

**Zbornik sažetaka
Međunarodna naučna
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SANUS 2025**

BOOK OF ABSTRACTS

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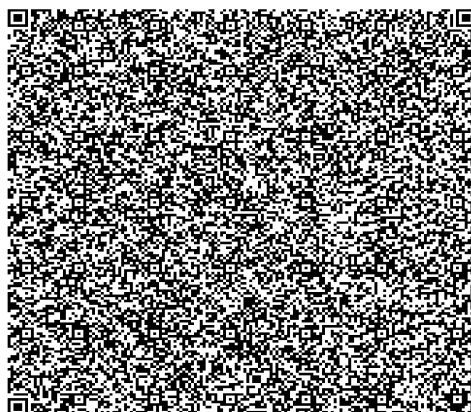
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Predgovor

Poštovani čitaoci,

Zbornik sažetaka koji je pred vama nastao je iz saopštenja koja su pripremljena za 4. Međunarodnu naučnu konferenciju „*Znanjem do zdravlja – SANUS 2025*“, koja je održana od 18. do 20. septembra u Prijedoru. Ova konferencija, koju su organizovali JU Visoka medicinska škola Prijedor, Akademija strukovnih studija Beograd (Odsek Visoka zdravstvena škola Zemun), Univerza v Ljubljani Zdravstvena fakulteta i Asocijacija laboratorijskih i sanitarnih zdravstvenih profesionalaca u BiH, okupila je veliki broj istraživača, stručnjaka i studenata iz područja zdravstvenih i srodnih naučnih oblasti, sa ciljem razmjene najnovijih saznanja, rezultata istraživanja i podsticanja međuinstitucionalne i interdisciplinarne saradnje. Na ovogodišnjoj konferenciji učestvuje 176 učesnika, sa ukupno 78 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.

Zbornik sadrži sažetke 3 plenarna predavanja renomiranih stručnjaka, 7 sekcijских predavanja, kao i 68 usmenih i posterskih prezentacija koje osvijetljavaju ključne teme savremene nauke i prakse.

Konferencija „*Znanjem do zdravlja – SANUS 2025*“, pruža platformu za razmjenu ideja, iskustava i inovacija, kao i za uspostavljanje novih oblika saradnje među stručnjacima iz različitih disciplina. Posebnu vrijednost daje učešće mladih istraživača i studenata, čije prisustvo i doprinos potvrđuju kontinuitet i budućnost naučnog rada u oblasti zdravstva.

Zahvaljujemo se svim autorima na prijavljenim radovima i doprinosu kvalitetu konferencije, kao i recenzentima na pažljivoj evaluaciji sažetaka. Posebnu zahvalnost dugujemo organizatorima, sponzorima i institucijama koje su podržale realizaciju ovog događaja.

Uvjereni smo da će ovaj Zbornik biti koristan resurs za sve učesnike, kao i inspiracija za buduće projekte i saradnju u okviru naučne zajednice.

Uredništvo Zbornika

Preface

Dear readers,

The Book of Abstracts which is in front of you is the result of the presentations prepared for the 4th International Scientific Conference "*Knowledge for Health – SANUS 2025*," which was held from September 18 to 20 in Prijedor. This conference, organized by the PI College of Health Sciences Prijedor, Bosnia and Herzegovina, the Academy of Applied Studies Belgrade (The College of Health Sciences Zemun, Republic of Serbia), the University of Ljubljana, Faculty of Health Sciences, Republic of Slovenia, and the Association of Laboratory and Sanitary Health Professionals in Bosnia and Herzegovina, gathered a large number of researchers, professionals, and students from the fields of health and related scientific areas, with the purpose of exchange the latest knowledge, research findings, and to foster inter-institutional and interdisciplinary collaboration.

This year's conference involves 176 participants, with a total of 78 abstracts, distributed across four thematic sessions:

1. Laboratory Medicine, Diagnostics and Healthcare
2. Rehabilitation, Physical and Mental Health
3. External Factors and Health Risk Prevention
4. Student Section

The Book of Abstracts contains abstracts of 3 plenary lectures by renowned experts, 7 sectional presentations, as well as 67 oral and poster presentations that highlight key topics in contemporary science and practice.

The "*Knowledge for Health – SANUS 2025*" conference provides a platform for the exchange of ideas, experiences, and innovations, as well as for establishing new forms of collaboration among experts from different disciplines. The participation of young researchers and students adds special value, as their presence and contributions confirm the continuity and future of scientific work in the field of healthcare.

We would like to thank all the authors for their submitted papers and their contribution to the quality of the conference, as well as the reviewers for their careful evaluation of the abstracts. Special thanks go to the organizers, sponsors, and institutions that supported the realization of this event.

We are confident that this Book of Abstract will be a valuable resource for all participants, as well as an inspiration for future projects and collaboration within the scientific community.

Editorship

Sadržaj

PLENARNA PREDAVANJA / PLENARY LECTURES	1
GOJAZNOST DANAS – PANDEMIJA 21. STOLJEĆA.....	3
OBESITY TODAY – A PANDEMIC OF THE 21ST CENTURY.....	4
POVEZANOST SINDROMA GORNJEG OTVORA GRUDNOG KOŠA SA BOLNIM RAMENOM I KVALITETOM SPAVANJA.....	5
ASSOCIATION OF THORACIC OUTLET SYNDROME WITH SHOULDER PAIN AND SLEEP QUALITY	6
ETARSKA ULJA: NEISTRAŽEN SVET RAZLIČITIH MOGUĆNOSTI.....	7
ESSENTIAL OILS: AN UNEXPLORED WORLD OF DIFFERENT POSSIBILITIES	9
PREDAVANJA PO POZIVU (SEKCIJSKO PREDAVANJE)	11
LECTURES BY INVITATION (SECTION LECTURE)	11
PROCJENA FRAGILNOSTI KOD OSOBA STARIJE ŽIVOTNE DOBI U BOSNI I HERCEGOVINI.....	13
ASSESSMENT OF FRAGILITY IN ELDERLY PERSONS IN BOSNIA AND HERZEGOVINA.....	14
EFIKASNOST ANTIBIOTIKA I NANOČESTICA U ERADIKACIJI BAKTERIJSKIH BIOFILMOVA.....	15
EFFICACY OF ANTIBIOTICS AND NANOPARTICLES IN ERADICATION OF MATURE BACTERIAL BIOFILMS	16
ŠTITNA ŽLIJEZDA I LIPIDNI PROFIL: KLINIČKO-LABORATORIJSKA KORELACIJA	17
THYROID FUNCTION AND LIPID PROFILE: A CLINICAL-LABORATORY CORRELATION	18
RADNA TERAPIJA U SRBIJI - PRVIH 60 GODINA (1964 – 2024).....	19
OCCUPATIONAL THERAPY IN SERBIA – FIRST 60 YEARS (1964 – 2024)	20
SUPLEMENTI U ISHRANI, UTICAJ NA ZDRAVLJE I MOGUĆE PREVARE	21
FOOD SUPPLEMENTS, IMPACT ON HEALTH AND POSSIBLE FRAUDS	23
PREDNOSTI METODE ROSA U PROCJENI RIZIKA OD MIŠIĆNO-KOŠTANIH OBOLJENJA PRI RADU NA RAČUNARU	25
ADVANTAGES OF THE ROSA METHOD IN ASSESSING THE RISK OF MUSCULOSKELETAL DISORDERS IN COMPUTER WORK.....	26
NAJSLABIJA KARIKA? KAKO LJUDSKO PONAŠANJE UGROŽAVA BEZBJEDNOST HRANE	27
THE WEAKEST LINK? HOW HUMAN BEHAVIOR THREATENS FOOD SAFETY ...	28
LABORATORIJSKA MEDICINA, DIJAGNOSTIKA, ZDRAVSTVENA NJEGA	29
LABORATORY MEDICINE, DIAGNOSTICS, HEALTH CARE.....	29

ALTRUIZAM U SESTRINSTVU	31
ALTRUISM IN NURSING	32
FEBRILNA NEUTROPENIJA	33
FEBRILE NEUTROPENIA	34
KOMPARATIVNA ANALIZA EPISTEMOLOŠKIH STAVOVA STUDENATA UNIVERZITETA U NOVOM SADU	35
COMPARING EPISTEMOLOGICAL BELIEFS ACROSS ACADEMIC DISCIPLINES: A MIXED-METHODS STUDY	36
UTICAJ USLOVA RADA NA INTRINZIČNO ZADOVOLJSTVO MEDICINSKIH SESTARA	37
THE IMPACT OF WORKING CONDITIONS ON THE INTRINSIC JOB SATISFACTION OF NURSES	38
DIFUZNI B KRUPNOĆELIJSKI LIMFOM- RELAPS REFRAKTORNI-PRIKAZ SLUČAJA.....	39
DIFFUSE B LARGE CELL LYMPHOMA - RELAPSE REFRACTORY - CASE REPORT	40
ISHRANA U PREKONCEPCIJSKOM I GESTACIJSKOM PERIODU	41
NUTRITION IN THE PRECONCEPTION AND GESTATION PERIOD	42
POVEZANOST KLINIČKO-PATOLOŠKIH KARAKTERISTIKA I EKSPRESIJE PD-L1 KOD PACIJENATA SA SKVAMOZNIM KARCINOMOM BRONHA	43
ASSOCIATION OF CLINICOPATHOLOGICAL CHARACTERISTICS AND PD-L1 EXPRESSION IN PATIENTS WITH SQUAMOUS CELL LUNG CANCER	44
PRIMJENA VJEŠTAČKE INTELIGENCIJE U MENADŽMENTU NAUČNIH ČASOPISA: IZAZOVI I MOGUĆNOSTI U BIOMEDICINSKOM IZDAVAŠTVU	45
APPLICATION OF ARTIFICIAL INTELLIGENCE IN THE MANAGEMENT OF SCIENTIFIC JOURNALS: CHALLENGES AND OPPORTUNITIES IN BIOMEDICAL PUBLISHING	46
ZAKONSKE REGULATIVE U PRIMENI MATIČNIH ĆELIJA	47
LEGAL REGULATIONS IN THE APPLICATION OF STEM CELLS	48
VJEŠTAČKA INTELIGENCIJA I SAVREMENA EDUKACIJA MEDICINSKIH PROFESIONALACA.....	49
ARTIFICIAL INTELLIGENCE AND MODERN EDUCATION OF MEDICAL PROFESSIONALS.....	50
FUNKCIONALNI ISHODI LEČENJA PRELOMA UZ PRIMENU 3D ŠTAMPANIH MODELA	51
FUNCTIONAL OUTCOMES IN FRACTURE MANAGEMENT ASSISTED BY 3D- PRINTED MODELS	52
URINARNI BIOMARKERI U DETEKCIJI RAKA PROSTATE	53
URINARY BIOMARKERS IN PROSTATE CANCER DETECTION	54

METAGENOMIKA I SEKVENCIONIRANJE NAREDNE GENERACIJE (NGS) – MOGUĆNOSTI I IZAZOVI	55
METAGENOMICS AND NEXT-GENERATION SEQUENCING (NGS) – OPPORTUNITIES AND CHALLENGES	56
METODA HEMILUMINESCENCIJE U MIKROBIOLOGIJI S OSVRTOM NA MOGUĆNOSTI SKRININGA I DIJAGNOSTIKE ZARAZNIH OBOLJENJA.....	57
CHEMILUMINESCENCE METHOD IN MICROBIOLOGY WITH A FOCUS ON SCREENING AND DIAGNOSIS OF INFECTIOUS DISEASES	58
FARMAKOTERAPIJA U LEČENJU DISLIPIDINEMIJE	59
PHARMACOTHERAPY IN THE TREATMENT OF DYSLIPIDEMIA	60
VJEŠTAČKA INTELIGENCIJA U BIOHEMIJSKOJ LABORATORIJI - UTICAJ NA DIJAGNOSTIKU	61
ARTIFICIAL INTELLIGENCE IN THE BIOCHEMICAL LABORATORY - IMPACT ON DIAGNOSTICS	62
SAVREMENA RADIOLOGIJA U SVJETLU VJEŠTAČKE INTELIGENCIJE	63
CONTEMPORARY RADIOLOGY IN THE LIGHT OF ARTIFICIAL INTELLIGENCE	64
ULOGA MOLEKULARNIH BIOMARKERA U ADENOKARCINOMIMA: DIJAGNOSTIČKE, PROGNOSTIČKE I TERAPIJSKE IMPLIKACIJE	65
ROLE OF MOLECULAR BIOMARKERS IN ADENOCARCINOMAS: DIAGNOSTIC, PROGNOSTIC AND THERAPEUTIC IMPLICATIONS	66
SAVREMENA ENZIMOLOGIJA: ZNAČAJ ZA DIJAGNOSTIKU, TERAPIJU I BIOTEHNOLOGIJU	67
MODERN ENZYMOLOGY: IMPORTANCE FOR DIAGNOSIS, THERAPY AND BIOTECHNOLOGY	68
PRIMJENA FAZI LOGIKE U KLASIFIKACIJI TUMORA ŠTITNE ŽLIJEZDE.....	69
APPLICATION OF FUZZY LOGIC IN THYROID TUMOR CLASSIFICATION	70
GOJAZNOST I OPŠTA ANESTEZIJA - PRINCIPI I KOMPLIKACIJE.....	71
OBESITY AND GENERAL ANESTHESIA – PRINCIPLES AND COMPLICATIONS...	72
PRISTUP U LEČENJU PSIHOTIČNIH POREMEĆAJA KOD MLADIH - PRIKAZ SLUČAJA.....	73
TREATMENT APPROACH TO PSYCHOTIC DISORDERS IN YOUNG ADULTS – A CASE REPORT.....	74
REHABILITACIJA, FIZIČKO I MENTALNO ZDRAVLJE.....	75
REHABILITATION, PHYSICAL AND MENTAL HEALTH	75
SISTEMATSKA ANALIZA UTICAJA TRENINGA SNAGE KOD KARDIOLOŠKIH PACIJENATA	77
SYSTEMATIC ANALYSIS OF THE EFFECTS OF STRENGTH TRAINING IN CARDIAC PATIENTS	78
UTICAJ INTERVALNOG TRENINGA NA PARAMETRE HODA OSOBA SA PARKINSONOVOM BOLEŠĆU- EKSPERIMENTALNA KLINIČKA STUDIJA	79

THE EFFECT OF INTERVAL TRAINING ON THE GAIT PARAMETERS OF PEOPLE WITH PARKINSON'S DISEASE: AN EXPERIMENTAL CLINICAL STUDY	80
MENTALNO ZDRAVLJE ADOLESCENATA I FIZIČKA AKTIVNOST	81
ADOLESCENT MENTAL HEALTH AND PHYSICAL ACTIVITY	82
UTICAJ REZILIJENTNOSTI I SOCIODEMOGRAFSKIH FAKTORA NA SOCIJALNU PODRŠKU LEČENIH ZBOG KARCINOMA DOJKE.....	83
THE IMPACT OF RESILIENCE AND SOCIODEMOGRAPHIC FACTORS ON SOCIAL SUPPORT AMONG BREAST CANCER SURVIVORS	84
FIZIČKA AKTIVNOST U GERIJATRIJSKOJ POPULACIJI	85
PHYSICAL ACTIVITY IN THE GERIATRIC POPULATION	86
OBAVLJANJE KUĆNIH POSLOVA KOD STARIJIH OSOBA	87
PERFORMING HOUSEWORK AMONG THE ELDERLY	88
OPTEREĆENJE U VRATU, RAMENU I RUCI ZAPOSLENIH U VISOKOJ ZDRAVSTVENOJ ŠKOLI PRI RADU ZA RAČUNAROM	89
BURDEN IN THE NECK, SHOULDER AND HANDS OF EMPLOYEES IN COLLEGE OF HEALTH SCIENCES WHILE WORKING AT THE COMPUTER.....	90
UTICAJ AKTIVNOG BAVLJENJA SPORTOM NA KVALITET ŽIVOTA OSOBA SA INTELEKTUALNIM SMETNJAMA: PILOT STUDIJA	91
THE IMPACT OF ACTIVE PARTICIPATION IN SPORTS ON THE QUALITY OF LIFE IN INDIVIDUALS WITH INTELLECTUAL DISABILITIES: A PILOT STUDY	92
NEFARMAKOLOŠKE METODE U TRETMANU DEMENCIJE.....	93
NON-PHARMACOLOGICAL METHODS IN THE TREATMENT OF DEMENTIA	94
KVALITET ŽIVOTA DECE I ADOLESCENATA SA CEREBRALNOM PARALIZOM – PREGLEDNI RAD.....	95
QUALITY OF LIFE OF CHILDREN AND ADOLESCENTS WITH CEREBRAL PALSY - A REVIEW	96
PROFESIONALNA AUTONOMIJA ZDRAVSTVENIH RADNIKA	97
PROFESSIONAL AUTONOMY OF HEALTHCARE WORKERS	98
RAZVOJ PISMENOSTI I PISANIH VEŠTINA KOD DECE: ANALIZA KLJUČNIH FAKTORA	99
DEVELOPMENT OF LITERACY AND WRITING SKILLS IN CHILDREN: ANALYSIS OF KEY FACTORS	100
PRIMENA TESTOVA ZA PROCENU MOTORIČKE SPRETNOSTI GORNJIH EKSTREMITETA U DEČJEM UZRASTU.....	101
APPLICATION OF TESTS FOR THE ASSESSMENT OF UPPER LIMB MOTOR DEXTERITY IN CHILDREN	102
MOGUĆNOSTI ARMEO SENSO APARATA U REHABILITACIJI NEUROLOŠKIH PACIJENATA.....	103
POSSIBILITIES OF THE ARMEO SENSO DEVICE IN THE REHABILITATION OF NEUROLOGICAL PATIENTS	104

ROBOTSKI ASISTIRANA REHABILITACIJA GORNJEG EKSTREMITETA NAKON MOŽDANOG UDARA.....	105
ROBOTIC-ASSISTED REHABILITATION OF THE UPPER EXTREMITY AFTER STROKE.....	106
SPOLJAŠNJI FAKTORI I PREVENCIJA RIZIKA PO ZDRAVLJE LJUDI	107
EXTERNAL FACTORS AND PREVENTION OF RISKS TO HUMAN HEALTH	107
ŠUMSKA TERAPIJA KAO SREDSTVO ZA PREVENCIJU BOLESTI U INTEGRATIVNOJ MEDICINI	109
FOREST THERAPY AS A PREVENTIVE APPROACH IN INTEGRATIVE MEDICINE	110
PROCENA TOPLOTNOG KOMFORA, OSVETLJENJA I BUKE NA RADNOM MESTU	111
ASSESSMENT OF WORKPLACE THERMAL COMFORT, LIGHTING.....	112
NOVE ANTIMIKROBNE STRATEGIJE U LIJEČENJU INFEKCIJA UZROKOVANIH MULTIREZISTENTNIM SOJEVIMA GRAM-POZITIVNIH BAKTERIJA.....	113
NEW ANTIMICROBIAL STRATEGIES IN THE TREATMENT OF INFECTIONS CAUSED BY MULTIDRUG-RESISTANT STRAINS OF GRAM-POSITIVE BACTERIA	114
PROCENA LIMITA DETEKCije <i>SALMONELLA</i> SPP. U VEŠTAČKO KONTAMINIRANOJ U PILEĆOJ PAŠTETI	115
ESTIMATION OF THE LIMIT OF DETECTION OF <i>SALMONELLA</i> SPP. IN ARTIFICIALLY CONTAMINATED CHICKEN PASTE.....	116
EFIKASNOST DEZINFICIJENASA NA SPREČAVANJE FORMIRANJA BIOFILMA I NA PLANKTONSKE <i>ESHERICHIA COLI</i> FORME IZOLOVANE IZ VODE ZA PIĆE	117
DISINFECTANTS ACTIVITY ON BIOFILM FORMATION AND AGAINST PLANKTONIC FORMS OF <i>ESCHERICHIA COLI</i> ISOLATED FROM DRINKING WATER.....	118
MERENJE SEDENTARNOG PONAŠANJA.....	119
MEASURING SEDENTARY BEHAVIOUR	120
FITONCIDNA SVOJSTVA ZASADA BORA (<i>Pinus sylvestris</i> L) U USMANSKOJ BOROVOJ ŠUMI (RUSKA FEDERACIJA	121
PHYTONCIDAL PROPERTIES OF PINE (<i>Pinus sylvestris</i> L) PLANTATIONS OF USMAN PINE FOREST (RUSSIAN FEDERATION)	122
FENOLOŠKE KARAKTERISTIKE ARIŠA U USLOVIMA MOSKOVSKE REGIJE	123
LARCH PHENOLOGY FEATURES IN MOSCOW REGION CONDITIONS	124
PRIRODOM INSPIRISANA RJEŠENJA I NJIHOVA PRIMJENA U PREVENCIJI PRIRODNIH KATASTROFA U SLIVU RIJEKE VRBAS	125
NATURE-BASED SOLUTIONS AND THEIR APPLICATION IN THE PREVENTION OF NATURAL DISASTERS IN THE VRBAS RIVER BASIN	126
ANALIZA KLIMATSKI KARAKTERISTIKA OPŠTINE MRKONJIĆ GRAD: UTICAJ NA GRADSKO ZELENILLO I ZDRAVLJE STANOVNIŠTVA	127

ANALYSIS OF THE CLIMATE CHARACTERISTICS OF THE MUNICIPALITY OF MRKONJIĆ GRAD: IMPACT ON THE URBAN GREENERY AND THE HEALTH OF THE POPULATION	128
ПОТЕНЦИЈАЛНИ ПОЗИТИВНИ ЕФЕКТА СОРКА НА ЗДРАВЉЕ ЛЈУДИ.....	129
POSITIVE EFFECTS OF SORGHUM ON HUMAN HEALTH	130
ANALIZA MIKRO I MAKRO ELEMENATA U UZORCIMA RUZMARINA ICP-OES METODOM	131
ANALYSIS OF MICRO AND MACRO ELEMENTS IN ROSEMARY SAMPLES BY ICP-OES	132
MED I PROIZVODI OD MEDA U OČUVANJU ZDRAVLJA LJUDI	133
HONEY AND HONEY-BASED PRODUCTS IN THE PRESERVATION OF HUMAN HEALTH.....	134
RASFF OBAVJEŠTENJA O RIZICIMA BEZBJEDNOSTI HRANE IZ BALKANSKIH DRŽAVA IZVEZENE U EVROPSKU UNIJU	135
RASFF NOTIFICATIONS OF FOOD SAFETY RISKS FROM BALKAN COUNTRIES EXPORTED TO THE EUROPEAN UNION	136
OSNIVANJE MEĐUNARODNOG PROVENIJEIČNOG TESTA HRASTA KITNJAKA (QERCUS PETRAEA (MATT.) LIBEL) – NAUKA ZA KONCEPT "JEDNO ZDRAVLJE“	137
ESTABLISHMENT OF AN INTERNATIONAL PROVENANCE TEST OF SESSILE OAK (QUERCUS PETRAEA (MATT.) LIEBL.) – SCIENCE FOR THE ONE HEALTH CONCEPT.....	139
ANTIOKSIDATIVNA AKTIVNOST HIDROLATA ŽALFIJE (<i>Salvia officinalis</i>).....	141
ANTIOXIDATIVE ACTIVITY OF SAGE (<i>Salvia officinalis</i>) HYDROLATE	142
REFRAKTOMETRIJSKO ODREĐIVANJE ČISTOĆE ETERIČNOG ULJA LIMUNA	143
REFRACTOMETRIC DETERMINATION OF THE PURITY OF LEMON ESSENTIAL OIL	144
PREVARE SA HRANOM – PREGLED INCIDENATA PRIJAVLJENIH U EU ALERT AND COOPERATION NETWORK I SISTEMU BRZOG UZBUNJIVANJA ZA HRANU I HRANU ZA ŽIVOTINJE.....	145
FOOD FRAUD – AN OVERVIEW OF INCIDENTS REPORTED TO ALERT AND COOPERATION NETWORK AND THE EU RAPID ALERT SYSTEM FOR FOOD AND FEED	146
OSOBI NE LIČNOSTI STUDENATA MEDICINSKIH I ZDRAVSTVENIH NAUKA ...	147
PERSONALITY CHARACTERISTICS OF STUDENTS OF MEDICAL AND HEALTH SCIENCES	148
BILJNI PROTEINI I NJIHOVA PRIMJENA U HRANI	149
PLANT PROTEINS FOR FOOD APPLICATIONS	150
PITOMI KESTEN (CASTANEA SATIVA MILL.) KAO FUNKCIONALNA HRANA: HEMIJSKI SASTAV PLODOVA IZ PRIRODNIH POPULACIJA BOSNE I HERCEGOVINE.....	151

SWEET CHESTNUT (CASTANEA SATIVA MILL.) AS A FUNCTIONAL FOOD: CHEMICAL COMPOSITION OF FRUITS FROM NATURAL POPULATIONS OF BOSNIA AND HERZEGOVINA	152
STUDENSKA SESIJA	153
KVALITET ŽIVOTA PACIJENATA OBOLELIH OD NEIVAZIVNOG UROTELNOG KARCINOMA MOKRAČNE BEŠIKE.....	155
QUALITY OF LIFE IN PATIENTS WITH NON-MUSCLE INVASIVE BLADDER CANCER.....	156
ISHRANA U RAZVOJU ALCHAJMEROVE BOLESTI – LEK ILI OTROV?	157
NUTRITION IN THE DEVELOPMENT OF ALZHEIMER'S DEMENTIA—MEDICINE OR POISON?	158
PROCES ZDRAVSTVENE NJEGE KOD BOLESNIKA S IMPLANTIRANIM CENTRALNIM VENOZNIM KATETEROM- PRIKAZ SLUČAJA	159
HEALTH CARE PROCESS IN PATIENTS WITH AN IMPLANTED CENTRAL VENOUS CATHETER - CASE REPORT	160
UTICAJ OBRAZOVANJA NA FORMIRANJE STAVOVA STUDENTICA PREMA TRUDNOĆI	161
THE EFFECT OF EDUCATION ON THE FORMATION OF STUDENTS' ATTITUDES TOWARD PREGNANCY	162
KOMUNIKACIJA NA ČETIRI NOGE - MOBING.....	163
COMMUNICATION ON FOUR LEGS – MOBING	164
ANTIOKSIDATIVNA AKTIVNOST ETANOLNIH EKSTRAKATA SEMENA GROŽĐA IZ MAKEDONSKOG VRANCA (<i>Vitis vinifera</i> L.).....	165
ANTIOXIDANT ACTIVITY OF GRAPE SEED ETHANOLIC EXTRACTS FROM MACEDONIAN VRANEC (<i>Vitis vinifera</i> L.).....	166
ANTIINFLAMATORNA AKTIVNOST HIDROLATA LISTOVA LOVORA (<i>Laurus nobilis</i> L.)	167
ANTI-INFLAMMATORY ACTIVITY OF LAUREL (<i>Laurus nobilis</i> L.) LEAVES HYDROLATE.....	168
UČESTALOST IZOLACIJE BAKTERIJE <i>STAPHYLOCOCCUS AUREUS</i> IZ BRISEVA NOSA STUDENATA VISOKE MEDICINSKE ŠKOLE U PRIJEDORU	169
FREQUENCY OF <i>STAPHYLOCOCCUS AUREUS</i> ISOLATION FROM NOSE SWABS OF THE STUDENTS OF THE COLLEGE OF HEALTH SCIENCES PRIJEDOR.....	170
ISTORIJSKI PRIKAZ RAZVOJA VAKCINACIJE DO KRAJA 19 VIJEKA	171
HISTORICAL OVERVIEW OF THE DEVELOPMENT OF VACCINATION UNTIL THE END OF THE 19th CENTURY	172
GASTROENTEROLOŠKI UZROCI SIDEROPENIJSKE ANEMIJE KOD BOLESNIKA BEZ MANIFESTNOG GASTROINTESTINALNOG KRVARENJA	173
GASTROENTEROLOGICAL CAUSES OF IRON DEFICIENCY ANEMIA IN PATIENTS WITHOUT OVERT GASTROINTESTINAL BLEEDING.....	174
INDEKS AUTORA / INDEX OF AUTHORS.....	175

PLENARNA PREDAVANJA

PLENARY LECTURES

GOJAZNOST DANAS – PANDEMIJA 21. STOLJEĆA

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Sažetak. Gojaznost je složena hronična bolest u kojoj abnormalna ili višak tjelesne masti narušava zdravlje, povećava rizik od dugotrajnih medicinskih komplikacija i smanjuje životni vijek. Prevalenca gojaznosti je u porastu i predviđa se da će porasti sa 14% u 2020 na 24% u 2035 god. zahvatajući oko 2 milijarde odraslih, adolescenata i djece. Zabrinjavajuće su predikcije o značajnom porastu prevalencije među djecom i adolescentima. Trenutno SZO smatra da je gojaznost „hronična složena bolest“, kojoj je dodijeljena posebna šifra po međunarodnoj klasifikaciji bolesti. Ideja gojaznosti kao samostalnog entiteta međutim, ostaje kontroverzna, kako unutar tako i izvan medicinske zajednice. Gojaznost je uzrokovana složenom interakcijom više genetskih, metaboličkih, bihevioralnih i faktora životne sredine, pri čemu se za poslednje smatra da su uzrok značajnog porasta prevalencije gojaznosti. Epidemiološke studije definišu gojaznost koristeći indeks tjelesne mase (ITM), što može stratifikovati i zdravstvene rizike povezane sa gojaznošću na nivou populacije. Sa porastom ITM rastu i zdravstvene komplikacije zbog viška tjelesne masti. Na individualnom nivou, komplikacije nastaju zbog viška adipoznosti, lokacije i distribucije adipoznosti i mnogih drugih faktora, uključujući ekološke, genetske, biološke i socioekonomske faktore. Gojaznost svakako predstavlja opasnost po zdravlje i opsežno je proučavana kao preteča drugih bolesti. Postoje dokazi da višak masnog tkiva može imati kliničke manifestacije i uzrokuje bolest izazivajući disfunkciju različitih organa i tkiva. Danas znamo da preko 200 različitih bolesti dovodimo u vezu sa gojaznošću, koji se često nazivaju komorbiditetima, a ne smatramo ih kliničkim manifestacijama same gojaznosti. Danas se smatra da bi liječenje gojaznosti trebalo da se odnosi na poboljšanje zdravlja i blagostanja, a ne samo na gubitak težine. Međutim, potrebno je više istraživanja kako bi se fokus liječenja gojaznosti pomjerio ka poboljšanju zdravstvenih ishoda usredsređenih na pacijenta, a ne samo na gubitak težine. Zato je neophodno povećavati znanja o ovoj bolesti i težiti boljim pristupima procjenjivanju i liječenju gojaznosti.

Ključne riječi: gojaznost, fenotipovi, komorbiditeti, prevencija, liječenje

OBESITY TODAY – A PANDEMIC OF THE 21ST CENTURY

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Abstract. Obesity is a complex chronic disease in which abnormal or excessive body fat impairs health, increases the risk of long-term medical complications, and reduces life expectancy. The prevalence of obesity is rising, and it is projected to increase from 14% in 2020 to 24% by 2035, affecting around 2 billion adults, adolescents, and children. Predictions of a significant increase in prevalence among children and adolescents are particularly concerning. Currently, the World Health Organization (WHO) defines obesity as a "chronic complex disease" and has assigned it a specific code in the International Classification of Diseases. However, the concept of obesity as an independent disease entity remains controversial, both within and outside the medical community. Obesity results from a complex interaction of multiple genetic, metabolic, behavioral, and environmental factors, with the latter being considered a major contributor to the rising prevalence of obesity. Epidemiological studies define obesity using the body mass index (BMI), which can also stratify health risks associated with obesity at the population level. As BMI increases, so do health complications due to excess body fat. On an individual level, complications arise from the amount, location, and distribution of adiposity, as well as many other factors, including environmental, genetic, biological, and socioeconomic factors. Obesity undoubtedly poses a health risk and has been extensively studied as a precursor to other diseases. There is evidence that excess fat tissue can have clinical manifestations and cause disease by disrupting the function of various organs and tissues. Today, we know that over 200 different diseases are associated with obesity. These are often referred to as comorbidities rather than clinical manifestations of obesity itself. Today, it is increasingly accepted that the treatment of obesity should focus on improving health and well-being, not just weight loss. However, more research is needed to shift the focus of obesity treatment toward improving patient-centered health outcomes, rather than solely targeting weight reduction. Therefore, it is essential to expand our understanding of this disease and strive for better approaches to assessing and treating obesity.

Key words: obesity, phenotypes, comorbidities, prevention, treatment

POVEZANOST SINDROMA GORNJEG OTVORA GRUDNOG KOŠA SA BOLNIM RAMENOM I KVALITETOM SPAVANJA

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Sažetak. Sindrom gornjeg grudnog otvora (**TOS**) nastaje kao rezultat specifičnog odnosa među anatomskim strukturama koje mogu izazvati kompresiju mišića, nerava i/ili krvnih sudova u predelu vrata, čime se ugrožava lokalna cirkulacija. Cilj ove studije bio je da se utvrdi prisustvo poremećaja spavanja i onesposobljenosti u predelu ramena, ruke i šake kod osoba obolelih od TOS-a, kao i da se utvrdi da li postoje razlike u tim nalazima u odnosu na osobe koje nemaju TOS. Uzorak u studiji obuhvatio je 82 pacijenta sa TOS-om i 81 osobu bez TOS-a, uzrasta od 19 do 66 godina. Podaci su prikupljeni primenom upitnika o onesposobljenosti ruke, ramena i šake (DASH) i indeksa kvaliteta spavanja u Pitsburgu (PSQI). Rezultati su pokazali da su i DASH ($t = -13.21$, $p < 0.001$) i PSQI ($t = -7.27$, $p < 0.001$) skorovi u grupi sa TOS-om bili viši u odnosu na kontrolnu grupu i da su bili u snažnoj i pozitivnoj korelaciji ($\rho = 0.58$, $p < 0.01$). Pošto pozitivni DASH skorovi mogu ukazivati na TOS, oni signaliziraju potrebu za daljom dijagnostičkom procenom. Kod osoba kod kojih je TOS već dijagnostikovao, visoki DASH skorovi upućuju na potrebu za dodatnim procenama kvaliteta sna, jer narušeni obrasci spavanja mogu negativno uticati na kvalitet života.

Ključne riječi: sindrom gornjeg grudnog otvora, poremećaji spavanja, onesposobljenost ruke, DASH upitnik, PSQI

ASSOCIATION OF THORACIC OUTLET SYNDROME WITH SHOULDER PAIN AND SLEEP QUALITY

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Abstract. Upper thoracic outlet syndrome (TOS) occurs due to specific anatomical relationships that can lead to compression of muscles, nerves, and/or blood vessels in the cervical region, thereby impairing local circulation. The aim of this study was to assess the presence of sleep disturbances and disability in the shoulder, arm, and hand in individuals diagnosed with TOS, and to examine whether significant differences exist compared to individuals without TOS. The study sample consisted of 82 patients with TOS and 81 control participants, aged 19 to 66 years. Data were collected using the Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire **and the** Pittsburgh Sleep Quality Index (PSQI). The results indicated that both DASH ($t = -13.21$, $p < 0.001$) and PSQI ($t = -7.27$, $p < 0.001$) scores were significantly higher in the TOS group compared to the control group, with a strong positive correlation between the two measures ($\rho = 0.58$, $p < 0.01$). Since elevated DASH scores may be indicative of TOS, they highlight the need for further diagnostic evaluation. In patients already diagnosed with TOS, high DASH scores may warrant additional assessment of sleep quality, as disrupted sleep patterns can have a detrimental effect on overall quality of life.

Key words: Thoracic Outlet Syndrome, Sleep Disorders, Upper Limb Disability, DASH Questionnaire, PSQI

ETARSKA ULJA: NEISTRAŽEN SVET RAZLIČITIH MOGUĆNOSTI

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Sažetak. Etarska ulja su isparljiva, tečna aromatična jedinjenja, koja predstavljaju sekundarne metabolite biljaka. To su nemasne, isparljive uljaste tečnosti (retko, čvrste i polučvrste), žućkaste ili bezbojne, bistre, intenzivnog mirisa, koje se dobijaju različitim fizičkim postupcima iz aromatičnih biljaka, destilacijom, ekstrakcijom ili nekom drugom metodom izolacije. Etarska ulja su prisutna u različitim delovima/organima biljke. Neka se nalaze u listovima (origano), semenu (badem), cvetu (jasmin), kori (bergamot), bobici (kleka), rizomu (đumbir), korenu (angelika), kori (sasafras), drvetu (agar drvo), smoli (tamjan), latici (ruža). U biljkama su zastupljena u malim količinama, najčešće manjim od 1%, a mogu varirati u širokim granicama od 0,05% do 20%. Aromatične biljke i etarska ulja se upotrebljavaju pre svega u farmaceutsko-kozmetičkoj i hemijskoj industriji i apotekama za izradu raznih lekovitih preparata, zatim u proizvodnji kozmetičkih i parfimerijskih proizvoda, u prehrambenoj industriji kao začim, dodatak u pripremi sireva, u industriji bezalkoholnih i alkoholnih napitaka, peciva, poslastica i sličnih proizvoda, u duvanskoj industriji kao i u industriji boja i lakova. Mikrobiološka ispravnost, poboljšane fizičko-hemijske i organoleptičke osobine proizvoda od etarskih ulja čine ih prihvatljivim, organizam ih usvaja bez neželjenih posledica, što nije slučaj sa nekim prehrambenim proizvodima koji često u sadrže sintetske antioksidanse. Zbog toga se etarska ulja najviše koriste u proizvodnji izuzetno cenjenih i vrednih biološki zdravstveno bezbednih proizvoda. Zahvaljujući mirisnim komponentama, najviše se koriste u kozmetičkoj industriji (proizvodnja parfema, sapuna, šampona, krema itd.), ali i u religioznim obredima. Takođe, intezivna je primena etarskih ulja u prehrambenoj industriji za aromatizaciju hrane i pića. Veoma često su i dodatak sredstvima za čišćenje u domaćinstvu. Primena etarskih ulja je doprinela razvoju posebnog oblika alternativne medicine, nazvane aromaterapija, koja je popularna u mnogim zemljama. Terapeutske efekte se postižu kroz različite načine primene etarskih ulja (inhalacija, masaža, kupke, komprese, oralnom, vaginalnom ili rektalnom upotrebom). Kada je reč o farmaceutskoj industriji, etarska ulja se mogu koristiti kao moćne droge. Etarska ulja imaju različita povoljna dejstva na organizam, među kojima se mogu pomenuti: protivupalno, ekspektorantno, umirujuće, diuretičko, antiseptičko, karminativno i sl. Mogu biti pomoćne materije u izradi lekova (poput materija koje koriguju ukus i miris lekova), a mogu biti i aktivne supstance (odgovorne za lekovito delovanje). Etarska ulja se intenzivno koriste u narodnoj medicini, prvenstveno zbog svojih antimikrobnih i antioksidativnih svojstava za lečenje različitih infekcija kože, sluzokože, gornjih disajnih puteva, digestivnog trakta, genitalija. Takođe, etarska ulja se primenjuju za poboljšanje

varenja, protiv bolova, protiv epileptičkih napada i drugih neuroloških poremećaja. Savremena medicina, međutim, najčešće ne koristi dovoljno njihov ogromni lekoviti potencijal, pa su veoma malo zastupljena. Razlog za to je nedostatak kliničkih studija na ljudima kojima bi bila potvrđena njihova lekovita svojstva. Naime, interes farmaceutske industrije u savremenom dobu je pretežno orijentisan na čiste biološki aktivne sintetske supstance. Ovakve supstance se na jednostavan način mogu industrijski proizvoditi u velikim količinama i koristiti za proizvodnju lekova. To nije slučaj sa prirodnim proizvodima u koje spadaju i biljni ekstrakti, etarska ulja i izolovana jedinjenja iz biljaka. Njihova proizvodnja, kao i standardizacija hemijskog sastava, znatno je složenija i manje pogodna za proizvodnju. Stoga se etarska ulja uglavnom koriste u alternativnoj medicini za lečenje raznih zdravstvenih problema.

Ključne riječi: Etarska ulja, Biološka aktivnot, Izolacija, Primena etarskih ulja

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ESSENTIAL OILS: AN UNEXPLORED WORLD OF DIFFERENT POSSIBILITIES

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Abstract. Essential oils are volatile, liquid aromatic compounds, which are secondary metabolites of plants. These are lean, volatile oily liquids (rare, solid and semi-solid), yellowish or colorless, clear, with an intense smell, which are obtained by different physical processes from aromatic plants: by distillation, extraction or other method of isolation. Essential oils are present in different parts/organs of the plant. May they be found in leaf (oregano), seed (almond), flower (jasmine), bark (bergamot), berry (juniper), rhizome (ginger), root (angelica), bark (sassafras), wood (agarwood), resin (incense), petal (rose). They are present in small amounts in plants, usually less than 1%, and can vary widely from 0.05% to 20%. Aromatic plants and essential oils are used primarily in the pharmaceutical-cosmetic and chemical industry and pharmacies for the production of various medicinal preparations, then in the production of cosmetic and perfumery products, in the food industry as a spice, additive in the preparation of cheeses, in the industry of non-alcoholic and alcoholic beverages, pastries, confectionery and similar products, in the tobacco industry as well as in the paint and varnish industry. Microbiological correctness, improved physico-chemical and organoleptic properties of essential oil products make them acceptable, the body adopts them without unwanted consequences, which is not the case with some food products that often contain synthetic antioxidants. That is why essential oils are mostly used in the production of highly valued and valuable biologically safe products. Due to the presence of fragrant components, they are mostly used in the cosmetic industry (production of perfumes, soaps, shampoos, creams, etc.), but also in religious ceremonies. Also, essential oils are intensively used in the food industry for flavoring food and drinks. They are often added to household cleaning products. The use of essential oils has contributed to the development of a special form of alternative medicine (aromatherapy), which is popular in many countries. Therapeutic effects are achieved through different ways of applying essential oils (inhalation, massage, baths, compresses, oral, vaginal or rectal use). When it comes to the pharmaceutical industry, essential oils can be used as powerful drugs. Essential oils have various beneficial effects on the body, among which can be mentioned: anti-inflammatory, expectorant, soothing, diuretic, antiseptic, carminative, etc. They can be auxiliary substances in the production of medicines (such as substances that correct the taste and smell of medicines), and they can also be active substances (responsible for the medicinal effect). Essential oils are extensively used in folk medicine, primarily due to their antimicrobial and antioxidant properties for the treatment of various infections of the skin, mucous membranes, upper respiratory tract, digestive tract, and genitals. Also, essential oils are used to improve digestion, against pain, against epileptic attacks and other neurological disorders. Modern medicine, however, usually does not use their enormous healing potential enough, so they are

very little represented. The reason for this is the lack of clinical studies on humans to confirm their medicinal properties. Namely, the interest of the pharmaceutical industry in the modern era is predominantly oriented towards pure biologically active synthetic substances. Synthetic substances can be industrially produced in large quantities in a simple way and used for the production of medicines. This is not the case with natural products, which include plant extracts, essential oils and isolated compounds from plants. Their production, as well as the standardization of the chemical composition, is much more complex and less suitable for production. Therefore, essential oils are mainly used in alternative medicine to treat various health problems.

Key words: Essential oils, Biological activity, Isolation, Application of essential oils

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**PREDAVANJA PO POZIVU
(SEKCIJSKO PREDAVANJE)**

**LECTURES BY INVITATION
(SECTION LECTURE)**

PROCJENA FRAGILNOSTI KOD OSOBA STARIJE ŽIVOTNE DOBI U BOSNI I HERCEGOVINI

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Sažetak. Fragilnost je vrlo učestala u populaciji starih osoba i sa sobom nosi rizik od loših zdravstvenih ishoda, uključujući povećanu smrtnost, institucionalizaciju, padove i hospitalizaciju. Cilj istraživanja je bio da se na osnovu korištenih upitnika, antropometrijskih i biohemijskih parametara ispitaju indikatori i učestalost fragilnosti kod osoba starijih od 65 godina u Bosni i Hercegovini. Studija presjeka je obuhvatila 510 osoba starijih od 65 godina starosti. Funkcionalni status ispitivan je pomoću Tinetti testa procjene hoda i ravnoteže. Fizička ograničenja su procijenjena i pomoću upitnika za dugotrajnu invalidnost Organizacije za ekonomsku saradnju i razvoj. Opšti upitnik za brzi skrining sarkopenije SARC-F korišten je kao potencijalni brzi skrining test na sarkopeniju, a procjena sarkopenije obuhvatila je i stisak šake, ustajanje sa stolice, Test „ustani i idi“, brzinu hoda, obim potkoljenice i obim nadlaktice. Nutritivni status procijenjen je pomoću Mini Nutritivna skala – MNA. Procjena socijalnog domena je izmjerena primjenom De Jongove skale usamljenosti, a psihološka uznemirenost Kesler-ovom skalom. Od laboratorijskih markera rađen je CRP-visoko senzitivni, HbA1C i albumin. Rezultati su pokazali da osobe sa sarkopenijom imaju veći broj hroničnih bolesti, broj posjeta ljekaru porodične medicine zbog ozbiljnih stanja i stanja koja nose rizik od umiranja, broj hospitalizacija i operativnih zahvata, kao i broj lijekova koje koriste. Uočeno je da ispitanici koji imaju sarkopeniju imaju i znatno veći procenat ozbiljanog poremećaja psihološkog distresa u odnosu na ispitanike koji su bili bez sarkopenije. Negativna korelacija pronađena je između tjelesne visine i SARC-F upitnika ($p=0,044$) a pozitivna između pomenutog upitnika i obima struka ($p=0,003$) kod žena, dok je kod muškaraca zabilježena negativna korelacija pomenutog upitnika i obima srednje cirkumferencije potkoljenice ($p=0,025$), što potkrepljuje činjenicu povezanosti sarkopenije i fragilnosti sa vrijednostima antropometrijskih parametara. Procjena fragilnosti treba uključiti detaljnu anamnezu, procjenu aktuelnog oboljenja, ispitivanje funkcionalnog, psihološkog i sociološkog statusa, određivanje antropometrijskih i laboratorijskih parametara.

Ključne riječi: fragilnost, sarkopenija, starije osobe, funkcionalni status, nutritivni status, antropometrijski parametri, biomarkeri.

ASSESSMENT OF FRAGILITY IN ELDERLY PERSONS IN BOSNIA AND HERZEGOVINA

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Abstract. Aging is an inevitable process that is also becoming a public health problem. Frailty is very common in the elderly population and carries with it the risk of poor health outcomes, including increased mortality, institutionalization, falls, and hospitalization. The aim of the research was to examine the indicators and frequency of frailty in persons over 65 years of age in Bosnia and Herzegovina based on the questionnaires, anthropometric and biochemical parameters used.

This cross-sectional study included 510 persons older than 65 years of age. Functional status was examined using the Tinetti test for assessing gait and balance. Physical limitations were also assessed using the long-term disability questionnaire of the Organization for Economic Cooperation and Development. The general questionnaire for rapid screening of sarcopenia SARC-F was used as a potential rapid screening test for sarcopenia, and the assessment of sarcopenia including hand grip, standing up from a chair, "get up and go" test, walking speed, midupper arm circumference (MUAC) and calf circumference (CC). Nutritional status was assessed using the Mini Nutritional Scale - MNA, and the assessment of the social domain was measured using the De Jong Loneliness Scale and the Kessler Psychological Distress Scale was used. This laboratory biomarkers were analyzed: CRP-highly sensitive, HbA1C and albumin. The results showed that people with sarcopenia have a higher number of chronic diseases, higher number of visits to the family medicine doctor due to serious conditions and conditions that carry the risk of dying, higher number of hospitalizations and surgeries, as well as the number of medications they use. A negative correlation was found between body height and the SARC-F questionnaire ($p=0.044$) and a positive correlation between the mentioned questionnaire and waist circumference ($p=0.003$) in women, while in men a negative correlation was recorded between the aforementioned height and the circumference of the middle leg circumference ($p=0.025$), which supports the fact of the connection between sarcopenia and frailty with the values of anthropometric parameters. Assessment of frailty should include detailed anamnesis, assessment of current illness, examination of functional, psychological and sociological status, determination of anthropometric and laboratory parameters.

Key words: frailty, sarcopenia, elderly people, functional status, nutritional status, anthropometric parameters, biomarkers.

EFIKASNOST ANTIBIOTIKA I NANOČESTICA U ERADIKACIJI BAKTERIJSKIH BIOFILMOVA

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Sažetak. Biofilmovi su bakterijske zajednice unutar kojih su antibiotici grupisani na osnovu metaboličkih i fizioloških potreba. Nastaju u nepovoljnim uslovima spoljašnje sredine ili tokom hroničnih infekcija kod čovjeka. Unutar biofilma bakterije su zaštićene od strane polisaharidnog omotača koji se produkuje jedino ukoliko su bakterije u formi biofilma. Pojedinačni oblici bakterija označeni kao planktonski, koji se inače testiraju u rutinskim laboratorijama su bez tog zaštitnog omotača i ne mogu dugo da opstanu u nepovoljnim uslovima. Rezistencija bakterija na antibiotike predstavlja globalni problem o kojem se veoma mnogo diskutuje, ali rezultati u razvoju novih antibiotskih supstanci ne prate brzinu razvoja rezistencije. Zbog toga je veoma bitno da se nađu nove vrste antibiotika (pojedinačnih ili u kombinacijama) i nove vrste drugih antimikrobnih supstanci koje će moći zamijeniti antibiotike ili kupiti dodatno vrijeme dok se ne razviju novi antibiotici. Dejstvo antibiotika na biofilme je danas gotovo minimalno, zavisno od starosti biofilma i vrste antibiotika. Koncentracije neophodne za uklanjanje zrelih biofilмова su 10-1000 puta veće od odzvoljenih i imaju najčešće toksično dejstvo. Takođe, korištenje antibiotika mora biti pravovremeno, jer subinhibitorne doze antibiotika djeluju kao odlični induktori za nastanak biofilma. Trenutno se najviše ulaže na polju nanočestica koje zbog svog naboja imaju sposobnost da ili oštete površinske bakterijske omotače ili da u unutrašnjosti bakterije oštete DNK ili ribosome. Neophodno je voditi računa o njihovoj koncentraciji (zbog eventualen toksičnosti), načinu sinteze (tzv. „zelena hemija“ se preferira zbog smanjenja toksičnih nusprodukata tokom sinteze) i cijeni početnih supstanci od kojih se sintetišu nanočestice. Aktuelna su ispitivanja antimikrobnog potencijala nanočestice metala poput srebra, bakra i selena, kao i nanočestice hitozana, dobijenog iz hitina morskih ljuskara. Značajno je naglasiti da veliki broj nanočestica pored antimikrobnog, pokazuje i antikancerogeno dejstvo.

Ključne riječi: biofilm, nanočestice, antibiotici

EFFICACY OF ANTIBIOTICS AND NANOPARTICLES IN ERADICATION OF MATURE BACTERIAL BIOFILMS

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Abstract. Biofilms are bacterial communities within which antibiotics are grouped based on metabolic and physiological needs. They arise in unfavorable environmental conditions or during chronic infections in humans. Inside the biofilm, the bacteria are protected by a polysaccharide coat that is produced only if the bacteria are in the form of a biofilm. Individual forms of bacteria labeled as planktonic, which are normally tested in routine laboratories, are without this protective coating and cannot survive for long in unfavorable conditions. Antibiotic-resistant bacteria are a worldwide issue that receives a lot of attention, yet the rate at which new antibiotic compounds are developed does not keep pace with the rate at which resistance is developing. Finding new types of antibiotics (either alone or in combination) and other antimicrobial compounds that can either take the place of antibiotics or buy time until new antibiotics are created is therefore crucial. Bacterial resistance to antibiotics is a global issue that is frequently discussed, yet the pace of new antibiotic development does not keep up with the rate of resistance increase. According to the type of antibiotic and the current condition of the biofilm, antibiotics currently have a negligible impact on biofilms. Mature biofilms have the most harmful effects and require concentrations 10–1000 times greater than those permitted. Additionally, because subinhibitory antibiotic concentrations are excellent biofilm inducers, antibiotics must be used precise and right on time. Currently, the majority of investment is being directed towards nanoparticles, which can either damage bacterial surface membranes or penetrate the cell, leading to the deterioration of DNA or ribosomes due to their charge. Attention must be given to their concentration, the synthesis methods (the so-called "green chemistry" is favored due to the reduction of toxic by-products during the synthesis process), and the cost of the initial materials needed for nanoparticle production. Research on the antimicrobial potential of metal nanoparticles, such as silver, copper, and selenium, as well as chitosan nanoparticles, is actively ongoing. It is important to note that some nanoparticles, besides their antimicrobial properties, also demonstrate anticancer effects.

Key words: biofilm, nanoparticles, antibiotics

ŠTITNA ŽLIJEZDA I LIPIDNI PROFIL: KLINIČKO- LABORATORIJSKA KORELACIJA

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Sažetak. Hormoni štitne žlijezde regulišu rast, diferencijaciju i metabolizam proteina, ugljikohidrata i lipida. Njihove disfunkcije, koje se manifestuju kao hipotireoza ili hipertireoza, značajno utiču na lipidni profil, povećavajući rizik od kardiovaskularnih bolesti. Utvrditi povezanost između koncentracija hormona štitne žlijezde i lipidnih parametara kod osoba sa smanjenom i povećanom funkcijom štitne žlijezde. Istraživanje je obuhvatilo 160 ispitanika prosječne starosne dobi 38 ± 8 godina, od čega 81% žena. Učesnici su podijeljeni u dvije skupine: sa hipotireozom i hipertireozom. Analizirane su koncentracije TSH, FT3 i FT4 hemiluminiscentnom imunoanalizom (Mindray CL-900i), dok su kolesterol, trigliceridi, HDL i LDL određeni enzimskom spektrofotometrijom na biohemijskom analizatoru (Mindray BS-480). Hipotireoza je utvrđena kod 53,6% ispitanika, uz prosječnu koncentraciju TSH $13,0 \mu\text{IU/mL}$ i snižene vrijednosti FT3 i FT4. Hipertireoza je prisutna kod 43,5% ispitanika, sa niskim TSH ($0,129 \mu\text{IU/mL}$) i povišenim FT3 i FT4. Kod hipotireoidnih pacijenata vrijednosti holesterola ($6,51 \pm 1,0 \text{ mmol/L}$), triglicerida ($2,42 \pm 0,7 \text{ mmol/L}$) i LDL-a ($4,14 \pm 1,0 \text{ mmol/L}$) bile su značajno povišene. Utvrđena je jaka pozitivna korelacija TSH sa kolesterolom, trigliceridima i LDL-om, dok su FT3 i FT4 pokazali srednje do jake negativne korelacije sa istim parametrima. Povezanost između hormona i HDL-a bila je slaba. Disfunkcija štitne žlijezde značajno utiče na lipidni status. Zbog povećanog kardiovaskularnog rizika, kod pacijenata sa hipotireozom i hipertireozom preporučuje se rutinska procjena lipidnog profila radi pravovremene dijagnoze i terapije.

Ključne riječi: hormoni štitne žlijezde, hipotireoza, hipertireoza, lipidni status

THYROID FUNCTION AND LIPID PROFILE: A CLINICAL-LABORATORY CORRELATION

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Abstract. Thyroid hormones regulate cell growth, differentiation, and the metabolism of proteins, carbohydrates, and lipids. Thyroid dysfunction, manifested as hypothyroidism or hyperthyroidism, has a significant impact on the lipid profile and increases the risk of cardiovascular diseases. To investigate the association between thyroid hormone concentrations and lipid parameters in individuals with reduced and increased thyroid function. The study included 160 participants with a mean age of 38 ± 8 years, of whom 81% were female. Participants were divided into two groups: those with hypothyroidism and those with hyperthyroidism. Serum concentrations of TSH, FT3, and FT4 were measured using chemiluminescent immunoassay (Mindray CL-900i), while cholesterol, triglycerides, HDL, and LDL were determined by enzymatic spectrophotometry on a biochemical analyzer (Mindray BS-480). Hypothyroidism was confirmed in 53.6% of participants, with an average TSH concentration of $13.0 \mu\text{IU/mL}$ and decreased FT3 and FT4 values. Hyperthyroidism was present in 43.5% of participants, characterized by low TSH ($0.129 \mu\text{IU/mL}$) and elevated FT3 and FT4 levels. In hypothyroid patients, cholesterol ($6.51 \pm 1.0 \text{ mmol/L}$), triglycerides ($2.42 \pm 0.7 \text{ mmol/L}$), and LDL ($4.14 \pm 1.0 \text{ mmol/L}$) values were significantly increased. A strong positive correlation was observed between TSH and cholesterol, triglycerides, and LDL, while FT3 and FT4 showed moderate to strong negative correlations with these parameters. The correlation between thyroid hormones and HDL was weak. Thyroid dysfunction significantly affects the lipid profile. Due to the increased cardiovascular risk, routine assessment of lipid parameters in patients with hypothyroidism and hyperthyroidism is recommended to ensure early diagnosis and treatment.

Keywords: thyroid hormones, hypothyroidism, hyperthyroidism, lipid profile

RADNA TERAPIJA U SRBIJI - PRVIH 60 GODINA (1964 – 2024)

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Sažetak. Osnivanje i razvoj radne terapije kao zdravstvene profesije u Srbiji počeli su još pre 1964. godine i prvog zvanično ustanovljenog programa edukacije radnih terapeuta. Tokom šezdeset godina, profesija radnog terapeuta se menjala i razvijala pod uticajem i u skladu sa različitim društveno-ekonomskim tranzicijama. Promene profesionalnih kompetencija i njihovo stalno usklađivanje sa savremenim pravcima razvoja radne terapije mogu se sagledati i kroz modifikacije u obrazovanju radnih terapeuta. Primena metode sistematske literarne analize od prvog nastavnog plana i programa studija radne terapije do najnovijeg kurikulumusa usklađenog sa Bolonjskim modelom obrazovanja pokazala je neke od pravaca u kojima se profesija razvijala. Zaključno, sve promene u okviru studijskih programa tokom godina obezbeđivale su studentima radne terapije snažnu vezu između teorijskog i praktičnog obrazovanja i rada u zdravstvenim i socijalnim ustanovama.

Ključne riječi: radna terapija; kompetencije radnih terapeuta; Bolonjski model obrazovanja

OCCUPATIONAL THERAPY IN SERBIA – FIRST 60 YEARS (1964 – 2024)

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Abstract. The foundation and development of occupational therapy as a health profession in Serbia began even before 1964 and the first officially established education program for occupational therapists. Over the course of sixty years, the profession of occupational therapist has changed and developed under the influence of and in accordance with various socio-economic transitions. Changes in professional competences and their constant alignment with contemporary trends in the development of occupational therapy can also be seen through modifications in the education of occupational therapists. Applying the method of systematic literary analysis from the first curriculum of occupational therapy studies to the newest curriculum aligned with the Bologna model of education had shown some of the directions in which profession developed. In conclusion, all changes within study programs throughout the years had been providing occupational therapy students a strong connection between theoretical and practical education and work in health and social institutions.

Key words: occupational therapy; occupational therapy competences; Bologna model of education

SUPLEMENTI U ISHRANI, UTICAJ NA ZDRAVLJE I MOGUĆE PREVARE

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Sažetak. Zbog globalno lošijeg kvaliteta namirnica, ali i ubrzanog tempa života u savremenom svijetu, sve je teže odolijevati izazovima u održavanju uravnotežene ishrane. Često se događa da u ishrani nedostaju određeni hranljivi sastojci, što može dovesti do niza različitih zdravstvenih problema kao što su npr. umor, oslabljena funkcija imunog sistema, slabe kosti i mišići, poremećaj nervne funkcije i drugo.

Zbog toga, dijetetski suplementi, iako nisu lijek i kao takvi ne mogu imati definisano farmakološko, imunološko ili metaboličko djelovanje, često, uz pravilno korištenje, mogu predstavljati ključni faktor za podršku, kako fizičkom tako i mentalnom zdravlju čovjeka. Kod nas su, slično kao u Evropskoj Uniji (EU), dijetetski suplementi (dodaci ishrani) definisani kao prehrambeni proizvodi čija je svrha dopuna uobičajenoj ishrani, a predstavljaju koncentrovani izvor hranljivih materija ili drugih materija prehrambenog ili fiziološkog dejstva, pojedinačno ili u kombinaciji, koji se stavljaju na tržište u doziranom obliku kao što su kapsule, pastile, tablete, pilule, vrećice praha, ampule tečnosti, bočice na kapaljku i u drugim sličnim oblicima za korištenje u odmjerenim malim količinama. Postojeća regulativa EU se uglavnom fokusirala na vitamine i minerale, kao i materije koje se koriste kao njihovi izvori. Za sastojke koji nisu vitamini i minerali, Evropska komisija je uspostavila usklađena pravila kako bi se osiguralo da su dodaci ishrani sigurno i propisno označeni, te da se potrošači zaštite od mogućih zdravstvenih rizika. Uspostavljenim pravilima zabranjuje se da se deklaracijom, prezentacijom i reklamiranjem, dijetetskim proizvodima pripisuju svojstva liječenja, dijagnostikovanja, ublažavanja, sprečavanja ili izliječenja bolesti. Širok raspon hranljivih materija i drugih sastojaka može biti prisutan u suplementima, gdje pored vitamina (B-kompleks, vitamini A, D i K, folna kiselina, biotin) i minerala (magnezijum, kalijum, natrijum, cink, željezo, bakar), mogu biti uključene masne kiseline (linolna, linolenska, EPA, DHA, arahidonska, alfa-lipoinenska), proteinski koncentрати (mliječni, sojini, od jaja, aminokiseline), biljni ekstrakti i žive kulture mikroorganizama. Osim toga, suplementi podrazumijevaju i jestive gljive, alge, pčelinje proizvode i druge materije sa hranljivim ili fiziološkim učinkom. Govoreći o suplementima obično se tu podrazumijevaju njegove potencijalne prednosti, a rijetko se obraća pažnja na ono što je u vezi s rizicima, odnosno njihovim neželjenim efektima. Neki literaturni podaci govore da se suplementi sve više neosnovano koriste, najčešće bez preporuke ljekara i uz oskudno znanje o njihovim eventualnim štetnim efektima. Naime, nerijetki su slučajevi da korisnici ignorišu preporuke i suplemente uzimaju po vlastitoj procjeni, najčešće u povećanoj količini što može izazvati odgovarajuće rizike po zdravlje. Suplementi su sve popularniji na tržištu, obično imaju visoku prodajnu vrijednost i stoga su idealna meta za prevare. Najčešće prevare su: kod deklarisanja proizvoda

(neadekvatno predstavljanje proizvodnog procesa, neistinito geografsko porijeklo, nepotpuna lista sastojaka); zamjena kvalitetnijeg (skupljeg) sastojka manje kvalitetnim; dodavanje neprijavljenih sastojaka radi poboljšanja njihovog kvaliteta; kopiranje brenda; siva zona (npr. prodaja viška neprijavljenog proizvoda); zabranjene zdravstvene tvrdnje o liječenju bolesti; internet prevare (lažni oglasi sa izmišljenim studijima i web sajtovi puni lažnih recenzija, krađe identiteta i drugo). Kao i kod svake druge prehrambene robe, upravljanje prevarama u vezi sa suplementima zahtijeva sistematski pristup kako bi se osigurala sigurnost i ispunili utvrđeni standardi kvaliteta proizvoda. Cilj rada je da se predstavje najznačajniji dijetetski suplementi u ishrani, njihov uticaj na zdravlje i moguće prevare u vezi s tim.

Ključne riječi: suplementi, vitamini, minerali, zdravlje, rizici, prevare

FOOD SUPPLEMENTS, IMPACT ON HEALTH AND POSSIBLE FRAUDS

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Abstract. Due to the global poor quality of food, as well as the accelerated pace of life in the modern world, it is increasingly difficult to resist the challenges of maintaining a balanced diet. It often happens that certain nutrients are lacking in the diet, which can lead to a number of different health problems such as fatigue, weakened immune system function, weak bones and muscles, nerve dysfunction, and more. Therefore, dietary supplements, although not a medicine and as such cannot have a defined pharmacological, immunological or metabolic effect, can often, with proper use, represent a key factor in supporting both physical and mental health. In our country, similar to the European Union (EU), dietary supplements (nutritional supplements) are defined as food products whose purpose is to supplement the usual diet, and which represent a concentrated source of nutrients or other substances with nutritional or physiological effects, individually or in combination, which are placed on the market in dosage form such as capsules, lozenges, tablets, pills, sachets of powder, ampoules of liquid, dropper bottles and in other similar forms for use in measured small quantities. Existing EU regulations have mainly focused on vitamins and minerals, as well as substances used as their sources. For ingredients other than vitamins and minerals, the European Commission has established harmonised rules to ensure that food supplements are safe and properly labelled, and to protect consumers from possible health risks. The established rules prohibit attributing properties of treatment, diagnosis, alleviation, prevention, or cure of diseases to dietary products through declarations, presentations, or advertising. A wide range of nutrients and other ingredients may be present in supplements, where in addition to vitamins (B-complex, vitamins A, D and K, folic acid, biotin) and minerals (magnesium, potassium, sodium, zinc, iron, copper), fatty acids (linoleic, linolenic, EPA, DHA, arachidonic, alpha-lipoic), protein concentrates (milk, soy, egg, amino acids), plant extracts and live cultures of microorganisms may be included. In addition, supplements include edible mushrooms, algae, bee products, and other substances with nutritional or physiological effects. When talking about supplements, their potential benefits are usually emphasized, and attention is rarely paid to what is related to the risks, namely, their side effects. Some literature data suggests that supplements are increasingly being used inappropriately, most often without a doctor's recommendation and with little knowledge about their possible harmful effects. Namely, it is not uncommon for users to ignore recommendations and take supplements at their own discretion, most often in increased quantities, which can cause corresponding health risks. Supplements are increasingly popular on the market, usually have a high resale value and because of that they are an ideal target for fraud. The most common frauds are: in product declaration (inadequate representation of the production process, false geographical origin, incomplete list of

ingredients); replacing a higher quality (more expensive) ingredient with a lower quality one; adding undeclared ingredients to improve their quality; copying a brand; the gray area (e.g. selling excess unreported product); prohibited health claims about treating diseases; internet fraud (fake ads with fictional studies and websites full of fake reviews, identity theft, etc.). As with any other food commodity, managing supplement fraud requires a systematic approach to ensure safety and meet established product quality standards. The aim of the paper is to present the most important dietary supplements in the diet, their impact on health and possible fraud related to them.

Key words: supplements, vitamins, minerals, health, risks, frauds

PREDNOSTI METODE ROSA U PROCJENI RIZIKA OD MIŠIĆNO-KOŠTANIH OBOLJENJA PRI RADU NA RAČUNARU

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Sažetak. Metoda ROSA (Rapid Office Strain Assessment) je validirani opservacijski alat razvijen za sistematsko procjenjivanje i kvantifikaciju izloženosti ergonomske rizicima u kancelarijskom radnom okruženju. Zasnovana je na poznatim metodama kao što su RULA (Rapid Upper Limb Assessment) i REBA (Rapid Entire Body Assessment) i temelji se na strukturiranoj kontrolnoj listi sa slikovnim prikazima, što omogućava dosljedno i ponovljivo procjenjivanje ergonomije računarskih radnih stanica. Metoda ROSA posebno se fokusira na prepoznavanje faktora rizika povezanih s razvojem mišićno-koštanih oboljenja povezanih s radom, kao što su nepravilni položaji tijela, dugotrajno statično sjedenje, nepravilno postavljanje monitora i ulaznih uređaja, te ponavljajući pokreti. Ova metoda omogućava objektivno bodovanje različitih komponenti radnog mjesta (npr. stolica, ekran, tastatura, miš, telefon), što vodi ka konačnoj ocjeni koja odražava nivo rizika i potrebu za ergonomske intervencijom. Jedna od glavnih prednosti metode ROSA je njena strukturiranost, koja omogućava sistematski pristup u identifikaciji ergonomske nedostataka i osigurava veću pouzdanost rezultata. Vizuelni prikazi olakšavaju upotrebu čak i onima bez specijaliziranog znanja iz ergonomije, čineći ovu metodu dostupnom široj grupi korisnika. Osim toga, ROSA ne zahtijeva posebnu opremu i omogućava brzu procjenu, što je posebno značajno u sredinama s ograničenim resursima. Zbog tih karakteristika, metoda je pogodna kako za klasične kancelarije, tako i za rad od kuće. Zahvaljujući svojoj praktičnosti, jednostavnoj upotrebi i jasnoj interpretaciji, ROSA metoda je široko prihvaćena kako u praksi medicine rada, tako i u istraživačkom okruženju. Smatra se jednom od najučinkovitijih metoda za otkrivanje mišićno-koštanih rizika kod radnika koji koriste ekrane na dodir ili računare – bilo u standardnim kancelarijskim uslovima ili prilikom rada na daljinu odnosno od kuće. ROSA tako služi ne samo kao dijagnostički alat, već i kao osnova za ciljne ergonomske intervencije s ciljem prevencije dugotrajnih mišićno-koštanih opterećenja.

Ključne riječi: ergonomija, mišićno-koštani poremećaji, procjena radnog mjesta, kancelarijsko okruženje, faktori rizika

ADVANTAGES OF THE ROSA METHOD IN ASSESSING THE RISK OF MUSCULOSKELETAL DISORDERS IN COMPUTER WORK

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Abstract. The ROSA method (Rapid Office Strain Assessment) is a validated observational tool developed for the systematic assessment and quantification of exposure to ergonomic risks in office work environments. It is modeled after established assessment systems such as RULA (Rapid Upper Limb Assessment) and REBA (Rapid Entire Body Assessment) and is based on a structured checklist with visual illustrations, enabling consistent and repeatable evaluation of computer workstation ergonomics. The ROSA method specifically focuses on identifying risk factors associated with the development of work-related musculoskeletal disorders, such as awkward postures, prolonged static sitting, improper positioning of monitors and input devices, and repetitive movements. The method allows objective scoring of various workstation components (e.g., chair, screen, keyboard, mouse, telephone), leading to a final score that reflects the level of risk and the need for ergonomic intervention. Among the key advantages of the ROSA method is its structured nature, which enables a systematic approach to identifying ergonomic deficiencies and ensures greater reliability of results. The visual representations make it easier to use even for individuals without specialized ergonomic knowledge, making the method accessible to a broader range of users. Moreover, ROSA does not require special equipment and allows for quick assessment, which is particularly important in resource-limited environments. Because of these features, the method is suitable for assessing both traditional office setups and home-based workstations. Due to its practicality, ease of use, and clear interpretation, ROSA method is widely accepted both in occupational medicine practice and in research settings. It is considered one of the most effective methods for detecting musculoskeletal risks in workers who use touchscreen devices or computers—both in conventional office environments and remote or home-based work. Thus, ROSA serves not only as a diagnostic tool but also as a basis for targeted ergonomic improvements aimed at preventing long-term musculoskeletal strain.

Key words: ergonomics, musculoskeletal disorders, workstation assessment, office environment, risk factors

NAJSLABIJA KARIKA? KAKO LJUDSKO PONAŠANJE UGROŽAVA BEZBJEDNOST HRANE

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Sažetak. Uprkos dobro razvijenim sistemskim pristupima, standardima i zakonodavstvu u oblasti bezbjednosti hrane, i dalje se javljaju brojna povlačenja proizvoda, prevare i bolesti prenosive hranom. Ljudski faktor na organizacionom i operativnom nivou uzrokuje neprihvatljiva odstupanja u procesima, koja se manifestuju u kritičnim situacijama. *Kultura bezbjednosti hrane* pojavila se kao novi koncept u suočavanju sa ovim izazovom. Ona predstavlja ključni faktor u osiguranju bezbjednosti, kvaliteta i higijene u prehrambenim objektima. Iako zakonski propisi i dokumentovani sistemi jasno definišu zadatke, odgovornosti i procedure, praktična primjena često izostaje zbog uticaja ljudskog ponašanja. Kultura bezbjednosti hrane, koja se ogleda u ponašanju zaposlenih prilikom rukovanja hranom, značajno utiče na bezbjednost proizvoda i javno zdravlje. Istraživanja pokazuju da, uprkos kontinuiranoj edukaciji, sistemi bezbjednosti hrane ostaju djelimično nekontrolisani zbog inherentnih ljudskih rizika vezanih za rad. Ponašanje zaposlenih – obilježeno dosljednošću, preciznošću i ispravnošću u izvršavanju zadataka – zavisi od znanja, motivacije, kompetencija, razumijevanja, higijenske svijesti, radnih stavova, zadovoljstva poslom i dostupnosti resursa. Kultura bezbjednosti hrane zavisi i od šireg organizacionog okvira: efikasnih sistema upravljanja zasnovanih na HACCP-u, politike preduzeća, posvećenosti menadžmenta, liderstva, svijesti zaposlenih, komunikacije, radnog okruženja i procjene rizika. Savremeni pristupi su se razvili izvan tradicionalnih okvira zasnovanih na usklađenosti, prelazeći ka sveobuhvatnim strategijama promjene ponašanja i organizacione transformacije. Operateri hrane sve češće primjenjuju dobrovoljne standarde, iznad zakonskih zahtjeva, kako bi unaprijedili svijest i kontrolu faktora rizika. Međutim, implementacija značajno varira između organizacija sa visoko razvijenom i onih sa niskom kulturom bezbjednosti hrane. Najnovija istraživanja ukazuju na glavne prepreke: ograničene resurse, poteškoće u komunikaciji o rizicima i izazove promjene ponašanja. Aktuelni trendovi stavljaju akcenat na praktičnu primjenu kroz digitalne alate, tehnike „gurkanja“ (*nudging*) i razvoj liderstva, umjesto na teorijske okvire. Ovaj razvoj ukazuje na pomak ka integrisanim tehnološkim rješenjima, procesima kontinuiranog unapređenja i intervencijama zasnovanim na dokazima koje obuhvataju organizacione i individualne faktore. Efikasna kultura bezbjednosti hrane zahtijeva usklađene napore na svim hijerarhijskim nivoima, sa naglaskom na posvećenost liderstva, efikasnu komunikaciju, obuku zaposlenih i sistematsko upravljanje rizicima, kako bi se obezbijedila dosljedna primjena praksi bezbjednosti hrane.

Ključne riječi: bezbjednost hrane, ljudski faktor, kultura bezbjednosti hrane, ljudsko ponašanje, alati za „nudging“

THE WEAKEST LINK? HOW HUMAN BEHAVIOR THREATENS FOOD SAFETY

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Abstract. Despite well-developed systemic approaches, standards, and food safety legislation, numerous recalls, food fraud, and foodborne diseases persist. The human factor at organizational and operational levels causes unacceptable process deviations manifesting in critical situations. Food Safety Culture has emerged as a new paradigm addressing this challenge. This paradigm represents a critical factor ensuring food safety, quality, and hygiene in establishments. While legislative requirements and documented systems clearly define tasks, responsibilities, and procedures, practical implementation often fails due to human behavioral factors. Food safety culture, reflected in employee behavior when handling food, significantly influences product safety and public health. Research demonstrates that despite continuous education, food safety systems remain incompletely controlled due to inherent work-related human risks. Employee behavior—characterized by consistency, accuracy, and correctness in task execution—is influenced by knowledge, motivation, competence, understanding, hygienic awareness, work attitudes, job satisfaction, and resource availability. Food safety culture depends on broader organizational elements: effective HACCP-based management systems, company policy, management commitment, leadership, employee awareness, communication, work environment, and risk assessment. Contemporary approaches have evolved beyond traditional compliance-based frameworks toward comprehensive behavioral and organizational transformation strategies. Food operators increasingly implement voluntary standards beyond legislative requirements to enhance awareness and control risk factors. However, implementation varies significantly between high and low food safety culture organizations. Recent research identifies major barriers: limited resources, risk communication difficulties, and behavioral change challenges. Current trends emphasize practical implementation through digital tools, "nudging" techniques, and leadership development rather than theoretical frameworks. This evolution demonstrates shifts toward integrated technology solutions, continuous improvement processes, and evidence-based interventions addressing organizational and individual factors. Effective food safety culture requires coordinated efforts across hierarchical levels, emphasizing leadership commitment, effective communication, employee training, and systematic risk management to achieve consistent food safety practice implementation.

Key words: food safety, human factor, food safety culture, human behavior nudging tools

**LABORATORIJSKA MEDICINA,
DIJAGNOSTIKA,
ZDRAVSTVENA NJEGA**

**LABORATORY MEDICINE,
DIAGNOSTICS, HEALTH CARE**

ALTRUIZAM U SESTRINSTVU

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Sažetak. Altruističko ponašanje u sestrinstvu je neophodno i može se potaknuti izazivanjem empatije. Cilj ovog rada bio je mapirati trendove naučne literature po pitanju ispitivanja altruizma u sestrinstvu. Korišćena je bibliometrijska analiza kako bi se utvrdio postavljeni cilj. Za analizu literature izabrana je baza podataka Dimensions. Nakon mnogo pokušaja traženja različitih kombinacija riječi konačna strategija pretrage je prema Boolean-ovom algoritmu uključivala sljedeće: “altruism” AND „nursing“. Sirovi podaci su ekstrahirani iz Dimensions baze u csv formatu. CSV fajl je obrađen u Vos Viewer programu. Jedinica analize se sastojala od 7 publikacija, a rezultati su prikazani tabelarno. Istraživanjem su obuhvaćene sve citatne baze, a od vrsta publikacija samo naučni originalni članci. Rezultati su pokazali da je ova tema u nauci imala eksponencijalni pad posljednje dvije godine. Identifikovani su najproduktivniji autori, časopisi i zemlje. Prema broju citata najrelevantniji časopis je Psihologija i Nurse Education in Practice. Pregled studija se koristio za mapiranje objavljene literature, a rezultati su se sintetizovali i identifikovale praznine. Osnovni zadatak altruizma je pomoć drugima bez nagrade, ali kroz izdvojene studije je identifikovan pad volje za požrtvovanost, visoka stopa sagorijevanja i umor od saosjećanja, što je zabrinjavajuće. Poznavanje glavnih pravaca istraživanja generisanih u ovoj oblasti omogućava istraživačima da sami prate trendove. Altruizam podstiče medicinske sestre da žrtvuju svoje vrijeme i obavljaju izazovne zadatke, a sve u korist pacijenata. Istraživači mogu koristiti ovu analizu u cilju identifikacije koncipiranja adekvatne metodologije po pitanju zastupljenosti altruizma u sestrinstvu što je nedovoljno istraženo.

Ključne riječi: Altruizam, sestrinstvo, medicinske sestre, empatija

ALTRUISM IN NURSING

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Abstract. Altruistic behavior in nursing is necessary and can be encouraged by eliciting empathy. The aim of this work was to map the trends of the scientific literature on the question of altruism in nursing. A bibliometric analysis was used to determine the set goal. The Dimensions database was chosen for literature analysis. After many attempts to search for different combinations of words, the final search strategy according to the Boolean algorithm included the following: "altruism" AND "nursing". Raw data was extracted from the Dimensions database in csv format. The CSV file was processed in the Vos Viewer program. The unit of analysis consisted of 7 publications, and the results are tabulated. The research included all citation databases, and from the types of publications, only scientific original articles. The results showed that this topic in science has experienced an exponential decline in the last two years. Also, the most productive authors, journals and countries were identified. According to the number of citations, the most relevant journal is Psychology and Nurse Education in Practice. A review of studies was used to map the published literature, and the results were synthesized and gaps were identified. The basic task of altruism is to help others without reward, but through isolated studies, a decline in willingness to sacrifice, a high burnout rate and compassion fatigue have been identified, which is worrying. Knowing the main lines of research generated in this field allows researchers to follow the trends themselves. Altruism encourages nurses to sacrifice their time and perform challenging tasks, all for the benefit of patients. Researchers can use this analysis in order to identify and design an adequate methodology regarding the representation of altruism in nursing, which is insufficiently researched.

Key words: Altruism, nursing, nurses, empathy

FEBRILNA NEUTROPENIJA

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Sažetak. Febrilna neutropenija (FN) je iatrogeni indukovani sindrom i jedna od najvažnijih komplikacija liječenja citotostatskom hemoterapijom kod hematološko-onkoloških bolesnika. Neutropenija je definisana smanjenim apsolutnim brojem granulocita ($< 1,5 \times 10^9 /L$). Pacijenti s neutropenijom pokazuju izraženu sklonost nastanku infekcija. Kod bolesnika s FN-om glavna klinička manifestacija je povišena tjelesna temperatura koja ne mora uvijek biti prisutna, npr kod osoba na kortikosteroidnoj terapiji ili osoba starije životne dobi. Febrilna neutropenija jedna je od najčešćih komplikacija hemioterapije i glavni uzrok morbiditeta oboljelih od malignih bolesti krvi. Prikazati distribuciju pacijenata sa febrilnom neutropenijom prema polu, starosnoj strukturi, primjeni primarne profilakse, distribuciju u odnosu na ukupan broj liječenih, vrstu maligniteta, te vrstu hemioterapijskog protokola. Ispitivanjem su obuhvaćeni pacijenti liječeni na Klinici za unutrašnje bolesti-odjeljenje hematologije sa opštom internom medicinom Univerzitetskog kliničkog centra Republike Srpske u periodu od 30. 06. 2022. do 31.12.2022. Podaci su statistički obrađeni, retrospektivno deskriptivnom metodom i prikazani grafički, apsolutnim i relativnim brojevima. FN registrovana je kod 53 (23,5 %) bolesnika s dijagnozom limfoproliferativne bolesti, kod 13 ili 24,5% bolesnika kod kojih je primijenjena primarna profilaksa. Medijan hospitalizacije bolesnika s FN je 10 dana. Veći broj pacijenata je ženskog pola, najveći broj pacijenata starosne grupe od 61-70 godina. 19 ili 35,84% pacijenata boluje od Non Hodginskog limfoma. Najveći broj oboljelih ili 14 pacijenata koji su imali komplikaciju febrilnu neutropeniju su primali hemoterapijski protokol R CHOP.

Ključne riječi: febrilna neutropenija, profilaksa, distribucija pacijenata, dijagnostički i terapijski tretman.

FEBRILE NEUTROPENIA

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Abstract. Febrile neutropenia (FN) is an iatrogeni induced syndrome and one of the most important complications of treatment with cytostat chemotherapy in hematological-oncological patients. Neutropenia is defined by a reduced absolute number of granulocytes ($< 1.5 \times 10^9 /L$). Patients with neutropenia show a pronounced tendency to infection. In patients with FN, the main clinical manifestation is an elevated body temperature, which does not always have to be present, for example in a person on corticosteroid therapy or an elderly person. Febrile neutropenia is one of the most common complications of chemotherapy and the main cause of morbidity in patients with malignant blood diseases. To show the distribution of patients with febrile neutropenia according to gender, age structure, use of primary prophylaxis, distribution in relation to the total number of treated patients, type of malignancy, and type of chemotherapy protocol. The study included patients treated at the Clinic for Internal Diseases - Department of Hematology with General Internal Medicine of the University Clinical Center of the Republic of Srpska in the period from June 30, 2022 to December 31, 2022. Data are statistically processed, retrospectively descriptive method and displayed graphically, absolute and relative numbers. FN was registered in 53 (23.5%) patients diagnosed with lymphoproliferative diseases, in 13 or 24.5% of patients who received primary prophylaxis. Median hospitalization of patients with FN is 10 days. The majority of patients are female, the largest number of patients are in the 61-70 age group. 19 or 35.84% of patients have non-Hodgkin's lymphoma. The largest number of patients or 14 patients who had complications of febrile neutropenia received chemotherapy protocol R CHOP.

Key words: febrile neutropenia, prophylaxis, distribution of patients, diagnostic and therapeutic treatment

KOMPARATIVNA ANALIZA EPISTEMOLOŠKIH STAVOVA STUDENATA UNIVERZITETA U NOVOM SADU

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Sažetak. Ovo mešovito istraživanje imalo je za cilj da ispita i uporedi epistemološka uverenja studenata Univerziteta u Novom Sadu oslanjajući se na Biglanovu klasifikaciju akademskih disciplina. Epistemološka uverenja — shvatanja pojedinaca o prirodi znanja i procesa učenja — igraju ključnu ulogu u načinu na koji studenti pristupaju učenju, rešavanju problema i usvajanju novih informacija, što je od suštinskog značaja za njihov akademski razvoj. Kvantitativni deo istraživanja je sproveden kao analitičko-deskriptivna, komparativna studija preseka. Podaci su prikupljeni u periodu od januara do marta 2024. godine. 387 studenata je anketirano korišćenjem multidimenzijalnog upitnika za procenu epistemoloških stavova. Kvantitativna analiza je sprovedena pomoću neparametrijskih statističkih metoda u SPSS 27 softveru. Nakon kvantitativne analize, 10 studenata je nasumično izabrano za kvalitativnu analizu. Uz pomoć MAXQDA softvera za kvalitativnu analizu podataka sprovedena je tematska analiza na osnovu transkripta polustrukturisanih intervjua. Rezultati faktorske analize potvrdili su strukturnu validnost predloženog modela. Rezultati ukazuju da studenti poseduju razvijena epistemološka uverenja ($p < 0,001$; $r = 0,840$). Uverenja o procesu učenja pokazala su se sofisticiranijima od stavova o prirodi znanja ($p < 0,001$; $r = 0,585$) kod većine ispitanika ($n = 222$). Nisu uočene značajne razlike u odnosu na Biglanovu klasifikaciju akademskih disciplina ($p = 0,066$; $p = 0,552$; $p = 0,461$). Kvalitativnom analizom istaklo se pet tematskih celina: studenti znanje vide kao promenljivo i međusobno povezano; učenje doživljavaju kao proces koji zahteva razumevanje i primenu; ističu važnost istrajnosti i unutrašnje motivacije pri savladavanju složenog gradiva; sposobnost za učenje povezuju sa unutrašnjim predispozicijama i spoljašnjim faktorima; a obrazovanje smatraju ključnim za lični i društveni razvoj. Ovo istraživanje pruža detaljan uvid u studentska shvatanja znanja i učenja, ističući značaj obrazovnih strategija usmerenih na razvoj dubljih epistemoloških uverenja.

Ključne reči: Epistemološka uverenja, visoko obrazovanje, Biglanova klasifikacija, mešovita studija

COMPARING EPISTEMOLOGICAL BELIEFS ACROSS ACADEMIC DISCIPLINES: A MIXED-METHODS STUDY

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Abstract. This mixed-methods study examined and compared the epistemological beliefs of university students in Serbia across various academic disciplines, using Biglan's classification of fields of study. Epistemological beliefs—individuals' conceptions of knowledge and learning—play a key role in shaping how students approach studying, problem-solving, and assimilating new information, all of which are essential for academic development. The quantitative part was designed as a cross-sectional, analytical-descriptive, and comparative study with data collected between January and March 2024. 387 students were surveyed using a multidimensional epistemological beliefs questionnaire, and the data was analysed using non-parametric statistical methods in SPSS 27. For the qualitative part, 10 students were randomly selected for semi-structured interviews, and thematic analysis was utilized to reveal key themes using the MAXQDA Software. Results of CFA analysis confirm the structure validity of the proposed model. Findings indicate that students possess sophisticated epistemological beliefs ($p < 0.001$; $r = 0,840$). Beliefs about learning were found to be more developed than the beliefs about knowledge ($p < 0.001$; $r = 0.585$) in majority of participants ($n = 222$). No significant differences in beliefs were found between students across Biglan's broader disciplinary categories ($p = 0.066$; $p = 0.552$; $p = 0.461$). Qualitative analysis revealed five key themes: students viewed knowledge as evolving and interconnected; emphasized that learning occurs through understanding and application; valued persistence and intrinsic motivation in managing complex material; saw learning ability as shaped by both internal and external factors; and perceived education as essential for personal and societal development. The integration of quantitative and qualitative findings offers a comprehensive understanding of how students conceptualize knowledge and learning, highlighting implications for educational practices aimed at fostering deeper epistemological development.

Key words: Epistemological beliefs, Higher education, Biglan's Classification, Mixed-method research

UTICAJ USLOVA RADA NA INTRINZIČNO ZADOVOLJSTVO MEDICINSKIH SESTARA

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Sazetak. U savremenim uslovima rada, zadovoljstvo medicinskih sestara predstavlja ključni faktor kvaliteta zdravstvene zaštite. Intrinzični aspekti zadovoljstva, koji se odnose na ličnu ispunjenost, samostalnost u radu i mogućnost profesionalnog razvoja, sve više dolaze u fokus menadžmenta u zdravstvu. Rad medicinske sestre nije samo tehnički zadatak već podrazumeva visok nivo profesionalne autonomije i emocionalne angažovanosti. Značaj zadovoljstva ovih radnika leži i u njihovoj direktnoj povezanosti sa pacijentima, gde subjektivna percepcija rada često reflektuje kvalitet zdravstvenih usluga u celini. Cilj ovog rada bio je da se ispita uticaj uslova rada na intrinzične aspekte zadovoljstva medicinskih sestara. Istraživanje je sprovedeno u tri zdravstvene ustanove u centralnoj Srbiji, na uzorku od 362 ispitanice. Primenjen je standardizovani upitnik, a obrada podataka izvršena je putem SPSS softvera korišćenjem deskriptivne statistike, analize pouzdanosti, korelacione i regresione analize. Rezultati su pokazali da su kontekstualne karakteristike posla najviše ocenjene ($M=4.08$), dok su indikatori intrinzičnog zadovoljstva takođe visoko ocenjeni (npr. zadovoljstvo ličnom ispunjenošću $M=4.09$, iskorišćenost sposobnosti $M=3.99$). Spearmanova korelaciona analiza potvrdila je postojanje pozitivne i statistički značajne veze između uslova rada i intrinzičnog zadovoljstva ($\rho=0.495$, $p<0.01$). Dodatno, regresiona analiza je pokazala da socijalne i motivacione karakteristike imaju poseban značaj za predikciju zadovoljstva, posebno kod mlađih ispitanica. ANOVA test je potvrdio statistički značajne razlike u zadovoljstvu prema godinama radnog staža. Zaključeno je da se unapređenjem motivacionih i kontekstualnih karakteristika posla može direktno uticati na povećanje intrinzičnog zadovoljstva medicinskih sestara, što ima važnu implikaciju za politiku zadržavanja kadra, prevenciju profesionalnog sagorevanja i unapređenje kvaliteta zdravstvenih usluga.

Ključne riječi: intrinzično zadovoljstvo, medicinske sestre, uslovi rada, karakteristike radnog mesta, zdravstvena zaštita

THE IMPACT OF WORKING CONDITIONS ON THE INTRINSIC JOB SATISFACTION OF NURSES

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Abstract. In contemporary healthcare systems, nurse job satisfaction represents a crucial factor in the quality of medical services. Intrinsic aspects of satisfaction—such as personal fulfillment, autonomy at work, and opportunities for professional development—are gaining increasing attention from healthcare management. Nursing is not merely a technical role; it involves a high degree of professional autonomy and emotional engagement. The importance of nurse satisfaction is underscored by their direct interaction with patients, where their subjective experience of work often reflects the overall quality of care. The aim of this study was to examine the impact of working conditions on the intrinsic job satisfaction of nurses. The research was conducted in three healthcare institutions in central Serbia, with a sample of 362 female participants. A standardized questionnaire was used, and data were analyzed using SPSS software through descriptive statistics, reliability analysis, as well as correlation and regression analysis. The results indicated that contextual job characteristics received the highest ratings ($M=4.08$), while indicators of intrinsic satisfaction were also rated highly (e.g., satisfaction with personal fulfillment $M=4.09$, use of abilities $M=3.99$). Spearman's correlation analysis confirmed a positive and statistically significant relationship between working conditions and intrinsic satisfaction ($\rho=0.495$, $p<0.01$). Furthermore, regression analysis showed that social and motivational job characteristics play a significant role in predicting satisfaction, particularly among younger respondents. The ANOVA test revealed statistically significant differences in satisfaction levels based on years of service. It was concluded that improving motivational and contextual job characteristics can directly enhance the intrinsic satisfaction of nurses, which holds important implications for workforce retention, prevention of professional burnout, and overall quality improvement in healthcare services.

Key words: intrinsic satisfaction, nurses, working conditions, job characteristics, healthcare quality

DIFUZNI B KRUPNOĆELIJSKI LIMFOM- RELAPS REFRAKTORNI-PRIKAZ SLUČAJA

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Sažetak. Difuzni B krupnoćelijski limfom (DLBCL) klasifikovan je kao limfom različitog entiteta u klasifikaciji Svjetske zdravstvene organizacije (WHO). Oko 30 % do 40 % svih limfoma kod odraslih osoba su difuzni B krupnoćelijski limfomi i čine najčešću podgrupu svih ne-Hodgkinovih limfoma. DLBCL obuhvata različitu grupu limfoidnih neoplazmi, koji imaju heterogena klinička, histološka, imunofenotipska, citogenetska i molekularna obilježja. Ovim radom kroz prikaz slučaja su prezentovane sledeće kliničke manifestacije bolesti: pacijent kome je 2018. godine urađena tonzilektomija i postavlja dijagnoza PH: NHL follicularae gradus, liječen sa 6 ciklusa IHT R-CHOP, postignuta CR bolesti, 8/2020-Prvi relaps bolesti, liječenje nastavljeno sa 6 ciklusa RFC. Ponovni relaps bolesti 2022, na prijemu orbitalno lijevo prisutna hiperemična edematozna tumefakcija, koja narušava arhitektoniku oka, u regiji svoda i zadnjeg zida epifaringusa vidljiva mekotkivna promjena. Urađene BK i tražena revizija pH nalaza koja pokaže da se radi o transformaciji bolesti u DBKL. 1/2023 odlučeno da se liječenje nastavi primjenom sistemske terapije Rituximab+ Bendamustin+Polituzumab vedotin. Vrlo rijetko folikularni limfom može pokazati mješavinu ćelija koje takođe uključuju agresivni difuzni B krupnoćelijski limfom.

Ključne riječi: limfom, transformacija, klinički put, dijagnostički i terapijski tretman

DIFFUSE B LARGE CELL LYMPHOMA - RELAPSE REFRACTORY - CASE REPORT

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Abstract. Diffuse large B cell lymphoma (DLBCL) is classified as a lymphoma of a different entity in the World Health Organization (WHO) classification. Approximately 30% to 40% of all lymphomas in adults are diffuse large B cell lymphomas and constitute the most common subgroup of all non-Hodgkin lymphomas. DLBCL includes a diverse group of lymphoid neoplasms, which have heterogeneous clinical, histological, immunophenotypic, cytogenetic and molecular features. In this work, the following clinical manifestations of the disease are presented through a case report: a patient who underwent tonsillectomy in 2018 and was diagnosed with PH: NHL follicularae gradus, Treated with 6 cycles of IHT R-CHOP, achieved CR of the disease, 8/2020-First relapse of the disease, treatment continued with 6 cycles of RFC. Relapse of the disease in 2022, on admission, a hyperemic edematous swelling was present on the left orbital surface, which disrupts the architecture of the eye, and soft tissue changes were visible in the region of the vault and posterior wall of the epipharynx. BK was performed and a revision of the ph findings was requested, which showed that the disease had transformed into DBKL. 1/2023 it was decided to continue treatment with systemic therapy Rituximab + Bendamustine + Polituzumab vedotin. Very rarely, follicular lymphoma can show a mixture of cells that also include aggressive diffuse large B cell lymphoma.

Key words: lymphoma, transformation, clinical pathway, diagnostic and therapeutic treatment.

ISHRANA U PREKONCEPCIJSKOM I GESTACIJSKOM PERIODU

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Sažetak. Zdravlje žene u trenutku začeća igra veliku ulogu za uspješnu trudnoću i zdravo dijete. Način ishrane, gojaznost i fizička neaktivnost su vrlo česte kod žena u reproduktivnom periodu, naročito u nerazvijenim zemljama. Edukovanost populacije o ovoj temi je vrlo niska, što predstavlja veliki problem za zdravstveno stanje budućih generacija, kao i naslijeđivanja obrasca higijensko dijetetskog režima ishrane od roditelja. Cilj rada je prikazati značaj edukacije populacije o ishrani u prekonceptijskom i gestacijskom periodu. Za izradu rada korišteni su različiti izvori, kao što su naučni, stručni radovi i publikacije koje su iz navedene oblasti. Izvori su pretraživani u elektronskim bazama podataka za medicinsku i zdravstveno-naučnu literaturu, kao što je PubMed, Elsevier, Wiley online biblioteka, Digitalni akademski arhivi i repozitoriji kao što su Dabar, Hrčak srce i stručni časopisi kao što su Evropski i Američki časopis ginekologije i akušerstva. Ključne riječi za pretragu su bile "ishrana i koncepcija", "planiranje trudnoće", "edukovanost roditelja", "posljedice loše ishrane na plod i novorođenče". Uloga diplomirane medicinske sestre je u visokom značaju, jer ona ostvaruje prvi kontakt sa ženama koje planiraju trudnoću, kroz preventivne centre. U pretraživanom petogodišnjem periodu dolazi se do zaključka da je neophodno ulaganje resursa u edukacije populacije koji planiraju začeće, jer kao rezultat se postiže više ciljeva, a to su zdrava populacija, zdravo začeće i trudnoća, smanjenje komplikacija tokom trudnoće koju može uzrokovati hronično oboljenje žene ili trudnice, kao i postizanje najvišeg cilja, a to je zdravo dijete. Usvajanjem higijensko dijetetskog režima dugoročno se djeluje i na dojenje, koje novorođenčetu u prvim danima života igra veliku ulogu u izgradnji imunog sistema, zadovoljenja nutritivnih i vitaminsko-mineralnih potreba. Najčešće se žene savjetuju o pravilnoj ishrani prije, tokom i nakon trudnoće. Međutim, oba roditelja u jednakoj mjeri daju genetski materijal tokom oplodnje zrele jajne ćelije, prilikom čega je edukacija muške populacije jednako značajna.

Ključne riječi: ishrana, prekonceptijski period, gestacijski period, uloga diplomirane medicinske sestre

NUTRITION IN THE PRECONCEPTION AND GESTATION PERIOD

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Abstract. A woman's health at the moment of conception plays a big role for a successful pregnancy and a healthy child. Diet, obesity and physical inactivity are very common in women during the reproductive period, especially in underdeveloped countries. The education level of the population on this topic is very low, which represents a big problem for the health of future generations, as well as the inheritance of a pattern of hygienic dietary nutrition from parents. The goal of the paper is to show the importance of educating the population about nutrition in the preconception and gestation period. Various sources were used for the creation of the work, such as scientific, professional works and publications from the aforementioned field. Sources were searched in electronic databases for medical and health-scientific literature, such as PubMed, Elsevier, Wiley online library, digital academic archives and repositories such as Dabar, Hrčak srce and professional journals such as the European and American Journal of Obstetrics and Gynecology. The keywords for the search were "nutrition and conception", "pregnancy planning", "parental education", "consequences of poor nutrition on the fetus and newborn". The role of a graduate nurse is of great importance, because she makes the first contact with women who are planning pregnancy, through preventive centers. In the searched five-year period, the conclusion is reached that it is necessary to invest resources in the education of the population planning to conceive, because as a result, several goals are achieved, namely a healthy population, healthy conception and pregnancy, reduction of complications during pregnancy that can be caused by a chronic illness of a woman or pregnant woman, as well as the achievement of the highest goal, which is a healthy child. Adopting a hygienic dietary regime also has a long-term effect on breastfeeding, which plays a major role in building the immune system and meeting nutritional and vitamin-mineral needs of a newborn in the first days of life. Most often, women are advised about proper nutrition before, during and after pregnancy. However, both parents contribute genetic material equally during the fertilization of a mature egg, in which case the education of the male population is equally important. **Key words:** nutrition, preconception period, gestational period, role of a graduate nurse

POVEZANOST KLINIČKO–PATOLOŠKIH KARAKTERISTIKA I EKSPRESIJE *PD-L1* KOD PACIJENATA SA SKVAMOZNIM KARCINOMOM BRONHA

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Sažetak. Skvamozni karcinom bronha ne reaguje uvek na standardnu onkološku terapiju. Većina aktuelnih istraživanja se bazira na imunoterapiji koja cilja kontrolne tačke ćelijske imunosti. Procena nivoa ekspresije *PD-L1* (engl. *programmed death-ligand 1* – ligand receptora programirane ćelijske smrti 1) je neophodan preduslov za donošenje odluke o potencijalnom lečenju monoklonskim antitelima inhibitorima *PD-1/PD-L1* signalnog puta. Cilj istraživanja je utvrditi povezanost ekspresije *PD-L1* kod skvamoznog karcinoma bronha sa kliničko–patološkim karakteristikama poput pola, prosečne starosti, pušačkog statusa, lokalizacija tumora, TNM stadijuma i ECOG Performans status skale kod pacijenata lečenih u Institutu za plućne bolesti Vojvodine (IPBV). Retrospektivno ispitivanje je obuhvatilo 94 ispitanika oba pola, u periodu od 1. januara do 31. decembra 2021. godine, kod kojih je na osnovu patohistološke analize dijagnostikovao skvamozni karcinom bronha i odrađena imunohistohemijska procena ekspresija *PD-L1*. Materijal za patohistološku analizu obrađen je u Službi za patoanatomsku i molekularnu dijagnostiku IPBV. Pozitivna *PD-L1* ekspresija (>1%) detektovana je kod 78,7% ispitanika, a 52,1% pokazalo je visoku ekspresiju (>50%). Multivarijantnom analizom nije pronađena statistički značajna povezanost procenta pozitivnosti tumorskih ćelija u odnosu na pol ($p=0,845$), lokalizaciju ($p=0,670$), pušački status ($p=0,323$) i TNM stadijuma ($p=0,603$). Statistički značajna povezanost dokazana je između ECOG Performans Status skale i *PD-L1* ekspresije <1% ($p=0,035$), dok marginalna povezanost postoji između *PD-L1* procenta ekspresije >50% i starosti ($p=0,058$). Ekspresija *PD-L1* kod pacijenata sa skvamoznim karcinomom bronha nije jasno povezana sa kliničkim karakteristikama bolesti i patohistološkim nalazom. Starost pacijenata i performans status mogu sugerisati postojanje *PD-L1* ekspresije. Druge ispitane kliničko–patološke karakteristike nisu od značajnosti. Dalja istraživanja na većem uzorku pacijenata su neophodna za donošenje adekvatnih zaključaka.

Ključne reči: Skvamozni karcinom bronha; Ekspresija *PD-L1*; Prediktivni biomarker; Kliničko–patološke karakteristike

ASSOCIATION OF CLINICOPATHOLOGICAL CHARACTERISTICS AND PD-L1 EXPRESSION IN PATIENTS WITH SQUAMOUS CELL LUNG CANCER

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Abstract. Squamous cell lung cancer does not always respond well to standard oncological treatments. Current research is largely focused on immunotherapy targeting immune checkpoints. Assessing the expression level of PD-L1 (programmed death-ligand 1) is a necessary prerequisite for considering treatment with monoclonal antibodies that inhibit the PD-1/PD-L1 signaling pathway. The aim of this study is to determine the association between PD-L1 expression in squamous cell lung cancer and clinicopathological characteristics, including gender, age, smoking status, tumor laterality, TNM stage, and ECOG performance status, in patients treated at the Institute for Pulmonary Diseases of Vojvodina. This retrospective study included 94 patients of both sexes diagnosed with squamous cell lung cancer between January 1 and December 31, 2021. Diagnosis was based on histopathological analysis, with additional immunohistochemical assessment of PD-L1 expression. Positive PD-L1 expression (>1%) was observed in 78.7% of patients, while 52.1% showed high expression levels (>50%). Multivariate analysis revealed no statistically significant association between PD-L1 expression and gender ($p=0.845$), tumor localization ($p=0.670$), smoking status ($p=0.323$), or TNM stage ($p=0.603$). A statistically significant association was found between PD-L1 expression <1% and ECOG performance status ($p=0.035$). A marginal association was observed between PD-L1 expression >50% and patient age ($p=0.058$). PD-L1 expression in squamous cell lung cancer patients does not appear to be significantly associated with most clinicopathological characteristics. However, patient age and ECOG performance status may suggest variations in PD-L1 expression. Further studies with larger sample sizes are needed to draw definitive conclusions.

Key words: Squamous cell lung cancer; PD-L1 expression; Predictive biomarker; Clinicopathological characteristics

PRIMJENA VJEŠTAČKE INTELIGENCIJE U MENADŽMENTU NAUČNIH ČASOPISA: IZAZOVI I MOGUĆNOSTI U BIOMEDICINSKOM IZDAVAŠTVU

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Sažetak. Savremeni izazovi u upravljanju naučnim časopisima, posebno u biomedicinskoj oblasti, zahtijevaju inovativna rješenja koja omogućavaju bržu, efikasniju i transparentniju obradu rukopisa bez kompromitovanja naučne i etičke rigoroznosti. Vještačka inteligencija (AI) sve više zauzima centralno mjesto u ovom procesu, uvodeći nove dimenzije u uređivački menadžment. Ovaj rad pruža pregled trenutnih i perspektivnih primjena AI tehnologija u ciklusu naučnog izdavaštva – od automatskog prepoznavanja tematske relevantnosti i lingvističke korektnosti, preko detekcije plagijata i fabriciranih podataka, do inteligentne selekcije recenzenata na osnovu semantičke i citatne analize. Poseban fokus stavljen je na biomedicinske časopise, gdje su brzina diseminacije rezultata i pouzdanost informacija od presudnog značaja za kliničku praksu, javno zdravstvo i dalje istraživanje. AI alati se u ovom kontekstu sve češće koriste za prepoznavanje statističkih nelogičnosti, evaluaciju metodološke strukture istraživanja i detekciju prekomjerne samocitiranosti ili pristrasnosti u recenzijama. Uprkos velikom potencijalu, u radu se detaljno razmatraju i ograničenja primjene AI – uključujući rizike od algoritamske pristrasnosti, nedostatak transparentnosti modela i mogući gubitak nijansirane stručne prosudbe. Autori predlažu okvir za etičku i funkcionalnu integraciju AI u uređivačke procese, koji uključuje hibridni pristup: kombinaciju automatizovanih alata i nadzora iskusnih urednika i naučnika. Zaključuje se da, iako AI ne može u potpunosti zamijeniti ljudsku stručnost, njegovo promišljeno uključivanje u uređivački menadžment naučnih časopisa – posebno u biomedicinskoj sferi – može znatno unaprijediti kvalitet i pouzdanost savremene komunikacije.

Ključne riječi: vještačka inteligencija, uređivanje naučnih časopisa, biomedicinska istraživanja, peer-review, etika u nauci

APPLICATION OF ARTIFICIAL INTELLIGENCE IN THE MANAGEMENT OF SCIENTIFIC JOURNALS: CHALLENGES AND OPPORTUNITIES IN BIOMEDICAL PUBLISHING

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Abstract. Modern challenges in managing scientific journals, particularly in the biomedical field, demand innovative solutions that enable faster, more efficient, and more transparent manuscript processing without compromising scientific and ethical rigor. Artificial intelligence (AI) is increasingly taking a central role in this process, introducing new dimensions to editorial management. This paper provides an overview of current and prospective applications of AI technologies throughout the scientific publishing cycle—from automatic recognition of thematic relevance and linguistic quality, through the detection of plagiarism and fabricated data, to intelligent reviewer selection based on semantic and citation analysis.

Special attention is given to biomedical journals, where the speed of data dissemination and the reliability of information are of critical importance for clinical practice, public health, and ongoing research. In this context, AI tools are increasingly used to identify statistical inconsistencies, assess methodological structures, and detect excessive self-citation or bias in peer review.

Despite its great potential, the paper also examines the limitations of AI application, including risks of algorithmic bias, lack of model transparency, and the possible loss of nuanced expert judgment. The authors propose a framework for the ethical and functional integration of AI into editorial processes, based on a hybrid model: a combination of automated tools and oversight by experienced editors and researchers. It is concluded that, although AI cannot fully replace human expertise, its thoughtful integration into the management of scientific journals—particularly in the biomedical domain—can significantly enhance the quality and reliability of contemporary scientific communication.

Key words: artificial intelligence, scientific journal management, biomedical research, peer review, research ethics

ZAKONSKE REGULATIVE U PRIMENI MATIČNIH ČELIJA

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Sazetak. Ubrzani razvoj regenerativne medicine i upotrebe matičnih ćelija praćen je značajnim etičkim, društvenim i pravnim izazovima. Dok naučna istraživanja napreduju, pravni okviri često kasne u definisanju načina dobijanja, primene i kontrole matičnih ćelija. Savremena društva se različito odnose prema statusu embriona, pravu na život, kao i komercijalnoj upotrebi matičnih ćelija, što dovodi do neujednačenosti u regulativama. Cilj ovog rada je da se analiziraju postojeće zakonske regulative u vezi sa primenom matičnih ćelija u terapijske svrhe, i da se sagleda uticaj etičkih i kulturoloških faktora na njihovo formiranje. Izvršena je sistematizacija naučnih i stručnih dokaza iz dostupne literature u oblasti pravnih regulativa primene matičnih ćelija u regenerativnoj medicini. U izradi su korišćene različite publikacije medicinskih časopisa, naučnih i stručnih radova, kao i dostupne literature iz udžbenika i stručnih knjiga. Pregled literature je izvršen korišćenjem elektronske baze podataka (PubMed interface MEDLINE -a iz National Library of Medicine, Google Scholar, Kobson i SCIndex). Rezultati ukazuju da su pravni sistemi u svetu snažno uslovljeni religijskim i kulturnim faktorima. Uočene su značajne razlike: od restriktivnih modela u Italiji, do liberalnih pristupa u Velikoj Britaniji, gde je dozvoljeno korišćenje embriona iz vantelesne oplodnje za istraživanja. Poseban primer predstavlja Iran, gde su islamski etički principi uspešno integrisani u pravnu regulativu, što je omogućilo stabilan razvoj u ovoj oblasti. U SAD postoji razlika između federalnog i državnog nivoa, što stvara pravnu fragmentaciju. Jasna zakonska regulativa podstiče kliničku primenu i poverenje javnosti, dok pravna neuređenost usporava naučni napredak. Zaključak pokazuje da je globalna harmonizacija etičkih i pravnih standarda preduslov za održiv i bezbedan razvoj terapije matičnim ćelijama, a da edukacija javnosti i jasni zakonski okviri predstavljaju ključ u prevazilaženju etičkih nedoumica.

Ključne reči: matične ćelije, zakonska regulativa, etički principi, embrionalne matične ćelije, regenerativna medicina

LEGAL REGULATIONS IN THE APPLICATION OF STEM CELLS

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Abstract. The rapid development of regenerative medicine and the use of stem cells has been accompanied by significant ethical, social, and legal challenges. While scientific research continues to advance, legal frameworks often lag in defining the methods for obtaining, applying, and overseeing stem cells. Contemporary societies differ in their stance on the status of the embryo, the right to life, and the commercial use of stem cells, leading to inconsistencies in regulation. The aim of this paper is to analyze the existing legal regulations concerning the therapeutic use of stem cells and to explore the influence of ethical and cultural factors on their formulation. A systematization of scientific and professional evidence from available literature on legal regulations in the application of stem cells in regenerative medicine has been conducted. Various sources were used, including publications from medical journals, scientific and professional papers, as well as textbooks and expert monographs. The literature review was conducted using electronic databases (PubMed interface of MEDLINE from the National Library of Medicine, Google Scholar, Kobson, and SCIndex). The results indicate that legal systems worldwide are strongly influenced by religious and cultural factors. Significant differences were observed: from restrictive models in Italy to more liberal approaches in the United Kingdom, where the use of embryos from in vitro fertilization for research purposes is permitted. Iran stands out as a specific example, where Islamic ethical principles have been successfully integrated into the legal framework, allowing for stable development in this field. In the United States, the distinction between federal and state levels creates legal fragmentation. Clear legal regulation promotes clinical application and builds public trust, while legal ambiguity slows scientific progress. The conclusion emphasizes that global harmonization of ethical and legal standards is a prerequisite for the sustainable and safe development of stem cell therapies, and that public education and well-defined legal frameworks are essential to overcoming ethical uncertainties.

Key words: stem cells, legal regulation, ethical principles, embryonic stem cells, regenerative medicine

VJEŠTAČKA INTELIGENCIJA I SAVREMENA EDUKACIJA MEDICINSKIH PROFESIONALACA

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Sažetak. Vještačka inteligencija (VI) transformiše medicinsku edukaciju kroz inovativne metode učenja, evaluacije i profesionalnog razvoja zdravstvenih radnika. Napredni algoritmi omogućavaju personalizovane pristupe učenju putem adaptivnih platformi, koje analiziraju performanse korisnika i prilagođavaju nastavne sadržaje njihovim individualnim potrebama. Simulacije zasnovane na VI, uključujući virtualne i proširene realnosti, omogućavaju realistično iskustvo u dijagnostici, terapijskim procedurama i hirurškoj obuci, smanjujući rizik za pacijente i poboljšavajući kliničku spremnost polaznika. Mašinsko učenje doprinosi preciznijoj procjeni znanja kroz napredne testove sa automatskom analizom odgovora i generisanjem prilagođenih povratnih informacija. Generativni modeli VI olakšavaju pretragu i sintezu medicinske literature, automatizujući analizu velikih količina podataka i omogućavajući bržu edukaciju o najnovijim istraživanjima. Uloga VI je značajna i u razvoju inteligentnih tutorskih sistema koji pružaju interaktivne scenarije učenja i asistiraju edukatorima u kreiranju nastavnih planova zasnovanih na analizi podataka o učenicima. Ipak, integracija VI u medicinsku edukaciju nosi i izazove, uključujući etička pitanja, verifikaciju algoritama i očuvanje kvaliteta kliničkog obrazovanja u kontekstu tehnološke podrške. Ključni fokus u budućnosti biće balansiranje tehnoloških inovacija sa tradicionalnim metodama edukacije, kako bi se osigurao visok nivo stručne kompetentnosti medicinskih profesionalaca.

Ključne riječi: vještačka inteligencija, medicinska edukacija, simulacije, mašinsko učenje, virtuelni pacijenti

ARTIFICIAL INTELLIGENCE AND MODERN EDUCATION OF MEDICAL PROFESSIONALS

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Abstract. Artificial intelligence (AI) is transforming medical education through innovative methods of learning, assessment, and professional development of healthcare workers. Advanced algorithms enable personalized learning approaches through adaptive platforms that analyze user performance and adjust educational content to their individual needs. AI-based simulations, including virtual and augmented reality, provide realistic experiences in diagnostics, therapeutic procedures, and surgical training, thereby reducing risks to patients and improving the clinical readiness of trainees. Machine learning contributes to more accurate knowledge assessment through advanced testing systems with automated response analysis and customized feedback generation. Generative AI models facilitate the search and synthesis of medical literature by automating the analysis of large data sets and enabling faster education on the latest research findings. AI also plays a significant role in the development of intelligent tutoring systems that provide interactive learning scenarios and assist educators in designing curricula based on learner data analysis. However, the integration of AI into medical education also presents challenges, including ethical concerns, algorithm validation, and maintaining the quality of clinical training in a technologically supported environment. A key future focus will be balancing technological innovation with traditional educational methods to ensure a high level of professional competence among medical professionals.

Key words: artificial intelligence, medical education, simulations, machine learning, virtual patients

FUNKCIONALNI ISHODI LEČENJA PRELOMA UZ PRIMENU 3D ŠTAMPANIH MODELA

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Sažetak. Pojava trodimenzionalne (3D) štampe u ortopedskoj hirurgiji omogućila je izradu pacijent-specifičnih anatomskih modela, personalizovanih implantata, hirurških vodiča, kao i tkivnih struktura dobijenih bioštampanjem ćelijskih suspenzija. Ova tehnologija poseduje visok klinički potencijal za unapređenje preoperativnog planiranja, simulacije hirurških zahvata i izvođenja operacija prilagođenih pacijentu, pružajući ortopedskim hirurzima veću preciznost i uspešnost operativnog lečenja. Cilj ovog rada je pregled savremenih mogućnosti primene 3D štampe u ortopedskoj hirurgiji, sa fokusom na funkcionalne ishode lečenja preloma. Analiza se zasniva na podacima iz recenziranih naučnih radova identifikovanih putem *Google Scholar*-a i relevantnih baza podataka uključujući *ScienceDirect*, *Scopus* i *MEDLINE*. Pretraga literature je sprovedena korišćenjem navedenih ključnih reči: „3D štampani modeli“, „prelomi“, „funkcionalni ishodi“ i „ortopedska hirurgija“. Primena 3D štampanih modela omogućila je bolju vizualizaciju složenih anatomskih struktura, precizniju repoziciju preloma i smanjenje intraoperativnih komplikacija. Brojne studije upućuju na to da ovakav pristup dovodi do skraćivanja trajanja operacije, manjeg gubitka krvi i upotrebe fluoroskopije, kao i veće verovatnoće postizanja optimalnijih funkcionalnih i anatomskih rezultata u poređenju sa konvencionalnim hirurškim tehnikama. Pored toga, pacijenti iskazuju visok stepen zadovoljstva pri korišćenju 3D štampanih gipseva. Primena ove savremene tehnologije otvorila je novu eru personalizacije i preciznosti u ortopedskoj hirurgiji, pružajući nove mogućnosti za značajno unapređenje kvaliteta zdravstvene usluge. Sa neprestanim razvojem tehnologije, materijala i stručnih znanja, u budućnosti se očekuju značajniji pomaci i mogućnosti primene 3D štampe u savremenim ortopedskim intervencijama.

Ključne reči: 3D štampa, prelomi kostiju, funkcionalni ishodi lečenja, ortopedska hirurgija

FUNCTIONAL OUTCOMES IN FRACTURE MANAGEMENT ASSISTED BY 3D-PRINTED MODELS

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Abstract. The introduction of three-dimensional (3D) printing in orthopedic surgery has made it possible to create patient-specific anatomical models, custom implants, surgical guides, and even living tissue via cellular bioprinting. This technology holds significant clinical potential to enhance preoperative planning, surgical simulation, and patient-tailored procedures, providing orthopedic surgeons with improved precision and success in operative treatment. This paper aims to review the modern possibilities of using 3D printing in orthopedic surgery, with a focus on the functional outcomes of fracture treatment. The analysis is based on data from peer-reviewed articles identified via Google Scholar and relevant databases, including ScienceDirect, Scopus, and MEDLINE. A literature search was conducted using the following keywords: “3D-printed models”, “fractures”, “functional outcomes” and “orthopedic surgery”. Using 3D-printed models enables better visualization of complex anatomical structures, more precise fracture repositioning, and reduction of intraoperative complications. Numerous studies demonstrate that this method yields shorter surgeries, reduced blood loss, decreased use of fluoroscopy, and a higher likelihood of achieving optimal functional and anatomical outcomes compared to traditional surgical procedures. In addition, patients report a high degree of satisfaction when using 3D-printed casts. The application of this modern technology has ushered in a new era of personalization and precision in orthopedic surgery, offering new opportunities to significantly improve the quality of healthcare. With the continuous development of technology, materials, and professional knowledge, more significant developments and possibilities for the application of 3D printing in modern orthopedic interventions are expected in the future.

Key words: 3D printing, bone fractures, functional treatment outcomes, orthopedic surgery

URINARNI BIOMARKERI U DETEKCIJI RAKA PROSTATE

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Sažetak. Rak prostate (CaP) predstavlja drugi najčešći oblik maligniteta među muškarcima na globalnom nivou, sa sve većom stopom incidencije. Urinarni biomarkeri predstavljaju obećavajući pristup u dijagnostici raka prostate, kao neinvazivna alternativa tradicionalnim metodama poput biopsije i PSA (prostata-specifičnog antigena) testa. Cilj rada je istražiti aktuelna znanja o vrijednosti urinarnih biomarkera i njihovoj detekciji. U radu je izvršena sveobuhvatna analiza trenutne upotrebe urinarnih biomarkera. Ovaj pregled se oslanja na podatke prikupljene iz recenziranih radova koji su navedeni u bazama Science Direct, Scopus, Medline i Google Scholar. Pretraga je obavljenja koristeći ključne riječi povezane sa temom. Biomarkeri kao što su antigen raka prostate (PCA3), transmembranska proteaza serin-2 (*TMPRSS2*) i biomarkeri metilacije specifične za CaP, kao što je glutation S-transferaza P (*GSTP1*), služe za procjenu rizika od raka prostate sa višim stepenom preciznosti. Ovi markeri analiziraju genetske i molekularne promjene specifične za rak prostate i mogu pomoći u diferencijaciji između agresivnih i manje agresivnih oblika bolesti. Pored pomenutih biomarkera i urinarni egzozomi imaju vrijedan potencijal za rani skrining, praćenje progresije bolesti, prognozu i liječenje. Rezultati pokazuju da su urinarni biomarkeri predmet istraživanja te da njihova upotreba u kliničkoj praksi postaje sve izraženija, pružajući dodatne informacije koje mogu unaprijediti odluke o daljem liječenju. U zaključku, urinarni biomarkeri predstavljaju važan korak napred u ranoj detekciji raka prostate, nudeći nadu za precizniju i personalizovaniju medicinu u onkologiji. Dalja istraživanja će biti ključna za utvrđivanje njihove pune efikasnosti i integraciju u standardne dijagnostičke protokole.

Ključne riječi: urin, biomarkeri, egzozomi, PSA, PCA3

URINARY BIOMARKERS IN PROSTATE CANCER DETECTION

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Abstract. Prostate cancer (CaP) is the second most common malignancy among men globally, with an increasing incidence rate. Urinary biomarkers represent a promising approach in prostate cancer diagnosis, as a non-invasive alternative to traditional methods such as biopsy and PSA (prostate-specific antigen) testing. The aim of the paper is to explore the current knowledge on the value of urinary biomarkers and their detection. The paper provides a comprehensive analysis of the current use of urinary biomarkers. This review relies on data collected from peer-reviewed papers listed in Science Direct, Scopus, Medline and Google Scholar. The search was performed using keywords related to the topic. Biomarkers such as prostate cancer antigen (PCA3), transmembrane protease serine -2 (*TMPRSS 2*) and methylation - specific biomarkers for CaP, as is glutathione S - transferase P (*GSTP 1*), are used to assess the risk of prostate cancer with a higher degree of precision. These markers analyze genetic and molecular changes specific to prostate cancer and can help differentiate between aggressive and less aggressive forms of the disease. In addition to the aforementioned biomarkers, urinary exosomes also have valuable potential for early screening, monitoring of disease progression, prognosis, and treatment. The results show that urinary biomarkers are a subject of research and that their use in clinical practice is becoming increasingly prominent, providing additional information that can improve decisions about further treatment. In conclusion, urinary biomarkers represent an important step forward in the early detection of prostate cancer, offering hope for more precise and personalized medicine in oncology. Further research will be crucial to determine their full effectiveness and integration into standard diagnostic protocols.

Key words: urine, biomarkers, exosomes, PSA, PCA3

METAGENOMIKA I SEKVENCIONIRANJE NAREDNE GENERACIJE (NGS) – MOGUĆNOSTI I IZAZOVI

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Sažetak. Otkrivanje uzročnika i postavljanje dijagnoze u savremenoj mikrobiološkoj naučnoj i kliničkoj praksi nailazi na sve veće izazove u pogledu genotipske i fenotipske raznovrsnosti samih mikroorganizama. „Čitanje“ genskog materijala daje pouzdane informacije o konkretnoj vrsti i soju uzročnika kao i o prisustvu gena koji će potencijalno, svojom ekspresijom, dovesti do povećanja virulentnosti i/ili doprinijeti razvoju otpornosti na komercijalnu terapiju. Metagenomika pruža enorman doprinos bržoj i sigurnijoj genskoj analizi uzoraka bez prethodne potrebe za izolovanjem i kultivisanjem uzročnika patološkog stanja. Razvoj analitičkih tehnika baziranih na sekvencioniranju nukleinskih kiselina omogućio je proučavanje nukleotidne strukture i načina njihovog funkcionisanja u pojedinačnim mikrobiološkim vrstama. Primat u savremenom sekvencioniranju zauzima sekvencioniranje naredne generacije označeno kao NGS (eng. *Next-Generation Sequencing*). Brzo paralelno sekvencioniranje dijelova DNA umnogome je „otvorilo vrata“ razvoju uticajnih dijagnostičkih metoda za identifikovanje mikrobioloških infektivnih agenasa. Osnovna klinička primjena NGS načina sekvencioniranja genskog materijala podrazumijeva: sekvencioniranje cijelokupnog genoma (eng. *Whole Genome Sequencing, WHS*) te ciljano i nasumično metagenomsko sekvencioniranje. Cilj predmetnog preglednog rada je opis osnovnih principa rada NGS tehnologije, te naglašava njen značaj i potencijal pri metagenomskim analizama.

Ključne riječi: metagenomika, NGS, analiza

METAGENOMICS AND NEXT-GENERATION SEQUENCING (NGS) – OPPORTUNITIES AND CHALLENGES

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Abstract. Identification of a causative agent and the determination of a diagnosis in modern scientific and clinical practice come across a variety of difficult challenges, mainly including the diversity of the genotype and phenotype of microorganisms. “Reading” of the genetic material gives reliable information about a species and the strain of a causative agent, as well as the awareness of the presence of a gene that will potentially, after its expression, cause an increase in virulent potential of the agent and/or amount to the differentiation of resistance to commercial therapy. Metagenomics gives an enormous contribution to the faster and safer genetic analysis of specimens with no need for prior isolation and cultivation of an agent. Development of analytic techniques based on nucleic acid sequencing enabled determination of the nucleotide structure and its function in each microbiological species. Next-generation sequencing (NGS) takes a major role in modern sequencing. Fast parallel sequencing of DNA fragments enabled the development of influential diagnostic methods for the identification of infective agents. The main clinical application of NGS technique includes: Whole Genome Sequencing (WHS), targeted and shotgun metagenomics sequencing. The focus of this review paper is explaining the main working principles of the NGS technology along with emphasizing the value and potential usage in metagenomics analyses.

Key words: metagenomics, NGS, analyse

METODA HEMILUMINESCENCIJE U MIKROBIOLOGIJI S OSVRTOM NA MOGUĆNOSTI SKRININGA I DIJAGNOSTIKE ZARAZNIH OBOLJENJA

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Sažetak. Hemiluminiscencijsko imunotestiranje (CLIA) je visoko osjetljiva i specifična metoda koja se koristi u mikrobiološkim laboratorijama za dijagnostiku infektivnih bolesti. CLIA koristi hemiluminiscentne supstrate i enzime, poput peroksidaze hrena (HRP) i alkalne fosfataze (AP), za detekciju antigena ili antitijela putem svjetlosnog signala. Postoji nekoliko formata CLIA testova, uključujući direktni hemiluminiscencijski imunotest (CLIA), hemiluminiscencijski enzimski imunotest (CLEIA) i elektrohemiluminiscencijski imunotest (ECLIA), koji se koriste prema vrsti analita i potrebama ispitivanja. Savremeni uređaji zasnovani na CLIA metodi omogućavaju preciznu i pouzdanu detekciju brojnih infektivnih agenasa, uključujući viruse, bakterije i parazite. Ovi uređaji su opremljeni sistemima za automatsku detekciju grešaka u pipetiranju i ispitivanju uzoraka, čime omogućavaju neprekidan rad i visoku efikasnost. Primjena CLIA metode u mikrobiologiji ključna je za preciznu dijagnozu i praćenje infektivnih bolesti. CLIA se koristi za dijagnostiku širokog spektra zaraznih bolesti izazvanih mikroorganizmima, uključujući viruse poput HIV-a, bakterije i parazite. Ova metoda omogućava visoko preciznu identifikaciju patogena, što je od velike važnosti za brzu i tačnu dijagnozu te odgovarajuće liječenje.

Ključne riječi: hemiluminiscencija, imunotestiranje, mikrobiologija, skrining, enzimi

CHEMILUMINESCENCE METHOD IN MICROBIOLOGY WITH A FOCUS ON SCREENING AND DIAGNOSIS OF INFECTIOUS DISEASES

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Abstract. Chemiluminescent immunoassay (CLIA) is a highly sensitive and specific method used in microbiological laboratories for diagnosing infectious diseases. CLIA utilizes chemiluminescent substrates and enzymes, such as horseradish peroxidase (HRP) and alkaline phosphatase (AP), for detecting antigens or antibodies through a light signal. Several CLIA test formats exist, including direct chemiluminescent immunoassay (CLIA), chemiluminescent enzyme immunoassay (CLEIA), and electrochemiluminescent immunoassay (ECLIA), with each being applied depending on the type of analyte and testing requirements. Modern devices based on the CLIA method offer precise and reliable detection of numerous infectious agents, including viruses, bacteria, and parasites. These devices are equipped with systems for automatic detection of pipetting and sample testing errors, ensuring continuous operation and high efficiency. Application of the CLIA method in microbiology is essential for accurate diagnosis and monitoring of infectious diseases. CLIA is widely used for diagnosing a broad range of infectious diseases caused by microorganisms, including viruses such as HIV, bacteria, and parasites. This method allows for highly accurate identification of pathogens, which is crucial for fast and precise diagnosis and appropriate treatment.

Key words: chemiluminescence, immunoassay, microbiology, screening, enzymes

FARMAKOTERAPIJA U LEČENJU DISLIPIDINEMIJE

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Sažetak. Dislipidemija je metabolički poremećaj koji se karakteriše povećanim vrednostima LDL holesterola, ukupnog holesterola i triglicerida u krvi. Nasuprot tome snižene su vrednosti HDL holesterola u krvi. Dislipidemija predstavlja značajan faktor rizika za razvoj aterosklerotičnih plakova na unutrašnjim stranama krvnih sudova što kasnije može da dovede do kardiovaskularnih bolesti, naročito akutnog infarkta miokarda, kao i mnogih moždanih bolesti poput cerebrovaskularnog infarkta. Smatra se da je posledica dislipidemije vodeći uzrok smrti u svetu. Cilj ovog rada bio je da se, pored pregleda savremenih pristupa u lečenju dislipidemije, istraži i nivo informisanosti, životne navike i terapijska praksa među ispitanicima putem sprovedene ankete. Podaci istraživanja ukazuju na nedovoljnu fizičku aktivnost, većina ispitanika ima nezdravu ishranu, dok manji procenat ispitanika aktivno puši, što dodatno povećava rizik od dislipidemije. Značajan nalaz predstavlja i podatak da izvestan broj ispitanika ne prati redovno svoj lipidni status, više od polovine ispitanika koristi terapiju za dislipidemiju, i to statine. Uloga farmaceuta u terapiji je prepoznata kao značajna i korisna, naročito informisanost o samoj bolesti i rizicima koje ona nosi. Zaključak ovog rada ističe važnost kontinuirane edukacije pacijenata, redovnog praćenja lipidnih vrednosti i aktivnog učešća farmaceuta u zdravstvenom vaspitanju, kao i nužnost promocije zdravog načina života kao osnovne komponente uspešnog lečenja dislipidemije.

Ključne reči: dislipidemija, lipidni profil, statini, farmaceuti, zdravstvena edukacija

PHARMACOTHERAPY IN THE TREATMENT OF DYSLIPIDEMIA

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Abstract. Dyslipidaemia is a metabolic disorder characterised by elevated levels of LDL cholesterol, total cholesterol and triglycerides in the blood. In contrast, the HDL cholesterol level in the blood is reduced. Dyslipidaemia is a significant risk factor for the development of atherosclerotic plaques on the inner walls of blood vessels, which can later lead to cardiovascular diseases, in particular acute myocardial infarction, as well as many brain diseases, such as cerebrovascular diseases. Dyslipidaemia is considered the most common cause of death in the world. This study aimed to provide an overview of modern approaches to the treatment of dyslipidaemia and to investigate the level of awareness, lifestyle habits, and therapeutic practice of the respondents through a survey. The research data indicates insufficient physical activity, the majority of respondents have an unhealthy diet, while a smaller percentage of respondents actively smoke, which further increases the risk of dyslipidaemia. An important finding is the fact that a certain number of respondents do not regularly monitor their lipid status. More than half of the respondents are taking a therapy for dyslipidaemia, namely statins. The role of pharmacists in therapy is seen as important and useful, particularly in providing information about the disease itself and the associated risks. The conclusion of this paper emphasises the importance of continuous patient education, regular monitoring of lipid levels and active involvement of pharmacists in health education, as well as the need to promote a healthy lifestyle as a fundamental component of successful treatment of dyslipidaemia.

Key words: dyslipidemia, lipid profile, statins, pharmacists, health education

VJEŠTAČKA INTELIGENCIJA U BIOHEMIJSKOJ LABORATORIJI - UTICAJ NA DIJAGNOSTIKU

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Sažetak. Primjenjena vještačka inteligencija (AI) u medicinsko-zdravstvenim laboratorijama uticala je na promjenu u radu dijagnostičkih laboratorija. AI vodi ka optimizaciji radnog toka i utiče na operativnu efikasnost laboratorije. U ovom pregledu dat je prikaz najnovih istraživanja u oblasti primjene AI u biohemijskim laboratorijama. Izvršen je pregled recenziranih radova referisanih u više baza (Science Direct, PubMed, Scopus, Research Gate i Google Scholar) koji su objavljeni između 2020. i 2025. Pretraživanje je izvršeno na osnovu ključnih riječi koje povezuju AI i dijagnostičke laboratorije. Ovaj rad počinje sa kratkim pregledom AI i modelima AI koji se trenutno koriste u medicinsko-zdravstvenim laboratorijama. Nakon toga, objašnjeni su postojeći izazovi AI modela, moguća rješenja i njihova primjena, a na kraju dat je uvid u mogućnosti primjene AI u budućnosti. Posljednjih godina učinjeni su značajni pomaci u razvoju AI aplikacija u biohemijskim i kliničko-hemijskim laboratorijama. Očekuje se ubrzanje ovog trenda u narednim godinama. AI značajno poboljšava mnoge procese u laboratoriji. Postojeće aplikacije se odnose na automatizaciju toka rada, analizu podataka o biomarkerima, obradu rezultata u realnom vremenu, lakše donošenje odluka od strane kliničkog osoblja, itd. Međutim, postoje i pitanja koja zahtijevaju oprez tokom uključivanja AI u laboratorijsku praksu. Ona se odnose na brigu za integritet podataka, potencijalne predrasude o korištenim algoritmima i određena etička pitanja. Laboratorije su spremne za veću automatizaciju i inkorporaciju AI i IoT tehnologija u budućnosti. Postojeće aplikacije utiču na provođenje svih faza analize u hemijskim i biohemijskim dijagnostičkim laboratorijama. Iako primjena AI u laboratorijskoj dijagnostici predstavlja potencijal za poboljšanje tačnosti rezultata i efikasnosti rada, te unapređenje ishoda zdravstvene zaštite, neophodno je odgovoriti na neka etička pitanja i izmijeniti pravni okvir za rješavanje pitanja vezanih za privatnost podataka i odgovornost algoritama.

Ključne riječi: Vještačka inteligencija, AI, Biohemijska laboratorija, Dijagnostička laboratorija

ARTIFICIAL INTELLIGENCE IN THE BIOCHEMICAL LABORATORY - IMPACT ON DIAGNOSTICS

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Abstract. The application of artificial intelligence (AI) in medical and health laboratories has influenced the change in the work of diagnostic laboratories. AI leads to workflow optimization and affects laboratory operational efficiency. This review provides an overview of the latest research in the field of AI application in biochemical laboratories. An overview of peer-reviewed papers referenced in several databases (Science Direct, PubMed, Scopus, Research Gate and Google Scholar) published between 2020 and 2025 was performed. The research was performed based on keywords connecting AI and diagnostic laboratories. This paper begins with a brief overview of AI and AI models currently used in medical and health laboratories. After that, the existing challenges of the AI model, possible solutions and their application were explained, and finally an insight into the possibilities of applying AI in the future was given. In recent years, significant progress has been made in the development of AI applications in biochemical and clinical chemistry laboratories. This trend is expected to accelerate in the coming years. AI significantly improves many processes in the laboratory. Existing applications are related to workflow automation, biomarker data analysis, real-time results processing, easier decision-making by clinical staff, etc. However, there are also issues that require caution when incorporating AI into laboratory practice. They relate to concern for data integrity, potential biases about used algorithms and certain ethical issues. Laboratories are ready for greater automation and incorporation of AI and IoT technologies in the future. Existing applications affect the performance of all phases of analysis in chemical and biochemical diagnostic laboratories. Although the application of AI in laboratory diagnostics represents the potential for improving the accuracy of results and efficiency of work, and improving health care outcomes, it is necessary to answer some ethical questions and change the legal framework for solving issues related to data privacy and the responsibility of algorithms.

Key words: Artificial intelligence, AI, Biochemical laboratory, Diagnostic laboratory

SAVREMENA RADIOLOGIJA U SVJETLU VJEŠTAČKE INTELIGENCIJE

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Sažetak. Primjena vještačke inteligencije (VI) u savremenoj radiologiji značajno unapređuje dijagnostičke procese, povećava učinkovitost i optimizira radni tok. Duboko učenje i konvolutivne neuronske mreže omogućuju automatsku analizu medicinskih snimaka (RTG, CT, MRI), ranu detekciju patoloških promjena, kvantifikaciju lezija i diferencijalnu dijagnozu. VI smanjuje dijagnostičke greške, poboljšava kvalitetu slike, omogućuje automatsko generiranje preliminarne izvještaja i olakšava upravljanje medicinskim podacima. Dodatno, integracija VI u radiološke informacijske sustave doprinosi bržoj obradi hitnih slučajeva i personaliziranoj medicini. Iako VI donosi brojne prednosti, izazovi poput regulativnih, etičkih pitanja, transparentnosti algoritama i potrebe za ljudskim ekspertizom ostaju ključni čimbenici u njezinoj implementaciji. Budući razvoj VI u radiologiji usmjeren je ka poboljšanju interpretabilnosti algoritama, integraciji s kliničkim podacima i unapređenju preciznosti dijagnostike.

Ključne riječi: vještačka inteligencija, radiologija, duboko učenje, dijagnostička tačnost, medicinska analiza slike, personalizirana medicina

CONTEMPORARY RADIOLOGY IN THE LIGHT OF ARTIFICIAL INTELLIGENCE

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Abstract. The application of artificial intelligence (AI) in contemporary radiology significantly enhances diagnostic processes, increases efficiency, and optimizes workflow. Deep learning and convolutional neural networks enable automatic analysis of medical images (X-ray, CT, MRI), early detection of pathological changes, lesion quantification, and differential diagnosis. AI reduces diagnostic errors, improves image quality, allows automatic generation of preliminary reports, and facilitates medical data management. Additionally, the integration of AI into radiology information systems contributes to faster emergency case processing and personalized medicine. Although AI brings numerous advantages, challenges such as regulatory and ethical issues, algorithm transparency, and the need for human expertise remain key factors in its implementation. The future development of AI in radiology is directed toward improving algorithm interpretability, integration with clinical data, and enhancing diagnostic accuracy.

Key words: artificial intelligence, radiology, deep learning, diagnostic accuracy, medical image analysis, personalized medicine

ULOGA MOLEKULARNIH BIOMARKERA U ADENOKARCINOMIMA: DIJAGNOSTIČKE, PROGNOСТИČKE I TERAPIJSKE IMPLIKACIJE

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Sažetak. Adenokarcinomi, koji se razvijaju iz žljezdanih epitelnih ćelija, predstavljaju najčešći histološki tip karcinoma koji se javlja u mnogim organima poput pluća, dojke, kolona, želuca i pankreasa. U savremenoj onkologiji, molekularni biomarkeri predstavljaju ključnu komponentu precizne (personalizovane) medicine, jer omogućavaju individualizovan pristup dijagnostici i terapiji karcinoma. Razvojem visokoosjetljivih molekularnih tehnologija, poput sekvenciranja nove generacije (NGS), značajno je unaprijeđena identifikacija somatskih i germinativnih mutacija koje imaju klinički značaj. Danas se molekularno profilisanje tumora sve češće koristi kako bi se odredila prisutnost specifičnih biomarkera koji sve više postaju alat ne samo za dijagnozu, već i za odluke o terapiji, praćenje efekta i otkrivanje recidiva. Ovaj pregledni rad prikazuje najčešće korištene molekularne biomarkere u kliničkoj praksi kod različitih adenokarcinoma, uključujući EGFR, KRAS, BRAF, HER2, BRCA, MSI i druge. Poseban fokus stavljen je na njihovu ulogu u dijagnostici, terapiji i procjeni prognoze, kao i na savremene terapijske pristupe zasnovane na prisustvu određenih biomarkera. Cilj rada je da prikaže značaj molekularnih biomarkera u personalizovanom pristupu liječenju adenokarcinoma i da doprinese boljem razumijevanju njihove kliničke primjene. Dostupna literatura procijenjena je iz baza podataka: PubMed, ScienceDirect i Google Scholar.

Ključne riječi: adenokarcinom, biomarker, targetirana terapija, genska mutacija, EGFR, ROS, HER2

ROLE OF MOLECULAR BIOMARKERS IN ADENOCARCINOMAS: DIAGNOSTIC, PROGNOSTIC AND THERAPEUTIC IMPLICATIONS

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Abstract. Adenocarcinomas, which arise from glandular epithelial cells, represent the most common histological type of carcinoma that can be found in many organs such as the lungs, breast, colon, stomach, and pancreas. In modern oncology, molecular biomarkers are key component of precision (personalized) medicine, enabling an individualized approach to cancer diagnosis and treatment. The development of highly sensitive molecular technologies, such as next-generation sequencing (NGS), has significantly improved the identification of somatic and germline mutations of clinical importance. Today, tumor molecular profiling is increasingly used to detect specific biomarkers that serve not only as diagnostic tools, but also support therapy decision-making, monitoring of treatment response, and recurrence detection. This review summarizes the most commonly used molecular biomarkers in clinical practice for various adenocarcinomas, including EGFR, KRAS, BRAF, HER2, BRCA, MSI, and others. Special emphasis is placed on their role in diagnosis, treatment, and prognosis assessment, as well as on modern therapy strategies based on the presence of specific biomarkers. The aim of this paper is to highlight the significance of molecular biomarkers in personalized treatment approaches for adenocarcinomas and to contribute a better understanding of their clinical application. The available literature was reviewed using databases such as PubMed, ScienceDirect, and Google Scholar.

Key words: adenocarcinoma, biomarker, targeted therapy, gene mutation, EGFR, ROS, HER2

SAVREMENA ENZIMOLOGIJA: ZNAČAJ ZA DIJAGNOSTIKU, TERAPIJU I BIOTEHNOLOGIJU

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Sažetak. Enzimologija predstavlja dinamično polje koje povezuje biohemiju, farmaciju i medicinu. Enzimi, kao visoko specifični biološki katalizatori, od suštinskog su značaja za metabolizam i održavanje homeostaze. Njihova primjena se proteže od osnovnih biohemijskih procesa do kliničke dijagnostike, terapije i biotehnoloških inovacija. Cilj rada je da se prikaže savremeni značaj enzima i koenzima u dijagnostici i terapiji, kao i njihova široka upotreba u biotehnologiji, sa posebnim akcentom na klinički relevantne enzime i dijagnostičke reagense. Rad je zasnovan na pregledu aktuelne literature dostupne u međunarodnim bazama podataka (PubMed, Scopus, Web of Science). Analizirani su izvori koji se odnose na klasifikaciju enzima, ulogu koenzima, upotrebu enzima u laboratorijskoj medicini i razvoj biotehnoloških metoda. Pregled pokazuje da enzimi poput ALT, AST, CK i LDH imaju ključnu ulogu u kliničkoj dijagnostici bolesti jetre, srca i mišića, dok amilaza i lipaza služe kao pouzdani markeri pankreasnih oboljenja. Koenzimi, uključujući NAD⁺, FAD i koenzim A, omogućavaju efikasno funkcionisanje enzima i posredno odražavaju nutritivni status organizma. U terapiji se enzimi koriste kao lijekovi (npr. asparaginaza u onkologiji), dok u biotehnologiji predstavljaju osnovu molekularne biologije, genetičkog inženjeringa i proizvodnje bioloških lijekova. Njihova primjena kao reagensa u PCR metodama, imunoesejima i biosenzorima značajno unapređuje preciznost laboratorijske dijagnostike. Savremena enzimologija prevazilazi granice osnovne biohemije i ima ključnu ulogu u personalizovanoj medicini, razvoju novih terapija i biotehnoloških inovacija. Razumijevanje funkcije enzima i koenzima otvara perspektive za integraciju dijagnostike i terapije, doprinoseći preciznijem i efikasnijem pristupu liječenju.

Ključne riječi: enzimi, koenzimi, dijagnostika, terapija, biotehnologija

MODERN ENZYMOLOGY: IMPORTANCE FOR DIAGNOSIS, THERAPY AND BIOTECHNOLOGY

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Abstract. Enzymology is a dynamic field that bridges biochemistry, pharmacy, and medicine. Enzymes, as highly specific biological catalysts, are essential for metabolism and the maintenance of homeostasis. Their application ranges from basic biochemical processes to clinical diagnostics, therapy, and biotechnological innovations. The aim of this paper is to present the modern significance of enzymes and coenzymes in diagnostics and therapy, as well as their broad use in biotechnology, with a special emphasis on clinically relevant enzymes and diagnostic reagents. The paper is based on a review of current literature available in international databases (PubMed, Scopus, Web of Science). Sources related to enzyme classification, the role of coenzymes, the use of enzymes in laboratory medicine, and the development of biotechnological methods have been analyzed. The review shows that enzymes such as ALT, AST, CK, and LDH play a key role in the clinical diagnosis of liver, heart, and muscle diseases, while amylase and lipase serve as reliable markers of pancreatic disorders. Coenzymes, including NAD⁺, FAD, and coenzyme A, enable efficient enzyme function and indirectly reflect the organism's nutritional status. In therapy, enzymes are used as drugs (e.g., asparaginase in oncology), while in biotechnology they form the foundation of molecular biology, genetic engineering, and the production of biological drugs. Their application as reagents in PCR methods, immunoassays, and biosensors significantly enhances the precision of laboratory diagnostics. Modern enzymology goes beyond the boundaries of basic biochemistry and plays a key role in personalized medicine, the development of new therapies, and biotechnological innovations. Understanding the function of enzymes and coenzymes opens perspectives for the integration of diagnostics and therapy, contributing to a more precise and efficient treatment approach.

Key words: enzymes, coenzymes, diagnostics, therapy, biotechnology

PRIMJENA FAZI LOGIKE U KLASIFIKACIJI TUMORA ŠTITNE ŽLIJEZDE

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Sažetak : U mnogim slučajevima ljekari ne mogu reći da li je tumor maligni ili benigni samo na osnovu jednog kriterija ocjene (npr. samo na osnovu njegove veličine, njegovog oblika ili granice). Ocjene u takvim i sličnim situacijama zavise od iskustva ljekara, a prate ih često izrazi; “blago povećanje”, “pojačano nakupljanje” itd., koje karakteriše aproksimacija i subjektivnost ljekara. U radu je razmotrena mogućnost primjene fazi logike u klasifikaciji tumora štitne žlijezde sa posebnim osvrtom na diferencijaciju između malignih i benignih tumora, koristeći kao ulazne varijable: veličinu čvora, snimak ultrazvuka (eho karakteristike), granica čvora, prisustvo mikrokalsifikacije, vaskularizaciju i rezultat biopsije finom iglom. Izlazna varijabla je ocjena rizika od malignosti. Praktična primjena ovakvog ekspertnog fazi sistema je doprinos smanjenju broja nepotrebnih operativnih zahvata kod benignih tumora, doprinos razvoju personalizovane medicine i pomoć ljekarima u donošenju odluka kod nejasnih situacija.

Ključne riječi:fazi logika,ekspertni sistemi, klasifikacija tumora, tumori štitne žlijezde.

APPLICATION OF FUZZY LOGIC IN THYROID TUMOR CLASSIFICATION

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Abstract. In many cases, doctors cannot tell whether a tumor is malignant or benign based only on one assessment criterion (eg only based on its size, shape or border). Assessments in such and similar situations depend on the doctor's experience, and are often accompanied by phrases; "slight increase", "increased accumulation", etc., characterized by approximation and subjectivity of the doctor. The paper discusses the possibility of applying fuzzy logic in the classification of thyroid tumors with special reference to the differentiation between malignant and benign tumors, using as input variables: the size of the node, the ultrasound image (echo characteristics), the boundary of the node, the presence of microcalcification, vascularization and the result of a fine needle biopsy. The output variable is the risk score of malignancy. The practical application of such an expert fuzzy system is a contribution to reducing the number of unnecessary operations in benign tumors, a contribution to the development of personalized medicine and helping doctors in making decisions in unclear situations.

Key words: fuzzy logic, expert systems, tumor classification, thyroid tumors

GOJAZNOST I OPŠTA ANESTEZIJA - PRINCIPI I KOMPLIKACIJE

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Sažetak. Rad ima za cilj prikazati izazove sa kojima se anesteziolozi suočavaju prilikom liječenja gojaznih pacijenata zajedno sa već postojećim komorbiditetima. Porast prevalencije gojaznosti uočen je u poslednjih nekoliko decenija. Svjetska zdravstvena organizacija definiše gojaznost kao prekomjerno ili abnormalno nakupljanje masti koje predstavlja rizik za pacijente. Indeks tjelesne mase preko 25kg/m² smatra se prekomjernom težinom, a preko 30kg/m² gojaznim. Gojaznost je dugo bila povezana sa štetnim efektima na zdravlje. Povezana je sa pratećim bolestima kao što su hipertenzija, dijabetes i bolesti koronarnih krvnih sudova. Pacijenti koji imaju prekomjernu težinu ili gojaznost mogu da razviju dislipidemiju, opstruktivnu apneju u snu, bolesti jetre i žučne kese, osteoartritis, rak i reproduktivne i psihološke poremećaje. Važno je napomenuti da je gojaznost glavni faktor rizika za razvoj astme i veća prevalencija ove bolesti se obično primjećuje kod gojaznih osoba u poređenju sa osobama koje nisu gojazne. Zbog ovih komorbiditeta i komplikacija koje prate gojaznost, liječenje gojaznih pacijenata, posebno onih koji su podvrgnuti hirurškim zahvatima, postaje sve izazovnije. Anesteziolozi se često suočavaju sa izazovom efikasnog liječenja gojaznih pacijenata zajedno sa njihovim već postojećim komorbiditetima. Gojaznost i prateći komorbiditeti značajno povećavaju rizik od preoperativnih, intraoperativnih i postoperativnih hirurških komplikacija. Preoperativno, većina komplikacija povezana je sa respiratornim sistemom, jer su gojazni pacijenti skloniji smanjenju zapremine pluća kolapsu pluća, abnormalnostima u plućima te različitog stepena hipoksemije. Intraoperativne komplikacije su povezane sa povećanim neuspjehom bloka, povredama perifernih nerava, trombotičkim komplikacijama i poteškoćama sa disajnim putevima. Postoperativno, povećan rizik od razvoja infarkta miokarda, infekcija rana i urinarnog trakta i duboke venske tromboze. Izazovi u pronalaženju odgovarajućih doza lijeka za indukciju i održavanje anestezije su prisutni. Korištene su sistematske metode za prikupljanje podataka, kvantitativni pristup za kritičku analizu i sintezu dokaza i kvalitativni pristup tumačenja podataka. Važno je da se gojaznim pacijentima pristupi na odgovarajući način preoperativno radi identifikacije faktora rizika u vezi sa anestezijom, kako bi se tim mogao adekvatno pripremiti za pravilno liječenje bilo koje komplikacije koja se može pojaviti tokom i nakon operacije.

Ključne riječi: gojaznost, opšta anestezija, komorbiditeti gojaznosti, komplikacije opšte anestezije

OBESITY AND GENERAL ANESTHESIA – PRINCIPLES AND COMPLICATIONS

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Abstract. This paper aims to highlight the challenges anesthesiologists face in managing obese patients with pre-existing comorbidities. The prevalence of obesity has increased significantly over recent decades. The World Health Organization defines obesity as excessive or abnormal fat accumulation that presents a risk to health. A body mass index (BMI) over 25 kg/m² is considered overweight, and over 30 kg/m² is classified as obese. Obesity has long been associated with adverse health outcomes and is frequently accompanied by comorbid conditions such as hypertension, diabetes, and coronary artery disease. Overweight and obese individuals are also at risk for dyslipidemia, obstructive sleep apnea, liver and gallbladder diseases, osteoarthritis, cancer, as well as reproductive and psychological disorders. Notably, obesity is a major risk factor for asthma, with a higher prevalence observed among obese individuals compared to those of normal weight. Due to these comorbidities and the complications associated with obesity, managing obese patients—particularly those undergoing surgical procedures—has become increasingly challenging. Anesthesiologists must address the dual challenge of treating obesity and its associated conditions. Obesity and related comorbidities significantly elevate the risk of perioperative complications, including preoperative, intraoperative, and postoperative events. Preoperatively, most complications are respiratory in nature, as obese patients are more prone to reduced lung volumes, atelectasis, pulmonary abnormalities, and varying degrees of hypoxemia. Intraoperative challenges include increased incidence of block failure, peripheral nerve injury, thrombotic complications, and difficult airway management. Postoperative risks are elevated for myocardial infarction, wound and urinary tract infections, and deep vein thrombosis. Determining appropriate dosages for induction and maintenance of anesthesia remains a critical issue. A systematic approach was employed for data collection, utilizing quantitative methods for critical analysis and evidence synthesis, alongside qualitative methods for data interpretation. It is crucial to perform appropriate preoperative assessments in obese patients to identify anesthesia-related risk factors, enabling the medical team to adequately prepare for the effective management of any complications that may arise during or after surgery.

Key words: obesity, general anesthesia, obesity-related comorbidities, general anesthesia complications

PRISTUP U LEČENJU PSIHOTIČNIH POREMEĆAJA KOD MLADIH - PRIKAZ SLUČAJA

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Sažetak. Psihijatrijski poremećaji uzrokovani intrakranijalnim lezijama, česti su ordinaciji izabranog lekara. Oni se preklapaju sa mentalnim poremećajima zdravlja. Najčešći simptomi kod mladih su školska fobija, anksioznost, promene raspoloženja i psihomotorna retardacija. Posebno vulnerabilna grupa stanovništva za mentalne poremećaje su deca i maldi (od 15 do 24 godina). Pod dijagnozom nekog mentalnog poremećaja je 11,3% dece u našoj zemlji. Prikaz slučaja mlade žene, bez porodične anamneze psihijatrijskih bolesti, koji je počeo kao poremećaj ponašanja i emocija u adolescenciji i razvio se u psihotični poremećaj sa halucinacijama i pokušajem suicida, a za koji će se utvrditi da kao anatomsku osnovu ima pinealnu cistu. Cilj nam je centralizovati ulogu izabranog lekara u praćenju i kontroli ovog kompleksnog stanja. Izvor podataka je medicinska dokumentacija pacijentkinje korišćena uz informisani pristanak u skladu sa zakonima Republike Srbije. Upotrebili smo metod posmatranja, anamneze, heteroanamneze, kliničke preglede. Na osnovu ključnih reči pretražili smo elektronske baze podataka i ostalu relevantnu medicinsku literaturu. Pacijentkinja stara 23 godine, od perioda adolescencije počinje da ispoljava psihijatrijsku simptomatologiju, u vidu poremećaja ponašanja i emocija. Složenost stanja praćena je višestrukim hospitalizacijama, lošim terapijskim odgovorom i komljansom lečenja. Prisutno je samopovređivanje i pokušaj suicida predoziranje lekovima. Tokom lečenja javljaju se brojni neželjeni efekti primenjenih lekova u vidu: povećanja telesne mase, nevoljnih pokreta glave i lica, epileptičkih napada, galaktoreje, koji dodatno otežavaju lečenje. Kao anatomski supstrat dijagnostikovana je pinealna cista. Mere koje smo preduzeli, uticale su da se popravi funkcionalni status i poboljšale kvalitet života pacijentkinje i njene porodice. Naše iskustvo se poklapa sa rezultatima brojnih radova koje smo pregledali. Pristup ovakvim stanjima treba da bude individualan u skladu sa pacijentovim stanjem, doživljajem zdravlja i potrebama. Ujedno treba da je i holistički, multidisciplinaran, kako bi se sprovedi svi aspekti lečenja i nege i popravio funkcionalni status i kvalitet života pacijenta. Izabrani lekar ima centralnu ulogu u praćenju toka bolesti, adherence terapije, neželjenih efekata lekova. Briga o zdravlju mladih i zdravstvenim uslugama koje dobijaju, treba da je stalni izazov i interes sistema zdravstvene zaštite i cele društvene zajednice.

Ključne reči: mentalni poremećaji, intrakranijalne lezije, emocionalno nestabilni poremećaj ličnosti

TREATMENT APPROACH TO PSYCHOTIC DISORDERS IN YOUNG ADULTS – A CASE REPORT

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Abstract. Psychiatric disorders caused by intracranial lesions are common in general practice. They overlap with mental health disorders. The most frequent symptoms among young people include school phobia, anxiety, mood swings and psychomotor retardation. Children and young adults (aged 15–24 years) represent a particularly vulnerable group for mental disorders. In Serbia, 11.3 % of children are diagnosed with a mental disorder. To report the case of a young woman without a family history of psychiatric disorders, who had a behavioural and emotional disorder during adolescence that later progressed into a psychotic disorder with hallucinations and a suicide attempt. The patient was ultimately found to have a pineal cyst as the anatomical substrate. The objective is to emphasize the central role of the general practitioner in the follow-up and monitoring of this complex condition. The source of data was the patient's medical record used with informed consent in accordance with the laws of the Republic of Serbia. Observation, medical history, heteroanamnesis and clinical examinations were performed. A keyword-based search was conducted in electronic databases and other relevant medical literature. A 23-year-old female patient presented with psychiatric symptoms that began in adolescence, initially in the form of behavioural and emotional disturbances. The complexity of her condition was reflected in multiple hospitalizations, poor therapeutic response and inadequate treatment adherence. Self-injurious behaviour and a suicide attempt by medication overdose were observed. Numerous treatment-related adverse effects of the administered drugs were noted, including weight gain, involuntary movements of the head and face, epileptic seizures and galactorrhea, which further complicated management. A pineal cyst was diagnosed as the anatomical substrate. The implemented measures improved the patient's functional status and the quality of life of both the patient and her family. This experience is consistent with the findings of numerous studies that were reviewed. The approach to such conditions should be individualised in accordance with the patient's condition, health perception and needs. At the same time, it should be holistic and multidisciplinary in order to address all aspects of treatment and care and to improve the patient's functional status and quality of life. The general practitioner has a central role in monitoring the course of the disease, treatment adherence and adverse drug effects. The health of young people and the health services they receive should remain a constant challenge and priority for the healthcare system and the wider community.

Key words: mental disorders, intracranial lesions, emotionally unstable (borderline) personality disorder

REHABILITACIJA, FIZIČKO I MENTALNO ZDRAVLJE

REHABILITATION, PHYSICAL AND MENTAL HEALTH

SISTEMATSKA ANALIZA UTICAJA TRENINGA SNAGE KOD KARDIOLOŠKIH PACIJENATA

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Sažetak. Kardiovaskularne bolesti (KVB) i dalje su vodeći uzrok smrti u cijelom svijetu. Tradicionalni programi kardiovaskularne rehabilitacije (KVR) dugo su bili fokusirani na aerobne vježbe, kao osnovni pristup za poboljšanje funkcionalne sposobnosti i smanjenje smrtnosti. Međutim, novija istraživanja ističu da integracija treninga snage u rehabilitaciju može značajno doprineti poboljšanju ishoda kod pacijenata sa KVB. Cilj ovog preglednog članka je da pruži sveobuhvatan pregled trenutnih naučnih dokaza o efikasnosti treninga snage u kardiovaskularnoj rehabilitaciji. Analiza je obuhvatila 31 publikaciju iz perioda 2020–2025. godine, izabrane na osnovu kriterijuma uključenja koji su zahtijevali da studije budu randomizovane kontrolisane studije (RCT), sistematski pregledi ili meta-analize i da se odnose na efekte treninga snage kod kardioloških pacijenata. Na osnovu analize istraživanja 31 studije može se zaključiti da trening snage kod kardioloških pacijenata ima značajan pozitivan uticaj u poboljšanju mišićne snage, aerobne kondicije i kvaliteta života, bez povećanja rizika od neželjenih događaja.

Ključne riječi: Snaga, Trening, Kardiološki pacijenti, Rehabilitacija

SYSTEMATIC ANALYSIS OF THE EFFECTS OF STRENGTH TRAINING IN CARDIAC PATIENTS

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Abstract. Cardiovascular diseases (CVD) are still the leading cause of death worldwide. Traditional cardiac rehabilitation programs have long been focused on aerobic exercise as the primary approach to improving functional capacity and reducing mortality. However, recent research points out that the integration of strength training into rehabilitation can significantly improve outcomes in patients with CVD. The aim of this paper is to provide a comprehensive overview of the current scientific evidence on the effectiveness of strength training in cardiac rehabilitation. The analysis included 31 publications from the period 2020–2025 selected based on inclusion criteria that required studies to be randomized controlled trials (RCTs), systematic reviews or meta-analyses and to be related to the effects of strength training in cardiac patients. Based on the research analysis of 31 studies, it can be concluded that strength training in cardiac patients has a significant positive impact in improving muscle strength, aerobic fitness and quality of life, without increasing the risk of adverse events.

Key words: Strength, Training, Cardiac patients, Rehabilitation

UTICAJ INTERVALNOG TRENINGA NA PARAMETRE HODA OSOBA SA PARKINSONOVOM BOLEŠĆU- EKSPERIMENTALNA KLINIČKA STUDIJA

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Sažetak. Trening hoda je važan i efikasan segment kineziterapije i rehabilitacije za osobe sa Parkinsonovom bolešću. Specifičnost poput intervalnog treninga u literaturi je ukazala na poboljšavanje kardiorespiratorne kondicije ali ne i na kvalitet hoda i dinamičku stabilnost. Cilj rada je ispitati uticaj tredmil intervalnog treninga kod osoba s Parkinsonovom bolešću na parametre hoda. Prospektivna eksperimentalna, dvostruko slijepa studija sprovedena kod 46 pacijenata starosti 63.3 ± 9.8 godina odabranih slučajnim uzorkovanjem raspoređenih u dve grupe na osnovu parnih i neparnih numera. Tokom 21 rehabilitacionog dana, svi ispitanici su imali 5 dana u sedmici istovjetan opšti program kineziterapije i okupacionu terapiju u trajanju od 80 min, a eksperimentalna grupa je imala i dodatni program na tredmil traci u vidu intervalnog treninga sa po 4 minute njihove prosječne brzine hoda i 3 minute pauze kroz 4 ponavljanja. Ishodi rehabilitacije praćeni su primjenom standardizovanih testova Tinetti Balance Scale, Time Up and Go (TUG) test te objektivnom analizom softverskog programa Zebris HP cosmos FDMT uređajem na početku i na kraju rehabilitacije. Mobilnost i balans pacijenata ocjenjen Tinetti testom je pokazao bolje rezultate u eksperimentalnoj grupi pre i posle tretmana, značajnost između grupa u pogledu promjene iznosila je $p = 0,3$. Statistička značajna razlika između grupa u pogledu UP&GO iznosila je $p = 0,4$. Pacijenti u obe grupe imaju sličnu fazu oslonca, fazu zamaha, dvostruki oslonac, dužinu koraka, vrijeme koraka i ritam, uključujući promjene nakon tretmana. Nije primjećena značajna razlika u poboljšanjima između grupa. U kontrolnoj grupi primijećeno je značajno smanjenje ukupnog dvostrukog oslonca i kadence. U eksperimentalnoj grupi primijećeno je značajno povećanje dužine koraka i povećanje brzine hoda. Objektivna mjerenja ishoda intervalnog treninga na tredmil traci nisu potvrdila veću značajnost i bolje rezultate prostorno-vremenskih parametara hoda u odnosu na standardni program rehabilitacije.

Ključne riječi: Intervalni tredmil trening, rehabilitacija, Parkinsonova bolest

THE EFFECT OF INTERVAL TRAINING ON THE GAIT PARAMETERS OF PEOPLE WITH PARKINSON'S DISEASE: AN EXPERIMENTAL CLINICAL STUDY

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Abstract. Gait training is an important and effective segment of kinesitherapy and rehabilitation for people with Parkinson's disease. Specificity such as interval training in the literature indicated an improvement in cardiorespiratory fitness, but not on gait quality and dynamic stability. The aim of this study is to examine the effect of treadmill interval training in people with Parkinson's disease on gait parameters. A prospective experimental, double-blind study conducted in 46 patients aged 63.3 ± 9.8 years selected by random sampling assigned to two groups based on even and odd numbers. During the 21 rehabilitation days, all subjects had 5 days a week the same general program of kinesitherapy and occupational therapy lasting 80 minutes, and the experimental group had an additional program on the treadmill in the form of interval training with 4 minutes of their average walking speed and 3 minutes of break through 4 repetitions. Rehabilitation outcomes were monitored by the application of standardized tests Tinetti Balance Scale, Time Up and Go (TUG) test and objective analysis of the software program Zebris HP cosmos FDMT device at the beginning and end of rehabilitation. The mobility and balance of patients assessed by the Tinetti test showed better results in the experimental group before and after treatment, the significance between the groups in terms of change was $p = 0.3$. The statistically significant difference between the groups in terms of UP&GO was $p = 0.4$. Patients in both groups have a similar support phase, swing phase, double support, stride length, stride time, and rhythm, including changes after treatment. There was no significant difference in improvements between the groups. In the control group, a significant reduction in total double support and cadence was observed. In the experimental group, a significant increase in stride length and an increase in walking speed were observed. Objective measurements of the outcomes of interval training on the treadmill did not confirm greater significance and better results of spatio-temporal gait parameters compared to the standard rehabilitation program.

Key words: Interval treadmill training, rehabilitation, Parkinson's disease

MENTALNO ZDRAVLJE ADOLESCENATA I FIZIČKA AKTIVNOST

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Sažetak. Mentalno zdravlje neprocjenjiv je resurs ličnog razvoja i društvenog funkcionisanja. Za uspješan fizički, socijalni, intelektualni i emocionalni razvoj mentalno zdravlje je prioritet. Značajan uticaj na emocionalnu stabilnost i subjektivno blagostanje adolescenata imaju problemi mentalnog zdravlja. Mnogi faktori imaju relevantan uticaj na mentalno zdravlje adolescenata, a najuticajniji faktor je fizička aktivnost. Cilj ovog rada bio je pregledom dostupne literature istražiti vezu između fizičke aktivnosti i mentalnog zdravlja adolescenata. U martu mjesecu 2025. godine dva autora su prema unaprijed utvrđenim kriterijima pretraživala naučne radove objavljene u relevantnim elektronskim bazama podataka. Korišćenjem ključnih riječi „adolescenti”, „fizička aktivnost”, „mentalno zdravlje“ i „mentalni poremećaji” u relevantnim bazama podataka (Scopus, PubMed, PsycInfo i SportDiscuss) pregledano je dvadeset radova. Istraživanje je uključilo devet radova. Radovi stariji od pet godina koji nisu proučavali povezanost fizičke aktivnosti s mentalnim zdravljem adolescenata, niti objavljeni u cijelini na engleskom jeziku su isključeni. Stanja mentalnog zdravlja imaju negativan i pozitivan psihološki odgovor. Negativan je povezana s neugodnim emocijama, a pozitivan sa psihološkim blagostanjem korisnim za život. Adolescenciju često prate problemi mentalnog zdravlja, a nedostatak fizičke aktivnosti povećava zastupljenost ovih problema. Fizička aktivnost koristan je mehanizam koji poboljšava fizičko zdravlje, pozitivno djeluje na mentalno zdravlje, interpersonalne vještine, kognitivne funkcije i pamćenje. Različiti oblici fizičke aktivnosti poput aerobnih vježbi utiču na neurohemijske mehanizme, poboljšavaju raspoloženje i motivaciju i aktiviraju prirodne antidepresive. Literatura potvrđuje značajan uticaj fizičke aktivnosti na bolji kvalitet sna, emocionalnu kontrolu, smanjenje stresa, simptoma depresije i anksioznosti. Ovaj pregled pokazao je značajnu pozitivnu korelaciju fizičke aktivnosti s mentalnim zdravljem adolescenata i istakao fizičku aktivnost kao korisnu intervenciju prevencije problema mentalnog zdravlja.

Ključne riječi: adolescenti, mentalno zdravlje, mentalni poremećaji, fizička aktivnost

ADOLESCENT MENTAL HEALTH AND PHYSICAL ACTIVITY

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Abstract. Mental health is an invaluable resource for personal development and social functioning. For successful physical, social, intellectual and emotional development, mental health is a priority. Mental health problems have a significant impact on the emotional stability and subjective well-being of adolescents. Many factors have a relevant impact on the mental health of adolescents, and the most influential factor is physical activity. The aim of this paper was to review the available literature to investigate the relationship between physical activity and the mental health of adolescents. In March 2025, two authors searched scientific papers published in relevant electronic databases according to predetermined criteria. Twenty papers were reviewed using the keywords "adolescents", "physical activity", "mental health" and "mental disorders" in relevant databases (Scopus, PubMed, PsycInfo and SportDiscuss). The research included nine papers. Papers older than five years that did not study the relationship between physical activity and the mental health of adolescents, nor were they published in their entirety in English, were excluded. Mental health conditions have a negative and positive psychological response. Negative is associated with unpleasant emotions, and positive with psychological well-being useful for life. Adolescence is often accompanied by mental health problems, and lack of physical activity increases the prevalence of these problems. Physical activity is a useful mechanism that improves physical health, has a positive effect on mental health, interpersonal skills, cognitive functions and memory. Various forms of physical activity such as aerobic exercise affect neurochemical mechanisms, improve mood and motivation and activate natural antidepressants. The literature confirms the significant impact of physical activity on better sleep quality, emotional control, reduction of stress, symptoms of depression and anxiety. This review showed a significant positive correlation of physical activity with adolescent mental health and highlighted physical activity as a useful intervention for the prevention of mental health problems.

Key words: adolescents, mental health, mental disorders, physical activity

UTICAJ REZILIJENTNOSTI I SOCIODEMOGRAFSKIH FAKTORA NA SOCIJALNU PODRŠKU LEČENIH ZBOG KARCINOMA DOJKE

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Sažetak. Iskustvo, suočavanje sa dijagnozom karcinoma i modalitetima lečenja, a zatim život u porodičnom, socijalnom i profesionalnom okruženju sa svim ograničenjima kako bolesti tako i/ili metoda lečenja zabrinjavajuće je i teško za pacijente i njihove porodice. Socijalna podrška i rezilijentnost izdvajaju se kao neki od najznačajnijih resursa za adekvatno suočavanje sa dugotrajnom stresnom situacijom. Ovom studijom želeli smo da najpre utvrdimo nivo percipirane socijalne podrške kao i rezilijentnost ispitanica uključenih u studiju. Takođe smo želeli da utvrdimo razlike u nivou percipirane socijalne podrške i rezilijentnosti u odnosu na sociodemografske varijable. Istraživanje je sprovedeno po tipu deskriptivno-analitičke studije preseka u kojoj je učestvovalo 193 ispitanice. Za procenu nivoa socijalne podrške primenjena je Multidimenzionalna skala percepovane socijalne podrške- MSPSS, dok je rezilijentnost procenjena primenom skale CD-RISC-25. Za statističku obradu podataka korišćen je programski paket SPSS® 26.0 (SPSS Inc., Chicago, Illinois). Korišćena je deskriptivna i inferencijalna statistika. Za utvrđivanje razlika primenjeni su *Mann-Whitney U* test i Studentov *t*-test. Korelacione analize izvršene su primenom Pirsonovog i Spirmanovog koeficijenata. Rezultati studije ukazuju na statistički značajnu korelaciju rezilijentnosti i percipirane socijalne podrške ($p < 0.001$; $r = 0.616$). Kada su u pitanju sociodemografske karakteristike naši rezultati ukazuju da varijable od značaja na nivo socijalne podrške jesu mesto stanovanja, nivo prihoda kao i proteklo vreme od završetka lečenja. U zaključku možemo reci da ispitanice sa dovoljnom socijalnom podrškom mogu biti otpornije na teškoće s kojima se suočavaju nakon završenog lečenja. Takođe, svi zdravstveni radnici bi trebalo da pruže pacijentkinjama odgovarajuće smernice kako bi tražile efikasnu socijalnu podršku, s ciljem poboljšanja njihove rezilijentnosti i kvaliteta života nakon lečenja raka dojke.

Ključne reči: Rezilijentnost, socijalna podrška, kvalitet života, karcinom dojke, sociodemografski faktori

THE IMPACT OF RESILIENCE AND SOCIODEMOGRAPHIC FACTORS ON SOCIAL SUPPORT AMONG BREAST CANCER SURVIVORS

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Abstract. The experience of facing a breast cancer diagnosis, undergoing treatment, and subsequently returning to family, social, and professional life—often with limitations caused by the illness and/or treatment—can be distressing and challenging for patients and their families. Social support and resilience have been identified as two of the most important resources for effectively coping with long-term stressful situations. The study aimed to assess the level of perceived social support and resilience among female breast cancer survivors. Additionally, we sought to examine differences in these variables in relation to sociodemographic characteristics. The research was conducted as a descriptive-analytical cross-sectional study including 193 participants. The Multidimensional Scale of Perceived Social Support (MSPSS) was used to measure social support, and resilience was assessed using the Connor-Davidson Resilience Scale (CD-RISC-25). Statistical analysis was performed using SPSS® 26.0 (SPSS Inc., Chicago, Illinois). Descriptive and inferential statistical methods were applied. To assess group differences, the Mann–Whitney U test and Student’s *t*-test were used. Pearson’s and Spearman’s correlation coefficients were used for correlation analyses. The results indicate a statistically significant correlation between resilience and perceived social support ($p < 0.001$; $r = 0.616$). Regarding sociodemographic variables, the level of social support was significantly associated with place of residence, income level, and the time elapsed since treatment completion. In conclusion, participants with adequate social support may be more resilient in coping with the challenges they face after completing breast cancer treatment. Furthermore, healthcare professionals should provide appropriate guidance to help patients seek effective social support, with the goal of improving their resilience and overall quality of life in the post-treatment period.

Key words: Resilience, Social Support, Quality of Life, Breast Cancer, Sociodemographic Factors

FIZIČKA AKTIVNOST U GERIJATRIJSKOJ POPULACIJI

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Sažetak. Starenje populacije predstavlja jedan od najvećih demografskih i zdravstvenih izazova savremenog društva, sa izraženim uticajem na kvalitet života i funkcionalnu sposobnost starijih osoba. Fizička aktivnost je prepoznata kao ključni faktor u očuvanju zdravlja i prevenciji hroničnih bolesti u trećem životnom dobu. Cilj ovog rada bio je da se prikažu mogućnosti i izazovi primjene fizičke aktivnosti u gerijatrijskoj populaciji, sa naglaskom na prepreke i potencijalne pravce unapređenja. Rad je urađen kao pregled relevantne literature sa fokusom na uticaj aerobnih vježbi, treninga snage i vježbi ravnoteže na zdravlje starijih osoba. Rezultati analize ukazuju da redovna i prilagođena fizička aktivnost može značajno smanjiti rizik od sarkopenije, padova, kardiovaskularnih i metaboličkih bolesti, ali i doprinijeti očuvanju kognitivnih funkcija i mentalnog zdravlja. Najčešće prepreke uključuju hronične bolesti, strah od povreda, nedostatak samopouzdanja, ograničene finansijske mogućnosti i neadekvatnu edukaciju zdravstvenih radnika. Diskusija je pokazala da personalizovani programi, bolja dostupnost subvencionisanih aktivnosti u zajednici, upotreba tehnologije i multidisciplinarni pristup predstavljaju najefikasnije strategije za dugoročno uključivanje starijih osoba u fizičku aktivnost. Zaključuje se da fizička aktivnost mora biti sastavni dio gerijatrijske zdravstvene zaštite, jer doprinosi produženju životnog vijeka, očuvanju funkcionalne nezavisnosti i unapređenju kvaliteta života starije populacije.

Ključne riječi: fizička aktivnost, gerijatrijska populacija, zdravo starenje, prepreke, kvalitet života

PHYSICAL ACTIVITY IN THE GERIATRIC POPULATION

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Abstract. Population aging is one of the major demographic and public health challenges of the 21st century, strongly affecting quality of life and functional capacity in older adults. Physical activity is recognized as a key factor in maintaining health and preventing chronic diseases in the elderly. The aim of this paper was to present the possibilities and challenges of implementing physical activity in the geriatric population, with emphasis on barriers and potential directions for improvement. This study was conducted as a review of relevant literature, focusing on the effects of aerobic exercise, strength training, and balance exercises on the health of older adults. Results indicate that regular and tailored physical activity can significantly reduce the risk of sarcopenia, falls, cardiovascular and metabolic diseases, while also contributing to the preservation of cognitive function and mental health. The most common barriers include chronic illnesses, fear of injury, lack of self-confidence, financial constraints, and insufficient education of healthcare professionals. The discussion highlighted that personalized programs, greater accessibility of subsidized community activities, the use of technology, and a multidisciplinary approach represent the most effective strategies for long-term engagement of older adults in physical activity. It is concluded that physical activity must be an integral part of geriatric healthcare, as it contributes to prolonged life expectancy, preservation of functional independence, and improvement of quality of life in the elderly population.

Key words: physical activity, geriatric population, healthy aging, barriers, quality of life

OBAVLJANJE KUĆNIH POSLOVA KOD STARIJIH OSOBA

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Sažetak. Prema definiciji Svjetske zdravstvene organizacije i Američkog udruženja radnih terapeuta, kućni poslovi su šira svakodnevna aktivnost, kao što su organiziranje i vođenje doma, pripremanje obroka i čišćenje. Njihovo samostalno funkcioniranje važno je za funkcioniranje pojedinca u životnoj sredini. Obavljanje kućnih poslova često je vezano za uloge i vrijednosti u porodici, tako da donosi smisao. Za starije predstavlja mnoge rutine i svakodnevnu strukturu, kao i profesionalni identitet. Brojne studije izvještavaju o problemima sa kojima se starije osobe susreću pri funkcionisanju u svom kućnom okruženju. Za praćenje izvođenja aktivnosti korištena je prilagođena metoda posmatranja OVACO (Working Postures Analysing System), koja je više puta prilagođavana. OWAS metoda identifikira položaje tijela tokom izvođenja aktivnosti. Osoba pokazuje deset aktivnosti. Koristili smo prilagođenu CORLETT metodu za snimanje bola. Istraživanje je obuhvatilo 60 učesnika starijih od 65 godina od oktobra 2023. do novembra 2024. godine. Istraživači su bili studenti radne terapije koji su tokom studija stekli znanja i vještine posmatranja koristeći OWAS metod. Posmatranje je obavljeno u kućnom okruženju starijih osoba. Učesnici su potpisali informirani pristanak. Upotreba mašine za pranje veša zahteva nepravilan položaj kičme, a korišćenje viših polica zahteva stepenicu ili merdevine. Viseći veš se često izvodi u visoko opterećenim položajima gornjih udova, a učesnici vrlo retko koriste opremu. Bol u lumbalnoj kičmi najčešće se javlja prilikom upotrebe mašine za pranje veša. Domaći ambijent često predstavlja prepreku učesnicima u obavljanju kućnih poslova, a starije osobe vrlo rijetko koriste ergonomska pomagala. Uprkos bolu, stariji ljudi žele da rade kućne poslove jer im to znači. Mladima treba pružiti edukaciju o efektivnim obrascima izvođenja aktivnosti, univerzalnom dizajnu životne sredine i korišćenju ergonomskih pomagala.

Ključne riječi: kućni poslovi, starije osobe, OVACO metoda posmatranja, ergonomija

PERFORMING HOUSEWORK AMONG THE ELDERLY

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Abstract. According to the definition of the World Health Organization and the American Association of Occupational Therapists, housework is a broader daily activity such as home organization and management, meal preparation, and cleaning. Their independent performance is important for the individual's functioning in their living environment. Performing housework is often tied to roles and values in the family, and therefore brings meaning. For the elderly, it represents numerous routines and daily structure, as well as occupational identity. Numerous studies report on the problems that accompany the elderly when functioning in the home environment. The adapted OVACO (Working Postures Analysing System) observation method, which has been adapted several times, was used to observe the performance of activities. The OWAS method identifies body positions during the performance of activities. The person demonstrates ten activities. The adapted CORLETT method was used to record pain. 60 participants over 65 years of age were included in the study from October 2023 to November 2024. The researchers were occupational therapy students who acquired knowledge and observation skills using the OWAS method during the study process. The observation took place in the home environment of the elderly. The participants signed an informed consent. The use of the washing machine is carried out in inappropriate spinal positions, for using higher shelves they need a stepladder or ladder. Hanging laundry is often carried out in high-load positions of the upper limbs, and the participants very rarely use equipment. Pain in the lumbar spine is most often expressed when using the washing machine. The home environment often presents an obstacle to participants in performing housework, and the elderly very rarely use ergonomic aids. Despite the pain, the elderly want to perform housework because they represent meaning to them. Education about effective patterns of activity performance, universal design environment and the use of ergonomic aids should be implemented with young people.

Key words: housework, elderly, OVACO observation method, ergonomics

OPTEREĆENJE U VRATU, RAMENU I RUCI ZAPOSLENIH U VISOKOJ ZDRAVSTVENOJ ŠKOLI PRI RADU ZA RAČUNAROM

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Sažetak. Problemi sa bolovima, parestezijama, slabošću mišića vrata, ramena i ruku česti su kod osoba koje rade sedeći posao i u radu koriste računar, a razlog su odsustvovanja sa posla zbog bolovanja. Ovi problemi ukazuju na potrebu za različitim personalnim i ergonomskim adaptacijama radnog mesta, bilo da su u pitanju kabineti/učionice, ili rad za računarom u kancelariji. Istraživanje je počelo u letnjem semestru školske 2024/25.g. uz saglasnost rukovodioca odseka Visoka zdravstvena škola i odobrenje Etičkog odbora. Obuhvatilo je 71 nastavnika u stalnom radnom odnosu i 24 ispitanika iz službe stalno zaposlenog nenastavnog osoblja koje u radu koristi računar. U istraživanju je korišćena prilagođena verzija upitnika Maastricht Upper Extremity Questionnaire – MUEQ. Cilj rada je da se prepoznaju problemi i da se eventualno predloži i organizuje obuka zaposlenih zaštitnim položajima i pokretima kojima se mogu olakšati tegobe i smanjiti opterećenje. Rezultati pokazuju da su najčešći simptomi umor i iscrpljenost u rukama (48% nastavnog i 63% nenastavnog osoblja), dok su parestezije i slabost nešto ređe, ali prisutne kod značajnog broja ispitanika. Statistički značajne razlike u distribuciji bola između grupa nisu potvrđene, ali je primećeno da nenastavno osoblje provodi više vremena za računarom i češće prijavljuje slabost i umor u rukama. Samo 28% ispitanika koristi ergonomska pomagala ili preventivne položaje. Zaključuje se da su tegobe gornjih ekstremiteta značajno zastupljene kod zaposlenih u visokom obrazovanju, uz nedovoljnu primenu ergonomskih strategija. Dobijeni nalazi ukazuju na potrebu za organizovanjem edukacije o zaštitnim položajima i pokretima, kao i za unapređenjem ergonomskog dizajna radnog mesta, čime bi se smanjilo opterećenje i unapredilo zdravlje i radna sposobnost zaposlenih.

Ključne reči: bol u ramenu, vratu, ruci; zaštitni položaji i pokreti; ergonomsko prilagođavanje

BURDEN IN THE NECK, SHOULDER AND HANDS OF EMPLOYEES IN COLLEGE OF HEALTH SCIENCES WHILE WORKING AT THE COMPUTER

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Abstract. Problems with pain, paresthesia, and weakness of the neck, shoulder, and arm muscles are common among people who have sedentary jobs and use computers at work, and are the reason for absences from work due to sick leave. These problems point to the need for different personal and ergonomic adaptations of the workplace, whether it is about offices/classrooms, or working at a computer in the office. The research began in the summer semester of the 2024/25 school year. with the consent of the head of the department of the College of Health Sciences and the approval of the Ethics Committee. It included 71 full-time teachers and 24 respondents from the service of full-time non-teaching staff who use a computer in their work. The research used an adapted version of the Maastricht Upper Extremity Questionnaire – MUEQ. The aim of the work is to recognize the problems and to possibly propose and organize the training of employees in protective positions and movements that can ease the discomfort and reduce the burden. The results show that the most common symptoms are fatigue and exhaustion in the hands (48% of teaching and 63% of non-teaching staff), while paresthesias and weakness are somewhat rarer, but present in a significant number of respondents. Statistically significant differences in the distribution of pain between the groups were not confirmed, but it was observed that non-teaching staff spend more time at the computer and more often report weakness and fatigue in the hands. Only 28% of respondents use ergonomic aids or preventive positions. Conclusion is that upper extremity complaints are significantly present among employees in higher education, with insufficient application of ergonomic strategies. The obtained findings point to the need to organize education on protective positions and movements, as well as to improve the ergonomic design of the workplace, which would reduce the workload and improve the health and work ability of employees.

Key words: pain in the shoulder, neck, arms; protective positions and movements; ergonomic adjustment

UTICAJ AKTIVNOG BAVLJENJA SPORTOM NA KVALITET ŽIVOTA OSOBA SA INTELEKTUALNIM SMETNJAMA: PILOT STUDIJA

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Sažetak. Integracija osoba sa intelektualnim smetnjama kod nas, kao i u zemljama Zapadnog Balkana odvija se sporo i fragmentarno. Često ni aktivnosti za koje već postoje adekvatni resursi i infrastruktura nemaju primjenu u integracionim procesima. Jedna od oblasti za koju je empirijski dokazano da pozitivno utiče na socijalnu inkluziju, kao i na opšte zdravlje osoba sa intelektualnim smetnjama, jeste sport. Cilj ovog rada je da široj javnosti približi važnost sporta, konkretno plivanja, prevashodno na psihofizičke sposobnosti sportista sa intelektualnim smetnjama radi stvaranja pozitivnog stava o njima i afirmisanja inkluzivnih vrijednosti. Istraživanje je sprovedeno na malom inicijalnom uzorku od 10 plivača (6 muškaraca i 4 žene) sa intelektualnim smetnjama, uzrasta od 18 do 37 godina. Prikupljeni su podaci iz oblasti fizičkog zdravlja (lična anamneza, nalaz pluća, srca, puls, krvni pritisak, EKG, visina, težina, indeks tjelesne mase, spirometrija, nalaz vida), kao i informacije o trenažnom procesu i takmičarskim rezultatima. Podaci su prikupljeni u tri vremenske tačke, što je omogućilo longitudinalno praćenje promjena u zdravstvenim indikatorima i sportskim dostignućima. Analiza je pokazala da su svi fiziološki parametri kod ispitanika bili relativno stabilni i u granicama prihvatljivih vrijednosti tokom cijelog perioda. Ova stabilnost je protumačena kao rezultat kontinuiranog bavljenja plivanjem i njegovog pozitivnog uticaja na fizičko zdravlje. U završnom dijelu rada analizirana su sportska postignuća ispitanika, sa posebnim osvrtom na potencijalni uticaj tih dostignuća na kvalitet njihovog života. Prvi nalazi ukazuju na to da profesionalno bavljenje sportom može imati značajan doprinos unapređenju kvaliteta života osoba sa intelektualnim smetnjama. To nam otvara mogućnosti za dublja istraživanja psihofizičkih sposobnosti kao i pozitivnih stavova prema sportistima sa intelektualnim smetnjama.

Ključne riječi: sport, plivanje, intelektualne smetnje, longitudinalno praćenje

THE IMPACT OF ACTIVE PARTICIPATION IN SPORTS ON THE QUALITY OF LIFE IN INDIVIDUALS WITH INTELLECTUAL DISABILITIES: A PILOT STUDY

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Abstract. The integration of individuals with intellectual disabilities in our country, as well as in the countries of the Western Balkans, remains slow and fragmented. In many cases, even the activities for which adequate resources and infrastructure exist are not utilized within integration efforts. One domain that has been empirically shown to positively influence both social inclusion and the general health of individuals with intellectual disabilities is sport. This paper aims to raise public awareness about the significance of sport, specifically swimming, on the psychophysical abilities of athletes with intellectual disabilities, in order to promote positive attitudes toward them and affirm inclusive values. The research was conducted on an initial sample of 10 swimmers (6 men and 4 women) with intellectual disabilities, aged 18 to 37 years. Data were collected on various physical health parameters (personal history, lung and heart function, pulse, blood pressure, ECG, height, weight, body mass index, spirometry, and vision), as well as information about the training process and competition results. Data were gathered at three different time points, allowing for longitudinal monitoring of changes in health indicators and athletic performance. The analysis showed that all physiological parameters in the participants were relatively stable and within acceptable ranges throughout the entire period. This stability was interpreted as a result of continuous swimming and its positive effect on physical health. In the final part of the paper, the athletes' sports achievements were analyzed, with a special focus on their potential impact on quality of life. The initial findings indicate that professional sports can significantly contribute to improving the quality of life of people with intellectual disabilities. These results open up opportunities for further research into psychophysical abilities and the development of positive public attitudes toward athletes with intellectual disabilities.

Key words: sport, swimming, intellectual disabilities, longitudinal monitoring

NEFARMAKOLOŠKE METODE U TRETMANU DEMENCIJE

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Sažetak. Demencija je degenerativna bolest koja pogađa više od 55 miliona svjetske populacije. Karakterišu je pogoršanja kognitivnih funkcija, poteškoće u komunikaciji, izražavanju i prepoznavanju emocija kao i pojava agresije, razdražljivosti i problema sa spavanjem što negativno utiče na cjelokupno funkcionisanje osobe, njegovu porodicu i cjelokupnu zajednicu. Cilj preglednog rada je prikazati efikasnost i značaj nefarmakoloških metoda u tretmanu osoba oboljelih od demencije. Ključne riječi korištene za pretragu baze podataka PubMed i Google Scholar su bile dementia, non-pharmalogological treatment, u intervalu od 2015 do 2025 godine. Analizirane su najčešće primjenjivane nefarmakološke metode: muzikoterapija, likovna terapija, terapija plesom i pokretom, radna terapija, te biblioterapija. Rezultati pokazuju da muzikoterapija poboljšava kratkotrajno pamćenje, komunikaciju, samoizražavanje, razvoj interpersonalnih vještina, razumijevanje tuđih emocija, smanjuje razdražljivost, agresiju, probleme sa spavanjem, besciljno lutanje i nemogućnost sjedenja ili ležanja na mjestu. Likovna terapija doprinosi razvoju kreativnosti, spontanosti, komunikacije te utiče na zadovoljstvo i smirenosti osobe. Terapija plesom i pokretom utiče na jačanje socijalnih odnosa i kognitivnu fleksibilnost i kvalitet života, pružajući osobama sa demencijom ponovan osjećaj sigurnosti i smirenosti. koji je narušen strepnjom i strahom od progresije bolesti. Radna terapija i biblioterapija dodatno unapređuju svakodnevno funkcionisanje i doprinose očuvanju psihosocijalnih sposobnosti. Nefarmakološke metode u tretmanu demncije ne mogu spriječiti progresiju bolesti ali su prikladne komplementarne metode u okviru interdisciplinarnog pristupa pružanja podrške osobama s demencijom.

Ključne riječi: demencija, nefarmakološke metode

NON-PHARMACOLOGICAL METHODS IN THE TREATMENT OF DEMENTIA

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Abstract. Dementia is degenerative disease that affects more than 55 million people worldwide. It is characterized by deterioration of cognitive functions, difficulties in communication, expression and recognition of emotions, as well as the appearance of aggression, irritability and sleep problems, which negatively affects the overall functioning of the person, his/her family and the entire community. The aim of the review is to show the effectiveness and significance of non-pharmacological methods in the treatment of people suffering from dementia. The keywords used to search the PubMed and Google Scholar databases were dementia, non-pharmacological treatment, in the interval from 2015 to 2025. The most frequently applied non-pharmacological methods were analyzed: music therapy, art therapy, dance and movement therapy, occupational therapy and bibliotherapy. The results show that music therapy improves short-term memory, communication, self-expression, development of interpersonal skills, understanding other people's emotions, reduces irritability, aggression, sleep problems, aimless wandering and inability to sit or lie still. Art therapy contributes to the development of creativity, spontaneity, communication and affects the satisfaction and calmness of the person. Dance and movement therapy affects the strengthening of social relationships and cognitive flexibility and quality of life, providing people with dementia with a renewed sense of security and calmness. which is disrupted by anxiety and fear of disease progression. Occupational therapy and bibliotherapy further improve everyday functioning and contribute to the preservation of psychosocial abilities. Non-pharmacological methods in the treatment of dementia cannot prevent the progression of the disease, but they are suitable complementary methods within the interdisciplinary approach to providing support to people with dementia.

Key words: dementia, non-pharmacological methods

KVALITET ŽIVOTA DECE I ADOLESCENATA SA CEREBRALNOM PARALIZOM – PREGLEDNI RAD

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Sažetak. Cerebralna paraliza (CP) kao heterogeno stanje sa različitim kliničkim prezentacijama praćena je brojnim telesnim oštećenjima i poremećajima koji ometaju funkcionisanje ovih osoba u socijalnoj sredini. Okolina, stavovi i barijere predstavljaju dodatne faktore koji ograničavaju funkcionisanje osoba s cerebralnom paralizom i dovode ih do nivoa povremene ili stalne socijalne inkompetencije. Cilj rada je da se pregledom dostupne literature prikažu novija istraživanja o deci sa cerebralnom paralizom, a sa posebnim osvrtom na kvalitet života. Pretragom Pub Med i Google Akademik baze podataka analizirani su radovi u kojima je ispitivan kvalitet života dece i adolescenata sa CP u Evropi, Severnoj Americi, Bosni i Hercegovini i u Republici Srbiji. Za potrebe ovog istraživanja aspekti kvaliteta života koji su procenjivani kod dece i adolescenata sa CP su u području dnevnih aktivnosti, pokretljivosti, zdravlja, uhranjenosti, bola, dužine boravka u bolnici, te isključenosti iz socijalnih grupa.

Ključne reči: kvalitet života, deca i omladina sa cerebralnom paralizom

QUALITY OF LIFE OF CHILDREN AND ADOLESCENTS WITH CEREBRAL PALSY - A REVIEW

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Abstract. Cerebral palsy (CP) as a heterogeneous condition with different clinical presentations is accompanied by numerous physical impairments and disorders that interfere with the functioning of these individuals in the social environment. The environment, attitudes and barriers represent additional factors that limit the functioning of individuals with cerebral palsy and lead them to the level of temporary or permanent social incapacity. The aim of the paper is to review the available literature and present recent research on children with cerebral palsy, with a special focus on quality of life. By searching the Pub Med and Google Scholar databases, papers that examined the quality of life of children and adolescents with CP in Europe, North America, Bosnia and Herzegovina and the Republic of Serbia were analyzed. For the purposes of this research, the aspects of quality of life that were evaluated in children and adolescents with CP were in the areas of daily activities, mobility, health, nutrition, pain, length of hospital stay, and exclusion from social groups.

Key words: quality of life, children and youth with cerebral palsy

PROFESIONALNA AUTONOMIJA ZDRAVSTVENIH RADNIKA

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Sažetak. Autonomija zdravstvenih radnika je izuzetno važan zadatak profesionalnog razvoja. Autonomija se određuje kao samoupravljanje, samostalnost i nezavisno funkcionisanje. Težnja zdravstvenog radnika je da djeluje slobodno i autonomno. Autonomija zdravstvenih radnika duboko je utemeljena, prije svega, u etici medicinske struke, a zatim i u profesionalnim kompetencijama koje treba da budu prožete pedagoško-psihološkim osnovama. Cilj rada je da se identifikuju bitne odrednice profesionalne autonomije zdravstvenih radnika, te da se ukaže na ulogu učenja i iskustva u njenom razvoju. Teoretičari ukazuju na činjenicu da pojedinac nikada nije u poziciji potpune autonomije. Svaki pojedinac se kreće na kontinuumu od heteronomije ka autonomiji. Pozicija zdravstvenog radnika je određena njegovim znanjem, uvjerenjima, stavovima, vještinama, iskustvom, odnosno svim sposobnostima. Autonomija zdravstvenog radnika predstavlja nivo njegovog razumijevanja, samostalnosti, samoaktivnosti, samoodređenja, samodjelovanja, kritičkog odnosa prema sebi, prema pacijentima i okruženju. Autonomiju često vežemo za iskustvo, što bi se na određen način moglo imenovati i kao profesionalna zrelost, jer je prema psiholozima autonomija pokazatelj zrelosti. Autonomija zdravstvenih radnika je objedinjeno (holističko) stanje vlastitog razvoja u moralnom, kognitivnom, emocionalnom i socijalnom pogledu. Profesionalna autonomija zdravstvenih radnika je cilj. Autonomija zdravstvenih radnika danas nikada ne može biti konačna, atoga je ona i polazna osnova za cjeloživotno učenje i permanento profesionalno usavršavanje.

Ključne riječi: autonomija, heteronomija, kompetencije, zdravstveni radnik, cjeloživotno učenje, profesionalni razvoj

PROFESSIONAL AUTONOMY OF HEALTHCARE WORKERS

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Abstract: The autonomy of healthcare workers is an extremely important task in professional development. Autonomy is defined as self-management, independence, and autonomous functioning. The aspiration of a healthcare worker is to act freely and autonomously. The autonomy of healthcare professionals is deeply rooted primarily in the ethics of the medical profession, and secondly in the professional competencies, which should be imbued with pedagogical- psychological foundations. The aim of this paper is to identify the key determinants of the professional autonomy of healthcare workers and to highlight the role of learning and experience in its development. Theorists point to the fact that an individual is never in a position of complete autonomy. Every individual moves along a continuum from heteronomy to autonomy. The position of a healthcare worker is determined by their knowledge, beliefs, attitudes, skills, experience — in other words, by all their capabilities. Professional autonomy represents the level of a healthcare worker's understanding, independence, self-activity, self-determination, self-action, and critical attitude toward themselves, their patients, and their environment. Autonomy is often linked to experience, which could, in a way, be referred to as professional maturity, since psychologists view autonomy as an indicator of maturity.

The autonomy of healthcare workers is a unified (holistic) state of personal development in moral, cognitive, emotional, and social terms. The professional autonomy of healthcare workers is a goal. However, this autonomy can never be final, which is why it also serves as the starting point for lifelong learning and ongoing professional development.

Key words: autonomy, heteronomy, competencies, healthcare worker, lifelong learning, professional development

RAZVOJ PISMENOSTI I PISANIH VEŠTINA KOD DECE: ANALIZA KLJUČNIH FAKTORA

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Sažetak. Razvoj pismenosti i pisanih veština kod dece predstavlja složen proces koji obuhvata porodične, motoričke i pedagoške faktore. Cilj rada je da pruži integrisani pregled ključnih uticaja na razvoj pisanja kod dece uzrasta od četiri do sedam godina. Primjenom analize literature i dostupnih empirijskih istraživanja, identifikovani su rani prediktori pismenosti, kao što su uključenost porodice, rana stimulacija i razvoj fine motorike. Metodologija rada obuhvatila je kvalitativnu i kvantitativnu analizu podataka iz prethodnih studija koje su koristile standardizovane testove, posmatranja i intervjue. Rezultati ukazuju da su motoričke sposobnosti, posebno vizuelno-motorička integracija, od suštinskog značaja za kvalitet rukopisa, dok rana intervencija, kreativni zadaci i podrška nastavnika pozitivno utiču na motivaciju i uspeh dece u pisanju. Zaključno, kombinacija rane porodične podrške, pedagoških metoda i stručnih intervencija ima ključnu ulogu u razvoju pismenosti, a dalja istraživanja trebalo bi da uključe i savremene digitalne alate kao dopunu tradicionalnim pristupima.

Ključne reči: pismenost, razvoj pisanja, motorika, rana intervencija, deca

DEVELOPMENT OF LITERACY AND WRITING SKILLS IN CHILDREN: ANALYSIS OF KEY FACTORS

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Abstract. The development of literacy and writing skills in children represents a key aspect of early education, directly impacting academic achievement and daily life. This paper analyzes significant factors that affect literacy development, including the role of the family environment, motor skills, and pedagogical methods. Through a review of the literature, the research of different methodological approaches provides insight into early predictors of literacy and their impact on handwriting quality. The paper also explores the role of teachers in encouraging writing development, as well as the implications of these findings for pedagogical practice. The need for improvement in research methods and practical application in education is highlighted, with the aim of supporting the development of writing skills in children.

Key words: Literacy, writing development, early literacy predictors, motor skills, cognitive aspects

PRIMENA TESTOVA ZA PROCENU MOTORIČKE SPRETNOSTI GORNJIH EKSTREMITETA U DEČJEM UZRASTU

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Sažetak. Manuelna spretnost, odnosno sposobnost precizne manipulacije predmetima pomoću ruku i prstiju, rezultat je koordinisane aktivnosti lokomotornog, senzornog, centralnog i perifernog nervnog sistema. Kod dece u razvoju, naročito onih sa razvojnim odstupanjima, narušena selektivnost pokreta može značajno otežati obavljanje svakodnevnih aktivnosti kao što su držanje predmeta, prenošenje iz ruke u ruku ili izvršavanje složenijih zadataka. Rana identifikacija ovih teškoća od izuzetne je važnosti za pravovremeno uključivanje u odgovarajuće rehabilitacione programe. Ovaj pregledni članak ima za cilj da prikaže karakteristike i primenu različitih testova fine motorike namenjenih proceni funkcionalnosti dominantne i nedominantne ruke kod dece različitog uzrasta. Ovi testovi mogu se koristiti pojedinačno ili u kombinaciji sa drugim dijagnostičkim instrumentima, čime se dobija potpunija slika o stepenu motoričke zrelosti i potrebama deteta. Poseban značaj imaju u proceni efekata (re)habilitacionih tretmana – na početku, tokom i po završetku procesa. Implementacija standardizovanih testova fine motorike u svakodnevnu kliničku i edukativnu praksu doprinosi preciznijem definisanju terapijskih ciljeva i boljem praćenju motoričkog napretka dece. Njihova primena doprinosi formiranju normativa za procenu motorike u dečjoj populaciji u našoj zemlji, u skladu sa savremenim principima rehabilitacije zasnovane na dokazima.

Ključne reči: fina motorika, spretnost, testovi, deca, rehabilitacija

APPLICATION OF TESTS FOR THE ASSESSMENT OF UPPER LIMB MOTOR DEXTERITY IN CHILDREN

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Abstract. Manual dexterity—the ability to perform precise manipulations of objects using the hands and fingers—is the result of coordinated activity of the locomotor, sensory, central, and peripheral nervous systems. In developing children, particularly those with developmental deviations, impaired selectivity of movement can considerably hinder the performance of daily activities such as holding objects, transferring them from one hand to the other, or executing more complex tasks. Early identification of these difficulties is of paramount importance for timely inclusion in appropriate rehabilitation programs. This narrative review aimed to present the characteristics and application of various fine motor tests designed to assess the functionality of both the dominant and non-dominant hand in children of different ages. These tests can be used individually or in combination with other diagnostic tools, thereby providing a more comprehensive picture of the child's level of motor maturity and needs. They are of particular significance in evaluating the effects of (re)habilitation interventions—at baseline, throughout the process, and upon its completion. The implementation of standardized fine motor tests in routine clinical and educational practice contributes to a more precise definition of therapeutic goals and more effective monitoring of children's motor progress. Their application also supports the establishment of normative data for motor assessment in the pediatric population of our country, in accordance with contemporary principles of evidence-based rehabilitation.

Key words: fine motor skills, dexterity, tests, children, rehabilitation

MOGUĆNOSTI ARMEO SENSO APARATA U REHABILITACIJI NEUROLOŠKIH PACIJENATA

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Sažetak. Rad ima za cilj da pokaže mogućnosti robotski asistiranog treninga uz korištenje aparata Armeo Senso u procesu rehabilitacije neuroloških pacijenata. U radu su prikazane mogućnosti robotski asistiranog treninga aparatom Armeo Senso uvježbavanja obima pokreta i koordinacije zahvaćenog gornjeg ekstremiteta kao i mogućnosti uvježbavanja balansa i koordinacije u različitim položajima tijela kod neuroloških i drugih pacijenata. U procjeni prije, tokom i nakon robotski asistiranog treninga Armeo Senso aparatom se koriste manuelni mišićni test i dinamometrija šake.

Ključne riječi: robotski asistirani trening, primjena, neurologija

POSSIBILITIES OF THE ARMEO SENSO DEVICE IN THE REHABILITATION OF NEUROLOGICAL PATIENTS

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Abstract. The paper aims to show the possibilities of robot-assisted training with the use of the Armeo Senso device in the rehabilitation process of neurological patients. The paper presents the possibilities of robot-assisted training with the Armeo Senso device for practicing range of motion and coordination of the affected upper extremity, as well as the possibility of practicing balance and coordination in different body positions in neurological and other patients. Manual muscle tests and hand dynamometry are used in the assessment before, during and after robot-assisted training with the Armeo Senso device.

Keywords: robot-assisted training, application, neurology

ROBOTSKI ASISTIRANA REHABILITACIJA GORNJEG EKSTREMITETA NAKON MOŽDANOG UDARA

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Sažetak. Konvencionalna rehabilitacija je bila primorana kroz svoju istoriju razviti brojne manuelne tehnike unutar koncepata kao što su Bobath, PNF i dr. U procesu rehabilitacije učestvuje čitav tim stručnjaka tokom dužeg vremenskog perioda, a terapija pokretom bazični je dio rada sa pacijentima. Paralelno sa razvojem velikog broja manualnih tehnika dogodio se značajan razvoj tehnologije, tako da danas u procesu rehabilitacije nalazimo primjenu robotike kao moćnog alata za funkcionalni oporavak. Termin “alat” je promišljeno izabran jer alat je dobar i uspješan koliko i osoba koja njime rukuje. U slučaju prikazanih aparata za robotski asistirani trening terapeut je odgovoran za poznavanje mogućnosti i ograničenja aparata ali još važnije samog pacijenta i da aktivnost aparata prilagođava trenutnom funkcionalnom statusu ruke pacijenta. Svaki zadatak mora da bude izvodljiv ali i dovoljno težak da za pacijenta predstavlja izazov, kako bi se na opisani način održavao optimalan nivo motivacije.

Ključne riječi: robotski asistirani trening, primjena, neurologija

ROBOTIC-ASSISTED REHABILITATION OF THE UPPER EXTREMITY AFTER STROKE

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Abstract. Conventional rehabilitation was forced throughout its history to develop numerous manual techniques within concepts such as Bobath, PNF, etc. In the rehabilitation process, a whole team of experts participates over a long period of time, and movement therapy is a basic part of working with patients. In parallel with the development of a large number of manual techniques, a significant development of technology took place, so that today in the rehabilitation process we find the application of robotics as a powerful tool for functional recovery. The term "tool" was carefully chosen because a tool is only as good and successful as the person who uses it. In the case of the presented devices for robot-assisted training, the therapist is responsible for knowing the capabilities and limitations of the device, but more importantly, the patient himself, and for adjusting the device's activity to the current functional status of the patient's hand. Each task must be feasible but also difficult enough to represent a challenge for the patient, in order to maintain an optimal level of motivation in the manner described.

Key words: robot-assisted training, application, neurology.

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

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

ŠUMSKA TERAPIJA KAO SREDSTVO ZA PREVENCIJU BOLESTI U INTEGRATIVNOJ MEDICINI

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Sažetak. Nastojanja da se razvijaju opšta znanja o preventivnoj ulozi šuma na pojavu raznih vrsta bolesti neminovno ukazuju na potrebu primjene svih zdravstvenih koristi koje šumski ekosistemi pružaju društvenoj zajednici. Šumski ekosistemi pored proizvoda ljekovitog bilja pružaju brojne terapeutske funkcije (slušne, vizuelne, taktilne i mirisne) imaju veliki značaj za prevenciju pojave raznih bolesti. Ove funkcije i učinci šuma korišćenjem biljne terapije utiču na holistički pristup liječenju i primjenu integrativne medicine sa fokusiranjem na individualne potrebe ljudi i povezivanje tradicionalne i moderne medicine. Fitoterapija ima važnu ulogu u integrativnoj medicini jer utiče na jačanje imunološkog sistema, regulaciju hormona i preventivu pojave bolesti. Udisanjem fitoncida smanjuje se lučenje hormona koji izazivaju stres (kortizol) a jača se imunološki sistem i sprečava anksioznost, hronični zamor, gojaznost, depresija, oslabljeno pamćenje i srčane bolesti. Šumska terapija povećava aktivnost „prirodnih ubica“ (natural kiler, NK) i preventivno se odražava na otpornost i poboljšanje opšteg zdravstvenog stanja ljudi. Cilj rada je da se na osnovu dosadašnjih istraživanja sintetišu znanja o preventivnoj terapeutskoj ulozi šuma u okviru integrativne medicine. U radu je primjenjen metod analize i sinteze dosadašnjih istraživanja u vezi terapeutskog djelovanja na prevenciju bolesti kod ljudi. Sinteza rezultata brojnih istraživanja pokazuje da šume imaju uticaj na emocionalne, introspektivne i kognitivne osobine kod ljudi koje se odražavaju na samorefleksiju i jačanje otpornosti.

Ključne riječi: Terapija, šuma, bolest, medicina

FOREST THERAPY AS A PREVENTIVE APPROACH IN INTEGRATIVE MEDICINE

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Abstract. Efforts to develop general knowledge about the preventive role of forests in reducing the occurrence of various diseases point to the necessity of applying all the health benefits that forest ecosystems provide to society. In addition to the abundance of medicinal plants, forest ecosystems offer numerous therapeutic functions-auditory, visual, tactile, and olfactory-which play a significant role in disease prevention. These functions, combined with the use of herbal therapy, contribute to a holistic approach to healing and the application of integrative medicine, which focuses on individual needs and connects traditional and modern medical practices. Phytotherapy plays an important role in integrative medicine as it contributes to strengthening the immune system, regulating hormones, and preventing disease. Inhaling phytoncides-bioactive compounds released by plants - reduces the secretion of stress hormones (such as cortisol), while simultaneously strengthening the immune system and alleviating conditions such as anxiety, chronic fatigue, obesity, depression, memory impairment, and heart disease. Forest therapy also increases the activity of natural killer (NK) cells, which positively affects overall resilience and improves general health. The aim of this paper is to synthesize existing knowledge on the preventive and therapeutic role of forests within the framework of integrative medicine, based on previous research. The methodology applied involves analysis and synthesis of relevant studies related to the therapeutic effects of forest environments on disease prevention in humans. The synthesis of numerous research findings shows that forests positively influence emotional, introspective, and cognitive aspects of human personality, thereby encouraging self-reflection and strengthening psychophysical resilience.

Key words: Therapy, forest, disease, medicine

III-2

PROCENA TOPLOTNOG KOMFORA, OSVETLJENJA I BUKE NA RADNOM MESTU

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Sažetak. Komfort na radnom mestu odnosi se na to kako pojedinci kontrolišu, prilagođavaju i upravljaju svojim radnim okruženjem kako bi obezbedili sopstveno blagostanje. Pored osnovnih zahteva kao što su bezbednost i zdravlje, radno okruženje mora da pruži i odgovarajuću podršku. Fizički komfort obuhvata standarde i propise koji osiguravaju bezbedno, zdravo i prijatno radno okruženje. To uključuje odgovarajuću temperaturu, kvalitet vazduha, dovoljno osvetljenje, prihvatljiv nivo buke, sanitarne prostorije i opštu čistoću. Funkcionalni komfort znači da radno okruženje podržava izvršavanje konkretnih zadataka koje zaposleni obavljaju. Psihološki komfort odnosi se na osećaj kontrole nad sopstvenim radnim prostorom, privatnošću i socijalnom dinamikom, što utiče na osećaj sigurnosti, pripadnosti i odgovornosti. Posebna pažnja mora se posvetiti mikroklimi, jer je ona ključni faktor komforta na radnom mestu. Kada su temperatura, relativna vlažnost i brzina kretanja vazduha pravilno prilagođeni prirodi posla i fizičkim zahtevima zaposlenih, govorimo o toplotnom komforu. Odstupanja, poput visoke temperature (iznad 28 °C), promaje ili veoma suvog vazduha, mogu izazvati nelagodnost i smanjiti radnu efikasnost. Poslodavci su dužni da obezbede odgovarajuće toplotne uslove u skladu sa zakonima i potrebama zaposlenih. Odgovarajuće osvetljenje treba da obezbedi dovoljno i ravnomerno osvetljenje, odgovarajuću temperaturu boje, dovoljne kontraste i da spreči odsjaj ili treperenje svetla. Pored veštačkog osvetljenja, važna je i dostupnost prirodne svetlosti. Nivo buke na radnom mestu mora ostati u dozvoljenim granicama kako ne bi narušavao koncentraciju ili izazivao stres. U decembru 2024. godine sproveli smo merenja mikroklimatskih uslova, osvetljenja i nivoa buke u dve zgrade, u ukupno 15 kancelarija sa 37 zaposlenih. Rezultati su pokazali nisku relativnu vlažnost u tri kancelarije, preveliku brzinu kretanja vazduha u šest i nedovoljno osvetljenje u dve kancelarije. Na osnovu ovih nalaza, pripremljene su preporuke za poboljšanje uslova i prosleđene upravama obe organizacije.

Ključne riječi: bezbednost i zdravlje na radu, kancelarija, mikroklima, osvetljenje, nivo buke

ASSESSMENT OF WORKPLACE THERMAL COMFORT, LIGHTING AND NOISE

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Abstract. Workplace comfort refers to how individuals control, adapt to, and manage their work environment to ensure their own well-being. In addition to basic requirements such as safety and health, the work environment also needs to provide adequate support. Physical comfort includes standards and regulations that ensure a safe, healthy and pleasant environment for work. It includes adequate temperature, air quality, sufficient lighting, acceptable noise levels, sanitary facilities and general cleanliness. Functional comfort means the working environment supports the execution of specific tasks performed by individuals. Psychological comfort refers to the feeling of control over one's workspace, privacy and social dynamics, which affects the sense of safety, belonging and responsibility. Special attention must be paid to the microclimate, as it is a key factor in workplace comfort. When temperature, relative humidity, and air velocity are appropriately adjusted to the nature of the work and physical demands on employees, we speak of thermal comfort. Deviations, such as high temperature (above 28 °C), draughts or very dry air, can cause discomfort and reduce work efficiency. Employers are obligated to ensure suitable thermal conditions in line with legislation and employees' needs. Adequate lighting should provide sufficient and uniform illumination, appropriate colour temperature, adequate contrasts and avoid glare or flickering. In addition to artificial lighting, the availability of natural light is also important. Noise levels at the workplace must remain within permissible limits to avoid impairing concentration or causing stress. In December 2024, we carried out measurements of microclimatic conditions, lighting and noise levels in two buildings, covering 15 offices and 37 employees. The results showed low relative humidity in three offices, excessive air velocity in six offices, and insufficient lighting in two offices. Based on the findings, recommendations for improving the conditions were made and shared with the management of both organisations.

Keywords: occupational safety and health, office, microclimate, lighting, noise levels

III-3

NOVE ANTIMIKROBNE STRATEGIJE U LIJEČENJU INFEKCIJA UZROKOVANIH MULTIREZISTENTNIM SOJEVIMA GRAM- POZITIVNIH BAKTERIJA

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Sažetak. Infekcije uzrokovane gram-pozitivnim, multirezistentnim bakterijama, posebno streptokokama, koagulaza pozitivnim stafilokokama i vankomicin rezistentnim enterokokama su decenijama veliki medicinski i ekonomski problem, što je dovelo do povećanog morbiditeta, mortaliteta i troškova zdravstvene zaštite. Multirezistentne bakterije su često prisutne u bolnicama i ustanovama za dugotrajnu njegu, inficirajući uglavnom osobe sa oslabljenim imunološkim sistemom, kao što su pacijenti na hroničnoj hemodijalizi i sa postoperativnim infekcijama rana, kao i primaoci transplantata solidnih organa. Svjetska zdravstvena organizacija kategoriše ove bakterije u grupu kritičnog, visokog i srednjeg prioriteta u zavisnosti od hitnosti razvoja novih antibiotika. Ovaj pregled ima za cilj da sumira najnovije nalaze o istraživanju i razvoju novih i neophodnih strategija za sprječavanje širenja antimikrobne rezistencije kod gram-pozitivnih bakterija. Pretraživanje literature o ovoj temi u posljednje dvije decenije obavljeno je u bazama podataka PubMed, Scopus i Google Scholar. Kako se broj novorazvijenih i odobrenih antibiotika smanjuje, ulažu se veliki naponi u pronalaženju novih antimikrobnih strategija za liječenje infekcija uzrokovanih multirezistentnim sojevima. Ovo uključuje (1) modifikaciju komercijalnih antibiotika da bi se pojačao njihov efekat, (2) razvoj i primjenu specifičnih monoklonskih antitela za neutralizaciju bakterija, (3) blokiranje proizvodnje faktora virulencije i inhibiciju quorum sensing, posebno u biofilmu, (4) modulaciju urođenog imunološkog odgovora probioticima i fekalnom transplantacijom, (5) upotrebu bakteriofaga zbog izražene sposobnosti inhibicije multirezistentnih bakterija koje izazivaju infekcije rana, (6) kombinovanu primjenu bakteriofaga i antibiotika i (7) prenamjenu lijekova koji ne pripadaju antibioticima. Uprkos potencijalu navedenih antimikrobnih strategija, fokus će i dalje biti na pronalaženju novih strategija za efikasnije rješavanje izazova antimikrobne rezistencije i poboljšanje javnog zdravlja.

Ključne riječi: multirezistencija, gram-pozitivne bakterije, antibiotici, alternativna antimikrobna strategija, kombinovana terapija

NEW ANTIMICROBIAL STRATEGIES IN THE TREATMENT OF INFECTIONS CAUSED BY MULTIDRUG-RESISTANT STRAINS OF GRAM-POSITIVE BACTERIA

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Abstract. Infections caused by gram-positive, multidrug-resistant bacteria, especially streptococci, coagulase-positive staphylococci, and vancomycin-resistant enterococci, have been a major medical and economic problem for decades, leading to increased morbidity, mortality, and healthcare costs. Multidrug-resistant bacteria are often found in hospitals and long-term care facilities, infecting mainly people with a weakened immune system, such as patients on chronic hemodialysis and with post-operative wound infections, as well as solid organ transplant recipients. The World Health Organization categorizes these bacteria into critical, high, and medium priority groups depending on the urgency of developing new antibiotics. This review aims to summarize the latest findings on the research and development of new and necessary strategies to prevent the spread of antimicrobial resistance in gram-positive bacteria. A literature search on this topic over the last two decades was conducted in the PubMed, Scopus, and Google Scholar databases. As the number of newly developed and approved antibiotics decreases, great efforts are being made to find new antimicrobial strategies to treat infections caused by multidrug-resistant strains. These include (1) modulation of commercial antibiotics to enhance their effect, (2) development and application of specific monoclonal antibodies to neutralize bacteria, (3) blocking the production of virulence factors and inhibition of quorum sensing especially in biofilm, (4) modulation of the innate immune response by probiotics and fecal transplantation, (5) use of bacteriophages due to their pronounced ability to inhibit multidrug-resistant bacteria that cause wound infections, (6) combined use of bacteriophages and antibiotics, and (7) repurposing of non-antibiotic drugs. Despite the potential of the aforementioned antimicrobial strategies, the focus will continue to be on finding new strategies to more effectively address the challenge of antimicrobial resistance and improve public health.

Key words: multiresistance, gram-positive bacteria, antibiotics, alternative antimicrobial strategy, combined therapy

PROCENA LIMITA DETEKCIJE *SALMONELLA* SPP. U VEŠTAČKO KONTAMINIRANOJ U PILEĆOJ PAŠTETI

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Sažetak. Salmoneloza je bolest koju izaziva bakterija salmonela. Uobičajeni simptomi infekcije salmonelom su dijareja, groznica, grčevi u stomaku, groznica, glavobolja, mučnina ili povraćanje. Ovi simptomi se obično javljaju nakon konzumiranja kontaminirane hrane. Efikasna izolacija salmonele iz hrane omogućava preventivno djelovanje ili identifikaciju uzročnika bolesti. Cilj ove studije bio je da odredi granice detekcije *Salmonella* spp. u vještački kontaminiranim uzorcima pileće paštete. Za kontaminaciju je korišćena bakterijska suspenzija *Salmonella enterica* subsp. *enterica* serovar Paratyphi B (ATCC 8759). Detekcija *Salmonella* spp. provedena je prema SRPS EN ISO 6579-1:2017, uključujući tri selektivna bujona za bogaćenje (Muller Kauffmann tetrationsat-novobiocin bujon, Rappaport-Vassiliadis bujon, selenit cistein bujon) i tri čvrste podloge za izolaciju (salmonela šigela agar, ksiloza lizin dezoskiholatni agar, bizmut sulfitni agar). Pripremljene su četiri koncentracije bakterijske suspenzije i uzorci pileće paštete su kontaminirani na četiri nivoa. Testirano je pet uzoraka koji nisu kontaminirani, ako nulti nivo kontaminacije. Broj pozitivnih nalaza salmonella i ukupan broj uzoraka po inokulacionom nivou obrađeni su u PODLOD_ver12.xls ECEL programu od Wirlich i Wilrich. Ovim programom se procenjuje funkcija vjerovatnoća detekcije (POD) i limit detekcije (LOD) kvalitativnih mikrobioloških metoda. Rezultati detekcije *Salmonella* spp. pokazali su LOD_{50%} 0.028 [0.017; 0.047] CFU u 1 g, i LOD_{95%} 0.122 [0.074; 0.202] CFU u 1 g. Rezultati detekcije *Salmonella* spp. izraženi po testiranoj porciji su za LOD_{50%} 0.706 [0.426; 1.171] CFU u 25 g, i za LOD_{95%} 3.051 [1.839; 5.062] u 25 g. Kombinacija primjenjenih selektivnih bujona za bogaćenje i čvrstih podloga za izolaciju nije pokazala razliku u rezultatima detekcije.

Ključne riječi: limit detekcije, mikrobiološko ispitivanje, pileća pašteta, *Salmonella* spp.

ESTIMATION OF THE LIMIT OF DETECTION OF *SALMONELLA* SPP. IN ARTIFICIALLY CONTAMINATED CHICKEN PASTE

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Abstract. Salmonellosis is the illness caused by the *Salmonella* bacteria. The usual symptoms of salmonella infections are diarrhoea, fever, abdominal cramps, chills, headache, nausea or vomiting. These symptoms typically appear after consuming contaminated food. Effective isolation of *Salmonella* from the food enables preventive action or the identification of the causative agent of the disease. This study aimed to determine the limit of detection of *Salmonellae* spp. in artificially contaminated samples of chicken paste. For contamination, a bacterial suspension of *Salmonella enterica* subsp. *enterica* serovar *Paratyphi* B (ATCC 8759) was used. The detection of *Salmonella* spp. performed following SRPS EN ISO 6579-1:2017, including three selective enrichment broths (Muller Kauffmann Tetrathionate-Novobiocin broth, Rappaport-Vassiliadis broth, Selenite Cystine broth) and three solid media for isolation (*Salmonella* Shigella agar, Xylose Lysine Desoxycholate agar, Bismut Sulfite agar). The four concentrations of bacterial suspension were prepared, and a samples of chicken pasta were artificially contaminated at four levels. Five of the samples were tested with no previous contamination, as the zero level of contamination. The number of positive findings of salmonellae and the total number of samples per inoculation level were used for calculation by the PODLOD_ver12.xls ECEL program by Wirlich and Wilrich. This program estimates the probability of detection (POD) function and the limit of detection (LOD) of qualitative microbiological methods. The results of the detection of *Salmonella* spp. showed a LOD_{50%} 0.028 [0.017; 0.047] CFU in 1 g, and LOD_{95%} 0.122 [0.074; 0.202] CFU in 1 g. The results of the detection of *Salmonella* spp. expressed per tested tested portion were LOD_{50%} 0.706 [0.426; 1.171] CFU in 25 g, and LOD_{95%} was 3.051 [1.839; 5.062] in 25 g. The combinations of applied enrichment broths and solid media for isolation did not show a difference in the results of detection.

Key words: chicken pasta, limit of detection, microbiological analysis, *Salmonella* spp.

**EFIKASNOST DEZINFICIJENASA NA SPREČAVANJE
FORMIRANJA BIOFILMA I NA PLANKTONSKE *ESHERICHIA
COLI* FORME IZOLOVANE IZ VODE ZA PIĆE**

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Sažetak. *Escherichia coli* je jedna od najvažnijih bakterija u okviru koncepta „Jedno zdravlje“ zbog svoje sposobnosti da kolonizuje i inficira različite životinjske i biljne domaćine, uključujući ljude. Takođe, ova bakterija može lako da preživi u spoljašnjoj sredini, npr. vodi. Formiranje biofilma omogućava bakteriji da preživi na neživim i živim objektima tokom dužeg perioda. Biofilm predstavlja visoko organizovanu bakterijsku sesilnu zajednicu ugrađenu u polisaharidni matriks, koju bakterije proizvode samo tokom formiranja biofilma. Biofilm je veoma otporan na antimikrobne lijekove i može se ukloniti samo fizičkim sredstvima, kao što su temeljno čišćenje ili tretman visokim koncentracijama hemijskih supstanci koje su često toksične. Naš cilj je bio da utvrdimo aktivnost dezinfekcionih sredstava na planktonske *E. coli* oblike, kao i njihovo preventivno desjstvo na formiranje biofilma. U ovu studiju je uključeno 30 sojeva *E. coli*, izolovanih iz uzoraka vode za piće sa živinarskih farmi. Da bismo ispitali aktivnost dezinfekcionih sredstava u sprečavanju stvaranja biofilma, koristili smo dvostruko opadajuće koncentracije (7,5%-0,01% za H₂O₂ i 1%-0,001% za varikinu) tokom prekonoćne inkubacije u mikrotitarskim pločama sa bakterijskim inokulumom na 37°C. Aktivnost dezinfekcionih sredstava na planktonske forme bakterija je određena bujon mikrodilucionom metodom sa istim opsegom koncentracija dezinfekcionih sredstava koji smo koristili za tretman prevencije biofilma. Uočena je statistički značajno veća aktivnost H₂O₂ i na planktonske forme bakterija i tokom formiranja biofilma, u odnosu na varikinu. Prosečan MIK za H₂O₂ za planktonske oblike je iznosio 0,022%, a MIKB (minimalna inhibitorna koncentracija za biofilm) bila je 0,021%. S druge strane, MIK varikine za planktonske oblike je bio 0,11%, a MIKB 0,33%. H₂O₂ je bio statistički značajno efikasniji kako za inhibiciju planktonskih oblika, tako i u sprečavanju formiranja biofilma. Naši rezultati pokazuju da je H₂O₂ bio efikasniji i protiv planktonskih oblika *E. coli* i posljedično bolje sprečavao formiranje biofilma nego varikina.

Ključne riječi: *Escherichia coli*, biofilm, planktonske forme, dezinficijensi

DISINFECTANTS ACTIVITY ON BIOFILM FORMATION AND AGAINST PLANKTONIC FORMS OF *ESCHERICHIA COLI* ISOLATED FROM DRINKING WATER

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Abstract. *Escherichia coli* is one of the most important bacterium within the "One Health" concept due to its ability to colonise and infect various animal and plant hosts, as well as humans. Also, this bacteria can easily survive in environment, such as water. Biofilm formation allows *E. coli* to survive on nonliving and living subjects for prolonged period. Biofilm represents a highly organised bacterial sessile community embedded within a polysaccharide matrix, produced by bacteria only during biofilm formation. Biofilm is very resistant to antimicrobial drugs and can only be removed through physical means, such as thorough cleaning and treatment with high concentrations of chemical substances that may have a toxic effect. Our goal was to determine the disinfectants activity against planktonic *E. coli* and during biofilm formation. In this study were included 30 strains of *E. coli*, isolated in drinking water samples obtained from poultry farms. To examine the activity of disinfectants in preventing biofilm formation, we utilised doubly decreasing concentrations (7.5%-0.01% for H₂O₂, and 1%-0.001% for bleach) during overnight incubation in microtiter plates with the bacterial inoculum at 37°C. Disinfectants activity against planktonic forms was determined by broth microdilution method with the same concentration range of disinfectants used for biofilm prevention treatment. We have noticed statistically significant higher activity of H₂O₂ against both planktonic forms and in biofilm prevention. Average H₂O₂ MIC for planktonic forms was 0.022% and MICB (minimal inhibitory concentration for biofilm) was 0.021%. On the other hand, median bleach MIC for planktonic forms was 0.11% and MICB was 0.33%. H₂O₂ was statistically more effiecent both for inhibition of planktonic forms, as well as in preventing biofilm formation. Our results show that H₂O₂ was more effective both against planktonic *E. coli* forms and consenquently in bioflm formation than bleach

Key words: *Escherichia coli*, planktonic, biofilm, disinfectants

MERENJE SEDENTARNOG PONAŠANJA

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Sažetak. Sedentarno ponašanje se metodološki definiše kao ponašanje ljudi tokom budnog stanja koje ne prelazi energetske trošak od 1,5 MET, što je uglavnom povezano sa niskom aktivacijom glavnih mišićnih grupa. Tokom poslednjih petnaest godina, eksponencijalno raste broj dokaza koji povezuju sedentarno ponašanje sa preranom smrtnošću, dijabetesom tipa 2, rakom, mišićno-koštanim poremećajima, gojaznošću i depresijom. Prekomerno sedenje i loše držanje negativno utiču na zdravlje kičme i povezani su sa bolom u donjem delu leđa. Ne postoji jedinstveni dnevni sedentarni prag koji predstavlja ozbiljan zdravstveni rizik. Prosečno dnevno vreme sedenja za kancelarijske radnike je oko 10 sati, a za studente 11 sati. Dugotrajno sedenje je značajan problem javnog zdravlja. Merenje sedentarnog ponašanja uključuje korišćenje subjektivnih (samoprocena) i objektivnih metoda. Sedentary Behaviour Questionnaire (SBQ) je često korišćen upitnik koji meri vreme sedenja radnim danima i vikendom. ActivPAL je jednosmerni akcelerometar koji meri vreme provedeno u različitim položajima tela (ležanje, sedenje, stajanje) i broj koraka, a validiran je kao pouzdan instrument za procenu sedentarnog ponašanja. U našem istraživanju, samoprocena vremena sedentarnosti sprovedena je kod 323 zaposlenih sa pretežno sedećim radnim mestima i kod 100 studenata Fakulteta zdravstvenih nauka Univerziteta u Ljubljani tokom radnog dana u oktobru 2024. Objektivno merenje korišćenjem ActivPAL-a sprovedeno je kod 20 osoba koje obavljaju pretežno sedeći posao. Prosečno samoprijavljeno vreme sedenja kod studenata iznosilo je 10,5 sati, što ukazuje na visok zdravstveni rizik, dok su objektivna merenja pokazala 9 sati. Pronađena je razlika od 30% između samoprocene i objektivnog merenja. Naši nalazi ističu zdravstvene rizike od preteranog sedenja i naglašavaju potrebu za efikasnim intervencijama. Samoprocena nije dovoljna za precizno praćenje, neophodno je koristiti objektivne metode merenja. Stoga preporučujemo sistematsku integraciju objektivnih merenja u istraživanja i praćenje sedentarnog ponašanja u obrazovnim i radnim okruženjima, u cilju promene ponašanja i promocije zdravlja.

Ključne riječi: sedentarno ponašanje, samoprocena, objektivno merenje sa ActivPAL-om, zdravstveni rizik, studenti i kancelarijski radnici

MEASURING SEDENTARY BEHAVIOUR

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Abstract. Sedentary behaviour is defined methodologically as people's behaviour in activities that do not exceed an energy expenditure of 1.5 METS during wakefulness, which is mainly associated with low activity of major muscle groups. In the last fifteen years, evidence has grown exponentially linking sedentary behaviour with early mortality, type 2 diabetes, cancer, musculoskeletal disorders, obesity, and depression. Excessive sitting and poor posture negatively affect spinal health and are associated with low back pain. There is no unified consensus on the daily sedentary threshold that presents a serious health risk. The average daily sitting time for office workers is about 10 hours and for students 11 hours. Prolonged sitting is a significant public health concern. Measurement methods include subjective self-reports and objective tools. The Sedentary Behaviour Questionnaire (SBQ) is commonly used to assess sitting time on weekdays and weekends. The ActivPAL accelerometer measures time spent in various body postures (lying, sitting, standing) and step count, and has been validated as a reliable instrument for assessing sedentary behaviour. In our study, self-reported sedentary time was collected from 323 predominantly sedentary employees and 100 students of the Faculty of Health Sciences at the University of Ljubljana during a working day in October 2024. Objective measurement using ActivPAL was conducted with 20 individuals engaged in sedentary work. Average self-reported sedentary time among students was 10.5 hours, indicating high health risk, while objective ActivPAL data showed 9 hours. A 30% discrepancy was found between self-reporting and objective measurement. Our findings highlight the health risks of excessive sedentary time and emphasize the need for effective interventions. Self-reporting alone is insufficient for accurate monitoring; objective measurement tools must be included in both research and practice. Therefore, we recommend systematic integration of objective monitoring in both academic and workplace settings to support behavioural change and health promotion.

Key words: sedentary behaviour, self-reporting, objective measurement with ActivPAL, health risk, students and office workers

FITONCIDNA SVOJSTVA ZASADA BORA (*Pinus sylvestris* L.) U USMANSKOJ BOROVOJ ŠUMI (RUSKA FEDERACIJA)

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Sažetak. Degradacija životne sredine povećava rizik od raznih bolesti, što pojedince i društvo u cjelini sve više usmjerava ka korišćenju prirodnih ljekovitih resursa iz šumskih ekosistema. Iz tog razloga se biološki aktivne biljne zajednice uspostavljaju kao šume sa posebnom namjenom, naročito u okviru urbanih aglomeracija. Cilj ovog rada je ispitivanje fitoncidne aktivnosti kultura običnog bora (*Pinus sylvestris* L.) pod različitim uslovima temperature i relativne vlažnosti vazduha. Predmet istraživanja su dječiji zdravstveni kompleksi koji se nalaze na posebno zaštićenim prirodnim područjima Usmanske regije (Ruska Federacija). Metod istraživanja je uključivao analizu uticaja prosječne temperature i vlažnosti vazduha na fitoncidnu aktivnost borovih sastojina, korišćenjem višestruke regresione analize. Rezultati pokazuju da na fitoncidnu aktivnost utiču ne samo temperatura vazduha, već i relativna vlažnost. Konkretno, što je vlažnost manja, a temperatura vazduha viša, to je fitoncidna aktivnost bora izraženija. Fitoncidna aktivnost kultura običnog bora opada na početku vegetacionog perioda (mart 2024), dok se tokom faze cvjetanja (april 2024) bilježi blagi porast aktivnosti. Postepeno povećanje fitoncidne aktivnosti uočava se od početka fenološke faze cvjetanja običnog bora.

Ključne riječi: fitoncidi, bijeli bor, Usmanska regija, šumski zasadi

**PHYTONCIDAL PROPERTIES OF PINE (*Pinus sylvestris* L)
PLANTATIONS OF USMAN PINE FOREST (RUSSIAN
FEDERATION)**

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Abstract. Environmental degradation increases the risk of various diseases, which leads individuals and society as a whole to rely on natural medicinal resources from forest ecosystems. For this reason, biologically active plant communities are established as special-purpose forests, particularly within urban agglomerations. The aim of this paper is to investigate the phytoncide activity of Scots pine (*Pinus sylvestris* L.) forest cultures under different temperature and relative humidity conditions. The subject of the research includes children's health complexes located in specially protected natural areas of the Usman region (Russian Federation). The research method involved analyzing the influence of average temperature and air humidity on the phytoncide activity of pine stands using multiple regression analysis. The results show that phytoncide activity is influenced not only by air temperature but also by relative humidity. Specifically, the lower the humidity and the higher the air temperature, the stronger the phytoncide activity of the pine. The phytoncide activity of Scots pine forest cultures decreases at the beginning of the vegetation period (March, 2024), but later during the flowering period (April, 2024), there is a slight increase in activity. A gradual increase in phytoncide activity is observed from the beginning of the phenological flowering phase of Scots pine.

Key words: Phytoncides, white pine, Usmansk district, forest plantations

FENOLOŠKE KARAKTERISTIKE ARIŠA U USLOVIMA MOSKOVSKJE REGIJE

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Sažetak. U radu su predstavljeni rezultati fenoloških posmatranja evropskog ariša na dvije lokacije. Proučavani su prirodni podmladak i samonikli primjerci evropskog ariša na zaštićenoj teritoriji «Nikolskaya Lesnaya Dacha» (severoistočni dio Moskovske regije), kao i aleja ariša zasađena 2005. godine na teritoriji Moskovskog državnog tehničkog univerziteta Bauman (centralni dio Moskovske regije). Posmatranja se kontinuirano sprovode od proljeća 2024. godine do danas, kombinacijom opšteprihvaćenih metoda. Na osnovu rezultata istraživanja u prvoj vegetacionoj sezoni, sastavljen je fenološki spektar za svaku lokaciju. Utvrđeno je da se evropski ariš uspješno prilagodio uslovima introdukcije i može se preporučiti za gajenje u šumama i parkovima Moskovske regije. Primjećeno je prisustvo zimzelenih iglica kod samoniklih ariša koje prezimljavaju pod snijegom. Radi potvrde dobijenih rezultata, posmatranja na ovim lokacijama će se nastaviti i narednih godina. Cilj ovog rada je procjena uspješnosti adaptacije evropskog ariša na uslove introdukcije (u centralnom i sjeveroistočnom dijelu Moskovske regije) proučavanjem njegovog fenološkog razvoja. Ova istraživanja su trenutno posebno relevantna, jer mogu poslužiti kao naučna osnova za uključivanje ariša u zaštitne šume Moskovske regije. Odavno je dokazano da čiste četinarske kulture imaju povećan rizik od požara, dok uvođenje ariša može smanjiti taj rizik bez gubitka vrijednosti zasada. Ariš je takođe vrijedna vrsta za urbano zelenilo jer zadržava dekorativne osobine veći dio godine i oslobađa fitoncide koji povoljno utiču na ljudsko zdravlje.

Ključne reči: evropski ariš, *Larix decidua* Mill., introdukcija, fenologija, Moskovska regija

LARCH PHENOLOGY FEATURES IN MOSCOW REGION CONDITIONS

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Abstract. The article presents the phenological observations results of European larch at two locations. Self-seeding and undergrowth of natural origin European larch on the protected area territory «Nikolskaya Lesnaya Dacha» (Moscow Region northeast) and larch alley, planted in 2005 on the territory of the Bauman Moscow State Technical University (Moscow Region center) were studied. Observations have been continuous since the spring of 2024 to the present to generally accepted methods combination. Based on the first growing season research results, a phenological spectrum has been compiled for each location. It has been established that European larch has successfully adapted to the introduction conditions and can be recommended for breeding in Moscow region forests and parks. The presence of evergreen needles of self-seeding larch, overwintering under the snow, was noted. In order to confirm the results, observations at the locations will continue over the next few years. The purpose of this work is to assess the European larch adaptation success to the introduction conditions (in the Moscow region center and northeast) by studying it's phenological development. Currently, this research is particularly relevant. It will serve as a scientific justification for the inclusion of larch in the Moscow region protective forests. It has long been proven that pure coniferous cultures have an increased fire risk, and larch will reduce the risk without losing the plantation value. Larch is also a valuable species for urban plantings, as it retains its decorative qualities for most of the year and releases phytoncides that have a beneficial effect on the human body.

Key words: European larch, *Larix decidua* Mill., the introducer, phenology, Moscow region.

PRIRODOM INSPIRISANA RJEŠENJA I NJIHOVA PRIMJENA U PREVENCIJI PRIRODNIH KATASTROFA U SLIVU RIJEKE VRBAS

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Sažetak. Prirodom inspirisana rješenja predstavljaju inovativan pristup koji koristi prirodu kao alat za prevenciju i ublažavanje prirodnih katastrofa. Područje zapadnog Balkana, a time i Republike Srpske, veoma je izloženo prirodnim katastrofama naročito u zadnjoj dekadi, gdje su poplave, bujice i klizišta najučestalije. Sliv rijeke Vrbas se karakteriše specifičnom geomorfologijom, te kanjonima i klisurama koje su oskudno obrasle vegetacijom. U višim zonama sliva nalaze se površine koje su kategorisane kao goleti, a koje predstavljaju žarišne zone erozije zemljišta, nastanka bujica, pa time i poplava u donjim dijelovima sliva. Pored toga, u gornjem dijelu sliva smješteni su kamenolomi za eksploataciju građevinskog kamena, gdje značajna količina frakcije kamena završi i u samom koritu rijeke, dok je u donjem dijelu sliva prisutna eksploatacija šljunka direktno iz korita rijeke Vrbas. navedeno značajno utiče i pospješuje negativan uticaj prirodnih katastrofa na životnu sredinu, ali i zdravlje ljudi. U radu su primjenjena terenska istraživanja i savremene digitalne tehnologije. Identifikovane su i mapirane površine koje su bez prisustva vegetacije u kanjonu rijeke Vrbas, ukupne površine oko 364.12 ha, koje predstavljaju glavni faktor rizika za pojavu bujica i erozije, dok je površina kamenoloma na istom području oko 76.69 ha, što dodatno utiče na ranjivost sliva. U okviru istraživanja analizirane su i potencijalne mogućnosti primjene rješenja zasnovanih na prirodi, kao što su pošumljavanje goleti adekvatnim vrstama i primjenom novijih tehnologija (npr. *seed balls*) i rekultivacija kamenoloma. Integracija rješenja zasnovanih na prirodi u postojeće strategije upravljanja vodnim i šumskim resursima je ključna za dugoročnu zaštitu sliva Vrbasa. Rezultati su ujedno i preporuka za razvoj konkretnih rješenja upravljanja slivovima šireg područja, kako bi pored zaštite od prirodnih katastrofa, došlo i do očuvanja zemljišta i pitke vode koja postaje sve značajniji resurs. Cilj rada je istraživanje mogućnosti primjene rješenja zasnovanih na prirodi u slivovima rijeka, kako bi se potpomogla obnova degradiranih površina i jačanje prirodnih mehanizama otpornosti ekosistema, usmjereno ka ublažavanju prirodnih katastrofa.

Ključne riječi: NbS, goleti, prirodne katastrofe, slivovi

Zahvalnica: Istraživanje je sprovedeno uz podršku Ministarstva za naučnotehnološki razvoj i visoko obrazovanje Republike Srpske.

NATURE-BASED SOLUTIONS AND THEIR APPLICATION IN THE PREVENTION OF NATURAL DISASTERS IN THE VRBAS RIVER BASIN

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Abstract. Nature-based solutions represent an innovative approach that uses nature as a tool for the prevention and mitigation of natural disasters. The area of the Western Balkans, and thus the Republic of Srpska, is very exposed to natural disasters, especially in the last decade, where floods, torrents and landslides are the most frequent. The Vrbas river basin is characterized by a specific geomorphology, and canyons and gorges that are sparsely covered with vegetation. In the higher zones of the watershed, there are areas that are categorized as bare, and which represent focal zones of soil erosion, torrential floods, and thus flooding in the lower parts of the watershed. In addition, in the upper part of the basin there are quarries for the exploitation of construction stone, where a significant amount of the stone fraction ends up in the riverbed itself, while in the lower part of the basin there is the exploitation of gravel directly from the bed of the Vrbas river. the aforementioned significantly affects and enhances the negative impact of natural disasters on the environment, as well as human health. Field research and modern digital technologies were applied in the work. Areas without the presence of vegetation in the canyon of the Vrbas River were identified and mapped, with a total area of about 364.12 ha, which represent the main risk factor for flash floods and erosion, while the quarry area in the same area is about 76.69 ha, which additionally affects the vulnerability of the watershed. As part of the research, the potential possibilities of applying solutions based on nature were analyzed, such as afforestation of bare areas with adequate species and the application of newer technologies (eg seed balls) and recultivation of quarries. The integration of nature-based solutions into existing water and forest resource management strategies is crucial for the long-term protection of the Vrbas watershed. The results are at the same time a recommendation for the development of concrete solutions for the management of watersheds in a wider area, so that in addition to protection from natural disasters, there is also the preservation of soil and drinking water, which is becoming an increasingly important resource. The aim of the work is to investigate the possibility of applying solutions based on nature in river basins, in order to support the restoration of degraded areas and the strengthening of natural mechanisms of ecosystem resistance, aimed at mitigating natural disasters.

Keywords: NbS, bare land, natural disasters, basins

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ANALIZA KLIMATSKI KARAKTERISTIKA OPŠTINE MRKONJIĆ GRAD: UTICAJ NA GRADSKO ZELENILLO I ZDRAVLJE STANOVNIŠTVA

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Sažetak. Klimatski ekstremi poput dugotrajnih toplotnih talasa ili nepredvidivih obilnih padavina, predstavljaju ozbiljan izazov kako za urbano zelenilo, tako i stanovništvo u gradskim sredinama, otežavajući adaptaciju urbanih sredina na nove klimatske uslove. U radu su analizirani klimatski podaci za područje opštine Mrkonjić Grad za vremenski period 1999-2021. godina. Opština Mrkonjić Grad nalazi se u sjeverozapadnom dijelu Republike Srpske sa specifičnim klimatskim karakteristikama. Meteorološka stanica smještena je na nadmorskoj visini od 591 m. Prosječna godišnja temperatura za analizirani period je 10.0°C. Najtopliji mjesec je jul sa prosječnom temperaturom vazduha od 19.8°C, a najhladniji je januar sa temperaturom -0.2°C. U istraživanom području javlja se karakterističan kontinentalni tip temperaturnog režima, jer je januar najhladniji, a jul najtopliji mjesec u godini. Prosječna godišnja suma padavina za istraživano područje iznosi 1119 mm. Najkišovitiji mjesec je maj sa 115 mm, dok je u februaru zabilježena najmanja količina padavina sa 77 mm. Na osnovu podataka dobijena vrijednost godišnjeg klimatskog indeksa po metodi *Thorntwaitte-Mather*-a ukazuje da je klima ovog područja perhumidna - A, dok je u vegetacionom periodu blago humidna – B1. Visoke vrijednosti temperature u ljetnim mjesecima imaju značajan uticaj na gradsko zelenilo, ali i na zdravlje stanovništva, posebno starijih i djece, jer mogu prouzrokovati toplotni udar i dehidraciju. Prisustvo gradskog zelenila može ublažiti negativne uticaje visokih temperatura, smanjujući efekat urbanog toplotnog ostrva. Pored uticaju na temperaturu, zelenilo u urbanim sredinama utiče i na poboljšanje kvaliteta vazduha. Prilikom izbora vrsta koje će se koristiti za osnivanje drvoreda ili za sadnju u parku na području opštine Mrkonjić Grad potrebno je prednost dati autohtonim vrstama koje su otporne na visoke temperature u ljetnim, odnosno niske temperature u zimskim mjesecima. Prilagođavanje urbanog zelenila klimatskim ekstremima postaje sve važnije za održivu budućnost urbanih sredina.

Ključne riječi: klima, Mrkonjić Grad, gradsko zelenilo, stanovništvo

Zahvalnica: Istraživanje je sprovedeno uz podršku Ministarstva za naučnotehnoški razvoj i visoko obrazovanje Republike Srpske.

ANALYSIS OF THE CLIMATE CHARACTERISTICS OF THE MUNICIPALITY OF MRKONJIĆ GRAD: IMPACT ON THE URBAN GREENERY AND THE HEALTH OF THE POPULATION

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Abstract. Climatic extremes, such as long-lasting heat waves or unpredictable heavy rainfall, represent a serious challenge for both urban greenery and the population in urban areas, making it difficult for urban areas to adapt to new climatic conditions. The paper analyzed climate data for the area of the Mrkonjić Grad municipality for the time period 1999-2021. year. The municipality of Mrkonjić Grad is located in the northwestern part of Republic of Srpska with specific climatic characteristics. The meteorological station is located at an altitude of 591 m. The average annual temperature for the analyzed period is 10.0°C. The warmest month is July with an average air temperature of 19.8°C, and the coldest is January with a temperature of -0.2°C. In the researched area, a characteristic continental type of temperature regime occurs, because January is the coldest and July is the warmest month of the year. The average annual amount of precipitation for the researched area is 1119 mm. The rainiest month is May with 115 mm, while the lowest amount of precipitation was recorded in February with 77 mm. Based on the data, the value of the annual climate index according to the Thornthwaite-Mather method indicates that the climate of this area is perhumid - A, while in the growing season it is slightly humid - B1. High temperature values in the summer months have a significant impact on the city's greenery, but also on the health of the population, especially the elderly and children, because they can cause heat stroke and dehydration. The presence of urban greenery can mitigate the negative effects of high temperatures, reducing the urban heat island effect. In addition to the influence on temperature, greenery in urban areas also affects the improvement of air quality. When choosing the species that will be used to establish a row of trees or for planting in the park in the area of the municipality of Mrkonjić Grad, it is necessary to give priority to autochthonous species that are resistant to high temperatures in the summer and low temperatures in the winter months. Adaptation of urban greenery to climatic extremes is becoming increasingly important for the sustainable future of urban environments.

Keywords: climate, Mrkonjić Grad, urban greenery, population

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ПОТЕНЦИЈАЛНИ ПОЗИТИВНИ ЕФЕКТА СИРКА НА ЗДРАВЉЕ ЉУДИ

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Сажетак. Сирак (*Sorghum bicolor* (L). Moench) је жито из породице трава (Poaceae) који се користи у исхрани људи, животиња и у индустријској преради. Толерантан је на сушу и дефицит воде и углавном се гаји у полусушним и сушним регионима Африке, Азије, Аустралије и Сјеверне и Јужне Америке, гдје се у највећој мјери користи у људској исхрани. Зрно сирака је основна храна за око 500 милиона људи у 30 земаља Африке и Азије. Сорте сирака које се гаје на нашим просторима спадају у врсту *S. bicolor*, а на основу начина гајења и употребе сврставају се у сирак за зрно, сирак метлаш, сирак шећерац и суданску траву. Циљ овог прегледног рада је да се истакну особености сирака на здравље људи. У срху прикупљања релевантних чињеница, аутори су извршили увид у водеће базе (ScienceDirect, Scopus, Google Scholar, PubMed) и анализирали истраживачке радове бројних аутора. Сирак има велики потенцијал свакодневне и функционалне хране која се може користити у оброцима као замјена за традиционална жита, као што су пшеница, пиринач и кукуруз. Висок садржај дијететских влакана (6%) помаже у варењу и може допринијети контроли тјелесне масе и кардиоваскуларних обољења. Присуство значајних протеина (9–13%) и есенцијалних минерала као што су фосфор, магнезијум, гвожђе и цинк чини сирак виталним нутритивним ресурсом у расту, одржавању и метаболичким функцијама људског организма. Садржај липида у сирку је низак (око 3%), али укључује вриједне масне киселине попут олеинске и линолне. Садржи комплекс витамина Б (тиамин, рибофлавин и ниацин) и витамин Е. Јединствене фитохемикалије сирака, као што су полифеноли, танини, стероли и фитинска киселина, показују антиоксидативне способности, које су повезане са смањењем ризика од хроничних болести и додатном улогом изван основних нутритивних функција. Полифеноли са антиоксидативним капацитетом помажу у смањењу оксидативног стреса у људском тијелу и указују на потенцијална антиканцерогена својства, танини служе као заштита од патогена, фитинске киселине смањују ризик од разних хроничних болести, а стероли доприносе снижавању ниво холестерола.

Кључне ријечи: Сирак (*Sorghum bicolor* (L). Moench), хемијски састав, функционална храна, људско здравље

POSITIVE EFFECTS OF SORGHUM ON HUMAN HEALTH

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Abstract. Sorghum (*Sorghum bicolor* (L.) Moench) is a cereal from the *Poaceae* family, used in human and animal nutrition and industrial processing. It is drought-tolerant and mainly cultivated in semi-arid and arid regions of Africa, Asia, Australia, and South and East America, where it is predominantly consumed by humans. Sorghum grain is a staple food for about 500 million people in 30 countries across Africa and Asia. The sorghum varieties grown in our region belong to *S. bicolor* and are classified by cultivation and used as grain, broomcorn, sweet sorghum, and Sudan grass. This review aims to highlight the characteristics of sorghum that impact human health. Relevant facts were gathered by reviewing major databases (ScienceDirect, Scopus, Google Scholar, PubMed) and analyzing research papers by numerous authors. Sorghum has great potential as an everyday and functional food, serving as a substitute for traditional cereals such as wheat, rice, and maize. Its high dietary fiber content (6%) aids digestion and may help in weight control and cardiovascular health. Significant levels of protein (9–13%) and essential minerals such as phosphorus, magnesium, iron, and zinc make sorghum a vital nutritional resource for growth, maintenance, and metabolic functions. Its low lipid content (about 3%) includes valuable fatty acids like oleic and linoleic acids. Sorghum contains B-complex vitamins (thiamine, riboflavin, and niacin) and vitamin E. Unique sorghum phytochemicals, such as polyphenols, tannins, sterols, and phytic acid, exhibit antioxidant properties associated with reduced risk of chronic diseases and additional roles beyond basic nutrition. Polyphenols with antioxidant capacity help reduce oxidative stress and suggest potential anticancer properties; tannins protect against pathogens; phytic acids reduce the risk of various chronic diseases; and sterols contribute to lowering cholesterol levels.

Keywords: Sorghum (*Sorghum bicolor* (L.) Moench), chemical composition, functional food, human health

ANALIZA MIKRO I MAKRO ELEMENATA U UZORCIMA RUZMARINA ICP-OES METODOM

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Sažetak. Ruzmarin (*Rosmarinus officinalis*) je mediteranska biljka koja se koristi, ne samo kao ukras, već i kao začim, a ima i ljekovita svojstva. Ova biljka sadrži mnogo ljekovitih supstanci, kao što su biljne masti, biljni hormoni, vitamin C, enzimi, eterična ulja, tanini, heterozidi, holin, cineol. Međutim, prisustvo teških metala, čak i u malim koncentracijama, može biti toksično i dovesti do ozbiljnih poremećaja i bolesti. U ovom radu vršena je analiza mikro i makro elemenata u uzorcima ruzmarina sa područja Hercegovine. Takođe, određen je i sadržaj mikro i makro elemenata u uzorcima zemljišta sa kojeg je ruzmarin uzet za analizu. Priprema uzoraka je vršena mokrom digestijom. Određivanje koncentracije mikro i makro elemenata vršeno je primjenom optičke emisije spektrometrije sa induktivno spregnutom plazmom (ICP-OES). Na osnovu dobijenih rezultata, najveća koncentracija makroelemenata izmjerena je za Ca i iznosi $11508,74 \pm 37,33$ mg/kg, a najniža koncentracija makroelemenata izmjerena je za Na i iznosi $387,77 \pm 1,64$ mg/kg. Izmjerene koncentracije teških metala (As, Cd, Pb) su ispod granice detekcije. Koncentracija mikro i makro elemenata u uzorcima zemljišta je ispod maksimalno dozvoljenih koncentracija.

Ključne riječi: makro i mikro elementi, ruzmarin, ICP-OES

ANALYSIS OF MICRO AND MACRO ELEMENTS IN ROSEMARY SAMPLES BY ICP-OES

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Abstract. Rosemary (*Rosmarinus officinalis*) is a Mediterranean plant that is used not only as a decoration, but also as a spice and has medicinal properties. This plant contains a lot of medicinal substances, such as vegetable fats, plant hormones, vitamin C, enzymes, essential oils, tannins, heterosides, choline, and cineole. However, the presence of some heavy metals, even in small concentrations, can be toxic and lead to serious diseases. In this paper, the determination of micro and macro elements in rosemary samples from Herzegovina region was carried out. Also, the content of elements in soil samples from which rosemary was taken for analysis was determined. Sample preparation was carried out by wet digestion. The concentration of selected metals in solutions after digestion was determined using inductively coupled plasma optical emission spectrometry (ICP-OES). Based on the obtained results, the highest concentration of macro elements was measured for Ca and is 11508.74 ± 37.33 mg/kg, and the lowest concentration of macro elements was measured for Na and is 387.77 ± 1.64 mg/kg. The measured concentrations of heavy metals (As, Cd, Pb) are below the detection limit. The concentration of micro and macro elements in soil samples is below the maximum permitted concentrations.

Key words: macro and micro elements, rosemary, ICP-OES

MED I PROIZVODI OD MEDA U OČUVANJU ZDRAVLJA LJUDI

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Sažetak. Med i pčelinji proizvodi, poput propolisa, matične mliječi, polena i voska, predstavljaju značajan prirodni resurs s višestrukim zdravstvenim koristima za ljude. Zbog bogatstva biološki aktivnih tvari – antioksidansa, flavonoida, enzima, aminokiselina, minerala i vitamina – med nije samo prirodni zaslađivač, već i funkcionalna hrana s potencijalom prevencije i potpore u liječenju različitih bolesti. Med pokazuje snažno antimikrobno, protuupalno, antioksidativno i imunomodulacijsko djelovanje, što ga čini korisnim u prevenciji i terapiji infekcija, rana, gastrointestinalnih smetnji te respiratornih bolesti. Propolis, bogat flavonoidima i fenolnim kiselinama, efikasno djeluje protiv bakterija, virusa i gljivica, dok matična mliječ ima potencijal u regulaciji metabolizma i hormonalne ravnoteže. Polen doprinosi jačanju imuniteta i koristi se u nutritivnoj rehabilitaciji. Naučna istraživanja potvrđuju da redovita konzumacija kvalitetnog meda može poboljšati lipidni profil, glikemijsku ravnotežu i antioksidativni status organizma, posebice u kontekstu kroničnih nezaraznih bolesti poput kardiovaskularnih oboljenja, dijabetesa i karcinoma. Međutim, efekti meda zavise od njegovog botaničkog porijekla, kvaliteta i načina prerade. Uprkos brojnim prednostima, važno je ukazati na potrebu za standardizacijom kvalitete meda, sprečavanjem falsifikovanja te edukacijom potrošača o pravilnom korištenju pčelinjih proizvoda. Daljnja klinička istraživanja nužna su kako bi se potvrdila terapijska efikasnost i definisale preporučene doze u ljudskoj populaciji.

Med i pčelinji proizvodi predstavljaju važan dio prirodne prevencije i podrške zdravlju ljudi. Njihova integracija u svakodnevnu ishranu, uz stručnu kontrolu i naučnu verifikaciju, može doprinijeti unapređenju javnog zdravlja i smanjenju rizika od kroničnih bolesti.

Ključne riječi: Med, proizvodi od meda, prevencija i terapija, zdravlje ljudi.

HONEY AND HONEY-BASED PRODUCTS IN THE PRESERVATION OF HUMAN HEALTH

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Abstract. Honey and bee products—such as propolis, royal jelly, pollen, and beeswax—are a valuable natural resource with numerous health benefits for humans. Due to their rich content of biologically active compounds, including antioxidants, flavonoids, enzymes, amino acids, minerals, and vitamins, honey serves not only as a natural sweetener but also as a functional food with preventive and therapeutic potential. Honey exhibits strong antimicrobial, anti-inflammatory, antioxidant, and immunomodulatory properties, making it beneficial in the prevention and treatment of infections, wound healing, gastrointestinal disturbances, and respiratory conditions. Propolis, rich in flavonoids and phenolic acids, is effective against bacteria, viruses, and fungi, while royal jelly contributes to metabolic and hormonal balance. Pollen enhances immune function and is used in nutritional rehabilitation. Scientific studies confirm that regular consumption of high-quality honey can improve the lipid profile, glycemic balance, and antioxidant status of the body, particularly in the context of chronic non-communicable diseases such as cardiovascular disorders, diabetes, and cancer. However, its effects depend on botanical origin, quality, and processing methods. Despite its numerous advantages, there is a need to emphasize the importance of quality standardization, prevention of adulteration, and public education regarding the proper use of bee products. Further clinical research is essential to validate therapeutic efficacy and establish recommended doses for human populations.

Honey and bee products represent a vital element of natural prevention and support for human health. Their integration into daily nutrition, under professional guidance and scientific verification, can significantly contribute to public health promotion and the reduction of chronic disease risks.

Key words: honey, honey-based products, prevention and therapy, human health.

RASFF OBAVJEŠTENJA O RIZICIMA BEZBJEDNOSTI HRANE IZ BALKANSKIH DRŽAVA IZVEZENE U EVROPSKU UNIJU

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Sažetak. Bezbjednost hrane je ključno pitanje za subjekte koji posluju sa hranom i može predstavljati veliku zabrinutost za potrošače. U Evropskoj uniji (EU) je 1979. godine uveden Sistem brzog uzbunjivanja za hranu i stočnu hranu (RASFF). Osnovni zadatak RASFF-a je prikupljanje izvještaja o potencijalno rizičnoj hrani i stočnoj hrani koja se uvozi u EU i obavještava države članice kako bi se mogao izvršiti brzi opoziv hrane i eliminisao rizik po zdravlje potrošača. Zemlje balkanske regije, koje nisu članice EU, nisu članice RASFF-a, ali mogu aktivno koristiti RASFF informacije. Razmjena informacija se provodi putem RASFF Window, odnosno web aplikacije pokrenute sa ciljem brzog obavještavanja zemalja izvan EU o relevantnim slučajevima. Autori u ovom radu žele da prikažu podatke o broju notifications i razloge za izdavanje notifications za hranu porijeklom iz balkanskih zemalja, a koja je prometovana u državama članicama EU. U tu svrhu istražen je ukupan broj izdatih obavještenja, kategorije proizvoda na koje se odnose obavještenja, najčešći hazardi, te Hazard classification i Risk decision za kontaminirane prehrambene proizvode. Pretraženi su podaci za period 2020-2025 (do 10.08.2025). Podaci predstavljeni u ovom radu predstavljaju rezultate pretrage RASFF Window i preuzeti su sa web aplikacije RASFF Window (<https://webgate.ec.europa.eu/rasff-window/screen/search>). Obrada podataka je izvršena u programu Microsoft Excel. Podaci su izvezeni u obliku Excel datoteke i klasifikovani prema ciljevima funkcije pivot tabele. Obrada podataka izvršena je korištenjem deskriptivne statistike. U posmatranom periodu najveći broj notifikacija odnosio se na proizvode iz Srbije (92) i Albanije (69). U istom periodu broj notifikacija za proizvode iz BiH iznosio je 40, proizvode iz Makedonije 29, dok su se svega 2 notifikacije odnosile na proizvode iz Crne Gore. Najveći broj notifikacija (za sve balkanske države) odnosio se na „Fruits and vegetables“ (85) i „Cereals and bakery products“ (21). Najčešći hazardi u kategoriji proizvoda „Cereals and bakery products“ bili su prisustvo acrylamide i Aflatoxins; u kategoriji „Fruits and vegetables“ prisustvo pesticida (chlorpyrifos 20, formetanate 20 i dr), te cadmiuma (9). U proizvodima od mesa od hazarda najčešće je utvrđeno prisustvo patogenih mikroorganizama. „Border reject notification“ (50) i „Information notification for attention“ (23) su najčešći oblici Hazard classification. Kao „Serious risk“ klasifikovano je 40, kao „Potential risk“ 19 i kao „Potential serious risk“ 17 identifikovanih slučajeva. 9 slučajeva je klasifikovano kao „No risk“. Ovi podaci se odnose na sve balkanske zemlje. Podaci koji se razmjenjuju kroz RASFF Window su veoma korisni za proizvođače hrane iz balkanskih država i mogu doprinijeti smanjenju rizika po bezbjednost hrane i uticati na povećanje obima izvoza hrane u EU.

Ključne riječi: Bezbjednost hrane, RASFF prozor, Kategorije proizvoda, Vrste hazarda, Zemlje Balkana

RASFF NOTIFICATIONS OF FOOD SAFETY RISKS FROM BALKAN COUNTRIES EXPORTED TO THE EUROPEAN UNION

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Abstract. Food safety is a key issue for food business operators and can be a major concern for consumers. The European Union (EU) introduced the Rapid Alert System for Food and Feed (RASFF) in 1979. The main task of RASFF is to collect reports on potentially risky food and feed imported into the EU and inform member states so that food can be quickly recalled and the risk to consumer health can be eliminated. The countries of the Balkan region, that are not members of the EU, are also not part of RASFF system, but they can actively use RASFF information. Information exchange is carried out through the RASFF Window, a web application launched with the aim of quickly informing countries outside the EU about relevant cases. In this paper, the authors want to present data on the number of notifications and the reasons for issuing notifications for food originating from the Balkan countries, which was marketed in EU member states. For this purpose, the total number of notifications issued, the product categories to which the notifications relate, the most common hazards, and the Hazard classification and Risk decision for contaminated food products were investigated. Data were searched for the period 2020-2025 (until 10.08.2025). The data presented in this paper represent the results of the RASFF Window search. Data was downloaded from the RASFF Window web application (<https://webgate.ec.europa.eu/rasff-window/screen/search>). Data processing was performed in Microsoft Excel. The data was exported as an Excel file and classified according to the objectives of the pivot table function. Data processing was performed using descriptive statistics. In the observed period, the largest number of notifications related to products from Serbia (92) and Albania (69). In the same period, the number of notifications for products from BiH was 40, products from Macedonia 29, while only 2 notifications related to products from Montenegro. The largest number of notifications (for all Balkan countries) were related to "Fruits and vegetables" (85) and "Cereals and bakery products" (21). The most common hazards in the product category "Cereals and bakery products" were the presence of acrylamide and Aflatoxins; in the category "Fruits and vegetables" the presence of pesticides (chlorpyrifos 20, formetanate 20, etc.), and cadmium (9). The presence of pathogenic microorganisms is most often found in meat products from the hazard classification. "Border reject notification" (50) and "Information notification for attention" (23) are the most common forms of Hazard classification. 40 cases were classified as "Serious risk", 19 as "Potential risk" and 17 as "Potential serious risk". 9 cases were classified as "No risk". These data refer to all Balkan countries. The data exchanged through the RASFF Window is very useful for food producers from Balkan countries and can contribute to reducing food safety risks and increasing the volume of food exports to the EU.

Key words: Food safety, RASFF window, Product categories, Hazard types, Balkan countries

**OSNIVANJE MEĐUNARODNOG PROVENIJENIČNOG TESTA
HRASTA KITNJAKA (*QUERCUS PETRAEA* (MATT.) LIBEL) –
NAUKA ZA KONCEPT "JEDNO ZDRAVLJE"**

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Sažetak. Globalni izazovi poput klimatskih promjena i gubitak biodiverziteta, dovode u fokus obezbjeđivanje održivosti i otpornosti šumskih ekosistema kao ključnog naučnog i ekološkog pitanja. Genetska raznovrsnost igra važnu ulogu u sposobnosti drvenastih vrsta da se prilagode promjenljivim uslovima životne sredine. Stoga, efikasno očuvanje i korišćenje genetskih resursa šumskog drveća je od suštinskog značaja za očuvanje stabilnosti ekosistema. U tom kontekstu, međunarodni provenijenični ogled hrasta kitnjaka (*Quercus petraea*) uspostavljen je na području Šumskog gazdinstva "Banjaluka", sa ciljem ispitivanja genetske varijabilnosti i adaptivnog potencijala ove važne privredne vrste u lokalnim ekološkim uslovima. Ogled obuhvata 21 provenijenciju porijeklom iz deset evropskih zemalja – Švedske, Danske, Francuske, Češke, Poljske, Mađarske, Bugarske, Sjeverne Makedonije, Srbije i Bosne i Hercegovine. Postavljen je po principu potpunog slučajnog blok rasporeda, sa četiri ponavljanja i razmakom sadnje 3x3 metra, sadni material 3+0, na površini od 1ha. Svaku provenijenciju čini 12 sadnica po bloku, ukupno 48 sadnica, što omogućava detaljno praćenje genetskih, fenotipskih i ekoloških osobina kroz vrijeme. Selekcija genetski superiornog sadnog materijala trebalo bi da poveća uspješnost prirodne obnove šuma i njihovu otpornost na buduće ekološke izazove indukovane promjenom klime. Značaj ovog oglada prevazilazi okvire lokalnog gazdovanja šumama, jer doprinosi razvoju adaptivnih strategija u šumarstvu šireg područja, podržava očuvanje biodiverziteta i zdravlja ekosistema, te doprinosi konceptu "Jedno zdravlje", koji prepoznaje međusobnu povezanost zdravlja ljudi, životinja i životne sredine. Ovaj ogled predstavlja važan iskorak ka integraciji šumarske genetike u multidisciplinarne pristupe rješavanja klimatske otpornosti i održivog razvoja šuma. Primarni cilj oglada jeste identifikacija najperspektivnijih genotipova za potrebe pošumljavanja u regionu, posebno onih koji pokazuju bolji rast, adaptabilnost i toleranciju na klimatski stres, te davanje naučnog doprinosa unapređenju načina gazdovanja šumama kitnjaka u Evropi.

Ključne riječi: provenijenični test, adaptacija, šumski genetički resursi, "Jedno zdravlje", biodiverzitet.

Zahvalnica: istraživanje je sprovedeno uz podršku Ministarstva za naučnotehnološki razvoj i visoko obrazovanje Republike Srpske, ugovor broj 19.032/961-21/24 od 30.12.2024. godine.

ESTABLISHMENT OF AN INTERNATIONAL PROVENANCE TEST OF SESSILE OAK (*QUERCUS PETRAEA* (MATT.) LIEBL.) – SCIENCE FOR THE ONE HEALTH CONCEPT

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Abstract. Global challenges such as climate change and biodiversity loss bring the sustainability and resilience of forest ecosystems into focus as a key scientific and ecological issue. Genetic diversity plays an important role in the ability of woody species to adapt to changing environmental conditions. Therefore, the effective conservation and use of genetic resources of forest trees is essential for maintaining ecosystem stability. In this context, an international provenance trial of Sessile oak (*Quercus petraea*) was established in the area of the “Banja Luka” Forest Management Unit, aiming to examine the genetic variability and adaptive potential of this important economic species in local ecological conditions. The trial includes 21 provenances from ten European countries – Sweden, Denmark, France, Czech Republic, Poland, Hungary, Bulgaria, North Macedonia, Serbia, and Bosnia and Herzegovina. It was designed using a complete randomized block layout, with four replications and a planting distance of 3x3 meters, using 3+0 planting material, on a total area of 1 ha. Each provenance consists of 12 seedlings per block, a total of 48 seedlings, enabling detailed monitoring of genetic, phenotypic, and ecological traits over time. The selection of genetically superior planting material should increase the success of natural forest regeneration and their resistance to future ecological challenges induced by climate change. The significance of this trial goes beyond local forest management, as it contributes to the development of adaptive strategies in forestry in a broader area, supports the conservation of biodiversity and ecosystem health, and contributes to the “One Health” concept, which recognizes the interconnection of human, animal, and environmental health. This research represents an important step towards integrating forest genetics into multidisciplinary approaches to addressing climate resilience and sustainable forest development. Main goal is to identify the most promising genotypes for afforestation in the region, particularly those showing better growth, adaptability, and tolerance to climate stress, thus making a scientific contribution to improving oak forest management practices in Europe.

Keywords: provenance test, adaptation, forest genetic resources, “One Health,” biodiversity.

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ANTIOKSIDATIVNA AKTIVNOST HIDROLATA ŽALFIJE (*Salvia officinalis*)

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Sažetak. Hidrolat žalfije (*Salvia officinalis*), nusproizvod destilacije eteričnog ulja žalfije, poznat je po svojim korisnim svojstvima, uključujući i antioksidativnu aktivnost. Antioksidansi štite organizam od oksidativnog stresa koji može izazvati oštećenja ćelija i doprinijeti razvoju bolesti, uključujući kardiovaskularne, neurodegenerativne poremećaje i rak. Zahvaljujući svom hemijskom sastavu, hidrolat žalfije neutrališe slobodne radikale i time pomaže smanjenju oksidativnog stresa. Ovaj hidrolat se često koristi u kozmetici za zaštitu kože od starenja i oštećenja izazvanih UV zračenjem, a također se primjenjuje u tradicionalnoj medicini za ublažavanje upala i poboljšanje opšeg zdravlja. Njegova primjena u obliku spreja ili u dodacima ishrani može pomoći u jačanju imunološkog sistema i poboljšanju opšeg zdravlja. Cilj ovog rada je bio ispitati antioksidativni potencijal hidrolata žalfije koji je dobijen hidrodestilacijom u aparaturi po Klevendžeru. Hemijski sastav hidrolata ispitan je gasnom hromatografijom sa masenim detektorom. Ispitivanje je je pokazalo da su dominantne komponente kamfor i eukaliptol. Antioksidacijska aktivnost određena je DPPH (2,2,-difetil-1-pikrilhidrazil radikal) metodom. Rezultati pokazuju obećavajuće antioksidativne karakteristike hidrolata žalfije.

Ključne riječi: žalfija, hidrolat, destilacija, antioksidans

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.

ANTIOXIDATIVE ACTIVITY OF SAGE (*Salvia officinalis*) HYDROLATE

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Abstract. Sage (*Salvia officinalis*) hydrolate, a byproduct of sage essential oil distillation, has beneficial antioxidant properties that help protect the body from oxidative stress, which can lead to diseases like cardiovascular conditions, neurodegenerative disorders, and cancer. Rich in bioactive compounds, sage hydrolate neutralizes free radicals, reducing oxidative damage. It is widely used in cosmetics for skin protection against aging and UV radiation, as well as in traditional medicine to reduce inflammation and improve general health. It is typically applied as a spray or dietary supplement to boost the immune system. The study aimed to assess the antioxidant potential of sage hydrosol obtained via hydrodistillation in a Clevenger apparatus. Chemical analysis through gas chromatography-mass detector revealed that camphor and eucalyptol were the dominant components. Antioxidant activity was tested using the DPPH radical method, showing significant antioxidant potential. The results suggest that sage hydrolate offers promising benefits in preventing oxidative damage, supporting immune health, and alleviating inflammation.

Key words: sage, hydrolate, distillation, antioxidant

Acknowledgments: This study was carried out within a project "Hydrodistillation and analysis of essential oils and hydrolates from medicinal and herbal plants from Herzegovina: Research on composition and effect as well as possible application in pharmacy and industry." No. 125 7064, financed by the Ministry of Scientific and Technological Development and Higher Education of the Republic of Srpska.

REFRAKTOMETRIJSKO ODREĐIVANJE ČISTOĆE ETERIČNOG ULJA LIMUNA

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Sažetak. Eterično ulje limuna se koristi u aromaterapiji zbog svog vrlo pozitivnog uticaja na raspoloženje. Poznato je da stimuliše kognitivne funkcije, naročito kod osoba sa Alchajmerovom bolešću. Kada se razblaži sa bademovim, jojobinim ili kokosovim uljem, može se lokalno primjeniti za liječenje akni, malih rana i gljivičnih infekcija, zahvaljujući svojim antimikrobnim svojstvima. Ulje limuna je korisno za ublažavanje mučnine kod trudnica. Koristi se u proizvodima za njegu kože zbog svojih revitalizujućih i antioksidativnih efekata. Međutim, treba ga koristiti s oprezom, jer može iritirati kožu ako se nanese nerazblaženo ili izazvati respiratorne probleme ako se udiše u velikim količinama. Fotosenzitivno je, pa treba izbjegavati izlaganje sunčevoj svjetlosti nakon upotrebe. Ulje limuna se koristi u komercijalnim i domaćim proizvodima koji su lako dostupni na tržištu te je praćenje kvaliteta vrlo važno. Tehnika koju Farmakopeja preporučuje je refraktometrija. Cilj ovog istraživanja je primjena refraktometrijske analize za određivanje čistoće sedam uzoraka eteričnog ulja limuna. Šest uzoraka eteričnog ulja limuna dobijeno je iz svježe kore limuna. Istraživanje je pokazalo da je 50% sintetisanih uzoraka imalo indeks refrakcije sličan komercijalnom eteričnom ulju, koji je bio blizu indeksa refrakcije navedenog u literaturi.

Gljučne riječi: limun, eterično ulje, aromaterapija, refraktometrijska analiza

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.

REFRACTOMETRIC DETERMINATION OF THE PURITY OF LEMON ESSENTIAL OIL

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Abstract. Lemon essential oil is popular in aromatherapy for its mood-lifting and energizing effects, reducing anxiety, and enhancing concentration. It also stimulates cognitive function, particularly in Alzheimer's patients. When diluted with carrier oils like almond, jojoba, or coconut oil, it can be applied topically to treat acne, small wounds, and fungal infections due to its antimicrobial properties. Additionally, it helps relieve nausea, especially in pregnant women, and is used in skincare for its revitalizing and antioxidant effects. However, lemon oil can irritate the skin if undiluted, cause respiratory issues if inhaled in large amounts, and it is photosensitive, so sunlight exposure should be avoided after use. It is commonly found in both commercial and homemade products. Refractometry is an effective technique for determining the purity of lemon essential oil, endorsed by the Pharmacopoeia. In this study, refractometric analysis was performed on seven lemon essential oil samples, including six synthesized from lemon peel and one commercial sample. Results showed that 50% of the synthesized samples had a refractive index similar to the commercial oil and literature data.

Key words: lemon, essential oil, aromatherapy, refractometric analysis

Acknowledgments: This study was carried out within a project "Hydrodistillation and analysis of essential oils and hydrolates from medicinal and herbal plants from Herzegovina: Research on composition and effect as well as possible application in pharmacy and industry." No. 125 7064, financed by the Ministry of Scientific and Technological Development and Higher Education of the Republic of Srpska.

**PREVARE SA HRANOM – PREGLED INCIDENATA
PRIJAVLJENIH U EU ALERT AND COOPERATION NETWORK I
SISTEMU BRZOG UZBUNJIVANJA ZA HRANU I HRANU ZA
ŽIVOTINJE**

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Sažetak: Prevare sa hranom vode ka ekonomskoj dobiti za prevarante i šteti za kupce. Osim toga, prevare sa hranom predstavljaju nepoštovanje i kršenje propisa o hrani, a mnoge prevare mogu uticati na zdravlje potrošača uzrokujući različite bolesti ili u ekstremnim slučajevima smrt. Cilj ovog rada je analiza prijavljenih slučajeva prevara u EU Rapid alert system for food and feed (RASFF), odnosno Alert and Cooperation Network' (ACN). U ovom radu prikazane su prevare sa hranom koje se najčešće dešavaju u Evropi. Tokom pregleda korišteni su podaci koji su objavljeni u javnoj bazi podataka RASFF-a, odnosno Alert and Cooperation Network' (ACN) u periodu 2016-2024. Broj zahtjeva članica ACN mreže u vezi sa sumnjom na prevaru povećao se sa 157 (2016) i 178 (2017) na 407 (2021), 600 (2022), odnosno 758 (2023). U 2020. godini najveći broj zahtjeva odnosio se na masti i ulja, ribu i proizvode od ribe, te živinsko meso i proizvode. Slična situacija je bila i 2021. godine, s tim da su na trećem mjestu bili zahtjevi u vezi sa crvenim mesom i proizvodima od mesa. 2022. i 2023. godine najveći broj zahtjeva se odnosio na med, živu stoku i crveno meso. Prema RASFF-u, u prevare sa hranom koje su najčešće prijavljene u posmatranom periodu spadaju: upotreba nedozvoljenih sastojaka, pogrešno označavanje, prodaje hrane poslije roka upotrebe, hrana koju nije pratila ispravna dokumentacija, hrana sa nepravilnim ili lažnim uvoznim deklaracijama itd. U svrhu otkrivanja i sprečavanja prevara sa hranom primjenjuju se različite analitičke tehnike. One su, uglavnom, fokusirane na ciljane pristupe radi identifikacije prethodno odabranih analiza. U radu je dat pregled najviše primjenjivanih tehnika. Iako su i metode otkrivanja i mjere prevencije u vezi sa problemima prevare u hrani implementirane u različitim lancima snabdijevanja hranom, takvi se događaji i dalje prijavljuju širom svijeta. Nadležni organi moraju identifikovati (i po potrebi sankcionisati), a subjekti u poslovanju sa hranom ublažiti i spriječiti pojavu prevara sa hranom.

Ključne riječi: Prevare sa hranom, ACN, RASFF, Evropska unija

FOOD FRAUD – AN OVERVIEW OF INCIDENTS REPORTED TO ALERT AND COOPERATION NETWORK AND THE EU RAPID ALERT SYSTEM FOR FOOD AND FEED

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Abstract: Food fraud leads to economic gain for fraudsters and harm for consumers. In addition, food fraud represents a disregard and violation of food regulations, and many frauds can affect consumer health by causing various illnesses or, in extreme cases, death. The aim of this paper is to analyze reported fraud cases in the EU's Rapid Alert System for Food and Feed (RASFF), or Alert and Cooperation Network (ACN). This paper presents an overview of the most common food fraud in Europe. During the review, data published in the public database of RASFF, i.e. Alert and Cooperation Network (ACN) in the period 2016-2024, were used. The number of requests from members of the ACN network regarding suspected fraud increased from 157 (2016) and 178 (2017) to 407 (2021), 600 (2022), and 758 (2023). In 2020, the largest number of requests were related to fats and oils, fish and fish products, and poultry meat and products. The situation was similar in 2021, with requirements related to red meat and products in third place. In 2022 and 2023, the largest number of requests were related to honey, livestock and red meat. According to RASFF, the most frequently reported food frauds in the observed period include: use of unauthorized ingredients, mislabeling, selling food after the expiration date, food not accompanied by proper documentation, food with incorrect or false import declarations, etc. Various analytical techniques are used to detect and prevent food fraud. They are mainly focused on targeted approaches for the identification of pre-selected analytes. The paper gives an overview of the most applied techniques. Although both detection methods and prevention measures related to food fraud problems have been implemented in various food supply chains, such situations continue to be reported worldwide. Competent authorities must identify (and sanction if necessary), and food business operators must mitigate and prevent food fraud.

Key words: Food fraud, ACN, RASFF, European Union

OSObine LIČNOSTI STUDENATA MEDICINSKIH I ZDRAVSTVENIH NAUKA

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Sažetak. Profesija medicinskog radnika navodi se kao humano zanimanje, uz koje se uobičajeno vezuju privrženost, odgovornost, savjesnost kao poželjne osobine ličnosti. Upravo individualne razlike u osobinama ličnosti igraju značajnu ulogu u izboru zanimanja, ali često određuju i radnu uspješnost. Takođe, usaglašenost između osobina zdravstvenih radnika i zahtjeva njihovog posla ključni su za kvalitetno pružanje zdravstvenih usluga. Cilj rada bio je sagledati distribuciju osobina ličnosti kod studenata medicinskih i zdravstvenih nauka, kao i sagledati relacije između socio-demografskih karakteristika ispitanika i osobina ličnosti. U radu smo koristili empirijsko-neeksperimentalni metod, a od instrumenata su primijenjeni BIG Five + 2 za procjenu osobina ličnosti i upitnik o socijalno-statusnim karakteristikama ispitanika. Uzorak istraživanja činilo je 277 studenata Medicinskog fakulteta u Foči. Dobijeni rezultati ukazuju da studenti najviše skorove ostvaruju na dimenziji ekstraverzije (AS=40,80; sd=8,75), otvorenosti (AS=38,95; sd=5,55), savjesnosti (AS=37,81; sd=7,12), pozitivne valence (AS=32,08; sd=7,64), a najmanje skorove na osobinama negativne valence (AS=15,70; sd=5,62), neuroticizma (AS=22,53; sd=7,89) i agresivnosti (AS=25,35; sd=8,75). Savremena istraživanja u medicinskoj profesiji ukazuju na to da je kvalitet zdravstvenih usluga oblikovan nizom faktora, te da uz tehnički i stručni aspekt profesije upravo psihološke dimenzije imaju formativnu ulogu u pružanju cjelovite i humanizirane brige za pacijente. U kontekstu unapređenja zdravstvene zaštite neophodno je provoditi kontinuirana istraživanja koja podrazumijevaju i brižljivo planiranje ljudskih resursa kao ključnog faktora uspjeha svake organizacije.

Ključne riječi: osobine ličnosti, zdravstveni radnici, studenti medicinskih i zdravstvenih nauka

PERSONALITY CHARACTERISTICS OF STUDENTS OF MEDICAL AND HEALTH SCIENCES

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Abstract. The profession of a medical worker is stated as a humane occupation, which is usually associated with attachment, responsibility, and conscientiousness as desirable personality traits. It is individual differences in personality traits that play a significant role in the choice of occupation, but often also determine work performance. Also, the compatibility between the characteristics of health workers and the demands of their work are crucial for the quality provision of health services. The aim of the work was to look at the distribution of personality traits among students of medical and health sciences, as well as to look at the relationship between the socio-demographic characteristics of the respondents and personality traits. In the work, we used an empirical-non-experimental method, and among the instruments used were the BIG Five + 2 for the assessment of personality traits and a questionnaire on the social-status characteristics of the respondents. The research sample consisted of 277 students of the Faculty of Medicine in Foča. The obtained results indicate that students achieve the highest scores on the dimension of extraversion (AS=40.80; sd=8.75), openness (AS=38.95; sd=5.55), conscientiousness (AS=37.81; sd=7.12), positive valence (AS=32.08; sd=7.64), and the lowest scores on the traits of negative valence (AS=15.70; sd=5.62), neuroticism (AS=22.53; sd=7.89) and aggressiveness (AS=25.35; sd=8.75). Contemporary research in the medical profession indicates that the quality of health services is shaped by a number of factors, and that along with the technical and professional aspect of the profession, psychological dimensions have a formative role in providing complete and humanized care for patients. In the context of improving health care, it is necessary to carry out continuous research, which also includes careful planning of human resources as a key factor in the success of any organization.

Key words: personality traits, healthcare workers, students of medical an

BILJNI PROTEINI I NJIHOVA PRIMJENA U HRANI

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Sažetak. Cilj ovog preglednog rada je usmjeren na kritički osvrt upotrebe različitih biljnih proteina i njihovu primjenu u hrani, obuhvatajući njihove tehnofunkcionalne osobine i mogućnosti razvoja novih proizvoda. Korištene metode rada su uključivale pregled literature u posljednjih 10 godina koristeći različite naučne baze (PUBMED, SCOPUS). Biljni proteini su privukli značajnu pažnju kao održiva i zdravstveno promotivna alternativa životinjskim proteinima u prehrambenoj industriji. Biljni proteini, dobijeni iz različitih izvora kao što su mahunarke, žitarice, orašasti plodovi i sjemenke, posjeduju multifunkcionalna svojstva, uključujući emulgovanje, želiranje i sposobnost zadržavanja vode, što je ključno za formulisanje hrane. Njihova primjena podržava sve veće interesovanje potrošača za biljnim, zdravim i hranjivim proizvodima, usklađenim sa ciljevima ekološke održivosti. Međutim, izazovi i dalje postoje, uključujući nepotpune profile aminokiselina, nižu svarljivost i senzorne probleme npr. ukusa pasulja, što može uticati na prihvatanje od strane potrošača i nutritivni kvalitet. Napredak u tehnikama ekstrakcije, modifikacije i miješanja poboljšao je funkcionalne performanse i nutritivnu vrijednost biljnih proteina, omogućavajući njihovu širu primjenu u zamjenama za meso, alternativnim mliječnim proizvodima, pekarskim proizvodima i grickalicama. Očekuje se da će buduće inovacije biti usmjerene na diverzifikaciju izvora proteina, poboljšanje teksture i ukusa proizvoda, kao i na primjenu novih tehnologija, na primjer precizne fermentacije i formulacije vođene vještačkom inteligencijom. Sveukupno, biljni proteini predstavljaju svestranu i važnu komponentu za razvoj održivih, zdravih i privlačnih prehrambenih proizvoda, doprinoseći globalnoj sigurnosti hrane i smanjenju uticaja na životnu sredinu. Kontinuirana interdisciplinarna istraživanja i saradnja industrije biće ključni za prevazilaženje trenutnih ograničenja i maksimalno iskorištavanje potencijala biljnih proteina u promjenjivom prehrambenom okruženju.

Ključne riječi: biljni proteini, hrana, nova hrana, cirkularna bioekonomija

PLANT PROTEINS FOR FOOD APPLICATIONS

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Abstract. This review aimed to focus on a critical literature overview of diverse plant proteins used in a food application, as well as their technofunctional properties and new product development. The involved methods included literature overview in the last 10 years by using different scientific bases (PUBMED, SCOPUS).

Plant proteins have gained significant attention as sustainable and health-promoting alternatives to animal proteins in food applications. Derived from diverse sources such as legumes, cereals, nuts, and seeds, plant proteins offer multifunctional properties including emulsification, gelation, and water-holding capacity, which are critical for food formulation. Their incorporation supports the growing consumer demand for plant-based, clean-label, and nutritious products aligned with environmental sustainability goals. However, challenges persist including incomplete amino acid profiles, lower digestibility, and sensory issues like beany flavors, which may affect consumer acceptance and nutritional quality. Advances in extraction, modification, and blending techniques have improved the functional performance and nutritional completeness of plant proteins, enabling their wider application in meat analogs, dairy alternatives, baked goods, and snacks. Future innovations are expected to focus on diversification of protein sources, enhancing product texture and flavor, and leveraging novel technologies such as precision fermentation and AI-driven formulation. Overall, plant proteins represent a versatile and essential component for the development of sustainable, healthy, and appealing food products, contributing to global food security and reduced environmental impact. Continued interdisciplinary research and industry collaboration will be pivotal to overcoming current limitations and maximizing the potential of plant proteins in the evolving food landscape.

Key words: plant proteins, food, novel food, circular bioeconomy

PITOMI KESTEN (*CASTANEA SATIVA* MILL.) KAO FUNKCIONALNA HRANA: HEMIJSKI SASTAV PLODOVA IZ PRIRODNIH POPULACIJA BOSNE I HERCEGOVINE

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Sažetak. Plod pitomog kestena (*Castanea sativa* Mill.) predstavlja značajan nutritivni resurs zahvaljujući visokom sadržaju skroba, dijetetskih vlakana, niskom udjelu masti, te prisustvu proteina i šećera. Zbog toga se sve više koristi u ljudskoj ishrani, posebno kao alternativa proizvodima koji sadrže gluten. Kesten takođe sadrži brojne minerale i bioaktivne komponente, čime dodatno doprinosi funkcionalnoj vrijednosti ishrane. Cilj ovog istraživanja bio je da se utvrdi osnovni hemijski sastav oljuštenih plodova pitomog kestena iz šest prirodnih populacija na području Bosne i Hercegovine (Prijedor, Banjaluka, Kostajnica, Konjic, Bratunac Bužim). Uzorci su analizirani na sadržaj vode, pepela, proteina, masti, skroba i ukupnih šećera. Primijenjene su standardizovane laboratorijske metode. Rezultati hemijske analize oljuštenog ploda pitomog kestena, obuhvatajući sve ispitivane populacije, pokazale su sljedeće prosječne vrijednosti: vlaga 41,6%, pepeo 1,1%, proteini 3,4%, masti 2,4%, skrob 33,2% i ukupni šećeri 6,9%. U okviru ispitivanih populacija, uzorci iz populacije Banjaluka su pokazali najviši sadržaj skroba (39,0%), dok je populacija Prijedor takođe imala visok nivo skroba (37,6%) uz povišen udio šećera (8,5%). Populacija Kostajnica se istakla najvećim sadržajem masti (3,4%) i šećera (9,9%). Populacija Konjic je karakteristična po najvišem sadržaju vode (48,1%), ali istovremeno i najnižim nivoima šećera i masti. Sadržaj pepela varirao je od 0,9% kod populacije Konjic do 1,2% kod populacija Banjaluka i Prijedor. Najviši sadržaj proteina (3,7%) zabilježen je kod populacije Bratunac. Populacija Bužim je za sva ispitivana svojstva imala vrijednosti ispod prosječnih vrijednosti. Rezultati ukazuju na prisustvo nutritivne varijabilnosti među analiziranim populacijama kestena. Ova varijabilnost može biti posljedica genetskih faktora, ali i uslova staništa. Istraživanje pruža osnovu za dalju valorizaciju plodova pitomog kestena sa aspekta prehrabene i funkcionalne vrijednosti, kao i za selekciju populacija sa poželjnim osobinama za upotrebu u prehrambenoj industriji i programima očuvanja genetičkih resursa. Ovo istraživanje doprinosi boljem razumevanju nutritivnog potencijala autohtonih populacija kestena u BiH.

Ključne riječi: pitomi kesten, skrob, šećer, nutritivni potencijal

SWEET CHESTNUT (*CASTANEA SATIVA* MILL.) AS A FUNCTIONAL FOOD: CHEMICAL COMPOSITION OF FRUITS FROM NATURAL POPULATIONS OF BOSNIA AND HERZEGOVINA

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Abstract. The sweet chestnut fruit (*Castanea sativa* Mill.) is a significant nutritional resource due to its high content of starch and dietary fiber, low fat content, and the presence of proteins and sugars. As a result, it's increasingly used in human nutrition, especially as a gluten-free alternative. Chestnuts also contain numerous minerals and bioactive components, further enhancing their functional food value. This research aimed to determine the basic chemical composition of peeled common chestnut fruits from six natural populations in Bosnia and Herzegovina (Prijedor, Banja Luka, Kostajnica, Konjic, Bratunac, Bužim). Samples were analyzed for water, ash, protein, fat, starch, and total sugar content using standardized laboratory methods. The chemical analysis of peeled common chestnut fruit from all surveyed populations revealed the following average values: moisture 41.6%, ash 1.1%, protein 3.4%, fat 2.4%, starch 33.2%, and total sugars 6.9%. Among the populations studied, samples from Banja Luka showed the highest starch content (39.0%), while Prijedor also had a high starch level (37.6%) along with elevated sugar content (8.5%). The Kostajnica population distinguished itself with the highest fat (3.4%) and sugar (9.9%) content. The Konjic population was characterized by the highest water content (48.1%), but simultaneously the lowest levels of sugars and fats. Ash content varied from 0.9% in the Konjic population to 1.2% in the Banja Luka and Prijedor populations. The highest protein content (3.7%) was recorded in the Bratunac population. The Bužim population exhibited values below the average for all analyzed properties. These results indicate significant nutritional variability among the chestnut populations, which may stem from both genetic factors and habitat conditions. This research provides a foundation for further valorization of common chestnut fruits in terms of their nutritional and functional value, as well as for selecting populations with desirable traits for use in the food industry and genetic resource conservation programs. This study contributes to a better understanding of the nutritional potential of indigenous chestnut populations in Bosnia and Herzegovina.

Key words: sweet chestnut, starch, sugar, nutritional potential

STUDENTSKA SESIJA

IV-1

**KVALITET ŽIVOTA PACIJENATA OBOLELIH OD
NEIVAZIVNOG UROTELNOG KARCINOMA MOKRAĆNE
BEŠIKE**

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Sažetak. Karcinom mokraćne bešike je deseto najčešće maligno oboljenje u svetu. Javlja se pretežno kod starijih osoba, sa medijanom starosti od 73 godine i ujedno većim rizikom od progresije u invazivnu formu bolesti. U skladu sa tim, Evropska urološka asocijacija (engl. *European Association of Urology*) starost preko 70 godina smatra nezavisnim prognostičkim faktorom. Cilj ovog istraživanja je bio proceniti nivo kvaliteta života pacijenata sa neinvazivnim karcinomom mokraćne bešike, kao i ispitati uticaj sociodemografskih karakteristika, kliničkih faktora i dužine praćenja na isti. Sprovedena je opservaciona analitička studija preseka na Klinici za urologiju Univerzitetskog kliničkog centra Vojvodine, anketiranjem 104 pacijenta (38 žena i 66 muškaraca), starosti od 37 do 87 godina, tokom redovnih uroloških kontrola. Za procenu kvaliteta života je korišćen upitnik EORTC QLQ-C30, uz analizu sociodemografskih i kliničkih parametara. Prosečan status opšteg zdravlja iznosio je 58.89/100, pri čemu su pacijenti najbolje funkcionisali u fizičkom i socijalnom domenu, dok je najniže bilo funkcionisanje u domenu životnih uloga. Najučestaliji simptomi su bili slabost, nesanica i bol, a najmanje prisutni gušenje, dijareja i mučnina. Žene su pokazale bolje fizičko funkcionisanje od muškaraca ($p < 0.05$), dok su muškarci češće imali nesanicu i gubitak apetita ($p < 0.05$). Stariji pacijenti su imali niži nivo opšteg zdravlja i fizičkog funkcionisanja ($p < 0.01$). Pacijenti imaju umeren nivo kvaliteta života, s najboljim fizičkim i socijalnim funkcionisanjem, dok se najveće poteškoće javljaju u ostvarivanju životnih uloga. Stariji pacijenti i muškarci imaju lošiji kvalitet života.

Ključne reči: kvalitet života, neinvazivni karcinom mokraćne bešike, zdravstvena nega, urologija

QUALITY OF LIFE IN PATIENTS WITH NON-MUSCLE INVASIVE BLADDER CANCER

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Abstract. Bladder cancer is the tenth most common malignancy worldwide, predominantly affecting older adults, with a median age of 73 years and a higher risk of progression to an invasive form. This study aimed to assess the quality of life in patients with non-muscle invasive bladder cancer (NMIBC) and evaluate the impact of sociodemographic characteristics, clinical factors, and follow-up duration. A cross-sectional observational analytical study was conducted at the Clinic of Urology, University Clinical Center of Vojvodina, including 104 patients (aged 37–87 years, using the EORTC QLQ-C30 questionnaire. The average general health status was 58.89/100, with the highest functioning observed in the physical and social domains, while role functioning was the lowest. The most common symptoms were fatigue, insomnia, and pain, whereas dyspnea, diarrhea, and nausea were the least reported. Women had better physical functioning than men ($p < 0.05$). Older patients had lower general health status and physical functioning ($p < 0.01$). Patients exhibit a moderate quality of life, with the highest scores in physical and social functioning, while the greatest challenges occur in role functioning. Older and male patients report a lower quality of life.

Keywords: quality of life, non-muscle invasive bladder cancer, nursing, urology

ISHRANA U RAZVOJU ALCHAJMEROVE BOLESTI – LEK ILI OTROV?

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Sažetak. Alchajmerova bolest (AB) je najčešća forma demencije, koja se klinički manifestuje pogoršanjem kognitivnih funkcija, prvenstveno pamćenja. Krajnji ishod bolesti predstavlja potpuna izmena ličnosti i poteškoće u obavljanju svakodnevnih aktivnosti. Prevalenca AB iznosi preko 30% kod starijih od 85 godina. Zbog sve većeg broja obolelih od AB i nedostatka adekvatne farmakološke terapije, pažnja se usmerava na preventivne strategije, te je cilj ovog preglednog rada bio da se ispita uticaj ishrane na brzinu razvoja AB na osnovu dostupne literature. Akcenat je stavljen na identifikaciju nutritivnih faktora koji učestvuju u modulaciji neurodegenerativnih procesa karakterističnih za AB. Analiza je zasnovana na podacima iz naučnih radova referisanih u bazama podataka *PubMed*, *Science Direct*, *Scopus* i *MEDLINE*. Pretraga literature je sprovedena na osnovu ključnih reči: „Alchajmerova bolest“, „ishrana“, „nutrijenti“, „mikrobiota“, „neurodegeneracija“. Istraživanja su potvrdila jasnu povezanost disbioze — u pravcu porasta proinflamatornih bakterijskih sojeva — sa nepravilnom ishranom, koja se smatra jednim od ključnih faktora u organizaciji intestinalnog mikrobioma, kao i sa neracionalnom primenom antibiotika. U skladu sa tim, korekcija promenljivih faktora rizika se pokazala kao najefikasniji način prevencije razvoja AB. Postoji veliko interesovanje za izučavanje uticaja mediteranske i DASH ishrane (engl. *Dietary approaches to stop hypertension*) na tok AB, zbog dokazanih antiinflamatornih svojstava. Takođe, vrlo su aktuelna istraživanja o izolovanom efektu pojedinih nutrijenata na kognitivne funkcije i razvoj AB kao što su grupe antioksidantnih, primarno neantioksidantnih i fitonutrijenata. Način ishrane može imati značajan uticaj na opšte zdravstveno stanje pojedinca, a pravilni nutritivni obrasci mogu doprineti prevenciji ili usporavanju razvoja AB.

Ključne reči: Alchajmerova bolest, neurodegeneracija, ishrana, nutritivni faktori, prevencija

NUTRITION IN THE DEVELOPMENT OF ALZHEIMER'S DEMENTIA—MEDICINE OR POISON?

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Abstract. The most common form of dementia, Alzheimer's dementia (AD) is the most prevalent form of dementia, clinically characterized by a decline in cognitive functions, particularly memory. The progression of the disease often leads to profound personality changes and difficulties in performing daily activities. The prevalence of AD exceeds 30% among individuals over 85 years of age. Given the rising number of patients diagnosed with Alzheimer's disease and the absence of effective pharmacological treatments, there is a growing focus on preventive strategies. This review aims to explore the impact of nutrition on the progression of AD development, drawing from the existing literature. It emphasizes the identification of nutritional factors that influence the neurodegenerative processes associated with AD. The analysis is based on data from articles indexed in PubMed, ScienceDirect, Scopus, and MEDLINE databases. A literature search was conducted based on the keywords: "Alzheimer's disease", "nutrition", "nutrients", "microbiota", and "neurodegeneration". Research has confirmed a clear connection between dysbiosis — in the direction of an increase in pro-inflammatory bacterial strains — with improper nutrition, which is considered one of the key factors in the organization of the intestinal microbiome, as well as with the irrational use of antibiotics. Therefore, addressing modifiable risk factors is the most effective strategy for preventing the onset of AD. There is significant interest in investigating the effects of the Mediterranean and DASH (Dietary Approaches to Stop Hypertension) diets on the progression of AD, owing to their established anti-inflammatory properties. Current research is also focused on the isolated effects of specific nutrients on cognitive functions and the development of AD, including various groups of antioxidants, non-antioxidants, and phytonutrients. Overall, diet plays a crucial role in an individual's overall health, and adopting appropriate nutritional habits may help prevent or slow the progression of Alzheimer's disease.

Key words: Alzheimer's disease, dementia, neurodegeneration, nutrition, nutritional factors, prevention

IV-3

**PROCES ZDRAVSTVENE NJEGE KOD BOLESNIKA S
IMPLANTIRANIM CENTRALNIM VENOZNIM KATETEROM-
PRIKAZ SLUČAJA**

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Sažetak. Proces zdravstvene njege je metoda koja omogućuje sistematizirano, logično te racionalno praćenje bolesnikova opšteg stanja, te omogućuje izradu plana zdravstvene njege koji treba poboljšati rješavanje aktuelnih bolesnikovih zdravstvenih tegoba. U radu cilj je prikazati upotrebu metoda/postupaka zdravstvene njege kod bolesnika s implantiranim centralnim venoznim kateterom, indikacije za provođenje specifičnih metoda/postupaka zdravstvene njege, definisanje ciljeva i metode izbora za specifične metode zdravstvene njege, te problemi s kojima se medicinska sestra susreće u izvršavanju svakodnevnih radnih zadataka. Opisivanjem metoda/postupaka zdravstvene njege iznalazi se metodologija za stvaranje planova koji su u direktnoj vezi s poboljšanjem kliničkog statusa bolesnika i rješavanja aktualnih tegoba bolesnika. Endovenozni kateter može se upotrebljavati kao privremena metoda, a rjeđe i trajno (s potkožnim ugrađenim jastučićem). Privremeni kateter se postavlja u slučaju nemogućnosti nativnog pristupa krvotoku (kreiranje arterio-venske fistule) ili u slučajevima nemogućnosti punkcije formiranje arteriovenske fistule (AV-fi stula). Kod pacijenta su definisane aktuelne i potencijalne sestrinske dijagnoze, I provedene brojne intervencije, a cilj je djelimično postignut. Pacijent je krvario nakon postavljanja endovenoznog katetera. Primijenjene su intervencije i krvarenje je zaustavljeno. Prevencija, postupanje prema protokolima zdravstvene njege centralnih endovenoznih katetera značajno smanjuju pojavu infekcija, te posljedično i nastanak najtežih komplikacija i nepotrebnih troškova liječenja. Holistički pristup u provođenju zdravstvene njege unapređuje kvalitetu provođenja iste.

Ključne riječi: proces zdravstvene njege, bolesnik, centralni venozni kateter, zdravstvena njega.

HEALTH CARE PROCESS IN PATIENTS WITH AN IMPLANTED CENTRAL VENOUS CATHETER - CASE REPORT

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Abstract. The health care process is a method that enables systematized, logical and rational monitoring of the patient's general condition, and enables the creation of a health care plan that should improve the resolution of the patient's current health problems. The aim of the paper is to show the use of health care methods/procedures in patients with an implanted central venous catheter, indications for the implementation of specific health care methods/procedures, definition of goals and selection methods for specific health care methods, and problems faced by nurses in performing daily work tasks. By describing the methods/procedures of health care, a methodology is found for creating plans that are directly related to improving the clinical status of the patient and solving the patient's current problems. An endovenous catheter can be used as a temporary method, and less often permanently (with a subcutaneous implanted pad). A temporary catheter is placed in case of impossibility of native access to the bloodstream (arterio-venous fistula creation) or in cases of impossibility of puncture, formation of arteriovenous fistula (AV fistula). Current and potential nursing diagnoses were defined for the patient, and numerous interventions were carried out, and the goal was partially achieved. The patient was bleeding after placement of an endovenous catheter. Interventions were applied and the bleeding was stopped. Prevention, treatment according to the health care protocols of central endovenous catheters significantly reduce the occurrence of infections, and consequently the occurrence of the most serious complications and unnecessary treatment costs. A holistic approach in the implementation of health care improves the quality of its implementation.

Key words: health care process, patient, central venous catheter, health care.

UTICAJ OBRAZOVANJA NA FORMIRANJE STAVOVA STUDENTICA PREMA TRUDNOĆI

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Sažetak. Nivo obrazovanja utiče na odgovornost, informisanost i percepciju trudnoće kao jednog od životnih događaja. Trudnoća je važan segment reproduktivnog zdravlja žene, a stavovi se oblikuju kroz različite društvene i obrazovne uticaje. Cilj ovog istraživanja je bio ispitati da li nivo obrazovanja utiče na stavove studentica prema trudnoći. Istraživanje je sprovedeno kvantitativnom metodom koristeći online anketu koja je sadržavala 20 pitanja, a ukupno je prikupljeno 98 odgovora. Anketa je bila anonimna i dobrovoljna, a učestvovala su isključivo studentice starosti do 25 godina i različitih godina studija. Rezultati su pokazali da 45% ispitanika smatra da je obrazovanje značajno uticalo na njihov stav o planiranju trudnoće, a kao najznačajniji faktori prilikom planiranja trudnoće obuhvatali su odgovore kao što su finansijska stabilnost, zdravstveno stanje i starosna dob. Čak 53% studentica izjavilo je da bi odložile trudnoću zbog obrazovanja te da se njih 55% još uvijek ne osjeća dovoljno socioekonomski, psihološki zrelo da bi bile u ulozi roditelja i emocionalno stabilno da bi bile u ulozi roditelja. Opciju prekida neplanirane trudnoće tokom studija odbilo bi 52% studentica dok bi 16.3% pristalo na abortus. Iz istraživanja se može zaključiti da većina posjeduje samosvijest o svom trenutnom ekonomskom i emocionalnom stanju, zbog čega ne razmatra trudnoću kao trenutnu odluku. Da bi obrazovanje doprinijelo boljem roditeljstvu složilo se 90.8% studentica. Obrazovanje značajno utiče na formiranje stavova o planiranju trudnoće. Obrazovanje značajno utiče na formiranje stavova o planiranju trudnoće, što se dugoročno odražava na zdrave i dobro pripremljene buduće majke, a svakako i lakši prolazak kroz trudnoću i prihvatanje nove uloge.

Ključne riječi: trudnoća, obrazovanje, studentice, reproduktivno zdravlje

THE EFFECT OF EDUCATION ON THE FORMATION OF STUDENTS' ATTITUDES TOWARD PREGNANCY

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Abstract. The level of education influences responsibility, awareness and perception of pregnancy as a life event. Pregnancy is an important segment of a woman's reproductive health, and attitudes are shaped through different social and educational influences. The aim of this research was to examine whether the level of education affects the attitudes of students towards pregnancy. The research was conducted using a quantitative method using an online survey that contained 20 questions, and a total of 98 responses were collected. The survey was anonymous and voluntary, and only female students up to 25 years of age and in different years of study participated. The results showed that 45% of the respondents believed that education had a significant impact on their attitude towards pregnancy planning, and the most important factors when planning a pregnancy included answers such as financial stability, health status and old age assets. As many as 53% of students stated that they would delay pregnancy for the sake of education and that 55% of them still do not feel socioeconomically, psychologically mature enough to be in the role of parents and emotionally stable to be in the role of parents. The option of terminating an unplanned pregnancy during studies would reduce 52% of students, while 16.3% would have an abortion. The research shows that the majority are self-aware of their current economic and emotional state, which is why they do not consider pregnancy as an immediate decision. 90.8% of the students agreed that education would contribute to better parenting. Education has a significant impact on the formation of attitudes about pregnancy planning. Education significantly affects the formation of attitudes about pregnancy planning, which in the long term affects the health and well-prepared future mothers, and certainly makes it easier to go through pregnancy and accept a new role.

Key words: pregnancy, education, female students, reproductive health

KOMUNIKACIJA NA ČETIRI NOGE - MOBING

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Sažetak. Komunikacija je mnogo značajna za sve profesije, a sestrinstvo posebno. Nažalost, u svakodnevnici pored asertivne komunikacije, aktuelna je i komunikacija na četiri noge. Cilj ovog rada bio je prikazati aktivnosti i postupke tokom komunikacije na četiri noge. Riječ mobing potiče od engleskog glagola to mob – što u prevodu na srpski jezik znači – bučno navaliti, nasrnuti u masi i riječi mobbish – prostački, grubo, agresivno. Zbog visoke učestalosti i dugog trajanja neprijateljskog ponašanja to maltretiranje dovodi do značajne mentalne, psihosomatske i socijalne patnje. Jedan od najvidljivijih načina na koje mobbing utječe na motivaciju je smanjenje samopouzdanja žrtve. Neprestano kritikovanje i ponižavanje dovode do toga da osoba počne sumnjati u vlastite sposobnosti. Gubitak vjere u sebe može uzrokovati pad motivacije jer osoba više ne vidi smisao u trudu koji ulaže u svoj posao. Prvi korak u rješavanju takve situacije može biti traženje podrške od nadređenih, kolega ili stručnjaka za ljudske resurse. Otvorena komunikacija o problemu ključna je za rješavanje situacije. Također, osobe koje doživljavaju mobbing trebaju potražiti profesionalnu pomoć kako bi se nosile s emocionalnim posljedicama. Osim svih navedenih načina rješavanja situacije, ukoliko ništa drugo ne pomaže, postoji i mogućnost sudskog postupka. Mobing može da traje samo dokle mu se dozvoli da traje. Organizacija i njeni menadžeri igraju najbitniju ulogu u njegovoj prevenciji. Kroz postavljanje i održavanje visokih etičkih normi i standarda, u okviru pozitivnog i podstičućeg organizacionog okruženja, mobing se neće ispoljiti.

Ključne riječi: mobing, prevencija, komunikacija, motivacija.

COMMUNICATION ON FOUR LEGS – MOBING

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Abstract. Communication is very important for all professions, and nursing in particular. Unfortunately, in everyday life, in addition to assertive communication, communication on four legs is also current. The aim of this work was to show activities and procedures during communication on four legs. The word mobbing comes from the English verb to mob - which translated into Serbian means - to rush noisily, attack in a crowd and the word mobbish - vulgar, rude, aggressive. Due to the high frequency and long duration of hostile behavior, this mistreatment leads to significant mental, psychosomatic and social suffering. One of the most visible ways in which mobbing affects motivation is by reducing the self-confidence of the victim. Constant criticism and humiliation lead to a person starting to doubt his own abilities. Loss of self-belief can cause a drop in motivation because a person no longer sees the meaning in the effort he invests in his work. The first step in dealing with such a situation may be to seek support from superiors, colleagues or HR professionals. Open communication about the problem is key to resolving the situation. Also, people who experience mobbing should seek professional help to deal with the emotional consequences. Apart from all the mentioned ways of solving the situation, if nothing else helps, there is also the possibility of court proceedings. Mobbing can only last as long as it is allowed to last. The organization and its managers play the most important role in its prevention. By establishing and maintaining high ethical norms and standards, within a positive and encouraging organizational environment, mobbing will not occur.

Keywords: mobbing, prevention, communication, motivation.

IV-6

ANTIOKSIDATIVNA AKTIVNOST ETANOLNIH EKSTRAKATA SEMENA GROŽĐA IZ MAKEDONSKOG VRANCA (*Vitis vinifera* L.)

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Sažetak. Grožđe (*Vitis vinifera* L.) je jedno od najzastupljenijih voća u svetu. Uzgoj i prerada grožđa podrazumevaju proizvodnju velikih količina nusproizvoda, kao što su komine grožđa, seme, kožica, stabljika i list. Seme grožđa sadrži vredne bioaktivne komponente kao što su masne kiseline, vitamini, fitosteroli i fenoli. Fenoli, naročito, predstavljaju prirodne antioksidante koji su u velikim količinama prisutni u semenu grožđa i njegovim ekstraktima. Cilj ovog istraživanja bio je da se odredi hemijski sastav i antioksidativna aktivnost etanolnih ekstrakata semena grožđa (Vranec, istočna Makedonija) nakon izolacije masnog ulja. Seme grožđa je obezmašćeno Soxhlet ekstrakcijom sa n-hexanom, a preostali biljni materijal je korišćen za ekstrakciju. Ekstrakti su dobijeni ultrazvučnom i refluks ekstrakcijom 96%-im V/V etanolom. Hemijski sastav ekstrakata određen je UHPLC-DAD-MS/MS analizom. Antioksidativni potencijal procenjen je primenom DPPH testa. Prinos ekstraktivnih materija u dobijenim ultrazvučnom i refluks ekstraktima iznosio je 1,96 i 3,39 g na 100 g biljnog materijala, respektivno. U oba ekstrakta određeno je 31 komponenta, dok su četiri komponente identifikovane (šikimska kiselina, galna kiselina, katehin i epikatehin). Ekstrakt dobijen refluks ekstrakcijom je pokazao bolju antioksidativnu aktivnost. Koncentracije ekstrakta dobijenih refluks i ultrazvučnom ekstrakcijom koje su bile potrebne za neutralisanje 50% početne koncentracije DPPH radikala (EC₅₀ vrednosti) iznosile su 0,064 mg/ml, odnosno 0,178 mg/ml. Dobijeni rezultati ukazuju na moguću primenu ekstrakata semena grožđa (kao nusproizvoda) u prehrambenoj i farmaceutskoj industriji kao obećavajućeg izvora prirodnih antioksidanasa.

Ključne riječi: *Vitis vinifera* L., Makedonski vranac, etanolni ekstrakti semena grožđa, hemijski sastav, antioksidativna aktivnost

Zahvalnice: Ovaj rad je podržan od strane Ministarstva nauke, tehnološkog razvoja i inovacija Republike Srbije kroz program finansiranja naučno-istraživačkog rada, broj 451-03-137/2025-03/200133 i 451-03-136/2025-03/200133.

ANTIOXIDANT ACTIVITY OF GRAPE SEED ETHANOLIC EXTRACTS FROM MACEDONIAN VRANEC (*Vitis vinifera* L.)

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Abstract. Grape (*Vitis vinifera* L.) is one of the most widely grown fruit in the world. The cultivation and processing of grapes involves the production of large quantities of *by-products* such as grape marc, seed, skin, stem and leaf. Grape seeds contain valuable bioactive compounds such as fatty acids, vitamins, phytosterols, and phenols. Phenols, in particular, are natural antioxidants abundantly present in grape seeds and their extracts. The aim of this study was to determine the chemical composition and antioxidant activity of ethanolic extracts of grape (Vranec, Eastern Macedonia) seed after the isolation of fatty oil. The grape seeds were defatted by Soxhlet extraction with n-hexane, and the remaining plant material was used for extraction. The extracts were obtained by ultrasonic and reflux extraction with 96% V/V ethanol. The chemical composition of extracts was determined by UHPLC-DAD-MS/MS analysis. Antioxidant potential was estimated using the DPPH assay. The yield of extractive matter in the obtained ultrasonic and reflux extracts was 1.96 and 3.39 g per 100 g of plant material, respectively. In both extracts were determined 31 components, while the four components were identified (shikimic acid, gallic acid, catechin and epicatechin). The reflux extract showed better antioxidant activity. The concentrations of reflux and ultrasonic extract required to neutralize 50% of the initial concentration of DPPH radicals (EC₅₀ value) were 0.064 mg/ml and 0.178 mg/ml, respectively. The obtained results indicate possible application of grape seed extracts (as *by-products*) in the food and pharmaceutical industries as a promising source of natural antioxidants.

Key words: *Vitis vinifera* L., Macedonian vranec, Grape seed ethanolic extracts, Chemical composition, Antioxidant activity

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ANTIINFLAMATORNA AKTIVNOST HIDROLATA LISTOVA LOVORA (*Laurus nobilis* L.)

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Sažetak. Lovor (*Laurus nobilis* L.) je aromatična zimzelena biljka iz porodice Lauraceae. List lovora se široko koristi kao začín i aroma u pripremi hrane. Takođe se koristi u farmaceutskoj i kozmetičkoj industriji zbog svojih antibakterijskih, antifungalnih, antioksidativnih, antidijabetičkih i citotoksičnih aktivnosti. Sadržaj etarskog ulja u listu lovora iznosi oko 1,5%. Najzastupljeniji sastojci etarskog ulja lovora su oksigenovani monoterpeni (1,8-cineol i α -terpinil-acetat), a zatim monoterpenski ugljovodonici i fenilpropanoidna jedinjenja. Inflamacija (upala) je biološki imunološki odgovor koji može biti izazvan različitim faktorima kao što su patogeni, oštećene ćelije i toksične supstance. Cilj ovog istraživanja bio je da se odrede ukupni sadržaj fenola i flavonoida u hidrolatu listova lovora, nusproizvodu hidrodistilacije, kao i njegova *in vitro* antiinflamatorna aktivnost. Hidrolat (voden faza suspenzije) je odvojen nakon izolacije etarskog ulja iz listova lovora (*Laurus nobilis* L., Lauraceae, Vitamin, Horgoš, Srbija). Ukupni sadržaj fenola i flavonoida je određen prema Folin-Ciocalteu metodi i reakcijom kompleksiranja sa $AlCl_3$, respektivno. Antiinflamatorna aktivnost hidrolata procenjena je pomoću testa sa goveđim serumskim albuminom (BSA). UHPLC hromatografija hidrolata listova lovora detektovala je 31 komponentu, od kojih je 27 identifikovano. Identifikovane komponente pripadaju grupi fenolnih jedinjenja, pretežno fenolnim kiselinama, flavonoidima i njihovim derivatima. Hidrolat je pokazao antiinflamatornu aktivnost prema BSA testu od $73,43 \pm 0,02\%$. Ova aktivnost je najverovatnije rezultat prisutnosti fenolnih jedinjenja u hidrolatu. Dobijeni rezultati su posebno značajni, s obzirom na to da je lovorov hidrolat nusproizvod hidrodistilacije, a na osnovu dobijenih rezultata, on predstavlja izvor izuzetno vrednih bioaktivnih komponenti sa antiinflamatornim delovanjem. Ipak, potrebna su dalja *in vitro* istraživanja kako bi se stekao sveobuhvatan uvid u antiinflamatorne mehanizme hidrolata. Pored toga, buduća istraživanja treba da se fokusiraju na analizu kvantitativnog sastava hidrolata i na antiinflamatornu aktivnost njihovih pojedinačnih komponenti.

Ključne reči: *Laurus nobilis* L., hidrolat, antiinflamatorna aktivnost

Zahvalnice: Ovaj rad je podržan od strane Ministarstva nauke, tehnološkog razvoja i inovacija Republike Srbije kroz program finansiranja naučno-istraživačkog rada, broj 451-03-137/2025-03/200133 i 451-03-136/2025-03/200133.

ANTI-INFLAMMATORY ACTIVITY OF LAUREL (*Laurus nobilis* L.) LEAVES HYDROLATE

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Abstract. Laurel (*Laurus nobilis* L.) is an aromatic evergreen plant from the Lauraceae family. Laurel leaf is widely used as a spice and a flavoring agent in food preparation. It is also used in the pharmaceutical and cosmetic industry, due to its antibacterial, antifungal, antioxidant, antidiabetic and cytotoxic activities. The content of essential oil in the laurel leaf is about 1.5%. The most abundant components in laurel leaf essential oil are oxidized monoterpenes (1,8-cineole and α -terpinyl-acetate), followed by monoterpene hydrocarbons and phenylpropanoid compounds. Inflammation is a biological immune response that can be triggered by a number of factors such as pathogens, damaged cells, and toxic compounds. The aim of this study was to determine the total phenolic and total flavonoid contents of laurel leaves hydrolate a by-product of hydrodistillation, as well as its *in vitro* anti-inflammatory activity. The hydrolate (the aqueous phase of the suspension) was separated after essential oil isolation from leaves of laurel (*Laurus nobilis* L., Lauraceae, Vitamin, Horgoš, Serbia). The total phenolic and total flavonoid contents were determined according to the Folin-Ciocalteu method and by the complexation reaction with $AlCl_3$, respectively. The anti-inflammatory activity of hydrolate was estimated by using the Bovine Serum Albumin (BSA) assay. UHPLC chromatography of bay leaves hydrolate detected 31 components, of which 27 were identified. The identified components belong to the group of phenolic compounds, mainly phenolic acids and flavonoids and their derivatives. The hydrolate showed anti-inflammatory activity obtained by BSA assay of $73.43 \pm 0.02\%$. This activity is most likely due to the presence of phenolic compounds in the hydrolate. The obtained results are particularly significant, considering that the laurel hydrolate is a by-product of hydrodistillation, and based on the obtained results, it represents a source of highly valuable bioactive components with anti-inflammatory activity. However, further *in vitro* studies are necessary to provide a comprehensive understanding of the anti-inflammatory mechanisms of hydrolate. Furthermore, future research should focus on the analysis of the quantitative composition of the hydrolate and the anti-inflammatory activity of its individual components.

Key words: *Laurus nobilis* L., Hydrolate, Anti-inflammatory activity

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UČESTALOST IZOLACIJE BAKTERIJE *STAPHYLOCOCCUS AUREUS* IZ BRISEVA NOSA STUDENATA VIŠKE MEDICINSKE ŠKOLE U PRIJEDORU

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Sažetak. *Staphylococcus aureus* je gram-pozitivna bakterija, koja je jedan od najčešćih izazivača humanih infekcija. Kod kliconoša može naseljavati sluznicu nosa i te osobe predstavljaju rezervoar ove bakterije, pa je mogu prenijeti na osobe sa kojima rade i žive. Cilj rada je bio da se ispita koliko su studenti Visoke medicinske škole u Prijedoru kolonizovani ovom bakterijom na sluznici nosa. U istraživanju je učestvovalo 30 ispitanika, koji studiraju na Visokoj medicinskoj školi u Prijedoru, kao redovni i vanredni studenti zdravstvene njege (1. godina) i sanitarno inženjerstvo (4. godina). Studenti su potpisali informisani pristanak i svima je uzet bris nosa. Bris je zasijan na krvni agar i inkubiran na 37°C tokom 24 sata. Nakon inkubacije specifične kolonije zlatno žute boje su ispitane katalaza testom i presijane na Baird-Parker agar za identifikaciju *Staphylococcus aureus*. Od ukupno 30 ispitanika, *Staphylococcus aureus* je izolovan kod 13 (43%) studenata, od koji su 2 (7%) redovni studenti (od ukupno 6), a ostalih 11 (36%) su vanredni studenti (od ukupno 24) koji su zaposleni u zdravstvenim ustanovama kao medicinski tehničari. Prema polu, bilo je zastupljeno 5 muških ispitanika i 25 ženskih, starosti od 21 do 47 godina. Nije uočena statistički značajna razlika u učestalosti izolacije *Staphylococcus aureus* kod redovnih i vanrednih studenata (Fišerov test, $p=0,67$). Iako nije uočena statistički značajna razlika u učestalosti izolacije *Staphylococcus aureus* iz brisa nosa između redovnih i vanrednih studenata, ipak veći značaj treba dati kolonizaciji vanrednih studenata koji su zaposleni u zdravstvenim ustanovama i mogu biti rezervoar ove bakterije.

Ključne riječi: *Staphylococcus aureus*, bris nosa, kliconoštvo

FREQUENCY OF *STAPHYLOCOCCUS AUREUS* ISOLATION FROM NOSE SWABS OF THE STUDENTS OF THE COLLEGE OF HEALTH SCIENCES PRIJEDOR

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Abstract. *Staphylococcus aureus* is a gram-positive bacterium, which is one of the most common causes of human infections. In human carriers who serves as a reservoir of this bacteria, *Staphylococcus aureus* colonize the mucous membrane of the nose, so they can transmit it to the people they work and live with. The aim of the work was to examine how many students of the Medical School in Prijedor are colonized with this bacteria in the nasal mucosa. In this study, 30 students were included, who are studying at the Medical School in Prijedor, as regular and part-time students of health care (1st year) and sanitary engineering (4th year). The students signed an informed consent and have taken a nose swab. The swabs were cultivated on blood agar and incubated at 37°C for 24 hours. After incubation, specific colonies of golden yellow color were tested by catalase test and inoculated on Baird-Parker agar for identification of *Staphylococcus aureus*. Out of a total of 30 subjects, *Staphylococcus aureus* was isolated from 13 (43%) students, of which 2 (7%) are full-time students (out of a total of 6), and the other 11 (36%) are part-time students (out of a total of 24) who are employed in healthcare institutions as medical technicians. According to gender, there were 5 male respondents and 25 female respondents, aged from 21 to 47 years. No statistically significant difference was observed in the frequency of isolation of *Staphylococcus aureus* in full-time and part-time students (Fisher's test, $p=0.67$). Although no statistically significant difference was observed in the frequency of isolation of *Staphylococcus aureus* from nasal swabs between full-time and part-time students, more importance should be given to the colonization of part-time students who are employed in health institutions and can be a reservoir of this bacterium.

Key words: *Staphylococcus aureus*, nose swab, carriers

ISTORIJSKI PRIKAZ RAZVOJA VAKCINACIJE DO KRAJA 19 VIJEKA

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Sažetak. Imunizacija je proces u kome je osoba, zbog primljene vakcine, imuna ili otporna na infektivnu bolest. Priča o vakcinaciji ne počinje od prve medicinski uokvirene vakcine Edvarda Jennera, već shvatanjem o rizicima zaraznih bolesti kod ljudi u davnim vremenima i pokušajima da se obezbijedi imunitet prema toj bolesti. Postoje saznanja da je četiristote godine prije nove ere, Hipokrat opisao zauške, difteriju, epidemiju žuticu i druga stanja, a da su već oko 1100 godine nove ere u Turskoj, Kini, mnogim afričkim zemljama i ponegdje u Evropi bile razvijene tehnike variolacije koje su uključivala inokulaciju djece i odraslih osušenim materijalom iz krasta dobijenim od pacijenata s velikim boginjama. Ovaj rad ima za cilj da sistematično predstavi događaje koji su uticali na razvoj procesa donošenja zakona ili uredbi o obavezi masovne imunizacije ljudi do kraja 19 vijeka. Zahvaljujući svijesti znamenitih ljudi tadašnjeg vremena, o rizicima širenja epidemija teških zaraznih bolesti, razne tehnike variolacije iz mnogih dalekih zemalja starog svijeta donesene su u Evropu i Ameriku. Time je podstaknut rad na medicinskim tehnikama kojim bi se spriječila pojava smrtno opasnih zaraznih bolesti što je dovelo do prvog ozbiljnog zakona koji je definisao vakcinaciju u Virdžiniji 1792 godine, a uključivao je kaznu u iznosu od 1.500 dolara ili šest mjeseci zatvora za svakoga ko namjerno širi velike boginje na način koji nije određen zakonom. Neki od tih znamenitih ljudi su: gospođa Mary Wortley Montagu supruga engleskog ambasador u Turskoj, engleski ljekar Charles Maitland, pronalazač iz 17 vijeka Benjamin Franklin, škotski ljekar Francis Home, ruska carica Katarina Velika, engleski ljekar Thomas Dimsdale kao i Džordž Vašington tadašnji komandant kontinentalne vojske u građanskom ratu u SAD. Nakon 1888. godine i osnivanja Instituta Paster u Parizu, počinje era uvođenja javno zdravstvenih zakona koji u svom sastavu imaju i segment vezan za obaveznu, preporučenu ili apsolutno dobrovoljnu imunizaciju čime počinje moderno doba u imunizaciji ljudi.

Ključne riječi: zarazne bolesti, variolacija, Jenner, vakcinacija, zakoni

HISTORICAL OVERVIEW OF THE DEVELOPMENT OF VACCINATION UNTIL THE END OF THE 19th CENTURY

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Abstract. Immunization is the process by which a person, due to a vaccine received, is immune or resistant to an infectious disease. The story of vaccination does not begin with the first medically framed vaccine by Edward Jenner, but with the understanding of the risks of infectious diseases in humans in ancient times and attempts to provide immunity to that disease. There is knowledge that in the fourth century BC, Hippocrates described mumps, diphtheria, epidemic jaundice and other conditions, and that by around 1100 AD, variolation techniques had been developed in Turkey, China, many African countries and some parts of Europe, which involved inoculating children and adults with dried scab material obtained from smallpox patients. This paper aims to systematically present the events that influenced the development of the process of passing laws or regulations on the obligation of mass immunization of people by the end of the 19th century. Thanks to the awareness of prominent people of that time, about the risks of spreading epidemics of serious infectious diseases, various techniques of variolation from many distant countries of the Old World were brought to Europe and America. This stimulated work on medical techniques to prevent the occurrence of deadly infectious diseases, which led to the first serious law defining vaccination in Virginia in 1792, which included a fine of \$ 1,500 or six months in prison for anyone who deliberately spread smallpox in a way not specified by law. Some of these prominent people are: Mrs. Mary Wortley Montagu, wife of the English ambassador to Turkey, English physician Charles Maitland, 17th century inventor Benjamin Franklin, Scottish physician Francis Home, Russian Empress Catherine the Great, English physician Thomas Dimsdale, as well as George Washington, then commander of the Continental Army in the US Civil War. After 1888 and the founding of the Pasteur Institute in Paris, the era of introducing public health laws began, which included a segment related to mandatory, recommended or absolutely voluntary immunization, thus beginning the modern era in human immunization.

Keywords: infectious diseases, variolation, Jenner, vaccination, laws

GASTROENTEROLOŠKI UZROCI SIDEROPENIJSKE ANEMIJE KOD BOLESNIKA BEZ MANIFESTNOG GASTROINTESTINALNOG KRVARENJA

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Sažetak. Sideropenijska anemija je najčešća nutritivna deficijencija u svetu. Gastrointestinalne lezije su značajan uzrok sideropenijske anemije kod odraslih, čak i u odsustvu manifestnog krvarenja. Cilj istraživanja bio je utvrditi najčešće uzroke, lokalizaciju i prirodu lezija gastrointestinalnog trakta kod bolesnika sa sideropenijskom anemijom bez znakova manifestnog krvarenja. Retrospektivna studija obuhvatila je 192 hospitalizovana pacijenta iz 2021. godine, bez kliničkih znakova gastrointestinalnog ili ekstraintestinalnog krvarenja. Svi su podvrgnuti endoskopskim i/ili radiološkim ispitivanjima uz laboratorijsku procenu statusa gvožđa. Lezije gastrointestinalnog trakta identifikovane su kao uzrok anemije kod 81,3% ispitanika. Gornji gastrointestinalni uzroci bili su prisutni kod 39% pacijenata (hižatalna hernija 25%, ulkusna bolest 19,2%, angiodisplazije 21,2%), donji uzroci kod 43% (divertikuloza 24%, hemoroidi 24%, karcinom kolona 21,2%), dok su sinhronne lezije zabeležene kod 8,3% pacijenata. Kod 25,5% bolesnika gastroenterološki uzrok nije utvrđen. Nije bilo značajnih razlika u lokalizaciji lezija prema polu ili starosnoj grupi. Zaključak je da se u većini slučajeva sideropenijske anemije bez manifestnog krvarenja etiologija nalazi u gastrointestinalnom traktu, sa nešto većom učestalošću lezija donjih delova. Bidirekciona endoskopija predstavlja ključ za pravovremenu dijagnozu i lečenje.

Ključne riječi: sideropenijska anemija, gastrointestinalne lezije, endoskopija, kolonoskopija, hižatalna hernija

GASTROENTEROLOGICAL CAUSES OF IRON DEFICIENCY ANEMIA IN PATIENTS WITHOUT OVERT GASTROINTESTINAL BLEEDING

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Abstract. Iron deficiency anemia (IDA) is the most common nutritional deficiency worldwide. Gastrointestinal lesions represent a significant cause of IDA in adults even without overt bleeding. The aim of this study was to determine the most common causes, localization, and nature of gastrointestinal lesions in patients with IDA without overt bleeding. A retrospective observational study included 192 hospitalized patients in 2021, without clinical signs of gastrointestinal or extraintestinal bleeding. All patients underwent endoscopic and/or radiological evaluation alongside laboratory assessment of iron status. Gastrointestinal lesions were identified as the cause of anemia in 81.3% of patients. Upper GI causes were found in 39% (hiatal hernia 25%, peptic ulcer disease 19.2%, angiodysplasia 21.2%), lower GI causes in 43% (diverticulosis 24%, hemorrhoids 24%, colorectal cancer 21.2%), and synchronous lesions in 8.3%. No gastrointestinal cause was found in 25.5% of patients. There were no significant differences in lesion localization by sex or age group. The conclusion is that in most patients with IDA without overt bleeding, the etiology lies within the gastrointestinal tract, with a slightly higher frequency of lower GI lesions. Bidirectional endoscopy is essential for timely diagnosis and treatment.

Key words: iron deficiency anemia, gastrointestinal lesions, endoscopy, colonoscopy, hiatal hernia

INDEKS AUTORA / INDEX OF AUTHORS

A

Adamović A. 73, 74
Alekovski S. 165, 166
Aleksandrić J. 73, 74
Aleksopoulos H. 73, 74
Alić N. 81, 82
Andrijević Lj. 67, 68
Antunović V. 131,
132, 141, 142, 143,
144

B

Babić M. 161, 162
Bajić G. 5, 6
Bakoć A. 147, 148
Božić Lj. 117, 118
Brajsovac M. 37, 38
Brenjo D. 129, 130
Brkić Borisavljević I.
41, 42

C

Capaković S. 73, 74
Čekrlja Đ. 91, 92
Cvetković D. 165, 166

Č

Čavić S. 159, 160
Čigoja I. 125, 126,
127, 128, 137, 139
Čolić T. 91, 92, 93, 94
Ćorić A. 51, 52, 155,
156, 157, 158

Ć

Ćuković M. 65, 66

D

Daničić V. 125, 126,
137, 139, 151, 152
Despotović L. 73, 74
Despotović M. 37, 38,
41, 42
Despotović M. 47, 48

Đ

Đerić K. 131, 132
Đukanović T. 137,
139
Đurđević – Milošević
D. 115, 116

E

Elez J. 115, 116

G

Gagula G. 115, 116
Glamočanin O. 91, 92
Glušac J. 149, 150
Gojković Cvjetković
V. 131, 132
Golić B. 117, 118
Govedar Z. 109, 110,
121, 122, 129, 130
Grbić S. 133, 134
Grujić I. 61, 62, 135,
136
Grujić R. 67, 68, 109,
110, 129, 130, 135,
136, 145, 146
Gvozdenović N. 51,
52

H

Hadživuković N. 13,
14, 31, 32, 65, 66

I

Ikadinović J. 155, 156
Ilić Todorović V. 59,
60
Ivanović M. 131, 132

J

Jakšić Jeremić I. 71,
72
Jalić N. 125, 126
Janković D. 113, 114
Jelić D. 143, 144
Jevšnik Podlesnik M.
27, 28
Jovanović M. 59, 60
Jovanović Mirković J.
59, 60
Jovičić N. 17, 18
Jović D. 33, 34, 39, 40
Jovović Z. 129, 130
Jurišić S. 55, 56

K

Kacjan Žgajnar K. 25,
26, 111, 112, 119, 120
Kalaba V. 115, 116
Kalajdžić O. 31, 32,
147, 148
Kaluderović Z. 73, 74
Kapović Solomun M.
125, 126, 127, 128,
137, 139
Karakaš S. 33, 34, 39,
40
Kasagić D. 117, 118

- Keneški B. 99, 100
 Kladar N. 141, 142
 Knežević D. 117, 118
 Knežević D. 57, 58
 Kosijer D. 173, 174
 Krasnik R. 101, 102
 Krunić M. 71, 72
 Kucurski Lj. 13, 14, 31, 32, 37, 38, 41, 42, 47, 48, 53, 54, 83, 84, 93, 94
- L
- Laštro D. 79, 80
 Lazić D. 161, 162
 Lukić M. 65, 66
- M
- Marjanović-Balaban Ž. 131, 132, 141, 142, 143, 144
 Marković M. 125, 126
 Martinenko A. 123, 124
 Mastikosa J. 143, 144
 Matejić J. 167, 168
 Matović S. 13, 14, 31, 32, 65, 66
 Matović S. 163, 164
 Medenica I. 45, 46, 49, 50
 Meljnik P. 123, 124
 Memić A. 169, 170
 Mihajlović D. 131, 132
 Mihaljčić D. 105, 106
 Mikanović B. 97, 98
 Milenković A. 165, 166, 167, 168
 Milenović N. 5, 6, 85, 86
 Milidrag A. 37, 38, 47, 48
- Milinković Z. 43, 44,
 Mirić N. 43, 44
 Miteva K. 165, 166
- N
- Nikitović J. 137, 139
 Nikolić I. 165, 166
 Nikolić S. 77, 78
 Nikolić V. 167, 168
- O
- Obradović M. 53, 54, 61, 62, 67, 68, 135, 136, 145, 146
 Obrenović M. 131, 132
 Ogurlić R. 81, 82
- P
- Pandurević A. 163, 164
 Pantelić J. 117, 118
 Pantelić J. 117, 118
 Pavičić N. 57, 58
 Pavlović D. 167, 168
 Pavlović J. 13, 14, 31, 32, 65, 66, 147, 148
 Pavlović K. 13, 14, 31, 32, 65, 66
 Pavlović S. 73, 74
 Pejić B. 63, 64
 Perućica R. 147, 148
 Petković B. 113, 114
 Petković B. 137, 139
 Petković M. 57, 58
 Petrović A. 115, 116
 Pilipović Spasojević O. 79, 80
 Plemelj Mohorič A. 87, 88, 119, 120
 Popov M. 155, 156
 Popović-Pejičić S. 3, 4
- Poznan V. 155, 156, 157, 158
 Prohorova N. 109, 110, 121, 122
 Pržulj N. 109, 110, 129, 130
- R
- Radević S. 47, 48
 Radović N. 13, 14, 31, 32
 Rajić B. 163, 164
 Rajlić N. 135, 136, 145, 146, 149, 150
 Ristić S. 45, 46, 49, 50, 63, 64
 Ristić S. 113, 114
 Romčević I. 43, 44
- S
- Savić Lj. 37, 38, 41, 42, 47, 48
 Savić M. 41, 42
 Savić Ž. 173, 174
 Savković G. 89, 90, 95, 96
 Savković N. 19, 20, 89, 90
 Simović A. 45, 46, 49, 50
 Slavković M. 37, 38
 Slunjski Tišma L. 93, 94
 Smiljanić M. 131, 132
 Sređić Cartes D. 5, 6, 85, 86
 Stanić M. 101, 102
 Stanojević J. 165, 166
 Stanojević K. 165, 166, 167, 168
 Stanojević Lj. 7, 9, 165, 166, 167, 168
 Stanojević M. 59, 60

Stijepić I. 77, 78, 91,
92

Stijepić M. 21, 23,
145, 146, 149, 150

Stojanović N. 69, 70

Stojković I. 59, 60

Stupar J. 101, 102

Stupar S. 103, 104

Stupar V. 137, 139

Sušić T. 89, 90, 95, 96

Š

Šegalo S. 17, 18

Škrbić R. 5, 6

Šmitran A. 15, 16,
117, 118, 169, 170

T

Talić T. 79, 80

Tomić S. 83, 84

Tomić S. 35, 36, 83,
84

Topola D. 31, 32

Tošić R. 125, 126

Trajković A. 59, 60

Travar M. 57, 58

Trkulja V. 129, 130

V

Velimirović A. 129,
130

Veselić T. 103, 104

Vladimirović O. 109,
110, 121, 122

Vlahović A. 35, 36,
83, 84

Volarević A. 47, 48

Vranešević M. 125,
126, 127, 128

Vučkovac J. 169, 170

Vuković J. 131, 132

Vuković N. 171, 172

Vuksnaović G. 147,
148

Z

Zavišić G. 113, 114

Zeljковиć D. 43, 44

Zeljковиć S. 137, 139

Zlatanović M. 37, 38,
47, 48

Zvezdanović J. 165,
166

Ž

Živanović S. 13, 14,
31, 32, 65, 66, 147,
148



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