (%)	Agree (%)	Disagree (%)	Strongly Disagree (%)
RQ1	61.3	36.7	1.5	.5
RQ2	63.8	33.7	2.5	-
RQ3	34.7	35.2	24.6	5.5
RQ4	RT Training (163) and Simulation (36)			
RQ5	RT Training (173) and Simulation (26)			

Incorporation of VR Technology in Educational Curriculum

In July 2024, University Geomedi officially integrated VR Technology into their educational program for MD Faculty of Medicine students thereby, contributing to cutting-edge academic accomplishment. Multiple VR sets were procured and installed in the simulation lab, assisting in the delivery of high-end academic Competency in the areas of anatomikal study, surgical skills, intensive care unit simulation, laboratory work, and OSCEs. With the cooperation of the university faculty and students, a de novo teaching and learning technique has been implemented with the goal of not only meeting higher academic standards but also developing better practitioners of tomorrow.[25]

DOI: 10.56580/GEOMEDI49

Conclusion

With the progressive technological advancements, simulators have become an integral part of medical training making it necessary for the educational model to modernize. The change from observational learning to practical training supported by AI has improved the performance capabilities of students giving them the correct exposure in their preclinical years. Although the use of simulators in dealing with certain medical competencies or clinical circumstances is still debatable, it plays a crucial role in safeguarding patient's safety, which is frequently compromised in unsupervised settings. Simulations are Moving closer to being fundamental instruments for instructing and assessing students, and in no more time, they may surpass their technical constraints to support the teaching of other interpersonal and social skills. However prime, they still may never completely replace conventional clinical training considering the occult nature of the human body and uncertainty of this profession. Given that "Medicine is a field beyond mathematics," the use of real-time physical training and simulators is equally crucial for enabling the physician to handle any type of clinical scenarios under any given circumstances thereby, providing the patient with the best possible healthcare services and treatment.

სიმულაცია მედიცინაში: სარგებელი თუ ზიანი?

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აბსტრაქტი

პანდემიის წლების პერიოდში, ცხოვრებამ გააუმჯობესა ჩვენი პერსპექტივა ტექნოლოგიებისა და ტექნოლოგიურად ორიენტირებულ ისეთ სერვისებთან დაკავშირებით, როგორიცაა ხელოვნური ინტელექტი, ვირტუალური რეალობა, გაძლიერებული რეალობა და სხვა ინტერნეტმანიპულაციები. ხელოვნური ინტელექტის განვითარებამ და მისმა გამოყენებამ ჯანდაცვაში, განსაკუთრებით სიმულაციური ტექნოლოგიის სახით, რევოლუციური ცვლილებები მოახდინა შედეგიანი სამედიცინო ტრენინგების ჩატარებაზე. მრავალმა საგანმანათლებლო დაწესებულებამ შეცვალა მოძველებული ტრადიციული მიდგომები, რათა უკეთესი

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კლინიკური ცოდნა და პრაქტიკა გადაეცათ სტუდენტებისათვის წინაკლინიკურ წლებში.

კვლევის მიზანს წარმოადგენდა სტუდენტის შეხედულებებისა და პრეფერენციების გააზრება სიმულაციურ ტექნოლოგიებთან მიმართებაში, თანამედროვე რეალობაში, კლინიკური ტრენინგების მიმდინარეობისას. ონლაინ გამოკითხვა ჩატარდა 2023 წლის თებერვალში და მონაცემები სიმულაციური ტექნოლოგიების აღქმის შესახებ შეგროვდა თვითადმინისტრირებული კითხვარის გამოყენებით, 5-ბალიანი ლიკერტის შკალის პასუხებით. ჩატარდა სანდოობის ტესტი სხვადასხვა ცვლად ერთეულებს შორის SPSS პროგრამის 29.0.0.0 ვერსიის გამოყენებით. მიღებული და შეფასებული იქნა 200 მონაწილის გამოკითხვა, რამაც აჩვენა დადებითი დამოკიდებულება სამედიცინო ტრენინგში სიმულაციის გამოყენების მიმართ, განსაკუთრებით, კლინიკურ პრაქტიკაში, უნარები, თავდაჯერებულობის მოპოვება და სწავლის კომფორტი. თუმცა, ამ ტექნოლოგიის ეფექტურობა ინფექციურ, გადაუდებელ ან ატიპიურ პაციენტებთან ურთიერთობისას, გაურკვეველი და სადავოა. მიუხედავად იმისა, რომ სიმულაციური ტექნოლოგია განიხილება, როგორც სასარგებლო დამატებითი დახმარება სამედიცინო ტრენინგისთვის, მისი უპირატესობები ტრადიციულ ტრენინგებთან შედარებით, სადებატო რჩება, გამოთქმული შეზღუდვების გამო, რაც ხაზს უსვამს სწავლების მულტიმოდალური მიდგომის მნიშვნელობას.

საკვანძო სიტყვები: ხელოვნური ინტელექტი, სამედიცინო ტრენინგი, მულტიდისციპლინური მიდგომა, სიმულაციური ტექნოლოგია, კლინიკური გამოცდილება, სწავლის კომფორტი.

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Original Research

Social Media Use and its impact on mental health among adolescents: A cross sectional study of Kathmandu

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Abstract

Background: Numerous studies have highlighted the link between excessive social media use and negative mental health outcomes.

Purpose: to identify the impact of use of social media among adolescents' studying in secondary schools of Kathmandu.

Methods: Cross sectional study design was used to identify the impact of use of social media among adolescents' studying in three secondary schools of Kathmandu. Students of aged 13 to 17 studying in class 8, 9 and 10 who consented to participated and available during time of data collection were selected purposively with the sample size of 327. Self-administered questionnaire developed on extensive literature reviewed consisting of socio-demographic information and social media use information in part one, impact of social media usage on mental health outcome in part two and also part three consisted of standard tool of Generalized Anxiety Disorder-7 (GAD-7). Ethical clearance was obtained from Institutional Review Committee (IRC), YHSA (2079-080-281). Frequency, percentage, mean and standard deviation were calculated for descriptive statistics as well as the Chi-square test was used for inferential statistical analysis of data using SPSS version 26.0.

Findings: Among 327 respondents participated, more than half were between 13-15 years with almost same percentage of male and female. Participants (43.4%) favour Facebook and 49.5% begin using social media at ages 9-12 years. More than half of the respondents (52.3%) use social media for 1-3 hours, while 34.6% use it for more than 4-6 hours. This study resulted half of the respondents (50.8%) had minimal anxiety, while 30.6% were experiencing mild anxiety. There has a significant relationship between the duration of social media use and sleep alteration, disruption of morning activities, change in behaviour, distraction in work or study, portrayer in certain image and anxiety among secondary level students in Kathmandu at p-value <0.05.

Research Limitation/Practical Implication: These findings underscore the urgent need for targeted interventions aimed at mitigating the negative impacts of excessive social media usage on adolescent mental health.

Originality/Value: This study explore the association between social media use and its impact in mental health aspects which includes alteration in sleeping patterns, disruption in regular morning activities, distraction in work or study, change in

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behavior, media portray of image, experience of cyber bullying and anxiety in Nepali secondary level students.

Keywords: Social Media Use, Impact, Mental Health

Background

Around 5.04 billion people spend time in social use worldwide with 75 million being teenagers [1]. In context of Nepal, 43.5% of total population that is 13.40 million people use social media as per data on January 2024[2]. Among them, the younger people between 16-24 aged are active social media users. As Meta and other social media only allows age above 15 for using social media, exact data of adolescents using social media could not be identified[2].

Typical active social media user spends more than 2 hours per day [1,2], which is excessive than the recommended daily screen time for adolescents as per Center for disease control and prevention guidelines [3]. Since 2022, there has been an increase in the excessive usage of social media among adolescents in Europe, Central Asia, and Canada [4]. A survey from USA on 2023 revealed that 37 % of teens spend 5 hours per day on using social media like youtube, TikTok and instagram [5,6], whereas in Nepal 43.6% of teens spent 4–8 hours per day on social media using youtube, facebook, instgram and TikTok [7].

Numerous studies have highlighted the link between excessive social media use and negative mental health outcomes [3, 6, 7, 8, 9]. A survey conducted in USA 2023 has showed that 41% of active social media users teens feel that their **overall mental health** as being **poor or very poor** [10].

Studies in China, India and Nepal have linked detrimental effects like anxiety, despair, low mental health indicators [7, 9, 11, 12].

Problematic social media use has decreased available time for study, work and sleep. Teenagers in Nepal who use social media excessively have been linked to addictive behaviours and difficulties in their academic careers [13, 14] which raise serious concerns about how it may affect teens' general wellbeing and ability to strike a healthy balance between online and offline activities [15].

Likewise, Pre sleep using of social media might disrupted sleep pattern as they might feel something might be missing leading in frequent waking to check updates [16]. Notably, 36% of teenagers say they wake up at least once throughout the night to check their gadgets, and 40% say they use a mobile device within five minutes of going to bed [17]. Sleep quality and quantity could also be affected by levels of anxiety and worry resulting from experiences of online harassment [16, 17].

Indulgence on excessive online activities has been subjected to experience of threats, derogatory remarks, and harassment. Cyber bullying has been associated with low mental health outcomes [19, 20, 21].

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Highlighting one positive side of life in social media has led to upward comparison and many find difficult to cope with idealized images of social media which has led to feeling of inadequacy and feeling of unfavourable opinions of their bodies [22]. Studies have shown that higher levels of online social comparison are associated with depressive symptoms in youth [21,22], and that appearance-specific comparisons on social media may heighten risk for comparison induced stress[23]and body image concerns [24]. School level Communication channel and education activities have been heavily influenced by social media use since COVID-19 in Nepal [25]. The increase integration of social media in education and in life of Nepali adolescents is alarming mental health concerns. Furthermore, researches conducted in Nepal revealed around half of secondary school students had severe anxiety [7]. Despite the lack of prior research in Nepal among adolescents, the impact of excessive usage of social media on mental health of adolescent should be understood. This study aimed to identify the impact of social media usage on mental health among adolescents.

Methodology

A cross sectional study was conducted to identify the impact of use of social media among adolescents' studying in secondary schools of Kathmandu. Three secondary schools were purposively selected and then all the students with aged 13 to 17 studying in class 8, 9 and 10 who consented to participated and available during time of data collection were included in the study. Sample size was calculated using formula $n=z^2pq/d^2$ using 95% Confidence level, 5% margin of error with prevalence of anxiety as 46.5% [7]. With 5% non-response rate, the final sample size was 393. [7] The data was collected among 327 secondary school students, 40 were not available during data collection as this was almost festival time of Nepal, remaining 20 didn't complete the tool completely, so the response rate was 83.20%.

Data were collected by using self-administered questionnaire developed based on extensive literature reviewed. The tool was divided on three parts. Part one consists of Socio-demographic information and social media use information. Part two measures Impact of social media usage on mental health outcome which includes alterations sleep patterns, distraction in study habits, and change in behavior, social comparison and experience of cyber-bullying. It consists of 4 point likert scale with following options 1-4 with never to nearly everyday. Pretesting of tool was done among 10% of School i.e among 40 participants, Ganesh Secondary School, Kathmandu.

Part three measures Anxiety by Generalized Anxiety Disorder-7 (GAD-7) scale which is reliable and valid in case of Nepal [26], 4-point Likert scale with the following options: 0-3 not at all to nearly every day.

Ethical clearance was obtained from

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Institutional Review Committee (IRC), YHSA (2079-080-281). Administrative department of selected schools were contacted for the permission of data collection. After getting permission from principal of each school, class coordinator of each class were contacted. Informed verbal and written parental consent and adolescent assent was taken from the Participants after explaining the purpose, objectives and rational of the study.

Each participant had akenabout 20-25 minutes for answering questions.

Researcher has respected the data and information provided by the participants and treated every participant equally without any discrimination, ethnicity, age and religion. Participants' right to refuse at any time during data collection were assured and accepted. The confidentiality was maintained by keeping information in

Only researcher could assess them and would not be disclosed to other than research purpose. Anonymity was ensured by writing code number instead of names in the questionnaire.

Frequency, percentage, mean and standard deviation were calculated for descriptive statistics as well as the Chi-square test was used for inferential statistical analysis of data using SPSS version 26.0.

Results

Table 1: Distribution of respondents according to socio-demographic characteristics

n= 327

Variables	Frequency	Percentage (%)
Age Group		
13-15	172	52.6
15-17	155	47.4
Gender		
Male	165	50.5
Female	162	49.5
Ethnicity		
Brahmin/Chhetri	122	37.3
Janajati	90	27.5
Newar	54	16.5
Dalit	33	10.1
Others*	28	8.6
Religion		
Hinduism	225	68.8
Buddhism	57	17.4
Christian	23	7.0
Islam	22	6.7
Educational level		
Class eight	91	27.8
Class nine	110	33.6

DOI: 10.56580/GEOMEDI50

Class ten	126	38.5
Father's education level		
Illiterate	25	7.6
Primary level (1-8class)	45	13.8
Secondary level (9-12class)	131	40.1
University Level and above	126	38.5
Occupation of Father		
Business	113	34.6
Private job	102	31.2
Government job	53	16.2
Labour	40	12.2
Agriculture	19	5.8

*others includes muslim, madhesi

Table 1 represents among 327 participants, more than half were between 13-15 years with almost same percentage of male and female. Most of the participants (68.6%) followed Hindu religion and being more than one third (37.3%) as Brahmin/Chhetri And from class ten (38.5%). On asking The fathers' education level, the highest percentages (44.3%) were secondary level graduates. The most common occupation of participants' fathers was business (34.6%).

Table 2: Social media related variables

n=327

Variables	Frequency	Percentage
Most used social media Platforms		
Facebook	141	43.4
Instagram	73	22.3
YouTube	34	10.4
Snapchat	4	1.2
Tik Tok	8	2.4
Two social media per day	33	10.1
Three	25	7.6
More than three	9	2.8
Starting age of social media		
Less than 5 years	5	1.5
5-8 years	38	11.6
9-12 years	162	49.5
12-17 years	122	37.3
Social media usage Duration		
Less than an hour per day	26	8
1-3 hrs	171	52.3
4-6hours	113	34.6
More than 6 hours per day	17	5.2

DOI: 10.56580/GEOMEDI50

Table 2 represents the information of social media use (SMU).The data provided relates to three aspects of social media usage: platform popularity, starting age of social media use, and usage duration. The data shows that 43.4% of participants favour Facebook as a social media use. Furthermore, near to half of participants (49.5%) begin using social media between the ages of 9 and 12 years. Additionally, the above data shows the duration of use of social media where more than half of the participants (52.3%) use social media for 1-3 hours, while 34.6% use it for more than 4-6 hours.

Table 3: Influence of social media usage on mental health

n= 327

Statement	Never	Rarely	Sometimes	Often
	f(%)	f(%)	f(%)	f(%)
Do you feel that excessive social media use has negatively affected your sleep patterns?	96(29.4%)	80(24.5%)	107(32.7%)	44(13.5%)
Do you check your social media account before you sleep?	56(17.1%)	77(23.5%)	190(58.1%)	4(1.2)
Do you feel like using your social media account in between your work or study?	101(30.9%)	75(22.9%)	124(37.9%)	27(8.3%)
Do you think your behavior toward others has changed after using social media?	208(63.60%)	34(10.4%)	72(22%)	13(3.97%)
Do you check your social media account just after waking up?	142(43.4%)	82(25.1%)	85(26%)	18(5.5%)
Do you feel pressure to portray a certain image or lifestyle on social media?	250(76.5%)	9(2.8%)	65(19.9%)	3(0.9%)
Have you ever been a victim of cyber-bullying (harassments) on social media?	275(84.1%)	5(1.5%)	47(14.4%)	0

Table 3 shows various aspects of social media's impact on users' lives, particularly regarding sleep patterns, behavior, checking social media just after waking up, social media pressure and experience of cyber bullying. Most of the participnats feel that excessive social media use has negatively affected their sleep patterns, whereas one third of the respondents (32.7%) think it has sometimes alternate the sleeping pattern. Regarding pre-sleep social media check-up, More than half (58.1%) check their social media accounts before bedtime.

DOI: 10.56580/GEOMEDI50

Most of the participants (37.9%) sometimes feel the urge to use social media during work or study. Majority of them don't agree that social media usage has not pressurized them to portray a certain image or lifestyle on social media(76.5%), nor being victim of cyber bullying (84.1%) and also they (43.4%) don't check their social media accounts immediately after waking up.

Table 4: Anxiety Level of respondents: Anxiety Level of respondents

n=327

Categories of Anxiety	Frequency	Percentage
Minimal Anxiety (0-4)	166	50.8
Mild Anxiety (5-9)	100	30.6
Moderate Anxiety (10-14)	51	15.6
Severe Anxiety(15-21)	10	3.1

Table 4 indicates the anxiety levels among the participants. Out of 327 participants, half of the them (50.8%) had minimal anxiety, while 30.6% were experiencing mild anxiety.

Table 5: Association between duration of social media with various impact of social media usage

n=327

Variables	Duration of social media		$\chi 2$ test	p-value
	Less than 3 hours	More than 3 hours		
Alteration of Sleeping pattern				
Yes	69(71.9%)	27(28.1%)	7.67	0.006
No	128(55.4%)	103(44.6%)		
Disruption regular Morning Activities				
Yes	97(68.3%)	45(31.7%)	6.81	0.009
No	100(54.1%)	85(45.9%)		

DOI: 10.56580/GEOMEDI50

Distraction in work or study due to feeling the urge to use social media during productive hours causing distraction in work and study Yes No	 72(71.3%) 125(55.3%)	 29(28.7%) 101(44.7%)	 7.44	 0.006
Change in Behaviour Yes No	148(71.2%) 49(41.2%)	60(29.8%) 70(58.8%)	28.40	0.000
Media portray of Image Yes No	158(63.2%) 39(50.6%)	92(36.8%) 38(49.4%)	3.87	0.04
Experience of Cyber bullying Yes No	168(61.1%) 29(55.8%)	107(38.9%) 23(44.2%)	0.517	0.47
Anxiety Yes No	177(66.5%) 20(32.8%)	89(33.5%) 41(67.2%)	23.60	0.000

The table 6 indicates a significant association between the duration of social media use (SMU) and sleep alteration, disruption of morning activities, change in behaviour, distraction in work or study, portrayer in certain image and anxiety among secondary level students in Kathmandu at p-value <0.05.

Discussion

The aim of this study is to identify the impact of social media use on the mental health status of the adolescents' students. In this study, more than half of the participants (52.3%) used social media for more than 1 hour and less than 3 hours whereas more than one third of the them (39.8%) had used social media excessive that is more than 3 hours. This finding Was less than with the study done in Nepal among adolescents which stated that around half of the adolescents used social media for more than 4 hours per day [7]. In context of Nepal, though school communication and assignments are circulated through social media, but the online education activities has not been started so using more than 3 hours per day

DOI: 10.56580/GEOMEDI50

for education purposes is more than recommended social media usage.

Near to one third of the participants (32.7%) think that their sleep pattern has been alternate by the use of social media, which may be influence by the checking the updates on social media before sleep (58.1%). Such finding was consistent with research by Woods and Scott, [18] and cohort study conducted among UK adolescents [19]. Also, prolonged engagement on social media and getting trap in scrolling might take away from time allocated for studying or doing any work [28] whereas in case of present study more than one third of respondents (37.9%) feel that their study or work has been disturbed by the use of social media in this study.

disrupts their daily morning routine was revealed in this study. Presenting one's image in positive outlook has been act of the most of the social media users; it is most common on users of facebook and instagram. In present study, 43.4% of the respondents used facebook and 22.3% use instagram, which is contrast with the findings of research by Pew Research Center which stated that youtube as the most common social media platform used among 13-17 years old adolescents [10]. Also, presenting oneself in positive outlook has not been observed in present study, most (76.5%) of them don't think they need to address in certain image to look good on social media whereas, 19.9% sometimes think they need to do so. Online harassment, cybervictimazation, cyberbullying has been observed in those who stay online more than 3 hours per day [30].

Only 14.4% stated that sometimes they had been victim of cyberbullying whereas the majority (84.1%) of them stated that they never involved in cyberbuying or cybervictimzation or online harassment. The rational might be the duration of social media usage among adolescent($p>0.05$).

Being expose to the news of online has impacted the emotional response and the change in behaviour [31] which is contrast to the present study, majority (63.60%) feel that they have-not observed change in behaviour due to social media influence. Rational behind might be the duration of social media use($p<0.05$).

This study observed that 49.3% has mild-severe form of anxiety; whereas one third of them had mild form of anxiety. The significant associations between social media and experience of anxiety are highlighted in studies of Dutch, Japan, Iran and Nepal. A longitudinal study among adolescents of Dutch identified that the increase in social media usage has been linked with higher levels of anxiety (M1a: $\beta T1,T2 = 0.176$, $p = 0.006$ and $\beta T2,T3 = 0.086$, $p = 0.046$) [19]. Similar results were revealed in the study of Japan which shows correlations between problematic social networking site use and anxiety symptoms [20]. Consistent with the study, Nepalese secondary students (38.65%)had minimal anxiety and 11.6% had severe anxiety [32]. The study found that people who used social media sites for longer than 3 hours reported higher levels of anxiety [18].

DOI: 10.56580/GEOMEDI50

In 2021, a cross-sectional study was conducted in Iran revealed that increase GAD7 score were linked with the past social media usage among 781 secondary school students [33].

Contrast to the above, findings underscored the significant association between frequent social media exposure and heightened risk of anxiety among Chienese Chinese teens [34].

Similarly, inconsistent findings were observed in study of Nepal and Canada, which shows 35.4% had severe anxiety and 43.7% had moderate to severe form of psychological distress [7,35]. The rational might be the duration and use of social media which is less in this study ($p<0.05$).

Conclusion

The study concluded that there is a association between social media use (more than 3 hours per day) with mental health aspects as disturbance in sleep pattern, change in behavior, disruption in regular morning activities, distraction in work and study, media portray of image and anxiety levels among secondary level students in Kathmandu. High usage patterns, such as staying up late, checking social media before bed and immediately after waking up, and feeling the urge to use social media during productive hours, are linked mental health issues. Although the majority of students reported minimal anxiety, a notable portion experienced mild to moderate anxiety, underscoring the mental health implications of social media use. Interventions aimed at promoting healthier social media habits could be beneficial in mitigating mental health issues among these students. Interventions should focus on raising awareness about the psychological impacts of excessive social media use and promoting healthier digital habits. By fostering a balanced approach to social media consumption and incorporating digital wellness strategies, educators and parents can help alleviate the negative effects on students' mental health, thereby promoting overall well-being and academic success.

Recommendation

Based on the findings of the study respondents experienced minimal to moderate anxiety, so it is recommended that policymakers, educators, and researchers integrate comprehensive life skills and mental health education into school curricula.

- Conducting routine awareness campaigns on responsible social media use and ensuring accessible counseling services are essential steps.
- Engaging parents through workshops to foster a supportive home environment and facilitating referrals for students diagnosed with anxiety are also crucial.

DOI: 10.56580/GEOMEDI50

- Additionally, utilizing features like the Digital Wellbeing Dashboard on smartphones to monitor screen time, set app limits, and promote mindful usage can help reduce anxiety levels associated with excessive digital engagement.

Limitations

- It can include potential self-reporting bias and the cross-sectional designs inability to establish causality definitively.
- The study includes respondents from only three secondary level schools which might not be a representative sample. Therefore, the findings may not be applicable to all, for those from different geographic regions or socio-economic Backgrounds.
- Most respondents were young population, so the study findings may not accurately reflect experiences and outcomes in other age groups, potentially introducing bias.

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სოციალური მედიის გამოყენება და მისი გავლენა მოზარდების ფსიქიკურ ჯანმრთელობაზე: კატმანდუს ჯვარედინი კვლევა

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აბსტრაქტი

საფუძველი: მრავალრიცხოვანმა კვლევამ ხაზი გაუსვა სოციალური მედიის გადაჭარბებულ გამოყენებასა და ფსიქიკური ჯანმრთელობის უარყოფით შედეგებს შორის კავშირს.

მიზანი: სოციალური მედიის გამოყენების გავლენის იდენტიფიცირება მოზარდებში, რომლებიც სწავლობენ კატმანდუს საშუალო სკოლებში.

მეთოდები: ჯვარედინი კვლევის დიზაინი გამოყენებული იყო სოციალური მედიის გამოყენების გავლენის დასადგენად მოზარდებში, რომლებიც სწავლობდნენ

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კატმანდუს 3 საშუალო სკოლაში. 13-დან 17 წლამდე ასაკის მოსწავლეებიდან, რომლებიც სწავლობდნენ მე-8, მე-9 და მე-10 კლასებში, თანხმდებოდნენ მონაწილეობაზე და ხელმისაწვდომნი იყვნენ მონაცემთა შეგროვების დროს, მიზანმიმართულად შერჩეულ იქნა 327 მონაწილე. თვითადმინისტრირებადი შემუშავებული კითხვარი შედგებოდა სამი ნაწილისაგან ვრცელი სოციალურ-დემოგრაფიული ინფორმაციით. პირველ ნაწილში მოცემული იყო სოციალური მედიის გამოყენების ინფორმაცია; მეორე ნაწილში - სოციალური მედიის გამოყენების გავლენა ფსიქიკური ჯანმრთელობის შედეგზე და მესამე ნაწილი შედგებოდა გენერალიზებული შფოთვითი აშლილობის-7 (GAD-7) სტანდარტული ინსტრუმენტისგან. ეთიკური მოწმობა მიღებულ იქნა ინსტიტუციური განხილვის კომიტეტისგან (IRC), YHSA (2079-080-281). სიხშირე, პროცენტი, საშუალო და სტანდარტული გადახრა გამოითვალა აღწერილობითი სტატისტიკისთვის, ასევე, გამოიყენებოდა Chi-square ტესტი მონაცემების დასკვნის სტატისტიკური ანალიზისთვის SPSS ვერსიის 26.0 გამოყენებით.

დასკვნები

327 რესპონდენტს შორის, ნახევარზე მეტი იყო 13-15 წლის, მამაკაცებისა და ქალების თითქმის თანაბარი პროცენტით. მონაწილეების დიდი ნაწილი (43.4%) ემხრობა Facebook-ს, ხოლო 49.5%-მა დაიწყო სოციალური მედიის გამოყენებას 9-12 წლის ასაკიდან. გამოკითხულთა ნახევარზე მეტი (52,3%) სოციალურ მედიას იყენებს 1-3 საათის განმავლობაში, ხოლო 34,6% 4-6 საათზე მეტხანს. ამ კვლევის შედეგად გამოკითხულთა ნახევარს (50.8%) ჰქონდა მინიმალური შფოთვა, ხოლო 30.6% განიცდიდა მსუბუქ შფოთვას. არსებობს მნიშვნელოვანი კავშირი სოციალური მედიის გამოყენების ხანგრძლივობასა და ძილის ცვლილებას, დილის აქტივობების შეფერხებას, ქცევის ცვლილებას, სამსახურში ან სწავლაში ყურადღების გაფანტვას, შფოთვასთან გარკვეულ კავშირს p-მნიშვნელობით <0,05 კატმანდუს სწავლების საშუალო საფეხურის მოსწავლეებში.

კვლევის შეზღუდვა/პრაქტიკული გავლენა: ეს დასკვნები ხაზს უსვამს მიზნობრივი ინტერვენციების გადაუდებელ აუცილებლობას, რომელიც მიზნად ისახავს სოციალური მედიის გადაჭარბებული გამოყენების ნეგატიური ზემოქმედების შერბილებას მოზარდების ფსიქიკურ ჯანმრთელობაზე.

ორიგინალობა/ღირებულება: ეს კვლევა იკვლევს კავშირს სოციალური მედიის გამოყენებასა და მის გავლენას შორის ფსიქიკური ჯანმრთელობის ასპექტებზე, რომელიც მოიცავს ძილის რეჟიმის შეცვლას, დილის რეგულარული აქტივობების დარღვევას, სამსახურში ან სწავლაში ყურადღების გაფანტვას, ქცევის ცვლილებას, მედიის გამოსახულებით ასახვას, კიბერ ბულინგისა და შფოთვის გამოცდილებას ნეპალში სწავლების საშუალო საფეხურის მოსწავლეებისთვის.

საკვანძო სიტყვები: სოციალური მედიის გამოყენება, გავლენა, ფსიქიკური ჯანმრთელობა.

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Scientific Report

The role of personnel management in ensuring the quality of medical activities

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Abstract

Personnel management is a field of knowledge and practical activity aimed at providing the organization with highly trained personnel who can perform the labor functions assigned to them and ensure optimal utilization. The quality of medical services is primarily related to the following indicators, which clearly indicate the role of the human factor: the timeliness of medical care; the correctness of the choice of methods of prevention, diagnosis, treatment and rehabilitation when providing medical care; the degree of achievement of the planned result. Social quality - is the quality of culture, which is formed by the behavior and position of medical personnel towards patients. Employees must know not only the technology of providing medical care, but also the rules of interaction and behavior with patients. The human factor plays an important role in the provision of medical care. Medical personnel give priority to obtaining new knowledge in the profile direction. The safety mechanism of medical activities and internal quality control are associated with the development of a corporate culture of medical service quality and safety. The goal of creating a competence center is to accumulate and promote the dissemination of positive experience in the field of quality management to medical organizations. Regular training of personnel should promote the development of skills in business communication, consultation, conflict resolution, and professional competence.

Keywords: Social quality. Profile knowledge. Competence center. Role design. Competence hierarchy.

Introduction

The changing world of healthcare includes the following reasons: a) External reasons - the consumer (patient), open information space, increased competition, regulatory authorities. b) Internal reasons: personnel, quality of professional education, medical technology. Let's get acquainted with the

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requirements imposed on medical personnel - based on international experience. Typical problems based on the audit results - section "Human Resources Management": The first requirement - formation and development of human resources (analysis of personnel development prospects; existence of a long-term personnel development plan); The second requirement - a system of personnel development and continuous learning (existence of a continuous learning program; existence of simulation centers in medical facilities; program for employee participation in scientific research); The third requirement - a personnel evaluation system (implementation of a personnel evaluation system; expert evaluation; evaluation by management; self-evaluation; thematic testing). Regular training of personnel should promote the development of skills in business communication, consultation, conflict resolution, and professional competence. Personnel risks [1]: risk of hiring low-skilled employees; risk of staff turnover; risk of adaptation; risk of inefficient use of workers (low labor productivity); risk of work motivation; risk of ineffective training; dependence on key employees.

A methodological approach to public management that ensures health interests is most effective when: Systematic processes take into account the interaction of different sectors; Taking into account different interests [2]; Accountability, transparency and participation of different parties are ensured; All stakeholders are involved; Practical intersectoral initiatives contribute to the formation of partnerships and the creation of an atmosphere of trust.

Health-friendly management tools for medical facilities - relevant: Creation of inter-agency committees (working groups, councils) taking into account different interests; Thematic consultations and intersectoral action groups; Partner platforms and citizen involvement [3]; Availability of comprehensive information and evaluation systems; Impact assessment and a combination of regulation and assurance; Legislative framework [4; 5; 6]; Use of adaptive strategies, sustainable structures and foresight.

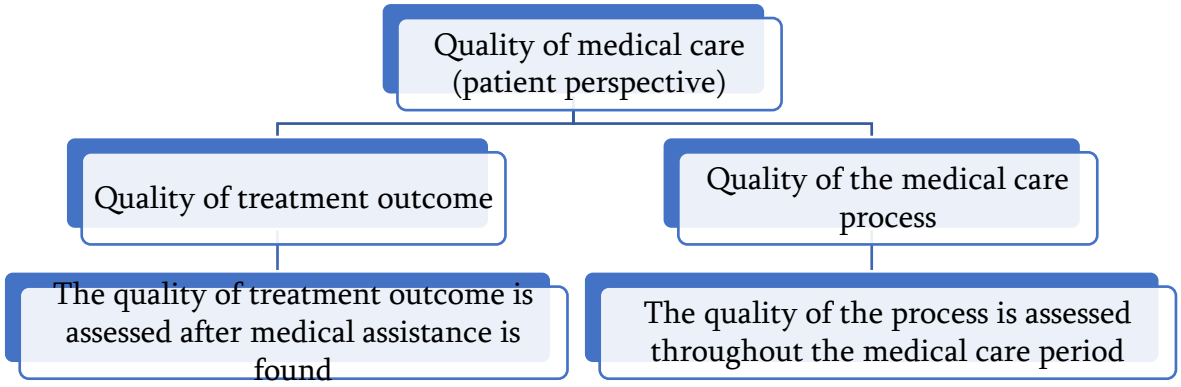
Research method

A new role for the health sector - partnering with other sectors requires training staff to: Understand the policy and administrative responsibilities of professional sectors; Build a knowledge base and evidence base for policy options and strategies; Assess health process; Establish regular platforms for outcomes as part of the policy development dialogue and problem- solving with other sectors; Assess the effectiveness of intersectoral working and develop comprehensive management policies; Build capacity through improved resources, institutional support and qualified staff. Patient expectations are constantly increasing, and patients are looking for

DOI: 10.56580/GEOMEDI48

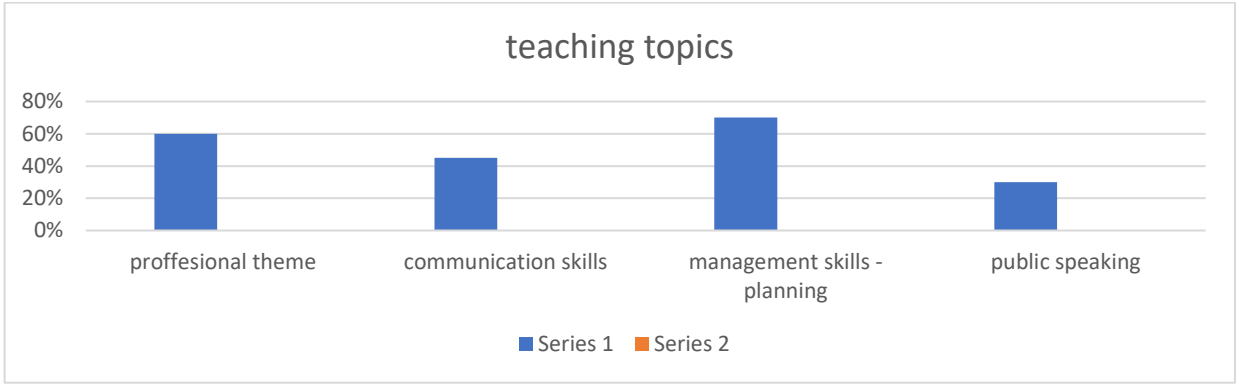
services that best meet their needs. The correspondence between patient expectations and external communication is presented in chart 1.

Chart 1. Quality of medical services



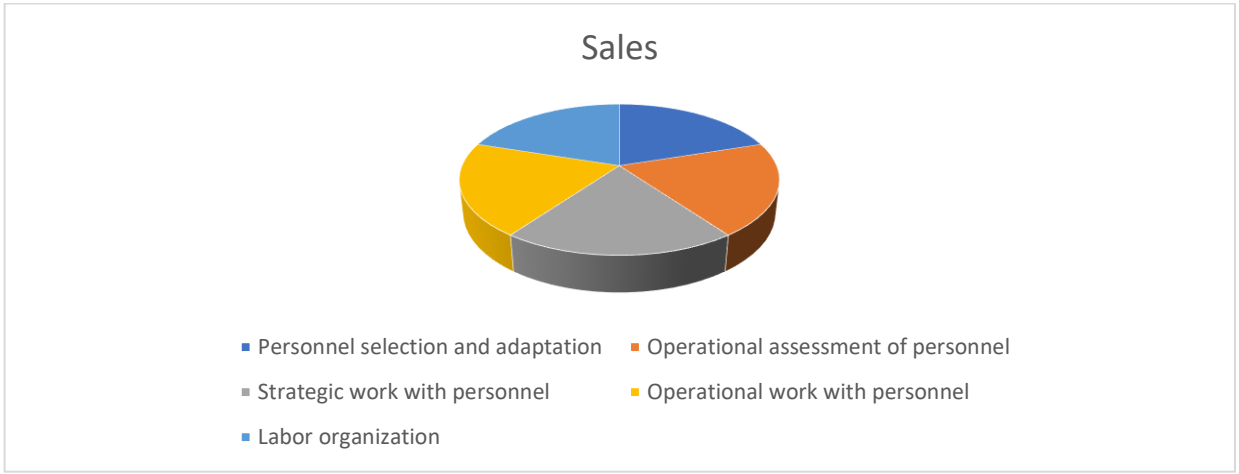
The study found that medical personnel at different levels prioritize acquiring new knowledge in the following professional areas - presented in Diagram 1.

Diagram 1. Priority study areas.



The presented practical suggestions are related to the security mechanism of medical activities and internal quality control (development of a corporate culture of quality and safety of medical services). Recommendations to be considered by the management of a medical facility are presented in Diagram 2.

Diagram 2. Recommendations related to personnel management.



DOI: 10.56580/GEOMEDI48

Advantages of implementing corporate governance: 1. Effective management of the activities of a medical organization through the creation of a collegial executive body 2. Rational distribution of responsibilities 3. Transparency of the activities of a medical organization and investment attractiveness (strategic plans and corporate events) 4. Ensuring financial sustainability 5. Improving the quality of medical services.

Result

Let's get acquainted with the competencies at the strategic and operational levels, which are reflected in Chart 2.

Chart 2 - A. Competence - Strategic Level

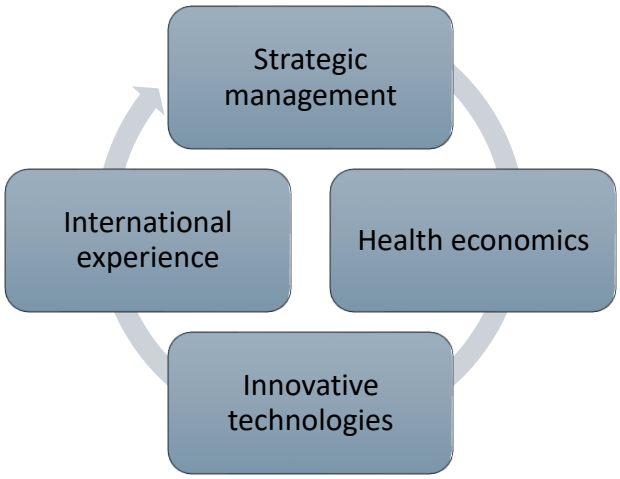
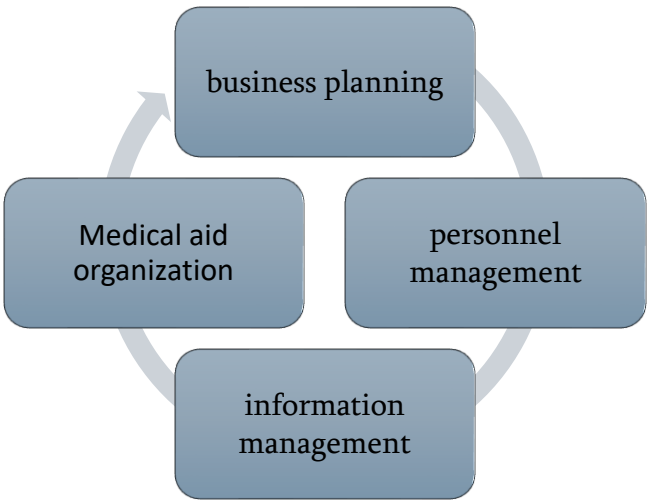


Chart 2 - B. Competence - Operational Level



Operational work with personnel includes training and development; labor organization includes management of business communication and the use of a motivation system; strategic work with personnel includes the preparation of a reserve of managers. The goal of creating a competence center is to accumulate and promote the dissemination of positive experience in the field of quality management among medical organizations: Competence center as a project site: implementation of healthcare projects; Consulting and methodological activities: information and consulting assistance in the implementation of projects, assistance in the development of documents; Audit activities: assessment of quality management systems created on the basis of practical recommendations of health supervision, provision of an expert opinion; Training: conducting lectures, trainings on the organization of a quality and safety assurance system for medical activities.

Human resources culture: a) planning of personnel requirements; b) leadership culture; c) learning culture - knowledge management; d) employee profile; e) role design; f) time management.

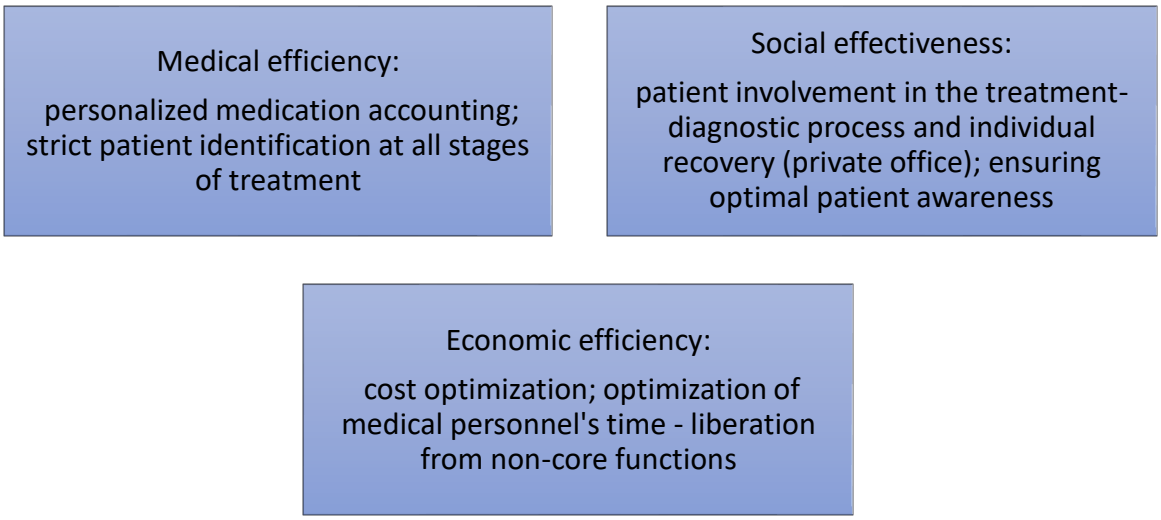
Personnel recruitment: a) personnel search; b) job interview; c) drawing up a contract; d) training a new employee.

Personnel support: a) incentive system; b) participation; c) pension scheme; d) discussion with difficult employees.

Human resources development: a) leadership development; b) team development; c) knowledge promotion; d) moderation of processes in the group; e) exchange of experience and advice from colleagues; f) continuous improvement.

The relationship between organizational effectiveness and optimal use of human resources is presented in chart 3.

Chart 3. Effectiveness assessment



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პერსონალის მენეჯმენტის როლი სამედიცინო საქმიანობის ხარისხის უზრუნველყოფაში

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აბსტრაქტი

პერსონალის მენეჯმენტი არის ცოდნისა და პრაქტიკული საქმიანობის სფერო, რომელიც მიზნად ისახავს ორგანიზაციის უზრუნველყოფას მაღალი ხარისხის მომზადებული პერსონალით, რომელსაც შეუძლია შეასრულოს მათთვის დაკისრებული შრომითი ფუნქციები და უზრუნველყოფილი იყოს ოპტიმალური გამოყენება. სამედიცინო მომსახურების ხარისხი უკავშირდება უპირატესად შემდეგ ინდიკატორებს, რომლებიც ნათლად მიანიშნებენ ადამიანური ფაქტორის როლზე: სამედიცინო დახმარების გაწევის დროულობა; სამედიცინო დახმარების გაწევისას პროფილაქტიკის, დიაგნოსტიკის, მკურნალობისა და რეაბილიტაციის მეთოდების არჩევის სისწორე; დაგეგმილი შედეგის მიღწევის ხარისხი. სოციალური ხარისხი - არის კულტურის ხარისხი, რომელიც ფორმირდება პაციენტების მიმართ სამედიცინო პერსონალის ქცევითა და პოზიციით. თანამშრომლებმა უნდა იცოდნენ არა მარტო სამედიცინო დახმარების გაწევის ტექნოლოგია, არამედ პაციენტებთან ურთიერთობისა და ქცევის წესები. ადამიანური ფაქტორი მნიშვნელოვან როლს თამაშობს სამედიცინო დახმარების გაწევაში. სამედიცინო პერსონალი პრიორიტეტს ანიჭებს პროფილური მიმართულებით ახალი ცოდნის მიღებას. სამედიცინო საქმიანობის უსაფრთხოების მექანიზმის დაცულობა და ხარისხის შიდა კონტროლი უკავშირდება სამედიცინო მომსახურების ხარისხისა და უსაფრთხოების კორპორატიული კულტურის განვითარებას. კომპეტენციის ცენტრის შექმნის მიზანია დაგროვდეს და ხელი შეუწყოს ხარისხის მართვის სფეროში დადებითი გამოცდილების გავრცელებას სამედიცინო ორგანიზაციებს. პერსონალის რეგულარულმა სწავლებამ ხელი უნდა შეუწყოს - საქმიანი კომუნიკაციის, კონსულტაციის, კონფლიქტის დარეგულირების, პროფესიული კომპეტენციის უნარების განვითარებას.

საკვანძო სიტყვები: სოციალური ხარისხი. პროფილური ცოდნა. კომპეტენციის ცენტრი. როლური დიზაინი. კომპეტენციური იერარქია.

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Medical Case Report

Chronic C Hepatitis with Hepatocellular Carcinoma – A Case Report

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Abstract

Nowadays chronic C hepatitis is a common infectious disease worldwide. Complications of this disease include: liver cirrhosis, acute and subacute live failure (hepatic encephalopathy, portal vein hypertension, ascites, hepatorenal syndrome), hepatocellular carcinoma (HCC). Since 2015 there is C-elimination program in Georgia, in which patients with chronic C hepatitis can be treated with antiviral drugs for 3,6 or 12 months. Although after antiviral therapy majority of patients get rid of the C hepatitis virus, due to liver damage (high, moderate or low) it is possible for patients to develop complications of chronic C hepatitis, including hepatocellular carcinoma. In our case report we present you 58-year-old patient, who was diagnosed with chronic C hepatitis in 2016 complicated with liver cirrhosis. Antiviral treatment was performed. Virus was eliminated, i.e. a solid viral respond was obtained. Due to liver damage he was hospitalized in the Center of infectious diseases, AIDS and clinical immunology, where he was diagnosed with HCC. The patient has been under constant monitoring until and AFP (alpha-fetoprotein), which is a marker of hepatocellular carcinoma, has always been within the normal range at <5.8 IU/ml. And with the last determination of AFP in the blood, the result was obtained >1000 IU/ml.

Keywords: C Hepatitis; liver cirrhosis; Hepatocellular carcinoma (HCC); Solid viral respond (SVR); Alfa feto-protein (AFP).

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Introduction

Hepatitis C virus (HCV), is a hepatotropic RNA virus, it is one of the leading causes of chronic hepatitis and chronic liver disease. Hepatocellular carcinoma (HCC) is one of the major complication that is associated with chronic C hepatitis, with significant mortality and morbidity rates. HCV-induced development of HCC is a gradual process and the duration and viral genotype has an influence on the development of the disease. HCC development includes many stages, for developing HCC is needed over 20 to 40 years (Fig. 1).

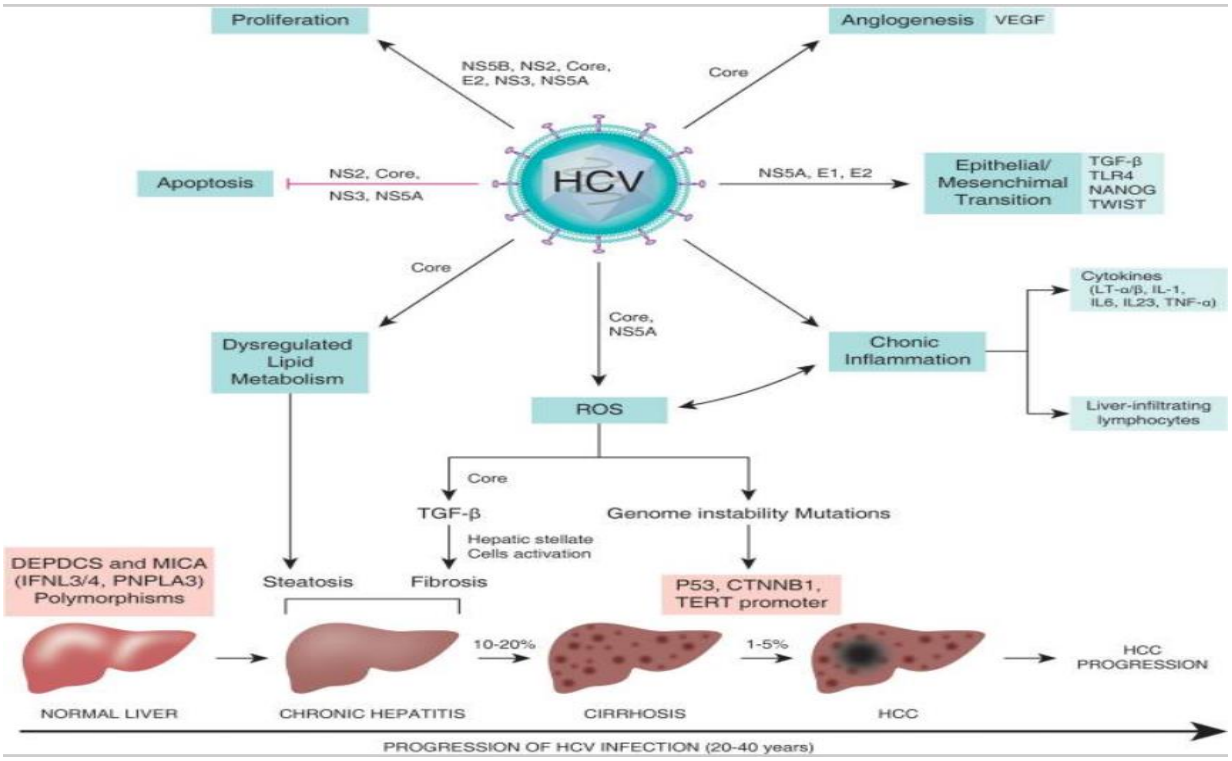

Figure 1. Hepatitis C Virus and Hepatocellular Carcinoma: A Narrative Review, Page Axley, Zunirah Ahmed, Sujan Ravi , Ashwani K Singal; National Library of Medicine (NIH).

There are factors that have an influence on HCV carcinogenesis. These factors include: viral-induced factors and host-induced immunologic response. For this time a direct oncogenic effect of HCV on liver cells has been only approved in animal models, but there are also studies, the results of which have shown that the HCV core protein may induce lipogenesis and disrupt oxidative stress metabolism.

The viral proteins of HCV can act directly on cell signaling pathways to promote the developing of HCC by inhibiting tumor suppressor genes and cell cycle check points. Also, by causing activation of signaling pathways that up-regulate growth and division HCV also can promote HCC development. There are some specific tumor suppressor genes inhibited by HCV core protein: retinoblastoma protein and p53 tumor suppressor. The loss of p53 and retinoblastoma is synergistic, that leads to a greater stage of carcinogenesis [1].

On 6.10.2024 a 58 year male referred to the

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Center of Infectious Pathology, AIDS and Clinical Immunology with complaints: severe general weakness, anorexia, bloating, difficulty urinating. He denied the use of alcohol, toxic substances and tobacco. In 2016 patients was diagnosed with chronic C hepatitis, liver cirrhosis (grade of liver damage F- with Metavir). Antiviral therapy was performed within the C-elimination state program, for 24 weeks sofosbuvir+ribavirin. A solid viral respond was obtained (SVR). The patient underwent laboratory and instrumental studies during hospitalization.

It should be noted that the patient was continuously monitored after receiving SVR. In 2022 patient was hospitalizes in the Center of Infectious diseases, AIDS and Clinical immunology, due to progression of liver damage with complaints: severe general weakness, anorexia, bloating, nausea, heaviness in epigastrium. Studies were conducted, as a result of which free fluid was found in the abdominal cavity. AFP conducted on 25/10/2022 – 1.46 IU/ml (N-<5.8). Subsequently, an abdominal ultrasound performed on 02/2024 revealed hepatosplenomegaly, portal vein thrombosis. A small amount of free fluid in the pelvic cavity. Sings of hepatocellular carcinoma were not present. 05/02/2024 AFP was again negative (2.38 IU/ml).

It also should be noted that radiological sings of HCC and elevated AFP revealed in the second half of 2024.

Results (2024/11)

1. Complete blood count (CBC) – Platelets - 84 *10^9/L, Rod neutrophils - 8% (N - 1-6 %), lymphocytes – 9% (N – 19-37%), total serum protein – 60 g/L (N65-58 g/L).
2. Coagulogram - PI 65% (N 70-100%), PT- 19.4sec (N 9-15sec)
3. CRP- 15 mg/L (N<6).
4. Biochemistry Blood Test: alkaline phosphatase – 174,1 U/L (N 30-115 U/L), total bilirubin – 57.6 umol/L (N<18.8 umol/L), bilirubin direct -25.4 umol/L (N<5 umol/L), Aspartate aminotransferase (AST) – 91.4 U/L (N- <41 U/L, alanine aminotransferase - 49,8 U/L (N <41 U/L), ammonium – 107.3 (N- 25-94), albumin – 25g/L (N35-50g/L). gamaglutamine transferase – 109.6 U/L (N<49U/L).
5. AFP ->1000 IU/ml (N<5.8 IU/ml).

6.07.11.2024 – Abdomen ultrasound: liver – Oblique-vertical size 142mm (N<140mm), craniocaudal size 121mm (N<100mm), anteroposterior midline size 72mm (N<50mm). The edges of the liver are irregular, the corners are thickened, the parenchyma is inhomogeneous. The structure is medium and coarse-grained. Echogenicity increased unevenly. Echo conductivity - impaired. Portal vei – intrahepatic – 14mm (N<11mm). A picture of complete thrombosis of the portal vein is shown. In the parenchyma, a hypoechoic nodule measuring 43X 36X 25 mm is visualized in the 8th segment, and an isoechoic nodule measuring 36X16 mm is visualized in the 8th segment. Spleen size - 154X70mm, structure – homogeneous, splenic vein in door 12mm, dilated, anastomoses are visualized. Free fluid in

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the abdominal cavity is found near the edge of the liver, in the lateral grooves and in the pelvic cavity in medium amounts.

14.10.2024 Abdominal MRT with contrast was performed. Result- In the first, third, fourth and seventh segments, hypervascular foci of small to 1 cm size in the arterial phase are revealed, without significant diffusion limitation or washout - LIRADS 3, in the sixth segment, along the branches of the portal veins, hypervascular foci of irregular shape and opaque contours up to 2.6 cm in size without diffusion limitation or washout are revealed - LIRADS 3. In connection with the subsegmental branch of the seventh segmental portal vein, a 0.8 cm-sized center with a hypervascular and later fibrous capsule in the arterial phase is revealed - LIRADS 4. In the fourth segment, a single thin cyst of 1.7 cm size is revealed. There is a small amount of fluid in the abdominal cavity.

The patient was consulted by oncologist. Due to multiple masses in liver parenchyma surgical intervention was not considered as an appropriate treatment. Patient was consulted by Transplantology specialist. Liver transplantation was planned. For now, patient is on the waitlist of liver transplantation, under the supervising of oncologist.

Discussion

There are several ways to diagnose Diagnose hepatocellular carcinoma. Periodic monitoring of patients at high risk for HCC is important. Early HCC screening uses abdominal ultrasound and AFP determination in the blood (AFP>400 μg/L - presence of HCC is suspected). We can also use computed tomography and magnetic resonance imaging to diagnose HCC, which are used in patients with abnormal ultrasound and AFP levels. Liver biopsy is also one of the diagnostic methods of hepatocellular carcinoma, but biopsy is not necessary in patients with typical manifestations of HCC by other instrumental or laboratory studies. The treatment of hepatocellular carcinoma involves many methods that require multi-discipline. Surgical treatment includes hepatectomy and carcinectomy. One of the treatment methods can also be liver transplantation, tumor ablation, etc. Conservative treatment includes radiation therapy, external or implantable radiotherapy, systemic treatment [2]. Successful treatment of chronic hepatitis C has significantly reduced the risk of developing hepatocellular carcinoma. At the same time, some patients, especially those with liver cirrhosis, remain at risk of developing HCC despite a robust viral response [3].

Conclusion

- By reviewing the case of a 58-year-old patient, we can conclude that hepatocellular carcinoma may develop due to progression of liver damage, despite antiviral treatment and solid viral response.
- Liver cirrhosis is an irreversible process, and despite the removal of its underlying cause, it is possible to develop

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its complications over time due to the the increase in liver damage during decompensation of cirrhosis.

- It is important for both medical staff and patients to understand that high-risk patients require constant monitoring.

Nota Bene for doctors

- The case described above shows that despite antiviral treatment and elimination of the virus, due to the progression of irreversible liver damage, liver cirrhosis complications may occur over time.
- Also, our goal is to emphasize the importance of monitoring after eliminating of the etiological factor, because from this case it is clear that in the case of constant monitoring after receiving a solid viral response, liver cirrhosis complications can be detected at an early stage.

ქრონიკული C ჰეპატიტი ჰეპატოცელულარული კარცინომით - ა ქეის-მოხსენება

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აბსტრაქტი

C-ქრონიკული ჰეპატიტი დღესდღეობით საკმაოდ გავრცელებული ინფექციური დაავადებაა მსოფლიო მასშტაბით. დაავადების გართულებებს წარმოადგენს ღვიძლის ციროზი, ღვიძლის მწვავე და ქვემწვავე უკმარისობა (ღვიძლისემიერი ენცეფალოპათია, პორტული ჰიპერტენზია, ასციტი, ჰეპატორენული სინდრომი), ჰეპატოცელულური კარცინომა (HCC). საქართველოში 2015 წლიდან მოქმედებს C-ელიმინაციის პროგრამა, რომელის ფარგლებშიც C - ქრონიკული ჰეპატიტის მქონე საქართველოს მოქალაქეებს შეუძლიათ 3, 6 და 12 თვიანი ანტივირუსული მკურნალობის ჩატარება. მიუხედავად იმისა, რომ ანტივირუსული მკურნალობის შემდეგ პაციენტების უმრავლესობა C ჰეპატიტის ვირუსისგან თავისუფლდება, ღვიძლის დაზიანების გამო (მაღალი, საშუალო თუ დაბალი) პაციენტთან შეიძლება განვითარდეს C ქრონიკული ჰეპატიტის გართულებები, მათ შორის ჰეპატოცელულური კარცინომა.

ჩვენს შემთხვევის განხილვაში წარმოგიდგენთ 58 წლის პაციენტს, რომელსაც C ქრონიკული ჰეპატიტის დიაგნოზი, გართულებული ღვიძლის ციროზით, დაესვა 2016 წელს. ჩაიტარა ანტივირუსული მკურნალობა. განთავისუფლდა ვირუსისგან, ანუ მიღებულ იქნა მყარი ვირუსული პასუხი (SVR). 2024 წელს კი ღვიძლის

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დაზიანების ხარისხიდან გამომდინარე იქნა ჰოსპიტალიზებული ინფექციური პათოლოგიის, შიდსის და კლინიკური იმუნოლოგიის ცენტრში, სადაც დაესვა ჰეპატოცელულური კარცინომის დიაგნოზი. პაციენტი ამ დრომდე მუდმივად იმყოფებოდა მონიტორინგის ქვეშ და წინა წლებში ჩატარებული AFP (ალფა-ფეტოპროტეინი), რომელიც არის ჰეპატოცელულური კარცინომის მარკერი, ყოველთვის იყო ნორმის ფარგლებში <5,8-ზე IU/ml. ხოლო AFP -ს ბოლო განსაზღვრით სისხლში შედეგი მიღებულ იქნა >1000 IU/ml.

საკვანძო სიტყვები: C ჰეპატიტი, ღვიძლის ციროზი, ჰეპატოცელულური კარცინომა (HCC), მყარი ვირუსული პასუხი (SVR), ალფაფეტოპროტეინი (AFP).

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Reasoned Opinion

Understanding Some Aspects of Semantic Evolution Research for the Marginal Effectiveness of Management

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Abstract
In the modern era of qualitative improvement of business internationalization, the qualitatively perfect understanding of the verbal component of managerial communications is attached more and more importance and, accordingly, special attention is given to the implementation of verbal contacts with maximum efficiency - without time and financial losses and with maximum results. Communication is understood as the process of transmitting information, namely, the process of encoding verbal information into non-verbal and, conversely, where it is essential, the process of presenting some action of one interlocutor to another interlocutor. In a standard meta-communicative act, non-verbal reactions are also important and reactions of admiration, surprise, hatred, etc. to them are obvious, i.e. the expression of some communicative acts, which have the meaning of reduced verbal components and are expressed in words of emotional significance.

Keywords: Semantic evolution, business internationalization, management, efficiency.

Main Text

The paper presents a study on the disclosure and definition of the content of communicative information, which is of great importance for the formation and emergence of managerial thinking, since it is impossible without linguistic material, linguistic terms and phrases. While communication is fundamentally related to the activities of a manager of any level, more precisely, the manager achieves success by flexibly managing business relations with the performer.

The manager, through verbal communication, transmits information to the performers about their participation in the conduct of production activities, informs about the motivation for high-quality fulfillment of customer requirements, which for them is the goal of increasing labor productivity, which, accordingly, leads to an increase in remuneration.

The paper defines the possibility of quality social interaction through visual

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communication, which is a complex communication approach and controls
the qualified education of a specialist, because in management, highly qualified personnel with higher education are the image of the firm, competitive advantage, successful activities of the firm, high-quality fulfillment of customer requirements, etc.

Since communication is carried out in physical space, we can consider them as a process of changes in low-energy signals, on the basis of which high-energy signal exchange-use arises. The system of their connection has received the name of a code, where the substantive side of the word is in correspondence with the expressive side. This allows changes to be made in physical space, not physical quantities, where we can talk about the means of transmitting communication: here we will use two channels - verbal and visual. It is precisely in these areas that a person found the opportunity to have a perfect mechanism for memorization, but before we delve into them, let's constancy of thought forms.

Although the emergence of thought is impossible without linguistic material, linguistic terms and phrases, thought and its verbal expression do not always coincide. The same thought can often be be expressed in different words. In this sense, it can be said that thought is is unchanged, but words change. Speech has its own structure, which does not coincide with the structure of thought, grammar expresses the structure of speech, and logic expresses the structure of thought. Memory does not coincide with the memorization of the verbal form that expresses them, because memorizing a thought is often more durable than expressing it in verbal form.

Thought is “the birth of internal ideas, where word cognition takes place and its inclusion in one’s own internal image of the world”, in the meaningful structure of the word [1]. As for verbal communication, it is based on lexically expressed units that represent the realities of the world. The latter form numerous units of the lexicon, from which a countless field of messages is created. Visual communication does not have such, predetermined units, which make the process of perception of visual communication more complete, because they do not require a list of pre-determined units and serve to understand the messages. In visual communication, too, we can find certain norms that determine the form of the necessary transmitted messages, determine the quality of social relations.

And what are social relations themselves?

They are considered one of the complex communicative approaches that control the education of a person, serve to access his thoughts, determine the quality of relations, and represent social relations. These are some kind of macrostructures, where we consider sentences, their expression, depiction, some kind of scenes and human actions and actions, where semantic structures can be equated with hierarchically organized macropositions with the help of macrostructures, which are considered a sufficient basis for further understanding of discourse, events and actions, where an innumerable number of semantic data are arranged.

Here, we consider interesting markers of

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Semantic topics, through which we discuss possible changes in the world, definitions of time and some of its periods, the intelligibility of the thinking of the participants in the discourse. Here, we try to expand and expand the possible sketch of a given "audience", discuss changes in perspectives and views, and exchange theories and scenarios.

This is a way of presenting a kind of modeling of the world. Here, certain values are deeply rooted in our own culture. Here, our spatial representations are designed for the audience, they belong to it. They are "endowed" with the quality of "antiquity" and are characterized by the ability to interpret the new.

When characterizing the communicative spatiality of the audience, we must take into account the fact that the speaker and the listener do not have absolutely the same codes and, therefore, it is likely that they do not have the same ability to remember. I. Lotman speaks of communication itself as a transfer of some text from "one" language to "other" language. "The possibility of my transfer is determined by the fact that the codes of both participants in communication, or the entire audience, despite the fact that they are not the same, create a mutually intersecting multiplicity" [2].

Here we can talk about two cases of information transfer, which an individual, individuals or the entire audience is trying to do.

One is information received from the outside. It is provided to the listener in its entirety. The second is the opportunity to acquire a certain part of the information, which is in depth.

This is a kind of proto-point of the past man, the so-called figurative meaning, "this is an attempt to read the world, man, as a book" [3].

For Conclusion:

We, being in the "captivity" of the digital or printed word, enrich our memory with certain knowledge. This is a continuous process of mechanically "enriching" our knowledge and "stacking-accumulation" it in memory. Speech here is a necessary condition for conducting the correct communication process. Here we can use the structures of knowledge presented by Jean Lacan.

This is a kind of information set, where information is recorded, which is provided to them uncensored. They are designed to please the audience. This is a kind of semantic evolution, a stock of our words and concepts and the peculiarities of their use. These are traditions and legends, where the history of any subject is presented in a certain form. "The discourse of the other is unknown to the subject" - concludes the scientist [4].

Linguistic units accumulate linguistic and extralinguistic information, representations and introduce into the system of forms a stream of associations that arise due to the connection with the processes of growth in the cognition of a person and appear to us as a continuous chain of impressions and associations [5].

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სემანტიკური ევოლუციის კვლევის ზოგიერთი ასპექტის გააზრება მენეჯმენტის ზღვრული ეფექტიანობისათვის

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აბსტრაქტი

ბიზნესის ინტერნაციონალიზაციის ხარისხისხობრივი სრულყოფის თანამედროვე ეპოქაში, სულ უფრო მეტი მნიშვნელობა ენიჭება მენეჯერული კომუნიკაციების ვერბალური მდგენელის ხარისხობრივად სრულყოფილ გააზრებას და, შესაბამისად, ვერბალური კონტაქტების ზღვრული ეფექტიანობით - დროითი და ფინანსური დანაკარგების გარეშე მაქსიმალური შედეგიანობით შესრულებას. კომუნიკაციაში გაიგება ინფორმაციის გადაცემის პროცესი, კერძოდ, ვერბალური ინფორმაციის არავერბალურში კოდირების პროცესი და, პირიქით, სადაც, არსებითია, ერთი მოსაუბრის მეორე მოსაუბრეზე რაიმე მოქმედების წარდგენის პროცესი. სტანდარტულ მეტაკომუნიკაციურ აქტში მნიშვნელოვანია არავერბალური რეაქციებიც და თვალნათელია მათზე აღტაცების, გაოცების, სიძულვილის და ა. შ. რეაქციები, ე. ი. რაღაც კომუნიკაციური აქტების გამოხატვა, რომელსაც რედუცირებული ვერბალური კომპონენტების მნიშვნელობა გააჩნია და გამოხატულია ემოციური მნიშვნელობის სიტყვებით.

საკვანძო სიტყვები: სემანტიკური ევოლუცია, ბიზესის ინტერნაციონალიზაცია, მენეჯმენტი, ეფექტიანობა.

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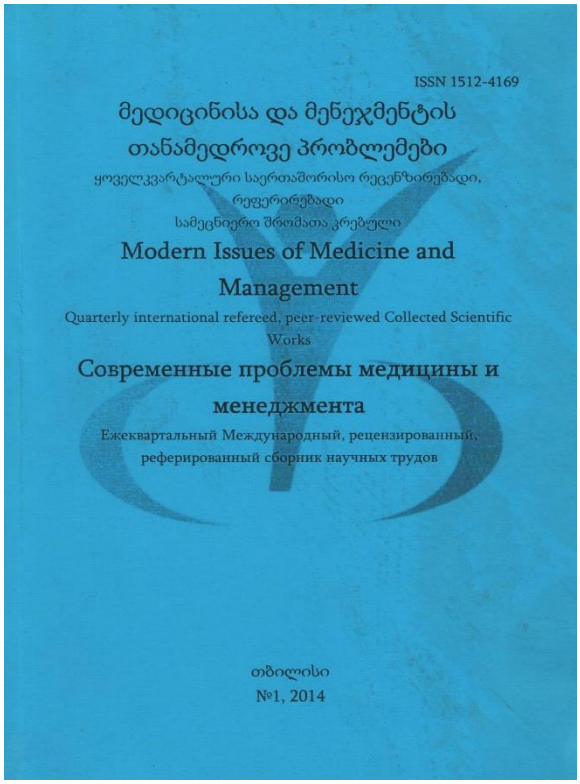
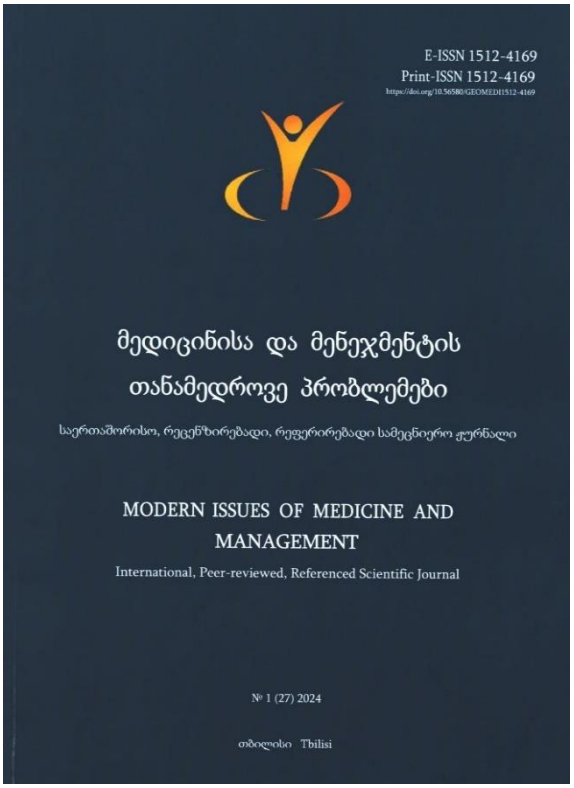
უნივერსიტეტ გეომედის ჟურნალის პირველი ნომერი 2014 წელს გამოიცა და მის პირველ ორნიშნა იუბილეს ჟურნალი არსებითი შედეგებით ეგებება - ხარისხობრივად მნიშვნელოვნად ამაღლდა შრომების მეცნიერული დონე და, ამასთანავე, მათ უკვე „ქრასრეფის“ უმაღლესი მსოფლიო სტანდარტის ციფრული იდენტიფიკატორები ენიჭებათ და „გუგლ სქოლარის“ გლობალურ ბაზაშიც ინდექსირებულები არიან.





University Geomedi scientific journal, "Modern Issues of Medicine and Management", Is 10 years old

The first issue of University Geomedi journal was published in 2014 and is celebrating its first two-digit anniversary with significant results - the scientific level of its works has significantly improved in quality, our publications are already marked with the highest world standard digital identifiers of CrossRef and are also indexed in the global database of „Google Scholar“. In the near strategy, indexing in new international databases is planned.

რევაზ ლორთქიფანიძეს

ვულოცავთ 60 წლის იუბილეს

რევაზ ლორთქიფანიძე - უნივერსიტეტ გეომედის პროფესორი და სამეცნიერო ჟურნალის აღმასრულებელი რედაქტორი, საქართველოს ეკონომიკურ მეცნიერებათა აკადემიის ნამდვილი წევრი და აკადემიკოს-მდივანი დაიბადა 1965 წლის 7 იანვარს. 1986 წელს წარჩინებით დაასრულა თბილისის სახელმწიფო უნივერსიტეტის საინჟინრო–ეკონომიკური ფაკულტეტი, 1989 წელს - საქართველოს მეცნიერებათა აკადემიის ეკონომიკისა და სამართლის ინსტიტუტის ასპირანტურა. მინიჭებული აქვს მეცნიერებათა დოქტორის სამეცნიერო ხარისხი (1999 წელს სადოქტორო დაცვის ნოსტრიფიკაცია 2005 წელს, ეკონომიქსის 08.00.01 სპეციალობით). როგორც ახალგაზრდა მეცნიერებათა დოქტორმა, 2001 წელს მოიპოვა საქართველოს პრეზიდენტის პირველი ხარისხის გრანტი. 2018 წელს, უმაღლესი შეფასებით დაასრულა ჰარვარდის უნივერსიტეტის კურსები „ამერიკული მთავრობა“ და „სამართლიანობა“. სხვადასხვა დროს მიენიჭა ნიუ–იორკის პოლიტიკურ მეცნიერებათა აკადემიის, ნიუ-იორკის მეცნიერებათა აკადემიის, კალიფორნიის მეცნიერებათა აკადემიის, რუსეთის საბუნებისმეტყველო მეცნიერებათა აკადემიის წევრობა, მიღებული აქვს სერთიფიკატები ევროკავშირის პროექტის “უფრო სუფთა წარმოების” საკითხებში, აშშ მინესოტასა და სხვა უნივერსიტეტებიდან. სკოლის წლებში, სწავლაში წარმატებებისათვის და, როგორც სასწავლო-შემოქმედებით ოლიმპიადებში გამარჯვებული, დაჯილდოვდა საქართველოს განათლების სამინისტროს ოქროს მედლითა და მრავალი დიპლომით, გადაეცა საქართველოს მეცნიერებათა აკადემიის სპეციალური სიგელი. საქართველოს ეკონომიკის სამინისტროს სისტემაში ასრულებდა აჭარის ეკონომიკის მინისტრის (1993-1998) და საქართველოს ეკონომიკისა და მდგრადი განვითარების სამინისტროს სახელმწიფო ქონების აღრიცხვის სამმართველოს უფროსის მოვალეობებს (სამინისტროს რეორგანიზებამდე 2010 წელს). ის 1200-ზე მეტი მეცნიერული პუბლიკაციისა და კონკურენციის ძალის განსაზღვრის ფორმულირების ავტორია, განავითარა ეკონომიკის სტრუქტურის ეფექტიანობის ფორმულირება ევროკომისიის ექსპერტთა მეთოდოლოგიის სრულყოფის საფუძველზე. კონკურენტთა უსასრულო რაოდენობრიობის პრიორიტეტული საჭიროების ნაცვლად, გლობალურ ენციკლოპედია ვიკიპედიაში აღინიშნა მისი "ატომური ბალანსის" ხარისხობრივად ახალი მიდგომის საჭიროება. მისი კვლევის ინტერესის სფეროებს წარმოადგენს ეკონომიკის ზოგადი თეორია (ფიზიკის გამოყენებით), ჯანდაცვის ეკონომიკური რეფორმები, სამრეწველო პოლიტიკა, მსოფლიო სავალუტო სისტემა, აშშ-ს და საქართველოს ეკონომიკა. მისი პუბლიკაციები განთავსებულია საქართველოს პარლამენტის ეროვნული ბიბლიოთეკის ციფრულ ბიბლიოთეკაში "ივერიელი".

უნივერსიტეტ გეომედის ჯანდაცვის ეკონომიკისა და მენეჯმენტის ფაკულტეტი

60th birthday Congratulations to

Revaz Lordkipanidze

Revaz Lordkipanidze - Professor of the University Geomedi and Executive Editor of the Scientific Journal, Full Member and Academician-Secretary of the Georgian Academy of Economic Sciences was born on January 7, 1965. In 1986, he graduated with honors from the Faculty of Engineering and Economics of Tbilisi State University, in 1989 - postgraduate studies at the Institute of Economics and Law of the Georgian Academy of Sciences. He has been awarded the scientific degree of Doctor of Sciences (the doctoral defense in 1999, nostrification in 2005, by the specialty 08.00.01 Economics). As a young Doctor of Sciences, in 2001 he received the First Degree Grant of the President of Georgia. In 2018, he graduated from Harvard University with the highest honors in the courses “American Government” and “Justice”. At various times, he was awarded membership in Academy of Political Science (NY), New York Academy of Sciences, California Academy of Sciences, Russian Academy of Natural Sciences and received certificates from the European Union project “Cleaner Production” from the University of Minnesota (USA) and other universities. During his school years, for research success and as a winner of educational and creative Olympiads, he was awarded with the Gold Medal of the Ministry of Education of Georgia and many diplomas, a special certificate of the Georgian Academy of Sciences. In the system of the Ministry of Economy of Georgia, he served as the Acting Minister of Economy of Adjara (1993-1998) and the Head of the State Property Accounting Management of the Ministry of Economy and Sustainable Development of Georgia (before the reorganization of the ministry in 2010). He is the author of more than 1200 scientific publications and a formulation for determining the strength of competition, developed a formulation for the effectiveness of the economic structure based on the improvement of the methodology of experts of the European Commission. Instead of the priority of infinite number of competitors, the global encyclopedia Wikipedia noted the need for a qualitatively new approach to his "atomic balance". His research interests include general economic theory (using physics), health economic reforms, industrial policy, the world monetary system, the US and Georgian economies. His publications are located in the digital library "Iverieli" of the National Library of the Parliament of Georgia.

Faculty of Health Care Economics and Management
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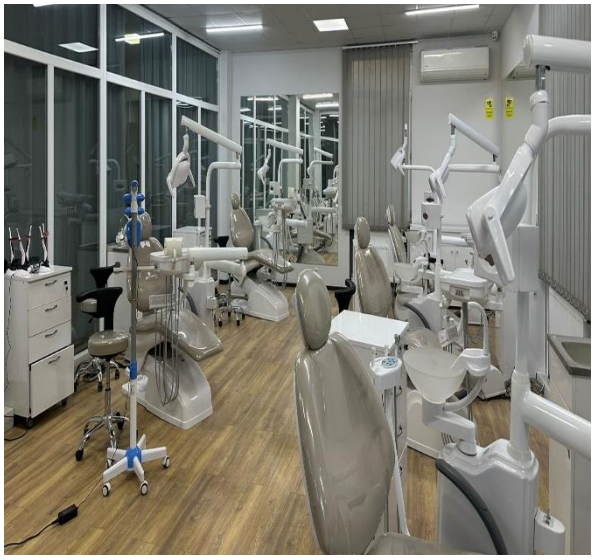

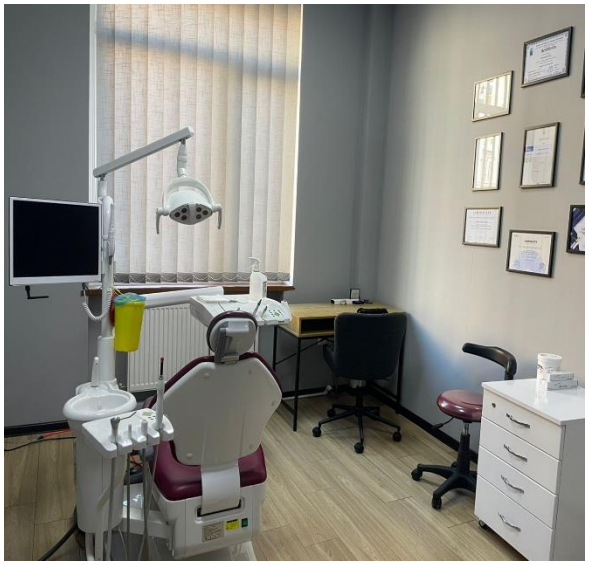

გეომედის საუნივერსიტეტო სტომატოლოგიური კლინიკა

ადამიანის სიცოცხლისუნარიანობის შენარჩუნება-გაძლიერება ჯანმრთელი პირის ღრუდან იწყება.

გამოცდილი და ახალგაზრდა ექიმების საუკეთესო შეხამებითა და უახლესი ტექნოლოგიების გამოყენებით, უნივერსიტეტ გეომედის სტომატოლოგიური კლინიკა სხვადასხვა სირთულის ქირურგიულ მანიპულაციებს სთავაზობს პაციენტებს, მათ შორის სიბრძნის კბილების ექსტრაქციას, დენტალურ იმპლანტაციას, ფესვის მწვერვალის რეზექციას, კლინიკური გვირგვინის დაგრძელებასა და სხვა.

ჩვენი მისამართია: თბილისი, **მეფე სოლომონ II-ის ქუჩა N4**. მობრანდით და თქვენ ნამდვილად კმაყოფილი დარჩებით. ☎ **(+995) 555 000 461**

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ავტორთა საყურადღებოდ!

1. ნაშრომი შესაძლებელია წარმოდგენილი იყოს როგორც ქართულ ენაზე (სრული ინგლისური თარგმანით), ასევე ინგლისურ ენაზე (ქართულ რეზიუმეს რედაქცია უზრუნველყოფს), ელექტრონული სახით, მეცნიერების შესაბამისი დარგის სპეციალისტის რეცენზიასა და ანტიპლაგიატის პროგრამაში შემოწმების პასუხთან ერთად. ჟურნალში გამოქვეყნებული სტატიის ავტორი ან ავტორთა ჯგუფის ხელმძღვანელი (corresponding author) შეიძლება იყოს მეცნიერების დოქტორი ან დოქტორანტი.
2. ნაშრომში დაცული უნდა იყოს შემდეგი თანმიმდევრობა:
ა) ნაშრომის სათაური, ავტორ(ებ)ის გვარი და სახელის ინიციალი, მონაცემები ავტორ(ებ)ზე - ქვეყანა, საფოსტო ინდექსი, სამუშაო ადგილი, ელექტრონული ფოსტა.
ბ) გამოყოფილი - აბსტრაქტი, საკვანძო სიტყვები (არაუმეტეს 300 სიტყვა).
გ) ტექსტი: შესავალი, მასალები და მეთოდები, მიღებული შედეგების განხილვა, დასკვნები, გამოყენებული ლიტერატურა. ფოტომასალა (JPG, TIFF ფორმატში - მინიმუმი რეზოლუციით 300 DPI), ცხრილები, სურათები, ნახაზები, გრაფიკები, სქემები და დიაგრამები - დასათაურებული და დანომრილი ; ფორმულები უნდა აღინიშნოს Microsoft Equation - ში.
3. ნაშრომის მოცულობა არ უნდა აღემატებოდეს 10 გვერდს, აბსტრაქტისა და გამოყენებული ლიტერატურის ჩათვლით.
4. ნაშრომი უნდა შესრულდეს Microsoft Word-ში Sylfaen შრიფტით.
5. ფურცლის ზომა A4, ველები: ზედა-2.0 სმ, ქვედა-2.0 სმ, მარცხენ -2.0 სმ, მარჯვენა-2.0 სმ; შრიფტის ზომა -12, ინტერვალი -1,15.
6. სამეცნიერო ნაშრომში დამოწმებული წყაროებისა და ლიტერატურის მითითების წესი: Chicago Manual of Style's "Author-Date": https://www.chicagomanualofstyle.org/tools citationguide/citation- guide-2.html. გამოყენებული ლიტერატურის სია უნდა მოიცეს ანბანური თანმიმდევრობით, მათ შორის ყოველი ავტორი აღინიშნოს გვარითა და სახელით, გვარის მძიმით გამოყოფით სახელისგან, რომლის შემდგომ აღინიშნება შრომის დასახელება და წიგნისა ან ჟურნალის სტატიის რეკვიზიტები. მაგალითად: Keng, Shao-Hsun, Chun-Hung Lin, and Peter F. Orazem. 2017. "Expanding College Access in Taiwan, 1978–2014: Effects on Graduate Quality and Income Inequality." Journal of Human Capital 11, no. 1 (Spring): 1–34. https://doi.org/10.1086/690235. შესაბამისად, ციტატები ტექსტში უნდა აღინიშნოს, როგორც (Keng, Lin, and Orazem 2017, 9–10).
7. სამეცნიერო ნაშრომი მიიღება ელექტრონულ ფოსტაზე journal@geomedi.edu.ge და ექვემდებარება სავალდებულო რეცენზირებას (peer review). თითოეული მიმართულებისათვის სარედაქციო კოლეგია არჩევს მინიმუმ ორ სპეციალისტს.
8. ნაშრომის გამოქვეყნების ან უარის შესახებ გადაწყვეტილება, ავტორს ეცნობება ნაშრომის წარდგენიდან არაუგვიანეს 5 სამუშაო დღის განმავლობაში.
9. ნაშრომში გამოქვეყნებულ მასალაზე პასუხისმგებელია ავტორი.
10. გამოქვეყნებულ ნაშრომზე ყველა ავტორს გადაეცემა შესაბამისი სერტიფიკატი.
11. ნაშრომის გამოქვეყნების საფასური 50 ლ-ია, სხვა ქვეყნის მოქალაქეებისათის - 50 აშშ დოლარის ექვივალენტი ლარი. ქართველი და სხვა ქვეყნის ავტორების ერთობლივი ნაშრ მის შემთხვევაში კი - 50 ლარი. უნივერსიტეტი აფილირებული აკადემიური პერსონალის სტატიების განსახილველად მიღება უფასოა. პუბლიკაციასთან დაკავშირებული ხარჯებს აფინანსებს უნივერსიტეტი.
12. უნივერსიტეტი იტოვებს უფლებას პლაგიატის აღმოჩენის შემთხვევაში იმოქმედოს უნივერსიტეტის „პლაგიატის აღმოჩენისა და რეაგირების წესის" შესაბამისად.

Paper submission Guideline !

1. The paper can be presented both in Georgian (with a full English translation) and in English (with a Georgian summary, which is provided by the editorial office), in electronic form, together with a review by a specialist in the relevant field of science and with an answer to the check in the anti-plagiarism program. The author of the article published in the journal or the head of the group of authors (corresponding author) can be a doctor of science or a doctoral candidate.
2. The following order should be observed in the paper:
a) Title of the work, last name and initial of the author(s), data on the author(s) - country, postal code, place of work, e-mail.
b) allocated - abstract, key words (no more than 300 words).
c) Text: introduction, materials and methods, discussion of obtained results, conclusions, used literature. Photographs (in JPG, TIFF format - minimum resolution 300 DPI), tables, images, drawings, graphs, charts and diagrams - titled and numbered (if there is one unit of this type of insert in the text, numbering is not required); Formulas should be noted in Microsoft Equation.
3. The length of the paper should not exceed 10 pages, including the abstract and references.
4. The paper should be written in Microsoft Word with Sylfaen font.
5. Sheet size A4, fields: top - 2.0 cm, bottom - 2.0 cm, left - 2.0 cm, right - 2.0 cm; Font size -12, spacing -1.15.
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