

Međunarodna naučna konferencija SANUS 2026

Zbornik sažetaka

International Scientific Conference SANUS 2026

BOOK OF ABSTRACTS

Prijedor, September 17-19, 2026

Scientific Conference SANUS 2026

Organizers

PI College of Health Sciences Prijedor, Republic of Srpska, Bosnia and Herzegovina
Academy of Applied Studies Belgrade, the College of Health Sciences, Republic of Serbia
Faculty of Health Sciences, University of Ljubljana, Republic of Slovenia
Consulting and Training Center KEY, Skopje, Macedonia
Association of Laboratory and Sanitary Health Professionals in Bosnia and Herzegovina
Graduate Nurses Association of the Republic of Srpska, Bosnia and Herzegovina
Association of Occupational Therapists in Bosnia and Herzegovina
Association of Physiotherapists of the Republic of Srpska

Editors: Prof. dr Radoslav Grujić, full professor; Dr Milka Stijepić, College professor

Text editing: mr Mira Obradović, College senior assistant

Text editing in English: Dijana Srdić, English Language and Literature Teacher

Responsible person for the organizer: Doc. dr Ilija Stijepić, director

Website: <https://sanusconference.org/>

Cover design: Nemanja Gruban

Printing house: Grafički atelje Grafit

Number of books printed: 100 pieces

CIP - Каталогизација у публикацији
Народна и универзитетска библиотека
Републике Српске, Бања Лука

61(048.3)(0.034.2)

МЕЂУНАРОДНА научна конференција "Знањем до здравља -
САНУС" (5 ; 2026 ; Приједор)

Zbornik sažetaka [Elektronski izvor] / Međunarodna naučna
konferencija [Znanjem do zdravlja] SANUS 2026, Prijedor, 17-19.
septembar 2026. godine ; [urednici Radoslav Grujić, Milka
Stijepić]. - Onlajn izd. - El. knjiga. - Prijedor : JU Visoka
medicinska škola, 2026

Način pristupa (URL): <https://sanusconference.org/>. - Насл. са
насл. екрана. - Опис извора дана 8.09.2026. - Ел. публикација у
ПДФ формату опсега XX, 170 стр. - Упор. срп. текст и енгл.
превод. - На спор. насл. стр.: Book of abstracts of scientific
conference SANUS 2026. - Насл. над текстом: Međunarodna
naučna konferencija SANUS 2026, Prijedor 17-19. septembar 2026.
- Регистар.

ISBN 978-99997-956-6-1

COBISS.RS-ID 144771073

President of the Scientific Committee

Prof. dr Radoslav Grujić, full professor, PI College of Health Sciences Prijedor, Bosnia and Herzegovina

Scientific Committee

Academician dr Snježana Popović - Pejičić, full professor, Faculty of Medicine Banja Luka, University of Banja Luka, Bosnia and Herzegovina

Academician dr Novo Pržulj, full professor, ANURS, University of Banja Luka, Agricultural Faculty, Banja Luka, Republic of Srpska, Bosnia and Herzegovina

Prof. dr Siniša Ristić, full professor, Faculty of Medicine in Foca, University of East Sarajevo, Bosnia and Herzegovina

Prof. dr Slavica Grujić, full professor, Faculty of Technology Banja Luka, University of Banja Luka, Bosnia and Herzegovina

Prof. dr Vineta Srebrenkoska, full professor, Faculty of Technology Stip, University of Stip, Macedonia

Prof. dr Vladimir Kakurinov, full professor, Consulting and Training Center KEY, Macedonia

Prof. dr Janja Bojanić, full professor, Public Health Institute of the Republic of Srpska, Bosnia and Herzegovina

Prof. dr Dragana Milutinović, full professor, Medical Faculty in Novi Sad, Republic of Serbia

Prof. dr Tsveta Georgieva, full professor, Applied Genomics and GMO Department National Center of Public Health and Analyses Sofia, Republic of Bulgaria

Prof. dr Sanja Tomić, full professor, Medical Faculty in Novi Sad, Republic of Serbia

Prof. dr Branislava Brestovački Svitlica, full professor, Medical Faculty in Novi Sad, Republic of Serbia

Prof. dr Martina Oder, associate professor, Dean of the Faculty of Health Sciences, University of Ljubljana, Republic of Slovenia

Prof. dr Veselin Medenica, associate professor, College of Social Work Belgrade, Republic of Serbia

Prof. dr Gordan Bajić, Faculty of Health Sciences, Pan-European University "APEIRON", Bosnia and Herzegovina

Prof. dr Tanja Čolić, associate professor, PI College of Health Sciences Prijedor, Bosnia and Herzegovina

Prof. dr Mile Despotović, associate professor, College of Nursing Čuprija, Republic of Serbia

Prof. dr Jelena Pavlović, associate professor, Faculty of medicine Foča, University of East Sarajevo, Bosnia and Herzegovina

Prof. dr Nataša Milenović, associate professor, Medical Faculty in Novi Sad, Republic of Serbia

Prof. dr Svjetlana Sredić, associate professor, Faculty of Mining and Geology, University of Banja Luka, Bosnia and Herzegovina

Prof. dr Pjotr Grigorevič Meljnik, Institute of Forestry, Russian Academy of Sciences, Moscow, Russia
Prof. dr Kenan Čaklovića, associate professor, Faculty of Health Studies Sarajevo, Bosnia and Herzegovina
Prof. dr Slobodan Stanić, associate professor, Public Health Institute of the Republic of Srpska, Bosnia and Herzegovina
Prof. dr Mojca Jevšnik Podlesnik, associate professor, Faculty of Health Sciences, University of Ljubljana, Republic of Slovenia
Prof. dr Vedrana Vejzović, associate professor, Malmö University, Sweden
Prof. dr Rok Fink, associate professor, Faculty of Health, University of Ljubljana, Republic of Slovenia
Prof. dr Slaven Grbić, associate professor, University of Veterinary Medicine, Budapest, Hungary
Doc. dr Igor Grujić, PI College of Health Sciences Prijedor, Bosnia and Herzegovina
Doc. dr Gordana Guzijan, Faculty of Medicine Banja Luka, University of Banja Luka, Bosnia and Herzegovina
Doc. dr Stanislav Palija, Institute for rehabilitation and physical medicine „Dr Miroslav Zotović“ Banja Luka, Bosnia and Herzegovina
Doc. dr Duška Jović, Faculty of Medicine Banja Luka, University of Banja Luka, Bosnia and Herzegovina
Doc. dr Vesna Kalaba, College professor, PI College of Health Sciences Prijedor, Bosnia and Herzegovina
Doc. dr Darijana AntoniĆ, Public Health Institute of the Republic of Srpska, Bosnia and Herzegovina
Doc. dr Sanela Domuz Vujnović, University Clinical Centre of the Republic of Srpska, Bosnia and Herzegovina
Doc. dr Dijana Laštro, Institute for rehabilitation and physical medicine “Dr Miroslav Zotović”, Banja Luka, Bosnia and Herzegovina
Doc. dr Ivana Ristić, Teacher Education Faculty, University of Priština, temporarily located in Kosovska Mitrovica, Republic of Serbia
Doc. dr Ilija Stijepić, PI College of Health Sciences Prijedor, Bosnia and Herzegovina
Doc. dr Goran Aljetić, College professor, PI College of Health Sciences Prijedor, Bosnia and Herzegovina
Doc. dr Adriano Friganović, University of Applied Health Sciences Zagreb, Republic of Croatia
Doc.dr Daniel Maestro, Faculty of Health Studies in Sarajevo, University of Sarajevo, Bosnia and Herzegovina
Doc. dr Sanela Pivač, Faculty of Health Care Angela Boškin, Republic of Slovenia
Doc. dr Vesna Gojković Cvjetković, Faculty of Technology Zvornik, University of East Sarajevo, Bosnia and Herzegovina
Doc. dr Natalija Hadživuković, Faculty of Medicine Foča, University of East Sarajevo, Bosnia and Herzegovina
Doc. dr Srđan Živanović, Faculty of Medicine Foča, University of East Sarajevo, Bosnia and Herzegovina

Dr Milka Stijepić, College professor, PI College of Health Sciences Prijedor, Bosnia and Herzegovina

Dr Dubravka Šimunović, University of Applied Health Sciences Zagreb, Republic of Croatia

Dr sci.med. Danijela Pecarski president of Academy of Applied Sciences, The College of Health Sciences Belgrade, Republic of Serbia

Dr sci. med. Mila Filipović, assistant to the president for teaching Academy of Applied Sciences, The College of Health Sciences Belgrade, Republic of Serbia

Dr Nada Savković, professor of Applied Sciences, Academy of Applied Sciences, The College of Health Sciences Belgrade, Republic of Serbia

Dr Željko Vlaisavljević, professor of Applied Sciences, Medica College for Vocational Studies in Healthcare, Republic of Serbia

Dr Thembekile Ncube, teacher, Faculty of Applied Sciences, Bulawayo, Zimbabwe

Dr Dragica Đurđević-Milošević, Institute of Chemistry, Technology and Microbiology, Belgrade, Republic of Serbia

Dr Gordana Zavišić, research associate, Faculty of Pharmacy Novi Sad, Republic of Serbia

Dr Jelena Tomović, research associate, Institute for Biological Research "Siniša Stanković", Republic of Serbia

Dr Gordana Jovanović, professor of Applied Studies, Academy of Applied Sciences Šabac, Unit for Medical, Business and Technological studies, Republic of Serbia

Dr Katarina Kacjan Žgajnar, high teacher, Faculty of Health Sciences, Republic of Slovenia

Dr Jovana Glušac, ProteinDistillery GmbH, Ostpreußenstraße 2/2, 73760 Ostfildern, Germany

Dr Miloš Ćirić, senior research associate, Institute for Chemistry, Technology and Metallurgy, Belgrade, Republic of Serbia

Dr Vlado Balaban, Palacký University Olomouc, Czech Republic

President of the Organizing Committee

Doc. dr Ilija Stijepić, PI College of Health Sciences Prijedor, Bosnia and Herzegovina

Organizing Committee

Prof. dr Tanja Čolić, associate professor, PI College of Health Sciences Prijedor, Bosnia and Herzegovina

Prof. dr Svjetlana Sredić, associate professor, Faculty of Mining and Geology, University of Banja Luka, Bosnia and Herzegovina

Prof. dr Jelena Pavlović, associate professor, Faculty of Medicine Foča, University of East Sarajevo, Bosnia and Herzegovina

Doc. dr Dijana Laštro, Institute for rehabilitation and physical medicine “Dr Miroslav Zotović”, Banja Luka, Bosnia and Herzegovina

Doc. dr Natalija Hadživuković, Faculty of Medicine Foča, University of East Sarajevo, Bosnia and Herzegovina

Doc. dr Srđan Živanović, Faculty of Medicine Foča, University of East Sarajevo, Bosnia and Herzegovina

Dr Boris Pejić, senior assistant, Faculty of Medicine Foča, University of East Sarajevo, Bosnia and Herzegovina

Dr Siniša Nikolić, College professor, PI College of Health Sciences Prijedor, Bosnia and Herzegovina

Dr Ljiljana Jovčić, head of the department College of Health Sciences Belgrade, Republic of Serbia

Dr Marija Trajkova, College of Health Sciences Belgrade, Republic of Serbia

ma Dragana Sredić Cartes, College senior assistant, PI College of Health Sciences Prijedor, Bosnia and Herzegovina

mr Darko Vujasinović, College senior assistant, PI College of Health Sciences Prijedor, Bosnia and Herzegovina

mr Mira Obradović, College senior assistant, PI College of Health Sciences Prijedor, Bosnia and Herzegovina

ma Dragan Gajić, College senior assistant, PI College of Health Sciences Prijedor, Bosnia and Herzegovina

ma Lidija Slunjski Tišma, College senior assistant, PI College of Health Sciences Prijedor, Bosnia and Herzegovina

ma Ljubiša Kucurski, College senior assistant, PI College of Health Sciences Prijedor, Bosnia and Herzegovina

ma Ljiljana Savić, College senior assistant, PI College of Health Sciences Prijedor, Bosnia and Herzegovina

mr Nikolina Rajlić, College senior assistant, PI College of Health Sciences Prijedor, Bosnia and Herzegovina

ma Bogdana Mraković, Institute for rehabilitation and physical medicine „Dr Miroslav Zotović“ Banja Luka, Bosnia and Herzegovina
ma Slađana Jokić, Institute for rehabilitation and physical medicine „Dr Miroslav Zotović“ Banja Luka, Bosnia and Herzegovina
ma Dijana Brborović, Institute for rehabilitation and physical medicine „Dr Miroslav Zotović“ Banja Luka, Bosnia and Herzegovina
ma Mirela Kecman Dakić, Institute for rehabilitation and physical medicine „Dr Miroslav Zotović“ Banja Luka, Bosnia and Herzegovina
ma Milica Predojević, Institute for rehabilitation and physical medicine „Dr Miroslav Zotović“ Banja Luka, Bosnia and Herzegovina
ma Milan Rožić, Institute for rehabilitation and physical medicine „Dr Miroslav Zotović“ Banja Luka, Bosnia and Herzegovina
mr Nemanja Jovičić, Association of Laboratory and Sanitary Health Professionals, Bosnia and Herzegovina
Dijana Kljajić, BA in Economics, PI College of Health Sciences Prijedor, Bosnia and Herzegovina
Dijana Srdić, English Language and Literature Teacher, PI College of Health Sciences Prijedor, Bosnia and Herzegovina
Mag. Alenka Plemelj-Mohorič, senior lecturer, Faculty of Health Sciences, University of Ljubljana, Republic of Slovenia
Belma Paraganlija Đurđević, Association of Laboratory and Sanitary Health Professionals, Bosnia and Herzegovina
Mila Štaka, Association of Laboratory and Sanitary Health Professionals, Bosnia and Herzegovina
Irena Vučen, librarian, PI College of Health Sciences Prijedor, Bosnia and Herzegovina

Predgovor

Sa posebnim zadovoljstvom predstavljamo Zbornik sažetaka 5. međunarodne naučne konferencije „Znanjem do zdravlja – SANUS 2026“, koju organizuje JU Visoka medicinska škola Prijedor, u saradnji sa Akademijom strukovnih studija Beograd – Odsekom Visoka zdravstvena škola Zemun, Univerzom u Ljubljani – Zdravstvenom fakultetom, Consulting and Training Center KEY Skoplje, Makedonija, Asocijacijom laboratorijskih i sanitarnih zdravstvenih profesionalaca u Bosni i Hercegovini, Udruženjem diplomiranih medicinaru zdravstvene njege Republike Srpske, Udruženjem radnih terapeuta Bosne i Hercegovine i Udruženjem fizioterapeuta Republike Srpske.

Međunarodna naučna konferencija „Znanjem do zdravlja – SANUS 2026“ nastavlja tradiciju okupljanja stručnjaka, naučnika, nastavnika, zdravstvenih profesionalaca i studenata s ciljem razmjene naučnih i stručnih dostignuća, unapređenja interdisciplinarne saradnje i promovisanja savremenih pristupa očuvanju i unapređenju zdravlja. Savremeni izazovi u oblasti zdravstva zahtijevaju kontinuirano sticanje novih znanja, povezivanje različitih naučnih disciplina i razmjenu iskustava, što ovakvim naučnim skupovima daje poseban značaj. Posebnu vrijednost konferenciji daje njena izražena međunarodna dimenzija. Na konferenciji učestvuje *187 učesnika iz 13 zemalja*, koji svojim naučnim i stručnim doprinosima potvrđuju značaj međunarodne saradnje i zajedničkog djelovanja u oblasti zdravstvenih nauka.

Zbornik sažetaka obuhvata ukupno *77 naučnih i stručnih sažetaka*, raspoređenih u okviru četiri tematske sesije:

1. Laboratorijska medicina, dijagnostika i zdravstvena njega;
2. Rehabilitacija, fizičko i mentalno zdravlje;
3. Spoljašnji faktori i prevencija rizika po zdravlje ljudi;
4. Studentska sekcija.

U okviru navedenih tematskih oblasti predstavljeni su sažeci *tri plenarna predavanja, pet predavanja po pozivu (sekcijских predavanja)*, kao i *69 usmenih i posterskih prezentacija*. Raznovrsnost tema i naučnih pristupa svjedoči o aktuelnosti istraživačkih pitanja, ali i o potrebi sagledavanja zdravlja čovjeka iz različitih perspektiva – od laboratorijske dijagnostike i zdravstvene njege, preko fizičkog i mentalnog zdravlja, do uticaja spoljašnjih faktora i mogućnosti prevencije zdravstvenih rizika.

Posebno mjesto u programu konferencije zauzima *Studentska sekcija*, koja pruža priliku mladim istraživačima da predstave rezultate svojih istraživanja, razvijaju naučnoistraživačke kompetencije i aktivno učestvuju u razmjeni znanja i iskustava. Uključivanje studenata u naučnoistraživački proces od posebnog je značaja za razvoj njihovih profesionalnih i istraživačkih kompetencija, ali i za stvaranje temelja za budući razvoj zdravstvenih profesija i zdravstvenih nauka.

Vjerujemo da će radovi predstavljeni na konferenciji i objedinjeni u ovom Zborniku doprinijeti širenju naučnih saznanja, podsticanju novih istraživanja i uspostavljanju buduće saradnje među stručnjacima i institucijama iz različitih zemalja.

Zahvaljujemo se svim autorima, učesnicima, predavačima, članovima naučnih i organizacionih odbora, recenzentima, saradnicima i suorganizatorima koji su svojim znanjem, radom i angažmanom doprinijeli uspješnoj organizaciji ovog značajnog međunarodnog skupa.

Preface

It is our great pleasure to present the Book of Abstracts of the 5th International Scientific Conference “Knowledge to Health – SANUS 2026”, organized by the Public Institution College of Health Sciences Prijedor, in cooperation with the Academy of Vocational Studies Belgrade – Department of Higher School of Health Studies Zemun, the University of Ljubljana – Faculty of Health Sciences, Consulting and Training Center KEY Skopje, Association of Laboratory and Sanitary Health Professionals in Bosnia and Herzegovina, Graduate Nurses Association of the Republic of Srpska, Association of Occupational Therapists of Bosnia and Herzegovina, and the Association of Physiotherapists of the Republic of Srpska.

The International Scientific Conference “Knowledge to Health – SANUS 2026” continues the tradition of bringing together experts, scientists, educators, healthcare professionals, and students with the aim of exchanging scientific and professional knowledge and achievements, fostering interdisciplinary cooperation, and promoting contemporary approaches to the preservation and improvement of health. Contemporary challenges in healthcare require continuous acquisition of new knowledge, integration of different scientific disciplines, and the exchange of experience, making scientific conferences such as this one particularly valuable. The conference is distinguished by its strong international dimension. A total of 187 participants from 13 countries are taking part in the conference, contributing their scientific and professional expertise and thereby reaffirming the importance of international cooperation and joint efforts in the field of health sciences.

The Book of Abstracts contains a total of 77 scientific and professional abstracts, organized within four thematic sessions:

1. Laboratory Medicine, Diagnostics and Health Care;
2. Rehabilitation, Physical and Mental Health;
3. External Factors and Prevention of Risks to Human Health;
4. Student Session;

Within these thematic areas, the abstracts of three plenary lectures, five invited lectures (session lectures), and 69 oral and poster presentations are included. The diversity of topics and scientific approaches reflects the relevance of current research questions, as well as the need to consider human health from different perspectives – from laboratory diagnostics and health care, through physical and mental health, to the impact of external factors and opportunities for the prevention of health risks.

A special place in the conference programme is dedicated to the Student Section, which provides young researchers with an opportunity to present the results of their research, develop their scientific and research competencies, and actively participate in the exchange of knowledge and experience. The involvement of students in the research process is particularly important for the development of their professional and research competencies, as well as for laying the foundations for the future development of healthcare professions and health sciences. We believe that the papers presented at the conference and compiled in this Book of Abstracts will contribute to the dissemination of scientific knowledge, encourage further research, and foster future cooperation among experts and institutions from different countries.

We would like to express our sincere gratitude to all authors, participants, lecturers, members of the Scientific and Organizing Committees, reviewers, collaborators, and co-organizers whose knowledge, work, and commitment contributed to the successful organization of this important international scientific event.

With the hope that this Book of Abstracts will serve as a valuable contribution to the further exchange of knowledge, experience, and ideas, we wish all readers an enriching and inspiring insight into the scientific and professional achievements presented at the conference.

Prijedor, 2026

The Editorial Board

Sadržaj

PLENARNA PREDAVANJA/PLENARY LECTURES	1
NUTRITIVNE I ZDRAVSTVENE KORISTI PROSA I DRUGIH VRSTA ŽITA.....	3
NUTRITIONAL AND HEALTH BENEFITS OF MILLET AND OTHER TYPES OF GRAINS	4
DIJABETES MELITUS I ZDRAVLJE KOSTI: SAVREMENI KONCEPT POVEZANOSTI SA OSTEOPOROZOM	5
DIABETES MELLITUS AND BONE HEALTH: CONTEMPORARY CONCEPTS OF ITS ASSOCIATION WITH OSTEOPOROSIS	6
GONARTROZA DANAS	7
GONARTHROSIS TODAY	8
PREDAVANJA PO POZIVU(SEKCIJSKA PREDAVANJA) / LECTURES BY INVITATION (SECTION LECTURE).....	9
PARADOKS 49%: SESTRINSKA RADNA SNAGA BOSNE I HERCEGOVINE IZMEĐU OBRAZOVNOG SISTEMA, SISTEMSKE NEVIDLJIVOSTI I EMIGRACIJE	11
THE 49% PARADOX: BOSNIA AND HERZEGOVINA'S NURSING WORKFORCE BETWEEN THE EDUCATIONAL SYSTEM AND EMIGRATION.....	12
PRIMJENA VJEŠTAČKE INTELIGENCIJE U INTERPRETACIJI LABORATORIJSKIH NALAZA.....	13
APPLICATION OF ARTIFICIAL INTELLIGENCE IN THE INTERPRETATION OF LABORATORY FINDINGS	14
ZNAČAJ PROCJENE MOTORIČKIH SPOSOBNOSTI ZA PLANIRANJE NASTAVE FIZIČKOG VASPITANJA	15
THE IMPORTANCE OF PHYSICAL FITNESS ASSESSMENT FOR PLANNING PHYSICAL EDUCATION CLASSES	16
TAIJIĆUEN KAO INOVATIVAN PRISTUP U FIZIKALNOJ REHABILITACIJI: PRIMJER INSTITUCIONALNE SARADNJE.....	17
TAI CHI AS AN INNOVATIVE APPROACH IN PHYSICAL REHABILITATION: A CASE OF INSTITUTIONAL COOPERATION.....	18
POSTBIOTICI PREMA PROBIOTICIMA: ANTIBAKTERIJSKI EFEKAT I POTENCIJALNA UPOTREBA KAO ALTERNATIVNIH ANTIBIOTSKIH AGENASA 19	
POSTBIOTICS VERSUS PROBIOTICS: ANTIBACTERIAL EFFECT AND POTENTIAL USE AS ALTERNATIVE ANTIBIOTIC AGENTS.....	20
LABORATORIJSKA MEDICINA, DIJAGNOSTIKA, ZDRAVSTVENA NJEGA/ LABORATORY MEDICINE, DIAGNOSTICS, HEALTH CARE.....	21
UTICAJ SESTRINSKIH UDRUŽENJA I ČASOPISA NA RAZVOJ ISTRAŽIVAČKE KULTURE U SESTRINSTVU	23
THE IMPACT OF NURSING ASSOCIATIONS AND JOURNALS ON THE DEVELOPMENT OF RESEARCH CULTURE IN NURSING	24

USLOVI RADA KAO DETERMINANTA EKSTRINZIČNOG ZADOVOLJSTVA MEDICINSKIH SESTARA I TEHNIČARA	25
WORKING CONDITIONS AS A DETERMINANT OF EXTRINSIC JOB SATISFACTION AMONG NURSES AND MEDICAL TECHNICIANS	26
ZNAČAJ ZDRAVSTVENE NEGE KOD OSOBA SA INVALIDITETOM, KROZ EDUKACIJU, SPROVOĐENJE PROGRAMA RANE INTERVENCIJE I AKTIVNO UČEŠĆE MEDICINSKIH SESTARA	27
THE IMPORTANCE OF HEALTH CARE FOR PEOPLE WITH DISABILITIES, THROUGH EDUCATION, IMPLEMENTATION OF EARLY INTERVENTION PROGRAMS AND THE ACTIVE PARTICIPATION OF NURSES	28
HEPATITIS B INFEKCIJA – UČESTALOST U BOSNI I HERCEGOVINI U PERIODU 2015.-2019. GODINE I NEGA OBOLELIH	29
HEPATITIS B INFECTION – PREVALENCE IN BOSNIA AND HERZEGOVINA DURING 2015–2019 AND CARE OF AFFECTED PATIENTS.....	30
POVEZANOST PRIDRŽAVANJA MEDITERANSKOG OBRASCA ISHRANE SA ZDRAVSTVENIM PARAMETRIMA I FAKTORIMA RIZIKA: ZNAČAJ ZA JAVNO ZDRAVLJE.....	31
ASSOCIATION BETWEEN ADHERENCE TO THE MEDITERRANEAN DIETARY PATTERN AND HEALTH PARAMETERS AND RISK FACTORS: IMPLICATIONS FOR PUBLIC HEALTH	32
PROCENA UNOSA ULTRA-PRERAĐENE HRANE: METODOLOŠKI PREGLED POSTOJEĆIH INSTRUMENATA I POTREBA ZA REGIONALNO PRILAGOĐENIM NOVA-UPF SCREENER-OM.....	33
ASSESSMENT OF ULTRA-PROCESSED FOOD INTAKE: METHODOLOGICAL REVIEW OF EXISTING INSTRUMENTS AND THE NEED FOR A REGIONALLY ADAPTED NOVA-UPF SCREENER	34
PRIMENA SAVREMENIH TEHNOLOGIJA U SESTRINSTVU: MOGUĆNOSTI I ZNAČAJ ZA UNAPREĐENJE NEGE PACIJENATA.....	35
APPLICATION OF MODERN TECHNOLOGIES IN NURSING: OPPORTUNITIES AND SIGNIFICANCE FOR IMPROVING PATIENT CARE	36
PRIMJENA FAZI LOGIKE U KLASIFIKACIJI MALIGNIH TUMORA ŠTITNE ŽLIJEZDE	37
APPLICATION OF FUZZI LOGIC IN THE CLASSIFICATION OF MALIGNANT TUMORS OF THE THYROID GLAND	38
INFORMACIONI SISTEMI ZA UPRAVLJANJE PODACIMA U MEDICINSKIM LABORATORIJAMA.....	39
INFORMATION SYSTEMS FOR DATA MANAGEMENT IN MEDICAL LABORATORIES.....	40
VJEŠTAČKA INTELIGENCIJA KAO DETERMINANTA BUDUĆNOSTI NAPREDNE ZDRAVSTVENE NJEGE: PREKIDANJE DOMINO EFEKTA ISCRPLJENOSTI KROZ DIGITALNU TRANSFORMACIJU.....	41

ARTIFICIAL INTELLIGENCE AS A DETERMINANT OF THE FUTURE OF ADVANCED NURSING CARE: BREAKING THE DOMINO EFFECT OF EXHAUSTION THROUGH DIGITAL TRANSFORMATION	42
AUTORSKI NOVA-UPF FREKVENCIJSKI MODUL ZA PROCENU UČESTALOSTI KONZUMIRANJA ULTRA-PRERAĐENE HRANE KOD ODRASLIH: PILOT-STUDIJA	43
AN AUTHOR-DEVELOPED NOVA-UPF FREQUENCY MODULE FOR ASSESSING ULTRA-PROCESSED FOOD CONSUMPTION IN ADULTS: A PILOT STUDY	44
RAZUMEVANJE MEDICINSKOG JEZIKA: UTICAJ TERMINOLOGIJE, POJMOVA I ŽARGONA NA KOMUNIKACIJU SA PACIJENTIMA	45
UNDERSTANDING MEDICAL LANGUAGE: THE IMPACT OF TERMINOLOGY, TERMS AND JARGON ON COMMUNICATING WITH PATIENTS	46
SPEKTROFOTOMETRIJSKA I ELEKTROHEMIJSKA ANALIZA ODREĐIVANJA UTICAJA ANTIHISTAMINIKA NA AKTIVNOST ENZIMA	47
SPECTROPHOTOMETRIC AND ELECTROCHEMICAL ANALYSIS OF THE EFFECT OF ANTIHISTAMINES ON ENZYME ACTIVITY	48
HIDROLAT LAVANDE (<i>Lavandula angustifolia</i>) KAO IZVOR PRIRODNIH ANTIOKSIDANASA: HEMIJSKI SASTAV I STABILNOST TOKOM SKLADIŠTENJA	49
LAVENDER HYDROSOL (<i>Lavandula angustifolia</i>) AS A SOURCE OF NATURAL ANTIOXIDANTS: CHEMICAL COMPOSITION AND STABILITY DURING STORAGE	50
ZAHTJEVI DOBRE LABORATORIJSKE PRAKSE (DLP) ZA LABORATORIJSKO OSOBLJE	51
GOOD LABORATORY PRACTICE (GLP) REQUIREMENTS FOR LABORATORY PERSONNEL	52
HPV VAKCINACIJA U SRBIJI: OBUHVAT IMUNIZACIJOM, INFORMISANOST I STAVOVI ADOLESCENATA	53
HPV VACCINATION IN SERBIA: IMMUNIZATION COVERAGE, AWARENESS, AND ATTUDIES OF ADOLESCENTS	54
STANJE ARTERIJSKOG PRITISKA, GLIKEMIJE I INDEKSA TELESNE MASE U POPULACIJI STUDENATA	55
ASSESSMENT OF ARTERIAL BLOOD PRESSURE, GLYCEMIA AND BODY MASS INDEX IN A STUDENT POPULATION	56
FARMAKOEKONOMSKI ASPEKTI PRIMENE SGLT-2 INHIBITORA U LEČENJU SRČANE INSUFICIJENCIJE: PREGLED ANALIZA ISPLATIVOSTI	57
PHARMACOECONOMIC ASPECTS OF THE USE OF SGLT-2 INHIBITORS IN THE TREATMENT OF HEART FAILURE: A REVIEW OF COST-EFFECTIVENESS ANALYSES	58
INTERAKCIJE ANTIDIJABETIČKIH LIJEKOVA SA DIJETETSKIM SUPLEMENTIMA KOJI SADRŽE BILJNE KOMPONENTE	59
INTERACTIONS OF ANTIDIABETIC DRUGS WITH DIETARY SUPPLEMENTS CONTAINING HERBAL COMPONENTS	60

PROCENA KVALITETA ŽIVOTA ŽENA U PERIODU MENOPAUZE I POSTMENOPAUZE I POVEZANOST MENOPAUZALNIH SIMPTOMA SA REPRODUKTIVNIM KARAKTERISTIKAMA I STAROSNOM DOBI.....	61
ASSESSMENT OF THE QUALITY OF LIFE OF WOMEN IN THE PERIODS OF MENOPAUSE AND POSTMENOPAUSE AND THE ASSOCIATION OF MENOPAUSAL SYMPTOMS WITH REPRODUCTIVE CHARACTERISTICS AND AGE.....	62
KLINIČKI ZNAČAJ MORFOLOŠKIH KARAKTERISTIKA KARCINOMA GRLIĆA MATERICE.....	63
CLINICAL SIGNIFICANCE OF MORPHOLOGICAL CHARACTERISTICS IN CERVICAL CANCER.....	64
KLINIČKO-LABORATORIJSKI ZNAČAJ HDL-HOLESTEROLA KAO BIOMARKERA KARDIOVASKULARNIH BOLESTI.....	65
CLINICAL AND LABORATORY SIGNIFICANCE OF HDL CHOLESTEROL AS A BIOMARKER OF CARDIOVASCULAR DISEASES.....	66
PRIMJENA UZV NA UREĐAJU SCOLIOSCAN U PRAĆENJU SKOLIOZE KOD DJECE	67
USE OF ULTRASOUND WITH THE SCOLIOSCAN DEVICE IN MONITORING SCOLIOSIS IN CHILDREN.....	68
UČESTALOST IDENTIFIKACIJE BAKTERIJE <i>STAPHYLOCOCCUS AUREUS</i> U BRISEVIMA RADNIH POVRŠINA I BRISEVIMA NOSA BOLNIČKOG OSOBLJA	69
FREQUENCY OF IDENTIFICATION OF <i>STAPHYLOCOCCUS AUREUS</i> IN SWABS FROM WORK SURFACES AND NASAL SWABS OF HOSPITAL STAFF	70
SPOSOBNOST PRODUKCIJE BIOFILMA KOD BAKTERIJSKIH UZROČNIKA HRONIČNIH INFEKCIJA SREDNJEG UHA	71
BIOFILM-FORMING CAPACITY OF BACTERIAL PATHOGENS CAUSING CHRONIC OTITIS MEDIA.....	72
SEKVENCIRANJE MITOHONDRIJSKE DNK U SAVREMENOJ LABORATORIJSKOJ DIJAGNOSTICI.....	73
MITOCHONDRIAL DNA SEQUENCING IN MODERN LABORATORY DIAGNOSTICS	74
REHABILITACIJA, FIZIČKO I MENTALNO ZDRAVLJE/REHABILITATION, PHYSICAL AND MENTAL HEALTH.....	75
MOGUĆNOSTI PRIMJENE VJEŠTAČKE INTELIGENCIJE I DIGITAL TWIN TEHNOLOGIJE U REHABILITACIJI I FIZIKALNOJ TERAPIJI.....	77
UNLOCKING THE POTENTIAL OF AI-POWERED DIGITAL TWINS IN TRANSFORMING REHABILITATION AND PHYSICAL THERAPY	78
PERIPROSTETIČNE INFEKCIJE U REVIZIONOJ ARTROPLASTICI KUKA I KOLJENA: ISKUSTVA JEDNOG CENTRA	79
PERIPROSTHETIC JOINT INFECTIONS IN HIP AND KNEE ARTHROPLASTY: A SINGLE CENTER EXPERIENCE	80

EFEKAT TERAPIJSKIH VJEŽBI U KOREKCIJI IDIOPATSKE SKOLIOZE KOD ADOLESCENATA	81
THE EFFECT OF THERAPEUTIC EXERCISES IN THE CORRECTION OF IDIOPATHIC SCOLIOSIS IN ADOLESCENTS	82
LOKOMAT PRO - ERIGO PRO – ANDAGO	83
LOKOMAT PRO – ERIGO PRO – ANDAGO	84
SCHROTH TEHNIKA U TRETMANU SKOLIOZA KOD ODRASLIH	85
SCHROTH METHOD IN THE TREATMENT OF ADULT SCOLIOSIS	86
METODE FIZIOTERAPEUTSKE PROCJENE OBOLJELIH OD DUCHENNEOVE MIŠIĆNE DISTROFIJE	87
METHODS OF PHYSIOTHERAPEUTIC ASSESSMENT OF PATIENTS WITH DUCHENNE MUSCULAR DYSTROPHY	88
ZNAČAJ PULMOLOŠKE REHABILITACIJE U LIJEČENJU BRONHIJALNE ASTME U DJEČIJOJ DOBI - PRIKAZ SLUČAJA	89
THE IMPORTANCE OF PULMONARY REHABILITATION IN THE TREATMENT OF BRONCHIAL ASTHMA IN CHILDHOOD – A CASE REPORT	90
FORMIRANJE ZAVRŠNE OCJENE U VISOKOM OBRAZOVANJU	91
FORMATION OF FINAL GRADE IN HIGHER EDUCATION	92
TERAPIJSKA IGRA KAO VID PODRŠKE DJECI SA SMETNJAMA U RAZVOJU SUOČENOM SA NASILJEM	93
THERAPEUTIC PLAY AS A FORM OF SUPPORT FOR CHILDREN WITH DEVELOPMENTAL DISABILITIES EXPOSED TO VIOLENCE	94
KUPOVINE NAMIRNICA KORIŠTENJEM TESTA VJEŠTINA	95
USING THE TEST OF GROCERY SHOPPING SKILLS	96
POZITIVAN UTICAJ ZDRAVE ISHRANE U ŠKOLI NA UČENIKE MLAĐEG ŠKOLSKOG UZRASTA	97
POSITIVE INFLUENCE OF HEALTHY NUTRITION IN SCHOOL ON STUDENTS HEALTH	98
PROCENA UMORA U RADNOJ TERAPIJI – PREGLEDNI RAD	99
EVALUATION OF FATIGUE IN OCCUPATIONAL THERAPY- REVIEW PAPER....	100
PRIMJENA TERAPIJE IGROM U RADNOJ TERAPIJI	101
APPLICATION OF PLAY THERAPY IN OCCUPATIONAL THERAPY	102
ROBOTSKI POTPOMOĞNUT TRENING KAO RADNOTERAPIJSKI MODALITET U TRETMANU DJECE SA LEZIOM PLEKSUS BRACHIALISA.....	103
ROBOT-ASSISTED TRAINING AS AN OCCUPATIONAL THERAPY MODALITY IN THE TREATMENT OF CHILDREN WITH BRACHIALIS PLEXUS LESIONS.....	104
PRIMENA VEŠTAČKE INTELIGENCIJE U KINEZITERAPIJI.....	105
APPLICATION OF ARTIFIICIAL INTELLIGENCE IN KINESITHERAPY	106

ZNAČAJ PLANINARENJA U OČUVANJU FIZIČKOG I MENTALNOG ZDRAVLJA I UNAPREĐENJU KVALITETA ŽIVOTA	107
THE IMPORTANCE OF HIKING IN MAINTAINING PHYSICAL AND MENTAL HEALTH AND IMPROVING QUALITY OF LIFE	108
OBRNUTA UČIONICA KAO NASTAVNI KONCEPT U BIOMEDICINSKOM OBRAZOVANJU	109
FLIPPED CLASSROOM AS A TEACHING CONCEPT IN BIOMEDICAL EDUCATION	110
UNIVERZALNI DIZAJN I DOBROBIT U RADNOM OKRUŽENJU KANCELARIJSKIH RADNIKA(prezentacija projekta NOO ULTRA)	111
UNIVERSALLY DESIGNED SUSTAINABLE AND GREEN BUILDINGS FOR HEALTH AND WELL (presentation of the NOO ULTRA project).....	112
SPOLJAŠNJI FAKTORI I PREVENCIJA RIZIKA PO ZDRAVLJE LJUDI / EXTERNAL FACTORS AND PREVENTION OF RISKS TO HUMAN HEALTH	113
PRIMJENA VJEŠTAČKE INTELIGENCIJE U OBRAZOVANJU ZDRAVSTVENIH PROFESIONALACA.....	115
APPLICATION OF ARTIFICIAL INTELLIGENCE IN THE EDUCATION OF HEALTH PROFESSIONALS.....	116
PERCEPCIJA KULTURE BEZBJEDNOSTI HRANE MEĐU ZAPOSLENIMA U SLOVENAČKIM UGOSTITELJSKIM OBJEKTIMA: EKSPLORATIVNO ISTRAŽIVANJE PUTEM UPITNIKA	117
PERCEIVED FOOD SAFETY CULTURE AMONG EMPLOYEES IN SLOVENIAN FOOD SERVICE ESTABLISHMENTS: AN EXPLORATORY QUESTIONNAIRE STUDY.....	118
RAZVOJ I VALIDACIJA INTEGRISANOG PROGRAMA ČIŠĆENJA I DEZINFEKCIJE U FABRIKAMA PREHRAMBENE INDUSTRIJE	119
DEVELOPMENT AND VALIDATION OF AN INTEGRATED CLEANING AND DISINFECTION PROGRAM IN FOOD INDUSTRY FACTORIES	120
BUDUĆI PRAVCI RAZVOJA PROIZVODNJE I PRERADE HRANE I (IS)HRANE LJUDI	121
FUTURE DIRECTIONS OF DEVELOPMENT OF FOOD PRODUCTION AND PROCESSING AND HUMAN NUTRITION.....	122
NOVI PREHRAMBENI TRENDOWI USMJERENI KA ODRŽIVOSTI: ULOGA PROTEINA, VLAKANA I PRIHVAĆENOSTI OD STRANE POTROŠAČA	123
NEW FOOD TRENDS TOWARD SUSTAINABILITY: THE ROLE OF PROTEIN, FIBER, AND CONSUMER ACCEPTANCE	124
PERSPEKTIVE U PROIZVODNJI OVSENOG JOGURTA SA DODATKOM KONCENTRATA BILJNIH PROTEINA.....	125
PERSPECTIVES IN THE PRODUCTION OF OAT YOGURT WITH THE ADDITION OF VEGETABLE PROTEIN CONCENTRATE.....	126
OPTIMIZACIJA DODATKA MEDA U PROIZVODNJI PROBIOTSKOG JOGURTA ..	127
OPTIMIZATION OF HONEY ADDITION IN PROBIOTIC YOGURT PRODUCTION	128

UTICAJ FALSIFIKATA MEDA I PROIZVODA OD MEDA NA JAVNO ZDRAVLJE	129
IMPACT OF HONEY AND HONEY-BASED PRODUCT FRAUD ON PUBLIC HEALTH	130
INDEKSI KVALITETA LIPIDA BILJNIH ULJA	131
LIPID QUALITY INDICES OF VEGETABLE OILS	132
ZNAČAJ <i>ESCHERICHIA COLI</i> U MIKROBIOLOGIJI HRANE I VODE: RAZLIKOVANJE INDIKATORSKIH I PATOGENIH SOJEVA	133
THE IMPORTANCE OF <i>ESCHERICHIA COLI</i> IN FOOD AND WATER MICROBIOLOGY: DIFFERENTIATION OF INDICATOR AND PATHOGENIC STRAINS	134
BEZBJEDNOST HRANE: NOVI TRENDOWI ZASNOVANI NA PRIMJENI I INFORMACIONIH TEHNOLOGIJA I VJEŠTAČKE INTELIGENCIJE	135
FOOD SAFETY: NEW TRENDS BASED ON THE APPLICATION OF BOTH INFORMATION TECHNOLOGY AND ARTIFICIAL INTELLIGENCE	136
ANALIZA PROTEINA GLIJADINA IZ ŽITARICA HPLC METODOM	137
ANALYSIS OF GLIADIN PROTEINS FROM CEREALS USING THE HPLC METHOD	138
LIGNIKOLNE GLJIVE I NJIHOV ZNAČAJ ZA ZDRAVLJE LJUDI	139
LIGNICOLLOUS FUNGI AND THEIR IMPORTANCE FOR HUMAN HEALTH	140
ANALIZA RADNOG OPTEREĆENJA I MIŠIĆNO-KOŠTANIH RIZIKA MEĐU ZAPOSLENIMA U ZUBOTEHNIČKOM LABORATORIJU	141
ANALYSIS OF WORKLOAD AND MUSCULOSKELETAL RISKS AMONG EMPLOYEES IN A DENTAL LABORATORY	142
PROCJENA RIZIKA ZA BEZBJEDNOST I ZDRAVLJE RADNIKA U PROCESU EKSPLOATACIJE I PRERADE TEHNIČKO-GRAĐEVINSKOG KAMENA	143
RISK ASSESSMENT FOR OCCUPATIONAL SAFETY AND HEALTH IN THE EXPLOITATION AND PROCESSING OF TECHNICAL STONE	144
IZMEĐU PREPORUKE I POVJERENJA: FAKTORI KOJI UTIČU NA IZBOR ZDRAVSTVENE USTANOVE KOD PACIJENATA	145
BETWEEN RECOMMENDATION AND TRUST: FACTORS INFLUENCING PATIENTS' CHOICE OF HEALTHCARE INSTITUTIONS	146
STUDENTSKA SESIJA/STUDENT SESSION	147
ULOGA MEDICINSKE SESTRE U PREVENCIJI I LIJEČENJU RAKA GRLIĆA MATERICE	149
ROLE OF THE NURSE IN THE PREVENTION AND TREATMENT OF CERVICAL CANCER	150
SPEKTROFOTOMETRIJSKA ANALIZA SADRŽAJA UKUPNIH FENOLA U LJEKOVITOM I ZAČINSKOM BILJU	151
SPECTROPHOTOMETRIC ANALYSIS OF TOTAL PHENOLIC CONTENT IN MEDICINAL AND AROMATIC PLANTS	153

CLARK I BRESLOW KAO GLAVNI PROGNOŠTIČKI PARAMETRI KOD MELANOMA KOŽE	155
CLARK AND BRESLOW AS THE MAIN PROGNOSTIC PARAMETERS IN CUTANEOUS MELANOMA.....	156
PROCJENA ZNANJA ZDRAVSTVENOG OSOBLJA O PROFESIONALNIM RIZICIMA U BOLNICAMA JUŽNOG TUNISA	157
EVALUATION OF HEALTHCARE STAFF'S KNOWLEDGE ABOUT OCCUPATIONAL RISKS IN SOUTHERN TUNISIAN HOSPITALS	158
DRUŠTVENE MREŽE U OBRAZOVANJU MEDICINSKIH SESTARA I BABICA: MULTICENTRIČNI I MEĐUNARODNI ISTRAŽIVAČKI PROTOKOL	159
SOCIAL MEDIA IN NURSING AND MIDWIFERY EDUCATION: A MULTICENTER AND INTERNATIONAL RESEARCH PROTOCOL	160
ISTRAŽIVANJE ULOGE ZDRAVSTVENIH INFLUENSERA NA DRUŠTVENIM MREŽAMA U OBLIKOVANJU PROFESIONALNOG IDENTITETA STUDENATA SESTRINSTVA I BABIŠTVA: MEĐUNARODNA KVALITATIVNA STUDIJA.....	161
EXPLORING THE ROLE OF HEALTH-RELATED SOCIAL MEDIA INFLUENCERS IN SHAPING THE PROFESSIONAL IDENTITY OF NURSING AND MIDWIFERY STUDENTS: AN INTERNATIONAL QUALITATIVE STUDY	162
AUTOFAGIJA/AUTOPHAGY	163
UTICAJ PROTEINA LEĆE, TIKVE I RIŽE NA PROCES FERMENTACIJE I PROMJENE TOKOM SKLADIŠTENJA SOJINOG JOGURTA OBOGAĆENOG MEDOM / THE INFLUENCE OF LENTIL, PUMPKIN, AND RICE PROTEINS ON THE FERMENTATION PROCESS AND CHANGES DURING STORAGE OF HONEY- ENRICHED SOY YOGURT	164
SISTEMSKA ANALIZA ISTRAŽIVAČKIH PODATAKA O UTICAJU TRIHALOMETANA IZ VODE ZA PIĆE NA NASTANAK KARCINOMA MOKRAĆNE BEŠIKE KOD LJUDI	165
SYSTEMATIC ANALYSIS OF RESEARCH DATA ON THE ASSOCIATION BETWEEN DRINKING WATER TRIHALOMETHANES AND THE INCIDENCE OF BLADDER CANCER IN HUMANS	166
INDEKS AUTORA / INDEX OF AUTHORS.....	167

PLENARNA PREDAVANJA

PLENARY LECTURES

NUTRITIVNE I ZDRAVSTVENE KORISTI PROSA I DRUGIH VRSTA ŽITA

***Novo Pržulj¹, Ana Velimirović², Dragan Brenjo³, Predrag Ilić⁴, Zoran Govedar^{4,5},
Radoslav Grujić⁶***

¹Akademija nauka i umjetnosti Republike Srpske, Banja Luka, Bosna i Hercegovina

²Univerzitet Crne Gore, Biotehnički fakultet, Podgorica, Crna Gora

³Agencija za bezbjednost hrane Bosne i Hercegovine, Mostar, Bosna i Hercegovina

⁴PSRI Institut za zaštitu i ekologiju Republike Srpske, Republika Srpska,
Bosna i Hercegovina

⁵Univerzitet u Banjoj Luci, Šumarski fakultet, Banja Luka, Republika Srpska,
Bosna i Hercegovina

⁶JU Visoka medicinska škola Prijedor, Nikole Pašića 4a, Republika Srpska,
Bosna i Hercegovina

Sažetak. Proso predstavlja opšti naziv za bezglutenske, sitnosjemene gajene vrste trava čije se zrno i vegetativni dijelovi koriste u ishrani ljudi, stoke, ptica i živine. Danas se proso uzgajaju u 93 zemlje na više od 30 miliona hektara, uglavnom u Aziji (oko 50%) i Africi (oko 40%), gdje i dalje predstavljaju važan izvor hrane. Proso zauzima peto mjesto u svjetskoj proizvodnji žitarica, poslije kukuruza, pšenice, ječma i sirka. Na području Zapadnog Balkana najpogodnije vrste su obični proso, barnyard proso, lisičji repak i kanarska trava (*Phalaris canariensis*), pri čemu je obični proso najviše zastupljen u proizvodnji. Zbog svoje višestruke upotrebe i dodatne nutritivne vrijednosti, vrste prosa nazivaju se „čudesnim kulturama“. Dobar su izvor energije, dijetetskih vlakana, sporo svarljivog i rezistentnog skroba. Bogati proteinima i esencijalnim aminokiselinama, uključujući sumporne aminokiseline, proso se široko koristi u ishrani vegana. Ovojnice zrna predstavljaju primarni izvor složenih dijetetskih vlakana otpornih na enzimsku digestiju. Zrno je takođe bogato mineralima i vitaminima, koji su uglavnom koncentrisani u aleuronskom sloju, klici i perikarpu. Nutrijenti prisutni u prosu pružaju brojne zdravstvene koristi, uključujući smanjenje učestalosti raka, gojaznosti, dijabetesa, kardiovaskularnih bolesti, gastrointestinalnih poremećaja, migrena i astme. Zbog niskog glikemijskog indeksa i visokog sadržaja vlakana, proso se smatra idealnom hranom za dijabetičare. Proso ima važnu ulogu u savremenoj ishrani kao potencijalni izvor esencijalnih hranljivih materija, naročito u zemljama u razvoju i nerazvijenim područjima. Međutim, zrno prosa sadrži i antinutritivne supstance, prirodno prisutne fitohemikalije koje smanjuju biodostupnost hranljivih materija. Kada se konzumiraju sirove, ove supstance mogu predstavljati zdravstveni rizik. Ipak, posljednjih godina određena antinutritivna jedinjenja, poput polifenola, prepoznata su kao nutraceutici zahvaljujući svojim antioksidativnim svojstvima. Antinutritivne supstance mogu se ukloniti odgovarajućim predtretmanom ili tehnikama prerade.

Ključne riječi: bezglutenska ishrana, bezbjednost hrane, dijetetska vlakna, prevencija kardiovaskularnih bolesti, metaboličko zdravlje.

NUTRITIONAL AND HEALTH BENEFITS OF MILLET AND OTHER TYPES OF GRAINS

***Novo Pržulj¹, Ana Velimirović², Dragan Brenjo³, Predrag Ilić⁴,
Zoran Govedar^{1,5}, Radoslav Grujić⁶***

¹Academy of Science and Arts of the Republic of Srpska, Banja Luka,
Bosnia and Herzegovina

²University of Montenegro, Biotechnical Faculty, Podgorica, Montenegro

³Food Safety Agency of Bosnia and Herzegovina, Mostar, Bosnia and Herzegovina

⁴PSRI Institute for Protection and Ecology of the Republic of Srpska, Republic of
Srpska, Bosnia and Herzegovina

⁵University of Banja Luka, Faculty of Forestry, Banja Luka, Republic of Srpska,
Bosnia and Herzegovina

⁶PI College of Health Sciences Prijedor, Nikole Pašića 4a, Republic of Srpska,
Bosnia and Herzegovina

Abstract. Millets is a general term for gluten-free, small-seeded cultivated grass species whose grains and vegetative parts are used as food for humans, livestock, birds, and poultry. Today, millets are grown in 93 countries on more than 30 million hectares, mainly in Asia (around 50%) and Africa (about 40%), where they remain important food sources. Millet ranks fifth in global cereal production, after maize, wheat, barley, and sorghum. In the Western Balkans, proso millet, barnyard millet, foxtail millet, and canary grass (*Phalaris canariensis*) are the most suitable, with proso millet being the most widely cultivated. Due to their versatility and added nutritional value, millet species are referred to as „miracle crops.” They are a good source of energy, dietary fiber, slowly digestible and resistant starch. Rich in proteins and essential amino acids, including sulfur-containing ones, millets are widely consumed by vegans. Millet bran is a primary source of complex dietary fiber, which is resistant to enzymatic digestion. The grains are also rich in minerals and vitamins, mainly concentrated in the aleurone layer, germ, and pericarp. Millet nutrients provide various health benefits, including reducing the incidence of cancer, obesity, diabetes, cardiovascular disease, gastrointestinal issues, migraines, and asthma. Due to its low glycemic index and high fiber content, millet is considered an ideal food for diabetics. Millets play an important role in modern diets as a potential source of essential nutrients, particularly in developing and underdeveloped countries. However, millet grains also contain antinutrients, naturally occurring phytochemicals that reduce nutrient bioavailability. When consumed raw, these compounds may pose health risks. Yet, in recent years, certain antinutritional compounds such as polyphenols have been recognized as nutraceuticals due to their antioxidant properties. Antinutrients can be removed through pretreatment or processing techniques.

Key words: gluten-free diet, food security, dietary fiber, cardiovascular prevention, metabolic health

DIJABETES MELITUS I ZDRAVLJE KOSTI: SAVREMENI KONCEPT POVEZANOSTI SA OSTEOPOROZOM

Snježana Popović-Pejičić^{1,2}, Anja Janković-Pejičić³, Nina Pejičić^{1,4}

¹ Medicinski fakultet Univerziteta u Banjoj Luci, Save Mrkalja 14, Banja Luka,
Republika Srpska, Bosna i Hercegovina

² Akademija nauka i umjetnosti Republike Srpske 'Bana Lazarevića 1', Banja Luka,
Republika Srpska, Bosna i Hercegovina

³ Medicinski Univerzitet Beč, Spitalgasse 23 1090 Vienna, Austrija

⁴ Univerzitetski klinički centar Republike Srpske 12 beba bb, Banja Luka,
Republika Srpska, Bosna i Hercegovina

Sažetak. Dijabetes melitus (DM) i osteoporoza su hronične bolesti sa rastućom prevalencijom. Danas više od 537 miliona osoba (10,5 %) širom svijeta boluje od DM, a prema najnovijim procjenama ~18–20 % ukupne populacije može imati osteoporozu, s jasnom razlikom kod žena ~23 % i muškaraca, ~11–12 %. DM često koegzistira sa osteoporozom, pa se često koristi termin dijaporoza ili dijabetesna osteopatija (DO). DO označava kompleks strukturnih i funkcionalnih poremećaja kostiju koji nastaju kao posljedica hronične hiperglikemije i drugih metaboličkih poremećaja u dijabetesu. Patofiziološki mehanizmi DO uključuju hroničnu hiperglikemiju, oksidativni stres, poremećaj Wnt signalnog puta, nakupljanje AGEs (akumulacija produkata glikozilacije), deficit insulina. T1DM i T2DM imaju različite profile rizika za poremećaj metabolizma kosti. T1DM povezan je sa smanjenom mineralnom gustinom kosti (BMD) i povećanim rizikom od fraktura, nezavisno od klasičnih faktora rizika. Kod osoba sa T2DM, i pored normalne ili povećane BMD, skeletni integritet može biti značajno kompromitovan, što ukazuje na važnost procjene kvaliteta, a ne samo kvantiteta koštane mase. Rizik od fraktura, naročito kuka, je povećan oko 1,3–1,7x, što ukazuje da BMD nije dovoljan pokazatelj koštanog oštećenja u T2DM. Studije ukazuje da je T2DM povezan sa smanjenom formacijom kostiju i povećanom resorpcijom kostiju, na šta utiču hormonske promjene, inflamacija i poremećeni ćelijski signalni putevi. Frakture u osoba sa T2DM češće dovode do komplikacija, lošijeg oporavka i veće smrtnosti. Određene klase antihiperglikemijskih lijekova mogu dodatno uticati na skeletni metabolizam, što treba uzeti u obzir u terapijskom odlučivanju. Metformin, DPP-4i i GLP1-RA imaju neutralni/pozitivni efekat na BMD/rizik od frakture. Inkretinske terapije mogu poboljšati formiranje kosti i imati protektivno dejstvo od gubitka kosti povezanih sa gubitkom težine. Negativne efekte na kost pokazuju tiazolidindioni, kanalifozin i preparati sulfonilureje. Procjena rizika za frakture i evaluacija metabolizma kosti trebaju biti integrisani dio standardne njege osoba sa dijabetesom.

Ključne riječi: Dijabetes melitus, osteoporoza, BMD (koštana mineralna gustina), frakture, antihiperglikemijski lijekovi

DIABETES MELLITUS AND BONE HEALTH: CONTEMPORARY CONCEPTS OF ITS ASSOCIATION WITH OSTEOPOROSIS

Snjezana Popovic-Pejicic^{1,2}, Anja Jankovic-Pejicic³, Nina Pejicic^{1,4}

¹Faculty of Medicine, University of Banja Luka Save Mrkalja 14, Banja Luka, Republic of Srpska, Bosnia and Herzegovina

²Academy of Sciences and Arts of the Republic of Srpska Bana Lazarevića 1, Banja Luka, Republic of Srpska, Bosnia and Herzegovina

³Medical University of Vienna (MedUni Vienna), Spitalgasse 23, 1090 Vienna, Austria

⁴University Clinical Centre of the Republic of Srpska 12 beba bb, Banja Luka, Republic of Srpska, Bosnia and Herzegovina

Abstract. Diabetes mellitus (DM) and osteoporosis are chronic diseases with an increasing global prevalence. Currently, more than 537 million people (10.5%) worldwide are living with DM, while the latest estimates suggest that approximately 18–20% of the overall population may have osteoporosis, with a clear sex-related difference affecting ~23% of women and ~11–12% of men. DM frequently coexists with osteoporosis, and the terms diapoporosis or diabetic osteopathy (DO) are increasingly used. DO refers to a complex of structural and functional bone abnormalities resulting from chronic hyperglycemia and other metabolic disturbances associated with diabetes. The pathophysiological mechanisms underlying DO include chronic hyperglycemia, oxidative stress, dysregulation of the Wnt signaling pathway, accumulation of advanced glycation end products (AGEs), and insulin deficiency. Type 1 diabetes mellitus (T1DM) and type 2 diabetes mellitus (T2DM) exhibit distinct risk profiles regarding bone metabolism disorders. T1DM is associated with reduced bone mineral density (BMD) and an increased fracture risk independent of classical risk factors. In contrast, in individuals with T2DM, despite normal or even increased BMD, skeletal integrity may be significantly impaired, highlighting the importance of assessing bone quality in addition to bone quantity. The risk of fractures, particularly hip fractures, is increased by approximately 1.3–1.7-fold, indicating that BMD alone is not a sufficient marker of skeletal impairment in T2DM. Studies suggest that T2DM is associated with decreased bone formation and increased bone resorption, influenced by hormonal alterations, inflammation, and disrupted cellular signaling pathways. Fractures in individuals with T2DM are more frequently associated with complications, poorer recovery, and increased mortality. Certain classes of antihyperglycemic agents may additionally affect skeletal metabolism and should therefore be considered during therapeutic decision-making. Metformin, DPP-4 inhibitors, and GLP-1 receptor agonists have neutral or beneficial effects on BMD and fracture risk. Incretin-based therapies may enhance bone formation and exert protective effects against bone loss associated with weight reduction. Conversely, thiazolidinediones, canagliflozin, and sulfonylureas have demonstrated adverse skeletal effects. Assessment of fracture risk and evaluation of bone metabolism should therefore be integrated into the standard care of individuals with diabetes.

Keywords: Diabetes mellitus, osteoporosis, BMD (bone mineral density), fractures, antihyperglycemic agents.

GONARTROZA DANAS

Stanislav Palija^{1,2}

¹Institut za fizikalnu medicinu, rehabilitaciju i ortopedsku hirurgiju „Dr Miroslav Zotović“, Slatinska 11, Banja Luka, Bosna i Hercegovina

²Medicinski fakultet Univerziteta u Banjoj Luci, Save Mrkalja 14, Banja Luka, Bosna i Hercegovina

Sažetak. Gonartroza, odnosno osteoartritis koljena, jedan je od najčešćih uzroka hroničnog bola, smanjene pokretljivosti i funkcionalnog ograničenja u odrasloj i starijoj populaciji. Savremeno razumijevanje gonartroze prevazilazi raniji koncept bolesti kao jednostavnog “trošenja hrskavice”. Danas se gonartroza posmatra kao bolest cijelog zgloba, uključujući zglobnu hrskavicu, subhondralnu kost, sinoviju, meniskuse, ligamente, mišiće i biomehaniku donjeg ekstremiteta. Dijagnoza gonartroze temelji se prvenstveno na kliničkoj slici, koja uključuje bol pri opterećenju, ukočenost, krepitacije, smanjen obim pokreta, otok i progresivno ograničenje svakodnevnih aktivnosti. Radiološka obrada ima važnu ulogu u procjeni uznapredovalosti bolesti i planiranju liječenja, ali radiološki nalaz ne mora uvijek korelirati s intenzitetom simptoma. Zbog toga je u savremenom pristupu ključno liječiti pacijenta, a ne samo radiološku sliku. Liječenje gonartroze mora biti individualizovano, multidisciplinarno i usmjereno na smanjenje bola, očuvanje funkcije, poboljšanje kvaliteta života i usporavanje funkcionalnog propadanja. Osnovu terapije čine edukacija pacijenta, terapijske vježbe, korekcija tjelesne mase, prilagođena fizička aktivnost i biomehanička podrška. Farmakološko liječenje, uključujući topikalne i oralne nesteroidne antireumatike, treba primjenjivati racionalno, uz procjenu rizika i koristi. Intraartikularne injekcije mogu imati mjesto kod odabranih pacijenata, ali ne predstavljaju trajno rješenje, niti zamjenu za aktivnu rehabilitaciju, a naglašena je i komercijalizacija ove terapije. Kod uznapredovale gonartroze, kada bol, deformitet i funkcionalno ograničenje značajno narušavaju kvalitet života, a konzervativno liječenje više nije dovoljno, indikovana je ortopedska procjena radi mogućeg operativnog liječenja. Od metoda na raspolaganju su biološke operacije u cilju korekcije deformiteta i preraspodjele sila (najčešće se izvodi visoka tibijalna osteotomija), te parcijalne i totalne artroplastike. Ove operacije predstavljaju efikasnu terapijsku opciju kod pravilno odabranih pacijenata, uz uslov realnih očekivanja, adekvatne preoperativne pripreme i postoperativne rehabilitacije. Gonartroza danas zahtijeva savremen, cjelovit i personalizovan pristup. Cilj liječenja nije samo ublažavanje bola, nego očuvanje pokreta, samostalnosti i kvaliteta života pacijenta.

Ključne riječi: terapijske vježbe, korekcija tjelesne težine, intraartikularne injekcije, artroplastika koljena.

GONARTHROSIS TODAY

Stanislav Palijski^{1,2}

¹Institute for Physical Medicine, Rehabilitation and Orthopedic Surgery „Dr
Miroslav Zotović“, Slatinska 11, Banja Luka, Bosnia and Herzegovina

²Medical Faculty, University of Banja Luka, Save Mrkalja 14, Banja Luka,
Bosnia i Herzegovina

Abstract. Gonarthrosis, a related osteoarthritis of the knee, is one of the most common causes of chronic pain, joint deformities and functional limitations in the elderly and aging population. The modern understanding of gonarthrosis goes beyond the traditional concept of “worn cartilage” and views it as a disease of the entire joint, including the cartilage, subchondral bone, synovium, menisci, ligaments, muscles, and biomechanics of the lower extremity. The diagnosis is based primarily on the clinical presentation: pain during weight-bearing, stiffness, crepitus, reduced range of motion, swelling, and progressive loss of function. Radiological assessment plays an important role in evaluating disease severity and planning treatment; however, the extent of radiological changes does not always correlate with symptom intensity. Therefore, in the modern approach, it is essential to treat the patient, not merely the radiological finding. The treatment of gonarthrosis must be individualized, multidisciplinary, and focused on pain reduction, preservation of mobility, improvement of stability, functional capacity, and quality of life. The foundation of conservative treatment consists of patient education, therapeutic exercises, muscle strengthening, biomechanical correction, adapted physical activity, weight reduction in overweight patients, and the use of assistive devices when indicated. Pharmacological therapy, including topical and oral nonsteroidal anti-inflammatory drugs, should be rational, time-limited, and adjusted to the patient’s comorbidities. Intra-articular injections, particularly corticosteroids, may have a role in painful, activated knees, although their effect is generally short-term. The use of hyaluronic acid, platelet-rich plasma, and other biological therapies requires careful patient selection and realistic presentation of expected outcomes. Arthroscopic lavage and debridement have no place in the routine treatment of primary degenerative gonarthrosis. In patients whose pain, deformity, and functional limitation significantly impair daily life, and in whom conservative measures are ineffective, assessment for surgical treatment is indicated. Available treatment methods include biological surgical procedures aimed at correcting deformity and redistributing mechanical forces, most commonly high tibial osteotomy, as well as partial and total arthroplasty. These procedures represent an effective therapeutic option in properly selected patients, provided that expectations are realistic and that adequate preoperative preparation and postoperative rehabilitation are ensured. Gonarthrosis today requires a modern, personalized, and team-based approach. The goal of treatment is not only pain reduction, but also preservation of function, independence, and an active life for the patient.

Keywords: therapy exercises, body weight correction, intra-articular injections, knee arthroplasty.

**PREDAVANJA PO POZIVU
(SEKCIJSKA PREDAVANJA)**

**LECTURES BY INVITATION
(SECTION LECTURE)**

PARADOKS 49%: SESTRINSKA RADNA SNAGA BOSNE I HERCEGOVINE IZMEĐU OBRAZOVNOG SISTEMA, SISTEMSKE NEVIDLJIVOSTI I EMIGRACIJE

Duška Jović¹

¹Univerzitet u Banjoj Luci, Medicinski fakultet, Katedra za sestrinstvo, Save Mrkalja 19, 78 000 Banja Luka, Republika Srpska, Bosna i Hercegovina

Sažetak. Globalni deficit sestrinskog kadra pozicionirao je Bosnu i Hercegovinu (BiH) kao jednu od vodećih zemalja porijekla sestrinskih profesionalaca za razvijene zdravstvene sisteme, primarno Njemačku. Cilj rada je analizirati i uporediti podatke o efikasnosti sistema obrazovanja sestrinskog kadra, strukturi zaposlenosti i nezaposlenosti na entitetskom nivou u BiH, te utvrditi intenzitet i trendove profesionalne emigracije. Primijenjena je metoda triangulacije sekundarnih statističkih podataka entitetskih zavoda za javno zdravlje, službi za zapošljavanje i visokoškolskih ustanova: Medicinski fakultet Banja Luka (MF BL) i Visoka medicinska škola (VMŠ) Prijedor. Globalni trendovi analizirani su uvidom u zvanični izvještaj OECD 2025 („International Migration Outlook 2025“) i podatke njemačkog Saveznog zavoda za statistiku (Destatis). Analiza obrazovnog ciklusa ukazuje na nisku stopu efikasnosti studiranja na MF BL (29,2% za Bachelor; 33,4% za Master), dok je VMŠ Prijedor efikasnija sa 54,7% diplomiranih. Triangulacija podataka otkriva sistemski paradoks u Republici Srpskoj gdje su diplomirane sestre statistički nevidljive u evidencijama zaposlenih ($n = 0$), iako na tržištu rada čine deficitarnu grupu sa 17 nezaposlenih sa visokom, naspram 531 sa srednjom spremom. Nasuprot tome, Federacija BiH bilježi trend akademizacije sa 1.035 zaposlenih visokoobrazovanih sestara. Prema izvještaju OECD 2025, stopa ekspatrijacije medicinskih sestara rođenih u BiH iznosi ekstremnih 49,1% (preko 20.350 lica). Broj iseljenih sestara u zemljama OECD-a porastao je sa 6.346 u 2000. na preko 20.000 u 2020., što predstavlja dramatičan rast od 221%. Samo u 2023. Njemačka je priznala 4.500 sestrinskih kvalifikacija iz BiH, čime država dijeli drugo mjesto u svijetu sa Filipinima. Podaci potvrđuju duboki strukturalni paradoks. Dok domaći sistem gubi kapital kroz administrativnu nevidljivost akademskog kadra i niske stope diplomiranja, Bosna i Hercegovina besplatno obučava sestrinski kadar za Njemačku. Očuvanje održivosti domaćeg zdravstvenog sistema zahtijeva hitno zakonsko vrednovanje Bachelor i Master stepena obrazovanja te dugoročnu tranziciju ka elementima Magnet modela za aktivno zadržavanje kadra.

Ključne riječi: sestrinska migracija, stopa ekspatrijacije, efikasnost sistema obrazovanja, Njemačka, Magnet model, Bosna i Hercegovina.

THE 49% PARADOX: BOSNIA AND HERZEGOVINA'S NURSING WORKFORCE BETWEEN THE EDUCATIONAL SYSTEM AND EMIGRATION

Duška Jović¹

¹University of Banja Luka, Faculty of Medicine, Department of Nursing, Save Mrkalja 19, 78 000 Banja Luka, Republic of Srpska, Bosnia and Herzegovina

Abstract. The global shortage of nursing staff has positioned Bosnia and Herzegovina (BiH) as one of the leading source countries of nursing professionals for developed healthcare systems, particularly Germany. This study aims to analyze and compare data on the efficiency of the nursing education system, the structure of employment and unemployment at the entity level in BiH, and to determine the intensity and trends of professional emigration. A triangulation method was applied to secondary statistical data obtained from entity institutes for public health, employment services, and higher education institutions—Faculty of Medicine Banja Luka (FM BL) and College of Health Sciences Prijedor (CHS Prijedor). Global trends were analyzed using the official OECD 2025 report (International Migration Outlook 2025) and data from the German Federal Statistical Office (Destatis). The analysis of the educational cycle indicates a low completion efficiency rate at FM BL (29.2% for Bachelor; 33.4% for Master), while CHS Prijedor proves more efficient with 54.7% of graduates. Data triangulation reveals a systemic paradox in the Republika Srpska entity, where graduate nurses are statistically invisible in employment records ($n = 0$), despite representing a scarce group on the labor market with 17 unemployed individuals with a higher education degree compared to 531 with a secondary school diploma. Conversely, the Federation of BiH entity records an academicization trend with 1,035 employed higher-educated nurses. According to the OECD 2025 report, the expatriation rate of BiH-born nurses stands at an extreme 49.1% (over 20,350 individuals). The number of emigrated nurses in OECD countries increased from 6,346 in 2000 to over 20,000 in 2020, representing a dramatic growth of 221%. In 2023 alone, Germany recognized 4,500 nursing qualifications from BiH, placing the country in a tie for second place globally alongside the Philippines. The data confirm a deep structural paradox. While the domestic system loses capital through the administrative invisibility of academic staff and low graduation rates, Bosnia and Herzegovina provides free training for the German nursing labor market. Preserving the sustainability of the domestic healthcare system urgently requires the formal legal valuation of Bachelor and Master degrees in nursing, alongside a long-term transition toward implementing Magnet model elements for active workforce retention.

Keywords: nursing migration, expatriation rate, educational system efficiency, Germany, Magnet model, Bosnia and Herzegovina.

PRIMJENA VJEŠTAČKE INTELIGENCIJE U INTERPRETACIJI LABORATORIJSKIH NALAZA

Đorđe Stojisavljević¹, Darija Knežević², Duška Jović², Igor Paravac², Ljubisa Preradović³

¹Univerzitetski računarski centar, Bulevar vojvode Petra Bojovića 1A, 78000, Banja Luka, Republika Srpska; Bosna i Hercegovina

²Medicinski fakultet Univerziteta u Banjoj Luci, Save Mrkalja 19 Banja Luka, Republika Srpska, Bosna i Hercegovina

³Arhitektonsko-građevinsko-geodetski fakultet, Bulevar vojvode Petra Bojovića 1A, 78000, Banja Luka, Republika Srpska, Bosna i Hercegovina

Sažetak. Interpretacija laboratorijskih rezultata predstavlja jedan od ključnih segmenata kliničkog odlučivanja i predstavlja dio svakodnevne medicinske prakse. Laboratorijska medicina obezbjeđuje objektivne, kvantitativne i kvalitativne podatke o fiziološkom i patološkom stanju pacijenta, ali ti podaci sami po sebi ne predstavljaju dijagnozu, niti imaju pun klinički značaj bez adekvatne medicinske interpretacije. Ovaj rad analizira stepen saglasnosti u interpretaciji laboratorijskih nalaza između sistema vještačke inteligencije MedGPT i ljekara u uslovima sa i bez navedenih kliničkih simptoma. Istraživanje je osmišljeno kao opservaciono i komparativno. Laboratorijski parametri su izabrani tako da obuhvate uobičajene biohemijske i hematološke pokazatelje koji se rutinski koriste u kliničkoj praksi i imaju dijagnostički značaj. Analiza je izvedena na kontrolisanom setu simuliranih laboratorijskih nalaza, sa i bez dodatnih kliničkih simptoma. Rezultati pokazuju visok nivo podudarnosti između MedGPT i ljekara pri interpretaciji izolovanih laboratorijskih podataka, bez statistički značajnih razlika u ocjenama. Saglasnost između ocjena vještačke inteligencije za laboratorijske nalaze bez simptoma i sa simptomima bila je umjerena, pri čemu je uočena statistički značajna razlika između ove dvije procjene ($p = 0,001$). Saglasnost između ocjena koje je dao ljekar za laboratorijske nalaze bez simptoma i sa simptomima bila je umjerena i statistički značajna ($p = 0,001$). Između ocjena vještačke inteligencije i ljekara za nalaze bez kliničkih simptoma utvrđena je visoka i statistički značajna saglasnost ($p < 0,001$). Ovi rezultati ukazuju da je prisustvo kliničkih simptoma značajno uticalo na način na koji je sistem vještačke inteligencije interpretirao iste laboratorijske nalaze. Nalazi ukazuju da sistemi vještačke inteligencije mogu predstavljati koristan alat za podršku u postanalitičkoj fazi laboratorijske medicine, uz neophodno zadržavanje centralne uloge ljekarskog kliničkog rasuđivanja.

Ključne riječi: vještačka inteligencija, laboratorijska medicina, interpretacija laboratorijskih nalaza.

APPLICATION OF ARTIFICIAL INTELLIGENCE IN THE INTERPRETATION OF LABORATORY FINDINGS

***Đorđe Stojisavljević¹, Darija Knežević², Duška Jović², Igor Paravac²,
Ljubisa Preradović³***

University Computer Center, Bulevar vojvode Petra Bojovića 1A, 78000
Banja Luka, Republic of Srpska; Bosnia and Herzegovina

² Faculty of Medicine, University of Banja Luka, Save Mrkalja 19, Banja
Luka, Republic of Srpska; Bosnia and Herzegovina

³ Faculty of Architecture, Civil Engineering and Geodesy, Bulevar vojvode
Petra Bojovića 1A, 78000 Banja Luka, Republic of Srpska, Bosnia and Herzegovina

Absrtact. Interpretation of laboratory results represents one of the key components of clinical decision-making and is an integral part of everyday medical practice. Laboratory medicine provides objective, quantitative, and qualitative data on a patient's physiological and pathological state; however, these data alone do not constitute a diagnosis and do not have full clinical significance without appropriate medical interpretation. This paper analyzes the level of agreement in the interpretation of laboratory test results between the artificial intelligence system MedGPT and physicians under conditions with and without reported clinical symptoms. The study was designed as an observational and comparative analysis. Laboratory parameters were selected to include common biochemical and hematological markers routinely used in clinical practice with established diagnostic value. The analysis was conducted on a controlled set of simulated laboratory results, both with and without additional clinical symptoms. The results demonstrate a high level of concordance between MedGPT and physicians when interpreting isolated laboratory data, with no statistically significant differences in assessments. Agreement between artificial intelligence assessments of laboratory findings with and without symptoms was moderate, with a statistically significant difference between the two conditions ($p = 0.001$). Agreement between physician assessments of laboratory findings with and without symptoms was also moderate and statistically significant ($p = 0.001$). A high and statistically significant level of agreement was observed between artificial intelligence and physicians for findings without clinical symptoms ($p < 0.001$). The inclusion of clinical symptoms leads to reduced agreement and greater variability in interpretations, but without significant differences in the final conclusions. These findings indicate that artificial intelligence systems can serve as a useful support tool in the post-analytical phase of laboratory medicine, while maintaining the central role of physicians' clinical judgment.

Key words: artificial intelligence, laboratory medicine, interpretation of laboratory results

ZNAČAJ PROCJENE MOTORIČKIH SPOSOBNOSTI ZA PLANIRANJE NASTAVE FIZIČKOG VASPITANJA

Radenko Dobraš¹

¹Fakultet fizičkog vaspitanja i sporta, Univerzitet u Banjoj luci, Bulevar vojvode
Petra Bojovića 1A, Banja Luka, Bosna i Hercegovina

Sažetak. Obzirom da je fizičko vaspitanje jedini školski predmet koji ima zdravstveni zadatak, neophodno je planiranju nastave fizičkog vaspitanja prići izuzetno ozbiljno, ne zanemarujući ni, naizgled najsitnije detalje. To znači, imajući u vidu bio-psiho-socijalnu prirodu čovjekovu, neophodnost uvida u svaku od navedenih komponenti. Što se tiče motoričkih sposobnosti koje spadaju u latentni prostor motorike, njihova procjena može da bude izuzetno složena, pogotovo ako ovaj proces prate određeni parazitarne faktori. Cilj rada je utvrditi koliko su pojedini testovi za procjenu motoričkih sposobnosti pouzdani i koji su problemi prisutni u njihovoj primjeni, posebno sa određenim uzrastima. Metode korištene u radu su metod teorijske analize, metode prikupljanja i obrade podataka. Iako je EUROFIT, test koji se, zbog svoje jednostavnosti, često koristi u procjeni motoričkih sposobnosti, standardizovan, u praktičnoj primjeni se mogu pojaviti problemi koji mogu dovesti do slučaja loše osjetljivosti, što predstavlja jedan od najvećih nedostataka svakog testa. U ovom radu takvim se pokazao test IZDRŽAJ U ZGIBU. Kao što je poznato, zadatak ispitanika je da se što duže zadrži na vratilu u položaju zgiba, čime bi trebalo da se procijeni statička snaga ruku i ramenog pojasa. Prilikom samog testiranja, utvrđeno je da značajan broj ispitanika ne može da se zadrži u željenom položaju ni jednu sekundu. Loša diskriminativnost ovog testa se ogleda u tome što je nemoguće utvrditi razlike po kriterijumu ovog testa između učenika koji nisu uspjeli da pravilno urade test. Odgovor na pitanje razloga ovakvih rezultata, možda leži u korelaciji između rezultata ovog testa i rezultata testa DINAMOMETRIJA ŠAKE kao i korelaciji IZDRŽAJA U ZGIBU i TJELESNE TEŽINE. Pokazalo se da postoji veća negativna korelacija između izdržaja u zgibu i tjelesne težine, nego pozitivna korelacija između izdržaja u zgibu i dinamometrije šake. O navedenom treba voditi računa prilikom planiranja nastave fizičkog vaspitanja i izboru instrumenata za procjenu motoričkih sposobnosti učenika.

Ključne riječi: fizičko vaspitanje, planiranje, motoričke sposobnosti, morfološke karakteristike

THE IMPORTANCE OF PHYSICAL FITNESS ASSESSMENT FOR PLANNING PHYSICAL EDUCATION CLASSES

***Radenko Dobraš**¹*

¹Faculty of Physical Education and Sport, University of Banja Luka, Bulevar vojvode Petra Bojovića 1A, Banja Luka, Bosnia and Herzegovina

Abstract. Given that physical education is the only school subject with an explicit health-related task, the planning of physical education classes must be approached with particular care, without neglecting even the seemingly smallest details. Considering the biopsychosocial nature of human beings, this implies the need to take into account each of these components. Physical fitness, which belong to the latent domain of motor functioning, can be particularly complex to assess, especially when the assessment process is affected by certain confounding factors. The aim of this paper is to determine the reliability of individual tests used to assess physical fitness and to identify problems that may arise in their application, particularly among specific age groups. The methods used in the study include theoretical analysis, as well as methods of data collection and data processing. Although EUROFIT, due to its simplicity, is frequently used for the assessment of physical fitness and has been standardized, practical implementation may involve certain problems that can result in poor sensitivity, which represents one of the major shortcomings of any assessment test. In this study, the Bent Arm Hang Test proved to be particularly problematic. As is well known, the task requires participants to maintain a flexed-arm position on a horizontal bar for as long as possible, thereby assessing the static strength of the arms and shoulder girdle. During testing, it was found that a considerable number of participants were unable to maintain the required position for even one second. The poor discriminative power of this test is reflected in the fact that it is impossible to determine differences, according to this test's criterion, among students who failed to perform the test correctly. The explanation for such results may lie in the correlation between performance on the Bent Arm Hang Test and the Handgrip Dynamometry Test, as well as between the Bent Arm Hang Test and body mass. The results showed a stronger negative correlation between bent arm hang performance and body mass than the positive correlation between bent arm hang performance and handgrip strength. These findings should be taken into consideration when planning physical education classes and selecting appropriate instruments for assessing students' physical fitness.

Keywords: physical education, planning, physical fitness, morphological characteristics

TAIDIĆUEN KAO INOVATIVAN PRISTUP U FIZIKALNOJ REHABILITACIJI: PRIMJER INSTITUCIONALNE SARADNJE

Anja Mudrenović¹, Ljiljana Stević¹

¹Filološki fakultet Univerziteta u Banjoj Luci, Vojvode Petra Bojovića 1A, Banja Luka, Republika Srpska, Bosna i Hercegovina

Sažetak. Taidićuen (kin. 太极拳 Taijiquan), kao tradicionalna kineska vještina, sve je više prepoznata kao komplementarna metoda u savremenoj fizikalnoj rehabilitaciji i fizioterapiji. Cilj ovog rada je da ispita mogućnosti primjene tehnike taidićuena kao inovativnog terapijskog pristupa, sa posebnim fokusom na njenu integraciju u institucionalne rehabilitacione okvire. Rad se zasniva na pregledu savremenih istraživanja koja se bave efektima taidićuena na balans, motoričku funkciju, hronični bol i oporavak nakon neuroloških i mišićno-koštanih oboljenja. Poseban akcenat stavljen je na primjer saradnje između Konfucijevog instituta Univerziteta u Banjoj Luci i Zavoda za fizikalnu medicinu i rehabilitaciju „Dr Miroslav Zotović“, u okviru koje su fizioterapeuti prošli obuku za primjenu tehnike taidićuena u rehabilitacionoj praksi. Rezultati pokazuju da taidićuen doprinosi poboljšanju funkcionalne pokretljivosti, posturalne stabilnosti i opšte fizičke spremnosti, naročito kod starije populacije i pacijenata u procesu rehabilitacije. Njegova niskointenzivna i prilagodljiva priroda omogućava sigurnu primjenu kod različitih grupa pacijenata. Integracija taidićuena u fizioterapijsku praksu odražava širi trend uključivanja holističkih i kulturološki utemeljenih pristupa u savremene zdravstvene sisteme, kao i značaj interkulturalne razmjene znanja u oblasti medicine i rehabilitacije.

Ključne riječi: Taidićuen, fizikalna rehabilitacija, fizioterapija, interkulturalna saradnja, balans

TAI CHI AS AN INNOVATIVE APPROACH IN PHYSICAL REHABILITATION: A CASE OF INSTITUTIONAL COOPERATION

Anja Mudrenović¹, Ljiljana Stević¹

¹ University of Banja Luka, Faculty of Philology, Vojvode Petra Bojovica 1A, Banja Luka, Republic of Srpska, Bosnia and Herzegovina

Abstract. Tai Chi (Taijiquan, 太极拳), as a traditional Chinese practice, is increasingly recognized as a complementary method in contemporary physical rehabilitation and physiotherapy. The aim of this paper is to examine the possibilities of applying Tai Chi as an innovative therapeutic approach, with a particular focus on its integration into institutional rehabilitation settings. The paper is based on a review of recent research addressing the effects of Tai Chi on balance, motor function, chronic pain, and recovery following neurological and musculoskeletal conditions. Special attention is given to the example of cooperation between the Confucius Institute at the University of Banja Luka and the Institute for Physical Medicine and Rehabilitation “Dr Miroslav Zotović”, within which physiotherapists have undergone training in the application of Tai Chi techniques in rehabilitation practice. The results indicate that Tai Chi contributes to improvements in functional mobility, postural stability, and overall physical fitness, particularly among elderly individuals and patients undergoing rehabilitation. Its low-intensity and adaptable nature allows for safe application across diverse patient groups. The integration of Tai Chi into physiotherapy practice reflects a broader trend of incorporating holistic and culturally grounded approaches into modern healthcare systems, as well as the importance of intercultural knowledge exchange in the field of medicine and rehabilitation.

Keywords: Tai Chi, physical rehabilitation, physiotherapy, intercultural cooperation, balance

POSTBIOTICI PREMA PROBIOTICIMA: ANTIBAKTERIJSKI EFEKAT I POTENCIJALNA UPOTREBA KAO ALTERNATIVNIH ANTIBIOTSKIH AGENASA

Gordana Zavišić¹, Drina Janković², Branka Petković³

¹Farmaceutski fakultet, Novi Sad, Univerzitet Privredna akademija u Novom Sadu, Heroja Pinkija 4, Novi Sad, Republika Srbija

²Institut za nuklearne nauke “Vinča” – Institut od nacionalnog značaja za Republiku Srbiju, Univerzitet u Beogradu, Mike Petrovića Alasa 12-14, Vinča, Beograd, Republika Srbija

³Institut za biološka istraživanja “Siniša Stanković” – Institut od nacionalnog značaja za Republiku Srbiju, Univerzitet u Beogradu, Bulevar despota Stefana 142, Beograd, Republika Srbija

Sažetak. Postbiotici, zajedno s probioticima, dobijaju sve veći značaj u naučnim istraživanjima prvenstveno zbog antimikrobnog efekta i modulacije crijevne mikrobiote. Za razliku od probiotika, koji se definišu kao živi organizmi koji pružaju zdravstvene koristi kada se primjenjuju u adekvatnim količinama, postbiotici su preparati neživih ili inaktiviranih mikroorganizama i/ili njihovih komponenti (ranije nazvanih parabioticima), kao i njihovih ekstraćelijskih metabolita (kratkolančane masne kiseline, lipidi, proteini, antimikrobni peptidi poput bakteriocina, enzimi, vodonik peroksid i polisaharidi) koji imaju biološke efekte na domaćina. Ovaj pregled sažima trenutna znanja o antimikrobnim mehanizmima djelovanja probiotika i postbiotika, ističe njihove razlike i prednosti i pruža kritički pogled na sigurnosne izazove. Prednost postbiotika u odnosu na probiotike je što pri njihovoj upotrebi nema rizika od širenja rezistencije na antibiotike, kao ni translokacije u sterilna tkiva i izazivanja infekcije poput endokarditisa ili sepse. Efikasnost konvencionalnih antibiotika sve je ograničenija zbog bakterijske rezistencije (višestruka rezistencija i panrezistencija na antibiotike), a spor razvoj novih antibiotika dodatno pogoršava ovaj problem. Stoga su u ovom revijalnom radu posebno obrađeni antibakterijski efekti postbiotika protiv multirezistentnih bakterija kao što su *Escherichia coli* koja proizvodi beta-laktamaze proširenog spektra (ESBL), *Salmonella enterica* serotip Typhimurium, *Klebsiella pneumoniae*, *Staphylococcus aureus* ATCC 25923, meticilin-rezistentni *S. aureus* (MRSA), *Pseudomonas aeruginosa* ATCC 27853 i *P. aeruginosa* PAO1. Pored antimikrobnih efekata, postbiotici pokazuju i širok spektar drugih bioloških aktivnosti, uključujući antioksidativne, antiinflamatorne, antidijabetičke, imunomodulatorne i antihipertenzivne efekte. Budući da postbiotici ne sadrže žive vijabilne ćelije, predstavljaju manje izazova u pogledu stabilnosti proizvoda u poređenju sa probioticima. S obzirom na sve navedeno, postoji sve veći interes za alternativne strategije kontrole bakterijskih infekcija i za otkrivanje i korišćenje bioaktivnih jedinjenja prirodnog porijekla, uključujući postbiotike, za inovativne primjene u farmaceutskoj, kozmetičkoj i prehrambenoj industriji.

Ključne riječi: postbiotici, antibakterijska strategija, prednosti, inovativne primjene

POSTBIOTICS VERSUS PROBIOTICS: ANTIBACTERIAL EFFECT AND POTENTIAL USE AS ALTERNATIVE ANTIBIOTIC AGENTS

Gordana Zavišić¹, Drina Janković², Branka Petković³

¹Faculty of Pharmacy, Novi Sad University Business Academy in Novi Sad, Heroja Pinkija 4, Novi Sad, Republic of Serbia,

²Vinča Institute of Nuclear Sciences – National Institute of the Republic of Serbia, University of Belgrade, Mike Petrovića Alasa 12-14, Vinča, Belgrade, Serbia;

³Institute for Biological Research “Siniša Stanković” – National Institute of the Republic of Serbia, University of Belgrade, Bulevar despota Stefana 142, Belgrade, Serbia

Abstract. Postbiotics, along with probiotics, are gaining increasing importance in scientific research primarily due to their antimicrobial effect and modulation of the intestinal microbiota. Unlike probiotics, which are defined as living organisms that confer health benefits when administered in adequate amounts, postbiotics are preparations of inanimate or inactivated microorganisms and/or their components (previously referred to as parabiotics), as well as their extracellular metabolites (such as short-chain fatty acids, lipids, proteins, antimicrobial peptides like bacteriocins, enzymes, hydrogen peroxide, and polysaccharides) that exert biological effects on the host. This review summarizes current knowledge about the antimicrobial mechanisms of action of probiotics and postbiotics, highlights their differences and advantages, and provides a critical view of safety challenges. The advantage of postbiotics over probiotics is that their use does not risk spreading antibiotic resistance nor translocating to sterile tissues and causing infections such as endocarditis or sepsis. The effectiveness of conventional antibiotics is increasingly limited due to bacterial resistance (multidrug resistance and pandrug resistance), and the slow development of new antibiotics further exacerbates this issue. Thus, this review specifically addresses the antibacterial effects of postbiotics against multidrug-resistant bacteria such as extended-spectrum beta-lactamase (ESBL)-producing *Escherichia coli*, *Salmonella enterica* serotype Typhimurium, *Klebsiella pneumoniae*, *Staphylococcus aureus* ATCC 25923, methicillin-resistant *S. aureus* (MRSA), *Pseudomonas aeruginosa* ATCC 27853, and *P. aeruginosa* PAO1. In addition to antimicrobial effects, postbiotics exhibit a wide range of other biological activities, including antioxidant, anti-inflammatory, antidiabetic, immunomodulatory, and antihypertensive effects. Since postbiotics do not contain live viable cells, they present fewer challenges regarding product stability compared to probiotics. Given all of the above, there is growing interest in alternative strategies for controlling bacterial infections and in discovering and using bioactive compounds of natural origin, including postbiotics, for innovative applications in the pharmaceutical, cosmetic, and food industries.

Keywords: postbiotics, antibacterial strategy, advantages, innovative applications

**LABORATORIJSKA MEDICINA,
DIJAGNOSTIKA,
ZDRAVSTVENA NJEGA**

**LABORATORY MEDICINE,
DIAGNOSTICS, HEALTH CARE**

UTICAJ SESTRINSKIH UDRUŽENJA I ČASOPISA NA RAZVOJ ISTRAŽIVAČKE KULTURE U SESTRINSTVU

*Jelena Pavlović¹, Sandra Matović¹, Natalija Hadživuković¹, Srdan Živanović¹,
Kristina Pavlović¹, Olivera Kalajdžić¹, Nataša Radović², Ljubiša Kucurski, Mira
Obradović³, Ljiljana Savić³*

¹Medicinski fakultet Foča, Univerzitet u Istočnom Sarajevu, Studentska 5, Republika
Srpska, Bosna i Hercegovina

²Univerzitetska bolnica Foča, Studentska 5, Republika Srpska, Bosna i Hercegovina

³JU Visoka medicinska škola Prijedor, Nikole Pašića 4a, Republika Srpska,
Bosna i Hercegovina

Sažetak. Put ka zdravlju vodi kroz stalna istraživanja i usvajanja novih znanja. Svrha sestrinskih istraživanja je dodavanje novog znanja već postojećem fondu znanja kojim sestrinstvo raspolaže. Cilj ovog rada bio je prikazati uticaj sestrinskih udruženja i časopisa na razvoj istraživačke kulture kod medicinskih sestara i tehničara. Sestrinska udruženja imaju ključnu i višedimenzionalnu ulogu u razvoju istraživačke kulture u sestrinstvu, jer djeluju kao most između kliničke prakse, obrazovanja i naučnoistraživačkog rada. Organizuju se aktivnosti poput seminara, radionica, kongresa i konferencija, gdje se medicinske sestre upoznaju sa savremenim istraživačkim metodama, analizom podataka i principima naučnog pisanja, što doprinosi razvoju istraživačkih kompetencija, posebno kod sestara koje nemaju formalno obrazovanje u oblasti naučnoistraživačkog rada. To smanjuje jaz između teorije i prakse, jača spremnost za primjenu naučnih dokaza u svakodnevnom radu. Sestrinska udruženja pružaju podršku u realizaciji istraživanja što uključuje mentorstvo, savjetovanje u vezi sa metodologijom, pomoć pri pisanju radova, kao i podsticanje publikovanja u stručnim i naučnim časopisima, povećava se vidljivost sestrinske profesije u akademskoj i društvenoj zajednici, medicinske sestre se afirmišu kao aktivni učesnici u stvaranju znanja. Umrežavanje udruženja kroz saradnju sa domaćim i međunarodnim organizacijama, univerzitetima i istraživačkim centrima, sestrinska udruženja omogućavaju razmjenu iskustava, zajedničke projekte i pristup savremenim trendovima u sestrinstvu što jača istraživačku kulturu i svijest i razvoj globalne perspektive profesije. Istraživačka svijest obuhvata priznanje da znanje stečeno kroz istraživanje može imati značajne implikacije kako za sestre tako i za pacijente. Primjer takve prakse je novoregistrovani naučno-stručni časopis NurseNexus Journal u Republici Srpskoj. Časopis predstavlja raspoloživu dokumentaciju i mjesto gdje se nalaze različite niti sestrinskog rada: teorija, praksa i nauka. Znanje koje se dobija i pomoću nauke je moć, a u kontekstu zdravlja ono je i odgovornost. Udruženja i časopisi imaju zagovaračku ulogu u promociji istraživačke kulture u sestrinstvu, utiču na zdravstvene politike i promovišu ulaganje u razvoj nauke i obrazovanja medicinskih sestara. Time doprinose izgradnji profesionalnog identiteta i jačanju pozicije sestrinstva kao samostalne i naučno utemeljene discipline.

Ključne riječi: Sestrinska udruženja, časopisi, istraživanje, medicinske sestre.

THE IMPACT OF NURSING ASSOCIATIONS AND JOURNALS ON THE DEVELOPMENT OF RESEARCH CULTURE IN NURSING

Jelena Pavlović¹, Sandra Matović¹, Natalija Hadživuković¹, Srdan Živanović¹,
Kristina Pavlović¹, Olivera Kalajdžić¹, Nataša Radović², Ljubiša Kucurski³, Mira
Obradović³, Ljiljana Savić³

¹Faculty of Medicine, Foča, University of East Sarajevo, Studentska 5, Republika
Srpska, Bosnia and Herzegovina

²University Hospital in Foča, Studentska, Republika Srpska,
Bosnia and Herzegovina

³PI College of Health Sciences Prijedor, Nikole Pašića 4a, Republic of Srpska,
Bosnia and Herzegovina

Abstract. The path to health lies in continuous research and the acquisition of new knowledge. The purpose of nursing research is to add new knowledge to the existing body of knowledge in nursing. The aim of this paper was to present the impact of nursing associations and journals on the development of a research culture among nurses and nursing technicians. Nursing associations play a key and multidimensional role in developing a research culture in nursing, as they act as a bridge between clinical practice, education, and scientific research. Activities such as seminars, workshops, congresses, and conferences are organized, where nurses are introduced to contemporary research methods, data analysis, and principles of scientific writing, which contributes to the development of research competencies, especially among nurses who do not have formal education in scientific research. This reduces the gap between theory and practice and strengthens readiness to apply scientific evidence in everyday work. Nursing associations provide support in conducting research, including mentorship, methodological guidance, assistance in writing papers, and encouragement of publication in professional and scientific journals, thereby increasing the visibility of the nursing profession in the academic and broader social community, and affirming nurses as active contributors to knowledge creation. Networking of associations through cooperation with national and international organizations, universities, and research centers enables the exchange of experiences, joint projects, and access to contemporary trends in nursing, which strengthens research culture, awareness, and the development of a global perspective of the profession. Research awareness includes recognition that knowledge gained through research can have significant implications for both nurses and patients. An example of such practice is the newly established scientific-professional journal *NurseNexus Journal* in Republika Srpska. The journal represents an available source of documentation and a place where different strands of nursing work *theory, practice, and science* are brought together. Knowledge gained through science is power, and in the context of health, it is also a responsibility. Associations and journals have an advocacy role in promoting research culture in nursing, influencing health policies, and encouraging investment in the development of science and the education of nurses. In this way, they contribute to building professional identity and strengthening the position of nursing as an independent, scientifically grounded discipline.

Keywords: Nursing associations, journals, research, nurses.

USLOVI RADA KAO DETERMINANTA EKSTRINZIČNOG ZADOVOLJSTVA MEDICINSKIH SESTARA I TEHNIČARA

*Milena Zlatanović¹, Marko Slavković², Milena Despotović³, Mile Despotović¹,
Christos Alexopoulos¹, Marko Bojić⁴, Ljubiša Kucurski⁵*

¹Akademija vaspitačko-medicinskih strukovnih studija, Odsek medicinskih studija
Ćuprija, ul. Lole Ribara, Ćuprija, Republika Srbija

²Ekonomski fakultet, Univerzitet u Kragujevcu, Liceja Kneževine Srbije 3,
Kragujevac, Republika Srbija

³ Specijalna bolnica za bolesti zavisnosti, Beograd, Republika Srbija

⁴ Visoka ekonomska škola strukovnih studija, Beograd, Republika Srbija

⁵JU Visoka medicinska škola Prijedor, Nikole Pašića 4a, Republika Srpska, Bosna i
Hercegovina

Sažetak. U savremenim uslovima rada, kvalitet radnog okruženja predstavlja jedan od ključnih faktora zadovoljstva medicinskih sestara i tehničara zaposlenih u zdravstvenim ustanovama. Ekstrinzično zadovoljstvo obuhvata zadovoljstvo platom, uslovima rada, organizacijom posla, međuljudskim odnosima i podrškom nadređenih, te ima značajnu ulogu u očuvanju stabilnosti zdravstvenog sistema i kvaliteta pružene zdravstvene zaštite. Cilj rada bio je da se ispita uticaj uslova rada na ekstrinzično zadovoljstvo medicinskih sestara i tehničara zaposlenih u zdravstvenim ustanovama u Srbiji. Istraživanje je sprovedeno u zdravstvenim ustanovama na teritoriji Centralne Srbije, na uzorku od 362 ispitanika. U strukturi uzorka dominirale su žene (83%), dok je najveći broj ispitanika bio starosti od 31 do 40 godina (35%). Prema dužini radnog staža, najzastupljeniji su bili zaposleni sa više od 20 godina radnog iskustva (35%), dok je najveći procenat ispitanika imao završenu srednju školu (71%). Za prikupljanje podataka korišćen je standardizovani upitnik, a statistička obrada izvršena je primenom IBM SPSS Statistics softvera, uz korišćenje deskriptivne statistike, analize pouzdanosti, korelacione i regresione analize, kao i ANOVA testa. Rezultati istraživanja pokazali su visok nivo pouzdanosti mernih skala, pri čemu je Cronbach's alpha za ekstrinzično zadovoljstvo iznosio $\alpha=0,872$. Utvrđena je pozitivna i statistički značajna povezanost između uslova rada i ekstrinzičnog zadovoljstva zaposlenih. Prosta regresiona analiza pokazala je da uslovi rada ostvaruju pozitivan i statistički značajan uticaj na ekstrinzično zadovoljstvo ($R^2=0,295$; $\beta=0,543$; $t=12,266$; $p<0,01$). Rezultati višestruke regresione analize ukazali su da socijalne ($\beta=0,486$; $p<0,001$) i kontekstualne karakteristike posla ($\beta=0,310$; $p<0,001$) imaju značajan pozitivan uticaj na ekstrinzično zadovoljstvo, dok motivacione karakteristike posla nisu pokazale statistički značajan efekat ($\beta=0,004$; $p=0,936$). Nalazi ukazuju na potrebu kontinuiranog unapređenja uslova rada kroz adekvatnu organizaciju posla, podršku rukovodećih struktura i jačanje profesionalne saradnje među zdravstvenim radnicima, kako bi se povećalo zadovoljstvo zaposlenih, doprinelo stabilnosti kadra i unapredio kvalitet zdravstvene zaštite.

Ključne reči: ekstrinzično zadovoljstvo, medicinske sestre, medicinski tehničari, uslovi rada, karakteristike posla, domovi zdravlja.

WORKING CONDITIONS AS A DETERMINANT OF EXTRINSIC JOB SATISFACTION AMONG NURSES AND MEDICAL TECHNICIANS

Milena Zlatanović¹, Marko Slavković², Milena Despotović³, Mile Despotović¹, Christos Alexopoulos¹, Marko Bojić⁴, Ljubiša Kucurski⁵

¹The Academy of Applied Preschool Teaching and Health Studies, Department of Medical Studies, St. Lole Ribara, Cuprija, Republic of Serbia

²Faculty of Economics, University of Kragujevac, Liceja Knezevine Srbije 3, Kragujevac, Republic of Serbia

³ Special Hospital for Addiction Diseases, Belgrade, Republic of Serbia

⁴ Higher school of economic vocational studies, Belgrade, Republic of Serbia

⁵PI College of Health Sciences Prijedor, Nikole Pašića 4a, Republic of Srpska, Bosnia and Herzegovina

Abstract. In contemporary working conditions, the quality of the work environment represents one of the key factors influencing the job satisfaction of nurses and medical technicians employed in healthcare institutions. Extrinsic job satisfaction includes satisfaction with salary, working conditions, work organization, interpersonal relationships, and supervisor support, and plays an important role in maintaining the stability of the healthcare system and the quality of healthcare services provided. The aim of this study was to examine the impact of working conditions on the extrinsic job satisfaction of nurses and medical technicians employed in healthcare institutions in Serbia. The research was conducted in healthcare institutions in Central Serbia on a sample of 362 respondents. Women predominated in the sample structure (83%), while the largest number of respondents were between 31 and 40 years of age (35%). According to years of service, employees with more than 20 years of work experience were the most represented (35%), while the highest percentage of respondents had completed secondary school education (71%). Data were collected using a standardized questionnaire, while statistical analysis was performed using IBM SPSS Statistics software, applying descriptive statistics, reliability analysis, correlation and regression analysis, as well as the ANOVA test. The research results demonstrated a high level of reliability of the measurement scales, with Cronbach's alpha for extrinsic job satisfaction amounting to $\alpha=0.872$. A positive and statistically significant relationship was identified between working conditions and employees' extrinsic job satisfaction. Simple regression analysis showed that working conditions had a positive and statistically significant effect on extrinsic job satisfaction ($R^2=0.295$; $\beta=0.543$; $t=12.266$; $p<0.01$). The results of multiple regression analysis indicated that social ($\beta=0.486$; $p<0.001$) and contextual job characteristics ($\beta=0.310$; $p<0.001$) had a significant positive effect on extrinsic job satisfaction, while motivational job characteristics did not show a statistically significant effect ($\beta=0.004$; $p=0.936$). The findings indicate the need for continuous improvement of working conditions through adequate work organization, support from managerial structures, and strengthening professional cooperation among healthcare workers, in order to increase employee satisfaction, contribute to workforce stability, and improve the quality of healthcare services.

Keywords: extrinsic job satisfaction, nurses, medical technicians, working conditions, job characteristics, primary healthcare institutions.

ZNAČAJ ZDRAVSTVENE NEGE KOD OSOBA SA INVALIDITETOM, KROZ EDUKACIJU, SPROVOĐENJE PROGRAMA RANE INTERVENCIJE I AKTIVNO UČEŠĆE MEDICINSKIH SESTARA

Sladana Arsić¹, Andrijana Petrović¹, Dragana Kljajić²

¹Akademija vaspitačko medicinskih strukovnih studija Kruševac, Odsek
medicinskih studija Čuprija, Republika Srbija

²Akademija strukovnih studija Beograd, Odsek Visoka zdravstvena škola,
Republika Srbija

Sažetak. Cerebralna paraliza je jedan od najčešćih uzroka fizičkog invaliditeta kod dece i karakterišu je trajni poremećaji pokreta i držanja tela uzrokovani oštećenjem mozga u razvoju u ranim fazama života. Cilj ovog rada je da predstavi značaj edukacije medicinskih sestara i njihovo učešće u zdravstvenoj nezi osoba sa invaliditetom, konkretno u radu sa pacijentima sa cerebralnom paralizom. Rad se zasniva na pregledu relevantne naučne i stručne literature dobijene iz medicinskih baza podataka MedLine; Google Scholar; PubMed. Posebna pažnja je usmerena na najčešće probleme u primeni zdravstvene nege kod ovih pacijenata, kao što su smanjena pokretljivost, oralno-motorni poremećaji, teškoće sa hranjenjem i gutanjem, bol i problemi u obavljanju svakodnevnih aktivnosti. Medicinske sestre igraju značajnu ulogu u proceni stanja ovih pacijenata, planiraju i sprovode sestrinske intervencije, sprečavaju moguće komplikacije i edukuju članove porodica. Multidisciplinarni pristup, koji uključuje saradnju sa lekarima, fizioterapeutima, logopedima, psiholozima i drugim zdravstvenim radnicima, neophodan je za postizanje optimalnih ishoda lečenja i rehabilitacije. Podrška porodice i kontinuirana edukacija roditelja predstavljaju važnu komponentu uspešne nege dece sa cerebralnom paralizom. Unapređenje zdravstvenih i socijalnih sistema podrške može značajno doprineti boljem kvalitetu života osobama sa invaliditetom.

Ključne reči: osobe sa invaliditetom, cerebralna paraliza, medicinska nega, rehabilitacija, edukacija

THE IMPORTANCE OF HEALTH CARE FOR PEOPLE WITH DISABILITIES, THROUGH EDUCATION, IMPLEMENTATION OF EARLY INTERVENTION PROGRAMS AND THE ACTIVE PARTICIPATION OF NURSES

Sladana Arsić¹, Andrijana Petrović¹ Dragana Kljajić²

¹The Academy of Applied Preschool Teaching and Health Studies Krusevac,
Department of medical studies Cuprija, Republic of Serbia

²Academy of Applied Studies Belgrade, The College of Health Sciences,
Republic of Serbia

Abstract. Cerebral palsy is one of the most common causes of physical disability in children and is characterized by permanent disorders of movement and posture caused by damage to the developing brain in the early stages of life. The aim of this paper is to present the importance of the education of nurses and their participation in the health care of people with disabilities, specifically in working with patients with cerebral palsy. The paper is based on a review of relevant scientific and professional literature obtained from medical databases Medline; Google Scholar; PubMed. Special attention is focused on the most common nursing problems in these patients, such as reduced mobility, oral motor disorders, feeding and swallowing difficulties, pain, and problems in performing daily activities. Nurses play a significant role in assessing the patient's condition, planning and implementing nursing interventions, preventing possible complications, and educating the family. A multidisciplinary approach, including cooperation with physicians, physiotherapists, speech therapists, psychologists, and other health professionals, is essential for achieving optimal treatment and rehabilitation outcomes. Family support and continuous education of parents represent an important component of successful care for children with cerebral palsy. Improving health and social support systems can significantly contribute to a better quality of life for people with disabilities.

Keywords: persons with disabilities, cerebral palsy, nursing care, rehabilitation, education

HEPATITIS B INFEKCIJA – UČESTALOST U BOSNI I HERCEGOVINI U PERIODU 2015.-2019. GODINE I NEGA OBOLELIH

Marija Kecman¹

¹JZU Bolnica Dr. Mladen Stojanović Prijedor, Prijedor, Republika Srpska,
Bosna i Hercegovina

Sažetak: Hepatitis B infekcija je ozbiljan svjetski zdravstveni problem. To je opasna infekcija jetre uzrokovana virusom B hepatitisa. Infekcija se javlja u akutnoj i hroničnoj formi. Moguće komplikacije su brojne i ugrožavaju život oboljenog. Bolest je samo zalečiva, infekcija se može kontrolisati ali ne i izliječiti. Pored kliničkog liječenja važna je i njega pacijenta. Etiologiju karakterišu horizontalni i vertikalni prenos virusa. Neophodno je dobro uzeti anamnezu, uraditi kvalitetan fizikalni pregled i virusološku dijagnostiku. Terapija je anti-virusna, kombinovana s supstitucionalnom i simptomatskom terapijom. Za dobru prevenciju potrebna je edukacija, testiranje, vakcinisanje, imuno-profilaksa. Ciljevi istraživanja: prikaz učestalosti Hepatitis B infekcije na teritoriji BiH u periodu 2015. do 2019. s osvrtom na period od 2021. do 2023. Prilikom istraživanja upotrebljene su deskriptivne metode kojima je urađena analiza medicinske dokumentacije. Statistički podaci uzeti su iz statističkih godišnjaka instituta za javno zdravlje Republike Srpske u Banjaluci i Federativne Bosne i Hercegovine u Sarajevu. Istraživanje je sprovedeno u maju 2024. godine u Prijedoru. Kroz rad, prikazani su osnovni elementi njege oboljelih i uloga medicinske sestre u ovom procesu. Važno je napraviti i sprovesti plan zdravstvene njege, postaviti sestrinske dijagnoze i stručno obaviti sestrinske intervencije. Neophodan je timski rad na prevenciji, testiranju, liječenju i njezi oboljelih. Svjetska zdravstvena organizacija je proglasila 28. juli za Dan borbe protiv Hepatitisa.

Ključne riječi: Hepatitis B, infekcija, virus, učestalost, zdravstvena nega, Bosna i Hercegovina.

HEPATITIS B INFECTION – PREVALENCE IN BOSNIA AND HERZEGOVINA DURING 2015–2019 AND CARE OF AFFECTED PATIENTS

Marija Kecman¹

¹JZU Bolnica Dr. Mladen Stojanović Prijedor, Prijedor, The Republic of Srpska, Bosnia and Herzegovina

Abstract: Hepatitis B infection is a serious global health problem. It is a dangerous liver infection caused by the hepatitis B virus. The infection occurs in acute and chronic forms. Possible complications are numerous and life-threatening. The disease is incurable; the infection can be controlled but not completely cured. In addition to clinical treatment, patient care is also important. The etiology is characterized by horizontal and vertical transmission of the virus. It is necessary to take a thorough medical history, perform a quality physical examination, and conduct virological diagnostics. Treatment is antiviral, combined with replacement and symptomatic therapy. For good prevention, education, testing, vaccination, and immunoprophylaxis are necessary. Research objectives: to present the prevalence of Hepatitis B infection in the territory of Bosnia and Herzegovina during the period from 2015 to 2019, with a focus on the period from 2021 to 2023. Descriptive methods were used in the research to analyze medical documentation. Statistical data were taken from the statistical yearbooks of the Institute of Public Health of the Republic of Srpska in Banja Luka and the Federation of Bosnia and Herzegovina in Sarajevo. The research was conducted in May 2024 in Prijedor. This paper presents the basic elements of patient care and the role of the nurse in this process. It is important to create and implement a health care plan, establish nursing diagnoses, and professionally carry out nursing interventions. Teamwork is essential for the prevention, testing, treatment, and care of patients. The World Health Organization has declared July 28th as World Hepatitis Day.

Keywords: Hepatitis B, infection, virus, prevalence, healthcare, Bosnia and Herzegovina

POVEZANOST PRIDRŽAVANJA MEDITERANSKOG OBRASCA ISHRANE SA ZDRAVSTVENIM PARAMETRIMA I FAKTORIMA RIZIKA: ZNAČAJ ZA JAVNO ZDRAVLJE

Milena Zlatanović¹, Ardea Milidrag², Nikola Savić³, Milica Brajsovac⁴, Lazar Despotović⁵, Ana Adamović⁶, Ljiljana Savić⁴

¹Akademija vaspitačko-medicinskih strukovnih studija, Odsek medicinskih studija
Čuprija, ul. Lole Ribara, Čuprija, Republika Srbija

²Farmaceutski fakultet Beograd, Univerzitet Edukons, Beograd, Republika Srbija

³Univerzitet Singidunum, Beograd, Republika Srbija

⁴JU Visoka medicinska škola Prijedor, Nikole Pašića 4a, Republika Srpska,
Bosna i Hercegovina

⁵Fakultet medicinskih nauka, Univerzitet u Kragujevcu, Svetozara Markovića 69,
Kragujevac, Republika Srbija

⁶Dom zdravlja Čuprija, Republika Srbija

Sažetak. Mediteranska ishrana danas se smatra jednim od najznačajnijih nutritivnih modela u prevenciji hroničnih nezaraznih bolesti, prvenstveno zahvaljujući povoljnom uticaju na kardiometaboličko zdravlje. Zasniva se na visokom unosu voća, povrća, integralnih žitarica, mahunarki, ribe i maslinovog ulja, uz ograničenu konzumaciju crvenog mesa i industrijski prerađenih namirnica. Cilj istraživanja bio je procena stepena pridržavanja mediteranskog obrasca ishrane u opštoj populaciji i ispitivanje povezanosti MedDietScore sa odabranim sociodemografskim, antropometrijskim i zdravstvenim parametrima. Istraživanje je sprovedeno kao opservaciona studija preseka u opštoj populaciji na uzorku od 200 ispitanika. Podaci su prikupljeni anonimnim anketiranjem primenom standardizovanog Mediterranean Diet Score upitnika, kojim je procenjivan stepen usklađenosti ispitanika sa principima mediteranske ishrane. Analizirani su podaci o svakodnevnoj fizičkoj aktivnosti, pušačkom statusu, indeksu telesne mase, obimu struka i prisustvu hipertenzije, dijabetesa, predijabetesa i dislipidemije. Statistička obrada podataka sprovedena je primenom deskriptivnih i analitičkih statističkih metoda, uz procenu statističke značajnosti na nivou $p < 0,05$. Prosečna vrednost MedDietScore iznosila je 26,48, pri čemu je najveći broj ispitanika pokazao umeren stepen pridržavanja mediteranskom obrascu ishrane. Statistički značajno više vrednosti MedDietScore zabeležene su kod ispitanica ženskog pola u poređenju sa muškarcima ($p=0,0001$), kao i kod fizički aktivnih ispitanika u odnosu na fizički neaktivne ($p=0,0028$). Utvrđena je statistički značajna negativna korelacija između BMI i MedDietScore ($\rho=-0,178$; $p=0,0116$), što ukazuje da viši BMI prati niži stepen pridržavanja mediteranskog obrasca ishrane. Takođe, potvrđena je statistički značajna povezanost obima struka sa MedDietScore ($p=0,0009$), pri čemu su ispitanici sa većim obimom struka imali niže vrednosti skora. Povezanost MedDietScore sa pušačkim statusom, hipertenzijom i kompozitnim metaboličkim rizikom nije dostigla statističku značajnost. Dobijeni rezultati ukazuju da je veći stepen pridržavanja mediteranskom obrascu ishrane povezan sa povoljnijim antropometrijskim i životnim karakteristikama ispitanika, što potvrđuje značaj promocije ovog modela ishrane u okviru javnozdravstvenih strategija. Rezultati istraživanja dodatno ukazuju na potrebu kontinuirane edukacije stanovništva o značaju pravilnih prehrambenih navika i zdravih stilova života.

Ključne reči: mediteranska ishrana, MedDietScore, faktori rizika, indeks telesne mase, javno zdravlje

ASSOCIATION BETWEEN ADHERENCE TO THE MEDITERRANEAN DIETARY PATTERN AND HEALTH PARAMETERS AND RISK FACTORS: IMPLICATIONS FOR PUBLIC HEALTH

Milena Zlatanović¹, Ardea Milidrag², Nikola Savić³, Milica Brajsovac⁴, Lazar Despotović⁵, Ana Adamović⁶, Ljiljana Savić⁴

¹The Academy of Applied Preschool Teaching and Health Studies, Department of Medical Studies, St. Lole Ribara, Cuprija, Republic of Serbia

²Faculty of Pharmacy Belgrade, EDUCONS University, Belgrade, Republic of Serbia

³Singidunum University, Belgrade, Republic of Serbia

⁴PI College of Health Sciences Prijedor, Nikole Pašića 4a, Republic of Srpska, Bosnia and Herzegovina

⁵Faculty of Medical Sciences, University of Kragujevac, Svetozara Markovića 69, Kragujevac, Republic of Serbia

⁶Primary Health Care Centre, Čuprija, Republic of Serbia

Abstract. The Mediterranean diet is currently recognized as one of the most important dietary patterns for the prevention of chronic non-communicable diseases, primarily due to its beneficial effects on cardiometabolic health. It is characterized by a high intake of fruits, vegetables, whole grains, legumes, fish, and olive oil, along with limited consumption of red meat and highly processed foods. The aim of this study was to assess adherence to the Mediterranean dietary pattern in the general population and to examine the association between the MedDietScore and selected sociodemographic, anthropometric, and health-related parameters. This cross-sectional observational study included 200 participants from the general population. Data were collected through an anonymous survey using the standardized Mediterranean Diet Score questionnaire, which was used to evaluate adherence to the principles of the Mediterranean diet. Information on daily physical activity, smoking status, body mass index (BMI), waist circumference, and the presence of hypertension, diabetes, prediabetes, and dyslipidemia was also analyzed. Statistical analysis was performed using descriptive and inferential statistical methods, with statistical significance set at $p < 0.05$. The mean MedDietScore was 26.48, with the majority of participants demonstrating moderate adherence to the Mediterranean dietary pattern. Significantly higher MedDietScore values were observed among female participants compared with males ($p = 0.0001$), as well as among physically active participants compared with physically inactive individuals ($p = 0.0028$). A statistically significant negative correlation was identified between BMI and MedDietScore ($\rho = -0.178$; $p = 0.0116$), indicating that higher BMI was associated with lower adherence to the Mediterranean dietary pattern. A significant association was also found between waist circumference and MedDietScore ($p = 0.0009$), with participants with larger waist circumferences showing lower scores. No statistically significant associations were observed between MedDietScore and smoking status, hypertension, or composite metabolic risk. The findings suggest that greater adherence to the Mediterranean dietary pattern is associated with more favorable anthropometric and lifestyle characteristics, highlighting the importance of promoting this dietary model within public health strategies. Furthermore, the results emphasize the need for continuous public education regarding healthy dietary habits and lifestyle practices.

Keywords: Mediterranean dietary pattern, MedDietScore, risk factors, body mass index, public health

**PROCENA UNOSA ULTRA-PRERAĐENE HRANE:
METODOLOŠKI PREGLED POSTOJEĆIH INSTRUMENATA I
POTREBA ZA REGIONALNO PRILAGOĐENIM NOVA-UPF
SCREENER-OM**

***Ardea Milidrag¹, Milena Zlatanović², Mile Despotović², Medo Gutić³,
Ivana Dimić³, Ljiljana Savić⁵, Ljubiša Kucurski⁵***

¹Farmaceutski fakultet Beograd, Univerzitet Edukons, Beograd, Srbija

²Odsek za medicinske studije, Akademija vaspitačko-medicinskih strukovnih studija
Kruševac, Čuprija, Srbija

³Fakultet medicinskih nauka, Univerzitet u Kragujevcu, Kragujevac, Srbija

⁴JZU Dom zdravlja „Dr Branko Zogović” Plav, Plav, Crna Gora

⁵JU Visoka medicinska škola Prijedor, Nikole Pašića 4a, Republika Srpska,
Bosna i Hercegovina

Sažetak. Procena unosa ultra-prerađene hrane predstavlja važan metodološki izazov u prehrambenoj epidemiologiji, jer klasični instrumenti za procenu ishrane često ne razlikuju domaće, zanatske, industrijski prerađene i ultra-prerađene oblike sličnih proizvoda. Cilj ovog rada bio je da se prikažu dostupni instrumenti za procenu konzumiranja ultra-prerađene i visoko prerađene hrane, sa posebnim osvrtom na njihovu potencijalnu primenljivost u Srbiji, Bosni i Hercegovini, Crnoj Gori i Hrvatskoj. Sproveden je ciljani narativni metodološki pregled javno dostupnih izvora, uključujući PubMed/MEDLINE, Google Scholar, ScienceDirect, Hrčak, SCIndeks, COBISS kataloge, EFSA izvore i Global Diet Quality Project. Pretraga je obuhvatila radove objavljene od 2009. do 2026. godine, na engleskom i jezicima regiona. Uključeni su radovi koji opisuju razvoj, validaciju, adaptaciju ili primenu FFQ instrumenata, NOVA-UPF screener-a, sQ-HPF alata ili regionalnih podataka o proceni ishrane. Međunarodni nalazi pokazuju da NOVA-orijentisani FFQ mogu proceniti uobičajeni unos i rangirati ispitanike prema relativnom unosu ultra-prerađene hrane, ali su manje pogodni za preciznu kvantifikaciju apsolutnog unosa. Kratki NOVA-UPF i HPF screener-i praktičniji su za populacioni skrining i online istraživanja, ali zahtevaju lokalnu adaptaciju, ekspertsku proveru, pilot testiranje, procenu test-retest pouzdanosti i validaciju prema referentnim dijetetičkim metodama. Regionalni podaci potvrđuju postojanje infrastrukture za procenu ishrane, uključujući EU Menu istraživanja, razvoj FFQ instrumenata i pojedinačne primene NOVA ili SIGA klasifikacije. Međutim, u analiziranim zemljama nije identifikovan javno dostupan validiran kratak NOVA-UPF ili sQ-HPF screener za opštu odraslu populaciju. Nalazi podržavaju razvoj regionalno prilagođenog NOVA-UPF/HPF modula zasnovanog na lokalno relevantnim kategorijama proizvoda, namenjenog skriningu i rangiranju, a ne preciznoj proceni gramaže ili energetske udela.

Ključne riječi: ultra-prerađena hrana, NOVA klasifikacija, procena ishrane, screener, regionalna adaptacija

ASSESSMENT OF ULTRA-PROCESSED FOOD INTAKE: METHODOLOGICAL REVIEW OF EXISTING INSTRUMENTS AND THE NEED FOR A REGIONALLY ADAPTED NOVA-UPF SCREENER

*Ardea Milidrag¹, Milena Zlatanović², Mile Despotović², Medo Gutić³,
Ivana Dimić³, Ljiljana Savić⁵, Ljubiša Kucurski⁵*

¹Faculty of Pharmacy Belgrade, EDUCONS University, Belgrade, Serbia

²Department of Medical Studies, The Academy of Applied Preschool Teaching and
Health Studies Kruševac, Čuprija, Serbia

³Faculty of Medical Sciences, University of Kragujevac, Kragujevac, Serbia

⁴Public Health Institution Primary Health Care Centre “Dr Branko Zogović” Plav,
Plav, Montenegro

⁵PI College of Health Sciences Prijedor, Nikole Pašića 4a, Republic of Srpska,
Bosnia and Herzegovina

Abstract. The assessment of ultra-processed food intake has become an important methodological issue in nutritional epidemiology, since conventional dietary instruments often fail to distinguish homemade, artisanal, industrially processed and ultra-processed forms of similar foods. The aim of this paper was to review available instruments for assessing ultra-processed and highly processed food consumption, with emphasis on their potential applicability in Serbia, Bosnia and Herzegovina, Montenegro and Croatia. A targeted narrative methodological review was conducted using PubMed/MEDLINE, Google Scholar, ScienceDirect, Hrčak, SCIndeks, COBISS catalogues, EFSA sources and the Global Diet Quality Project. The search covered publications from 2009 to 2026 in English and in regional languages. Included publications described the development, validation, adaptation or application of food frequency questionnaires, NOVA-UPF screeners, sQ-HPF tools, or regional dietary assessment data. International evidence shows that NOVA-based FFQs can estimate habitual intake and rank individuals according to relative ultra-processed food consumption, but they are less suitable for precise quantification of absolute intake. Short NOVA-UPF and HPF screeners are more practical for population screening and online surveys, but require local adaptation, expert review, pilot testing, test-retest reliability assessment and validation against reference dietary methods. Regional data indicate the existence of dietary assessment infrastructure, including EU Menu-based surveys, FFQ development and individual applications of NOVA or SIGA classification. However, no publicly available validated short NOVA-UPF or sQ-HPF screener for the general adult population was identified in the reviewed countries. These findings support the development of a regionally adapted NOVA-UPF/HPF module based on locally relevant product categories and validated for screening and ranking, rather than precise estimation of grams or energy share.

Keywords: ultra-processed food, NOVA classification, dietary assessment, screener, regional adaptation

PRIMENA SAVREMENIH TEHNOLOGIJA U SESTRINSTVU: MOGUĆNOSTI I ZNAČAJ ZA UNAPREĐENJE NEGE PACIJENATA

Andela Komosar^{1,2}, Nataša Egelić - Mihailović^{1,2}, Duška Jović¹

¹Univerzitet u Banjoj Luci, Medicinski fakultet, Katedra za sestrinstvo, Banja Luka, Republika Srpska, Bosna i Hercegovina

²Univerzitetski klinički centar Republike Srpske, Banja Luka, Republika Srpska, Bosna i Hercegovina

Sažetak. U cilju unapređenja kvaliteta, bezbednosti i efikasnosti zdravstvene nege, savremeni zdravstveni sistemi sve više integrišu digitalnu tehnologiju i alate zasnovane na veštačkoj inteligenciji. U sestrinstvu, ove tehnologije imaju značajan potencijal u unapređenju nege pacijenata, posebno u smislu donošenja odluka u zdravstvenoj nezi, kontinuiranog monitoringa, optimizacije radnih procesa i razvoju digitalnih kompetencija medicinskih sestara. Cilj ovog rada je bio da se analiziraju načini na koje primena digitalnih tehnologija u sestrinstvu doprinosi poboljšanju nege pacijenata, sa posebnim osvrtom na bezbednost pacijenata, kliničke ishode i efikasnost rada medicinskih sestara. Studija je dizajnirana kao pregled literature. Pretraga je sprovedena u bazama *PubMed*, *Google Scholar* i *SCIndex* u periodu od 26. do 30. aprila 2026. godine. Uključeni su radovi objavljeni od januara 2020. do januara 2026. godine, na engleskom i srpskom jeziku. Nakon pregleda naslova, sažetaka i dostupnih punih tekstova, od ukupno 38 identifikovanih publikacija, 19 studija je uključeno u kvalitativnu analizu. Analiza je sprovedena tematskim pristupom kroz identifikaciju ključnih oblasti primene digitalnih tehnologija u sestrinskoj praksi. Rezultati ukazuju da najznačajnije oblasti primene digitalnih tehnologija obuhvataju sisteme za podršku donošenja odluka u zdravstvenoj nezi, elektronsku zdravstvenu dokumentaciju, alate za kontinuirani monitoring pacijenata i digitalne edukacione platforme. Analizirane studije pokazuju da primena ovih tehnologija doprinosi standardizaciji sestrinskih postupaka, pravovremenom prepoznavanju kliničkog pogoršanja, smanjenju mogućnosti greške i efikasnijoj organizaciji rada. Posebno se ističe značaj sistema ranog upozorenja i kontinuiranog monitoringa u unapređenju bezbednosti pacijenata i efikasnijoj proceni njihovog zdravstvenog stanja. Dodatno, primena informacionih sistema smanjuje administrativno opterećenje i omogućava medicinskim sestrama više vremena za neposredan rad sa pacijentima. Digitalne tehnologije predstavljaju značajan resurs za unapređenje kvaliteta zdravstvene nege, bezbednosti pacijenata i efikasnosti rada medicinskih sestara. Njihova uspešna integracija zahteva kontinuiranu edukaciju medicinskih sestara, razvoj digitalnih kompetencija i adekvatnu organizacionu i tehnološku podršku zdravstvenih ustanova.

Ključne reči: digitalne tehnologije; sestrinstvo; zdravstvena nega; veštačka inteligencija; kliničko rasuđivanje.

APPLICATION OF MODERN TECHNOLOGIES IN NURSING: OPPORTUNITIES AND SIGNIFICANCE FOR IMPROVING PATIENT CARE

Andela Komosar^{1,2}, Nataša Egelić - Mihailović^{1,2}, Duška Jović¹

¹ University of Banja Luka, Faculty of Medicine, Department of Nursing, Banja Luka, Republic of Srpska, Bosnia and Herzegovina

² University Clinical Centre of the Republic of Srpska, Banja Luka, Republic of Srpska, Bosnia and Herzegovina

Abstract. Modern healthcare systems are increasingly integrating digital technologies and artificial intelligence-based tools to improve the quality, safety, and efficiency of healthcare. In nursing, these technologies have significant potential to improve patient care, particularly in terms of clinical decision-making, continuous monitoring, workflow optimization, and the development of nurses' digital competencies. The aim of this study was to analyze the ways in which the application of digital technologies in nursing contributes to improving patient care, with particular emphasis on patient safety, clinical outcomes, and nursing efficiency. The study was designed as a literature review. A search was conducted in the PubMed, Google Scholar, and SCIndex databases between April 26 and April 30, 2026. Papers published between January 2020 and January 2026 in English and Serbian were included. After reviewing titles, abstracts, and available full texts, 19 studies were included in the qualitative analysis out of a total of 38 identified publications. Further analysis was performed using a thematic approach through the identification of key areas of digital technology application in nursing practice. The results indicate that the most important areas of digital technology application include clinical decision support systems, electronic health records, continuous patient monitoring tools, and digital educational platforms. The analyzed studies show that the use of these technologies contributes to the standardization of nursing procedures, timely recognition of clinical deterioration, reduction of errors, and improved work organization. The importance of early warning systems and continuous monitoring in enhancing patient safety and supporting clinical decision-making is particularly emphasized. In addition, the implementation of information systems reduces administrative burden and enables nurses to devote more time to direct patient care. It can be concluded that digital technologies represent a valuable resource for improving the quality of healthcare, patient safety, and nursing efficiency. Their successful integration requires continuous education of healthcare professionals, development of digital competencies, and adequate organizational and technological support within healthcare institutions.

Keywords: digital technologies; nursing, healthcare; artificial intelligence; clinical decision-making

PRIMJENA FAZI LOGIKE U KLASIFIKACIJI MALIGNIH TUMORA ŠTITNE ŽLIJEZDE

Nenad Stojanović¹

¹Univerzitet u Banja Luci, Filozofski Fakultet, Bulevar vojvode Petra Bojovića 1A,
Banja Luka, Republika Srpska, Bosna i Hercegovina

Sažetak: Jedan od fundamentalnih problema klasične TNM klasifikacije tumora štitne žlezde jeste njeno oslanjanje na diskretne granice veličine tumora, nesigurnost u radiološkoj proceni limfnih čvorova, heterogenost histoloških podtipova, sistem stadijuma zavisao od starosti i drugi parametri klasifikacije. Pristup fazi logike omogućava obnavljanje kontinuiteta u modelu klasifikacije bioloških procesa koje je klasični TNM sistem klasifikacije pokušao da diskretizuje. U radu je predstavljen model primene fazi logike u klasifikaciji kojim bi se prevazišla neka od pomenutih ograničenja u TNM klasifikaciji malignih tumora štitne žlezde. Model je zasnovan na principu funkcionisanja FLC procesa, odnosno koristeći definisane fazi brojeve i fazi logiku konstruisan je model kojim se može izvršiti TNM klasifikacija tumora štitne žlijezde.

Ključne riječi: TNM sistem klasifikacije, fazi logika, fazi logički kontrolori, tumori štitne žlijezde.

APPLICATION OF FUZZI LOGIC IN THE CLASSIFICATION OF MALIGNANT TUMORS OF THE THYROID GLAND

Nenad Stojanović¹

¹University of Banja Luka, Faculty of Philosophy, Bulevar vojvode Petra Bojovića 1A, Banja Luka, Republic of Srpska, Bosnia and Herzegovina

Abstract: One of the fundamental problems of the classical TNM classification of thyroid tumors is its reliance on discrete boundaries for tumor size, uncertainty in the radiological assessment of lymph nodes, heterogeneity of histological subtypes, the age-dependent staging system, and other classification parameters. A fuzzy logic approach enables the restoration of continuity into the classification model of biological processes that the classical TNM classification system attempted to discretize. The paper presents a model of the application of fuzzy logic in the classification, which would overcome some of the mentioned limitations in the TNM classification of malignant tumors of the thyroid gland. The model is based on the principle of the FLC process, that is, using defined phase numbers and phase logic, a model has been constructed that can perform the TNM classification of thyroid gland tumors.

Key words: TNM classification system, phase logic, fuzzy logic control, thyroid tumors.

INFORMACIONI SISTEMI ZA UPRAVLJANJE PODACIMA U MEDICINSKIM LABORATORIJAMA

Igor Grujić^{1,2}, Mira Obradović^{1,3}

¹ JU Visoka medicinska škola Prijedor, Nikole Pasica 4A, 79202 Prijedor,
Republika Srpska, Bosna i Hercegovina

² Fakultet informacionih tehnologija, Panevropski univerzitet Apeiron,
Vojvode Pere Krece 13, 78102 Banja Luka, Bosna i Hercegovina

³ Medicinski fakultet Univerziteta u Novom Sadu, student doktorskih studija,
Hajduk Veljkova 3, Novi Sad, Republika Srbija

Sažetak. Informacioni sistemi su postali stvarnost medicinskih laboratorija. Razvijena su dva sistema LIS i LIMS, između kojih postoje razlike u funkcionalnosti i vrsti laboratorija u kojima se primjenjuju. U ovom radu autori žele da predstavljaju sličnosti i razlike ova dva sistema, te buduće pravce razvoja i ukažu na ključne elemente na koje laboratorije treba da obrate pažnju tokom izbora informacionog sistema koji će koristiti u praksi. U tu svrhu u bazama Scopus i PubMed pregledani su radovi koji su publikovani u poslednjih 10 godina u vodećim časopisima u svijetu. Razlike između LIS-a i LIMS-a nalaze se u tokovima rada, podršci za primjenu standarda upravljanja i cijeni. Ova dva sistema se brzo razvijaju, pri čemu svaki preuzima dio funkcionalnosti od drugog. Budući LIS/LIMS će predstavljati digitalni nervni sistem laboratorije, koji je interoperabilan, zasnovan na standardima, potpomognut vještačkom inteligencijom i usko povezan sa kvalitetom, propisima i širim kliničkim donošenjem odluka.

Ključne riječi: Zdravstvene laboratorije, digitalizacija, LIS, LIMS

INFORMATION SYSTEMS FOR DATA MANAGEMENT IN MEDICAL LABORATORIES

Igor Grujic^{1,2}, Mira Obradovic^{1,3}

¹College of Health Sciences - Prijedor, Nikole Pasica 4A, 79202 Prijedor, Republic of Srpska, Bosnia and Herzegovina

²Faculty of Information Technology, Paneuropean University Apeiron, Vojvode Pere Krece 13, 78102 Banja Luka, Bosnia and Herzegovina

³Faculty of Medicine of the University of Novi Sad, Phd student Hajduk Veljkova 3, Novi Sad, Republic of Serbia

Abstract. Information systems have become the reality of medical laboratories. Two systems have been developed, LIS and LIMS, between which there are differences in functionality and type of laboratories in which they are applied. In this paper, the authors want to present the similarities and differences of these two systems, as well as future directions of development and point out the key elements that laboratories should pay attention to when choosing an information system to use in practice. For this purpose, the Scopus and PubMed databases reviewed papers that have been published in the last 10 years in the leading journals in the world. The differences between LIS and LIMS are found in workflows, support for the application of management standards, and pricing. These two systems are evolving rapidly, with each taking over some of the functionality from the other. The future LIS/LIMS will represent the laboratory's digital nervous system, which is interoperable, standards-based, AI-assisted and closely linked to quality, regulation and broader clinical decision-making.

Keywords: Health laboratories, digitalization, LIS, LIMS

VJEŠTAČKA INTELIGENCIJA KAO DETERMINANTA BUDUĆNOSTI NAPREDNE ZDRAVSTVENE NJEGE: PREKIDANJE DOMINO EFEKTA ISCRPLJENOSTI KROZ DIGITALNU TRANSFORMACIJU

Radmila Jević¹, Nataša Egelić- Mihailović^{1,2}, Duška Jović¹

¹Univerzitet u Banjoj Luci, Medicinski fakultet, Katedra za sestrinstvo, Banja
Luka, Republika Srpska, Bosna i Hercegovina

²Univerzitetski klinički centar Republike Srpske, Banja Luka, Republika
Srpska, Bosna i Hercegovina

Sažetak. Savremeni sestrinski poziv suočava se sa kritičnim nivoom profesionalne iscrpljenosti, pri čemu kognitivno preopterećenje i administrativni pritisak pokreću destruktivni domino efekat iscrpljenosti koji direktno ugrožava bezbjednost pacijenata. Cilj ovog rada je sistematizovati i kritički evaluirati dostupne naučne dokaze o uticaju vještačke inteligencije na redukciju faktora iscrpljenosti kod medicinskih sestara, uz definisanje uloge medicinskih sestara u implementaciji ovih tehnologija. Sproveden je sistematski pregled literature kroz baze podataka PubMed, Google Scholar i Web of Science, pri čemu je analizirano 25 odabranih naučnih radova objavljenih u periodu od 2020. do 2026. godine, uz primjenu PRISMA protokola i Polit i Beck hijerarhije dokaza. Rezultati analize pokazuju da intervencije vještačke inteligencije mogu preuzeti do 30% rutinskih i administrativnih zadataka, čime se direktno smanjuje kognitivno opterećenje kao prva domina u nizu iscrpljenosti. Upotreba virtuelnih asistenata, VR simulacija i digitalizovanih evaluacionih alata (Mini-CEX) značajno doprinosi emocionalnoj stabilnosti, smanjenju depersonalizacije i jačanju samoeфикаsnosti sestrinskog kadra. U regionalnom kontekstu Balkana, ефикаsnost ovih rješenja direktno zavisi od prevazilaženja tehnofobije kroz kontinuiranu edukaciju. Zaključak rada ukazuje da uspješno prekidanje domino efekta iscrpljenosti zahtijeva sinergijski model njege u kojem vještačka inteligencija pruža tehničku podršku i kognitivno rasterećenje, dok medicinske sestre zadržavaju humanu dimenziju, етиčki nadzor i strateško liderstvo u digitalnoj transformaciji.

Ključne riječi: vještačka inteligencija, sindrom sagorijevanja, digitalna transformacija, medicinska sestra napredne prakse, liderstvo u sestrinstvu

ARTIFICIAL INTELLIGENCE AS A DETERMINANT OF THE FUTURE OF ADVANCED NURSING CARE: BREAKING THE DOMINO EFFECT OF EXHAUSTION THROUGH DIGITAL TRANSFORMATION

Radmila Jeftić¹, Nataša Egeljić- Mihailović^{1,2}, Duška Jović¹

¹University of Banja Luka, Faculty of Medicine, Department of Nursing,
Banja Luka, Republic of Srpska, Bosnia and Herzegovina

²University Clinical Centre of the Republic of Srpska, Banja Luka, Republic of
Srpska, Bosnia and Herzegovina

Abstract. The contemporary nursing profession faces a critical level of professional exhaustion, where cognitive overload and administrative pressure trigger a destructive domino effect that directly compromises patient safety. The aim of this paper is to systematize and critically evaluate available scientific evidence regarding the impact of artificial intelligence on reducing exhaustion factors among nurses, while defining the role of nurses in the implementation of these technologies. A systematic literature review was conducted using PubMed, Google Scholar, and Web of Science databases, analyzing 25 selected scientific papers published between 2020 and 2026, applying the PRISMA protocol and the Polit and Beck hierarchy of evidence. The results indicate that artificial intelligence interventions can take over up to 30% of routine and administrative tasks, thereby directly reducing cognitive load, the first domino in the sequence of exhaustion. The use of virtual assistants, VR simulations, and digitized evaluation tools (Mini-CEX) contributes significantly to emotional stability, reduced depersonalization and enhanced self-efficacy among nursing staff. In the Balkan regional context, the efficacy of these solutions depends directly on overcoming technophobia through continuous education. In conclusion, breaking the domino effect of exhaustion requires a synergistic care model where artificial intelligence provides technical support, while nurses maintain the human dimension, ethical oversight, and strategic leadership in digital transformation.

Keywords: artificial intelligence, burnout, digital transformation, advanced practice nurse, nursing leadership.

AUTORSKI NOVA-UPF FREKVENCIJSKI MODUL ZA PROCENU UČESTALOSTI KONZUMIRANJA ULTRA-PRERAĐENE HRANE KOD ODRASLIH: PILOT-STUDIJA

***Ardea Milidrag¹, Milena Zlatanović², Mile Despotović², Tatjana Mladenović⁴,
Lazar Despotović³, Ljiljana Savić⁴, Ljubiša Kucurski⁴***

¹Farmaceutski fakultet Beograd, Univerzitet Edukons, Beograd, Srbija

²Odesek za medicinske studije, Akademija vaspitačko-medicinskih strukovnih studija
Kruševac, Čuprija, Srbija

³Fakultet medicinskih nauka, Univerzitet u Kragujevcu, Kragujevac, Srbija

⁴JU Visoka medicinska škola Prijedor, Nikole Pašića 4a, Republika Srpska,
Bosna i Hercegovina

Sažetak. Procena unosa ultra-prerađene hrane predstavlja metodološki izazov, jer klasični instrumenti za procenu ishrane često ne razlikuju domaće, zanatske i industrijski formulisane varijante sličnih proizvoda. Cilj ove pilot presječne studije bio je da se ispita primenljivost, interna konzistentnost i preliminarne performanse autorskog NOVA-UPF frekvencijskog modula prilagođenog regionalnim prehrambenim navikama i dostupnim proizvodima. Anonimni online upitnik popunilo je 200 odraslih ispitanika. Modul je obuhvatio 15 kategorija ultra-prerađene hrane, bodovanih od 0 do 6 prema prijavljenoj učestalosti konzumiranja, čime je formiran preliminarni UPF frequency score teorijskog raspona 0–90. Uzorak su većinom činile žene (69,0%), ispitanici mlađi od 45 godina (72,5%) i osobe iz gradske sredine (65,0%). BMI ≥ 25 kg/m² imalo je 59,0% ispitanika, dok je najmanje jedan analizirani metabolički poremećaj prijavilo 41,5%. Posmatrani UPF skor kretao se od 0 do 60, sa srednjom vrednošću $20,84 \pm 12,75$, medijanom 19 i interkvartilnim rasponom 11–26. Interna konzistentnost modula bila je visoka (Cronbach's $\alpha = 0,882$). Korigovane item-total korelacije bile su veće od 0,30 za 14 od 15 stavki, u rasponu 0,361–0,679; jedino su proteinske pločice, „fit“ slatkiši i zamene za obrok imale nižu vrednost ($r = 0,277$), dok se α pri uklanjanju pojedinačnih stavki kretala od 0,868 do 0,884. Najčešće kategorije konzumirane najmanje jednom nedeljno bile su industrijski slatkiši (62,0%), industrijski sosovi i prelive (53,0%), slane grickalice (52,5%), industrijski keks/napolitanke/vafli (52,5%), mesne prerađevine (48,0%), industrijski kolači i slatka peciva (47,5%) i zaslađeni gazirani napici (46,0%). UPF skor bio je viši kod muškaraca nego kod žena (medijana 24,0 prema 17,5; $p = 0,002$) i smanjivao se sa starošću ($\rho = -0,325$; $p < 0,001$), dok nije bio značajno povezan sa BMI kategorijom ni obrazovanjem. Modul pokazuje dobru primenljivost za brzi skrining i rangiranje učestalosti konzumiranja ultra-prerađene hrane, ali zahteva validaciju prema 24-časovnim prisjećanjima ili dnevnicima ishrane pre upotrebe kao instrumenta za procenu stvarnog unosa.

Ključne riječi: ultra-prerađena hrana, NOVA klasifikacija, procena ishrane, frekvencijski skor, pilot-istraživanje.

AN AUTHOR-DEVELOPED NOVA-UPF FREQUENCY MODULE FOR ASSESSING ULTRA-PROCESSED FOOD CONSUMPTION IN ADULTS: A PILOT STUDY

Ardea Milidrag¹, Milena Zlatanović², Mile Despotović², Tatjana Mladenović³, Lazar Despotović³, Ljiljana Savić⁴, Ljubiša Kucurski⁴

¹Faculty of Pharmacy Belgrade, EDUCONS University, Belgrade, Serbia

²Department of Medical Studies, The Academy of Applied Preschool Teaching and Health Studies Kruševac, Čuprija, Serbia

³Faculty of Medical Sciences, University of Kragujevac, Kragujevac, Serbia

⁴PI College of Health Sciences Prijedor, Nikole Pašića 4a, Republic of Srpska, Bosnia and Herzegovina

Abstract. Ultra-processed food intake is difficult to assess using conventional dietary tools because similar food groups may include homemade, artisanal and industrially formulated products. This pilot cross-sectional study examined the feasibility, internal consistency and preliminary performance of an author-developed NOVA-UPF frequency module adapted to common regional food products and dietary habits. An anonymous online questionnaire was completed by 200 adults. The module included 15 ultra-processed food categories, scored from 0 to 6 according to reported frequency of consumption, producing a preliminary UPF frequency score with a theoretical range of 0–90. The sample was predominantly female (69.0%), younger than 45 years (72.5%) and urban (65.0%); BMI ≥ 25 kg/m² was present in 59.0%, while at least one analysed metabolic disorder was reported by 41.5% of participants. The observed UPF score ranged from 0 to 60, with a mean of 20.84 ± 12.75 , median 19 and interquartile range 11–26. Internal consistency was high (Cronbach's $\alpha = 0.882$). Corrected item-total correlations exceeded 0.30 for 14 of 15 items, ranging from 0.361 to 0.679; only protein bars, “fit” sweets and meal replacements showed a lower value ($r = 0.277$), while alpha if item deleted ranged from 0.868 to 0.884. The most frequently consumed categories at least once weekly were industrial sweets (62.0%), industrial sauces and dressings (53.0%), salty snacks (52.5%), industrial biscuits/wafers (52.5%), processed meat products (48.0%), industrial cakes and sweet pastries (47.5%) and sugar-sweetened beverages (46.0%). The UPF score was higher in men than women (median 24.0 vs. 17.5; $p = 0.002$) and decreased with age ($p = -0.325$; $p < 0.001$), but was not significantly associated with BMI category or education. The module appears feasible for rapid screening and ranking of UPF consumption frequency, but requires validation against 24-hour recalls or dietary records before use as an intake estimation tool.

Key words: ultra-processed food, NOVA classification, dietary assessment, frequency score, pilot study

RAZUMEVANJE MEDICINSKOG JEZIKA: UTICAJ TERMINOLOGIJE, POJMOVA I ŽARGONA NA KOMUNIKACIJU SA PACIJENTIMA

Draženka Topola¹, Branislava Brestovački Svitlica²

¹JU Dom za lica sa invaliditetom Prijedor, Bosna i Hercegovina;

²Univerzitet u Novom Sadu, Medicinski fakultet, Republika Srbija

Sažetak. Medicinski žargon predstavlja specifičan vid stručne komunikacije koji, iako olakšava rad zdravstvenih profesionalaca, može značajno otežati razumevanje informacija kod pacijenata. Cilj ovog istraživanja bio je ispitati nivo razumevanja medicinskog žargona kod pacijenata, kao i uticaj sociodemografskih faktora na to razumevanje. Istraživanje je obuhvatilo analizu razlika u odnosu na starost, nivo obrazovanja, mesto stanovanja i prethodno zdravstveno iskustvo. Rezultati pokazuju da mlađi, obrazovaniji ispitanici i oni iz urbanih sredina značajno bolje razumeju medicinsku terminologiju u odnosu na starije, manje obrazovane i ispitanike iz ruralnih područja. Takođe, pacijenti sa hroničnim bolestima pokazuju viši nivo razumevanja, što ukazuje na značaj iskustva i učestalog kontakta sa zdravstvenim sistemom. Posebno je uočeno da žene sa hroničnim oboljenjima imaju bolje razumevanje u odnosu na muškarce. Rezultati ukazuju na postojanje komunikacijskog jaza između zdravstvenih radnika i određenih grupa pacijenata, što može negativno uticati na ishode lečenja i poverenje u zdravstveni sistem. Zaključuje se da je neophodno prilagođavanje komunikacije pacijentu, uz upotrebu jednostavnog jezika, proveru razumevanja i razvoj strategija za unapređenje zdravstvene pismenosti.

Ključne riječi: medicinski žargon, zdravstvena pismenost, komunikacija, pacijenti, sociodemografski faktori, razumevanje

UNDERSTANDING MEDICAL LANGUAGE: THE IMPACT OF TERMINOLOGY, TERMS AND JARGON ON COMMUNICATING WITH PATIENTS

Draženka Topola¹, Branislava Brestovački Svitlica²

¹PI Residential Home for persons with disabilities, Prijedor,
Bosnia and Herzegovina;

²Faculty of Medicine of the University of Novi Sad,
Novi Sad, Republic of Serbia;

Abstract. Medical jargon represents a specific form of professional communication which, although it facilitates the work of healthcare professionals, can significantly hinder patients' understanding of information. The aim of this study was to examine the level of patients' understanding of medical jargon, as well as the influence of sociodemographic factors on that understanding. The research included an analysis of differences in relation to age, level of education, place of residence, and prior healthcare experience. The results indicate that younger and more educated participants, as well as those from urban areas, have a significantly better understanding of medical terminology compared to older, less educated individuals and those from rural areas. Additionally, patients with chronic diseases demonstrated a higher level of understanding, highlighting the importance of experience and frequent contact with the healthcare system. It was also observed that women with chronic conditions showed better understanding compared to men. The findings point to the existence of a communication gap between healthcare professionals and certain patient groups, which may negatively affect treatment outcomes and trust in the healthcare system. It is concluded that communication should be adapted to the patient, with the use of plain language, verification of understanding, and the development of strategies to improve health literacy.

Key words: medical jargon, health literacy, communication, patients, sociodemographic factors, understanding

Spektrofotometrijska i elektrohemijska analiza određivanja uticaja antihistaminika na aktivnost enzima

Safija Herenda¹, Edhem Hasković²

¹Univerzitet u Sarajevu, Prirodno-matematički fakultet, Odsjek za hemiju, Zmaja od Bosne 33-35, 71 000, Sarajevo, Bosna i Hercegovina;

²Univerzitet u Sarajevu, Prirodno-matematički fakultet, Odsjek za biologiju, Zmaja od Bosne 33-35, 71 000, Sarajevo, Bosna i Hercegovina

Sažetak, Loratadin je antihistaminik druge generacije koji se koristi za liječenje alergijskih stanja poput rinitisa i urtikarije. Njegova glavna farmakološka aktivnost zasniva se na selektivnom vezivanju za histaminske H1 receptore, čime se blokira djelovanje histamina i ublažavaju simptomi alergije. U ovom radu ispitan je uticaj antihistaminika loratidina na aktivnost jetrenog enzima primjenom spektrofotometrijske i elektrohemijske metode. Spektrofotometrijska metoda se zasniva na praćenju promjene apsorbanse loratidina na 250 nm i na temperaturi od 37°C, dok su elektrohemijske tehnike (ciklična voltametrija i hronoamperometrija) pružile uvid u redoks karakteristike biosenzora. Promjene u redoks potencijalu ukazuju na transformaciju loratidina u desloratadin. Elektrohemijski podaci se koriste kao komplementarni pokazatelj enzimskog metabolizma. U tu svrhu napravljen je biosenzor na GC elektrodi, pomoću kojeg je mjerena aktivnost jetrenog enzima aspartat aminotransferaze (AST) u odsustvu i prisustvu loratidina kao inhibitora. Rezultati ukazuju na koncentracijski zavisnu kompetitivnu inhibiciju enzimskih aktivnosti, pri čemu intenzitet efekta varira u odnosu na strukturu i farmakološki profil ispitivanog spoja i nastalog enzim-inhibitor kompleksa. Kombinacija primijenjenih metoda pokazala se kao pouzdana i komplementarna strategija za karakterizaciju interakcija antihistaminika i enzima, doprinoseći boljem razumijevanju njihovih farmakodinamičkih svojstava i potencijalnih kliničkih implikacija.

Ključne riječi: Spektrofotometrijska metoda, elektrohemijska metoda, loratidin, AST, enzimska kinetika.

Zahvala:

Istraživanje je podržalo Federalno ministarstvo obrazovanja i nauke, Sarajevo, broj 05-35-3573-1/25.

SPECTROPHOTOMETRIC AND ELECTROCHEMICAL ANALYSIS OF THE EFFECT OF ANTIHISTAMINES ON ENZYME ACTIVITY

Safija Herenda¹, Edhem Hasković²

¹University of Sarajevo, Faculty of Science, Department of Chemistry, Zmaja od Bosne 33-35, 71000 Sarajevo, Bosnia and Herzegovina

²University of Sarajevo, Faculty of Science, Department of Biology, Zmaja od Bosne 33-35, 71000 Sarajevo, Bosnia and Herzegovina

Abstract. Loratadine is a second-generation antihistamine used in the treatment of allergic conditions such as rhinitis and urticaria. Its primary pharmacological activity is based on selective binding to histamine H1 receptors, thereby blocking the action of histamine and alleviating allergy symptoms. In this study, the influence of loratadine on liver enzyme activity was investigated using spectrophotometric and electrochemical methods. The spectrophotometric method was based on monitoring changes in loratadine absorbance at 250 nm at 37°C, while electrochemical techniques (cyclic voltammetry and chronoamperometry) provided insight into the redox characteristics of the biosensor. Variations in redox potential indicated the transformation of loratadine into desloratadine. Electrochemical data served as complementary indicators of enzymatic metabolism. For this purpose, a biosensor was constructed on a glassy carbon (GC) electrode, which was used to measure the activity of the liver enzyme aspartate aminotransferase (AST) in the absence and presence of loratadine as an inhibitor. The results demonstrated concentration-dependent competitive inhibition of enzymatic activity, with the intensity of the effect varying according to the structure and pharmacological profile of the compound and the resulting enzyme–inhibitor complex. The combination of applied methods proved to be a reliable and complementary strategy for characterizing antihistamine–enzyme interactions, contributing to a deeper understanding of their pharmacodynamic properties and potential clinical implications.

Keywords: Spectrophotometric method, electrochemical method, loratadine, AST, enzyme kinetics.

Acknowledgment

This research was supported by funding through grant number 05-35-3573-1/25 provided by the Federal Ministry of Education and Science, Sarajevo.

HIDROLAT LAVANDE (*Lavandula angustifolia*) KAO IZVOR PRIRODNIH ANTIOKSIDANASA: HEMIJSKI SASTAV I STABILNOST TOKOM SKLADIŠTENJA

Sanja Berić¹, Nebojša Kladar², Željka Marjanović-Balaban³, Vesna Antunović⁴

¹Institut za javno zdravstvo Republike Srpske, Jovana Dučića 1, 78000 Banja Luka;

²Univerzitet u Novom Sadu, Medicinski fakultet, Hajduk Veljkova 3, 21000 Novi Sad, Republika Srbija;

³Univerzitet u Banjoj Luci, Šumarski fakultet, Vojvode Petra Bojovića 1a, 78000 Banja Luka, Republika Srpska, Bosna i Hercegovina;

⁴Univerzitet u Banjoj Luci, Medicinski fakultet, Vojvode Petra Bojovića 1a, 78000 Banja Luka, Republika Srpska, Bosna i Hercegovina;

Sažetak. Hidrolati predstavljaju vrijedne nusproizvode procesa destilacije eteričnih ulja i sve više privlače pažnju zbog potencijalne primjene u farmaceutskoj, kozmetičkoj i prehrambenoj industriji. Cilj ovog rada bio je ispitati hemijski sastav hidrolata lavande, odrediti sadržaj ukupnih fenola i flavonoida, te procijeniti stabilnost antioksidativne aktivnosti tokom skladištenja. Istraživanje je obuhvatilo analizu antioksidativne aktivnosti svježeg hidrolata neposredno nakon proizvodnje, kao i uzorka nakon tri sedmice čuvanja u kontrolisanim uslovima. Hemijski sastav hidrolata analiziran je GC-MS metodom, pri čemu su identifikovana dominantna isparljiva jedinjenja karakteristična za lavandu, među kojima su najzastupljeniji bili linalol, kamfor i eukaliptol. Sadržaj ukupnih fenola određen je spektrofotometrijskom metodom primjenom Folin-Ciocalteu reagensa, dok je sadržaj ukupnih flavonoida određivan metodom kompleksiranja sa aluminijum-hloridom. Rezultati su pokazali prisustvo fenola (5,45 mgGAE/g) i flavonoida (0,42 mg mgQE/g) koji doprinose njegovim funkcionalnim svojstvima. Antioksidativna aktivnost procijenjena je primjenom DPPH metode u svježem hidrolatu i nakon tri sedmice skladištenja. Svježi hidrolat ispoljio je izraženu sposobnost neutralizacije slobodnih radikala, što potvrđuje njegov antioksidativni potencijal. Nakon tri sedmice skladištenja uočen je blagi pad antioksidativne aktivnosti, što ukazuje na to da je hidrolat i nakon navedenog perioda zadržao značajnu biološku aktivnost. Dobijeni rezultati potvrđuju da hidrolat lavande predstavlja vrijedan prirodni proizvod sa izraženim antioksidacijskim svojstvima i potencijalom za primjenu kao funkcionalni sastojak u različitim formulacijama. Istovremeno, rezultati ukazuju na značaj pravilnog skladištenja radi očuvanja hemijske stabilnosti i biološke aktivnosti proizvoda.

Ključne riječi: lavanda, hidrolat, fenoli, flavonoidi, antioksidansi

Zahvalnica: Ova studija izvedena je u okviru projekta „Hidrodestilacija i analiza eteričnih ulja i hidrolata iz ljekovitog i začinskog bilja sa prostora Hercegovine: Istraživanje sastava i dejstva kao i moguća promjena u farmaciji i industriji“ br. 125 7064, finansiranog od strane Ministarstva za naučnotehnološki razvoj i visoko obrazovanje Republike Srpske.

LAVENDER HYDROSOL (*Lavandula angustifolia*) AS A SOURCE OF NATURAL ANTIOXIDANTS: CHEMICAL COMPOSITION AND STABILITY DURING STORAGE

Sanja Berić¹, Nebojša Kladar², Željka Marjanović-Balaban³, Vesna Antunović⁴

¹Institute of Public Health of the Republic of Srpska, Jovana Dučića 1, 78000 Banja Luka, Bosnia and Herzegovina

²University of Novi Sad, Faculty of Medicine, Hajduk Veljkova 3, 21000 Novi Sad, Republic of Serbia

³University of Banja Luka, Faculty of Medicine, Vojvode Petra Bojovića 1a, 78000 Banja Luka, Bosnia and Herzegovina

⁴University of Banja Luka, Faculty of Forestry, Vojvode Petra Bojovića 1a, 78000 Banja Luka, Bosnia and Herzegovina

Abstrakt. Hydrosols represent valuable by-products of essential oil distillation and are increasingly gaining attention due to their potential applications in the pharmaceutical, cosmetic, and food industries. The aim of this study was to investigate the chemical composition of lavender hydrosol, determine the total phenolic and flavonoid content, and assess the stability of its antioxidant activity during storage. The study included the analysis of antioxidant activity of fresh hydrosol immediately after production, as well as after three weeks of storage under controlled conditions. The chemical composition of the hydrosol was analyzed using GC–MS, revealing dominant volatile compounds characteristic of lavender, with linalool, camphor, and eucalyptol being the most abundant. Total phenolic content was determined spectrophotometrically using the Folin–Ciocalteu method, while total flavonoid content was assessed using the aluminum-chloride complexation method. The results demonstrated the presence of phenolic compounds (5.45 mg GAE/g) and flavonoids (0.42 mg QE/g), contributing to the functional properties of the hydrosol. Antioxidant activity was evaluated using the DPPH assay in both fresh samples and those stored for three weeks. The fresh hydrosol exhibited a pronounced free radical scavenging capacity, confirming its antioxidant potential. After three weeks of storage, a slight decrease in antioxidant activity was observed; however, the hydrosol retained significant biological activity. These findings confirm that lavender hydrosol is a valuable natural product with notable antioxidant properties and potential for use as a functional ingredient in various formulations. At the same time, the results highlight the importance of proper storage conditions to preserve its chemical stability and biological activity.

Keywords: lavender, hydrosol, phenolics, flavonoids, antioxidant

Acknowledgment: This study was conducted within the project “Hydrodistillation and analysis of essential oils and hydrosols from medicinal and aromatic plants from the Herzegovina region: Investigation of composition and biological effects, as well as potential applications in pharmacy and industry” (No. 125 7064), funded by the Ministry for Scientific and Technological Development and Higher Education of the Republic of Srpska.

ZAHTJEVI DOBRE LABORATORIJSKE PRAKSE (DLP) ZA LABORATORIJSKO OSOBLJE

***Mira Obradović^{1,2}, Radoslav Grujić¹, Igor Grujić^{1,3}, Brankica Kaurin
Šarac⁴***

¹JU Visoka medicinska škola Prijedor, Nikole Pašića 4a, Republika Srpska,
Bosna i Hercegovina

²Medicinski fakultet Univerziteta u Novom Sadu, student doktorskih studija,
Hajduk Veljkova 3, Novi Sad, Republika Srbija

³Fakultet informacionih tehnologija, Panevropski univerzitet Apeiron,
Vojvode Pere Krece 13, 78102 Banja Luka, Bosna i Hercegovina

⁴JZU „Dom zdravlja“ Prijedor, Republika Srpska, Bosna i Hercegovina

Sažetak. Dobra laboratorijska praksa (DLP) predstavlja sveobuhvatan sistem kvaliteta kojim se uređuje organizacioni proces i uslovi pod kojima se laboratorijske aktivnosti planiraju, izvode, nadziru, bilježe, arhiviraju i izvještavaju. Ljudski resursi čine osnovni stub svake laboratorije, jer su upravo stručnost, obučenost i odgovornost zaposlenih ključni faktori u ostvarivanju tačnih i pravovremenih rezultata. Cilj rada je analizirati i prikazati zahtjeve DLP koji se odnose na laboratorijsko osoblje, s fokusom na ulogu kontinuirane edukacije i kompetentnosti u obezbjeđenju kvaliteta i pouzdanosti laboratorijskih rezultata. Istraživanje je sprovedeno kao pregledna studija zasnovana na analizi dostupne naučne i stručne literature, te relevantnih međunarodnih i nacionalnih standarda i profesionalnih smjernica (ISO 15189:2022, ISO/IEC 17025:2017, OECD GLP, CLIA). Podaci su prikupljeni pretragom baza *ScienceDirect*, *Scopus*, *PubMed* i *Google Scholar* korištenjem ključnih riječi: „*Good Laboratory Practice*“, „*laboratory personnel*“, „*competency*“, „*training*“ i „*ISO 15189*“. U analizu su uključeni radovi objavljeni u posljednjih deset godina, odabrani na osnovu tematske relevantnosti kroz pregled naslova, sažetaka i punih tekstova, sa fokusom na kompetentnost i odgovornost laboratorijskog osoblja. Svi analizirani izvori potvrđuju da je ljudski faktor presudan u sprječavanju laboratorijskih grešaka. Analiza pokazuje da predanalitička faza predstavlja najčešći izvor laboratorijskih grešaka od 46–68%, a u pojedinim studijama i preko 80%, pri čemu je većina nepravilnosti direktno povezana sa ljudskim faktorom. Dokumentovanje obuka, periodična provjera kompetencija i kontinuirano obrazovanje predstavljaju osnovu kvaliteta. Zahtjevi DLP-a za osoblje nisu samo administrativna formalnost, već strateški okvir za izgradnju kompetentnog, motivisanog i stabilnog tima. Samo integrisanim pristupom zapošljavanju, obuci i evaluaciji moguće je obezbijediti tačne i pouzdane rezultate, čime laboratorija direktno doprinosi bezbjednosti pacijenata i kredibilitetu zdravstvenog sistema.

Ključne riječi: sistem kvaliteta, kompetencije, ISO 15189, predanalitička faza, kontinuirana edukacija

GOOD LABORATORY PRACTICE (GLP) REQUIREMENTS FOR LABORATORY PERSONNEL

Mira Obradović^{1,2}, Radoslav Grujić¹, Igor Grujić^{1,3}, Brankica Kaurin Šarac⁴

¹PI College of Health Sciences Prijedor, Nikole Pašića 4A, 79202 Prijedor, Republic of Srpska, Bosnia and Herzegovina

²Faculty of Medicine of the University of Novi Sad, PhD student, Hajduk Veljkova 3, Novi Sad, Republic of Serbia

³Faculty of Information Technology, Pan-European University Apeiron, Vojvode Pere Krece 13, 78102 Banja Luka, Bosnia and Herzegovina

⁴PZU "Health Center" Prijedor, Republic of Srpska, Bosnia and Herzegovina

Abstract. Good Laboratory Practice (GLP) represents a comprehensive quality system that governs the organizational process and the conditions under which laboratory activities are planned, performed, monitored, recorded, archived, and reported. Human resources constitute the fundamental pillar of every laboratory, as the expertise, training, and responsibility of employees are key factors in achieving accurate and timely results. The aim of this paper is to analyze and present GLP requirements related to laboratory personnel, with a focus on the role of continuous education and competency in ensuring the quality and reliability of laboratory results. The research was conducted as a review study based on the analysis of available scientific and professional literature, as well as relevant international and national standards and professional guidelines (ISO 15189:2022, ISO/IEC 17025:2017, OECD GLP, CLIA). Data were collected by searching the ScienceDirect, Scopus, PubMed, and Google Scholar databases using the keywords: “*Good Laboratory Practice*”, “*laboratory personnel*”, “*competency*”, “*training*” and “*ISO 15189*.” Studies published in the last ten years were included in the analysis, selected based on thematic relevance through a review of titles, abstracts, and full texts, with a focus on the competency and responsibility of laboratory personnel. All analyzed sources confirm that the human factor is crucial in preventing laboratory errors. The analysis shows that the pre-analytical phase represents the most common source of laboratory errors, accounting for 46–68%, and in some studies even over 80%, with the majority of irregularities directly related to human factors. Documentation of training, periodic competency assessments, and continuous education form the foundation of quality. GLP requirements for personnel are not merely an administrative formality, but a strategic framework for building a competent, motivated, and stable team. Only through an integrated approach to recruitment, training, and evaluation is it possible to ensure accurate and reliable results, thereby enabling the laboratory to directly contribute to patient safety and the credibility of the healthcare system.

Key words: quality system, competencies, ISO 15189, pre-analytical phase, continuous education

HPV VAKCINACIJA U SRBIJI: OBUHVAT IMUNIZACIJOM, INFORMISANOST I STAVOVI ADOLESCENATA

Milica Ilić¹, Maja Trailović¹, Milica Mančić¹, Saška Stajić¹, Christos Alexopoulos¹, Mile Despotović¹, Filip Jovanović², Milena Zlatanović¹

¹Akademija vaspitačko-medicinskih strukovnih studija, Kruševac, Srbija

²Opšta bolnica Čuprija, Republika Srbija

Sažetak. Humani papiloma virus (HPV) ubraja se među najčešće polno prenosive infekcije i predstavlja važan javnozdravstveni problem zbog značajne uloge u nastanku karcinoma grlića materice i drugih malignih oboljenja. Iako HPV vakcinacija predstavlja efikasnu meru primarne prevencije, obuhvat imunizacijom u mnogim zemljama, uključujući Srbiju, još uvek nije na zadovoljavajućem nivou. Cilj rada bio je analiza obuhvata HPV vakcinacijom u Republici Srbiji, kao i ispitivanje informisanosti, znanja i stavova adolescenata o HPV infekciji i vakcinaciji. Istraživanje je sprovedeno kao studija preseka i retrospektivna analiza podataka. Retrospektivni deo istraživanja obuhvatio je analizu godišnjih izveštaja Svetske zdravstvene organizacije (WHO) i Instituta za javno zdravlje Srbije „Dr Milan Jovanović Batut“, dok je studija preseka realizovana putem anonimnog upitnika među 51 adolescentom. Rezultati pokazuju da je program HPV vakcinacije u Srbiji, započet 2022. godine primenom devetovalentne vakcine Gardasil 9, doveo do značajnog povećanja broja datih doza, sa 20.130 u 2022. godini na 63.198 u 2023. godini, dok je prvu dozu tokom 2023. godine primilo 31.011 osoba. Istovremeno, istraživanje među adolescentima pokazalo je visok nivo informisanosti o HPV infekciji, budući da je 92,2% ispitanika čulo za virus, dok je 86,3% upoznato sa njegovom povezanošću sa karcinomom grlića materice. Takođe, većina ispitanika zna da HPV vakcina postoji i da je namenjena i muškom i ženskom polu. Uprkos tome, prisutna je izražena rezervisanost prema vakcinaciji, jer samo 30,2% ispitanika smatra vakcinu bezbednom, dok je spremnost za imunizaciju niska. Kao najčešći razlozi odbijanja navode se nedovoljna informisanost i strah od neželjenih efekata. Posebno zabrinjava podatak da gotovo polovina ispitanika ne smatra da je u riziku od HPV infekcije, uprkos prepoznavanju virusa kao ozbiljne zdravstvene pretnje. Dobijeni rezultati ukazuju da, uprkos rastu obuhvata HPV vakcinacijom i zadovoljavajućem nivou informisanosti mladih, i dalje postoji potreba za kontinuiranom edukacijom i jačanjem poverenja u vakcinu. Unapređenje preventivnih i edukativnih aktivnosti moglo bi značajno doprineti povećanju obuhvata imunizacijom i prevenciji malignih oboljenja izazvanih HPV infekcijom u Srbiji.

Ključne reči: Humani papiloma virus, HPV vakcinacija, adolescenti, prevencija, karcinom grlića materice.

HPV VACCINATION IN SERBIA: IMMUNIZATION COVERAGE, AWARENESS, AND ATTITUDES OF ADOLESCENTS

Milica Ilić¹, Maja Trailović¹, Milica Mančić¹, Saška Stajić¹, Christos Alexopoulos¹, Mile Despotović¹, Filip Jovanović², Milena Zlatanović¹

¹The Academy of Applied Preschool Teaching and Health Studies, Krusevac, Serbia

²General Hospital Čuprija, Republic of Serbia

Abstract. Human papilloma virus (HPV) is among the most common sexually transmitted infections and represents a significant public health issue due to its major role in the development of cervical cancer and other malignant diseases. Although HPV vaccination is an effective measure of primary prevention, immunization coverage in many countries, including Serbia, is still not at a satisfactory level. The aim of this study was to analyze HPV vaccination coverage in the Republic of Serbia, as well as to examine the awareness, knowledge, and attitudes of adolescents regarding HPV infection and vaccination. The research was conducted as a retrospective cross-sectional study and data analysis. The retrospective part of the study included an analysis of annual reports from the World Health Organization (WHO) and the Institute of Public Health of Serbia „Dr Milan Jovanović Batut“, while the cross-sectional study was carried out through an anonymous questionnaire among 51 adolescents. The results indicate that the HPV vaccination program in Serbia, introduced in 2022 with the administration of the nine-valent Gardasil 9 vaccine, led to a significant increase in the number of administered doses, from 20,130 in 2022 to 63,198 in 2023, while 31,011 individuals received the first dose during 2023. At the same time, the survey among adolescents showed a high level of awareness regarding HPV infection, since 92.2% of respondents had heard about the virus, while 86.3% were familiar with its association with cervical cancer. In addition, most respondents knew that the HPV vaccine exists and that it is intended for both males and females. Despite this, a certain level of hesitation toward vaccination was observed, as only 30.2% of respondents considered the vaccine to be safe, while willingness to be immunized remained low. The most common reasons for vaccine refusal were insufficient information and fear of side effects. Particularly concerning is the finding that almost half of the respondents did not consider themselves at risk of HPV infection, despite recognizing the virus as a serious health threat. The obtained results indicate that, despite the increasing HPV vaccination coverage and a satisfactory level of awareness among young people, there is still a need for continuous education and strengthening confidence in vaccines. Improving preventive and educational activities could significantly contribute to increasing immunization coverage and preventing malignant diseases caused by HPV infection in Serbia.

Keywords: Human papilloma virus, HPV vaccination, adolescents, prevention, cervical cancer.

STANJE ARTERIJSKOG PRITISKA, GLIKEMIJE I INDEKSA TELESNE MASE U POPULACIJI STUDENATA

Aleksandar Aleksić¹, Luka Aleksić², Nemanja Nenezić¹, Tijana Simić¹, Teodora Džopalić¹, Lazar Despotović³, Filip Jovanović⁴, Sonja Pavlović¹

¹Akademija vaspitačko-medicinskih strukovnih studija, Kruševac, Odsek medicinskih studija Čuprija, Čuprija, Republika Srbija

²Opšta bolnica Zaječar, Republika Srbija

³Univerzitet u Kragujevcu, Medicinski fakultet, Kragujevac, Srbija

⁴Opšta Bolnica Čuprija, Republika Srbija

Sažetak. Kardiometabolički faktori rizika, uključujući arterijski pritisak, glikemiju i indeks telesne mase (BMI), imaju značajnu ulogu u nastanku kardiovaskularnih i metaboličkih oboljenja. Povezanost između povećane telesne mase i povišenog krvnog pritiska dobro je dokumentovana u opštoj populaciji, ali je njen značaj u mlađim, zdravim grupama manje istražen. Indeks telesne mase (BMI) predstavlja važan pokazatelj nutritivnog statusa i povezan je sa metaboličkim poremećajima, uključujući poremećaj regulacije glikemije. Iako se poremećaji ovih parametara češće javljaju u odrasloj i starijoj populaciji, njihova procena u mlađim, naizgled zdravim grupama, kao što su studenti, može biti značajna za ranu identifikaciju rizika. Cilj ovog rada bio je da se procene vrednosti arterijskog pritiska, glikemije i BMI kod studenata, kao i da se ispita postojanje povezanosti BMI sa varijacijama ovih parametara. Istraživanje je sprovedeno kao studija preseka u populaciji studenata, na uzorku od 63 ispitanika. Kod svih ispitanika izmereni su telesna visina i masa, na osnovu čega je izračunat BMI, kao i vrednosti sistolnog i dijastolnog arterijskog pritiska i glikemije. Podaci su analizirani primenom deskriptivne statistike, dok je povezanost između BMI i ostalih parametara procenjena korelacionom analizom. Statistička značajnost postavljena je na $p < 0,05$. Prosečna vrednost BMI iznosila je $23,6 \pm 4,1 \text{ kg/m}^2$. Prekomerna uhranjenost registrovana je kod 19 studenata, dok je gojaznost utvrđena kod 5 studenata. Prosečna vrednost sistolnog arterijskog pritiska bila je $117,1 \pm 8,5 \text{ mmHg}$, a dijastolnog arterijskog pritiska $74,9 \pm 8,4 \text{ mmHg}$. Povišene vrednosti arterijskog pritiska (≥ 130 i/ili $\geq 85 \text{ mmHg}$) registrovane su kod 22,2%. Prosečna vrednost glikemije iznosila je $5,12 \pm 0,98 \text{ mmol/L}$. Vrednosti glikemije $\geq 5,6 \text{ mmol/L}$ registrovane su kod 7 studenata (11,1%). Korelacionom analizom utvrđena je slaba pozitivna povezanost između BMI i sistolnog arterijskog pritiska ($r = 0,23$; $p = 0,073$), koja nije dostigla statističku značajnost. Između BMI i dijastolnog arterijskog pritiska nađena je slaba, ali statistički značajna pozitivna korelacija ($r = 0,26$; $p = 0,038$). Nije utvrđena povezanost između BMI i glikemije ($r = 0,004$; $p = 0,973$). Rezultati ovog istraživanja pokazuju da su kod ispitivane studentske populacije vrednosti arterijskog pritiska i glikemije uglavnom bile u granicama očekivanih vrednosti za mlade i zdrave osobe. Kod studenata su utvrđene uglavnom normalne vrednosti arterijskog pritiska i glikemije. BMI nije bio povezan sa glikemijom, ali je pokazao blagu pozitivnu povezanost sa arterijskim pritiskom, posebno dijastolnim. Rezultati ukazuju na značaj ranog praćenja telesne mase i arterijskog pritiska i u mlađoj, naizgled zdravoj populaciji.

Glavne reči: sistolni i dijastolni krvni pritisak, glikemija, indeks telesne mase

ASSESSMENT OF ARTERIAL BLOOD PRESSURE, GLYCEMIA AND BODY MASS INDEX IN A STUDENT POPULATION

Aleksandar Aleksić¹, Luka Aleksić², Nemanja Nenezić¹, Tijana Simić¹, Teodora Džopalić¹, Lazar Despotović³, Filip Jovanović⁴, Sonja Pavlović¹

¹The Academy of Applied Preschool Teaching and Health Studies, Department of Medical Studies Čuprija, Čuprija, Republic of Serbia

²General Hospital Zaječar, Republic of Serbia

³University of Kragujevac, Faculty of Medical Sciences, Kragujevac, Republic of Serbia

⁴General Hospital Čuprija, Republic of Serbia

Abstract. Cardiometabolic risk factors, including blood pressure, glycemia and body mass index (BMI), play a significant role in the development of cardiovascular and metabolic diseases. The association between increased body weight and elevated blood pressure has been well documented in the general population. However, its significance has been less extensively studied in younger, healthy groups. Body mass index (BMI) is an important indicator of nutritional status and is associated with metabolic disorders, including impaired glycemic regulation. Although abnormalities in these parameters occur more frequently in adult and elderly populations, their assessment in younger, apparently healthy groups, such as students, may be important for the early identification of health risks. The aim of this study was to assess blood pressure, glycemia and body mass index (BMI) among students and to examine the association between BMI and variations in these parameters. The study was conducted as a cross-sectional study in a student population and included a sample of 63 students. Body height and weight were measured in all participants, and BMI was calculated accordingly. Systolic and diastolic blood pressure, as well as glycemic values, were also assessed. Data were analysed using descriptive statistics, while the association between BMI and the other parameters was evaluated using correlation analysis. Statistical significance was set at $p < 0.05$. The mean BMI was $23.6 \pm 4.1 \text{ kg/m}^2$. Overweight status was identified in 19 students, while obesity was observed in 5 students. The mean systolic blood pressure was $117.1 \pm 8.5 \text{ mmHg}$ and the mean diastolic blood pressure was $74.9 \pm 8.4 \text{ mmHg}$. Elevated blood pressure values (≥ 130 and/or $\geq 85 \text{ mmHg}$) were recorded in 22.2% of the students. The mean glycemic value was $5.12 \pm 0.98 \text{ mmol/L}$. Glycemic values $\geq 5.6 \text{ mmol/L}$ were observed in 7 students (11.1%). Correlation analysis revealed a weak positive association between BMI and systolic blood pressure ($r = 0.23$; $p = 0.073$), which did not reach statistical significance. A weak but statistically significant positive correlation was found between BMI and diastolic blood pressure ($r = 0.26$; $p = 0.038$). No association was found between BMI and glycemia ($r = 0.004$; $p = 0.973$). The results of this study indicate that blood pressure and glycemic values in the investigated student population were generally within the expected range for young and healthy individuals. The majority of students exhibited normal blood pressure and glycemic values. BMI was not associated with glycemia but showed a mild positive association with blood pressure, particularly with diastolic blood pressure. These findings highlight the importance of early monitoring of body weight and blood pressure even in younger, apparently healthy populations.

Keywords: systolic and diastolic blood pressure, glycemia, body mass index

FARMAKOEKONOMSKI ASPEKTI PRIMENE SGLT-2 INHIBITORA U LEČENJU SRČANE INSUFICIJENCIJE: PREGLED ANALIZA ISPLATIVOSTI

Đorđe Baletić^{1,3}, Nataša Božić^{1,3}, Violeta Ilić Todorović², Nina Đukanović¹, Aleksandar Rašković³, Mile Despotović², Jasmina Jovanović Mirković², Filip Jovanović⁴

¹Univerzitet „BIJELJINA“ Bijeljina, Farmaceutski fakultet, Bijeljina,
Bosna i Hercegovina

²Akademija vaspitačko-medicinskih strukovnih studija, Odsek medicinskih studija,
Čuprija, Republika Srbija

³Univerzitet u Novom Sadu, Medicinski fakultet, Novi Sad, Republika Srbija

⁴Opšta bolnica Čuprija, Republika Srbija

Sažetak. Inhibitori natrijum-glukoznog kotransportera 2 (engl. Sodium Glucose Transport Protein 2 Inhibitors, SGLT-2) postaju ključni u lečenju dijabetesa tipa 2 (engl. Type 2 Diabetes Mellitus, T2DM) blokiranjem reapsorpcije glukoze u proksimalnim tubulima, što smanjuje hiperglikemiju i pruža kardiovaskularne irenoprotektivne benefite. Cilj ovog istraživanja je analiziranje farmakoeekonomskih aspekata primene SGLT-2 inhibitora u lečenju srčane insuficijencije (engl. Heart Failure, HF), sa posebnim osvrtom na rezultate analiza isplativosti (engl. cost-effectiveness, CEA) i njihovog značaja za zdravstvene sisteme. Sproveden je narativni pregled literature putem baze podataka PubMed, Scopus i Web of Science, fokusirajući se na dostupnost podataka iz randomizovanih kliničkih studija, meta-analiza i farmakoeekonomskih modela koji porede terapiju SGLT-2 inhibitorima sa standardnom terapijom. Studije su pokazale da terapija SGLT-2 inhibitorima kod srčane insuficijencije sa smanjenom ejekcionom frakcijom (engl. Heart Failure with Reduced Ejection Fraction, HFrEF) povećava QALY za oko +0.23 do +0.70 i produžava godine života (engl. Life Years, LY) za +1.21 LY, uz značajno smanjenje hospitalizacija. ICER se kretao od 5.541 USD/QALY u Kini do oko 68.300 USD/QALY u Sjedinjenim Američkim Državama (engl. United States of America, USA), ali je u svim analizama ostao ispod nacionalnih pragova isplativosti. Uprkos većim troškovima terapije, rezultati potvrđuju da su SGLT-2 inhibitori farmakoeekonomski opravdan dodatak standardnoj terapiji. Primena SGLT-2 inhibitora u lečenju srčane insuficijencije opravdana je ne samo klinički, već i farmakoeekonomski. Njihova upotreba može doprineti optimizaciji resursa zdravstvenog sistema kroz smanjenje finansijskog opterećenja bolesti i unapređenje kvaliteta života pacijenata.

Ključne reči: SGLT-2 inhibitori, srčana insuficijencija, analiza isplativosti, kvalitet života, zdravstveni troškovi.

PHARMACOECONOMIC ASPECTS OF THE USE OF SGLT-2 INHIBITORS IN THE TREATMENT OF HEART FAILURE: A REVIEW OF COST-EFFECTIVENESS ANALYSES

Đorđe Baletić^{1,3}, Nataša Božić^{1,3}, Violeta Ilić Todorović², Nina Đukanović¹, Aleksandar Rašković³, Mile Despotović², Jasmina Jovanović Mirković², Filip Jovanović⁴

¹Bijeljina University, Faculty of Pharmacy, Bijeljina, Bosnia and Herzegovina

²The Academy of Applied Preschool Teaching and Health Studies, Department of Medical Studies, Čuprija, Republic of Serbia

³University of Novi Sad, Faculty of Medicine, Novi Sad, Republic of Serbia

⁴General Hospital Čuprija, Republic of Serbia

Abstract. Sodium Glucose Transport Protein 2 (SGLT-2) Inhibitors are becoming crucial in the treatment of Type 2 Diabetes Mellitus (T2DM) by blocking glucose reabsorption in the proximal tubules, which reduces hyperglycemia and provides cardiovascular and renoprotective benefits. The aim of this research is to analyze the pharmacoeconomic aspects of the use of SGLT-2 inhibitors in the treatment of heart failure (HF), with special reference to the results of cost-effectiveness analyses (CEA) and their importance for health systems. A comprehensive literature review was conducted through the PubMed, Scopus, and Web of Science databases, focusing on the availability of data from randomized clinical trials, meta-analyses, and pharmacoeconomic models comparing SGLT-2 inhibitor therapy with standard therapy. Studies have shown that therapy with SGLT-2 inhibitors in heart failure with reduced ejection fraction (HFrEF) increases QALY by about +0.23 to +0.70 and prolongs life years by +1.21 LY, with a significant reduction in hospitalizations. The ICER ranged from 5,541 USD/QALY in China to around 68,300 USD/QALY in the United States of America, but remained below national cost-effectiveness thresholds in all analyses. Despite the higher costs of therapy, the results confirm that SGLT-2 inhibitors are a pharmacoeconomically justified addition to standard therapy. The use of SGLT-2 inhibitors in the treatment of heart failure is justified not only clinically, but also pharmacoeconomically. Their use can contribute to the optimization of health system resources by reducing the financial burden of the disease and improving the quality of life of patients.

Key words: SGLT-2 inhibitors, heart failure, cost-effectiveness analysis, quality of life, Health Care Costs.

INTERAKCIJE ANTIDIJABETIČKIH LIJEKOVA SA DIJETETSKIM SUPLEMENTIMA KOJI SADRŽE BILJNE KOMPONENTE

***Nataša Božić^{1,2}, Đorđe Baletić^{1,2}, Violeta Ilić Todorović³, Ljiljana Tomić¹,
Aleksandar Rašković², Mile Despotović^{3,4}, Jasmina Jovanović Mirković³ Hristos
Aleksopoulos³***

¹Univerzitet "BIJELJINA" Bijeljina, Farmaceutski fakultet, Bijeljina,
Bosna i Hercegovina

²Univerzitet u Novom Sadu, Medicinski fakultet, Novi Sad, Republika Srbija

³Akademija vaspitačko-medicinskih strukovnih studija, Odsek medicinskih studija,
Ćuprija, Republika Srbija

⁴Medicinski fakultet Foča, Univerziteta u Istočnom Sarajevu,

Sažetak. Dijabetes melitus tipa 2 često je udružen sa arterijskom hipertenzijom, dislipidemijom, kardiovaskularnim bolestima i hroničnom bubrežnom bolešću, zbog čega su pacijenti izloženi polifarmaciji. Takvi terapijski režimi povećavaju rizik od klinički značajnih interakcija između antidijabetičkih lijekova, drugih lijekova i dijetetskih suplemenata, što može dovesti do hipoglikemije, hiperglikemije i pogoršanja metaboličke kontrole. Dati kritički pregled farmakološki i klinički relevantnih interakcija antidijabetičkih lijekova sa dijetetskim suplementima biljnog porijekla, uz naglasak na njihove kliničke implikacije. Sproveden je narativni pregled literature u bazama PubMed, Scopus i Web of Science za period od januara 2000. do decembra 2025. godine. Uključene su originalne studije, sistematski pregledi i meta-analize koje su analizirale farmakokinetičke, farmakodinamičke i kliničke aspekte interakcija. Najveći rizik od interakcija uočen je kod sulfonilureja, glinida i insulina, prvenstveno zbog mogućnosti teške hipoglikemije. Ključni mehanizmi uključuju modulaciju CYP450 sistema (CYP3A4, CYP2C9, CYP2C8), promjene u aktivnosti P-glikoproteina, kao i varijacije u apsorpciji i eliminaciji. Suplementi sa biljnim komponentama, poput kantariona, ginsenga, aloe vere, karele, ginkgo bilobe i cimeta, mogu izazvati farmakokinetičke i/ili farmakodinamičke interakcije. Interakcije antidijabetičkih lijekova i biljnih suplemenata predstavljaju značajan izazov u liječenju dijabetesa tipa 2. Prevencija neželjenih ishoda zahtijeva individualizovan pristup, redovno praćenje glikemije i bubrežne funkcije, kao i sistematsku procjenu ukupne terapije, uključujući suplemente.

Ključne riječi: dijabetes melitus tipa 2; polifarmacija; interakcije lijek–dijetetski suplementi; interakcija lijek–biljka; CYP450; P-glikoprotein; hipoglikemija.

INTERACTIONS OF ANTIDIABETIC DRUGS WITH DIETARY SUPPLEMENTS CONTAINING HERBAL COMPONENTS

Nataša Božić^{1,2}, Đorđe Baletić^{1,2}, Violeta Ilić Todorović³, Ljiljana Tomić¹, Aleksandar Rašković², Mile Despotović^{3,4}, Jasmina Jovanović Mirković³, Christos Alexopoulos³

¹Bijeljina University, Faculty of pharmacy, Bijeljina, Bosnia and Herzegovina

²University of Novi Sad, Faculty of Medicine, Novi Sad, Serbia

³The Academy of Applied Preschool Teaching and Health Studies, Department of Medical Studies, Čuprija, Serbia

⁴Faculty of Medicine Foca, University of East Sarajevo, Bosnia and Herzegovina

Abstract. Type 2 diabetes mellitus is frequently associated with arterial hypertension, dyslipidemia, cardiovascular diseases, and chronic kidney disease, which leads to polypharmacy. Such therapeutic regimens increase the risk of clinically significant interactions between antidiabetic drugs, other medications, and dietary supplements, potentially resulting in hypoglycemia, hyperglycemia, and impaired metabolic control. To provide a critical review of pharmacological and clinically relevant interactions between antidiabetic drugs and herbal dietary supplements, with emphasis on their clinical implications. A narrative literature review was conducted using PubMed, Scopus, and Web of Science databases, covering the period from January 2000 to December 2025. Original studies, systematic reviews, and meta-analyses analyzing pharmacokinetic, pharmacodynamic, and clinical aspects of these interactions were included. The highest risk of interactions was observed with sulfonylureas, glinides, and insulin, primarily due to the potential for severe hypoglycemia. Key mechanisms include modulation of the CYP450 enzyme system (CYP3A4, CYP2C9, CYP2C8), alterations in P-glycoprotein activity, as well as changes in drug absorption and elimination. Herbal supplements such as St. John's wort, ginseng, aloe vera, bitter melon, ginkgo biloba, and cinnamon may cause pharmacokinetic and/or pharmacodynamic interactions. Interactions between antidiabetic drugs and herbal supplements represent a significant challenge in the management of type 2 diabetes mellitus. Prevention of adverse outcomes requires an individualized therapeutic approach, regular monitoring of glycemia and renal function, and systematic evaluation of all therapies, including supplements.

Keywords: type 2 diabetes mellitus; polypharmacy; drug–dietary supplement interactions; drug–herb interactions; CYP450; P-glycoprotein; hypoglycemia.

PROCENA KVALITETA ŽIVOTA ŽENA U PERIODU MENOPAUZE I POSTMENOPAUZE I POVEZANOST MENOPAUZALNIH SIMPTOMA SA REPRODUKTIVNIM KARAKTERISTIKAMA I STAROSNOM DOBI

Selena Savić¹, Veljko Prokić², Jelena Đekić², Ivan Stojković³, Tijana Jončić², Jasmina Jovanović Mirković⁴

¹Srednja medicinska škola Zaječar, Republika Srbija

²Opšta Bolnica Čuprija, Republika Srbija

³Dom zdravlja Jagodina, Republika Srbija

⁴Akademija vaspitačko-medicinskih strukovnih studija, Kruševac, Odsek Medicinskih studija Čuprija, Republika Srbija

Sažetak. Menopauza predstavlja značajnu fazu u životu žene koja je povezana sa brojnim hormonskim promenama koje se mogu manifestovati fizičkim, psihološkim i urogenitalnim promenama. Intenzitet menopauzalnih simptoma razlikuje se među ženama i može značajno uticati na kvalitet života, svakodnevno funkcionisanje i opšte zdravstveno stanje. Procena simptoma i njihovog uticaja na kvalitet života predstavlja važan element savremenog pristupa zdravstvenoj zaštiti žena u menopauzi i postmenopauzi. Cilj istraživanja bio je da se proceni kvalitet života žena u periodu menopauze i postmenopauze, kao i da se ispita povezanost intenziteta menopauzalnih simptoma sa odabranim reproduktivnim karakteristikama i starosnom dobi ispitanica. Istraživanje je sprovedeno kao studija preseka tokom juna i jula 2025. Godine, na uzorku od 60 žena starijih od 40 godina sa područja Zaječara. Istraživanje je odobreno od strane Etičkog odbora Zdravstvenog centra u Zaječaru (odluka broj 30008/1). Podaci su prikupljeni anketnim upitnikom koji je obuhvatio sociodemografske i reproduktivne karakteristike ispitanica, kao i standardizovane instrumente: Menopause Rating Scale (MRS) za procenu intenziteta menopauzalnih simptoma i Menopause-Specific Quality of Life Questionnaire (MENQOL) za procenu kvaliteta života. Za statističku analizu korišćene su metode deskriptivne statistike, Studentov t-test i analiza varijanse (ANOVA). Statistička značajnost određena je na nivou $p < 0,05$. Najveći procenat ispitanica pripadao je starosnoj grupi 61–65 godina (26,7%). Analizom menopauzalnih simptoma utvrđeno je da su somatske tegobe bile najizraženije, sa najvišom prosečnom vrednošću na somatskoj subskali MRS (AS = 8,72). Prosečna vrednost ukupnog MRS skora iznosila je $22,08 \pm 7,85$, što ukazuje na umeren stepen izraženosti menopauzalnih simptoma. Žene koje su imale bolne menstrualne cikluse ostvarile su statistički značajno više vrednosti ukupnog MRS skora u odnosu na žene koje nisu imale bolne cikluse ($p = 0,002$). Nije utvrđena statistički značajna razlika u izraženosti menopauzalnih simptoma između različitih starosnih grupa ($p = 0,268$). Rezultati istraživanja ukazuju da menopauzalni simptomi predstavljaju značajan faktor koji može uticati na kvalitet života žena u periodu menopauze i postmenopauze. Najizraženije su bile somatske tegobe, dok je prisustvo bolnih menstrualnih ciklusa bilo povezano sa većom izraženošću menopauzalnih simptoma. Primena standardizovanih instrumenata MRS i MENQOL omogućava objektivniju procenu simptoma i njihovog uticaja na kvalitet života, što može doprineti pravovremenom prepoznavanju žena kojima je potrebna dodatna zdravstvena podrška. Dalja istraživanja na većem broju ispitanica praćenjem raznosvrtnih starosnih dobi mogu doprineti boljem razumevanju faktora koji utiču na tok menopauze.

Ključne reči: Menopauza, postmenopauza, menopauzalni simptomi, kvalitet života, Menopause Rating Scale, MENQOL.

ASSESSMENT OF THE QUALITY OF LIFE OF WOMEN IN THE PERIODS OF MENOPAUSE AND POSTMENOPAUSE AND THE ASSOCIATION OF MENOPAUSAL SYMPTOMS WITH REPRODUCTIVE CHARACTERISTICS AND AGE

*Selena Savić¹, Veljko Prokić², Jelena Đekić², Ivan Stojković³, Tijana Jončić²,
Jasmina Jovanović Mirković⁴*

¹Secondary Medical School Zaječar, Republic of Serbia

²General Hospital Cuprija, Republic of Serbia

³Jagodina Health Center, Republic of Serbia

⁴The Academy of Applied Preschool Teaching and Health Studies, Department of Medical Studies, Cuprija, Republic of Serbia

Abstract. Menopause represents a significant phase in a woman's life and is associated with numerous hormonal changes that may manifest as physical, psychological, and urogenital symptoms. The intensity of menopausal symptoms varies among women and can significantly affect quality of life, daily functioning and general health. Assessing symptoms and their impact on quality of life is an important element of the modern approach to health care for menopausal and postmenopausal women. The research aimed to assess the quality of life of women in the periods of menopause and postmenopause, and to examine the association between the intensity of menopausal symptoms and selected reproductive characteristics and the age of the participants. The research was conducted as a cross-sectional study during June and July 2025 on a sample of 60 women over the age of 40 from the area of Zaječar. The research was approved by the Ethics Committee of the Health Centre in Zaječar (decision number 30008/1). Data were collected using a questionnaire that included the sociodemographic and reproductive characteristics of the respondents, as well as standardised instruments: the Menopause Rating Scale (MRS) for assessing the intensity of menopausal symptoms and the Menopause-Specific Quality of Life Questionnaire (MENQOL) for assessing quality of life. Descriptive statistics, Student's t-test and analysis of variance (ANOVA) were used for statistical analysis. Statistical significance was determined at the level of $p < 0.05$. The largest proportion of respondents belonged to the age group 61–65 years (26.7%). Analysis of menopausal symptoms revealed that somatic complaints were the most pronounced, with the highest mean value on the somatic subscale of the MRS ($AS = 8.72$). The mean value of the total MRS score was 22.08 ± 7.85 , which indicates a moderate degree of expression of menopausal symptoms. Women who had painful menstrual cycles achieved statistically significantly higher values of the total MRS score compared with women who did not have painful cycles ($p = 0.002$). No statistically significant difference was found in the expression of menopausal symptoms between different age groups ($p = 0.268$). The results of the research indicate that menopausal symptoms are a significant factor affecting the quality of life of women during menopause and postmenopause. Somatic complaints were the most pronounced, while painful menstrual cycles were associated with a greater intensity of menopausal symptoms. The use of standardised MRS and MENQOL instruments enables a more objective assessment of symptoms and their impact on quality of life, which can contribute to the timely identification of women who need additional health support. Further research with a larger number of subjects, across a wider age range, could improve understanding of the factors influencing the course of menopause.

Keywords: Menopause, postmenopause, menopausal symptoms, quality of life, Menopause Rating Scale, MENQOL

KLINIČKI ZNAČAJ MORFOLOŠKIH KARAKTERISTIKA KARCINOMA GRLIĆA MATERICE

Živorad Gajanin¹, Radoslav Gajanin^{2,3}, Vesna Gajanin², Dejan Đokanović^{2,3},
Aleksandar Guzijan^{2,3}, Mirjana Čuk⁴, Saša Vujinović^{2,3}, Milena Brkić^{2,5}

¹ Dom zdravlja Kotor Varos, Republika Srpska, Bosna i Hercegovina,

² Univezitet u Banjoj Luci, Medicinski fakultet, Banja Luka, Republika Srpska,
Bosna i Hercegovina

³ Univerzitetski klinički centar Republike Srpske, Banja Luka, Republika Srpska,
Bosna i Hercegovina

⁴ Univerzitet Istočno Sarajevo, Medicinski fakultet, Foča, Republika Srpska,
Bosna i Hercegovina

⁵ Zdravstvena ustanova Talmma medic, Banja, Republika Srpska,
Bosna i Hercegovina,

Sažetak. Karcinom cerviksa (CC) je na četvrtom mjestu po učestalosti u svijetu poslije karcinoma dojke, debelog crijeva i pluća. Utvrditi uticaj kliničkih i morfoloških karakteristika tumora na preživljavanje pacijentica oboljeih od karcinoma cerviksa. U studiju je uključeno ukupno 101 pacijentica sa CC kod kojih je urađena hirurška intervencija. Analizirane su demografske karakteristike, period praćenja, preživljavanje, tip operativnog zahvata, histološki tip tumora, histološki gradus tumora i dubina invazije strome cerviksa. Dobijeni podaci su obrađeni prema osnovnim deskriptivnim statističkim metodama i korišćeni su adekvatni testovi za utvrđivanje razlike. Najmlađa pacijentica je imala 29 godina, a najstarija 76 godina, a prosječna starost je 51.11 godina. Pacijentice su najčeće bile u petoj ili šestoj deceniji života. Prosječno vrijeme praćenja pacijentica je bilo 69.73 mjeseci. Najčešća vrsta operativnog zahvata je bila radikalna histerektomija sa regionalnom limfonodektomijom u 97% slučajeva. Skvamocelularni karcinom je bio u 92,1% slučajeva i tumor je bio najčešće gradusa 2, 74,3% slučajeva. Prosječna dubina invazije strome cerviksa je iznosila 15,4 mm. Utvrđeno je da je prosječna dubina invazije veća kod pacijentica koje nisu preživjele u vrijeme zaključivanja studije (17,4 mm) u odnosu na pacijentice koje su preživjele (14,05 mm). Na period preživljavanja nisu uticali: starost pacijentice, vrsta operativnog zahvata, histološki tip tumora, histološki gradus tumora. Dubina invazije strome cerviksa utiče na preživljavanje pacijentica oboljele od carcinoma cerviksa. Histološki tip i histološki gradus tumora u našoj studiji nisu uticali na preživljavanje.

Ključne riječi: Karcinom cerviksa, Morfološke karakteristike, Preživljavanje.

CLINICAL SIGNIFICANCE OF MORPHOLOGICAL CHARACTERISTICS IN CERVICAL CANCER

Živorad Gajanin¹, Radoslav Gajanin^{2,3}, Vesna Gajanin², Dejan Đokanović^{2,3}, Aleksandar Guzijan^{2,3}, Mirjana Čuk⁴, Saša Vujinović^{2,3}, Milena Brkić^{2,5}

¹ General Hospital, Kotor Varos, Republic of Srpska, Bosnia and Herzegovina

²University of Banja Luka, Faculty of Medicine, Banja Luka, Republic of Srpska, Bosnia and Herzegovina,

³University clinical center Republic of Srpska, Banja Luka, Republic of Srpska, Bosnia and Herzegovina

⁴University of East Sarajevo, Faculty of Medicine, Foča, Republic of Srpska, Bosnia and Herzegovina

⁵ZdravstvenaHealth Institution Talmma medic, , Banja Luka, Republic of Srpska, Bosnia and Herzegovina

Abstract. Cervical cancer (CC) is the fourth most common malignancy worldwide, after breast, colorectal, and lung cancer. To assess the impact of clinical and morphological tumour characteristics on survival in patients with cervical cancer. This study initially included 101 patients with cervical cancer who underwent surgical treatment. Demographic characteristics, follow-up duration, survival, type of surgical procedure, histological tumour type, histological grade, and depth of cervical stromal invasion were analysed. Data were processed using descriptive statistical methods, and appropriate statistical tests were applied to assess differences between groups. Patient age ranged from 29 to 76 years, with a mean age of 51.11 years. Most patients were in the fifth or sixth decade of life. The mean follow-up duration was 69.73 months. The most frequently performed procedure was radical hysterectomy with regional lymphadenectomy, undertaken in 97% of cases. Squamous cell carcinoma was the predominant histological type, accounting for 92.1% of cases, while grade 2 tumours were the most common, representing 74.3% of cases. The mean depth of cervical stromal invasion was 15.4 mm. A greater mean depth of invasion was observed in patients who had died by the end of follow-up compared with survivors (17.4 mm vs 14.05 mm). Survival was not significantly associated with age, type of surgical procedure, histological tumour type, or histological grade. Depth of cervical stromal invasion appears to be an important morphological parameter in cervical cancer and may be associated with patient survival. In contrast, histological tumour type and histological grade were not associated with survival in our cohort.

Keywords: cervical cancer; morphological characteristics; survival.

KLINIČKO-LABORATORIJSKI ZNAČAJ HDL-HOLESTEROLA KAO BIOMARKERA KARDIOVASKULARNIH BOLESTI

Dušica Plavšić¹, Mira Obradović^{2,3}

¹ZU specijalistički centar „Kuća zdravlja“ Bijeljina, Republika Srpska,
Bosna i Hercegovina

²JU Visoka medicinska škola Prijedor, Nikole Pašića 4a, Republika Srpska,
Bosna i Hercegovina

³Medicinski fakultet Univerziteta u Novom Sadu, student doktorskih studija,
Hajduk Veljkova 3, Novi Sad, Republika Srbija

Sažetak. HDL (lipoprotein visoke gustine) predstavlja važan dio lipidnog profila i tradicionalno se smatra zaštitnim faktorom u razvoju kardiovaskularnih bolesti. Njegova osnovna funkcija je reverzni transport holesterola iz perifernih tkiva prema jetri, uz brojne antiaterogene, antiinflamatorne i antioksidativne efekte. Određivanje HDL-holesterola (HDL-C) predstavlja standardnu laboratorijsku analizu u procjeni lipidnog statusa i kardiovaskularnog rizika. Međutim, savremena istraživanja ukazuju da smanjena koncentracija HDL-C može služiti kao biomarker za kardiovaskularne bolesti. Rad ima za cilj ispitati vrijednosti HDL-holesterola i procijeniti njihov kliničko-laboratorijski značaj kao biomarkera u procjeni kardiovaskularnog rizika u odnosu na pol i dob ispitanika. Istraživanjem je obuhvaćeno 100 ispitanika kod kojih je određena koncentracija HDL-holesterola u ZU Specijalistički centar „Kuća zdravlja“ Bijeljina. Analizirani su podaci o polu, dobi i vrijednostima HDL-holesterola. Interpretacija dobijenih rezultata izvršena je u skladu sa savremenim saznanjima o kliničko-laboratorijskom značaju HDL-holesterola u procjeni kardiovaskularnog rizika. Statistička obrada podataka izvršena je u programu IBM SPSS Statistics, primjenom odgovarajućih deskriptivnih i inferencijalnih statističkih metoda. Prosječna vrijednost HDL-holesterola iznosila je $1,21 \pm 0,27$ mmol/L. Žene su imale statistički značajno više vrijednosti HDL-holesterola u odnosu na muškarce ($1,29 \pm 0,24$ naspram $1,08 \pm 0,27$ mmol/L; $p < 0,001$). Nisu utvrđene statistički značajne razlike u vrijednostima HDL-holesterola između dobnih grupa ($p = 0,357$). Prema referentnim vrijednostima laboratorije (HDL $< 1,60$ mmol/L – snižen HDL), snižen HDL zabilježen je kod 92,0% ispitanika, bez statistički značajne povezanosti sa polom ($p = 0,707$) i dobi ($p = 0,279$). Žene su imale statistički značajno više vrijednosti HDL-holesterola u odnosu na muškarce, dok nije utvrđena značajna povezanost vrijednosti HDL-holesterola sa dobi ispitanika. Dobijeni rezultati potvrđuju značaj HDL-holesterola kao važnog laboratorijskog parametra u procjeni lipidnog statusa i kardiovaskularnog rizika. Iako HDL-C predstavlja koristan biomarker, njegovu vrijednost potrebno je interpretirati zajedno sa LDL-holesterolom, trigliceridima, ukupnim holesterolom i drugim faktorima kardiovaskularnog rizika.

Ključne riječi: lipidni status, dislipidemija, laboratorijska dijagnostika, kardiovaskularni rizik

CLINICAL AND LABORATORY SIGNIFICANCE OF HDL CHOLESTEROL AS A BIOMARKER OF CARDIOVASCULAR DISEASES

Duška Plavšić¹, Mira Obradović^{2,3}

¹Specialist Medical Center "Kuća zdravlja", Bijeljina, Republic of Srpska, Bosnia and Herzegovina

²PI College of Health Sciences Prijedor, Nikole Pašića 4A, 79202 Prijedor, Republic of Srpska, Bosnia and Herzegovina

³Faculty of Medicine of the University of Novi Sad, PhD student, Hajduk Veljkova 3, Novi Sad, Republic of Serbia

Abstract. High-density lipoprotein (HDL) is an important component of the lipid profile and has traditionally been regarded as a protective factor against the development of cardiovascular diseases. Its primary function is the reverse transport of cholesterol from peripheral tissues to the liver, accompanied by numerous antiatherogenic, anti-inflammatory, and antioxidant effects. Measurement of HDL cholesterol (HDL-C) is a standard laboratory test used in the assessment of lipid status and cardiovascular risk. However, contemporary research indicates that reduced HDL-C concentrations may serve as a biomarker of cardiovascular disease. The aim of this study was to evaluate HDL cholesterol levels and assess their clinical and laboratory significance as a biomarker in cardiovascular risk assessment according to sex and age. The study included 100 participants whose HDL cholesterol concentrations were determined at the Specialist Medical Center "Kuća zdravlja" in Bijeljina. Data on sex, age, and HDL cholesterol values were analyzed. The obtained results were interpreted in accordance with current knowledge regarding the clinical and laboratory significance of HDL cholesterol in cardiovascular risk assessment. Statistical analysis was performed using IBM SPSS Statistics software, applying appropriate descriptive and inferential statistical methods. The mean HDL cholesterol concentration was 1.21 ± 0.27 mmol/L. Women had significantly higher HDL cholesterol levels than men (1.29 ± 0.24 vs. 1.08 ± 0.27 mmol/L; $p < 0.001$). No statistically significant differences in HDL cholesterol levels were observed among different age groups ($p = 0.357$). According to the laboratory reference values (HDL < 1.60 mmol/L indicating low HDL), reduced HDL levels were found in 92.0% of participants, with no statistically significant association with sex ($p = 0.707$) or age ($p = 0.279$). Women exhibited significantly higher HDL cholesterol levels than men, whereas no significant association was found between HDL cholesterol levels and participants' age. The obtained results confirm the importance of HDL cholesterol as a valuable laboratory parameter in the assessment of lipid status and cardiovascular risk. Although HDL-C is a useful biomarker, its clinical significance should be interpreted together with LDL cholesterol, triglycerides, total cholesterol, and other cardiovascular risk factors.

Keywords: lipid profile, dyslipidemia, laboratory diagnostics, cardiovascular risk

PRIMJENA UZV NA UREĐAJU SCOLIOSCAN U PRAĆENJU SKOLIOZE KOD DJECE

Milan Mrđa¹

¹Institut za fizikalnu medicinu, rehabilitaciju i ortopedsku hirurgiju Dr Miroslav
Zotović, Slatinska 11 Banja Luka, Bosna i Hercegovina

Sažetak. Ultrazvučna procjena kičme primjenom Scolioscan-a predstavlja savremenu metodu za praćenje djece sa skoliozom bez izlaganja jonizujućem zračenju. Procedura je sigurna, brza i bezbolna. Cilj rada je prikazati značaj i ulogu medicinskog tehničara u izvođenju procedure. Prikazan je tok procedure sa osvrtom na ulogu tehničara koja obuhvata pripremu pacijenta, pozicioniranje, davanje jasnih instrukcija i standardizovano izvođenje skeniranja prema definisanom protokolu. Nakon uvođenja ultrazvuka u svakodnevnu kliničku praksu značajno se smanjio broj RTG snimaka kod djece. Medicinski tehničar ima ključnu ulogu u procesu izvođenja postupka. Njegova stručnost i dosljedna primjena protokola direktno utiče na kvalitet dijagnostičkog postupka i pouzdanost dobijenih nalaza. U budućnosti cilj je dalje smanjenje broja RTG snimaka radi što bezbjednijeg praćenja pacijenata sa skoliozom.

Ključne riječi: Ultrazvuk, skolioza, Scolioscan.

USE OF ULTRASOUND WITH THE SCOLIOSCAN DEVICE IN MONITORING SCOLIOSIS IN CHILDREN

Milan Mrda¹

¹Institute for rehabilitation and physical medicine “Dr Miroslav Zotović”, Banja
Luka, Bosnia and Herzegovina

Abstract. Ultrasound assessment of the spine using Scolioscan is a modern method for monitoring children with scoliosis without exposure to ionizing radiation. The procedure is safe, fast, and painless. The aim of this paper is to present the importance and role of the medical technician in performing the procedure. The procedure is described with particular emphasis on the technician's role, which includes patient preparation, positioning, providing clear instructions, and performing standardized scanning according to a defined protocol. Following the introduction of ultrasound into routine clinical practice, the number of X-ray examinations in children has been significantly reduced. The medical technician plays a key role in performing the procedure. Their expertise and consistent adherence to the protocol directly affect the quality of the diagnostic procedure and the reliability of the findings obtained. In the future, the goal is to further reduce the number of X-ray examinations in order to ensure safer monitoring of patients with scoliosis.

Keywords: Ultrasound, scoliosis, Scolioscan.

UČESTALOST IDENTIFIKACIJE BAKTERIJE *STAPHYLOCOCCUS AUREUS* U BRISEVIMA RADNIH POVRŠINA I BRISEVIMA NOSA BOLNIČKOG OSOBLJA

Aldin Mahmutović¹, Marija Tubak Kosić², Amela Dubinović-Rekić¹

¹ Kantonalna bolnica „Dr Irfan Ljubijankić“, Darivalaca krvi 67, Bihać,
Bosna i Hercegovina

² Medicinski fakultet Univerziteta u Banjoj Luci, Save Mrkalja 14, Banjaluka,
Bosna i Hercegovina.

Sažetak. *Staphylococcus aureus* je jedan od najznačajnijih uzročnika bolničkih infekcija. Prisustvo ove bakterije u nosu medicinskog osoblja i na radnim površinama predstavlja ozbiljan epidemiološki problem. Cilj ovog rada bio je utvrditi učestalost identifikacije bakterije *Staphylococcus aureus* u brisevima nosa kod medicinskog kadra i brisevima radnih površina na odabranim odjelima Kantonalne bolnice „Dr Irfan Ljubijankić“ u Bihaću u periodu od 1.7.2025. do 1.1.2026. godine. Istraživanje je obuhvatilo 524 brisa nosa uzetih po standardnom mikrobiološkom protokolu za bakteriološku analizu, usklađenih sa važećim preporukama i 30 briseva uzetih sa različitih površina. Brisevi nosa uzeti su sa odjela kirurgije, interno „A“, mikrobiologija, ortopedija, pedijatrija, infektivni odjel, odjel za respiratorne bolesti te odjel anestezije i reanimacije, od kojih je 38 (7,25%) bilo pozitivno. Brisevi radnih površina uzeti su na odjelima hirurgije, ginekologije, internog „A“, hemodijalize i specijalističkih ambulanti gdje su na gotovo svim odjelima izolovani slučajevi koje ne zadovoljavaju kriterijume čistoće izuzev odjela ginekologije. Nakon obrade briseva podaci su analizirani metodama deskriptivne statistike. Rezultati koje smo dobili ukazuju na to da postoji potreba za pojačan nadzor i kontrolu, te pojačane kontrole bolničkih infekcija.

Ključne riječi: *Staphylococcus aureus*, bolničke infekcije, bris nosa, bris radne površine

FREQUENCY OF IDENTIFICATION OF STAPHYLOCOCCUS AUREUS IN SWABS FROM WORK SURFACES AND NASAL SWABS OF HOSPITAL STAFF

Aldin Mahmutović¹, Marija Tubak Kosić², Amela Dubinović-Rekić¹

¹ Cantonal Hospital “Dr Irfan Ljubijankić“, Darivalaca krvi 67, Bihac, Bosnia and Herzegovina,

² Faculty of Medicine, University of Banja Luka, Save Mrkalja 14, Banja Luka, Bosnia and Herzegovina.

Abstract. *Staphylococcus aureus* is one of the most significant causative agents of hospital-acquired infections. The presence of this bacterium in the nasal cavities of healthcare staff and on work surfaces represents a serious epidemiological concern and a potential risk. The aim of this study was to determine the frequency of identification of *Staphylococcus aureus* in nasal swabs collected from healthcare staff and in swabs obtained from work surfaces in selected departments of the Cantonal Hospital “Dr Irfan Ljubijankić” in Bihać during the period from 1 July 2025 to 1 January 2026. The study included 524 nasal swabs collected according to the standard microbiological protocol for bacteriological analysis, in accordance with the applicable recommendations, and 30 work surface swabs collected from various surfaces. Following the processing of the swabs, the data were analyzed using descriptive statistical methods. Nasal swabs were collected from the medical staff in the departments of surgery, internal medicine “A”, microbiology, orthopaedics, paediatrics, infectious diseases, pulmonology, and the department of anaesthesiology and resuscitation, of which 38 (7.25%) tested positive. Work surface swabs were collected from the departments of surgery, gynaecology, internal medicine “A”, haemodialysis, and specialist outpatient ambulances. The test results showed that surface swab samples that did not meet the cleanliness criteria were detected in every department, with the exception of gynaecology. The results obtained indicate the need for enhanced surveillance and monitoring, as well as strengthened implementation of hospital infection prevention and control measures.

Key words: *Staphylococcus aureus*, hospital-acquired infections, nasal swab, work surface swab, healthcare staff

SPOSOBNOST PRODUKCIJE BIOFILMA KOD BAKTERIJSKIH UZROČNIKA HRONIČNIH INFEKCIJA SREDNJEG UHA

***Marija Tubak Kosić¹, Ljiljana Božić¹, Maja Travar^{1,2}, Aldin Mahmutović³,
Dalibor Vranješ^{1,2}***

¹ Medicinski fakultet Univerziteta u Banjoj Luci, Save Mrkalja 14, Banjaluka,
Bosna i Hercegovina,

² Univerzitetski klinički centar Republike Srpske, Dvanaest beba bb, Banjaluka,
Bosna i Hercegovina,

³ Kantonalna bolnica „Dr Irfan Ljubijankić“, Darivalaca krvi 67, Bihać,
Bosna i Hercegovina.

Sažetak. Formiranje biofilma predstavlja jedan od najvažnijih mehanizama virulencije bakterija odgovornih za nastanak i održavanje hroničnih infekcija, uključujući hronične infekcije srednjeg uha. Prisustvo biofilma doprinosi povećanoj otpornosti mikroorganizama na antimikrobna sredstva i otežava uspješnost liječenja. Cilj ove studije je ispitati učestalost bakterijskih uzročnika hroničnih infekcija srednjeg uha, procijeniti njihovu sposobnost produkcije biofilma i analizirati dejstvo 3% vodonik-peroksida i salicil alkohola na formirani biofilm. Istraživanje je obuhvatilo 30 bakterijskih izolata dobijenih iz briseva uha pacijenata sa hroničnim infekcijama srednjeg uha. Sposobnost formiranja biofilma određena je metodom mikrotitarskih ploča. Nakon formiranja biofilma ispitivano je dejstvo 3% vodonik-peroksida i salicil alkohola, a količina biofilma procijenjena je spektrofotometrijskim mjerenjem optičke gustine boje gencijana ljubičaste. Rezultati ukazuju da je najčešće izolovana bakterijska vrsta bila *Staphylococcus aureus* (43,33%), zatim *Pseudomonas aeruginosa* (16,67%), dok su ostale bakterije bile zastupljene u manjem procentu. Većina analiziranih izolata pokazala je sposobnost formiranja biofilma, pri čemu su dominirali umjereni produktori. Nakon tretmana vodonik-peroksidom i salicil alkoholom uočene su promjene u raspodjeli kategorija produkcije biofilma, ali nisu utvrđene statistički značajne razlike u odnosu na netretirane izolate, što ukazuje na potrebu za daljim istraživanjima efikasnijih strategija za kontrolu biofilma.

Ključne riječi: biofilm, hronični otitis medija, vodonik-peroksid, salicil alkohol, antibiofilm aktivnost

BIOFILM-FORMING CAPACITY OF BACTERIAL PATHOGENS CAUSING CHRONIC OTITIS MEDIA

Marija Tubak Kosić¹, **Ljiljana Božić¹**, **Maja Travar^{1,2}**, **Aldin Mahmutović³**,
Dalibor Vranješ^{1,2}

¹ Faculty of Medicine University of Banjaluka, Save Mrkalja 14, Banjaluka,
Bosnia and Herzegovina,

² University Clinical Center of Republic of Srpska, Banja Luka,
Bosnia and Herzegovina,

³ Cantonal Hospital “Dr Irfan Ljubijankić“, Darivalaca krvi 67, Bihac,
Bosnia and Herzegovina.

Abstract. Biofilm formation is one of the most important bacterial virulence mechanisms responsible for the development and persistence of chronic infections, including chronic otitis media. The presence of biofilm contributes to increased microbial resistance to antimicrobial agents and reduces the effectiveness of treatment. The aim of this study was to determine the prevalence of bacterial pathogens causing chronic otitis, assess their ability to produce biofilm, and evaluate the effects of 3% hydrogen peroxide and salicylic alcohol on established biofilms. The study included 30 bacterial isolates obtained from ear swabs of patients with chronic otitis media. Biofilm formation was assessed using the microtiter plate method. After biofilm formation, the effects of 3% hydrogen peroxide and salicylic alcohol were evaluated, and biofilm biomass was quantified spectrophotometrically by measuring optical density of the gentian violet dye. The results showed that *Staphylococcus aureus* was the most frequently isolated bacterial species (43.33%), followed by *Pseudomonas aeruginosa* (16.67%), while other bacterial species were identified less frequently. Most of the analyzed isolates demonstrated the ability to form biofilms, with moderate biofilm producers being the predominant group. Although treatment with hydrogen peroxide and salicylic alcohol resulted in changes in the distribution of biofilm production categories, no statistically significant differences were observed compared with untreated isolates, indicating the need for further research into more effective strategies for biofilm control.

Keywords: biofilm, chronic otitis media, hydrogen peroxide, salicylic alcohol, antibiofilm effect

SEKVENCIRANJE MITOHONDRIJSKE DNK U SAVREMENOJ LABORATORIJSKOJ DIJAGNOSTICI

***Kristina Pavlović¹, Jelena Pavlović¹, Sandra Matović¹, Natalija Hadživuković¹,
Srđan Živanović¹, Marija Lukić²***

¹Medicinski fakultet Foča, Univerzitet u Istočnom Sarajevu, Studentska 5,
Republika Srpska, Bosna i Hercegovina

²Medicinski fakultet Univerziteta u Beogradu, dr Subotića 8, 11000 Beograd,
Republika Srbija

Sažetak. Patogene varijante u mitohondrijskoj DNK (mtDNK) predstavljaju značajan uzrok nasljednih metaboličkih poremećaja poznatih kao mitohondrijske bolesti. Mitohondrijske bolesti obuhvataju heterogenu grupu nasljednih i stečenih poremećaja funkcije mitohondrija koji se mogu manifestovati u bilo kojem životnom dobu i zahvatiti različite organske sisteme, pri čemu su najčešće pogođena tkiva sa visokim energetske zahtjevima, poput mišića i mozga. Prva saznanja o povezanosti patogenih promjena u mtDNK sa kliničkim manifestacijama, opisana su 1988. godine, a od tada je identifikovano više stotina patogenih varijanti oje se povezuju sa razvojem mitohondrijskih bolesti. Tradicionalno, dijagnostika mitohondrijskih bolesti oslanjala se na klinički fenotip, metaboličke promjene, radiološku dijagnostiku i patohistološke analize, međutim, sa razvojem savremenih visokoprotočnih dijagnostičkih tehnika i njihovom sve većom dostupnošću, veći fokus se stavlja na molekularnu dijagnostiku. U početku molekularne dijagnostike mitohondrijskih bolesti, najviše se primjenjivalo Sanger sekvenciranje pojedinačnih regiona mitohondrijske DNK, koje je dugi niz godina predstavljalo zlatni standard u identifikaciji genetičkih varijanti. Razvojem visokoprotočnih tehnologija sekvenciranja nove generacije (NGS) omogućena je paralelna analiza kompletne mitohondrijske DNK uz veću brzinu, osjetljivost i pouzdaniju detekciju patogenih genetičkih varijanti, čime je značajno unaprijeđena molekularna dijagnostika. Cilj ovog rada je prikazati značaj sekvenciranja mitohondrijske DNK u savremenoj laboratorijskoj dijagnostici, uz pregled dostupnih sekvencijskih pristupa, njihovih prednosti i ograničenja, kao i mogućnosti primjene u dijagnostici mitohondrijskih bolesti. Pregled relevantne literature izvršen je pretragom baza podataka PubMed, ScienceDirect i Google Scholar.

Ključne riječi: mitohondrijska DNK, mitohondrije, mitohondrijske bolesti, sekvenciranje, molekularna dijagnostika, NGS

MITOCHONDRIAL DNA SEQUENCING IN MODERN LABORATORY DIAGNOSTICS

***Kristina Pavlović¹, Jelena Pavlović¹, Sandra Matović¹, Natalija Hadživuković¹,
Srdan Živanović¹, Marija Lukić²***

¹Faculty of Medicine Foča, University of East Sarajevo, Studentska 5
Republic of Srpska, Bosnia and Herzegovina

²Medical faculty of University in Belgrade, dr Subotića 8, 11000 Belgrade,
Republic of Serbia

Abstract. Pathogenic variants in mitochondrial DNA (mtDNA) represent a significant cause of inherited metabolic disorders known as mitochondrial diseases. Mitochondrial diseases encompass a heterogeneous group of inherited and acquired disorders of mitochondrial function that can manifest at any age and affect various organ systems, with tissues characterized by high energy demands, such as muscles and the brain, being most commonly affected. The first evidence of an association between pathogenic changes in mtDNA and clinical manifestations was described in 1988, and since then, hundreds of pathogenic variants associated with the development of mitochondrial diseases have been identified. Traditionally, the diagnosis of mitochondrial diseases relied on the clinical phenotype, metabolic abnormalities, radiological examinations, and histopathological analyses. However, with the development of modern high-throughput diagnostic techniques and their increasing availability, greater emphasis has been placed on molecular diagnostics. In the early stages of molecular diagnosis of mitochondrial diseases, Sanger sequencing of individual regions of mitochondrial DNA was most commonly used and represented the gold standard for the identification of genetic variants for many years. The development of next-generation sequencing (NGS) technologies has enabled the parallel analysis of the entire mitochondrial DNA with greater speed and sensitivity and more reliable detection of pathogenic genetic variants, thereby significantly improving the molecular diagnosis of mitochondrial diseases. The aim of this paper is to present the significance of mitochondrial DNA sequencing in modern laboratory diagnostics, including an overview of available sequencing approaches, their advantages and limitations, as well as their potential applications in the diagnosis of mitochondrial diseases. A review of the relevant literature was conducted by searching the PubMed, ScienceDirect, and Google Scholar databases.

Keywords: mitochondrial DNA, mitochondria, mitochondrial diseases, sequencing, molecular diagnostics, NGS

REHABILITACIJA, FIZIČKO I MENTALNO ZDRAVLJE

REHABILITATION, PHYSICAL AND MENTAL HEALTH

MOGUĆNOSTI PRIMJENE VJEŠTAČKE INTELIGENCIJE I DIGITAL TWIN TEHNOLOGIJE U REHABILITACIJI I FIZIKALNOJ TERAPIJI

Gordana Gardašević¹

¹Univerzitet u Banjoj Luci, Elektrotehnički fakultet, Republika Srpska,
Bosna i Hercegovina

Sažetak. Primjena digitalnih tehnologija i vještačke inteligencije u zdravstvu i medicini predstavlja revolucionarni iskorak u načinu liječenja pacijenata i administracije kompletnog zdravstvenog sistema. Iako su ove tehnologije još u početnim fazama primjene, rezultati koji su do sada postignuti ohrabruju i pružaju mogućnost da se definišu novi pravci razvoja i terapijskih procedura. Tehnologija „digitalnog blizanca“ omogućava da se kreira digitalna i dinamička replika realnog sistema koja omogućava predikciju budućih stanja i detekciju nepovoljnih događaja. To je veoma značajno i u praćenju pacijenta i njegovog oporavka. Ove virtuelne replike pacijenata omogućavaju personalizovane planove liječenja simuliranjem različitih scenarija rehabilitacije i predviđanjem ishoda za svakog pojedinačnog pacijenta. Koristeći podatke u realnom vremenu, terapeuti za rehabilitaciju mogu kontinuirano pratiti napredak pacijenta, prilagođavajući terapiju po potrebi kako bi se optimizovao oporavak. Ova dinamička povratna sprega osigurava da terapija bude blagovremena i efikasna tokom cijelog procesa rehabilitacije. U radu je dat prijedlog AI-bazirane DT arhitekture za monitoring napretka u rehabilitaciji pacijenata.

Ključne riječi: vještačka inteligencija, digitalne tehnologije, digitalni blizanci, rehabilitacija, fizikalna terapija

UNLOCKING THE POTENTIAL OF AI-POWERED DIGITAL TWINS IN TRANSFORMING REHABILITATION AND PHYSICAL THERAPY

Gordana Gardašević¹

¹University of Banja Luka, Faculty of Electrical Engineering, Republic of Srpska, Bosnia and Herzegovina

Abstract. The integration of digital technologies and artificial intelligence (AI) into healthcare marks a significant advancement in patient care and the management of healthcare systems. While these technologies remain in the early stages of implementation, initial outcomes are promising and suggest new avenues for development and therapeutic strategies. Digital twin (DT) technology enables the creation of digital, dynamic replicas of real-world systems, facilitating the prediction of future states and the identification of adverse events. This capability is particularly valuable for monitoring patients and tracking their recovery. Virtual patient replicas support the development of personalized treatment plans by simulating various rehabilitation scenarios and forecasting individual patient outcomes. By leveraging real-time data, rehabilitation therapists can continuously assess patient progress and adjust therapy to optimize recovery. This dynamic feedback mechanism ensures that therapeutic interventions remain timely and effective throughout the rehabilitation process. This paper proposes an artificial intelligence-based digital twin architecture for monitoring patient rehabilitation progress.

Key words: artificial intelligence, digital technologies, digital twin, rehabilitation, physical therapy

PERIPROSTETIČNE INFEKCIJE U REVIZIONOJ ARTROPLASTICI KUKA I KOLJENA: ISKUSTVA JEDNOG CENTRA

Stanislav Palija^{1,2}, Vesna Vujić-Aleksić^{1,2}, Gordana Ljubojević¹, Tatjana Nožica-Radulović^{1,2}, Goran Talić^{1,2}, Saša Vujnović^{2,3}

¹Institut za fizikalnu medicinu, rehabilitaciju i ortopedsku hirurgiju „Dr Miroslav Zotović“, Slatinska 11, Banja Luka, Bosna i Hercegovina

²Medicinski fakultet Univerziteta u Banjoj Luci, Save Mrkalja 14, Banja Luka, Bosna i Hercegovina

^{2,3}Zavod za kliničku radiologiju, UKC Republike Srpske, Republika Srpska, Bosna i Hercegovina

Sažetak. Periprostetične infekcije (PI) su rijetke, ali ozbiljne komplikacije artroplastike kuka i koljena, povezane sa visokim morbiditetom i značajnim troškovima liječenja. Dijagnoza PI predstavlja izazov, jer dijagnostički kriterijumi nisu u potpunosti usaglašeni, klinička slika varira, a PI se mogu javiti u periodu od četiri nedjelje do dvije godine nakon primarne artroplastike. Periprostetične infekcije predstavljaju jedan od vodećih razloga za revizionu artroplastiku, uz primjenu dugotrajne antimikrobne terapije. Cilj ovog rada bio je utvrditi udio revizionih artroplastika u ukupnom broju artroplastika kuka i koljena izvedenih u Institutu za fizikalnu medicinu, rehabilitaciju i ortopedsku hirurgiju „Dr Miroslav Zotović“ Banja Luka, Bosna i Hercegovina, učestalost pozitivnih mikrobioloških nalaza, te mikrobiološki profil i antimikrobnu osjetljivost izolovanih uzročnika. Retrospektivna opservaciona studija obuhvatila je pacijente kojima je izvedena artroplastika kuka ili koljena u periodu od januara do decembra 2025. godine (n=1551). Revizionu artroplastiku izvedena je kod 99 pacijenata (6,4%), od kojih je kod 62 pacijenta postojala sumnja na PI. Mikrobiološka analiza sprovedena je na ukupno 180 uzoraka; 111 uzoraka bilo je mikrobiološki negativno (61,7%), a 69 uzoraka mikrobiološki pozitivno (38,3%). Iz mikrobiološki pozitivnih uzoraka izolovana su ukupno 74 mikroorganizma, među kojima su dominirale bakterije iz roda *Staphylococcus* (n=57; 77,0%), a njihova osjetljivost bila je visoka prema većini antimikrobnih lijekova prvog izbora, ali niska prema pojedinim fluorohinolonima. Rezultati pokazuju da su udio revizionih artroplastika u ukupnom broju artroplastika kuka i koljena, te dominacija bakterija iz roda *Staphylococcus* kao uzročnika PI u skladu sa dostupnim podacima iz literature. Istovremeno, uočena rezistencija na pojedine fluorohinolone naglašava značaj kontinuiranog lokalnog praćenja antimikrobne osjetljivosti, radi optimizacije empirijske i ciljane antimikrobne terapije. Prevencija i liječenje PI zahtijevaju multidisciplinarni pristup i kontinuiran nadzor nad racionalnom primjenom antimikrobnih lijekova.

Ključne riječi: periprostetična infekcija, artroplastika kuka, artroplastika koljena, revizionu artroplastika, antimikrobna osjetljivost

PERIPROSTHETIC JOINT INFECTIONS IN HIP AND KNEE ARTHROPLASTY: A SINGLE CENTER EXPERIENCE

Stanislav Palija^{1,2}, Vesna Vujić-Aleksić^{1,2}, Gordana Ljubojević¹, Tatjana Nožica-Radulović^{1,2}, Goran Talić^{1,2}, Saša Vujnović^{2,3}

¹Institute for Physical Medicine, Rehabilitation and Orthopedic Surgery „Dr Miroslav Zotović“, Slatinska 11, Banja Luka, Bosnia and Herzegovina

²Medical Faculty, University of Banja Luka, Save Mrkalja 14, Banja Luka, Bosnia and Herzegovina

³Institute of Clinical Radiology, University Clinical Center of the Republic of Srpska, Republic of Srpska, Bosnia and Herzegovina

Abstract. Periprosthetic joint infections (PJIs) are rare but serious complications of hip and knee arthroplasty, associated with high morbidity and healthcare costs. Diagnosing PJIs is challenging due to the absence of universally accepted diagnostic criteria, the variability of clinical presentation, and the fact that PJIs may occur from four weeks to two years after primary arthroplasty. Periprosthetic joint infections are among the leading indications for revision arthroplasty, which is accompanied by prolonged antimicrobial therapy. The aim of this study was to determine the proportion of revision arthroplasties among the total number of hip and knee arthroplasties performed at the Institute for Physical Medicine, Rehabilitation and Orthopedic Surgery „Dr Miroslav Zotović“, Banja Luka, Bosnia and Herzegovina, the frequency of positive microbiological findings, as well as the microbiological profile and antimicrobial susceptibility of the isolated pathogens. This retrospective observational study included patients who underwent hip or knee arthroplasty between January and December 2025 (n=1551). Revision arthroplasty was performed in 99 patients (6,4%), of whom 62 had suspected PJI. Microbiological analysis was conducted on a total of 180 samples, of which 111 (61,7%) were microbiologically negative and 69 (38,3%) were microbiologically positive. A total of 74 isolates were obtained from positive samples, with *Staphylococcus* spp. being the most frequent (n=57; 77,0%) and exhibiting high susceptibility to most first-line antimicrobial agents but low susceptibility to certain fluoroquinolones. The results indicate that the proportion of revision arthroplasties, as well as the predominance of *Staphylococcus* spp. as causative agents of PJIs, are consistent with available literature data. Furthermore, the observed resistance to certain fluoroquinolones highlights the importance of continuous local surveillance of antimicrobial susceptibility to optimize both empirical and targeted antimicrobial therapy. Prevention and management of PJIs require a multidisciplinary approach and continuous monitoring to ensure rational use of antimicrobial agents.

Key words: periprosthetic joint infection, hip arthroplasty, knee arthroplasty, revision arthroplasty, antimicrobial susceptibility

EFEKAT TERAPIJSKIH VJEŽBI U KOREKCIJI IDIOPATSKE SKOLIOZE KOD ADOLESCENATA

Ranka Ogurlić¹

¹JZU Dom zdravlja Herceg Novi, Nikole Ljubibratića 1, Herceg Novi, Republika Crna Gora

Sažetak: Adolescentna idiopatska skolioza (AIS) je česta trodimenzionalna deformacija kičmenog stuba koja nastaje tokom rasta i razvoja. Može uzrokovati različite zdravstvene probleme, a terapijske vježbe su efikasan metod liječenja. Rad je analizirao i upoređivao efikasnost različitih kineziterapijskih postupaka u liječenju adolescentne idiopatske skolioze. U martu 2026. godine sproveden je pregled literature u bazama podataka PubMed, Cochrane Library, Web of Science i Google Scholar. Korišćenjem ključnih riječi „adolescenti“, „adolescentna idiopatska skolioza“, „terapija vježbom“, „fizioterapeutske vježbe specifične za skoliozu“ i „vježbe stabilizacije trupa“ identifikovano je petnaest radova. Sedam radova je ispunilo kriterijume uključenja. Isključene su neregizirane, nepotpune publikacije, kojie nisu na engleskom jeziku, i publikacije koje nisu proučavale efikasnost kineziterapije kod AIS. Rezultati ukazuju da specifične vježbe mogu usporiti, ili zaustaviti progresiju krivine, smanjiti bol, poboljšati držanje i pozitivno uticati na sliku o sebi. Različite intervencije, specifične za skoliozu, usmjerene na trodimenzionalne vježbe, stabilnost i ravnotežu, pravilno disanje i kontrolu posture dale su pozitivne efekte, Vježbe stabilizacije trupa značajno doprinose jačanju mišića, ali ističe se Schroth metod zbog značajnog uticaja na korekciju ugla krivine, rotaciju torakalne kičme, povećanje pokretljivosti, estetsku deformaciju i kvalitet života. Međutim, dostupni dokazi nisu potvrdili superiornost jednog kineziterapijskih postupaka u odnosu na druge. Potrebna su dalja istraživanja kako bi se preciznije odredilo koji je pristup najefikasniji za liječenja ovog deformiteta.

Ključne riječi: Adolescentna idiopatska skolioza; Vježbanje; Fizioterapeutske vježbe specifične za skoliozu.

THE EFFECT OF THERAPEUTIC EXERCISES IN THE CORRECTION OF IDIOPATHIC SCOLIOSIS IN ADOLESCENTS

Ranka Ogurlić¹

¹PHI Health Center Herceg Novi, Nikole Ljubibratića 1, Herceg Novi, Republic Montenegro

Abstract: Adolescent idiopathic scoliosis (AIS) is a common three-dimensional deformation of the spine that occurs during growth and development. It can cause various health problems, and therapeutic exercises are an effective method of treatment. The paper analyzed and compared the effectiveness of various kinesitherapy procedures in the treatment of adolescent idiopathic scoliosis. In March 2026, a literature review was conducted in the PubMed, Cochrane Library, Web of Science and Google Scholar databases. Using the keywords "adolescents", "adolescent idiopathic scoliosis", "exercise therapy", "physiotherapy exercises specific to scoliosis" and "trunk stabilization exercises" fifteen papers were identified. Seven papers met the inclusion criteria. Non-reviewed, incomplete publications, not in English, and publications that did not study the effectiveness of kinesitherapy in AIS were excluded. The results indicate that specific exercises can slow down or stop the progression of the curve, reduce pain, improve posture and have a positive effect on self-image. Various interventions, specific for scoliosis, aimed at three-dimensional exercises, stability and balance, proper breathing and posture control have had positive effects. Trunk stabilization exercises significantly contribute to muscle strengthening, but the Schroth method stands out due to its significant impact on the correction of the curve angle, rotation of the thoracic spine, increased mobility, aesthetic deformation and quality of life. However, the available evidence did not confirm the superiority of one kinesitherapy procedure over the other. Further research is needed to determine more precisely which approach is most effective for treating this deformity.

Keywords: Adolescent idiopathic scoliosis; Exercising; Physiotherapy exercises specific for scoliosis.

LOKOMAT PRO - ERIGO PRO – ANDAGO

Nemanja Grahovac¹, Dejan Dakić¹, Faruk Đumišić¹

¹JZU Institut za fizikalnu medicinu, rehabilitaciju i ortopedsku hirurgiju „Dr
Miroslav Zotović“ Banja Luka, Slatinska 11 7800 Banja Luka ,
Bosna i Hercegovina

Sažetak. Lokomat Pro je jedan od najsavremenijih uređaja koji se koristi za lokomotornu terapiju pacijenata sa određenim stepenom invalidnosti koji uzrokuju neurološki, mišićni i koštani poremećaji odnosno oboljenja. To je računarski kontroliran i usklađen uređaj sa ortozama i pokretnom trakom kojim sva podešavanja izvodi osoba sa posebnom obukom od strane proizvođača. Kao i svaki medicinski uređaj tako i za Lokomat postoje odgovarajuće indikacije i kontraindikacije. Da bi se pratilo napredovanje kroz rehabilitacioni program vrše se odgovarajuća testiranja pacijenata na samom aparatu kao i odgovarajućih standardizovanih testova (Tinetti skala balansa, Fugle-Meyer, Test hoda¹⁰). Nakon Lokomata nastavak rehabilitacije se vrši na aparatu Andago koji je zadužen za korekciju balansa. Lokomatu predhodi rehabilitacioni tretman na Erigo aparatu za vertikalizaciju nepokretnih pacijenata uz robotsko asistiranje koraćanje i aktivaciju mišićne pumpe. Preporučeno je uvezivanje rehabilitacije u nizu Erigo, Lokomat i onda Andago. U našem radu najčešće su prisutni pacijenti na rehabilitaciji nakon Moždanog udara, Multiple skleroze i neuropatije, dok se isto koristi za rehabilitaciju traumatskih povreda mozga, Cerebralne paralize. Funkcionalni trening utiče na prenos težine, ravnotežu, vraćanje funkcije donjih ekstremiteta, korekcije šeme hoda.

Ključne riječi: Lokomat Pro, Erigo Pro, Andago Pro, Moždani udar, šema hoda

LOKOMAT PRO – ERIGO PRO – ANDAGO

Nemanja Grahovac¹, Dejan Dakić¹, Faruk Đumišić¹

¹PHI Institute for Physical Medicine, Rehabilitation and Orthopedic Surgery “Dr
Miroslav Zotović” Banja Luka, Slatinska 11, 78000 Banja Luka,
Bosnia and Herzegovina

Abstrakt. The Lokomat Pro is one of the most advanced devices used for locomotor therapy in patients with varying degrees of disability caused by neurological, muscular, and skeletal disorders or diseases. It is a computer-controlled and synchronized system equipped with robotic orthoses and a treadmill, where all adjustments are performed by a professional specifically trained by the manufacturer. As with any medical device, specific indications and contraindications apply to the Lokomat. To monitor progress through the rehabilitation program, patients undergo appropriate testing on the device itself, as well as standardized clinical assessments (Tinetti Balance Scale, Fugl-Meyer Assessment, 10-Meter Walk Test). Following Lokomat therapy, rehabilitation continues on the Andago device, which is designed for balance correction. Lokomat therapy is preceded by a rehabilitation treatment on the Erigo device, used for the verticalization of immobile patients combined with robotic-assisted stepping and muscle pump activation. Linking the rehabilitation process in a sequential progression Erigo, Lokomat and then Andago is highly recommended. In our clinical practice, the most common patients undergoing rehabilitation are those recovering from stroke, multiple sclerosis, and neuropathies, while the system is also utilized for the rehabilitation of traumatic brain injuries and cerebral palsy. Functional training directly affects weight transfer, balance, restoration of lower limb function, and gait pattern correction.

Keywords: Lokomat Pro, Erigo Pro, Andago, Stroke, gait pattern

SCHROTH TEHNIKA U TRETMANU SKOLIOZA KOD ODRASLIH

Milana Javorac¹, Dragana Novković²

¹Institut za fizikalnu medicinu, rehabilitaciju i ortopedsku hirurgiju “Dr Miroslav Zotović”, Banja Luka, Bosna i Hercegovina

Sažetak. Adultna skolioza predstavlja kompleksnu trodimenzionalnu deformaciju kičmenog stuba koja je često praćena bolom, degenerativnim promjenama, poremećajem posture i funkcionalnim ograničenjima, što značajno utiče na kvalitet života oboljelih. Cilj rada je prikazati principe Schroth metode i njen značaj u konzervativnom tretmanu odraslih osoba sa skoliozom, uz statistički prikaz rezultata. Schroth metoda predstavlja individualizovan pristup zasnovan na trodimenzionalnoj korekciji deformiteta kroz elongaciju, derotaciju, korektivno disanje, posturalnu kontrolu i funkcionalnu integraciju korigovanih obrazaca pokreta. Terapijski program prilagođava se tipu skoliotične krivine i funkcionalnom statusu pacijenta. Poseban značaj ima kontakt rukama terapeuta, kojim se kroz taktilnu facilitaciju poboljšavaju proprioceptivna percepcija, posturalna svijest i razumijevanje korektivnih pokreta, što omogućava preciznije izvođenje vježbi i efikasnije usvajanje korektivnog disanja. Dosadašnja klinička iskustva i dostupni naučni podaci ukazuju da Schroth metoda kod odraslih osoba doprinosi smanjenju bola, smanjenju mišićnog spazma, poboljšanju mobilnosti grudnog koša, respiratorne funkcije, balansa i funkcionalnih sposobnosti, te može usporiti progresiju deformiteta. Iako se kod odraslih pacijenata ne očekuje značajno smanjenje Cobbovog ugla, postižu se značajna poboljšanja funkcionalnog statusa i kvaliteta života. Zaključuje se da Schroth metoda predstavlja efikasan konzervativni pristup u tretmanu adultne skolioze, pri čemu stručnost terapeuta, kvalitet taktilnog vođenja i aktivno učešće pacijenta imaju ključnu ulogu u postizanju terapijskih ciljeva.

Ključne riječi: adultna skolioza, Schroth metoda, fizioterapija, bol, posturalna korekcija

SCHROTH METHOD IN THE TREATMENT OF ADULT SCOLIOSIS

Milana Javorac¹, Dragana Novković¹

¹Institute for Physical Medicine, Rehabilitation, and Orthopedic Surgery “Dr Miroslov Zotović”, Banja Luka, Bosnia and Herzegovina

Abstract. Adult scoliosis represents a complex, three-dimensional deformity of the spinal column that is frequently accompanied by pain, degenerative changes, postural misalignment, and functional limitations, which significantly affect the patients' quality of life. The aim of this paper is to present the principles of the Schroth method and its significance in the conservative treatment of adult individuals with scoliosis, along with a statistical overview of the results. The Schroth method represents an individualized approach based on the three-dimensional correction of the deformity through elongation, derotation, corrective breathing, postural control, and the functional integration of corrected movement patterns. The therapeutic program is tailored to the specific type of scoliotic curve and the patient's functional status. The therapist's hands-on contact holds particular importance, as it enhances proprioceptive perception, postural awareness, and the understanding of corrective movements through tactile facilitation, enabling more precise execution of exercises and a more effective mastery of corrective breathing. Current clinical experience and available scientific data indicate that the Schroth method in adults contributes to pain reduction, decreased muscle spasm, improved chest wall mobility, enhanced respiratory function, balance, and functional capacity, and can slow down the progression of the deformity. Although a significant reduction in the Cobb angle is not expected in adult patients, substantial improvements are achieved in functional status and quality of life. It is concluded that the Schroth method represents an effective conservative approach in the treatment of adult scoliosis, wherein the therapist's expertise, the quality of tactile guidance, and the patient's active participation play a crucial role in achieving therapeutic goals.

Keywords: adult scoliosis, Schroth method, physiotherapy, pain, postural correction

METODE FIZIOTERAPEUTSKE PROCJENE OBOLJELIH OD DUCHENNEOVE MIŠIĆNE DISTROFIJE

Dragana Popović¹

¹Institut za fizikalnu medicinu, rehabilitaciju i ortopedsku hirurgiju „Dr Miroslav Zotović“, Banja Luka, Bosna i Hercegovina

Sažetak. Duchenneova mišićna distrofija (DMD) je progresivna neuromišićna bolest koju karakteriše postepeno opadanje funkcionalnih sposobnosti oboljelih. Pravovremena, objektivna i kontinuirana fizioterapeutska procjena je neophodna za precizno praćenje progresije bolesti, rano prepoznavanje dinamike njenog razvoja, te prilagođavanje i optimizaciju terapijskih postupaka. Cilj rada je analizirati praktične i validirane metode fizioterapeutske procjene koje omogućavaju objektivno praćenje progresije bolesti u različitim funkcionalnim fazama. Rad je zasnovan na analizi savremenih kliničkih smjernica, protokola kao i dostupne stručne i naučne literature iz oblasti fizikalne terapije i rehabilitacije oboljelih od neuromišićnih bolesti. Relevantni izvori identifikovani su pretraživanjem elektronskih baza podataka PubMed i Google Akademik, sa fokusom na metode procjene funkcionalnog statusa i praćenje progresije simptoma kod pacijenata sa Duchenneovom mišićnom distrofijom. Dobijeni rezultati ukazuju da izbor testova i skala za procjenu mora biti usklađen sa funkcionalnim statusom pacijenta. U ambulatornoj fazi koriste se validirani testovi poput North Star Ambulatory Assessment (NSAA) i 6-minutni test hoda (6MWT). Kod pacijenata u neambulatornoj fazi ključni instrumenti su Performance of Upper Limb (PUL) i Egen Klassifikation 2 (EK2) skale, koji precizno definišu motoričke sposobnosti i nivo funkcionalne samostalnosti. Provedeno istraživanje je analizom i sistematskim prikazom validiranih skala pokazalo njihovu praktičnu vrijednost i potvrđeno je da one omogućavaju objektivno praćenje progresije bolesti i precizno definisanje funkcionalnog statusa pacijenta. Smatramo da bi u budućnosti bilo izuzetno korisno provesti praktično kliničko istraživanje na ovu temu, kako bi se dodatno potvrdila primjenjivost ovih metoda u našim kliničkim uslovima.

Ključne riječi: Duchenneova mišićna distrofija, fizioterapeutska procjena, motoričke funkcije, funkcionalni testovi

METHODS OF PHYSIOTHERAPEUTIC ASSESSMENT OF PATIENTS WITH DUCHENNE MUSCULAR DYSTROPHY

Dragana Popović¹

¹Institute for Physical Medicine, Rehabilitation and Orthopedic Surgery "Dr Miroslov Zotović", Banja Luka, Bosnia and Herzegovina

Abstract. Duchenne muscular dystrophy (DMD) is a progressive neuromuscular disease characterized by a gradual decline in the functional abilities of patients. Timely, objective, and continuous physiotherapeutic assessment is essential for precise monitoring of disease progression, early identification of its development dynamics, and adjustment and optimization of therapeutic procedures. The aim of this paper is to analyze practical and validated physiotherapeutic assessment methods that enable objective monitoring of disease progression in different functional stages. The paper is based on an analysis of contemporary clinical guidelines, protocols, and available professional and scientific literature in the field of physical therapy and rehabilitation of patients with neuromuscular diseases. Relevant sources were identified by searching electronic databases PubMed and Google Scholar, focusing on methods for assessing functional status and monitoring symptom progression in patients with Duchenne muscular dystrophy. The obtained results indicate that the choice of assessment tests and scales must be aligned with the patient's functional status. In the ambulatory stage, validated tests such as the North Star Ambulatory Assessment (NSAA) and the 6-minute walk test (6MWT) are used. For patients in the non-ambulatory stage, the key instruments are the Performance of Upper Limb (PUL) and Egen Klassifikation 2 (EK2) scales, which precisely define motor abilities and the level of functional independence. The conducted research, through analysis and systematic review of validated scales, demonstrated their practical value and confirmed that they enable objective monitoring of disease progression and precise definition of the patient's functional status. We believe it would be extremely useful to conduct practical clinical research on this topic in the future to further confirm the applicability of these methods in our clinical conditions.

Key words: Duchenne muscular dystrophy, physiotherapeutic assessment, motor functions, functional tests

ZNAČAJ PULMOLOŠKE REHABILITACIJE U LIJEČENJU BRONHIJALNE ASTME U DJEČIJOJ DOBI - PRIKAZ SLUČAJA

Jelena Dabić¹, Andrea Grbić¹, Milana Railić¹

¹Institut za fizikalnu medicinu, rehabilitaciju i ortopedsku hirurgiju „Dr Miroslav
Zotović“, Banja Luka, RS/BiH

Sažetak. Bronhijalna astma kod djece je hronična opstruktivna inflamatorna bolest disajnih puteva koja uzrokuje suženje bronhija i otežano disanje. Predmet izučavanja ovog rada jesu principi na kojima se zasniva respiratorna rehabilitacija, tačnije fizioterapijska procjena i intervencije koje koristimo u rehabilitaciji pacijenata sa respiratornim tegobama. Cilj pulmološke rehabilitacije je individualno liječenje pacijenata koje odgovara njegovom zdravstvenom stanju i funkcionalnim sposobnostima. U ovom radu je prikazana fizioterapijska procjena i program fizikalne i sport terapije kod djeteta sa bronhijalnom astmom, uključenog u tronedeljnu pulmološku rehabilitaciju. Kao fizioterapijsku procjenu koristili smo 6 – minutni test hoda, spirometriju, respiratorni index, Power breathe. Program fizikalne terapije obuhvatao je: disajnu gimnastiku i trening inspiratorne muskulature tri puta sedmično i leđnu gimnastiku sa ciljem aktivacije i jačanja dijafragme, asistiranu eliminaciju sekreta aparatom. U okviru sport terapije pacijent je imao trening izdržljivosti, vježbe mišićne snage, kao i igre prilagođene djeci. Disajnu gimnastiku smo sprovodili tri puta sedmično i obuhvatala je vježbe jačanja respiratorne muskulature, obuku olakšavajućih položaja, kojima smo obučili pacijenta olakšavajućim položajima pri naporu i vježbe disanja, odnosno pravilnim tehnikama disanja. Sport terapija je imala efekat u poboljšanju fizičke sposobnosti. Trening izdržljivosti smo sprovodili tri puta sedmično, obuhvatao je hod uz stepenice igre u sali, test 6 minuta hoda i ergometar. Penjenjem uz stepenice smo omogućili da se ekscentrična mišićna opterećenja ugrade u trening. Efikasnost pulmološke rehabilitacije kod djece sa bronhijalnom astmom manifestovalo se prvenstveno poboljšanjem fizičkog stanja, poboljšanjem disanja i olakšavajućem izbacivanju sekreta. Pulmološka rehabilitacija je omogućila svjesnost o pravilnom dijafragmalnom disanju, povećanoj fizičkoj izdržljivosti i efikasnijem radu pluća.

Ključne riječi: Astma, fizioterapijska procjena, fizikalna i sport terapija, igra

THE IMPORTANCE OF PULMONARY REHABILITATION IN THE TREATMENT OF BRONCHIAL ASTHMA IN CHILDHOOD – A CASE REPORT

Jelena Dabić¹, Andrea Grbić¹, Milana Railić¹

¹Institute for Physical Medicine, Rehabilitation and Orthopedic Surgery "Dr Miroslav Zotović", Banja Luka, Bosnia and Herzegovina

Abstract. Bronchial asthma in children is a chronic obstructive inflammatory disease of the airways that causes bronchial narrowing and difficulty breathing. This paper focuses on the principles underlying respiratory rehabilitation, specifically physiotherapy assessment and the interventions used in the rehabilitation of patients with respiratory problems. The aim of pulmonary rehabilitation is to provide individualized treatment tailored to the patient's health status and functional abilities. This paper presents a physiotherapy assessment and a physical and sports therapy program for a child with bronchial asthma who participated in a three-week pulmonary rehabilitation program. Physiotherapy assessment included the 6-minute walk test, spirometry, respiratory index, and POWERbreathe assessment. The physical therapy program included breathing exercises and inspiratory muscle training three times a week, as well as back exercises aimed at activating and strengthening the diaphragm and device-assisted secretion clearance. As part of sports therapy, the patient participated in endurance training, muscle-strengthening exercises, and age-appropriate games. Breathing exercises were performed three times a week and included exercises to strengthen the respiratory muscles, training in positions that facilitate breathing during physical exertion, and instruction in proper breathing techniques. Sports therapy contributed to an improvement in physical capacity. Endurance training was performed three times a week and included stair climbing, indoor games, the 6-minute walk test, and ergometer training. Stair climbing allowed eccentric muscle loading to be incorporated into the training program. The effectiveness of pulmonary rehabilitation in children with bronchial asthma was primarily reflected in improved physical condition, improved breathing, and easier clearance of respiratory secretions. Pulmonary rehabilitation also increased awareness of proper diaphragmatic breathing, improved physical endurance, and contributed to more efficient lung function.

Keywords: asthma, physiotherapy assessment, physical and sports therapy, play

FORMIRANJE ZAVRŠNE OCJENE U VISOKOM OBRAZOVANJU

Dragana Sredić Cartes^{1,2}, Mira Obradović^{1,2}, Luka Matijević^{1,3}

¹ JU Visoka medicinska škola Prijedor, Nikole Pašića 4A Prijedor,
Republika Srpska, Bosna i Hercegovina

² Medicinski fakultet Novi Sad, Hajduk Veljkova 3, Novi Sad,
Republika Srbija

³ Institut za fizikalnu medicinu, rehabilitaciju i ortopedsku hirurgiju „Dr
Miroslav Zotović“, Banja Luka, Republika Srpska, Bosna i Hercegovina

Sažetak. Formiranje završne ocjene predstavlja ključni segment visokog obrazovanja jer odražava nivo stečenih znanja i kompetencija studenata, ali i utiče na njihov dalji akademski i profesionalni razvoj. Cilj rada bio je analizirati komponente koje učestvuju u formiranju završne ocjene, ispitati savremene prakse u različitim obrazovnim sistemima te identifikovati glavne izazove i preporuke za unapređenje ovog procesa. U radu je primijenjena metoda analize i sinteze relevantne naučne literature iz oblasti obrazovanja i evaluacije znanja, uz komparativni pristup različitim obrazovnim sistemima. Rezultati ukazuju da završna ocjena najčešće obuhvata kombinaciju sumativnih i formativnih komponenti, pri čemu dominantna uloga završnih ispita može negativno uticati na motivaciju i kvalitet učenja. S druge strane, kontinuirano praćenje kroz formativne aktivnosti, uz pravovremenu povratnu informaciju i mogućnost ponavljanja zadataka, doprinosi boljem akademskom uspjehu i većem angažmanu studenata. Takođe, uočene su značajne razlike među zemljama u pogledu ponderisanja ocjenjivačkih komponenti, uz trend ka kriterijumskom ocjenjivanju i većoj fleksibilnosti sistema, naročito nakon pandemije COVID-19. Kao ključni problemi izdvajaju se nedostatak transparentnosti, inflacija ocjena, neravnomjerna zastupljenost komponenti i nedovoljna pedagoška obuka nastavnika. Zaključno, unapređenje sistema ocjenjivanja zahtijeva uspostavljanje jasnih i transparentnih kriterijuma, balans između različitih oblika evaluacije te kontinuiranu edukaciju nastavnog kadra, kako bi završna ocjena što vjerodostojnije odražavala stvarne kompetencije studenata.

Ključne riječi: završna ocjena, visoko obrazovanje, formativno ocjenjivanje, sumativno ocjenjivanje, evaluacija

FORMATION OF FINAL GRADE IN HIGHER EDUCATION

Dragana Sredić Cartes^{1,2}, Mira Obradović^{1,2}, Luka Matijević^{1,3}

¹ PI College of Health Sciences Prijedor, Nikole Pašića 4A, Prijedor, Republic of Srpska, Bosnia and Herzegovina

²Faculty of Medicine, Hajduk Veljkova 3, Novi Sad, Republic of Serbia

³Institute for Physical Medicine, Rehabilitation and Orthopedic Surgery "Dr Miroslav Zotović", Banja Luka, Bosnia and Herzegovina

Abstract. The formation of the final grade represents a key segment of higher education, as it reflects the level of knowledge and competencies acquired by students, while also influencing their further academic and professional development. The aim of this paper was to analyze the components involved in the formation of the final grade, examine contemporary practices in different educational systems, and identify the main challenges and recommendations for improving this process. The study applied the method of analysis and synthesis of relevant scientific literature in the field of education and knowledge assessment, using a comparative approach across different educational systems. The results indicate that the final grade most often includes a combination of summative and formative components, where the dominant role of final exams can negatively affect motivation and the quality of learning. On the other hand, continuous monitoring through formative activities, along with timely feedback and the opportunity to repeat tasks, contributes to better academic performance and greater student engagement. Additionally, significant differences among countries were observed in terms of weighting assessment components, with a trend toward criterion-based assessment and greater system flexibility, particularly after the COVID-19 pandemic. Key issues identified include a lack of transparency, grade inflation, uneven representation of components, and insufficient pedagogical training of teaching staff. In conclusion, improving the assessment system requires the establishment of clear and transparent criteria, a balance between different forms of evaluation, and continuous professional development of teaching staff, so that the final grade more accurately reflects students' actual competencies.

Keywords: final grade, higher education, formative assessment, summative assessment, evaluation

TERAPIJSKA IGRA KAO VID PODRŠKE DJECI SA SMETNJAMA U RAZVOJU SUOČENOM SA NASILJEM

Tanja Čolić¹, Borka Vukajlović²

¹JU Visoka medicinska škola Prijedor, Nikole Pašića 4a, Prijedor, Republika
Srpska, Bosna i Hercegovina

²Nezavisni univerzitet Banja Luka, Veljka Mladenovića 12e, Banja Luka, Republika
Srpska, Bosna i Hercegovina

Sažetak. Nasilje nad djecom predstavlja jedan od najozbiljnijih oblika ugrožavanja dječjih prava, sa dugotrajnim posljedicama po emocionalni, kognitivni i socijalni razvoj. Posebno ranjivu grupu čine djeca sa smetnjama u razvoju, koja su značajno češće izložena različitim oblicima nasilja, a istovremeno imaju otežanu mogućnost prijavljivanja zlostavljanja i slabije razvijene mehanizme zaštite. Ovaj rad predstavlja teorijsku analizu terapijske igre, kao vidljive podrške djeci sa smetnjama u razvoju koja su doživjela nasilje, uz osvrt na preventivne mjere zaštite i etičke principe u radu s ovom populacijom. U radu se, na osnovu međunarodne i regionalne literature, razmatraju specifičnosti traumatskih iskustava kod djece sa smetnjama u razvoju, kao i psihološki efekti nasilja, uključujući emocionalnu disregulaciju, regresiju u razvoju, probleme u ponašanju i povećan rizik od mentalnih poremećaja. Poseban akcenat stavljen je na terapijsku igru kao razvojni i terapijski medij koji omogućava simboličko izražavanje emocija, prerađivanje traumatskih sadržaja i jačanje adaptivnih sposobnosti. Različiti pristupi terapijskoj igri (nedirektivni, direktivni, kognitivno-bihevioralni) razmatraju se kroz prizmu prilagođavanja razvojnim potrebama djece sa smetnjama u razvoju, uz naglasak na strukturu, individualizaciju i ulogu terapeuta. Rad takođe analizira preventivne mjere na primarnom, sekundarnom i tercijarnom nivou, s posebnim osvrtom na kontekst Bosne i Hercegovine i Republike Srpske. Ukazuje na potrebu za jačanjem multisektorske saradnje, kontinuiranom edukacijom stručnjaka i razvojem inkluzivnih politika. Zaključuje se da terapijska igra predstavlja nezamjenjiv alat u podršci djeci sa smetnjama u razvoju koja su izložena nasilju, dok efikasna zaštita zahtijeva sistemski, multidisciplinarni i etički utemeljen pristup.

Ključne riječi: terapijska igra, nasilje nad djecom, djeca sa smetnjama u razvoju, trauma, prevencija

THERAPEUTIC PLAY AS A FORM OF SUPPORT FOR CHILDREN WITH DEVELOPMENTAL DISABILITIES EXPOSED TO VIOLENCE

Tanja Čolić¹, Borka Vukajlović²

¹PI College of Health Sciences Prijedor, Nikole Pašića 4a, Prijedor, Republic of Srpska, Bosnia and Herzegovina

²Independent University of Banja Luka, Veljka Mladenovića 12e, Banja Luka, Republic of Srpska, Bosnia and Herzegovina

Abstract. Violence against children represents one of the most serious violations of children's rights, with long-term consequences for emotional, cognitive, and social development. Children with developmental disabilities are a particularly vulnerable group, as they are significantly more likely to experience various forms of violence while having diminished capacity to report abuse and weaker protection mechanisms. This paper provides a theoretical analysis of therapeutic play as a form of support for children with developmental disabilities who have experienced violence, with a focus on preventive measures and ethical principles in professional practice. Based on international and regional literature, the paper discusses the specific characteristics of traumatic experiences in children with developmental disabilities, as well as the psychological effects of violence, including emotional dysregulation, developmental regression, behavioral problems, and increased risk of mental disorders. Special emphasis is placed on therapeutic play as a developmental and therapeutic medium that enables symbolic expression of emotions, processing of traumatic content, and strengthening of adaptive capacities. Different approaches to therapeutic play (non-directive, directive, cognitive-behavioral) are examined through the lens of adaptation to the developmental needs of children with disabilities, highlighting the importance of structure, individualization, and the therapist's role. The paper also analyzes preventive measures at primary, secondary, and tertiary levels, with particular reference to the context of Bosnia and Herzegovina and the Republic of Srpska. It emphasizes the need for strengthening multisectoral cooperation, continuous professional education, and the development of inclusive policies. It concludes that therapeutic play is an indispensable tool in supporting children with developmental disabilities exposed to violence, while effective protection requires a systemic, multidisciplinary, and ethically grounded approach.

Key words: therapeutic play, violence against children, children with developmental disabilities, trauma, prevention

KUPOVINE NAMIRNICA KORIŠTENJEM TESTA VJEŠTINA

Alenka Plemelj Mohorič¹

¹Univerzitet u Ljubljani, Fakultet zdravstvenih nauka, Ljubljana, Slovenia

Sažetak. Test vještina kupovine namirnica (TOGSS) je standardizovana, funkcionalna i u prirodnom okruženju provedena procjena koju su razvili Catana Brown, Melisa Rempfer i Edna Hamera 2009. godine. Namijenjena je procjeni sposobnosti pojedinca za efikasno i tačno obavljanje kupovine u srednje velikoj prodavnici prehrambenih proizvoda. Procjena vrednuje stvarno izvođenje aktivnosti, povezuje kogniciju i svakodnevno funkcionisanje, pomaže u planiranju tretmana i omogućava praćenje napretka u rehabilitaciji. Brojne studije navode da osobe sa poremećajima mentalnog zdravlja imaju poteškoće u efikasnosti kupovine, troše više vremena i prave više nepotrebnih prolazaka između polica. Procjena je provedena kod 10 osoba sa poremećajem mentalnog zdravlja i 10 osoba bez poremećaja mentalnog zdravlja, starosti između 30 i 65 godina. Istraživanje je provedeno u srednje velikoj prodavnici kompanije Hofer tokom aprila i maja 2025. godine. Učesnici su potpisali informirani pristanak. Ispitanici sa poremećajem mentalnog zdravlja postigli su niži broj bodova za tačnost, imali veći broj nepotrebnih prolazaka i trebalo im je više vremena za kupovinu proizvoda. Češće su ostavljali kolica za kupovinu i postavljali više pitanja. Izvođenje kupovine kod osoba sa poremećajem mentalnog zdravlja pokazalo je poteškoće s pažnjom, pamćenjem, planiranjem i organizacijom ponašanja. Rezultati našeg istraživanja slični su nalazima stranih istraživanja. Posmatranje kupovine u stvarnom okruženju pruža mnogo informacija o reakcijama na neočekivane situacije. Radnoterapijski tretman osoba sa poremećajem mentalnog zdravlja trebao bi se odvijati u korisnikovom kućnom okruženju, zbog čega želimo proširiti upotrebu procjene vještina kupovine namirnica među radnim terapeutima.

Ključne riječi: svakodnevno funkcionisanje, kupovina, radna terapija, mentalni poremećaji

USING THE TEST OF GROCERY SHOPPING SKILLS

Alenka Plemelj Mohorič¹

¹University of Ljubljana, Faculty of Health Sciences, Ljubljana, Slovenia

Abstract. The Test of Grocery Shopping Skills (TOGSS) is a standardized, functional, and naturalistic assessment developed by Catana Brown, Melisa Rempfer, and Edna Hamera in 2009. It is designed to assess an individual's ability to perform grocery shopping efficiently and accurately in a medium-sized grocery store. The assessment evaluates actual task performance, links cognition with everyday functioning, helps plan treatment, and enables monitoring of rehabilitation progress. Numerous studies report that individuals with mental health disorders experience difficulties with shopping efficiency, spend more time shopping, and make more unnecessary trips between store aisles. The assessment was conducted with 10 individuals with mental health disorders and 10 individuals without mental health disorders, aged between 30 and 65 years. The study was carried out in a medium-sized Hofer grocery store during April and May 2025. The participants signed informed consent forms. Participants with mental health disorders achieved lower accuracy scores, made a higher number of unnecessary trips, and required more time to purchase the products. They also left their shopping carts more frequently and asked more questions. Grocery shopping performance in individuals with mental health disorders demonstrated difficulties with attention, memory, planning, and organization of behavior. The results of our study are similar to findings reported in international research. Observing shopping performance in a real-life environment provides extensive information about responses to unexpected situations. Occupational therapy intervention for individuals with mental health disorders should take place in the user's home environment; therefore, we aim to promote the use of grocery shopping skills assessment among occupational therapists.

Key words: daily functioning, shopping, occupational therapy mental disorders

POZITIVAN UTICAJ ZDRAVE ISHRANE U ŠKOLI NA UČENIKE MLAĐEG ŠKOLSKOG UZRASTA

Goran Aljetić¹, Marijana Milanović², Branislav Milanović²

¹JU Visoka medicinska škola Prijedor, Nikole Pašića 4A, Prijedor, Republika
Srpska, Bosna i Hercegovina

²JU Osnovna škola „Meša Selimović“ Janja, Bijeljina, Republika Srpska
Bosna i Hercegovina

Sažetak. Zdrava ishrana ima značajnu ulogu u pravilnom rastu i razvoju djece mlađeg školskog uzrasta, kao i u formiranju njihovih životnih navika. Cilj ovog rada je ispitati uticaj organizovane zdrave ishrane u školi na fizičko zdravlje, koncentraciju i školski uspjeh učenika. Istraživanje je sprovedeno tokom tri godine na uzorku od 20 učenika koji trenutno pohađaju treći razred osnovne škole „Meša Selimović“ u Janji, a koji su od prvog razreda uključeni u program zdrave ishrane. U okviru programa učenici konzumiraju nutritivno uravnotežene obroke, piju isključivo vodu, te ne konzumiraju sokove ni grickalice tokom boravka u školi. Metode istraživanja obuhvatile su anketiranje, posmatranje i analizu školskog uspjeha u posmatranom periodu. Dobijeni rezultati ukazuju da učenici pokazuju bolju koncentraciju na času, stabilniji nivo energije i poboljšano opšte zdravstveno stanje, uz smanjenu učestalost umora i nezdravih prehrambenih navika. Takođe je uočen pozitivan trend u školskom uspjehu i većoj uključenosti u nastavne aktivnosti. Rezultati potvrđuju značaj kontinuiranog sprovođenja programa zdrave ishrane u školama, te se zaključuje da ovakav pristup značajno doprinosi cjelokupnom razvoju učenika i formiranju zdravih životnih navika.

Ključne riječi: zdrava ishrana, učenici, voda, zdravlje

POSITIVE INFLUENCE OF HEALTHY NUTRITION IN SCHOOL ON STUDENTS HEALTH

Goran Aljetic¹, Marijana Milanovic², Branislav Milanovic²

¹College of Health Sciences, Nikole Pašića 4A, Prijedor, Republic of Srpska,
Bosnia and Herzegovina

²Primary School „Meša Selimović“ Janja, Republic of Srpska,
Bosnia and Herzegovina

Abstract. Healthy nutrition plays an important role in the proper growth and development of younger school-age children, as well as in shaping their lifelong habits. The aim of this paper is to examine the impact of organized healthy nutrition in schools on students' physical health, concentration, and academic performance. The research was conducted over a three-year period on a sample of 20 students who are currently in the third grade of the “Meša Selimović” Primary School in Janja, and who have been following a healthy nutrition program since the first grade. As part of the program, students consume nutritionally balanced meals, drink only water, and do not consume sugary drinks or snacks during their time at school. The research methods included surveys, observation, and analysis of academic performance over the observed period. The results indicate that students demonstrate better concentration in class, more stable energy levels, and improved overall health, along with a reduced occurrence of fatigue and unhealthy eating habits. A positive trend in academic performance and increased participation in classroom activities was also observed. The findings confirm the importance of continuous implementation of healthy nutrition programs in schools, leading to the conclusion that such an approach significantly contributes to students' overall development and the formation of healthy lifestyle habits.

Key words: healthy nutrition, students, water, primary school, health

PROCENA UMORA U RADNOJ TERAPIJI – PREGLEDNI RAD

Nada Savković¹, Gordana Savković¹

¹ Akademija strukovnih studija Beograd, Odsek Visoka zdravstvena škola, Cara Dušana 254. 11080 Zemun, Beograd, Republika Srbija;

Sažetak. Pacijenti sa hroničnim reumatskim i neurološkim bolestima i stanjima, osim bola, ograničenja pokretljivosti, smanjenja mišićne snage i izdržljivosti, suočavaju se prilikom izvođenja svakodnevnih aktivnosti i sa iskustvom umora. Umor se ispoljava i kao fizički i kao kognitivni, psihološki, emotivni zamor koji otežava ne samo motoričke performanse nego i planiranje, izbor i donošenje odluka na uobičajenom dnevnom nivou i ugrožava ukupan profesionalni i socijalni angažman osobe. Prisustvo umora i njegovih oscilacija je nešto što se podrazumeva u rehabilitaciji osoba sa hroničnim bolestima i stanjima, kao simptom je potcenjen u odnosu na ostale prisutne simptome, evidentira se najčešće opisno i uopšteno i kada ga pominju pacijenti i kada o njemu podnose izveštaj radni terapeuti. Smanjenje ili odsustvo zamora po završenom ciklusu rehabilitacije, pripisuje se često smanjenom bolu, poboljšanim motoričkim performansama, povećanoj pokretljivosti, jačoj snazi mišića i poboljšanom opštem stanju pacijenata. Iako je umor prisutan i predstavlja jednu od osnovnih smernica u doziranju terapijskog opterećenja, a pokazatelj je i opšte promene stanja, uočljiv je manjak standardizovanih instrumenata za procenu i samoprocenu koji se bave isključivo umorom - na početku, u toku i po završenom tretmanu. Testovi i metode procene umora mogu, osim u doziranju da pomognu i u praćenju sveukupnog napretka i upotpune postojeću medicinsku dokumentaciju. Cilj preglednog rada je prikaz pojedinih testova koji se mogu koristiti kao dopuna radno terapijske dokumentacije sa svrhom potpunijeg sagledavanja uticaja umora na pacijente koji žive sa hroničnim bolestima i/ili stanjima. Pregled dostupne literature iz Pub Med i Google Scholar baza podataka.

Ključne reči: zamor, procena, hronične reumatske i neurološke bolesti i stanja, radna terapija

EVALUATION OF FATIGUE IN OCCUPATIONAL THERAPY- REVIEW PAPER

Nada Savković¹, Gordana Savković¹

¹ Academy of Applied Studies Belgrade, College of Health Sciences, Cara Dušana
254, 11080 Zemun, Belgrade, Republic of Serbia;

Abstract. Patients with chronic rheumatic and neurological diseases and conditions, in addition to pain, limitation of mobility, reduction of muscle strength and endurance, face the experience of fatigue when performing daily activities. Fatigue manifests itself as both physical and cognitive, psychological, emotional fatigue that hinders not only motor performance, but also planning, choice and decision-making at the common daily level and endangers a person's overall professional and social engagement. The presence of fatigue and its oscillations is something that is taken for granted in the rehabilitation of people with chronic diseases and conditions, as a symptom it is underestimated in relation to other present symptoms, it is recorded most often descriptively, in general when mentioned by patients as well as when occupational therapists submit a report about it. The reduction or absence of fatigue after completing a rehabilitation cycle is often attributed to reduced pain, improved motor performance, increased mobility, stronger muscle strength and improved general condition of patients. Although fatigue is present and represents one of the basic guidelines in the dosage of the therapeutic load, and is also an indicator of a general change in condition, there is a noticeable lack of standardized instruments for assessment and self-assessment that deal exclusively with fatigue at the beginning, during and after the treatment. Tests and methods for assessing fatigue can, apart from a guide in dosing, also help in monitoring overall progress and complete existing medical documentation. Aim of the review article is to present certain tests that can be used as a supplement to occupational therapy documentation with the purpose of a more complete understanding of the impact of fatigue on patients living with chronic diseases and/or conditions. Review of available literature from Pub Med and Google Scholar databases.

Key words: fatigue, assessment, chronic rheumatic and neurological diseases and conditions, occupational therapy

PRIMJENA TERAPIJE IGROM U RADNOJ TERAPIJI

Dragana Davidović¹, Dubravka Šimunović², Dijana Laštro³

¹Institut za fizikalnu medicinu, rehabilitaciju i ortopedsku hirurgiju “Dr Miroslav Zotović”, Banja Luka, Bosna i Hercegovina,

²Zdravstveno veleučilište Zagreb, Zagreb, Hrvatska,

³Univerzitet u Banjoj Luci, Medicinski fakultet, Banja Luka, Republika Srpska, Bosna i Hercegovina

Sažetak. Igra predstavlja osnovnu okupaciju djeteta i prirodan način učenja, komunikacije i interakcije sa okruženjem. Kroz igru djeteta razvija motoričke, kognitivne, emocionalne i socijalne sposobnosti, stiče iskustva i usvaja vještine značajne za svakodnevno funkcionisanje. Kod djece sa razvojnim teškoćama, traumatskim iskustvima, hroničnim oboljenjima ili drugim izazovima, igra dobija dodatni značaj kao terapijski medij koji omogućava izražavanje emocija, razvoj adaptivnih obrazaca ponašanja i unapređenje participacije u svakodnevnim aktivnostima. U radnoj terapiji terapija igrom predstavlja strukturisan i ciljno usmjeren pristup koji koristi djetetovu prirodnu motivaciju za igru u ostvarivanju terapijskih ciljeva. Cilj rada bio je prikazati značaj i mogućnosti primjene terapije igrom u radnoj terapiji djece, sa osvrtom na njenu ulogu u unapređenju funkcionalnih sposobnosti, okupacionih performansi i kvaliteta života djeteta. Rad je koncipiran kao pregledni rad zasnovan na analizi relevantne domaće i strane stručne i naučne literature iz oblasti terapije igrom, radne terapije i pedijatrijske rehabilitacije. Pregled literature ukazuje da terapija igrom doprinosi razvoju motoričkih, senzomotornih, kognitivnih, emocionalnih i socijalnih vještina, unapređuje komunikaciju, emocionalnu regulaciju, samostalnost i aktivno učešće djeteta u svakodnevnim aktivnostima. Primjena terapije igrom omogućava radnom terapeutu procjenu djetetovih sposobnosti, interesovanja i nivoa uključenosti u igru, što predstavlja osnovu za planiranje individualizovanih terapijskih intervencija. Posebna vrijednost ovog pristupa ogleda se u mogućnosti prilagođavanja aktivnosti djetetovim potrebama i sposobnostima, čime se povećava motivacija za terapijski proces i ostvarivanje funkcionalnih ciljeva. Na osnovu analizirane literature može se zaključiti da terapija igrom predstavlja značajan terapijski pristup u savremenoj pedijatrijskoj radnoj terapiji. Njena planska i razvojno prilagođena primjena omogućava unapređenje funkcionalnih sposobnosti, participacije i kvaliteta života djece, zbog čega zauzima važno mjesto u rehabilitacionoj praksi.

Ključne riječi: terapija igrom, radna terapija, pedijatrija.

APPLICATION OF PLAY THERAPY IN OCCUPATIONAL THERAPY

Dragana Davidović¹, Dubravka Šimunović², Dijana Laštro³

¹ Institute for Physical Medicine, Rehabilitation and Orthopaedic Surgery “Dr Miroslav Zotović”, Banja Luka, Bosnia and Herzegovina

² University of Applied Health Sciences, Zagreb, Croatia

³ University of Banja Luka, Faculty of Medicine, Banja Luka, Republika Srpska, Bosnia and Herzegovina

Abstract. Play is a child's primary occupation and a natural means of learning, communication, and interaction with the environment. Through play, children develop motor, cognitive, emotional, and social skills, gain experiences, and acquire abilities essential for everyday functioning. In children with developmental disabilities, traumatic experiences, chronic illnesses, or other challenges, play assumes an additional therapeutic role as a medium that facilitates emotional expression, promotes adaptive behavioural patterns, and enhances participation in everyday activities. In occupational therapy, play therapy is a structured and goal-oriented intervention that utilizes the child's natural motivation for play to achieve therapeutic goals. The aim of this paper was to present the significance and potential applications of play therapy in pediatric occupational therapy, with particular emphasis on its role in improving functional abilities, occupational performance, and quality of life. This paper was designed as a narrative review based on the analysis of relevant national and international scientific and professional literature in the fields of play therapy, occupational therapy, and pediatric rehabilitation. The reviewed literature indicates that play therapy contributes to the development of motor, sensorimotor, cognitive, emotional, and social skills, while improving communication, emotional regulation, independence, and active participation in everyday activities. Furthermore, the application of play therapy enables occupational therapists to assess children's abilities, interests, and level of engagement in play, providing the basis for planning individualized therapeutic interventions. An important advantage of this approach is its flexibility in adapting activities to each child's individual needs and abilities, thereby increasing motivation for therapy and facilitating the achievement of functional goals. Based on the reviewed literature, it can be concluded that play therapy represents a valuable therapeutic approach in contemporary pediatric occupational therapy. Its planned, individualized, and developmentally appropriate application contributes to improved functional abilities, occupational participation, and quality of life in children, making it an important component of modern rehabilitation practice.

Keywords: play therapy; occupational therapy; pediatrics

ROBOTSKI POTPOMOGNUT TRENING KAO RADNOTERAPIJSKI MODALITET U TRETMANU DJECE SA LEZIJOM PLEKSUS BRACHIALISA

Aleksandar Lužija¹ Dijana Laštro²

¹Institut za fizikalnu medicinu, rehabilitaciju i ortopediju hirurgiju "Dr. Miroslav Zotović" Banja Luka, Republika Srpska, Bosna i Hercegovina,

²Univerzitet u Banjoj Luci, Medicinski fakultet, Banja Luka, Republika Srpska, Bosna i Hercegovina

Sažetak. Robotski asistiran trening (RAT) omogućava preciznu kontrolu pokreta, ponavljanje pokreta u velikom broju, pruža motivaciju i povratne informacije korisnicima, kao i smanjenje rizika od povreda. Cilj istraživanja je prikazati uticaj robotski potpomognutog treninga kao modalitet u radnoterapijskoj praksi u procesu osposobljavanja djece sa paralizom plexus brachialis. Case study je provedena na uzorku od 2 ispitanika s dijagnozom „Paresis plexus brachialis“. Kod ispitanika je primijenjen RAT pet puta sedmično tokom 4 nedelje na Armeo Spring Pediatric uređaju u trajanju od 30 minuta na zahvaćenom ekstremitetu i 60 minuta individualnog programa radne terapije za povećanje stepena samostalnosti i učestvovanja u aktivnostima svakodnevnog života sa elementima Bobath koncepta. Za potrebe istraživanja korišten je metod objektivnog mjerenja uz pomoć uređaja Armeo Spring Pediatric Hocoma, dinamometrija (GMS) i standardizovane testove Canadian Occupational Performance Measure (COMP), Bartel Indeks (BI). Nakon provedenog terapijskog postupka, oba ispitanika (PS1 i PS2) imaju bolju pokretljivost u A-ROM projekciji u svim segmentima desnog gornjeg ekstremiteta. A-MOV projekcija je pokazala veći obim putanje kod oba ispitanika u desnom gornjem ekstremitetu u sve tri ravni i bolju fluidnost pokreta. Kod oba ispitanika A-GOL je verifikovao poboljšanje koordinacije, kraći omjer putanje ruke, manje odstupanje i nestabilnost u radnom prostoru. Vrijednost GMS PS1 (D-5/7 kg i L-10/10 kg), dok je kod PS2 promjenjena bila značajna na obe strane (L-26/27 i D-23/26 kg). Vrijednosti BI kod PS1 inicijalni (BI-94) i finalni (BI-94) i PS2 inicijalni (BI-98) i finalni (BI-98), se nisu značajno promijenile. Promjena je značajna u prosječnim vrijednostima okupacija na kraju tretmana (COPM) kod PS1 izvođenje ($p=1,0$) i zadovoljstvo ($p=1,0$) i PS2 izvođenje ($p=0,75$) i zadovoljstvo ($p=1,0$). Robotski potpomognut trening u kombinaciji sa konvencionalnim programom radne terapije je doveo do značajnog poboljšanja funkcionalnih kapaciteta gornjih ekstremiteta, a samim tim i olakšao izvođenje svakodnevnih životnih aktivnosti.

Ključne riječi: robotski asistiran trening, radna terapija, aktivnosti svakodnevnog života

ROBOT-ASSISTED TRAINING AS AN OCCUPATIONAL THERAPY MODALITY IN THE TREATMENT OF CHILDREN WITH BRACHIALIS PLEXUS LESIONS

Aleksandar Lužija¹ Dijana Laštro²

¹Institute for Physical Medicine, Rehabilitation and Orthopaedic Surgery "Dr Miroslav Zotović", Banja Luka, Bosnia and Herzegovina,

²University of Banja Luka, Faculty of Medicine, Banja Luka, Republika Srpska, Bosnia and Herzegovina

Abstract. Robot-assisted training (RAT) enables precise control of movements, repetition of movements in large numbers, provides motivation and feedback to users, as well as reducing the risk of injuries. The goal of the research is to show the impact of robot-assisted training as a modality in occupational therapy practice in the process of training children with brachial plexus paralysis. Subjects and methods: The case study was conducted on a sample of 2 subjects diagnosed with "Paresis plexus brachialis". In the subjects, RAT was applied five times a week for 4 weeks on the Armeo Spring Pediatric device for 30 minutes on the affected extremity and 60 minutes of an individual occupational therapy program to increase the degree of independence and participation in activities of daily life with elements of the Bobath concept. For the purposes of the research, an objective measurement method was used with the help of the Armeo Spring Pediatric Hocoma device, dynamometry (GMS) and standardized tests Canadian Occupational Performance Measure (COMP), Bartel Index (BI). Results: After the therapeutic procedure, both subjects (PS1 and PS2) have better mobility in the A-ROM projection in all segments of the right upper extremity. A-MOV projection showed a greater volume of the path in both subjects in the right upper extremity in all three planes and better fluidity of movement. In both subjects, A-GOL verified the improvement of coordination, a shorter arm path ratio, less deviation and instability in the workspace. The value of GMS PS1 (D-5/7 kg and L-10/10 kg), while the PS2 changed significantly on both sides (L-26/27 and D-23/26 kg). BI values at PS1 initial (BI-94) and final (BI-94) and PS2 initial (BI-98) and final (BI-98) did not change significantly. The change is significant in the average values of occupations at the end of treatment (COPM) in PS1 performance ($p=1.0$) and satisfaction ($p=1.0$) and PS2 performance ($p=0.75$) and satisfaction ($p=1.0$). Conclusion: Robot-assisted training in combination with a conventional occupational therapy program led to a significant improvement in the functional capacities of the upper extremities, and thus facilitated the performance of daily life activities.

Keywords: robot-assisted training, occupational therapy, activities of daily life

PRIMENA VEŠTAČKE INTELIGENCIJE U KINEZITERAPIJI

Sladana Arsić¹

¹Akademija vaspitačko medicinskih strukovnih studija Kruševac, Odsek
madicinskih studija Čuprija, Republika Srbija

Sažetak. Kineziterapija je veoma važan proces u funkcionalnom oporavku i rehabilitaciji pacijenata. Primenom kineziterapije pacijenti postižu visok stepen oporavka svojih fizičkih i funkcionalnih sposobnosti. Poslednjih godina, napredak tehnologija i veštačke inteligencije (VI) dovodi do značajnih promena u ovoj oblasti. Algoritmi veštačke inteligencije analiziraju podatke o funkcionalnom statusu pacijenata, uključujući i postojeću dijagnozu, kako bi obezbedili bržu i precizniju terapiju. Uloga veštačke inteligencije zasnovana je na kreiranju personalizovanih programa vežbi. Postojeće tehnologije i senzori prate pokrete pacijenata, mišićnu aktivnost i proces oporavka u realnom vremenu. Osim toga, veštačka inteligencija i u toku same aktivnosti pacijenata, analizira podatke koje prati i fizioterapeutima optimizuje preporuke za vežbanje. Robotizovani sistemi podrške i virtuelna realnost omogućavaju pacijentima izvođenje kineziterapijskih vežbi u kontrolisanom okruženju. Integracija VI sa ovim tehnologijama ubrzava motoričko učenje i poboljšava preciznost pokreta. Analizom podataka o efikasnosti kineziterapije i efektima postignuća, veštačka inteligencija može unapred predvideti rizike i raditi na smanjenja verovatnoće njihovog nastanka. Ona može biti korisna, samo ako se ispravno koristi. Na taj način uz iskustvo i znanje fizioterapeuta i pomoć velikog broja informacija sa kojim veštačka inteligencija raspolaže, pacijent se bolje analizira i pronalazi se odgovarajući tretman. Veštačka inteligencija u kineziterapiji menja način oporavka kroz analizu pokreta, praćenje napretka i personalizovane vežbe. Kamere i senzori prate telo i greške u hodu ili vežbanju. Zato je veoma korisna kod vežbi koordinacije, balansa, ravnoteže, jačanja mišića, kontrolu bola i svih aktivnih pokreta. Međutim, pored navedenih prednosti, veštačka inteligencija ima i svojih ograničenja, nema toplog ljudskog dodira i stručne ruke terapeuta. Iz tih razloga ne može se koristiti za primenu pasivnih pokreta i tehnika, kao i tehnika manipulacije i mobilizacije. Ipak, primena veštačke inteligencije u rehabilitaciji je sve prisutnija. S obzirom da se javljaju različite nove mogućnosti, veoma je važno osigurati efikasno i bezbedno korišćenje ovih tehnologija.

Ključne reči: veštačka inteligencija, kineziterapija, savremene tehnologije, analiza podataka

APPLICATION OF ARTIFIICAL INTELLIGENCE IN KINESITHERAPY

Sladana Arsić¹

¹The Academy of Applied Preschool Teaching and Health Studies, Department of medical studies Čuprija, Republic of Serbia

Abstract. Kinesitherapy is a very important process in the functional recovery and rehabilitation of patients. By applying kinesitherapy, patients achieve a high degree of recovery of their physical and functional abilities. In recent years, advances in technology and artificial intelligence (AI) have led to significant changes in this field. Artificial intelligence algorithms analyze data on patients' functional status, including existing diagnoses, to provide faster and more accurate therapy. The role of artificial intelligence is based on the creation of personalized exercise programs. Existing technologies and sensors monitor patient movements, muscle activity and the recovery process in real time. In addition, artificial intelligence analyzes the data it monitors during the patient's activity and optimizes exercise recommendations for physiotherapists. Robotic support systems and virtual reality allow patients to perform kinesitherapy exercises in a controlled environment. Integrating AI with these technologies accelerates motor learning and improves movement precision. By analyzing data on the effectiveness of kinesitherapy and the effects of achievement, artificial intelligence can predict risks in advance and work to reduce the likelihood of their occurrence. It can only be useful if used correctly. In this way, with the experience and knowledge of the physiotherapist and the help of the large amount of information that artificial intelligence has at its disposal, the patient is better analyzed and the appropriate treatment is found. Artificial intelligence in kinesitherapy is changing the way of recovery through movement analysis, progress monitoring and personalized exercises. Cameras and sensors monitor the body and errors in walking or exercising. That is why it is very useful for coordination, balance, balance, muscle strengthening, pain control and all active movements exercises. However, in addition to the above advantages, artificial intelligence has its limitations, there is no warm human touch and the expert hand of a therapist. For these reasons, it cannot be used for the application of passive movements and techniques, as well as manipulation and mobilization techniques. However, the application of artificial intelligence in rehabilitation is increasingly present. As various new possibilities arise, it is very important to ensure the efficient and safe use of these technologies.

Keywords: artificial intelligence, kinesitherapy, modern technologies, data analysis

ZNAČAJ PLANINARENJA U OČUVANJU FIZIČKOG I MENTALNOG ZDRAVLJA I UNAPREĐENJU KVALITETA ŽIVOTA

Lidija Slunjski Tišma¹, Aleksandar Tišma², Marko Sarić³

¹ JU Visoka medicinska škola Prijedor, Nikole Pašića 4a, Prijedor,
Bosna i Hercegovina

² Bolnica za fizikalnu medicinu i rehabilitaciju „Mlječanica”, Republika Srpska,
Bosna i Hercegovina

³ Ministarstvo odbrane Bosne i Hercegovine, Hamdije Kreševljakovića 98,
Sarajevo, Bosna i Hercegovina

Sažetak. Savremeni urbani i sedenterni način života, uz svakodnevnu izloženost različitim stresorima, predstavlja značajan faktor rizika za narušavanje zdravlja pojedinca i društva u cjelini. Planinarenje, kao oblik fizičke aktivnosti na otvorenom, podrazumijeva kretanje po planinskim i brdskim predjelima i predstavlja jedan od prirodnih i pristupačnih oblika rekreacije. Cilj ovog preglednog rada je prikazati značaj i prednosti planinarenja, sa posebnim osvrtom na njegove efekte na fizičko i mentalno zdravlje, kao i na kvalitet života. Pretraga literature obavljena je u bazama podataka PubMed i Google Scholar, korištenjem ključnih riječi: planinarenje, fizičko zdravlje, mentalno zdravlje i kvalitet života. Analizirani su radovi objavljeni u periodu od 2020. do 2025. godine. Pregledom dostupne literature utvrđuju se brojni pozitivni efekti planinarenja na različite aspekte fizičkog zdravlja, uključujući funkciju kardiovaskularnog, lokomotornog, endokrinog i imunološkog sistema. U kontekstu mentalnog zdravlja, planinarenje se povezuje sa smanjenjem stresa, poboljšanjem raspoloženja, povećanjem osjećaja mira i emocionalne stabilnosti. Boravak u prirodnom okruženju i planinarenje kao oblik slobodne aktivnosti mogu imati značajnu ulogu u unapređenju zdravlja i kvaliteta života osoba različitih starosnih grupa. Stoga planinarenje može predstavljati značajan element preventivnih i rehabilitacionih programa, uz stručni nadzor i primjenu odgovarajućih mjera sigurnosti.

Ključne riječi: planinarenje, fizičko zdravlje, mentalno zdravlje, kvalitet života

THE IMPORTANCE OF HIKING IN MAINTAINING PHYSICAL AND MENTAL HEALTH AND IMPROVING QUALITY OF LIFE

Lidija Slunjski Tišma¹, Aleksandar Tišma², Marko Sarić³

¹ College of Health Sciences Prijedor, Nikole Pašića 4A, Prijedor
Bosnia and Herzegovina

²Hospital for Physical Medicine and Rehabilitation "Mlječanica", Republic of
Srpska, Bosnia and Herzegovina

³Ministry of Defense of Bosnia and Herzegovina, Hamdije Kreševljakovića 98,
Sarajevo, Bosnia and Herzegovina

Abstract. The modern urban and sedentary lifestyle, together with daily exposure to various stressors, represents a significant risk factor for impaired individual and public health. Hiking, as a form of outdoor physical activity, involves walking through mountainous and hilly areas and represents one of the most natural and accessible forms of recreation. The aim of this review paper is to present the importance and benefits of hiking, with particular emphasis on its effects on physical and mental health, as well as quality of life. A literature search was conducted in the PubMed and Google Scholar databases using the following keywords: hiking, physical health, mental health, and quality of life. Studies published between 2020 and 2025 were analyzed. The review of the available literature indicates numerous positive effects of hiking on various aspects of physical health, including the functioning of the cardiovascular, musculoskeletal, endocrine, and immune systems. In terms of mental health, hiking is associated with stress reduction, improved mood, increased feelings of peace, and emotional stability. Spending time in natural environments and engaging in hiking as a form of leisure activity may play an important role in promoting health and improving the quality of life among people of different age groups. Therefore, hiking may represent an important component of preventive and rehabilitation programs, provided that professional supervision is ensured and appropriate safety measures are followed.

Key words: hiking, physical health, mental health, quality of life

OBRNUTA UČIONICA KAO NASTAVNI KONCEPT U BIOMEDICINSKOM OBRAZOVANJU

Siniša Ristić¹, Ilija Stijepić², Nebojša Mitrović³

¹Medicinski fakultet Foča, Univerzitet u Istočnom Sarajevu, Studentska 5,
Republika Srpska, Bosna i Hercegovina

²JU Visoka medicinska škola Prijedor, Nikole Pašića 4a Republika Srpska,
Bosna i Hercegovina

³Pedagoški fakultet Bijeljina, Semberskih ratara 1E, Republika Srpska,
Bosna i Hercegovina

Sažetak. Obrnuta učionica (Flipped Classroom) predstavlja obrazovni pristup usmjeren na studenta koji mijenja tradicionalni redoslijed nastavnih aktivnosti i procesa učenja. U ovom modelu studenti usvajaju osnovna znanja prije nastave putem digitalnih resursa kao što su video-predavanja, stručna literatura, podcasti i interaktivni materijali za učenje, dok je vrijeme provedeno u učionici posvećeno aktivnim strategijama učenja, uključujući učenje zasnovano na problemima, timsko učenje, diskusije o slučajevima, simulacije i zajedničko rješavanje problema. Sve veća složenost biomedicinskih nauka i potreba za razvojem kognitivnih vještina višeg reda doprinijeli su sve široj primjeni modela obrnute učionice u dodiplomskom i postdiplomskom biomedicinskom obrazovanju. Ovaj obrazovni pristup zasniva se na konstruktivističkoj teoriji učenja i podstiče angažovanost studenata, samostalno učenje, kritičko razmišljanje, kliničko rasuđivanje, komunikacijske vještine i dugotrajnije zadržavanje znanja. Brojna istraživanja pokazala su da primjena obrnute učionice može unaprijediti zadovoljstvo studenata, akademski uspjeh, motivaciju i spremnost za kliničku praksu u poređenju s tradicionalnom nastavom zasnovanom na predavanjima. Nadalje, integracija digitalnih tehnologija, sistema za upravljanje učenjem, alata zasnovanih na vještačkoj inteligenciji i multimedijalnih obrazovnih resursa proširila je mogućnosti za personalizovana i adaptivna iskustva učenja. Uprkos svojim prednostima, uspješna implementacija obrnute učionice zahtijeva pažljivo planiranje nastavnog procesa, kontinuirano stručno usavršavanje nastavnika, odgovarajuću tehnološku infrastrukturu i spremnost studenata za samostalno učenje. Izazovi mogu uključivati povećano vrijeme potrebno za pripremu, nejednak pristup digitalnim resursima te otpor prema promjenama ustaljenih obrazovnih praksi. Obrnuta učionica se pokazala kao obećavajuća pedagoška strategija u biomedicinskom obrazovanju, usklađena sa savremenim kurikulumima zasnovanim na kompetencijama i zahtjevima modernih zdravstvenih profesija. Buduća istraživanja trebala bi biti usmjerena na dugoročne obrazovne ishode, optimizaciju nastavnog dizajna i integraciju novih tehnologija kako bi se maksimalno povećala efikasnost ovog inovativnog modela nastave.

Ključne riječi: izvrnuta učionica, biomedicinska edukacija, medicinska edukacija, aktivno učenje, studentski usmjerena nastava, kompetencijsko obrazovanje

FLIPPED CLASSROOM AS A TEACHING CONCEPT IN BIOMEDICAL EDUCATION

Siniša Ristić¹, Ilija Stijepić², Nebojša Mitrović³

¹Faculty of Medicine, Foča, University of East Sarajevo, Studentska 5, Republika Srpska, Bosnia and Herzegovina

³PI College of Health Sciences Prijedor, Nikole Pašića 4a, Republic of Srpska, Bosnia and Herzegovina

³Faculty of Pedagogy Bijeljina, Semberskih ratara 1E, Republika Srpska, Bosnia and Herzegovina

Abstract. The flipped classroom represents a student-centered educational approach that reverses the traditional sequence of teaching and learning activities. In this model, students acquire foundational knowledge before class through digital resources such as video lectures, readings, podcasts, and interactive learning materials, while classroom time is dedicated to active learning strategies, including problem-based learning, team-based learning, case discussions, simulations, and collaborative problem-solving. The growing complexity of biomedical sciences and the need to develop higher-order cognitive skills have contributed to the increasing adoption of the flipped classroom model in undergraduate and postgraduate biomedical education. This educational approach is grounded in constructivist learning theory and promotes learner engagement, self-directed learning, critical thinking, clinical reasoning, communication skills, and knowledge retention. Numerous studies have demonstrated that flipped classroom interventions can improve student satisfaction, academic performance, motivation, and preparedness for clinical practice when compared with traditional lecture-based instruction. Furthermore, the integration of digital technologies, learning management systems, artificial intelligence tools, and multimedia educational resources has expanded the possibilities for personalized and adaptive learning experiences. Despite its advantages, successful implementation of the flipped classroom requires careful instructional design, faculty development, technological infrastructure, and student readiness for independent learning. Challenges may include increased preparation time, unequal access to digital resources, and resistance to changes in established educational practices. The flipped classroom has emerged as a promising pedagogical strategy for biomedical education, aligning with contemporary competency-based curricula and the demands of modern healthcare professions. Future research should focus on long-term educational outcomes, optimization of instructional design, and the integration of emerging technologies to maximize the effectiveness of this innovative teaching model.

Key words: flipped classroom; biomedical education; medical education; active learning; student-centered learning; competency-based education

**UNIVERZALNI DIZAJN I DOBROBIT U RADNOM OKRUŽENJU
KANCELARIJSKIH RADNIKA
(prezentacija projekta NOO ULTRA)**

Alenka Plemelj Mohorič¹, Nevenka Gričarč¹ Mateja Dovjak²

¹Univerzitet u Ljubljani, Fakultet zdravstvenih nauka, Ljubljana, Slovenija

²Univerzitet u Ljubljani, Slovenija, Fakultet za građevinarstvo i geodeziju

Sažetak. U okviru projekta NOO ULTRA (Univerzitet u Ljubljani za održivo društvo) –Demonstracijski centar, obnovljeni su nastavni planovi i programi studijskih programa visokog obrazovanja. Uveden je novi kurs, Univerzalno dizajnirane održive i zelene zgrade za zdravlje i dobrobit. Kao dio zadataka kursnog projekta, studenti su proveli dvije pilot studije. Cilj studija bio je analizirati radno okruženje kancelarijskih radnika zaposlenih u javnim ustanovama i, na osnovu nalaza, razviti konceptualni dizajn kancelarijskog okruženja orijentisanog na dobrobit. Aktivnosti su obuhvatale sljedeće korake: 1. Objektivna i subjektivna procjena kvaliteta unutrašnjeg okruženja na radnom mjestu u saradnji sa zaposlenima; 2. Dizajniranje modifikacija sjedilačkih radnih stanica, s naglaskom na održavanje zdravlja i dobrobiti; 3. Mjerenje sjedilačkog ponašanja prije i nakon implementacije predloženih promjena; 4. Primjena ergonomskih principa u dizajnu modifikacija radnog okruženja; 5. Implementacija strategija za smanjenje sjedilačkog ponašanja, uključujući aktivne pauze, podsjetnike i edukaciju; 6. Razmatranje važnosti senzornih inputa na radnom mjestu; 7. Obavljanje aktivnosti opuštanja. Mjerenja odabranih parametara kvalitete unutrašnjeg okoliša nisu premašila propisane regulatorne granice i ostala su unutar preporučenih vrijednosti. Mjerenja sjedilačkog ponašanja korištenjem activPAL uređaja pokazala su da se među zaposlenicima koji su sudjelovali u intervenciji koja je kombinirala bihevioralne upute i stol podesiv po visini, prosječno trajanje sjedilačkog ponašanja smanjilo. Također su procijenjeni senzorni profili zaposlenika i njihovi odgovori na odabrane senzorne strategije. Kroz iskustveno učenje, zaposlenici su stekli veću svijest i razumijevanje senzornih strategija koje im mogu pomoći u regulaciji optimalnog nivoa uzbuđenja, što je važno za obavljanje radnih zadataka. Na temelju nalaza iz prethodnih koraka, studenti su razvili konceptualni dizajn za ured orijentiran na dobrobit i namjenski prostor za pauzu i opuštanje. Konceptualni dizajn uključivao je visokokvalitetno prirodno dnevno svjetlo i mjere za sprječavanje pregrijavanja, aktivni sistem ventilacije i ovlaživanje zraka, akustičnu zaštitu i odgovarajuću prostornu akustiku, toplinsku udobnost, unutarnje zelenilo, stolove podesive po visini, strategije koje potiču kretanje i ergonomsku opremu za rad na računaru. Dva projektna zadatka pokazuju značajan potencijal za daljnja istraživanja i za razvoj pristupa zasnovanih na dokazima za promociju dobrobiti zaposlenih, održavanje zdravlja i poboljšanje kvaliteta radnog okruženja.

Ključne riječi: radno okruženje, kancelarijski radnici, sjedilačko ponašanje, senzorni profil

**UNIVERSALLY DESIGNED SUSTAINABLE AND GREEN
BUILDINGS FOR HEALTH AND WELL
(presentation of the NOO ULTRA project)**

Alenka Plemelj Mohorič¹, Nevenka Gričarč¹ Mateja Dovjak²

¹University of Ljubljana, Faculty of Health Sciences, Ljubljana, Slovenia

²University of Ljubljana Slovenia, Faculty of Civil and Geodetic Engineering

Abstract. Within the NOO ULTRA project (University of Ljubljana for a Sustainable Society) –Demonstration Centre, the curricula of higher education study programmes were renewed. A new course, Universally Designed Sustainable and Green Buildings for Health and Well-being, was introduced. As part of the course project assignments, students conducted two pilot studies. The aim of the studies was to analyse the work environment of office workers employed in public institutions and, based on the findings, to develop a conceptual design of a well-being-oriented office environment. The activities comprised the following steps: 1. Objective and subjective assessment of indoor environmental quality in the workplace in collaboration with employees; 2. Design of modifications to sedentary workstations, with an emphasis on maintaining health and well-being; 3. Measurement of sedentary behaviour before and after the implementation of the proposed changes; 4. Application of ergonomic principles in the design of modifications to the work environment; 5. Implementation of strategies to reduce sedentary behaviour, including active breaks, reminders, and education; 6. Consideration of the importance of sensory input in the workplace; 7. Performing relaxation activities. Measurements of selected indoor environmental quality parameters did not exceed the prescribed regulatory limits and remained within the recommended values. Measurements of sedentary behavior using the activPAL device showed that, among employees who participated in an intervention combining behavioural prompts and a height-adjustable desk, the average duration of sedentary behaviour decreased. Employees' sensory profiles and their responses to selected sensory strategies were also assessed. Through experiential learning, employees gained greater awareness and understanding of sensory strategies that may assist them in regulating their optimal level of arousal, which is important for performance of work-related tasks. Based on the findings from the preceding steps, students developed a conceptual design for a well-being-oriented office and a dedicated break and relaxation space. The conceptual design incorporated high-quality natural daylighting and measures to prevent overheating, an active ventilation system and air humidification, acoustic protection and appropriate spatial acoustics, thermal comfort, indoor greenery, height-adjustable desks, movement-promoting strategies, and ergonomic equipment for computer-based work. The two project assignments demonstrate considerable potential for further research and for the development of evidence-based approaches to promoting employee well-being, maintaining health, and improving the quality of work environments.

Key words: work environment, office workers, sedentary behaviour, sensory profile

**SPOLJAŠNJI FAKTORI I
PREVENCIJA RIZIKA PO
ZDRAVLJE LJUDI**

**EXTERNAL FACTORS AND
PREVENTION OF RISKS TO
HUMAN HEALTH**

PRIMJENA VJEŠTAČKE INTELIGENCIJE U OBRAZOVANJU ZDRAVSTVENIH PROFESIONALACA

Igor Grujić¹, Ilija Stijepić¹

¹Visoka medicinska škola Prijedor, Nikole Pašića 4A, 79202 Prijedor, Republika
Srpska, Bosna i Hercegovina

Sažetak. Veliki broj zdravstvenih organizacija u svijetu već implementira vještačku inteligenciju (AI) za istraživanje, pružanje njege i razvoj politike u zdravstvu. To nameće potrebu da studenti zdravstvenih fakulteta tokom studiranja steknu znanje i vještinu korištenja AI u budućem profesionalnom radu. Cilj ovog istraživanja je analiza potreba i nastojanje visokoškolskih ustanova da nastavnicima i studentima omoguće korištenje AI u redovnim aktivnostima i da se utvrdi stepen unapređenja metoda obrazovanja i podizanja nivoa znanja studenata zdravstvenih nauka. Pored vlastitog iskustva u ovoj oblasti, analizom više publikovanih radova autori su stekli uvid u iskustvo drugih visokoškolskih ustanova na uvođenju AI u rad sa studentima. Posebna pažnja je posvećena korištenju AI u redovnim obrazovnim aktivnostima, te uticaj na unapređenje istraživanja nastavnika i studenata. U radu se prate oblasti primjene i alati vještačke inteligencije koji su dozvoljeni ili mogu biti dozvoljeni za ove svrhe. U radu je dat pregled prednosti i prepreka za korištenje AI u postojećem okruženju. Da bi se podstaklo usvajanje AI među nastavnicima, potrebno je da se nova tehnologija percipira kao korisna i jednostavna (za poboljšanje nastave i učenja, provođenje provjere znanja i povratnih informacija, te za podršku administraciji i upravljanju nastavnim procesom). AI ima ogroman potencijal za budućnost obrazovanja zdravstvenih radnika i njege pacijenata, ali zahtijeva da se riješe tehničke, etičke i druge prepreke vezane za implementaciju, koje vode do bezbjedne i efikasne njege. Usvajanje AI potrebno je kako bi se studentima pomoglo da steknu digitalnu pismenost, kritičko razmišljanje, kreativnost i vještine rješavanja problema. Da bi se razvio specifičan i empirijski zasnovan okvir implementacije AI, potrebna su dalja istraživanja o aspektima jedinstvenim za implementaciju AI u visokom obrazovanju zdravstvenih radnika, kao što su izgradnja povjerenja, rješavanje pitanja transparentnosti, razvoj objašnjivih i interpretativnih rješenja i rješavanje etičkih pitanja u vezi sa privatnošću i zaštitom podataka.

Ključne riječi: Vještačka inteligencija, visoko obrazovanje, zdravstvene nauke, nastavnici, studenti

APPLICATION OF ARTIFICIAL INTELLIGENCE IN THE EDUCATION OF HEALTH PROFESSIONALS

Igor Grujić¹, Ilija Stijepić¹

¹College of Health Sciences Prijedor, Nikole Pašića 4A, 79202 Prijedor, Republic of
Srpska, Bosnia and Herzegovina

Abstract. A large number of healthcare organizations around the world are already implementing artificial intelligence (AI) for healthcare research, care delivery and policy development. This imposes the need for health faculty students to acquire the knowledge and skills of using AI in their future professional work during their studies. The goal of this research is to analyze the needs and efforts of higher education institutions to enable teachers and students to use AI in regular activities and to determine the degree of improvement of education methods and raising the level of knowledge of health science students. In addition to their own experience in this area, by analyzing several published works, the authors gained insight into the experience of other higher education institutions in introducing AI in work with students. Special attention is paid to the use of AI in regular educational activities, and the impact on the improvement of teachers and students research. The paper tracks the areas of application and tools of artificial intelligence that are permitted or may be permitted for these purposes. The paper provides an overview of the advantages and obstacles for the use of AI in the existing environment. In order to encourage the adoption of AI among teachers, it is necessary to perceive the new technology as useful and simple (for improving teaching and learning, conducting knowledge assessment and feedback, and for supporting the administration and management of the teaching process). AI has enormous potential for the future of healthcare education and patient care, but requires addressing technical, ethical, and other implementation barriers that lead to safe and effective care. Adoption of AI is needed to help students acquire digital literacy, critical thinking, creativity and problem-solving skills. In order to develop a specific and empirically based framework for AI implementation, further research is needed on aspects unique to the implementation of AI in higher education of healthcare professionals, such as building trust, addressing transparency issues, developing explainable and interpretable solutions, and addressing ethical issues related to privacy and data protection.

Keywords: Artificial intelligence, higher education, health sciences, teachers, students

PERCEPCIJA KULTURE BEZBJEDNOSTI HRANE MEĐU ZAPOSLENIMA U SLOVENAČKIM UGOSTITELJSKIM OBJEKTIMA: EKSPLOATIVNO ISTRAŽIVANJE PUTEM UPITNIKA

Mojca Jevšnik Podlesnik¹, Katja Senegačnik², Tomaž Langerholc²

¹University of Ljubljana, Faculty of Health Sciences, Zdravstvena pot 5, 1000
Ljubljana, Slovenija

²University of Maribor, Faculty of Agriculture and Life Sciences, Pivola 10,
2311 Hoče, Slovenia

Sažetak. Kultura sigurnosti hrane predstavlja važan dio šireg sistema osiguranja sigurnosti hrane zasnovanog na zakonodavstvu Evropske unije i smatra se ključnim faktorom za osiguranje zdravstveno ispravne hrane duž cijelog agroprehrambenog lanca. Primjena kulture sigurnosti hrane u ugostiteljskim objektima u Sloveniji još uvijek je nedovoljno istražena. Cilj ovog rada bio je procijeniti prikladnost anketnog upitnika za ocjenu kulture sigurnosti hrane i dobiti uvid u njenu primjenu među zaposlenima u ugostiteljskim objektima u Sloveniji. Također, cilj je bio prepoznati moguće nedostatke i prilike za unapređenje koje bi mogle doprinijeti većoj sigurnosti hrane i smanjenju rizika za potrošače. Anketni upitnik poslan je u 384 ugostiteljska objekta u Sloveniji, a prikupljen je 241 ispunjeni upitnik. Upitnik je obuhvatio pet elemenata kulture sigurnosti hrane: vođenje, komunikaciju, posvećenost i angažovanost, svijest i resurse. Svaki element sadržavao je pet ili šest tvrdnji koje su ispitanici ocjenjivali pomoću petostepene Likertove skale. Statistička analiza pokazala je da su dobijeni rezultati uglavnom uporedivi sa rezultatima prethodnih istraživanja, što ukazuje da je upitnik prikladan alat za procjenu kulture sigurnosti hrane u ugostiteljskim objektima. Rezultati su pokazali visok nivo kulture sigurnosti hrane među zaposlenima. Ipak, prepoznate su određene mogućnosti za unapređenje, uključujući veću upotrebu vizuelnih pomagala poput plakata i upozoravajućih znakova, uvođenje sistema priznanja i nagrađivanja zaposlenih od strane menadžmenta, kao i osiguravanje dovoljnog broja zaposlenih i dovoljno vremena za sigurno obavljanje poslova. Rezultati također ukazuju da bi kombinovanje kvantitativnih anketnih metoda sa kvalitativnim pristupima omogućilo sveobuhvatniju procjenu pojedinačnih elemenata kulture sigurnosti hrane.

Ključne riječi: kultura sigurnosti hrane, ugostiteljski objekti, sigurnost hrane, anketni upitnik, zaposleni

PERCEIVED FOOD SAFETY CULTURE AMONG EMPLOYEES IN SLOVENIAN FOOD SERVICE ESTABLISHMENTS: AN EXPLORATORY QUESTIONNAIRE STUDY

Mojca Jevšnik Podlesnik¹, Katja Senegačnik², Tomaž Langerholc²

¹University of Ljubljana, Faculty of Health Sciences, Zdravstvena pot 5, 1000 Ljubljana, Slovenia

²University of Maribor, Faculty of Agriculture and Life Sciences, Pivola 10, 2311 Hoče, Slovenia

Abstract. Food safety culture is an important component of the broader food safety assurance system established under European Union legislation and represents a key factor in ensuring safe food throughout the agri-food chain. The implementation of food safety culture in Slovenian food service establishments remains insufficiently explored. The aim of this study was to evaluate the suitability of a survey questionnaire for assessing food safety culture and to gain insight into its implementation among employees in food service establishments in Slovenia. The study also aimed to identify potential shortcomings and opportunities for improvement that could contribute to enhanced food safety and reduced risks for consumers. The survey questionnaire was distributed to 384 food service establishments in Slovenia, and 241 completed questionnaires were collected. The questionnaire assessed five elements of food safety culture: leadership, communication, commitment and engagement, awareness, and resources. Each element included five or six statements evaluated using a five-point Likert scale. Statistical analysis showed that the obtained results were largely comparable with findings from previous studies, indicating that the questionnaire represents a suitable tool for assessing food safety culture in food service establishments. The results demonstrated a generally high level of food safety among employees. Nevertheless, several areas for improvement were identified, including greater use of visual aids such as posters and warning signs, the implementation of employee recognition and reward systems by management, and ensuring sufficient staffing levels and adequate time for safe work performance. The findings also suggest that combining quantitative survey methods with qualitative approaches would provide a more comprehensive assessment of individual food safety culture elements.

Key words: food safety culture, food service establishments, food safety, survey questionnaire, employees

RAZVOJ I VALIDACIJA INTEGRISANOG PROGRAMA ČIŠĆENJA I DEZINFEKCIJE U FABRIKAMA PREHRAMBENE INDUSTRIJE

Radoslav Grujić¹, Milka Stijepić¹

¹JU Visoka medicinska škola, Prijedor, Republika Srpska, Bosnia and Herzegovina

Sažetak. Brojne opasnosti po bezbjednost hrane prisutne su u fabrikama prehrambene industrije. Različiti postupci čišćenja i dezinfekcije primjenjuju se za eliminisanje opasnosti i sprečavanje njihovog negativnog uticaja na hranu. Cilj ovog rada je razvoj integrisanog programa čišćenja i dezinfekcije u objektima za proizvodnju, preradu i skladištenje hrane, te validacije programa i praćenja efikasnosti primjenjenih postupaka. Sprečavanje mikrobiološke i hemijske kontaminacije može se postići razvojem efikasnih standardnih operativnih postupaka za sanitaciju (SSOP), implementacijom HACCP-a ili sličnog sistema upravljanja bezbjednošću hrane i standarda ISO 22000. U radu je dat opis ciljeva čišćenja i dezinfekcije površina u kontaktu sa hranom, prikazani su osnovni principi sanitarnog dizanja i na osnovu toga je razvijena SSOP. Posebna pažnja je posvećena rješavanju problema tokom čišćenja proteina, masti i ulja, skroba i polisaharida, te naslaga kamenca na površinama u kontaktu sa hranom. Program validacije programa čišćenja i dezinfekcije treba da potvrdi efikasnost u procesa zaštite prehrambenih proizvoda od kontaminacije i bezbjednih proizvoda. Prijedlog programa za validaciju operacija čišćenja i dezinfekcije hrane prikazan je na primjeru validacije programa za uklanjanje alergena u hrani. Validacija protokola čišćenja i dezinfekcije za standardne sisteme proizvodnje hrane treba se provoditi sa istim nivoom kontrole kao i za sisteme alergena. Tako se može osigurati da mikrobiološka kontaminacija ne predstavlja problem. Preporučuje se primjena HACCP program koji uključuje program validacije sa odgovarajućim testovima verifikacije. Provođenje i validacija integrisanog sistema čišćenja i dezinfekcije pogona za proizvodnju hrane su preduslov za osiguranje bezbjednosti prehrambenih proizvoda i ispunjenje strogih propisa i međunarodnih standarda

Ključne riječi: Proizvodnja hrane, integrisani program sanitacije, SSOP, HACCP, standardi, testovi verifikacije

DEVELOPMENT AND VALIDATION OF AN INTEGRATED CLEANING AND DISINFECTION PROGRAM IN FOOD INDUSTRY FACTORIES

Radoslav Grujić¹, Milka Stijepić¹

¹PI College of Health Sciences Prijedor, Republic of Srpska, Bosnia and
Herzegovina

Abstract. Many food safety hazards are present in food industry factories. Several cleaning and disinfection procedures are applied to eliminate hazards and prevent their negative impact on food. The goal of this paper is the development of an integrated cleaning and disinfection program in facilities for food production, processing and storage, as well as program validation and monitoring of the effectiveness of applied procedures. Prevention of microbiological and chemical contamination can be achieved by developing effective standard operating procedures for sanitation (SSOP), implementing HACCP or a similar food safety management system and the ISO 22000 standard. The paper describes the objectives of cleaning and disinfection of surfaces in contact with food, shows the basic principles of sanitation. SSOP was developed based on that. Special attention is paid to solving problems during the cleaning of proteins, fats and oils, starches and polysaccharides, and scale deposits on surfaces in contact with food. The validation program of the cleaning and disinfection program should confirm the effectiveness in the process of protecting food products from contamination and safe products. The proposed program for the validation of food cleaning and disinfection operations is shown on the example of the validation of the program for the removal of allergens in food. Validation of cleaning and disinfection protocols for standard food production systems should be performed with the same level of control as for allergen systems. Thus, it can be ensured that microbiological contamination is not a problem. It is recommended to implement a HACCP program that includes a validation program with appropriate verification tests. The implementation and validation of an integrated system of cleaning and disinfection of food production facilities are prerequisite for ensuring the safety of food products and meeting strict regulations and international standards.

Keywords: Food production, integrated sanitation program, SSOP, HACCP, standards, verification tests

BUĐUĆI PRAVCI RAZVOJA PROIZVODNJE I PRERADE HRANE I (IS)HRANE LJUDI

Radoslav Grujić¹

¹ JU Visoka medicinska škola Prijedor, Nikole Pašića 4a, Prijedor Republika Srpska, Bosna i Hercegovina

Sažetak. Ujedinjene nacije prognoziraju da će do 2025. godine broj stanovnika na planeti Zemlja dostići 9,7 milijardi. Potrebe za ljudskom hranom u tom periodu porašće za 50-70%, zavisno od vrste hrane. Traženje odgovora na pitanje „Kako osigurati proizvodnju dovoljne količine bezbjedne i nutritivno vrijedne hrane za cjelokupno stanovništvo“ predstavlja cilj ovog rada. Tokom pripreme teksta pretraženi su radovi sa futurističkom analizom, pri čemu je izvršen uvid u naučne baze Science Direct i Scopus. U radu su diskutovani savremeni pravci u razvoju novih prehrambenih proizvoda, proizvodnji i preradi hrane za ljude i životinje, pakovanju hrane, bezbjednosti i kvalitetu hrane i primjeni modernih digitalnih tehnologija u lancu snabdijevanja hranom. Iako inovativne tehnologije nude rješenja za brojne izazove u ovoj oblasti, njihova implementacija je prilično teška i zahtjevna. Savladavanje ovih izazova zahtijeva rješavanje troškova, kompatibilnosti, propisa i prihvatanja od strane potrošača. Budućnost proizvodnje hrane zavisiće od sposobnosti ljudi da se nose sa složenim izazovima, istovremeno iskorištavajući potencijal inovacija za stvaranje otpornijeg i održivijeg globalnog sistema.

Ključne riječi: hrana budućnosti, proizvodnja, prerada, pakovanje, bezbjednost i kvalitet, ICT u lancu snabdijevanja hranom

FUTURE DIRECTIONS OF DEVELOPMENT OF FOOD PRODUCTION AND PROCESSING AND HUMAN NUTRITION

Radoslav Grujić¹

¹PI College of Health Sciences Prijedor, Nikole Pašića 4A, Republic of Srpska, Bosnia and Herzegovina

Abstract: The United Nations predicts that by 2025 the number of people on planet Earth will reach 9.7 billion. The need for human food in that period will increase by 50-70%, depending on the type of food. The aim of this paper is to find an answer to the question "How to ensure the production of sufficient quantities of safe and nutritionally valuable food for the entire population". During the preparation of the text, papers with futuristic analysis were searched, and the scientific databases Science Direct and Scopus were consulted. The paper discusses contemporary directions in the development of new food products, production and processing of food and feed, food packaging, food safety and quality, and the application of modern digital technologies in the food supply chain. Although innovative technologies offer solutions to numerous challenges in this area, their implementation is quite difficult and demanding. Overcoming these challenges requires addressing costs, compatibility, regulations and consumer acceptance. The future of food production will depend on people's ability to cope with complex challenges, while harnessing the potential of innovation to create a more resilient and sustainable global system.

Keywords: food of the future, production, processing, packaging, safety and quality, ICT in the food supply chain

NOVI PREHRAMBENI TRENDOWI USMJERENI KA ODRŽIVOSTI: ULOGA PROTEINA, VLAKANA I PRIHVAĆENOSTI OD STRANE POTROŠAČA

Jovana Glušac¹, Milka Stijepić², Dragica Đurđević Milošević³, Nikolina Rajlić²

¹ProteinDistillery GmbH, Ostpreußenstraße 2/2, 73760 Ostfildern, Germany

²JU Visoka medicinska škola Prijedor, Nikole Pašića 4a, 71 000, Prijedor,
Republika Srpska, Bosna i Hercegovina

³Institut za hemiju, tehnologiju i mikrobiologiju Prokupačka 41, 11000 Beograd,
Republika Srbija

Sažetak. Industrija hrane trenutno prolazi kroz značajne promjene usmjerene ka razvoju inovativnih proizvoda koji odgovaraju kako nutritivnim potrebama stanovništva, tako i izazovima očuvanja životne sredine. Savremeni prehrambeni trendovi sve više su oblikovani rastućim zahtjevima za održivošću, upotrebom sastojaka sa pozitivnim uticajem na zdravlje te proizvodnim sistemima zasnovanim na efikasnom korištenju resursa. U tom kontekstu, alternativni izvori proteina, uključujući biljne i mikrobne proteine, kao i sastojke dobijene procesima fermentacije, izdvajaju se kao značajni pokretači inovacija u razvoju novih proizvoda. Istovremeno, sastojci bogati vlaknima, dobijeni iz žitarica, mahunarki, voća i recikliranih nusproizvoda prehrambene industrije, privlače sve veću pažnju zbog svojih funkcionalnih, nutritivnih i tehnološko-funkcionalnih svojstava. Integracija proteina i vlakana u nove prehrambene matrice omogućava razvoj proizvoda usklađenih sa savremenim zahtjevima potrošača za zdravijom i održivom ishranom. Međutim, pored nutritivne vrijednosti i uticaja na životnu sredinu, prihvatljivost od strane potrošača predstavlja ključni faktor tržišnog uspjeha. Senzorna svojstva, tekstura, ukus, prepoznatljivost proizvoda, cijena i povjerenje u tvrdnje o održivosti značajno utiču na kupovno ponašanje i dugoročnu prihvaćenost proizvoda. Aktuelni trendovi ukazuju na to da potrošači iskazuju veću spremnost za prihvatanje novih prehrambenih proizvoda kada su zdravstvene koristi i prednosti održivosti jasno predstavljene i podržane odgovarajućim senzornim kvalitetom. Ovaj pregledni rad daje osvrt na savremene prehrambene trendove, s posebnim naglaskom na inovacije zasnovane na održivosti, diverzifikaciju izvora proteina, strategije obogaćivanja vlaknima te ulogu prihvatljivosti potrošača u uspješnoj komercijalizaciji proizvoda. Buduća istraživanja treba da budu usmjerena na multidisciplinarne pristupe koji objedinjuju prehrambenu tehnologiju, procjenu održivosti i nauku o potrošačima, s ciljem ubrzanja tranzicije ka otpornijim prehrambenim sistemima.

Ključne riječi: prehrambeni trendovi; održivost; proteini; vlakna; prihvatljivost potrošača

NEW FOOD TRENDS TOWARD SUSTAINABILITY: THE ROLE OF PROTEIN, FIBER, AND CONSUMER ACCEPTANCE

Jovana Glušac¹, Milka Stijepić², Dragica Đurđević Milošević³, Nikolina Rajlić²

¹ProteinDistillery GmbH, Ostpreußenstraße 2/2, 73760 Ostfildern, Germany

²PI College of Health Science Prijedor, Nikole Pašića 4a, 71 000, Prijedor,
Republic of Srpska, Bosnia and Hercegovina

³Institute of Chemistry, Technology and Microbiology, Prokupačka 41, 11000
Belgrade, Republic of Serbia

Abstract. The food industry is currently experiencing a significant shift toward innovative products that address both nutritional needs and environmental challenges. Recent food trends are increasingly shaped by the growing demand for sustainability, health-promoting ingredients, and resource-efficient production systems. In this context, alternative protein sources, including plant proteins, microbial proteins, and fermentation-derived ingredients, have emerged as key drivers of product innovation. Simultaneously, fiber-rich ingredients obtained from cereals, legumes, fruits, and upcycled by-products are receiving increased attention due to their functional, nutritional, and techno-functional benefits. The integration of protein and fiber into novel food matrices supports the development of products aligned with current consumer expectations for healthier and more sustainable diets. However, beyond nutritional value and environmental impact, consumer acceptance remains a critical determinant of market success. Sensory attributes, texture, taste, familiarity, price, and trust in sustainability claims strongly influence purchasing behavior and long-term adoption. Current trends suggest that consumers show greater acceptance of novel foods when health benefits and sustainability advantages are clearly communicated and supported by desirable sensory quality. This review summarizes emerging food trends with emphasis on sustainability-driven innovation, diversification of protein sources, fiber enrichment strategies, and the role of consumer acceptance in successful product commercialization. Future research should focus on multidisciplinary approaches that combine food technology, sustainability assessment, and consumer science to accelerate the transition toward resilient food systems.

Keywords: food trends; sustainability; protein; fiber; consumer acceptance

PERSPEKTIVE U PROIZVODNJI OVSENOG JOGURTA SA DODATKOM KONCENTRATA BILJNIH PROTEINA

Milka Stijepić¹, Radoslav Grujić¹, Nikolina Rajlić¹

¹JU Visoka medicinska škola Prijedor, Nikole Pašića 4a, Prijedor, Republika Srpska, Bosna i Hercegovina

Sažetak. Rast potražnje za funkcionalnim i biljnim prehrambenim proizvodima doveo je do intenzivnog razvoja biljnih alternativa jogurtu, među kojima ovсени jogurt zauzima značajno mjesto zbog povoljnog nutritivnog sastava, prisustva β -glukana i dobre senzorske prihvatljivosti. Međutim, osnovni izazovi u proizvodnji ovсениh napitaka i jogurta jeste nizak sadržaj proteina, slabija tekstura i manja stabilnost u odnosu na mliječne proizvode. Cilj ovog preglednog rada je usmjeren na kritički osvrt upotrebe različitih biljnih proteina u proizvodnji ovсениog jogurta, uključujući njihove tehnološke i funkcionalne osobine, te njihov uticaj na kvalitet ovсениog jogurta. Korištene metode rada su uključivale pregled literature u posljednjih 10 godina, koristeći sopstvena istraživanja i različite naučne baze (PUBMED, SCOPUS). U formulaciji ovсениog jogurta sve češće se koriste koncentрати i izolati biljnih proteina, naročito proteini graška, soje, pirinča, tikve, leće i drugih mahunarki i žitarica. Dodavanje biljnih proteina poboljšava nutritivnu vrijednost, sadržaj esencijalnih aminokiselina, stabilnost gela, viskoznost i sposobnost zadržavanja vode. Fermentacija pomoću bakterija mliječne kiseline ima ključnu ulogu u formiranju karakterističnog ukusa, teksture i funkcionalnih svojstava ovсениog jogurta. Razvoj ovog proizvoda dodatno podstiču tržišni trendovi usmjereni ka veganskoj ishrani, smanjenju potrošnje proizvoda životinjskog porijekla i održivoj proizvodnji hrane. Iako postoje određeni tehnološki i senzorski izazovi u proizvodnji (pojava zrnatosti, sedimentacije, izraženog “biljnog” ukusa i nestabilnosti tokom skladištenja), primjena biljnih proteina i unapređenje tehnoloških procesa ukazuju na značajne perspektive razvoja i šire komercijalne primjene ovсениog jogurta u budućnosti. Savremena istraživanja ukazuju da kombinovanje ovsa sa proteinima graška i soje daje najbolje rezultate u pogledu teksture i nutritivnog kvaliteta, dok proteini pirinča i tikve doprinose poboljšanju aminokiselinskog sastava i funkcionalnih osobina proizvoda.

Ključne riječi: ovсени jogurt, biljni proteini, fermentacija, funkcionalna hrana

PERSPECTIVES IN THE PRODUCTION OF OAT YOGURT WITH THE ADDITION OF VEGETABLE PROTEIN CONCENTRATE

Milka Stijepić¹, Radoslav Grujić¹, Nikolina Rajlić¹

¹PI College of Health Sciences, Nikole Pašića 4a, Prijedor, Republic of Srpska, Bosnia and Hercegovina

Abstract. The growing demand for functional and plant-based food products has led to the intensive development of plant-based yogurt alternatives, among which oat yogurt holds a significant position due to its favorable nutritional composition, the presence of β -glucans, and good sensory acceptability. However, the main challenges in the production of oat beverages and yogurts include low protein content, weaker texture, and lower stability compared to dairy products. The aim of this review paper is to critically examine the use of different plant proteins in the production of oat yogurt, including their technological and functional properties, as well as their impact on oat yogurt quality. The methods used in this work included a literature review of the last 10 years, based on both own research and various scientific databases (PUBMED, SCOPUS). In oat yogurt formulation, plant protein concentrates and isolates are increasingly used, particularly proteins from pea, soy, rice, pumpkin, lentil, and other legumes and cereals. The addition of plant proteins improves nutritional value, essential amino acid content, gel stability, viscosity, and water-holding capacity. Fermentation using lactic acid bacteria plays a key role in forming the characteristic flavor, texture, and functional properties of oat yogurt. The development of this product is further driven by market trends focused on vegan diets, reduced consumption of animal-derived products, and sustainable food production. Although there are certain technological and sensory challenges in production (such as graininess, sedimentation, pronounced “beany” flavor, and instability during storage), the application of plant proteins and improvements in technological processes indicate significant potential for development and broader commercial application of oat yogurt in the future. Contemporary research indicates that combining oats with pea and soy proteins provides the best results in terms of texture and nutritional quality, while rice and pumpkin proteins contribute to improving the amino acid profile and functional properties of the product.

Keywords: oat yogurt, plant proteins, fermentation, functional food

OPTIMIZACIJA DODATKA MEDA U PROIZVODNJI PROBIOTSKOG JOGURTA

Milka Stijepić¹, Jovana Glušac², Dragica Đurđević Milošević³, Nikolina Rajlić¹

¹JU Visoka medicinska škola Prijedor, Nikole Pašića 4a, Republika Srpska,
Bosna i Hercegovina

²ProteinDistillery GmbH, Ostpreußenstraße 2/2, 73760 Ostfildern, Germany

³Institut za hemiju, tehnologiju i mikrobiologiju, Prokupačka 41, Beograd,
Republika Srbija

Sažetak. Probiotski jogurt predstavlja funkcionalni prehrambeni proizvod sa značajnim nutritivnim i zdravstvenim benefitima. U cilju poboljšanja fizičko-hemijskih i senzorskih karakteristika, često se razmatra dodatak prirodnih zaslađivača poput meda. Optimizacija dodatka meda u proizvodnji probiotkog jogurta predstavlja važan tehnološki korak, s ciljem postizanja optimalnog balansa između fizičko-hemijskih svojstava, senzorske prihvatljivosti i očuvanja vitalnosti probiotkih bakterija. Oslanjajući se na vlastita istraživanja i koristeći različite naučne baze (PubMed, Scopus, Google Scholar), cilj ovog preglednog rada je bio je da se analiza uticaj različitih koncentracija meda od 2%, 4% i 6% na kvalitet proizvedenog probiotkog jogurta. Pri tome, optimalni dodatak meda treba da obezbijedi minimalnu sinerezu, maksimalan viskozitet, optimalne teksturalne parametre (maksimalnu čvrstoću i konzistenciju, minimalnu kohezivnost i indeks viskoziteta), te visoku prihvatljivost proizvoda izraženu preko odabranih senzorskih osobina. Rezultati ukazuju da dodatak meda značajno utiče na kvalitet i stabilnost proizvoda, pri čemu se koncentracija od 4% izdvaja kao optimalna.

Ključne riječi: probiotki jogurt, med, optimizacija, fizičko-hemijski i senzorski parametri

OPTIMIZATION OF HONEY ADDITION IN PROBIOTIC YOGURT PRODUCTION

Milka Stijepić¹, Jovana Glušac², Dragica Đurđević Milošević³, Nikolina Rajlić¹

¹PI College of Health Sciences, Nikole Pašića 4a, Prijedor, Republic of Srpska, Bosnia and Hercegovina,

²ProteinDistillery GmbH, Ostpreußenstraße 2/2, 73760 Ostfildern, Germany,

³Institute of Chemistry, Technology and Microbiology, Prokupačka 41, Belgrade, Republic of Serbia

Abstract. Probiotic yogurt is a functional food product with significant nutritional and health benefits. In order to improve its physicochemical and sensory characteristics, the addition of natural sweeteners such as honey is often considered. Optimizing the addition of honey in probiotic yogurt production represents an important technological step aimed at achieving an optimal balance between physicochemical properties, sensory acceptability, and the preservation of probiotic bacterial viability. Based on our own research and by using various scientific databases (PubMed, Scopus, and Google Scholar), the aim of this review paper was to analyze the effects of different honey concentrations (2%, 4%, and 6%) on the quality of produced probiotic yogurt. In this context, the optimal addition of honey should ensure minimal syneresis, maximum viscosity, optimal textural parameters (maximum firmness and consistency, minimum cohesiveness and viscosity index), as well as high product acceptability expressed through selected sensory attributes. The results indicate that the addition of honey significantly affects the quality and stability of the product, with the 4% concentration standing out as optimal.

Key words: probiotic yogurt, honey, optimization, physico-chemical and sensory parameters

UTICAJ FALSIFIKATA MEDA I PROIZVODA OD MEDA NA JAVNO ZDRAVLJE

Slaven Grbić^{1,2}, Ljiljana Stojanović-Bjelić²

¹Univerzitet veterinarske medicine u Budimpešti, István utca 2, Budimpešta, Mađarska

²Panevropski univerzitet Apeiron, Banja Luka, Republika Srpska, Bosna i Hercegovina

Sažetak. Med i proizvodi od meda predstavljaju prehrambene proizvode visoke nutritivne, biološke i tržišne vrijednosti, zbog čega su često predmet različitih oblika falsifikovanja. Najčešći oblici patvorenja obuhvataju dodavanje šećernih sirupa, prikrivanje botaničkog i geografskog porijekla, neadekvatno označavanje, miješanje meda različitog kvaliteta, kao i stavljanje na tržište proizvoda koji ne odgovaraju deklarisanom sastavu. Cilj rada je da se ukaže na javnozdravstveni značaj falsifikata meda i proizvoda od meda, sa posebnim osvrtom na rizike za potrošače, bezbjednost hrane i povjerenje u sistem kontrole kvaliteta. U radu je primijenjena deskriptivno-analitička metoda pregleda dostupnih podataka o pojavnim oblicima falsifikovanja, mogućim zdravstvenim posljedicama i značaju laboratorijske kontrole. Falsifikovani med može dovesti do nutritivne obmane potrošača, povećanog unosa jednostavnih šećera, pogoršanja metaboličkog rizika kod osjetljivih grupa, kao i do izloženosti nepoželjnim reziduama ili kontaminantima ukoliko proizvod potiče iz nekontrolisanih izvora. Poseban problem predstavljaju proizvodi od meda koji se reklamiraju sa nedozvoljenim zdravstvenim tvrdnjama, čime se potrošači mogu dovesti u zabludu i odložiti traženje stručne zdravstvene pomoći. Efikasna zaštita javnog zdravlja zahtijeva stalni nadzor tržišta, primjenu savremenih laboratorijskih metoda za utvrđivanje autentičnosti, jačanje inspeksijske kontrole i edukaciju potrošača. Zaključuje se da falsifikovanje meda nije samo ekonomski problem, već i značajan javnozdravstveni rizik koji zahtijeva multidisciplinarni pristup stručnjaka iz oblasti veterinarske medicine, javnog zdravlja, prehrambene tehnologije i kontrole hrane.

Ključne riječi: med, falsifikovanje hrane, javno zdravlje, bezbjednost hrane, potrošači

IMPACT OF HONEY AND HONEY-BASED PRODUCT FRAUD ON PUBLIC HEALTH

Slaven Grbić^{1,2}, Ljiljana Stojanović-Bjelić²

¹University of Veterinary Medicine Budapest, István utca 2, Budapest, Hungary

²Pan-European University Apeiron, Banja Luka, Republic of Srpska,
Bosnia and Herzegovina

Abstract. Honey and honey-based products are food products of high nutritional, biological and market value, which makes them frequent targets of different forms of food fraud. The most common forms of adulteration include the addition of sugar syrups, misrepresentation of botanical and geographical origin, inadequate labelling, mixing of honey of different quality, and marketing of products that do not correspond to the declared composition. The aim of this paper is to highlight the public health importance of honey and honey-based product fraud, with special emphasis on consumer risks, food safety and trust in the quality control system. A descriptive and analytical review method was used to examine available data on forms of adulteration, possible health consequences and the importance of laboratory control. Adulterated honey may lead to nutritional deception of consumers, increased intake of simple sugars, worsening of metabolic risk in vulnerable groups, and possible exposure to undesirable residues or contaminants if the product originates from uncontrolled sources. A particular concern is the marketing of honey-based products with unauthorized health claims, which may mislead consumers and delay seeking professional medical advice. Effective protection of public health requires continuous market surveillance, application of modern laboratory methods for authenticity testing, strengthened inspection control and consumer education. It can be concluded that honey fraud is not only an economic issue, but also a significant public health risk requiring a multidisciplinary approach involving experts in veterinary medicine, public health, food technology and food control.

Key words: honey, food fraud, public health, food safety, consumers

INDEKSI KVALITETA LIPIDA BILJNIH ULJA

Jelena Banović Fuentes^{1,2}, Jovica Banović^{1,2}, Ljilja Torović¹

¹Univerzitet u Novom Sadu, Medicinski fakultet, Katedra za farmaciju,
Republika Srbija

²Opšta bolnica „Dr Mladen Stojanović“, Prijedor, Bosna i Hercegovina

Sažetak. Jestiva biljna ulja, dobijena iz semena, plodova i pulpe biljaka, predstavljaju značajan izvor lipida u ljudskoj ishrani. Njihova proizvodnja je u stalnom porastu, a najzastupljenija su palmino, sojino, repičino, suncokretovo, kokosovo i maslinovo ulje. Sastav masnih kiselina varira u zavisnosti od biljne vrste i geografskog porekla, što utiče na nutritivni i zdravstveni značaj ulja. Za procenu kvaliteta ulja koriste se zdravstveni indeksi kvaliteta lipida. U ovoj studiji analizirano je 25 biljnih ulja primenom GC-FID, a na osnovu masno-kiselinskog sastava izračunati su indeksi: odnos polinezasićenih i zasićenih masnih kiselina (PNMK/ZMK), hipo-/hiperholesterolemijski indeks (H/H), indeks aterogenosti (IA), indeks trombogenosti (IT) i indeks nezasićenosti (IN). Najviše vrednosti PNMK/ZMK i H/H indeksa pokazalo je ulje šipka (23,24 i 9,78), dok su povoljne vrednosti zabeležene i kod ulja lana, konoplje, suncokreta, kajsije i šljive; najniže vrednosti imali su kokosovo i palmino ulje (PNMK/ZMK 0,01–0,23; H/H 0,7–1,33). Najniže IA i IT vrednosti, koje ukazuju na povoljniji uticaj na kardiovaskularno zdravlje, utvrđene su kod ulja lana, šipka, kajsije i konoplje (IA 0,04–0,08; IT 0,01–0,11), znatno ispod preporučene granične vrednosti 1, dok je kokosovo ulje pokazalo najnepovoljnije vrednosti (23,4 i 10,5). Najviši IN, koji ukazuje na veću osetljivost na oksidaciju, zabeležen je kod ulja lana, šipka, konoplje, maline, pasjeg trna, maka, ruže, soje, suncokreta i crnog kima (144–208); najniže vrednosti imali su kokosovo (6) i palmino ulje (65), dok su ostala ulja imala IN od 93 (maslinovo) do 135 (bundevino). Rezultati ukazuju na značajne razlike u kvalitetu biljnih ulja i njihovom potencijalnom uticaju na zdravlje, posebno na kardiovaskularni sistem. Posebno se ističu ulja lana, konoplje i kajsije, koja su slabije zastupljena u ishrani stanovništva regiona. Promovisanje upotrebe raznovrsnih biljnih ulja može doprineti unapređenju zdravlja.

Ključne reči: biljna ulja, indeksi kvaliteta lipida, javno zdravlje, rizik i dobit

LIPID QUALITY INDICES OF VEGETABLE OILS

Jelena Banović Fuentes^{1,2}, Jovica Banović^{1,2}, Ljilja Torović¹

¹University of Novi Sad, Faculty of Medicine, Department of Pharmacy, Republic of Serbia

²General Hospital “Dr Mladen Stojanović”, Prijedor, Bosnia and Herzegovina

Abstract. Edible vegetable oils, obtained from plant seeds, fruits, and pulp, represent an important source of dietary lipids in human nutrition. Their production is continuously increasing, with palm, soybean, rapeseed, sunflower, coconut, and olive oils being the most commonly used. The fatty acid and health relevance. Therefore, lipid quality indices are used to evaluate oil quality. In this study, 25 vegetable oils were analysed by GC-FID, and fatty acid composition data were used to calculate the polyunsaturated/saturated fatty acids ratio (PUFA/SFA), hypocholesterolemic/hypercholesterolemic index (H/H), atherogenic index (AI), thrombogenic index (TI), and unsaturation index (UI). The highest PUFA/SFA and H/H values were observed in rosehip oil (23.24 and 9.78, respectively), while favourable values were also recorded for flaxseed, hemp, sunflower, apricot, and plum oils; the lowest values were found in coconut and palm oils (PUFA/SFA 0.01–0.23; H/H 0.7–1.33). The lowest AI and TI values, indicating a more favourable effect on cardiovascular health, were found in flaxseed, rosehip, apricot, and hemp oils (AI 0.04–0.08; TI 0.01–0.11), well below the recommended threshold of 1, whereas coconut oil showed the least favourable values (23.4 and 10.5, respectively). The highest UI values, indicating greater susceptibility to oxidation, were recorded in flaxseed, rosehip, hemp, raspberry, sea buckthorn, poppy seed, rose, soybean, sunflower, and black cumin oils (144–208); the lowest values were found in coconut (6) and palm oil (65), while others ranged from 93 (olive) to 135 (pumpkin). The results indicate substantial differences in the quality of vegetable oils and their potential health impacts, particularly on cardiovascular health. Oils such as flaxseed, hemp, and apricot are especially prominent but less commonly consumed in the region. Promoting the use of diverse vegetable oils may contribute to improved public health outcomes.

Keywords: vegetable oils, lipid quality indices, public health, risk and benefit

ZNAČAJ *ESCHERICHIA COLI* U MIKROBIOLOGIJI HRANE I VODE: RAZLIKOVANJE INDIKATORSKIH I PATOGENIH SOJEVA

Dragica Đurđević-Milošević¹, Andrijana Petrović¹, Jasmina Elez¹, Thembekile Ncube²

¹Institut za hemiju, tehnologiju i mikrobiologiju, Prokupačka 41, 11000 Beograd, Republika Srbija

²National University of Science and Technology, RJPR+75X, Cnr Cecil Avenue & Gwanda Road, Bulavajo, Zimbabve

Sažetak. *Escherichia coli* je jedna od najznačajnijih bakterijskih vrsta u mikrobiologiji hrane i vode zbog svog dvostrukog značaja kao higijenskog indikatorskog organizma i, zbog određenih sojeva, ozbiljnog uzročnika bolesti koje se prenose hranom. Ovaj pregledni rad opisnog karaktera razmatra mikrobiološki značaj bakterije *E. coli*, sa posebnim naglaskom na njenu ulogu u proceni sanitarnog kvaliteta hrane i vode, kao i rizike po javno zdravlje povezane sa patogenim sojevima. Posebna pažnja posvećena je razlikama u morfologiji kolonija među sojevima *E. coli* od higijenskog značaja i sojevima *Escherichia coli* koji proizvode šiga toksin (STEC), uključujući serotipove od velikog epidemiološkog značaja. Razmatrene su varijacije u izgledu kolonija na često korišćenim selektivnim, diferencijalnim i hromogenim podlogama, kao i druge bakterijske osobine koje se koriste u rutinskim postupcima izolacije i identifikacije. Te osobine obuhvataju fermentaciju laktoze i sorbitola, enzimsku aktivnost, način rasta na selektivnim podlogama, biohemijske reakcije i serološka svojstva koja omogućavaju razlikovanje indikatorskih i patogenih sojeva. Ovaj pregledni rad ima za cilj da istakne značaj odabranih sojeva *E. coli* kao pokazatelja fekalne kontaminacije i higijenskog kvaliteta, uz istovremeno naglašavanje značaja patogenih sojeva *E. coli* kao uzročnika bolesti koje se prenose hranom i vodom. Pored toga, rad se bavi uobičajenim praktičnim ograničenjima i neizvesnostima sa kojima se susreće laboratorijska praksa tokom izolacije, detekcije i identifikacije ovih mikroorganizama i izazovima nauke da na njih odgovori perspektivnim rešenjima.

Ključne riječi: *Escherichia coli*, mikrobiologija hrane, mikrobiologija vode, higijenski indikatori, šiga toksin-produkujuće *E. coli* (STEC)

THE IMPORTANCE OF ESCHERICHIA COLI IN FOOD AND WATER MICROBIOLOGY: DIFFERENTIATION OF INDICATOR AND PATHOGENIC STRAINS

Dragica Đurđević-Milošević¹, Andrijana Petrović¹, Jasmina Elez¹, Thembekile Ncube²

¹Institut of Chemistry, Technology and Microbiology, Prokupačka 41, 11000 Belgrade, Republic of Serbia

²National University of Science and Technology, RJPR+75X, Cnr Cecil Avenue & Gwanda Road, Bulawayo, Zimbabwe

Abstract. *Escherichia coli* is one of the most important bacterial species in food and water microbiology due to its dual significance as both a hygienic indicator organism and, in certain strains, a serious foodborne pathogen. This descriptive review examines the microbiological importance of *E. coli*, with particular emphasis on its role in the assessment of the sanitary quality of food and water, as well as the public health risks associated with pathogenic strains. Special attention is given to differences in colony morphology among *E. coli* strains of hygienic relevance and Shiga toxin-producing *Escherichia coli* (STEC), including serotypes of major epidemiological concern. Variations in colony appearance on commonly used selective, differential, and chromogenic media are discussed, along with other bacterial characteristics used in routine isolation and identification procedures. These characteristics include lactose and sorbitol fermentation, enzymatic activity, growth behaviour on selective media, biochemical reactions, and serological properties that support differentiation between indicator and pathogenic strains. This review aims to highlight the significance of selected *E. coli* strains as indicators of faecal contamination and hygienic quality, while also emphasising the importance of pathogenic *E. coli* strains as causative agents of food- and waterborne disease. In addition, the paper addresses common practical limitations and uncertainties encountered in laboratory practice during the isolation, detection, and identification of these microorganisms, as well as the challenges faced by science in responding to them with promising solutions.

Keywords: *Escherichia coli*; food microbiology; water microbiology; hygienic indicators; Shiga toxin-producing *E. coli* (STEC)

BEZBJEDNOST HRANE: NOVI TRENDOWI ZASNOVANI NA PRIMJENI I INFORMACIONIH TEHNOLOGIJA I VJEŠTAČKE INTELIGENCIJE

Radoslav Grujić¹, Igor Grujić¹

¹JU Visoka medicinska škola, Prijedor, Republika Srpska, Bosna i Hercegovina

Sažetak. Napredak sistema zasnovanih na informaciono-komunikacionim tehnologijama (ICT) i vještačkoj inteligenciji (AI) omogućio je novi pristup higijeni hrane. Ovi sistemi omogućavaju upravljanje svim aspektima bezbjednosti hrane, uključujući postupke sanitacije u prehrambenim objektima. U ovom kontekstu često se koristi pojam FoodTech, koji odražava konvergenciju naprednih tehnologija unutar prehrambene industrije. Cilj rada je da se predstave mogućnosti sistema zasnovanih na vještačkoj inteligenciji, senzorima tehnologije 4.0 (kao što su Internet stvari – IoT) i blockchain-u u oblasti bezbjednosti hrane. Ovaj rad pruža uvid mogućnosti za njihovu primjenu za poboljšanje higijene i bezbjednosti hrane u cijelom lancu snabdijevanja hranom. Tokom pisanja rada korištene su reference referisane u ScienceDirect i Scopus-u objavljene, a u posljednjih 2 godine. Pored toga, u radu su analizirani preduslovi za korištenje i principi korištenja IoT-a i vještačke inteligencije. Od različitih ICT tehnologija koje se koriste u preradi hrane, integralnim se smatraju barkodiranje i IoT. Uprkos postojećim ograničenjima, budućnost ICT-a u bezbjednosti hrane je ogromna. S obzirom na napredak tehnologije, korištenje i implementacija ICT-a učiniće hranu bezbjednom za jelo olakšavajući do sada komplikovane procedure. Sistemi za praćenje u realnom vremenu, koji koriste senzore zasnovane na AI i IoT tehnologiju su efikasni u ranom otkrivanju kontaminacije u procesima prerade i distribucije hrane i automatizaciji kontrole kvaliteta i bezbjednosti hrane. Integrirajući vještačku inteligenciju, internet stvari, blockchain i robotiku, Bezbjednost hrane 4.0 uvodi revoluciju u upravljanje higijenom i postavlja osnove za održive i inteligentne prehrambene sisteme. Ove digitalne tehnologije formiraju adaptivan i inteligentan okvir sposoban za rješavanje novih izazova u higijeni i bezbjednosti hrane.

Ključne riječi: Bezbjednost hrane 4.0, IoT, vještačka inteligencija, budućnost proizvodnje i bezbjednosti hrane

FOOD SAFETY: NEW TRENDS BASED ON THE APPLICATION OF BOTH INFORMATION TECHNOLOGY AND ARTIFICIAL INTELLIGENCE

Radoslav Grujic¹, Igor Grujic¹

¹PI College of Health Sciences Prijedor, Republic of Srpska,
Bosnia and Herzegovina

Abstract. The advancement of systems based on information and communication technologies (ICT) and artificial intelligence (AI) has enabled a new approach to food hygiene. These systems enable the management of all aspects of food safety, including sanitation procedures in food facilities. In this context, the term FoodTech is often used, which reflects the convergence of advanced technologies within the food industry. The aim of the work is to present the possibilities of systems based on artificial intelligence, technology 4.0 sensors (like Internet of Things - IoT) and blockchain in the field of food safety. This paper provides insight into the possibilities for their application to improve food hygiene and safety in the entire food supply chain. During the writing of the paper, references published in the last 2 years, referenced in ScienceDirect and Scopus were referred. In addition, the paper analyzed the prerequisites for the use and principles of using IoT-a and artificial intelligence. Of the various ICT technologies used in food processing, barcoding and IoT are considered integral. Despite the existing limitations, the future of ICT in food safety is huge. Given the advancement of technology, the use and implementation of ICT will make food safe to eat by simplifying previously complicated procedures. Real-time monitoring systems using sensors based on AI and IoT are effective in early detection of contamination in food processing and distribution processes and automation of quality control and food safety. Integrating artificial intelligence, IoT, blockchain and robotics, Food Safety 4.0 is revolutionizing hygiene management and laying the foundations for sustainable and intelligent food systems. These digital technologies form an adaptive and intelligent framework capable of solving new challenges in food hygiene and safety.

Keywords: Food safety 4.0, IoT, artificial intelligence, future of production and food safety

ANALIZA PROTEINA GLIJADINA IZ ŽITARICA HPLC METODOM

Vesna Gojković Cvjetković¹, Jovan Toholj¹, Željka Marjanović-Balaban²

¹Univerzitet u Istočnom Sarajevu, Tehnološki fakultet Zvornik,
Bosna i Hercegovina

²Univerzitet u Banja Luci, Šumarski fakultet Banja Luka, Bosna i Hercegovina

Sažetak. Žitarice su jednogodišnje biljke čiji se plodovi koriste u ishrani ljudi i životinja. U ovu grupu spadaju: pšenica (*Triticum*), raž (*Secale*), ječam (*Hordeum*), pirinač (*Oriza*), ovas (*Avena*) i kukuruz (*Zea mays*). Pored navedenih, u žitarice se ubrajaju još i proso (*Panicum*), sirak (*Sorgum*), heljda i hibrid pšenice i raži pod nazivom triticales. Uzimajući u obzir da je broj osoba koje su alergične na frakciju glutena (glijadina) u porastu svakim danom, cilj ovog rada je bio da se analiziraju proteini glijadina iz različitih vrsta žitarica i njihovih proizvoda koji su dostupni na tržištu Republike Srpske, odnosno Bosne i Hercegovine. Glijadini su ekstrahovani iz uzoraka pšeničnog, raženog, zobenog, speltinog i ječmenog brašna (po 3 proizvođača za svaku vrstu) 70% (v/v) etanolom. Hromatografsko razdvajanje je vršeno na koloni Zorbax SB-C3 (Agilent) pri temperaturi kolone od 45 °C, pritisku 80 bar, vrijeme razdvajanja 16,0, na HPLC aparatu (Agilent Technologies 1260 Infinity). Mjerenje apsorbcije je vršeno na dvije talasne dužine, 210 i 280 nm. Obrada rezultata je vršena na softveru Agilent OpenLAB CDS ChemStation. Na osnovu dobijenih rezultata najveća ukupna količina proteina je izdvojena iz uzoraka pšeničnog brašna kod proizvođača 3 ($X_{sr}=31,00$), prilikom mjerenja apsorbcije na 210 nm. Tom prilikom je unutar frakcije $\omega 5$ glijadina izdvojeno $X_{sr}=3,33$, unutar $\omega 1,2$ $X_{sr}=6,33$, unutar $\alpha+\beta$ $X_{sr}=12,66$ i unutar γ glijadina $X_{sr}=6,66$ proteina.

Ključne riječi: glijadini, žitarice, HPLC

ANALYSIS OF GLIADIN PROTEINS FROM CEREALS USING THE HPLC METHOD

Vesna Gojković Cvjetković¹, Jovan Toholj¹, Željka Marjanović-Balaban²

¹University of East Sarajevo, Faculty of Technology Zvornik,
Bosnia and Herzegovina

²University of Banja Luka, Faculty of Forestry Banja Luka, Bosnia and
Herzegovina

Abstract. Cereals are annual plants whose fruits are used in human and animal nutrition. This group includes: wheat (*Triticum*), rye (*Secale*), barley (*Hordeum*), rice (*Oryza*), oats (*Avena*) and corn (*Zea mays*). In addition to the above, cereals also include millet (*Panicum*), sorghum (*Sorghum*), buckwheat and a hybrid of wheat and rye called triticale. Taking into account that the number of people who are allergic to the gluten fraction (gliadin) is increasing every day, the aim of this work was to analyze gliadin proteins from different types of cereals and their products that are available on the market of the Republic of Srpska, i.e. Bosnia and Herzegovina. Gliadins were extracted from samples of wheat, rye, oat, spelt and barley flour (3 manufactures for each type) with 70% (v/v) ethanol. Chromatographic separation was performed on a Zorbax SB-C3 column (Agilent) at a column temperature of 45 °C, a pressure of 80 bar, a separation time of 16.0, on an HPLC apparatus (Agilent Technologies 1260 Infinity). Absorbance measurements were performed at two wavelengths, 210 and 280 nm. Results were processed using the Agilent OpenLAB CDS ChemStation software. Based on the obtained results, the highest total amount of protein was isolated from wheat flour samples from manufacturer 3 ($X_{av}=31.00$), when measuring absorbance at 210 nm. On this occasion, within the $\omega 5$ gliadin fraction, $X_{sr}=3.33$ was isolated, within $\omega 1.2$ $X_{sr}=6.33$, within $\alpha+\beta$ $X_{sr}=12.66$ and within γ gliadin $X_{sr}=6.66$ proteins.

Keywords: gliadins, cereals, HPLC

LIGNIKOLNE GLJIVE I NJIHOV ZNAČAJ ZA ZDRAVLJE LJUDI

***Zoran Govedar¹, Dragan Karadžić², Nadezhda Prohorova³, Radoslav Grujić⁴,
Novo Pržulj¹***

¹ Akademija nauka i umjetnosti Republike Srpske, Bana dr Todora Lazarevića 1,
Banja Luka 78000, Republika Srpska, Bosna i Hercegovina

² Šumarski fakultet, Univerzitet u Beogradu, Kneza Višeslava 1, 11000 Beograd,
Republika Srbija

³ Voronješki državni šumarsko-tehnički univerzitet nazvan po G.F. Morozov,
Timiriazeva ul., 8, 394613, Voronješka oblast, Rusija

⁴ JU Visoka medicinska škola Prijedor, Nikola Pašić 4a 79101 Prijedor, Republika
Srpska, Bosna i Hercegovina

Sažetak. Gljive spadaju među najstarije žive organizme na Zemlji jer su se pojavile u prekambrijalnom periodu. Jestive gljive se od davnina koriste za ishranu ali i za preventivnu zaštitu zdravlja i liječenje ljudi. Lignikolne gljive su makrogljive i primarni su razarači lignoceluloze (drвета) koje imaju jedinstvenu sposobnost razgradnje lignocelulozne biomase (lignina, celuloze i hemiceluloze) pomoću ekstracelularnih enzima. Koriste se u medicinske svrhe jer imaju širok spektar djelovanja na više bolesti a posebno su značajne zbog antikancerogenog dejstva, povećavanja imuniteta kod ljudi, regulišu nivo holesterola u krvi i dr. U okviru preventivne medicine sve veći značaj zauzima mikoterapija korišćenjem svježih ili prerađenih jestivih gljiva (ekstrakt, infuz, dekokt, macerat, tinktura, prah, krema i dr.). U radu su istaknute najznačajnije lignikolne gljive iz rodova *Armillaria* (Fr.) Staude, *Ganoderma* P. Karst., *Inonotus* P. Karst., *Trametes* F., *Schizophyllum* Fr., *Sparassis* Fr., *Fomes* (Fr.) Fr. i *Grifola* Gray, njihova ljekovita svojstva i bioaktivna komponenta ili dio gljive sa ljekovitim svojstvima koji se mogu koristiti u preventivnoj medicini ali i za liječenje određenih bolesti.

Key words: Lignikolne gljive, medicina, zdravlje ljudi

LIGNICOLLOUS FUNGI AND THEIR IMPORTANCE FOR HUMAN HEALTH

Zoran Govedar¹, Dragan Karadžić², Nadezhda Prohorova³, Radoslav Grujić⁴,
Novo Pržulj¹

¹ Academy of Science and Arts of the Republic of Srpska, Bana dr Todora
Lazarevića 1, Banja Luka 78000

² Faculty of Forestry, University of Belgrade, Kneza Visaslava 1, 11000 Belgrade,
Republic of Serbia

³ Voronezh State Forestry Technical University named after G.F. Morozov,
Timiryazeva st., 8, 394613, Voronezh region, Russia

⁴ PI College of Health Sciences Prijedor, Nikola Pasic 4a 79101 Prijedor,
Republic of Srpska, Bosnia and Herzegovina

Abstract: Fungi are among the oldest living organisms on Earth because they appeared in the Precambrian period. Edible mushrooms have been used since ancient times for food, but also for preventive health protection and treatment of people. Lignicholic fungi are macrofungi and are the primary destroyers of lignocellulose (wood) that have the unique ability to degrade lignocellulosic biomass (lignin, cellulose, and hemicellulose) by extracellular enzymes. They are used for medical purposes because they have a wide range of effects on several diseases and are especially important because of their anticancer effect, increasing immunity in humans, regulating blood cholesterol levels, etc. Within preventive medicine, mycotherapy using fresh or processed edible mushrooms (extract, infusion, decoction, macerate, tincture, powder, cream, etc.) is becoming increasingly important. The paper highlights the most important lignicholic fungi from the genera *Armillaria* (Fr.) Staude, *Ganoderma* P. Karst., *Inonotus* P. Karst., *Trametes* F., *Schizophyllum* Fr., *Sparassis* Fr., *Fomes* (Fr.) Fr. and *Grifola* Gray, their medicinal properties and bioactive component or part of the mushroom with medicinal properties that can be used in preventive medicine, but also for the treatment of certain diseases.

Key words: Lignicholic fungi, medicine, human health

ANALIZA RADNOG OPTEREĆENJA I MIŠIĆNO-KOŠTANIH RIZIKA MEĐU ZAPOSLENIMA U ZUBOTEHNIČKOM LABORATORIJU

Katarina Kacjan Žgajnar¹

¹Univerzitet u Ljubljani, Zdravstveni fakultet, Zdravstvena pot 5, 1000 Ljubljana,
Republika Slovenija

Sažetak. Zubni tehničari su izloženi brojnim profesionalnim faktorima rizika koji mogu doprinijeti razvoju mišićno-koštanih poremećaja povezanih s radom. Njihov rad karakterišu dugotrajno sjedenje, statični položaji tijela, ponavljajući fini pokreti, visoki vizualni zahtjevi te česta upotreba vibrirajućih ručnih alata, često duže od četiri sata dnevno. Razumijevanje ovih faktora rizika od ključnog je značaja za unapređenje uslova rada i prevenciju profesionalnih zdravstvenih problema. Cilj rada je prikazati praktičnu primjenu metode Quick Exposure Check (QEC) te procijeniti izloženost zubnih tehničara ergonomskim faktorima rizika povezanim s mišićno-koštanim poremećajima u zubotehničkim laboratorijama. Procjena je provedena na odabranim radnim mjestima u zubotehničkim laboratorijama primjenom QEC metode. Evaluacija je bila usmjerena na položaj tijela, ponavljajuće pokrete, primjenu sile, tempo rada, vizualne zahtjeve i izloženost vibrirajućim ručnim alatima tokom tipičnih radnih zadataka. Posmatranja su provedena direktno na radnom mjestu tokom rutinskih aktivnosti, uključujući brušenje, poliranje, modeliranje i završnu obradu. Rezultati su pokazali, da su zubni tehničari izloženi značajnim ergonomskim faktorima rizika povezanim s razvojem mišićno-koštanih poremećaja povezanih s radom. Visok nivo izloženosti utvrđen je posebno u području vrata, ramena, ručnih zglobova i donjeg dijela leđa zbog dugotrajnog statičnog sjedenja, ponavljajućih finih pokreta i kontinuirane vizualne koncentracije. Upotreba vibrirajućih alata tokom dužeg vremenskog perioda, često više od četiri sata dnevno, dodatno povećava fizičko opterećenje i potencijalni rizik od poremećaja gornjih ekstremiteta. Ovi nalazi su u skladu s prethodnim istraživanjima koja ukazuju, da zubni tehničari predstavljaju profesionalnu grupu s visokim rizikom za razvoj mišićno-koštanih i drugih profesionalnih zdravstvenih problema. Istraživanje pokazuje, da je QEC metoda praktičan alat za identifikaciju ergonomskih rizika na radnom mjestu, te naglašava važnost ergonomskih intervencija i unapređenja organizacije rada s ciljem stvaranja sigurnijeg i zdravijeg radnog okruženja.

Ključne riječi: ergonomski faktori rizika, mišićno-koštani poremećaji povezani s radom, Quick Exposure Check (QEC), zubni tehničari

ANALYSIS OF WORKLOAD AND MUSCULOSKELETAL RISKS AMONG EMPLOYEES IN A DENTAL LABORATORY

*Katarina Kacjan Žgajnar*¹

¹University of Ljubljana, Faculty of Health Sciences, Ljubljana, Republic of Slovenia

Abstract. Dental technicians are exposed to multiple occupational risk factors that may contribute to the development of work-related musculoskeletal disorders (WMSDs). Their work is characterized by prolonged sitting, static postures, repetitive fine motor tasks, high visual demands, and the frequent use of vibrating handheld tools, often for more than four hours per day. Understanding these risk factors is essential for improving working conditions and preventing occupational health problems. The aim is to present the practical application of the Quick Exposure Check (QEC) method and to assess the exposure of dental technicians to ergonomic risk factors associated with WMSDs in dental laboratory workplaces. The assessment was conducted in selected dental laboratory workplaces using the QEC method. The evaluation focused on body posture, repetitive movements, force exertion, work pace, visual demands, and exposure to vibrating handheld tools during typical tasks. Observations were performed directly at the workplace during routine activities, including grinding, polishing, modeling and finishing procedures. The findings indicated that dental technicians are exposed to several significant ergonomic risk factors associated with the development of work-related musculoskeletal disorders. High exposure levels were identified particularly in the neck, shoulder, wrist, and lower back regions due to prolonged static sitting postures, repetitive fine motor movements, and sustained visual concentration. The use of vibrating tools for extended periods, frequently exceeding four hours per day, further increased physical strain and the potential risk of upper limb disorders. These findings are consistent with previous research indicating that dental technicians represent a high-risk occupational group for musculoskeletal and occupational health problems. The study demonstrates that the QEC method is a practical tool for identifying workplace ergonomic risks and highlights the importance of ergonomic interventions and improved work organization to promote safer and healthier working environments.

Key words: ergonomic risk factors, work-related musculoskeletal disorders, Quick Exposure Check (QEC), dental technicians

PROCJENA RIZIKA ZA BEZBJEDNOST I ZDRAVLJE RADNIKA U PROCESU EKSPLOATACIJE I PRERADE TEHNIČKO- GRAĐEVINSKOG KAMENA

Ljubica Fiqun¹, Biljana Vranješ², Dejana Aničić¹

¹Rudarski fakultet, Univerzitet u Banjoj Luci, Prijedor, Bosna i Hercegovina

²Mašinski fakultet, Univerzitet u Banjoj Luci, Banja Luka, Bosna i Hercegovina

Sažetak. U radu je prikazana procjena rizika po bezbjednost i zdravlje radnika u procesu eksploatacije i prerade tehničko-građevinskog kamena, sa ciljem identifikacije, analize i vrednovanja ključnih opasnosti i štetnosti u radnom okruženju. Analizirane su sve faze tehnološkog procesa, uključujući bušenje i miniranje, utovar i transport, kao i preradu mineralne sirovine. Posebna pažnja posvećena je identifikaciji dominantnih rizika, među kojima se izdvajaju izloženost prašini, povišenom nivou buke i vibracija, opasnosti od mehaničkih povreda pri radu sa rudarskom mehanizacijom i eksplozivnim sredstvima, kao i rad na otvorenom i štetni klimatski uslovi. Procjena rizika izvršena je primjenom Kinney metode, koja podrazumijeva kvantifikaciju rizika na osnovu vjerovatnoće nastanka neželjenog događaja, učestalosti izloženosti i težine mogućih posljedica. Na osnovu dobijenih vrijednosti izvršena je klasifikacija rizika i utvrđeni prioriteti za njihovo smanjenje. Na osnovu rezultata istraživanja definisane su odgovarajuće preventivne i korektivne mjere, koje obuhvataju tehničke, organizacione i lične mjere zaštite. Predložene mjere imaju za cilj smanjenje nivoa rizika, unapređenje uslova rada i povećanje ukupnog nivoa bezbjednosti i zdravlja radnika. Rezultati rada ukazuju na značaj kontinuiranog praćenja i unapređenja sistema upravljanja bezbjednošću i zdravljem na radu u sektoru eksploatacije i prerade tehničko-građevinskog kamena.

Ključne riječi: procjena rizika, Kinney metoda, kamenolom, bezbjednost i zdravlje na radu.

RISK ASSESSMENT FOR OCCUPATIONAL SAFETY AND HEALTH IN THE EXPLOITATION AND PROCESSING OF TECHNICAL STONE

Ljubica Figun¹, Biljana Vranješ², Dejana Aničić¹

¹Faculty of Mining, University of Banja Luka, Prijedor, Bosnia and Herzegovina

²Faculty of Mechanical Engineering, University of Banja Luka, Banja Luka, Bosnia and Herzegovina

Abstract. This paper presents a risk assessment for occupational safety and health of workers in the exploitation and processing of technical-building stone, with the aim of identifying, analyzing, and evaluating key hazards and harmful factors in the working environment. All phases of the technological process were analyzed, including drilling and blasting, loading and transportation, as well as mineral processing. Special attention was given to the identification of dominant risks, including exposure to dust, elevated levels of noise and vibrations, hazards of mechanical injuries when working with mining machinery and explosives, as well as adverse climatic conditions in outdoor work. The risk assessment was carried out using the Kinney method, which involves risk quantification based on the probability of occurrence of an undesired event, frequency of exposure, and severity of potential consequences. Based on the obtained values, risk classification was performed and priorities for risk reduction were defined. Based on the research results, appropriate preventive and corrective measures were proposed, including technical, organizational, and personal protective measures, with the aim of reducing risk levels, improving working conditions, and enhancing overall occupational safety and health. The results indicate the importance of continuous monitoring and improvement of the occupational safety and health management system in the sector of technical-building stone exploitation and processing.

Keywords: risk assessment, Kinney method, quarry, occupational safety and health

IZMEĐU PREPORUKE I POVJERENJA: FAKTORI KOJI UTIČU NA IZBOR ZDRAVSTVENE USTANOVE KOD PACIJENATA

Dragana Aleksić Matić¹, Vesna Ćurić¹

¹ZU Medico-S, Banja Luka, Bosna i Hercegovina

Sažetak. Savremeni zdravstveni sistemi suočavaju se sa promjenama u načinu donošenja odluka pacijenata, gdje tradicionalni modeli zasnovani na dostupnosti usluge sve više ustupaju mjesto modelima zasnovanim na povjerenju, iskustvu i preporuci. Cilj rada je analiza ključnih faktora koji utiču na izbor zdravstvene ustanove kod pacijenata u različitim oblastima zdravstvene zaštite, sa posebnim osvrtnom na ulogu preporuke i percepcije kvaliteta usluge. Istraživanje je zasnovano na analizi podataka prikupljenih kroz direktnu komunikaciju sa pacijentima i evaluaciju izvora dolaska pacijenata u okviru zdravstvene ustanove. Posmatrani su faktori kao što su preporuka prijatelja i porodice, preporuka ljekara, kvalitet usluge, online reputacija i drugi relevantni parametri. Rezultati pokazuju da više od 80% pacijenata dolazi na osnovu preporuke, što ovaj faktor čini dominantnim u procesu donošenja odluke. Kvalitet usluge i povjerenje u zdravstveni tim identifikovani su kao ključni sekundarni faktori koji potvrđuju izbor zdravstvene ustanove. Digitalni kanali i online prisustvo imaju manji direktni uticaj, ali značajno doprinose formiranju percepcije i dodatnoj validaciji odluke. Zaključak ukazuje da strategije zdravstvenih ustanova treba da budu usmjerene na izgradnju povjerenja, kontinuirano unapređenje kvaliteta usluge i sistemsko podsticanje pozitivnog iskustva pacijenata, uz integraciju digitalnih kanala kao podrške procesu donošenja odluka.

Ključne riječi: povjerenje, preporuka, zdravstvena zaštita, pacijenti, donošenje odluka

BETWEEN RECOMMENDATION AND TRUST: FACTORS INFLUENCING PATIENTS' CHOICE OF HEALTHCARE INSTITUTIONS

Dragana Aleksic Matic¹, Vesna Curic²

¹Medico-S Healthcare Institution, Banja Luka, Bosnia i Hercegovina

Abstract. Modern healthcare systems are increasingly shaped by changes in patient decision-making processes, where traditional models based on service availability are being replaced by models driven by trust, experience, and recommendations. The aim of this paper is to analyze the key factors influencing patients' choice of healthcare institutions across different areas of healthcare, with a particular focus on the role of recommendations and perceived quality of care. The research is based on the analysis of data collected through direct patient communication and evaluation of patient acquisition sources within a healthcare institution. Factors such as recommendations from family and friends, physician referrals, quality of service, online reputation, and other relevant parameters were examined. The results indicate that more than 80% of patients choose healthcare providers based on recommendations, making this the dominant decision-making factor. Service quality and trust in the medical team were identified as key secondary factors that confirm the final choice. Digital channels and online presence have a smaller direct impact, but significantly contribute to shaping perception and validating the decision. The conclusion highlights that healthcare institutions should focus on building trust, continuously improving service quality, and systematically enhancing patient experience, while integrating digital channels as support in the decision-making process.

Keywords: trust, recommendation, healthcare, patients, decision-making

STUDENTSKA SESIJA

STUDENT SESSION

ULOGA MEDICINSKE SESTRE U PREVENCIJI I LIJEČENJU RAKA GRLIĆA MATERICE

Danka Kusmuk¹, Magdalena Ćirković¹, Slađan Spremo¹, Sara Matović¹

¹Medicinski fakultet Foča, Univerzitet u Istočnom Sarajevu, Studentska 5,
Republika Srpska, Bosna i Hercegovina

Sažetak. U Republici Srpskoj godišnje od raka grlića materice oboli oko 180 žena, a od istog premine oko 50 žena godišnje. Ovi epidemiološki podaci nam govore u prilog tome da je ovom problemu potrebno pristupiti sa ozbiljnošću, naročito jer se karcinom grlića materice uspješno može prevenirati i liječiti. Sestra kao član multidisciplinarnog tima zauzima važno mjesto u prevenciji i liječenju karcinoma grlića materice. Sestra kroz društveno-vaspitni rad sprovodi primarnu prevenciju kroz edukaciju stanovništva. Takođe, naglašava postojanje prevencije u vidu HPV vakcine i daje potrebne informacije o istoj. Učestvuje u sekundarnoj prevenciji organizacijom skrining testova, i pružanjem psihološke podrške pacijentkinjama koje učestvuju u skriningu. Nakon uspostavljanja dijagnoze, sestra procjenjuje stanje pacijentkinje, pruža psihološku njegu. Učestvuje u svim etapama liječenja, bilo ono hirurško, radioterapija ili hemioterapija. Sestra ima holistički pristup tokom cijelog trajanja liječenja. Ona učestvuje u kontroli bola. Pomaže pacijentkinji u fizičkoj njezi. Pruža palijativnu njegu ukoliko je to potrebno. Uloga sestre je, dakle, velika i nezamjenjiva.

Ključne riječi: rak grlića materice, prevencija, vakcinacija, skrining, liječenje, zdravstvena njega

ROLE OF THE NURSE IN THE PREVENTION AND TREATMENT OF CERVICAL CANCER

Danka Kusmuk¹, Magdalena Ćirković¹, Slađan Spremo¹, Sara Matović¹

¹Faculty of Medicine Foča, University of East Sarajevo, Studentska 5, Republic of Srpska, Bosnia and Herzegovina

Abstract. In the Republic of Srpska, approximately 180 women are diagnosed with cervical cancer annually, while around 50 women die from the disease each year. These epidemiological data suggest that this issue must be approached with great seriousness, particularly because cervical cancer can be successfully prevented and treated. As a member of a multidisciplinary team, the nurse holds a vital position in the prevention and treatment of cervical cancer. Through socio-educational work, the nurse implements primary prevention by educating the population. Furthermore, the nurse emphasizes the availability of prevention via the HPV vaccine and provides necessary information regarding it. The nurse participates in secondary prevention by organizing screening tests and providing psychological support to patients undergoing screening. Once a diagnosis is established, the nurse assesses the patient's condition and provides psychological care. The nurse participates in all stages of treatment, whether surgical, radiotherapy, or chemotherapy, maintaining a holistic approach throughout the entire process. Key responsibilities include pain management, assistance with physical care, and providing palliative care when necessary. Therefore, the role of the nurse is significant and irreplaceable.

Keywords: cervical cancer, prevention, vaccination, screening, treatment, nursing care.

SPEKTROFOTOMETRIJSKA ANALIZA SADRŽAJA UKUPNIH FENOLA U LJEKOVITOM I ZAČINSKOM BILJU

Gabriela Čolić¹, Olivera Milašinović¹, Željka Marjanović-Balaban²

¹ JU Visoka medicinska škola Prijedor, Student prvog ciklusa, Nikole Pašića 4a, Prijedor, Republika Srpska, Bosna i Hercegovina

² Šumarski fakultet Univerziteta u Banjoj Luci, Bulevar vojvode Petra Bojovića 1a, Banja Luka, Republika Srpska, Bosna i Hercegovina

Sažetak. Prema definiciji Svjetske zdravstvene organizacije, ljekovito bilje se definiše kao biljna vrsta čiji jedan ili više biljnih dijelova sadrže biološki aktivne supstance koje se mogu koristiti u terapijske svrhe ili u hemijsko-farmaceutskoj sintezi, a aromatično bilje kao biljna vrsta koja sadrži jednu ili više aktivnih supstanci posebnog mirisa ili okusa, koje se koriste za proizvodnju mirisa, kozmetičkih proizvoda, napitaka i aroma za životne namirnice. Ekološki parametri staništa ključni su faktori koji determinišu sadržaj fenola u biljnoj sirovini. Fenolna jedinjenja, kao dominantna grupa sekundarnih metabolita u ljekovitom i začinskom bilju, definišu sposobnost neutralizacije slobodnih radikala, što direktno utiče na farmakološku vrijednost i nutritivne benefite biljnih ekstrakata. Cilj ovog istraživanja bio je da se odredi sadržaj ukupnih fenola u vodenim ekstraktima samoniklog ljekovitog i začinskog bilja sa prostora Hercegovine, i to: list lovora (*Laurus nobilis* L.), list žalfije (*Salvia officinalis* L.), grančica sa iglicama ruzmarina (*Rosmarinus officinalis* L.), cvijet zove (*Sambucus nigra* L.), cvijet lavande (*Lavandula angustifolia* L.) i plod šipurka (*Rosa canina* L.). Klima Hercegovine, poznata po svom specifičnom spoju mediteranskih i kontinentalnih uticaja, predstavlja „prirodni stresor“ koji biljku podstiče na proizvodnju visokih koncentracija sekundarnih metabolita. List lovora koristi se kao začin i aroma u pripremi hrane, kao i u farmaceutskoj i kozmetičkoj industriji zbog svojih antibakterijskih, antifungalnih i antioksidativnih karakteristika. List žalfije bogat je eteričnim uljima, taninima, flavonoidima i fenolnim kiselinama, a ima širok spektar farmakološkog djelovanja. Ruzmarin je mediteranska biljka koja se koristi kao začin, ali ima i ljekovita svojstva. Sadrži vitamin C, enzime i eterična ulja. Zova je bogata ugljenim hidratima, proteinima, mastima, organskim kiselinama, mineralima, vitaminima i eteričnim uljima. Poznata je kao „prirodni lijek za disajne puteve“, a koristi se i u kozmetičkoj i prehrambenoj industriji. Cvjetovi lavande bogati su linaloolom, kumarinom i flavonoidima, a koriste se u medicini zbog sedativnog, antiseptičkog i protivupalnog djelovanja, kao i u kozmetičkoj i prehrambenoj industriji. Šipurak je jedna od najejenjenijih samoniklih biljaka koja se smatra „bombom“ vitamina i minerala, bogatom fenolnim jedinjenjima. Koristi se u narodnoj medicini, kozmetičkoj i prehrambenoj industriji. Vodeni ekstrakti navedenog i ispitanog ljekovitog i začinskog bilja dobijeni su kao nusproizvodi hidrodestilacije u aparaturi po Klevendžeru, a sadržaj ukupnih fenola određen je prema Folin-Ciocalteu metodi. Određivanje ukupnog sadržaja flavonoida, kao podgrupe fenolnih jedinjenja, izvršeno je prema metodi Ordoni i saradnika. Rezultati su prikazani kao srednje vrijednosti tri nezavisna mjerenja $\pm$ standardna devijacija,

uz primjenu ANOVA testa sa nivoom značajnosti od 0,001 ($p < 0,001$). Dobijeni rezultati su pokazali da je sadržaj ukupnih fenola u vodenim ekstraktima visok. U vodenom ekstraktu lista lovora iznosi $46,736 \pm 0,029$ mg GAE/g WE, žalfije $94,096 \pm 0,004$ mg GAE/g WE, ruzmarina $67,210 \pm 0,064$ mg GAE/g WE, zove $73,501 \pm 0,016$ mg GAE/g WE, lavande $80,691 \pm 0,066$ mg GAE/g WE i šipurka $43,756 \pm 0,011$ mg GAE/g WE, a ukupnih flavonoida $1,577 \pm 0,022$ mg QE/g WE, $5,638 \pm 0,050$ mg QE/g WE, $2,029 \pm 0,057$ mg QE/g WE, $8,336 \pm 0,023$ mg QE/g WE, $3,571 \pm 0,014$ mg QE/g WE i $1,449 \pm 0,097$ mg QE/g WE, respektivno. Procentualni udio flavonoida u ukupnim fenolima kretao se od 3,02% kod ruzmarina do 11,34% kod zove. Na osnovu dobijenih rezultata, a imajući u vidu da je riječ o nusproizvodu, može se zaključiti da ispitani vodeni ekstrakti predstavljaju izvor izuzetno vrijednih bioaktivnih komponenti, te da su potrebna dalja istraživanja sa ciljem sticanja sveobuhvatnog uvida u njihovu moguću praktičnu primjenu.

Ključne riječi: ljekovito bilje, začinsko bilje, fenoli, vodeni ekstrakt

SPECTROPHOTOMETRIC ANALYSIS OF TOTAL PHENOLIC CONTENT IN MEDICINAL AND AROMATIC PLANTS

Gabriela Čolić¹, Olivera Milašinović¹, Željka Marjanović-Balaban²

¹ College of Health Studies Prijedor, Undergraduate student, Nikole Pašića 4a, Prijedor, Republic of Srpska, Bosnia and Herzegovina

² Faculty of Forestry, University of Banja Luka, Bulevar vojvode Petra Bojovića 1a, Banja Luka, Republic of Srpska, Bosnia and Herzegovina

Abstract. According to the definition of the World Health Organization, medicinal plants are defined as plant species whose one or more parts contain biologically active substances that can be used for therapeutic purposes or in chemical-pharmaceutical synthesis, while aromatic plants are defined as plant species that contain one or more active substances with a specific aroma or taste, used in the production of fragrances, cosmetic products, beverages, and food flavorings. Ecological habitat parameters are key factors determining the phenolic content in plant raw materials. Phenolic compounds, as a dominant group of secondary metabolites in medicinal and aromatic plants, determine the ability to neutralize free radicals, which directly affects the pharmacological value and nutritional benefits of plant extracts. The aim of this study was to determine the total phenolic content in aqueous extracts of wild medicinal and aromatic plants from the Herzegovina region, namely: bay leaf (*Laurus nobilis* L.), sage leaf (*Salvia officinalis* L.), rosemary twigs with needles (*Rosmarinus officinalis* L.), elderflower (*Sambucus nigra* L.), lavender flower (*Lavandula angustifolia* L.), and rosehip fruit (*Rosa canina* L.). The climate of Herzegovina, known for its specific combination of Mediterranean and continental influences, represents a “natural stressor” that stimulates plants to produce high concentrations of secondary metabolites. Bay leaves are used as a spice and flavoring agent in food preparation, as well as in the pharmaceutical and cosmetic industries due to their antibacterial, antifungal, and antioxidant properties. Sage leaves are rich in essential oils, tannins, flavonoids, and phenolic acids and exhibit a wide range of pharmacological effects. Rosemary is a Mediterranean plant used as a spice but also possesses medicinal properties. It contains vitamin C, enzymes, and essential oils. Elder is rich in carbohydrates, proteins, fats, organic acids, minerals, vitamins, and essential oils. It is known as a “natural remedy for respiratory tract conditions” and is also used in the cosmetic and food industries. Lavender flowers are rich in linalool, coumarin, and flavonoids and are used in medicine due to their sedative, antiseptic, and anti-inflammatory effects, as well as in cosmetics and food production. Rosehip is one of the most valued wild plants, considered a “vitamin and mineral bomb,” rich in phenolic compounds. Aqueous extracts of the investigated medicinal and aromatic plants were obtained as by-products of hydrodistillation using a Clevenger apparatus, and the total phenolic content was determined using the Folin–Ciocalteu method. The total flavonoid content, as a subgroup of phenolic compounds, was determined according to the method of Ordonez et al. The results are presented as mean values of three independent measurements $\pm$ standard deviation, using ANOVA with a significance level of 0.001 ($p < 0.001$). The obtained results showed that the content of total phenolics in the aqueous extracts was high. The values were 46.736 ± 0.029

mg GAE/g WE for bay leaf, 94.096 ± 0.004 mg GAE/g WE for sage, 67.210 ± 0.064 mg GAE/g WE for rosemary, 73.501 ± 0.016 mg GAE/g WE for elder, 80.691 ± 0.066 mg GAE/g WE for lavender, and 43.756 ± 0.011 mg GAE/g WE for rosehip, while the total flavonoid content was 1.577 ± 0.022 mg QE/g WE, 5.638 ± 0.050 mg QE/g WE, 2.029 ± 0.057 mg QE/g WE, 8.336 ± 0.023 mg QE/g WE, 3.571 ± 0.014 mg QE/g WE, and 1.449 ± 0.097 mg QE/g WE, respectively. The percentage of flavonoids in total phenolics ranged from 3.02% in rosemary to 11.34% in elder. Based on the obtained results, and considering that these are by-products, it can be concluded that the investigated aqueous extracts represent a source of highly valuable bioactive components, and that further research is needed to gain a comprehensive insight into their potential practical application.

Keywords: medicinal plants, aromatic plants, phenols, aqueous extracts

CLARK I BRESLOW KAO GLAVNI PROGNOСТИČKI PARAMETRI KOD MELANOMA KOŽE

Marina Aničić¹, Goran Tukić^{1,2}

¹JU Visoka medicinska škola Prijedor, Nikole Pašića 4a, 79101 Prijedor,
Bosna i Hercegovina

²JZU Bolnica „Dr Mladen Stojanović” Prijedor, Republika Srpska,
Bosna i Hercegovina

Sažetak. Clarkov nivo invazije i Breslowova debljina opisuju dubinu prodora melanoma, ali nemaju jednaku ulogu u savremenom stadiranju. Cilj rada bio je analizirati njihovu raspodjelu i međusobnu povezanost te odnos sa odabranim kliničko-patološkim obilježjima melanoma kože. Retrospektivnom deskriptivno-analitičkom studijom obuhvaćeni su anonimizovani podaci iz medicinske dokumentacije 29 pacijenata liječenih u JZU Bolnica „Dr Mladen Stojanović” Prijedor. Analizirani su pol, lokalizacija, histološki tip tumora, invazija limfnih sudova, Clarkov nivo, Breslowova debljina i pT kategorija, a povezanost Clarkovog nivoa i Breslowove debljine procijenjena je Spearmanovim koeficijentom korelacije ranga. Clarkov nivo IV utvrđen je kod 22 pacijenta (75,9%), a nodularni melanom kod 26 (89,7%). Prosječna Breslowova debljina iznosila je $3,41 \pm 1,69$ mm, medijana 4,0 mm, uz raspon 1,0-8,0 mm. Najčešća pT kategorija bila je pT3b (44,8%), dok je invazija limfnih sudova evidentirana kod 58,6% pacijenata. Utvrđena je snažna pozitivna povezanost Clarkovog nivoa i Breslowove debljine (Spearmanov $\rho=0,720$; $p<0,001$). Rezultati potvrđuju da oba parametra odražavaju napredovanje tumora u dubinu, ali Breslowova debljina, zbog veće objektivnosti, bolje ponovljivosti i neposredne uloge u pT klasifikaciji, ima centralni značaj u savremenoj prognostičkoj procjeni. Nalaze treba tumačiti uz ograničenja malog retrospektivnog uzorka i nedostatka podataka o kliničkom ishodu.

Ključne riječi: melanom kože, Breslowova debljina, Clarkov nivo, prognoza, pT kategorija

CLARK AND BRESLOW AS THE MAIN PROGNOSTIC PARAMETERS IN CUTANEOUS MELANOMA

Marina Aničić¹, Goran Tukić^{1,2}

¹PI College of Health Sciences Prijedor, Nikole Pašića 4a, 79101 Prijedor, Bosnia and Herzegovina

²PHI Hospital „Dr Mladen Stojanović” Prijedor, Republic of Srpska, Bosnia and Herzegovina

Abstract. Clark level of invasion and Breslow thickness describe the depth of melanoma invasion, but they do not have an equal role in contemporary staging. The aim of this study was to analyze their distribution and mutual relationship, as well as their relationship with selected clinicopathological features of cutaneous melanoma. A retrospective descriptive-analytical study included anonymized data from the medical records of 29 patients treated at the Dr Mladen Stojanović Hospital in Prijedor. Sex, tumor location, histological tumor type, lymphatic vessel invasion, Clark level, Breslow thickness, and pT category were analyzed, and the relationship between Clark level and Breslow thickness was assessed using Spearman's rank correlation coefficient. Clark level IV was found in 22 patients (75.9%), and nodular melanoma in 26 (89.7%). The mean Breslow thickness was 3.41 ± 1.69 mm, the median was 4.0 mm, with a range of 1.0-8.0 mm. The most common pT category was pT3b (44.8%), while lymphatic vessel invasion was recorded in 58.6% of patients. A strong positive correlation was found between Clark level and Breslow thickness (Spearman's $\rho=0.720$; $p<0.001$). The results confirm that both parameters reflect tumor progression in depth, but Breslow thickness, owing to its greater objectivity, better reproducibility, and direct role in pT classification, has central importance in contemporary prognostic assessment. The findings should be interpreted with consideration of the limitations of the small retrospective sample and the lack of clinical outcome data.

Keywords: cutaneous melanoma, Breslow thickness, Clark level, prognosis, pT category

PROCJENA ZNANJA ZDRAVSTVENOG OSOBLJA O PROFESIONALNIM RIZICIMA U BOLNICAMA JUŽNOG TUNISA

Hassen Teyeb¹, Laarayedh Sarra², Yasser Bettaib³, Manal Kouken⁴, Lamia Jbeli⁵, Houyem Said Laatiri¹, Olfa Bouallegue¹

¹ Istraživačka laboratorija, Medicinski fakultet Ibn El Jazzar, Univerzitet u Sousseu, Tunis.

² Odjel za anatomsku i citološku patologiju, Regionalna bolnica Sadok Mkaddem, Djerba. Medicinski fakultet Ibn El Jazzar, Univerzitet u Sousseu, Tunis.

³ Bolnica distrikta Sidi Makhoulouf, Medenine, Tunis.

⁴ Odjel hitne medicine, Regionalna bolnica Sadok Mkaddem, Djerba, Tunis.

⁵ Odjel opšte medicine, Regionalna bolnica Zarzis, Tunis.

Sažetak. Kao članica International Labour Organization od 1956. godine, Tunis je potpisao konvencije koje štite radnike i unapređuju uslove rada. Naime, sve tuniske ustanove i kompanije sa 500 ili više zaposlenih treba da imaju vlastitu službu medicine rada. Ustanove sa manjim brojem zaposlenih mogu formirati zajedničke službe medicine rada. Na radnom mjestu zdravstveni radnici, kao i svi drugi zaposleni, mogu biti izloženi brojnim rizicima. U ovoj studiji procijenjeno je znanje zdravstvenog osoblja u četiri regionalne bolnice o profesionalnim rizicima, posebno hemijskim i biološkim rizicima. Validirani upitnik distribuiran je putem Google Forms platforme medicinskom i paramedicinskom osoblju četiri bolnice koje djeluju u okviru Regionalne zdravstvene direkcije Medenine. Ispitanici su uglavnom bili tehničari (40,5%) i medicinske sestre/tehničari (37,8%), zaposleni pretežno u laboratorijama (56%) ili prijemnim bolničkim odjelima (32%). U vezi sa identifikacijom rizika, osoblje je najčešće navodilo biološke rizike, posebno profesionalnu izloženost krvi, kao i hemijske rizike. Zapravo, 65% ispitanika izjavilo je da je izloženo biološkim rizicima, dok je 43% identifikovalo hemijske rizike. Mnogi članovi osoblja nisu upoznati sa sigurnosno-tehničkim listovima (Safety Data Sheets) ili ih ne koriste u svakodnevnoj praksi. Iako je većina osoblja prošla obuku o biološkim rizicima, 56% njih nije bilo obučeno u vezi sa hemijskim rizicima. Takođe je utvrđeno da osoblje nije dovoljno edukovano o upravljanju profesionalnim rizicima. Značajno je da je 73% učesnika dalo pogrešan odgovor kada su upitani o individualnim ili kolektivnim mjerama zaštite. Na osnovu rezultata ove studije planiran je program obuke na regionalnom i lokalnom nivou kako bi se otklonile uočene slabosti. Studija je još uvijek u toku i cilj joj je uključiti veći broj zaposlenih.

Ključne riječi: bolnica, profesionalni rizici, prevencija, evaluacija, Tunis.

EVALUATION OF HEALTHCARE STAFF'S KNOWLEDGE ABOUT OCCUPATIONAL RISKS IN SOUTHERN TUNISIAN HOSPITALS

Hassen Teyeb¹, Laarayedh Sarra², Yasser Bettaib³, Manal Kouken⁴, Lamia Jbeli⁵
, Houyem Said Laatiri¹, Olfa Bouallegue¹

¹Research laboratory, Faculty of Medicine Ibn EL Jazzar, University of Sousse, Tunisia

²Anatomical and Cytological Pathology department at Sadok Mkaddem Regional Hospital, Djerba. Faculty of Medicine Ibn EL Jazzar, University of Sousse, Tunisia.

³Hospital of circumscription of Sidi Makhlouf, Medenine, Tunisia.

⁴Emergency department, Sadok Mkaddem Regional Hospital, Djerba, Tunisia.

⁵General Medecine department, Regional Hospital of Zarzis, Tunisia.

Abstract. As a member of International Labour Organization since 1956, Tunisia was signed the conventions protecting workers and improving work conditions. In fact, all Tunisian facilities and companies with 500 workers or more should have their own occupational health department. However, the other with less than this number of staff, can create such an occupational health group. In workplace, medical staff, as well as any workers, can be exposed to many risks. We evaluate in this study the knowledge of healthcare staff in four regionals hospitals about professional risks, especially chemical and biological risks. A validated questionnaire was distributed by google forms to medical and paramedical staff of four hospitals afflied to regional health direction of Medenine. Responders were mainly technicians (40.5%) and nurses (37.8%) working mainly in laboratory (56%) or admission hospital departement (32%). About risk identification, staff mentionated biological risks mainly Occupational Exposure to Blood as well as chemical risks. In fact, 65% of respondents reported being exposed to biological risks, whereas 43% identified chemical risks. Many staff members are either unfamiliar with Safety Data Sheets or do not utilize them in their daily practice. If most of staff were trained about biological risk, 56% of them are not trained concerning chemical risk. It was also seem that staff are not trained about professionnal risk management, Notably, 73% of participants gave wrong response when they were asqued for individual or collective protection. In the light of this study, we planned a traing program at regional and local level to adress these weakness. This study is ongoing and aims to include a larger number of staff members.

Key words: Hospital, Occupationnal risks, Prevention, Evaluation, Tunisia

DRUŠTVENE MREŽE U OBRAZOVANJU MEDICINSKIH SESTARA I BABICA: MULTICENTRIČNI I MEĐUNARODNI ISTRAŽIVAČKI PROTOKOL

***Aysun Bayram¹, Magdalena Dziurka², Müge Tezel¹, Betül Bal³, Beata
Dobrowolska^{2*}***

¹ Karadeniz Tehnički Univerzitet, Fakultet zdravstvenih nauka, Trabzon, Turska

² Medicinski univerzitet u Lublinu, Lublin, Poljska

³ Univerzitet Yozgat Bozok, Akdağmadeni Fakultet zdravstvenih nauka, Yozgat, Turska

Sažetak. Ovaj istraživački protokol razvijen je kroz saradnju istraživača iz Turske i Poljske i ima za cilj procjenu uloge društvenih mreža i influensera na društvenim mrežama u obrazovanju medicinskih sestara i babica, kao i implikacija ovog fenomena na obrazovne procese. Glavni ciljevi protokola su: (I) prilagoditi Upitnik o društvenim mrežama u obrazovanju sestrinstva (SMQNT) poljskom jeziku, (II) sprovesti komparativnu analizu rezultata SMQNT među studentima sestrinstva i babištva u Poljskoj i Turskoj, i (III) sprovesti detaljnu analizu stavova studenata o ulozi influensera na društvenim mrežama u njihovim obrazovnim procesima. Istraživanje se sprovodi u okviru multicentrične strukture koja uključuje ukupno tri različite institucije: jednu iz Poljske i dvije iz Turske. Proces istraživanja sastoji se od četiri glavne faze: (1) metodološka faza; (2) komparativna faza; (3) kvalitativna faza; i (4) faza izvještavanja. Etička odobrenja za ovaj istraživački protokol dobijena su i u Turskoj i u Poljskoj. Ovaj protokol predstavlja međunarodni, multicentrični istraživački okvir usmjeren na ispitivanje percepcija studenata sestrinstva i babištva o fenomenu društvenih mreža u zdravstvenom sektoru kroz međukulturalni, multidimenzionalni i mješoviti metodološki pristup.

Ključne riječi: obrazovanje medicinskih sestara, obrazovanje babica, društvene mreže, studenti.

SOCIAL MEDIA IN NURSING AND MIDWIFERY EDUCATION: A MULTICENTER AND INTERNATIONAL RESEARCH PROTOCOL

Aysun Bayram¹, Magdalena Dziurka², Müge Tezel¹, Betül Bal³, Beata Dobrowolska^{2,*}

¹ Karadeniz Technical University, Faculty of Health Sciences, Trabzon, Türkiye

² Medical University of Lublin, Lublin, Poland

³ Yozgat Bozok University, Akdağmadeni School of Health Sciences, Yozgat, Türkiye

Abstract. This study protocol was developed through collaboration between researchers from Türkiye and Poland and aims to evaluate the role of social media and social media influencers in nursing and midwifery education, as well as the implications of this phenomenon for educational processes. The protocol's primary objectives are: (I) to adapt the Social Media Questionnaire for Nursing Education (SMQNT) to Polish language, (II) to conduct a comparative analysis of SMQNT findings among nursing and midwifery students in Poland and Türkiye, and (III) to conduct an in-depth analysis of students' views regarding the role of social media influencers in their educational processes. The research is being conducted within a multi-center structure involving a total of three different institutions: one from Poland and two from Türkiye. The research process consists of four main phases: (1) methodological phase; (2) comparative phase; (3) qualitative phase; and (4) reporting phase. Ethical committee approvals were obtained from both Türkiye and Poland for this study protocol. This protocol presents an international, multi-center research framework aimed at examining nursing and midwifery students' perceptions of social media phenomena in the health sector through a cross-cultural, multidimensional, and mixed-methods approach.

Key words: Nursing education, midwifery education, social media, student.

**ISTRAŽIVANJE ULOGE ZDRAVSTVENIH INFLUENSERA NA
DRUŠTVENIM MREŽAMA U OBLIKOVANJU PROFESIONALNOG
IDENTITETA STUDENATA SESTRINSTVA I BABIŠTVA:
MEĐUNARODNA KVALITATIVNA STUDIJA**

***Magdalena Dziurka¹, Aysun Bayram², Zeynur Es², Betül Bal³, Beata
Dobrowolska^{1,*}***

¹ Medicinski univerzitet u Lublinu, Lublin, Poljska

² Karadeniz Tehnički univerzitet, Fakultet zdravstvenih nauka, Trabzon, Turska

³ Univerzitet Yozgat Bozok, Visoka škola zdravstvenih nauka Akdağmadeni,
Yozgat, Turska

Sažetak: Cilj ove studije bio je istražiti perspektive studenata sestrinstva i babištva o ulozi zdravstvenih influensera na društvenim mrežama te identifikovati implikacije koje ovi influenseri imaju na njihovo obrazovanje, profesionalni identitet i profesionalni razvoj. Studija je sprovedena korištenjem kvalitativnog deskriptivnog istraživačkog dizajna. Realizovana je kao multicentrična studija na tri različita univerziteta: jednoj instituciji u Poljskoj i dvije u Turskoj. Populaciju istraživanja činili su studenti osnovnih i master studija sestrinstva i babištva upisani na ove institucije. Ukupno je u studiju uključeno 36 studenata, od čega 16 iz Poljske i 20 iz Turske. Podaci su prikupljeni putem polustrukturisanih intervju a licem u lice i analizirani tematskom analizom. Etička odobrenja pribavljena su u obje zemlje. Nalazi su pokazali da su studenti zdravstvene influensere na društvenim mrežama prvenstveno procjenjivali na osnovu pouzdanosti informacija, profesionalne kompetencije, kliničkog iskustva i etičkog stava. Učesnici su ove influensere doživljavali kao pristupačan i podržavajući izvor učenja, posebno u vezi sa kliničkim vještinama, primjerima iz prakse i profesionalnom motivacijom. Međutim, naglasili su da je sadržaj često površan, da zahtijeva provjeru i da ne može zamijeniti formalno obrazovanje. Utvrđeno je da društvene mreže doprinose razvoju vještina, kliničkoj pripremi i formiranju profesionalnog identiteta studenata, ali su istovremeno prepoznate i kao potencijalno rizično okruženje zbog dezinformacija, etičkih kršenja i nesklada između teorije i prakse. Zaključno, rezultati ukazuju da zdravstveni influenseri na društvenim mrežama mogu predstavljati pristupačan i motivišući izvor učenja za studente sestrinstva i babištva. Međutim, njihova obrazovna vrijednost može se koristiti na smislen i siguran način samo uz kritičko vrednovanje, etičku osviještenost i akademski nadzor.

Ključne riječi: influenseri, studenti babištva, studenti sestrinstva, društvene mreže.

EXPLORING THE ROLE OF HEALTH-RELATED SOCIAL MEDIA INFLUENCERS IN SHAPING THE PROFESSIONAL IDENTITY OF NURSING AND MIDWIFERY STUDENTS: AN INTERNATIONAL QUALITATIVE STUDY

Magdalena Dziurka¹, Aysun Bayram², Zeynur Es², Betül Bal³, Beata Dobrowolska^{1,}*

¹ Medical University of Lublin, Lublin, Poland

² Karadeniz Technical University, Faculty of Health Sciences, Trabzon, Türkiye

³ Yozgat Bozok University, Akdağmadeni School of Health Sciences, Yozgat, Türkiye

Abstract. The aim of this study is to explore the perspectives of nursing and midwifery students on the role of social media influencers in the healthcare field and to identify the implications of these influencers on their education, career identity, and professional development. The study was conducted using a qualitative descriptive research design. It was carried out as a multi-center study at a total of three different universities: one institution in Poland and two in Türkiye. The study population consisted of undergraduate and graduate nursing and midwifery students enrolled at these three institutions. A total of 36 students were included in the study, comprising 16 students from Poland and 20 students from Türkiye. Data were collected through face-to-face semi-structured interviews with the students and analysed by using thematic analysis. Ethical committee approvals were obtained from both countries. The findings revealed that students primarily evaluated social media influencers in the healthcare field based on information reliability, professional competence, clinical experience, and ethical stance. Participants viewed these influencers as an accessible and supportive learning resource, particularly regarding clinical skills, case examples, and professional motivation; however, they emphasized that the content was mostly superficial, in need of verification, and incapable of replacing formal education. Social media has been found to be beneficial for students in terms of skill development, clinical preparation, and the formation of professional identity; however, it has also been identified as a risky environment regarding misinformation, ethical violations, and the mismatch between theory and practice. In conclusion, the findings indicate that social media influencers in the health field offer an accessible and motivating learning resource for nursing and midwifery students; however, their educational value can only be utilized in a meaningful and safe manner within the framework of critical evaluation, ethical awareness, and academic oversight.

Keywords: Influencers, midwifery students, nursing students, social media.

AUTOFAGIJA

Magdalena Ćirković¹, Danka Kumsuk¹, Slađan Spremo¹, Sara Matović¹, Mia Glišić¹, Božana Rajić¹

¹Medicinski fakultet Foča, Univerzitet u Istočnom Sarajevu, Studentska 5,
Republika Srpska, Bosna i Hercegovina

Sažetak. Autofagija predstavlja proces u kojim ćelija razgrađuje nepotrebne i disfunkcionalne dijelove ćelija. Ovaj proces je evolucijski dobro očuvan mehanizam pomoću kog je ćelija preživljavala. Osim toga, ćelije ovaj katabolički proces koriste radi obezbjeđivanja dovoljno hranjivih materija. Rad pruža detaljan istorijski pregled uvođenja termina autofagije i njegovog potpunog razjašnjenja, čija je ključna godina 2016. kada je Jošinori Osumi dobio Nobelovu nagradu za razjašnjenje ove složene funkcije ćelije. Cilj rada je bio ukazati na faktore koji dovode ćeliju do autofagije, kao što su oštećenje organela, nakupljanje proteina, oksidativni stres, nedostatak insulina i ostali faktori. Objasnićemo mehanizam kojim ćelija postiže proces autofagije, te njenu osnovnu podjelu na makroautofagiju, mikroautofagiju i autofagiju posredovanu proteinima. Proces autofagije je takođe i regulatorni proces kojim ćelije mogu da stupe u apoptozu, odnosno programiranu ćelijsku smrt tipa dva. Od kada je otkriven i razjašnjen ovaj proces, uočava se mogućnost njene primjene u prevenciji i liječenju određenih hroničnih stanja i oboljenja, kao što su neurodegenerativna oboljenja, karcinomi i infekcije.

Ključne riječi: autofagija, katabolički proces, mikroautofagija, makroautofagija

AUTOPHAGY

Magdalena Ćirković¹, Danka Kumsuk¹, Slađan Spremo¹, Sara Matović¹, Mia Glišić¹, Božana Rajić¹

¹Faculty of Medicine Foča, University of East Sarajevo, Studentska 5, Republic of
Srpska, Bosnia and Herzegovina

Abstract. Autophagy is a process in which a cell degrades its own unnecessary and dysfunctional components. This process is an evolutionarily well-preserved mechanism that has enabled cellular survival throughout history. Furthermore, cells utilize this catabolic process to ensure an adequate supply of nutrients. This paper provides a detailed historical overview of the introduction of the term "autophagy" and its complete elucidation, with the key year being 2016, when Yoshinori Ohsumi received the Nobel Prize for clarifying this complex cellular function. In this paper, we address the stress factors that induce autophagy in cells, such as organelle damage, protein aggregation, oxidative stress, insulin deficiency, and other factors. We explain the mechanisms through which the cell achieves the process of autophagy, as well as its primary classification into macroautophagy, microautophagy, and chaperone-mediated autophagy. The process of autophagy is also a regulatory mechanism through which cells can enter apoptosis, or programmed cell death type II. Since the discovery and clarification of this process, there has been a significant focus on its potential application in the prevention and treatment of certain chronic conditions and diseases, such as neurodegenerative disorders, cancers, and infections.

Keywords: autophagy, catabolic process, macroautophagy, microautophagy

UTICAJ PROTEINA LEĆE, TIKVE I RIŽE NA PROCES FERMENTACIJE I PROMJENE TOKOM SKLADIŠTENJA SOJINOG JOGURTA OBOGAĆENOG MEDOM

Sunčica Knežević¹, Milka Stjepić¹

¹JU Visoka medicinska škola Prijedor, Nikole Pašića 4a, Prijedor,
Republika Srpska, Bosna i Hercegovina

Sažetak. Sojino mlijeko predstavlja značajnu sirovinu za proizvodnju biljnih fermentisanih proizvoda zahvaljujući povoljnom nutritivnom sastavu i prisustvu bioaktivnih komponenti. Cilj ovog rada bio je ispitati uticaj dodatka biljnih proteinskih preparata tikve, leće i riže, u kombinaciji sa medom, na promjene pH vrijednosti, elektrohemijskog potencijala i titracione kiselosti fermentisanog sojinog jogurta tokom fermentacije i skladištenja. Fermentacija je provedena primjenom probiotičke kulture *Bifidobacterium bifidum*, a praćenje promjena vršeno je tokom fermentacije, kao i prvog, sedmog i četrnaestog dana skladištenja. Rezultati su pokazali kontinuiran pad pH vrijednosti tokom fermentacije kod svih uzoraka, pri čemu je uzorak sa dodatkom proteina leće pokazao sporiju acidifikaciju i veću stabilnost tokom skladištenja. Uzorci sa dodatkom proteina riže i kontrolni uzorak pokazali su intenzivnije zakiseljavanje. Elektrohemijski potencijal pokazao je razlike između uzoraka, pri čemu je protein leće imao najizraženiji uticaj na redoks karakteristike sistema. Tokom skladištenja zabilježena je relativna stabilnost svih analiziranih parametara, što ukazuje na dobru održivost fermentisanih proizvoda.

Ključne riječi: sojin jogurt, biljni proteini, fermentacija, pH vrijednost, elektrohemijski potencijal, titraciona kiselost

THE INFLUENCE OF LENTIL, PUMPKIN, AND RICE PROTEINS ON THE FERMENTATION PROCESS AND CHANGES DURING STORAGE OF HONEY-ENRICHED SOY YOGURT

Sunčica Knežević¹, Milka Stjepić¹

¹PI College of Health Sciences, Nikole Pašića 4a, Prijedor,
Republic of Srpska, Bosnia and Herzegovina

Abstract. Soy milk represents an important raw material for the production of fermented plant-based products because of its favorable nutritional composition and the presence of bioactive compounds. The aim of this study was to investigate the influence of pumpkin, lentil, and rice protein preparations combined with honey on changes in pH value, electrochemical potential, and titratable acidity of fermented soy yogurt during fermentation and storage. Fermentation was carried out using the probiotic culture *Bifidobacterium bifidum*, while the changes were monitored during fermentation and on the 1st, 7th, and 14th day of storage. The results showed a continuous decrease in pH values during fermentation in all samples, while the sample with lentil protein exhibited slower acidification and greater stability during storage. Samples containing rice protein and the control sample showed more intensive acidification. Electrochemical potential differed among the samples, with lentil protein showing the most pronounced effect on the redox characteristics of the system. During storage, relative stability of all analyzed parameters was observed, indicating good stability of the fermented products.

Key words: soy yogurt, plant proteins, fermentation, pH value, electrochemical potential, titratable acidity

SISTEMSKA ANALIZA ISTRAŽIVAČKIH PODATAKA O UTICAJU TRIHALOMETANA IZ VODE ZA PIĆE NA NASTANAK KARCINOMA MOKRAĆNE BEŠIKE KOD LJUDI

Nedeljka Vuković¹

¹ Student doktorantskih studija Medicinskog fakulteta Univerziteta u Banjoj Luci, Save Mrkalja 14, Banja Luka, Republika Srpska, Bosna i Hercegovina

Sažetak. Trihalometani (THM) pripadaju supstancama koje se nazivaju nus-produkti dezinfekcije (NPD). Nastaju u procesu proizvodnje vode za piće kada se voda dezinfikuje hlorom, a pri tome voda sadrži organske materije i otkriveni su 1974. godine. Karcinom mokraćne bešike nastaje kada ćelije u bešici, koja je šuplji organ u obliku balona smješten u donjem dijelu trbuha u koji se skladišti mokraćna, počnu da rastu bez kontrole. Američki nacionalni institut za rak (NIR) je 1976. godine objavio rezultate studije prema kojoj su potvrđeni kancerogeni učinci hloroforma (osnovne supstance trihalometana), a 1979. godine oni se definišu kao kancerogeni. U ponovljenom istraživanju 1985. dokazano je da je u istraživanju iz 1976. postojala greška u načinu ekspozicije laboratorijskih životinja hloroformu, te ne mogu predstavljati osnov za procjenu rizika od uticaja THM na zdravlje ljudi. Svjetska zdravstvena organizacija (SZO) je 1984. objavila prve Smjernice na ovu temu, a radna grupa Međunarodne agencije za istraživanje raka (MOIR) je 1991. godine objavila monografiju sa analizom rezultata istraživanja vezanih za dokazivanje veze između THM u vodi za piće i karcinoma kod ljudi i zaključila da u tom momentu nisu postojali dokazi o kancerogenom uticaju trihalometana. Cilj ovoga rada jeste utvrditi uz pomoć zaključaka iz izabranih radova, objavljenih u periodu 2014- 2024 godina, da li je sada jasnija i potvrđena veza između THM iz vode za piće i karcinoma mokraćne bešike. Metodologija za potrebe ovog rada je podrazumijevala analizu istraživačkih studija koje analiziraju odnos trihalometana iz vode za piće i pojave karcinoma mokraćne bešike kod ljudi, objavljene u bazama naučnih publikacija Pubmed, Google Scholar ili Research gate u periodu od 2014. do 2024. godine i razvrstavanje istih prema nivoima dokaza. Sistemska analiza istraživačkih podataka o uticaju THM iz vode za piće u navedenom istraživačkom periodu pokazala je da se ne može donijeti jasan i nedvosmislen zaključak o direktnom uticaju THM iz vode za piće na nastanak karcinoma mokraćne bešike kod ljudi.

Ključne riječi: hlorisanje vode, THM u vodi za piće, prevalencija, faktori rizika i karcinom mokraćne bešike

SYSTEMATIC ANALYSIS OF RESEARCH DATA ON THE ASSOCIATION BETWEEN DRINKING WATER TRICHALOMETHANES AND THE INCIDENCE OF BLADDER CANCER IN HUMANS

Nedeljka Vuković¹

¹ PhD candidate, Faculty of Medicine, University of Banja Luka, Save Mrkalja 14,
Banja Luka, Republic of Srpska, Bosnia and Herzegovina

Abstract. Trihalomethanes (THMs) are categorized as disinfection by-products (DBPs). They are generated during drinking water treatment when chlorine disinfectants react with natural organic matter; their presence was first identified in 1974. Bladder cancer is characterized by the uncontrolled proliferation of cells within the bladder, a hollow, balloon-like pelvic organ responsible for urine storage. In 1976, the U.S. National Cancer Institute (NCI) released findings confirming the carcinogenicity of chloroform—the primary THM constituent—leading to its classification as a carcinogen by 1979. However, a 1985 re-evaluation demonstrated methodological flaws in the 1976 animal exposure protocols, suggesting they were insufficient for human health risk assessments of THMs. While the World Health Organization (WHO) issued its inaugural guidelines on this subject in 1984, a 1991 monograph by the International Agency for Research on Cancer (IARC) concluded that available epidemiological evidence was insufficient to establish a definitive carcinogenic link between THMs in drinking water and human cancer. The objective of this study is to evaluate, through a review of peer-reviewed literature published between 2014 and 2024, whether the association between drinking water THMs and bladder cancer has become more clearly defined or confirmed. The methodology involved a systematic analysis of research studies exploring the relationship between THM exposure and bladder cancer incidence. Sources were retrieved from the PubMed National Institutes of Health (.gov), Google Scholar, and ResearchGate databases and stratified according to their level of evidence. This systematic analysis of research data indicates that a definitive, unambiguous conclusion regarding the direct causal impact of drinking water THMs on the development of human bladder cancer remains elusive.

Key words: water chlorination, trihalomethanes (THM), drinking water, prevalence, risk factors, bladder cancer.

INDEKS AUTORA / INDEX OF AUTHORS

A

Adamović A. 31, 32
Aleksić A. 55, 56
Aleksić L. 55, 56
Aleksić Matić D. 145, 146
Alexopoulos C. 25, 26, 53, 54, 59, 60
Aljetic G. 97, 98
Aničić D. 143, 144
Aničić M. 155, 156
Antunović V. 49, 50
Arsić S. 27, 28, 105, 106

B

Bal B. 159, 160, 161, 162
Baletić Đ. 57, 58, 59, 60
Banović Fuentes J. 131, 132
Banović J. 131, 132
Bayram A. 159, 160, 161, 162
Berić S. 49, 50
Bettaib Y. 157, 158
Bojić M. 25, 26
Bouallegue O. 157, 158
Božić Lj. 71, 72
Božić N. 57, 58, 59, 60
Brajsovac M. 31, 32
Brenjo D. 3, 4
Brestovački Svitlica B. 45, 46
Brkić M. 63, 64

Č

Čolić G. 151, 153
Čolić T. 93, 94
Čirković M. 149, 150, 163
Čuk M. 63, 64
Ćurić V. 145, 146

D

Dabić J. 89, 90
Dakić D. 83, 84
Davidović D. 101, 102
Despotović L. 31, 32, 43, 44, 55, 56
Despotović M. 25, 26

Despotović M. 25, 26, 33, 34, 43, 44, 53, 54, 57, 58, 59, 60
Dimić I. 33, 34
Dobraš R. 15, 16
Dobrowolska B. 159, 160, 161, 162
Dovjak M. 111, 112
Dubinović-Rekić A. 69, 70
Dziurka M. 159, 160, 161, 162

Dž

Džopalić T. 55, 56

Đ

Đekić J. 61, 62
Đokanović D. 63, 64
Đukanović N. 57, 58
Đumišić F. 83, 84
Đurđević Milošević D. 123, 124, 127, 128, 133, 134

E

Egeljić – Mihailović N. 35, 36, 41, 42
Elez J. 133, 134
Eš Z. 161, 162

F

Figun Lj. 143, 144

G

Gajanin R. 63, 64
Gajanin V. 63, 64
Gajanin Ž. 63, 64
Gardašević G. 77, 78
Glišić M. 163
Glušac J. 123, 124, 127, 128
Gojković Cvjetković V. 137, 138
Govedar Z. 3, 4, 139, 140
Grahovac N. 83, 84
Grbić A. 89, 90
Grbić S. 129, 130
Gričarč N. 111, 112

Grujić I. 39, 40, 51, 52, 115, 116, 135, 136
Grujić R. 3, 4, 51, 52, 119, 120, 121, 122, 125, 126, 135, 136, 139, 140
Gutić M. 33, 34
Guzijan A. 63, 64

H

Hadživuković N. 23, 24, 73, 74
Hasković E. 47, 48
Herenda S. 47, 48

I

Ilić M. 53, 54
Ilić P. 3, 4
Ilić Todorović V. 57, 58, 59, 60

J

Janković-Pejičić A. 5, 6
Janković D. 19, 20
Javorac M. 85, 86
Jbeli L. 157, 158
Jeftić R. 41, 42
Jevšnik Podlesnik M. 117, 118
Jončić T. 61, 62
Jovanović F. 53, 54, 55, 56, 57, 58
Jovanović Mirković J. 57, 58, 59, 60, 61, 62
Jović D. 11, 12, 13, 14, 35, 36, 41, 42

K

Kacjan Žgajnar K. 141, 142
Karadžić D. 139, 140
Kaurin Šarac B. 51, 52
Kecman M. 29, 30
Kladar N. 49, 50
Kljajić D. 27, 28
Komosar A. 35, 36
Kouken M. 157, 158
Kusmuk D. 149, 150, 163
Knežević S. 164
Knežević D. 13, 14
Kalajdžić O. 23, 24

Kucurski Lj. 23, 24, 25,
26, 33, 34, 43, 44

L

Langerholc T. 117, 118
Laštro D. 101, 102, 103,
104
Lukić M. 73, 74
Lužija A. 103, 104

Lj

Ljubojević G. 79, 80

M

Mahmutović A. 69, 70,
71, 72
Mančić M. 53, 54
Marjanović-Balaban Ž.
49, 50, 137, 138, 151, 153
Matijević L. 91, 92
Matović S. 149, 150, 163
Matović S. 23, 24, 73, 74
Milanović B. 97, 98
Milanović M. 97, 98
Milašinović O. 151, 153
Milidrag A. 31, 32, 33,
34, 43, 44
Mitrović N. 109, 110
Mladenović T. 43, 44
Mrđa M. 67, 68
Mudrenović A. 17, 18

N

Ncube T. 133, 134
Nenezić N. 55, 56
Novković D. 85, 86
Nožica-Radulović T. 79,
80

O

Obradović M. 23, 24, 39,
40, 51, 52, 65, 66, 91, 92
Ogurlić R. 81, 82

P

Palija S. 7, 8, 79, 80
Paravac I. 13, 14

Pavlović J. 23, 24, 73, 74
Pavlović K. 23, 24, 73, 74
Pavlović S. 55, 56
Pejičić N. 5, 6
Petković B. 19, 20
Petrović A. 27, 28
Petrović A. 133, 134
Plavšić D. 65, 66
Plemelj Mohorić A. 95,
96, 111, 112
Popović D. 87, 88
Popović-Pejičić S. 5, 6
Preradović Lj. 13, 14
Prohorova N. 139, 140
Prokić V. 61, 62
Pržulj N. 3, 4, 139, 140

R

Radović N. 23, 24
Railić M. 89, 90
Rajić B. 163
Rajlić N. 123, 124, 125,
126, 127, 128
Rašković A. 57, 58, 59,
60
Ristić S. 109, 110

S

Said Laatiri H. 157, 158
Sarić M. 107, 108
Sarra L. 157, 158
Savić Lj. 23, 24, 31, 32,
33, 34, 43, 44
Savić N. 31, 32
Savić S. 61, 62
Savković G. 99, 100
Savković N. 99, 100
Senegačnik K. 117, 118
Simić T. 55, 56
Slavković M. 25, 26
Slunjski Tišma L. 107,
108
Spremo S. 149, 150, 163
Sređić Cartes D. 91, 92
Stajić S. 53, 54
Stević Lj. 17, 18

Stijepić I. 109, 110, 111,
112
Stijepić M. 119, 120, 123,
124, 125, 126, 127, 128,
164
Stojanović N. 37, 38
Stojanović-Bjelić Lj. 129,
130
Stojisavljević Đ. 13, 14
Stojković I. 61, 62

Š

Šimunović D. 101, 102

T

Talić G. 79, 80
Teyeb H. 157, 158
Tezel M. 159, 160
Tišma A. 107, 108
Toholj J. 137, 138
Tomić Lj. 59, 60
Topola D. 45, 46
Torović Lj. 131, 132
Trailović M. 53, 54
Travar M. 71, 72
Tubak Kosić M. 69, 70,
71, 72
Tukić G. 155, 156

V

Velimirović A. 3, 4
Vranješ B. 143, 144
Vranješ D. 71, 72
Vujić-Aleksić V. 79, 80
Vujinović S. 63, 64
Vujnović S. 79, 80
Vukajlović B. 93, 94
Vuković N. 165, 166

Z

Zavišić G. 19, 20
Zlatanović M. 25, 26, 31,
32, 33, 34, 43, 44, 53, 54

Ž

Živanović S.
23, 24, 73, 74



ГРАД ПРИЈЕДОР



Institut za fizikalnu medicinu,
rehabilitaciju i ortopedsku hirurgiju
Dr Miroslav Zotović



EastCode