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SUMMER SCHOOL
OF CLINICAL
NUTRITION AND
DIET THERAPY

EXPPAND

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The **EXPPAND** project is financed by the European Social Fond and will be held from 2018 until the year 2021 in Zagreb, Croatia. The project has been developed and will be implemented by the School of Medicine University of Zagreb and its partners – the Croatian Medical Association, School of Dental Medicine, Faculty of Veterinary Medicine, Faculty of Pharmacy and Biochemistry and Faculty of Food Technology and Biotechnology of the University of Zagreb.

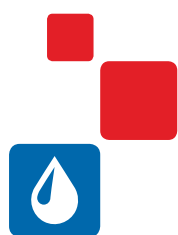
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Projekt **EXPPAND** financiran je od strane Europskog socijalnog fonda i provodit će se od 2018. do 2021. godine u Zagrebu, Hrvatskoj. Nositelj projekta je Medicinski fakultet Sveučilišta u Zagrebu, a provodi se u suradnji s partnerima – Hrvatskim liječničkim zborom, Stomatološkim fakultetom, Veterinarskim fakultetom, Farmaceutsko-biokemijskim fakultetom te Prehrambeno-biotehnoškim fakultetom Sveučilišta u Zagrebu.

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The History of Diet Therapy and Clinical Nutrition

Prof. Darija Vranešić Bender, PhD

The importance of optimal nutrition for health was recognised even by the ancient Egyptians, and the oldest evidence of this are the pictorial records from 5000 BC. Records on papyrus dating back to 1500 BC show that the ancient Egyptians knew how to prescribe a diet for the sick and injured, and that their doctors used different foods as “medicine” that would later be commonly recommended in many European countries. Thus, for example, honey was perhaps the most effective of all medicine used at that time. It was originally used for healing wounds, but since it proved to be extremely effective in treating infections, it later became an integral part of many oral medications. In fact, the ancient Egyptians believed that all infections, including external ones, were the result of a disturbance of internal balance.

Although he was not the first to realise the importance of nutrition in maintaining health, Hippocrates certainly made a remarkable contribution to the “popularisation” of the idea of using food as medicine. According to the teachings of Hippocrates, which was in line with the beliefs of the ancient Egyptians, digestion plays an important role in maintaining health, and because of its effect on digestion, food is also more important to the sick person than the medicine itself. Following Hippocrates’ teachings, dietary recommendations were continuously developed by physicians such as Galen, Maimonides and Paracelsus in the following centuries. However, the first scientific explanations and insights about nutrition date back to the 18th century, when French physician René de Réaumur laid the foundations for the biochemistry of digestion. In the same century, it was observed for the first time that certain foods can in fact cure a certain disease. These were citrus fruits that were used to successfully treat scurvy - a disease known today to be a result of vitamin C deficiency.

The development of nutrition science in the last century ranged from identifying and recognising nutrient deficiencies, preventing and addressing them to developing a balanced nutrition model with the aim of promoting health and reducing the risk of certain diseases. In the last thirty years, the focus of interest has shifted from the hypothesis of deficiency to the hypothesis of excess and the illnesses associated with excess body weight and obesity.

The first foundation for modern clinical nutrition was also laid by the ancient Egyptians. Medical records from the age of ancient Egypt, dating back to 3000 BC, describe the use of nutritional enemas (a mixture of wine, milk, whey, wheat and broth) as an alternative way to feed patients and treat diarrhoea.

The ideas of Capivacceus (1598), Aquapendente (1617), Von Helmont (1646) and Boerhaave (1710) paved the way for the development of a nasogastric feeding method using rudimentary versions of feeding tubes. John Hunter, the founder of British surgery, describes in 1790, in a manner appropriate to modern medical thinking, the use of a feeding tube for delivering food to the stomach. This tube was made of eel skin and whalebone. The next significant steps in the development of enteral nutrition occurred in 1910, when Max Einhorn described the first application of the duodenal tube, and in 1958, when Barron and Fallis developed the first enteral pump and methods of continuous administration of enteral formulas. In 1980 Gauderer and Ponsky describe percutaneous endoscopic gastrostomy (PEG).

The first attempts to provide feeding via the blood vessels were described in the 17th and 18th century. The first attempt to administer olive oil parenterally is mentioned in France as early as 1678!

Enteral formulas have been developing continuously since the mid-twentieth century, and first prototype of the elementary enteral formula, which appeared in 1949, represents an important turning point. Of particular importance for the development of enteral formulas is NASA’s human crew space programme and the need to develop enteral formulas suitable for feeding astronauts, with particular focus on reducing stool volume. Russian astronaut Gherman Titov (August 1961) and American John Glenn (February 1962) were the first people who were fed enteral formulas in space. Significant progress has been made from the silent entry of enteral formulas into clinical medicine fifty years ago to today.

Povijest dijetoterapije i kliničke prehrane

Prof. dr. sc. Darija Vranešić Bender

Važnost koju optimalna prehrana ima za zdravlje spoznali su još stari Egipćani, a najstariji dokaz o tome jesu slikovni zapisi koji potječu iz 5000. g. prije Krista. Zapisi na papirusu iz razdoblja 1500 g. prije Krista svjedoče da su drevni Egipćani znali propisati prehranu za bolesne i ozlijeđene te da su njihovi liječnici upotrebljavali različite namirnice kao „lijeckove“ koji će se kasnije uobičajeno preporučivati u brojnim europskim zemljama. Tako je, primjerice, med bio možda i najdjelotvorniji od svih lijekova koji su se tada upotrebljavali. Prvotno se koristio za cijeljenje rana, no s obzirom na to da se pokazao izuzetno djelotvornim u liječenju infekcija, kasnije je bio sastavni dio mnogih lijekova koji su se uzimali oralno. Naime, stari Egipćani vjerovali su da su sve infekcije, pa i one vanjske, rezultat poremećaja unutarnje ravnoteže.

Iako nije bio prvi koji je spoznao važnost prehrane u očuvanju zdravlja, Hipokrat je zasigurno dao izuzetan doprinos „popularizaciji“ ideje uporabe hrane kao lijeka. Prema Hipokratovu učenju, koje se podudaralo s vjerovanjem starih Egipćana, probava ima važnu ulogu u održavanju zdravlja, pa je i hrana, zbog utjecaja na probavu, bolesnoj osobi važnija od samog lijeka. Oslanjajući se na Hipokratovo učenje, prehrambene preporuke u narednim stoljećima nastavljaju razvijati liječnici poput Galena, Majmonida i Paracelsusa. Ipak, prva znanstvena objašnjenja i spoznaje o prehrani potječu tek iz 18. stoljeća kada francuski liječnik René de Réaumur postavlja temelje biokemije probave. U istom je stoljeću prvi put uočeno da određene namirnice uistinu liječe određenu bolest. Radilo se o citrusima kojima se uspješno liječio skorbut – bolest za koju se danas zna da je rezultat nedostatka vitamina C.

Razvoj znanosti o prehrani u prošlom stoljeću kretao se od uočavanja i prepoznavanja manjka nutrijenata, njegove prevencije i rješavanja do razvoja modela uravnotežene prehrane, s ciljem promicanja zdravlja i smanjenja rizika od nastanka pojedinih bolesti. Posljednjih trideset godina fokus interesa pomaknuo se s hipoteze nedostatka na hipotezu obilja i bolesti vezane uz prekomjernu tjelesnu težinu i pretilost.

Prvi pečat modernoj kliničkoj prehrani također su dali stari Egipćani. Medicinski zapisi iz razdoblja starog Egipta, 3000 godina prije Krista, opisuju primjenu nutritivnih klizmi (mješavina vina, mlijeka, sirutke, pšenice, bujona) kao alternativnog načina hranjenja bolesnika i liječenja proljeva.

Capivaceus (1598.), Aquapendente (1617.), Von Helmont (1646.) i Boerhaave (1710.) svojim idejama otvaraju put razvoju nazogastričnog načina hranjenja primjenom primitivnih oblika sondi. John Hunter, rodonačelnik britanske kirurgije, opisuje 1790. godine, na način primjeren suvremenom medicinskom razmišljanju, primjenu nutritivne sonde za unos hrane u želudac. Ta je sonda bila načinjena od jeguljine kože i kitove kosti. Sljedeći značajni koraci u razvoju enteralne prehrane zbili su se 1910. godine, kada je Max Einhorn opisao prvu primjenu duodenalne sonde te 1958. godine, kada Barron i Fallis razvijaju prvu enteralnu pumpu i načine kontinuirane primjene enteralnih pripravaka. Gauderer i Ponsky 1980. godine opisuju perkutanu endoskopsku gastrostomiju (PEG).

Prvi pokušaji hranjenja krvožilnim putem opisani su u XVII. i XVIII. stoljeću. Prvi pokušaj primjene maslinova ulja parenteralnim putem spominje se u Francuskoj 1678. godine!

Enteralne formule razvijaju se neprekidno od sredine dvadesetog stoljeća, a prekretnicu predstavlja prototip elementarnog enteralnog pripravka koji se pojavio 1949. godine. Osobitu važnost za razvoj enteralnih pripravaka ima NASA-in program svemirskih letova s ljudskom posadom i potreba za razvojem enteralnih pripravaka pogodnih za hranjenje astronauta, s naglaskom na smanjenju volumena stolice. Ruski astronaut German Titov (kolovoz 1961.) i američki John Glenn (veljača 1962.) prvi su ljudi koji su se hranili enteralnim pripravcima u svemiru. Od tihog ulaska enteralnih formula u kliničku medicinu prije pedeset godina do danas postignut je značajan napredak.

The basic concept of modern parenteral nutrition was described in 1945 (Brunschwig et al.). Considerable and continuous advances in the science of clinical nutrition, which primarily involve the development of techniques and solutions for enteral and parenteral nutrition, now make it possible to feed all patients who cannot or do not want to eat as well as those who are unable to absorb nutrients from the intestinal lumen.

Introduction to nutrition science

Asst. Prof. Ivana Rumora Samarin, PhD

Nutrition science is a relatively young science that links foods to health and disease. Among the many different but similar definitions, one defines nutrition science as the science of food, nutrients and other substances therein, their action, interaction, and balance in relation to health and disease and the processes by which the organism ingests, digests, absorbs, transports, utilises and excretes food substances. Broader definitions include the social, economic, cultural, and psychological implications of food and eating. The Greek physician Hippocrates, "Father of medicine" realised that food impacts a person's health, body and mind and helps prevent illness as well as maintain wellness (400 B.C.). His well-known statement "*Let food be thy medicine and medicine be thy food*", is the basis of nutrition science.

During the lecture, the most important periods in the history of nutrition science together with the main nutrition researchers will be presented. From James Lind who provided the first scientific evidence that certain foods and specific nutrients are needed to prevent illness (scurvy in sailors), over Sanctorius and Lavoisier whose researches represent early milestones in nutrition that caused major shifts in thinking about the interactions between food and the body. Followed by French physiologist Magendie who first distinguished that food is made of specific components (carbohydrate, protein, and fat) and German physiologist Liebig, who showed that those food components are used as fuel inside the body. Funk and Hopkins gave the concept that deficiency diseases were caused by the lack of specific chemicals in the diet (later called vitamins) – the start of the vitamin era. After that followed the period of the evolution of new nutrition, and the birth of functional foods and nutraceuticals, and gaining an understanding of the physiological roles beyond nutrition. Also, the late 20th century is the period of nutrigenomics and the concept of individualised nutrition. Followed by the 21st century – the period of the -omics coming of age.

The basic knowledge about food and nutrients will be presented with special emphasis on different nutrient classifications based on their general functions in the body. Basic knowledge about the relationship between food and health will be provided, together with basic knowledge about a healthy diet, dietary reference intakes and digestion as well as about factors that affect food choices.

Translational research: prediction, prevention, personalisation and participation in nutrition

Prof. Donatella Verbanac, PhD

In the last - decades of the 20th century, huge advances in fundamental biomedical research were achieved. However, obstacles between applied, clinical and basic research have not disappeared, but on the contrary, they were greater than ever before. These reasons catalysed the implementation of the initiative named "translational science" which has been embraced by many respectable institutions and individuals. Translational science connects public scientific institutions, the academic biomedical community, and industry. It has resulted from the necessity for more effective

Osnovna koncepcija suvremene parenteralne prehrane opisana je 1945. godine (Brunschwig i sur.). Znanat i stalan napredak u znanosti o kliničkoj prehrani, koji prije svega uključuje razvoj tehnika i otopina za enteralnu i parenteralnu prehranu, danas omogućuje hranjenje svih bolesnika koji ne mogu ili ne žele uzimati hranu te onih kod kojih nije moguća apsorpcija nutritivnih sastojaka iz crijevnog lumena.

Uvod u znanost o prehrani

Doc. dr. sc. Ivana Rumora Samarín

Znanost o prehrani relativno je mlada znanost koja povezuje hranu sa zdravljem i bolestima. Između mnogo različitih, ali sličnih definicija, znanost o prehrani definira se kao znanost o hrani, nutrijentima i drugim u njoj sadržanim tvarima, njihovu djelovanju, međudjelovanju, ravnoteži u odnosu na zdravlje i bolesti te o procesima kojima organizam unosi, probavlja, apsorbira, transportira, iskorištava i izlučuje tvari iz hrane. Šira definicija uključuje sociološki, ekonomski, kulturološki i psihološki utjecaj hrane i njene konzumacije. Grčki liječnik Hipokrat, „Otac medicine“, uvidio je da hrana utječe na zdravlje, tijelo i um osobe kako bi pridonijela sprečavanju bolesti, ali održavanju zdravlja (400. pr. Kr.) te je poznata njegova izjava „*Neka hrana bude tvoj lijek, a tvoj lijek neka bude tvoja hrana*“, jedan od temelja znanosti o prehrani.

Tijekom predavanja predstaviti će se određena najvažnija razdoblja u povijesti znanosti o prehrani zajedno s glavnim istraživačima. Od Jamesa Lind koji je pružio prve znanstvene dokaze da su određena hrana i specifični nutrijenti potrebni za sprečavanje bolesti (skorbut u mornara), preko Sanctoriusa i Lavoisiera čija istraživanja predstavljaju najranija dostignuća u znanosti o prehrani, a koja su uzrokovala glavne prekretnice u razmišljanju o međudjelovanju hrane i tijela. Uslijedili su francuski fiziolog Magendie koji je prvi razaznao da je hrana sastavljena od specifičnih sastavnica (ugljikohidrati, proteini i masti) i njemački fiziolog Liebig koji je pokazao da se ti sastavni dijelovi hrane upotrebljavaju kao gorivo unutar tijela. Funk i Hopkins predstavili su koncept da su deficijencije uzrokovane nedostatkom pojedinih specifičnih kemijskih spojeva u prehrani (kasnije nazvanih vitamini), što je obilježilo početak vitaminskog doba. Potom je uslijedilo razdoblje evolucije nove znanosti o prehrani i razvoj koncepta funkcionalne hrane i nutraceutika te povećanje razumijevanja fizioloških uloga izvan same prehrane. Također, kasno 20. stoljeće predstavlja razdoblje nutrigenomike i koncepta personalizirane prehrane. Prati ga 21. stoljeće – početak razdoblja „-omika“.

Tijekom predavanja predstaviti će se osnovno znanje o hrani i nutrijentima s posebnim naglaskom na klasifikaciju nutrijenata temeljem njihovih općih funkcija u tijelu. Pružit će se osnovno znanje o odnosu hrane i zdravlja, zajedno s osnovnim znanjem o pravilnoj prehrani, prehrambenim referentnim vrijednostima za unos te probavi, kao i o čimbenicima koji utječu na odabir hrane.

Translacijska istraživanja: predikcija, prevencija, personalizacija i participacija u prehrani

Prof. dr. sc. Donatella Verbanac

U posljednjih nekoliko desetljeća 20. stoljeća postignut je izniman napredak u temeljnom biomedicinskom istraživanju. Međutim, prepreke između primjene, kliničkog i temeljnog istraživanja nisu nestale, veću su naprotiv, postale veće no ikad. Ti su razlozi katalizirali primjenu inicijative pod nazivom „translacijska znanost“ koju su usvojile mnoge ugledne ustanove i pojedinci. Translacijska znanost povezuje znanstvene ustanove, akademsku biomedicinsku zajednicu i industriju. Nastala je iz potrebe za učinkovitijim otkrivanjem novih terapijskih mogućnosti

discovery of new therapeutic options and medicines, as well as from the need for the creation of stronger links between fundamental research and applied practice, particularly the clinical one. Fundamental scientific discoveries on the molecular or cellular level are typically done in research laboratories. In order to contribute to the improvement of human health and healthcare, basic research has to be translated from the laboratory to the clinical and afterwards the industrial practice level. The connection between research and application should be more efficient and productive.

At the same time, requirements and the complexity of drug discovery and clinical research increased due to regulatory demands and increased costs of these processes. Therefore, the new concept of translational research created at the beginning of the 21st century has been developed to integrate discoveries resulting from basic, clinical or population research into clinical practice and has been created in order to reduce the incidence of morbidity and provide new means for the development and implementation of novel therapeutic options. This approach represents the basis of translational medicine developed with the support of specifically skilled professionals, scientists who can connect basic scientific discoveries with clinical research and translate results of clinical trials into a change in clinical and industrial practice utilising results and data collected from different sources. The purpose of all these initiatives was to facilitate the process of turning early discoveries into drugs and medical instruments, improve the overall patient care and enhance preventive measures.

The translational research approach can be applied in many areas of biological/biotechnological sciences and medicine, however, a special use has been found in the development of specific, targeted ("smart") medicines involving also broad public health measures and activities for the prevention of chronic degenerative diseases, particularly metabolic diseases. Translational science is expected to play a key role in the introduction of personalised or tailored therapy. Implementation of such activities requires collaboration and investment in knowledge and skills by academic institutions, hospitals, industry, but also regulatory agencies that issue licenses for the marketing, distribution, and sales of drugs. Implementation of these specific procedures and the successful interaction of existing knowledge require large multi- and trans-disciplinary teams of experts who know how to apply the tools they have at their disposal.

New initiatives in healthcare are today based on the so-called P4 principles. They include predictive, preventive, personalised and participatory biomedical and biotechnological approaches. Through these principles, the vast majority of the new technologies, industrial applications, scientific knowledge and emerging technical innovations can be directly applied to developed sustainable human welfare.

Energy, Macro & Micronutrients: basics of physiology and dietary requirements

Asst. Prof. Ivana Rumora Samarin, PhD

The food that we consume is constituted from six classes of nutrients (carbohydrates, lipids, proteins, water, vitamins, and minerals) which are classified according to the body's needs into macronutrients (carbohydrates, lipids, proteins, and water) – needed in large amounts, and micronutrients (vitamins and minerals) – needed in small amounts. Together, the macronutrients and micronutrients in our diet provide us with energy, contribute to the structure of our bodies, and regulate the biological processes that go on inside us. Each nutrient provides one or more of these functions, but all nutrients together are needed to grow, maintain and repair the body, and support reproduction.

Energy is, after water, the most important requirement to sustain life and human life can continue for approximately 60 days without food energy. Energy consumed is expressed in heat units known as kilocalories (kcal) or kilojoules (kJ) where one kcal is equal to 4.184 kJ. Energy yield from the oxidation of macronutrients after correction is rounded off to 4 kcal (16.8 kJ)/g for proteins and carbohydrates and to 9 kcal (37.8 kJ)/g for lipids. Recommendations for adults given as a range of acceptable macronutrient intakes by Food and Nutrition Board of the National Academy of Sciences are

i lijekova, kao i iz potrebe za stvaranjem snažnijih poveznica između temeljnog istraživanja i primijenjene prakse, osobito kliničke. Temeljna znanstvena otkrića na molekularnoj i staničnoj razini obično se provode u istraživačkim laboratorijima. Da bi doprinijelo poboljšanju zdravlja ljudi i zdravstvene skrbi, osnovno istraživanje mora se prenijeti iz laboratorija na razinu kliničke, a potom i na razinu industrijske prakse. Veza između istraživanja i primjene mora biti učinkovitija i produktivnija.

Istovremeno, zahtjevi i složenost otkrivanja lijekova i kliničkih istraživanja povećala se uslijed regulatornih zahtjeva i povećanih troškova tih procesa. Stoga je novi koncept translacijskog istraživanja, stvoren na početku 21. stoljeća, razvijen da bi integrirao otkrića nastala iz osnovnog, kliničkog ili populacijskog istraživanja u kliničku praksu te je zamišljen kako bi se smanjila incidencija pobola i pribavila nova sredstva za razvoj i primjenu novih terapijskih mogućnosti. Ovaj pristup predstavlja osnovu translacijske medicine razvijene uz pomoć posebno osposobljenih stručnjaka, znanstvenika koji mogu povezivati osnovna znanstvena otkrića s kliničkim istraživanjem i prenijeti rezultate kliničkih ispitivanja u promjenu kliničke i industrijske prakse koristeći rezultate i podatke prikupljene iz različitih izvora. Svrha svih ovih inicijativa bila je olakšati postupak pretvorbe ranih otkrića u lijekove i medicinske instrumente, poboljšati cjelokupnu brigu za bolesnika i unaprijediti preventivne mjere.

Pristup translacijskog istraživanja može se primijeniti u mnogo područja bioloških/biotehnoloških znanosti i medicine, međutim, posebna se uporaba našla u razvoju specifičnih, ciljanih („pametnih“) lijekova, uključujući i široke mjere javnog zdravstva i aktivnosti za prevenciju kroničnih degenerativnih bolesti, osobito metaboličkih bolesti. Očekuje se da će translacijska znanost imati ključnu ulogu u uvođenju personaliziranog ili prilagođenog liječenja. Primjena takvih aktivnosti zahtijeva suradnju i ulaganje u znanje i vještine akademskih ustanova, bolnica, industrije, ali i regulatornih agencija koje izdaju dozvole za stavljanje u promet, distribuciju i prodaju lijekova. Za primjenu ovih specifičnih postupaka i uspješnu interakciju postojećeg znanja potrebni su veliki multi- i transdisciplinarni timovi stručnjaka koji znaju kako primijeniti alate koji su im na raspolaganju.

Nove inicijative u zdravstvu danas se temelje na takozvanim P4 načelima. Oni uključuju prediktivni, preventivni, personalizirani i participativni biomedicinski i biotehnološki pristup. Tim se načelima velika većina novih tehnologija, industrijskih primjena, znanstvenog znanja i novonastalih tehničkih inovacija može izravno primijeniti na razvoj održive dobrobiti ljudi.

Energija, makro- i mikronutrijenti: osnove fiziologije i prehrambenih potreba

Doc. dr. sc. Ivana Rumora Samarin

Hrana koju konzumiramo sastoji se od šest kategorija nutrijenata (ugljikohidrati, lipidi, proteini, voda, vitamini i minerali) koji se, prema količinama potrebnim organizmu, svrstavaju u makronutrijente (ugljikohidrati, lipidi, proteini i voda) koji su potrebni u velikim količinama i mikronutrijente (vitamini i minerali) koji su potrebni u malim količinama. Makro- i mikronutrijenti u našoj prehrani osiguravaju energiju, doprinose strukturi tijela i reguliraju biološke procese koji se zbivaju u nama. Svaki nutrijent obavlja jednu ili više navedenih funkcija, no svi su nutrijenti zajedno potrebni kako bi omogućili rast, održavanje i obnovu tijela te podržali reprodukciju.

Energija je, nakon vode, najvažniji uvjet za održavanje života, a čovjek može preživjeti otprilike 60 dana bez energije iz hrane. Unesena energija izražava se u jedinicama topline poznatima kao kilokalorije (kcal) ili kilodžuli (kJ) pri čemu 1 kcal odgovara 4,184 kJ. Energija dobivena oksidacijom makronutrijenata nakon korekcija zaokružuje se na 4 kcal (16,8 kJ) za proteine i ugljikohidrate te na 9 kcal (37,8 kJ)/g za lipide. Preporuke Odbora za hranu i prehranu Nacionalne akademije za znanost dane su u obliku raspona prihvatljivog unosa makronutrijenata za odrasle i izražene

expressed as a percentage of the total intake of energy and are 20–35% fat, 45–65% carbohydrate, and 10–35% protein. During the lecture, definitions as well as methods and equations for the calculation of energy needs will be given. Also, the macronutrients will be elaborated in detail, with emphasis on composition, digestion and intake recommendations.

Carbohydrates are the body's preferred energy source and they are used in the form of glucose, providing the major substrate for energy metabolism within the brain, kidney and red blood cells. They are divided into monosaccharides, disaccharides and complex carbohydrates (polysaccharides). Proteins provide all the functional and structural components of the body: skin, bone, muscle, blood, and all the organs. It consists of one or more long chains of amino acids linked by peptide bonds, and are divided into complete (contain all 9 essential amino acids) and incomplete proteins (lacking one or more essential amino acids). Fats have a chemical structure of triacylglycerol. Physical and chemical properties in food are determined by differences in their component fatty acids. Fatty acids must be consumed through diet because they cannot be made by the body. Two essential fatty acids are linoleic acid and alpha-linolenic acid.

Vitamins are organic molecules needed in small amounts to maintain health, traditionally assigned to two groups, based on their solubility in water (vitamin C and the B-vitamins) or fat (vitamins A, D, E, K). Minerals are elements that are essential nutrients needed in small amounts to provide a variety of diverse functions in the body. They are classified as major (need to be consumed in amounts of at least 100 mg/day), trace (need to be consumed in amounts less than 100 mg/day), or ultra-trace (need to be consumed in amounts less than 1 mg/day) minerals. For each micronutrient, the main sources, together with recommendations for intake and major functions as well as deficiency symptoms will be elaborated.

Biologically active compounds from food & herbs: screening, selection and clinical applications

Prof. Donatella Verbanac, PhD

Biologically active compounds abound at both pharmacy and table with neither food nor drugs being expected to ever be able to completely substitute the other. Although modern pharmaceuticals are commonly accepted as a miracle of the 20th century, we must remember that food remains important to health as well. Dietary intake can enhance our ability to heal faster, reduce symptoms and minimise disability.

However, despite the fact that almost all nutrients possess some pharmacological properties, there are ingredients that due to their unique composition and mechanisms of action, exhibit moderate but still well recognised therapeutic effect. The compounds that are responsible for this effect became gradually more interesting study topics in numerous academic and private research laboratories. Although it is often financially impracticable to perform extensive clinical studies on some widely used nutraceuticals, particularly mild immunostimulants, it has been agreed that the benefit of dietary antioxidants in nutritional excess is probably greater than was previously thought. Extensive clinical studies on important dietary antioxidants such as vitamins and microelements suggest that there are indeed some prophylactic health benefits, although these studies are subjected to continuous revisions.

Even greater benefits are expected from the chemical modification of specific plant phenolic constituents. Potent nutritional antioxidants are coumarines, flavonoids (like quercetin), polyphenols (like resveratrol), rosmarinic acid, etc. The challenges for advancement of natural source derived therapeutics include the development of discovery, validation and manufacturing technologies that are compatible with multifunctional phytochemical mixtures, but also the ability to identify and genetically manipulate complex biosynthetic pathways in plants and other organisms.

In order to identify a mode of action and potential therapeutic applications of novel natural compounds, a research cascade can be shaped in several ways. Primary clues on potential actions of a purified and structurally characterised

su kao postoci ukupnog energetskog unosa te iznose 20 – 35 % za masti, 45 – 65 % za ugljikohidrate i 10 – 35 % za proteine. U predavanju će se predstaviti definicije te metode i jednadžbe za izračun energetskih potreba. Također, detaljno će se obraditi makrohranjivi, s naglaskom na sastavnice, probavu i preporuke za unos.

Ugljikohidrati su preferirani izvor energije organizma i koriste se u obliku glukoze te predstavljaju glavni supstrat za energetski metabolizam mozga, bubrega i crvenih krvnih stanica. Dijele se na monosaharide, disaharide i složene ugljikohidrate (polisaharide). Proteini osiguravaju sve funkcionalne i strukturalne sastavnice tijela: kožu, kosti, mišiće, krv i sve organe. Sastoje se od jednog ili više dugih lanaca aminokiselina povezanih peptidnim vezama te se dijele na potpune (sadrže svih devet esencijalnih aminokiselina) i nepotpune proteine (nedostaje im jedna ili više esencijalnih aminokiselina). Masti imaju kemijsku strukturu triacilglicerola. Fizikalna i kemijska svojstva hrane određena su razlikama u sastavu masnih kiselina. Masne kiseline moraju biti prisutne u prehrani jer ih tijelo ne može samo proizvesti. Dvije esencijalne masne kiseline jesu linolenska i alfa-linolenska kiselina.

Vitamini su organske molekule koje su potrebne u malim količinama za održavanje zdravlja i tradicionalno se dijele u dvije skupine na temelju njihove topljivosti u vodi (vitamin C i B vitamini) ili u mastima (vitamini A, D, E, K). Minerali su esencijalni nutrijenti potrebni u malim količinama kako bi omogućili brojne raznolike funkcije u tijelu. Svrstavaju se u makromineralne (potrebno ih je unositi u količinama od najmanje 100 mg dnevno), minerale u tragovima (potrebno ih je unositi u količinama manjim od 100 mg dnevno) ili minerale u ultratragovima (potrebno ih je unositi u količinama manjim od 1 mg dnevno). Tijekom predavanja obradit će se glavni izvori za svaki mikronutrijent, zajedno s preporukama za unos i glavnim funkcijama, kao i simptomima manjka.

Biološki aktivni spojevi u hrani i biljkama: probir, odabir i kliničke primjene

Prof. dr. sc. Donatella Verbanac

Farmaceutska i prehrambena znanstvena disciplina obiluju biološki aktivnim spojevima, međutim ni od hrane ni od lijekova ne očekuje se da će ikada moći u potpunosti zamijeniti jedni druge. Iako su moderni farmaceutski oblici, lijekovi, opće prihvaćeni kao čudo 20. stoljeća, moramo se prisjetiti da i prehrana također ostaje važna komponenta za naše zdravlje. Ciljani dijetetski unos može unaprijediti ozdravljenje od bolesti, smanjiti i skratiti vrijeme pobola.

Usprkos činjenici da gotovo svi nutrijenti imaju određena farmakološka svojstva, postoje sastojci koji uslijed svojeg jedinstvenog sastava i mehanizma djelovanja pokazuju umjeren, no još uvijek jasno prepoznat terapijski učinak. Spojevi koji su odgovorni za ovaj učinak polako su postali sve zanimljivije teme istraživanja u brojnim akademskim i privatnim istraživačkim laboratorijima. Iako je često financijski nepraktično provoditi opsežna klinička ispitivanja na nekim nutraceuticima široke uporabe, osobito blagih imunostimulansa, utvrdilo se da su koristi prehrambenih antioksidansa u nutritivnom suvišku vjerojatno veće nego što se ranije mislilo. Opsežna klinička ispitivanja važnih prehrambenih antioksidansa, kao što su vitamini i mikroelementi, ukazuju da doista postoje neke profilaktične zdravstvene koristi, iako su ta ispitivanja predmet neprekidnih revizija.

Očekuju se čak i veće koristi od kemijske modifikacije specifičnih biljnih fenolnih sastojaka. Potentni su prehrambeni antioksidansi kumarini, flavonoidi (poput kvercetina), polifenoli (poput resveratrola), ružmarinska kiselina itd. Izazovi za napredak lijekova dobivenih iz prirodnih izvora uključuju razvoj otkrivanja, validacije i proizvodnih tehnologija koje su sukladne s multifunkcionalnim fitokemijskim mješavinama, ali i sposobnost identifikacije i genetske manipulacije složenih biosintetskih putova u biljkama i drugim organizmima.

Da bi se identificirao način djelovanja i potencijalne terapijske primjene novih prirodnih sastojaka, istraživački slijed može se oblikovati na nekoliko načina. Primarne indicije o potencijalnim djelovanjima pročišćenih i strukturalno

compound are gained through an *in silico* similarity search, which can lead to optimal selection of specific assays for biological characterisation.

However, several general features should be looked into. First, one should be sure that the compound is of high purity, and that the solubility issue will not jeopardise the outcome. And second, any compound that is intended for prolonged use, particularly as a supplement, chronic treatment medication, should be “clean” of any antimicrobial activity or cytotoxic effects. The approaches in screening natural compounds and their derivatives will be presented and discussed in relation to the design of functional food. Awareness of links between food and health increases every day and the drive to develop functional foods has arisen from the growing interest in the relationship between diet-specific food ingredients and health. Healthy eating can make a key contribution to health and well-being, but busy consumers may not have the time to access their optimal diet. Functional foods can provide health-enhancing ingredients in a convenient form. Most recent advances in food and nutrition sciences have highlighted the possibility of modulating some specific physiological functions in the organism through food intake.

Basics of meal planning

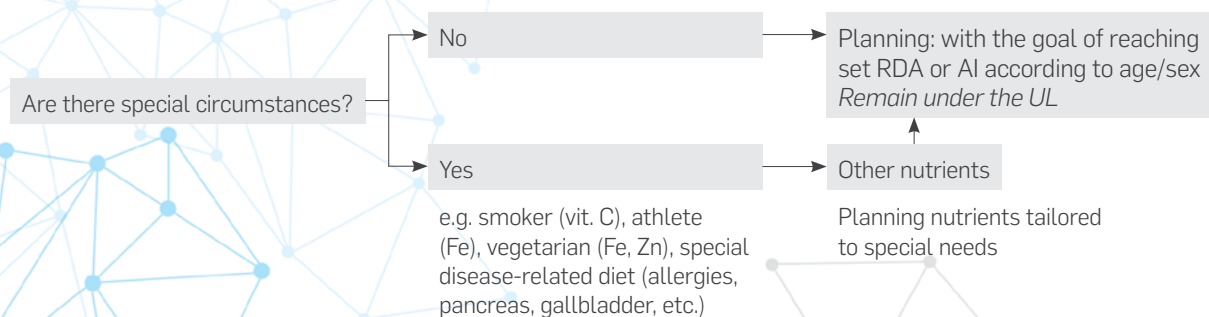
Prof. Jasenka Gajdoš Kljusurić, PhD

For whom? What and how much? Is there something specific about the planned diet (athlete, smoker, etc.)? Are there any preferences (or allergies)? How do we evaluate the quality of the diet plan? These questions are just some of the things that have to be answered before planning meals/menus. Nutrition planning means drafting a plan regarding the type of food and meals to be consumed over one or more days according to the individual's energy and nutritional requirements by applying nutritional recommendations.

Nutritional standards (recommendations) represent the recommended daily intake of energy, nutrients and preservatives necessary to maintain the body's physiological functions and individual's health. One of the main rules of planning is: MODERATION. Eating in moderation, combined with moderate body activity, is the best choice for everyone.

Nutrition planning is done in 2 steps. Setting appropriate nutrition goals and, as a next step, designing a nutrition plan that the individual will actually consume. Nutrition planning guide shown in the figure below can help you plan individual diets.

Individual nutrition planning



The goal of individual nutrition planning is to ensure specific intake that has an acceptable low risk of inadequate nutrient intake, while reducing the risk of excessive intake of all nutrients, which is why these recommendations exist. All intake must be under specified UL values. Inadequate intake or deviation from recommendations should not exceed 2–3%, however this decision is left to the nutritionists planning the diet. It is very important to take into account the correct content of macronutrients in the total energy input.

karakteriziranih spojeva dobivene su putem *in silico* pretraživanja sličnosti, koje može dovesti do optimalnog odabira specifičnih testova za biološku karakterizaciju.

Međutim, potrebno je uzeti u obzir nekoliko općih obilježja. Prvo, potrebno je biti siguran da su spojevi visoke čistoće te da pitanje topljivosti neće ugroziti ishod. Drugo, svaki spoj koji je namijenjen za dugotrajnu primjenu, osobito kao dodatak, lijek za kronično liječenje, mora biti „čist“ od svake antimikrobne aktivnosti ili citotoksičnih učinaka. Pristupi u probiru prirodnih spojeva i njihovih derivata predstaviti će se i komentirati u odnosu na dizajn funkcionalne hrane. Svijest o poveznici između hrane i zdravlja svakodnevno se povećava te je poticaj za razvoj funkcionalne hrane proizašao iz rastućeg interesa za odnos između sastojaka hrane specifičnih za prehranu i zdravlja. Zdrava prehrana može biti ključan doprinos zdravlju i dobrobiti, no zaposleni potrošači možda neće imati vremena za pristup svojoj optimalnoj prehrani. Funkcionalna hrana može pružiti sastojke za unapređenje zdravlja u prikladnom obliku. Najnovijim dosezima u znanosti o hrani i prehrani istaknuta je mogućnost moduliranja nekih specifičnih fizioloških funkcija u organizmu unosom funkcionalne hrane i dodataka prehrani.

Osnove planiranja prehrane

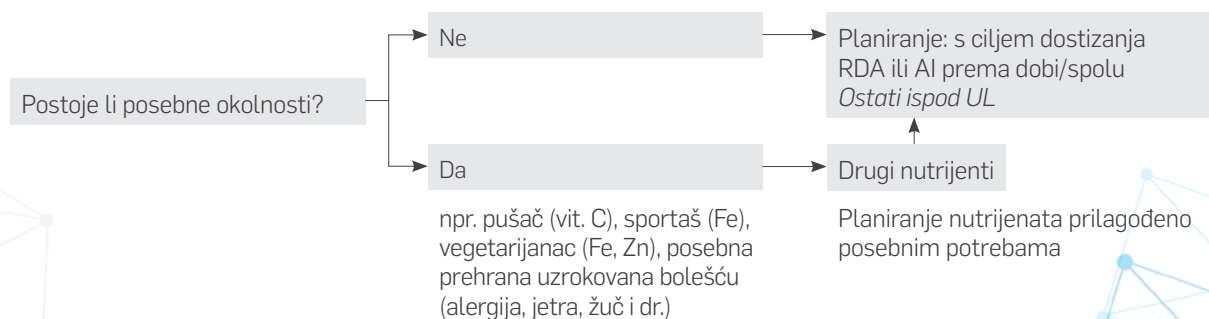
Prof. dr. sc. Jasenka Gajdoš Kljusurić

Za koga? Što i koliko? Je li nešto specifično u planiranoj prehrani (sportaš, pušač i sl.)? Ima li nekih preferencija (ili alergija)? Kako procjenjujemo kvalitetu plana prehrane? Navedena pitanja samo su neka na koja se mora odgovoriti prije samog planiranja jela/jelovnika. Planiranje prehrane podrazumijeva sastavljanje plana o vrsti namirnica ponuđenih u određenom broju obroka za jedan ili više dana prema energetske i prehranbenim potrebama korisnika, primjenjujući prehranbene standarde.

Prehranbeni standardi (Preporuke) predstavljaju preporučeni dnevni unos energije, hranjivih i zaštitnih tvari neophodnih za održavanje fizioloških funkcija organizma i zdravlje pojedinca. Jedno od glavnih pravila u planiranju jest: UMJERENOST. Jedenje u umjerenim količinama, kombinirano s umjerenom tjelesnom aktivnosti, najbolji je izbor za svakoga.

Planiranje prehrane za pojedinca uključuje dva koraka. Prvo se moraju postaviti odgovarajući ciljevi vezani za prehranu, a kao sljedeći korak mora se osmisliti plan prehrane koji će pojedinac konzumirati. Kao pomoć u planiranju služi vodič za planiranje prehrane pojedinaca prikazan na slici koja slijedi.

Planiranje prehrane za pojedinca



U planiranju prehrane za pojedinca cilj je ponudom osigurati unos koji ima prihvatljivo malu opasnost nedostatnog unosa nutrijenata uz istovremeno smanjenje opasnosti od previsokih unosa za sve nutrijente, što je i razlog nastanka preporuka. Sav unos mora biti manji od UL vrijednosti. Nedovoljan unos ili neslaganje s preporukama ne bi trebalo prelaziti 2 – 3 %, ali se ta odluka svakako prepušta nutricionistima koji planiraju prehranu. Vrlo je važno uzeti u obzir pravilnu zastupljenost makronutrijenata u udjelu energije.

Using mobile apps for monitoring nutritional intake

More than half of smartphone users in the US have downloaded a health-related app. Most commonly used health-related apps are used for monitoring and tracking physical activity and nutrition, and are engaged with on a daily basis. The same study showed that 47% of users downloaded the app to monitor their food consumption, while 46% downloaded the app to lose body weight. Many such apps provide users with additional methods for monitoring their health or achieving health-related goals. A growing number of health-related apps can be a potential solution to the problem of obesity. Research has shown that using health-related apps can successfully lead to behavioural changes related to weight loss or body mass management. One study has shown that test subjects using mobile apps to monitor nutritional intake burn less calories than those who use websites or traditional dietary methods for the same purpose. Similarly, when comparing the use of apps for monitoring nutritional intake with groups using websites and eating diaries, data subjects who used mobile apps exhibited greater adherence and loss of body weight. The popularity of smartphones allows access to a large number of obese people. Once developed, a smartphone app for monitoring nutritional intake can be made globally available to other smartphone users over the Internet. A nutritional intake monitoring app can help users quickly find nutritional information of food while shopping, and can count their daily energy intake and compare it with set goals. In one study conducted on 23 weight loss apps, 17 of the 23 apps were found to be within 100 kcal compared to the traditional intake monitoring by weighing food. There are also special apps for specific health-related conditions, such as diabetes. Diabetes monitoring apps allow patients to report blood glucose levels, monitor insulin injections and oral medication, record exercising and other physical activities, intake of carbohydrates and other foods. Information on calories or nutrients provided by mobile apps can be useful for users that have to monitor their diabetes and nutrition. It should be noted that the most effective use of mobile apps has been shown in adolescents who are usually more in-tune with using apps than older users. However, there is still plenty of room left for personalised patient education, especially using mobile apps focused on nutritional and clinical guidelines. There are some apps that educate users by scanning food packaging labels. Regular and frequent self-control is a fundamental component of losing body weight and improving glycemic control in patients suffering from diabetes.

Ethics in applied nutrition services

Prof. Jasenka Gajdoš Kljusurić, PhD

Ethics is a roadmap that must be as objective as possible so that all parties could have the option of free choice. Ethics means setting fundamental values and when food and nutrition are added to the mix – dealing with global issues such as unequal distribution of food, social justice and climate change – it can result in the inability to act and indecision. Thus the ethics of food and nutrition means reviewing all information related to food and/or nutrition, highlighting advantages and disadvantages while considering possible consequences in order to make the right decision.

Food choice implications are far-reaching. The struggle is real. How and what to eat to start building a better world? Can only 100% sustainable produce be considered ethical or is it ethical to eat only organically grown food? Are all processed foods unhealthy? Do manufacturers adulterate food and drink products trying to cheat us – the consumers?

These are just some of the issues that highlight why ethics of food and nutrition is such an important topic for everyone involved in the production, preparation, and consumption of food, but also for those handling leftover waste or waste generated during food production. When talking about food and nutrition, “ethics” can implicate a wide range of different values, from economic issues to environmental concerns, but also the treatment of farm workers or whether food is grown locally (fresher produce and smaller carbon footprint).

Choosing a unique ethical framework that determines how everybody should eat is as “simple” as searching for causes of stress affecting health. Different people make different choices, which can also be said for food. In other words, one’s ethics aren’t necessarily the same as another’s ethics, but both can be right.

Primjena mobilnih aplikacija za praćenje prehranbenog unosa

Više od polovice Amerikanaca koji se koriste pametnim telefonima preuzelo je aplikaciju povezanu s očuvanjem zdravlja. Najčešće korištene zdravstvene aplikacije odnose se na tjelesnu aktivnost i prehranu, a upotrebljavaju se svakodnevno. Isto istraživanje pokazalo je da je 47 % korisnika preuzelo aplikaciju kako bi pratili konzumaciju hrane, dok je 46 % preuzelo aplikaciju kako bi izgubili tjelesnu masu. Mnoge takve aplikacije korisnicima pružaju dodatne metode za praćenje zdravlja ili postizanje zdravstvenih ciljeva. Povećanje broja aplikacija povezanih sa zdravljem predstavlja potencijalno rješenje u rješavanju problema pretilosti. Istraživanja su pokazala da upotreba aplikacija povezanih s očuvanjem zdravlja može uspješno dovesti do promjene ponašanja povezanog s gubitkom težine ili upravljanja tjelesnom masom. U jednom istraživanju dokazano je da sudionici koji se koriste mobilnim aplikacijama za praćenje prehranbenog unosa troše manje kalorija od onih koji upotrebljavaju internetske stranice ili tradicionalne dijetetičke metode za praćenje prehranbenog unosa. Slično tome, kada se uspoređi uporaba aplikacija povezanih s praćenjem prehranbenog unosa s grupama koje su upotrebljavale internetske stranice i skupinama dnevnika prehrane, sudionici koji su upotrebljavali mobilne aplikacije imali su veće pridržavanje i gubitak tjelesne mase. Popularnost pametnih telefona omogućuje pristup velikom broju pretilih osoba. Jednom razvijen program za praćenje prehranbenog unosa putem aplikacije za pametne telefone može biti međunarodno dostupan drugim korisnicima pametnih telefona putem interneta. Aplikacija za praćenje prehranbenog unosa može korisnicima brzo pronaći nutritivna svojstva hrane za vrijeme kupovine namirnica te može svakodnevno računati energetske unos hranom te ga uspoređivati s dnevnim ciljem. U jednom istraživanju provedenom na 23 aplikacije za mršavljenje pokazalo se da je 17 aplikacija od njih 23 bilo unutar 100 kcal u usporedbi s praćenjem unosa vaganjem hrane. Također, postoje aplikacije razvijene za određena zdravstvena stanja, poput dijabetesa. Aplikacije za praćenje dijabetesa omogućuju pacijentima prijavu unosa razine glukoze u krvi, praćenje unosa injekcije inzulina i oralnih lijekova, bilježenje tjelesne aktivnosti, unos ugljikohidrata i drugih namirnica. Informacije o kalorijama ili hranjivim tvarima iz hrane dostupne u mobilnim aplikacijama korisne su za ispitanikovu skrb o dijabetesu i prehrani. Treba napomenuti da je najučinkovitija uporaba mobilnih aplikacija dokazana u adolescenata koji se obično više i uspješnije koriste aplikacijama od starijih korisnika. Međutim, postoji mogućnost za personaliziraniju edukaciju pacijenata, osobito za mobilne aplikacije koje su usmjerene na prehranbene i kliničke smjernice. Naime, postoje i aplikacije koje omogućuju edukaciju korisnika o čitanju deklaracije na ambalažama hrane. Redovito i česta samokontrola temeljna je komponenta gubitka tjelesne mase i poboljšane kontrole glikemije kod dijabetesa.

Etika u primijenjenim nutricionističkim uslugama

Prof. dr. sc. Jasenka Gajdoš Kljusurić

Etika je putokaz koji mora biti što objektivniji kako bi sve strane imale mogućnost slobodnog izbora. Etika predstavlja postavljanje temeljnih vrijednosti i kada se tome pridoda hrana i prehrana – suočavanje s globalnim pitanjima nejednake raspodjele hrane, socijalnom pravdom, klimatskim promjenama, to dovodi do svojevrsne paralize i neodlučnosti. Tako etika hrane i prehrane predstavlja sagledavanje svih informacija povezanih s hranom i/ili prehranom, ističući prednosti i mane uz sagledavanje posljedica, a sve u cilju donošenja ispravne odluke.

Implikacije izbora hrane dalekosežne su. Tegobe su stvarne. Kako i što jesti kako bi se započeo put prema boljem svijetu? Je li etično samo ono što je 100 % održivo ili je etično hraniti se samo organski uzgojenom hranom? Je li sva procesirana hrana nezdrava? Patvore li hranu i pića i varaju nas, potrošače?

Ovo su samo neka pitanja koja pokazuju da je etika hrane i prehrane važna tema za sve uključene u proizvodnju, pripremu, konzumiranje hrane, ali i one koji se bave njenim otpadom ili otpadom pri njezinoj proizvodnji. Kada je u pitanju hrana i prehrana, „etika“ može obuhvatiti širok raspon vrijednosti, od ekonomskih pitanja do brige za okoliš, ali i način na koji se tretiraju radnici na farmi ili na činjenicu je li hrana lokalna (svježije i manji ugljikov otisak).

Odabir jedinstvenog etičkog okvira koji određuje kako bi svatko trebao jesti jednako je „jednostavan“ kao traženje uzroka stresa na zdravlje. Ono što je izbor jedne osobe nije nužno izbor druge, što se može reći i za hranu. Drugim riječima, etika jedne osobe nije i etika druge, ali obje mogu biti u pravu.

Nutritional Status in Health and Disease

Prof. Darija Vranešić Bender, PhD

Nutritional history includes determining dietary habits, getting an insight into relevant lifestyle and dietary elements, clinical data and medical history, as well as measuring selected anthropometric and biochemical parameters that reflect the nutritional status of the body. Nutritional status is an important factor affecting an individual's health status as well as outcome and recovery from illness or injury. Its evaluation can facilitate the diagnosis and assessment of the severity of the disease as well as enable a more successful treatment.

Dietary habits are determined by way of dietary methods used to evaluate energy intake and macronutrient and micronutrient intake, as well as to determine eating habits and behaviour. Dietary methods most frequently used for this purpose are food diaries, 24-hour recall, the Food Frequency Questionnaire (FFQ) and an interview about eating habits.

Measuring anthropometric parameters usually refers to body weight and height, body mass index, skinfold thickness (biceps, triceps, subscapular and suprailiac areas), upper arm volume of the non-dominant hand while sitting and measuring waist and hip circumference.

The biochemical parameters which are most frequently determined are a complete blood count, general biochemistry, lipid screening, and the total amount of protein and select vitamins and minerals in the serum.

When evaluating a patient's nutritional status, a brief screening is initially performed using one of the validated methods, followed by a comprehensive nutritional status assessment in patients with a recognised nutritional risk. The methods for assessing the individual components of nutritional status are divided into dietetic, anthropometric and biochemical methods and clinical examination. The purpose of screening is to detect malnutrition and then, if necessary, include nutritional support. The goal of nutritional support is the prevention and improvement of mental or physical function deterioration, reduction of the number of complications associated with the disease or its treatment, shortened treatment and recovery time as well as cost reduction.

A review of the studies to date shows marked disagreement in the use of nutritional status assessment methods. The most commonly used and mentioned method in European literature is NRS-2002. This method has been validated in various clinical situations and is recommended by the European Society for Clinical Nutrition and Metabolism (ESPEN). This method is useful for assessing the condition of older patients on admission to hospital. In addition to the rapid detection of nutritionally endangered persons, this method also enables the assessment of possible further exacerbation depending on concomitant diseases and the re-evaluation of patients whose nutritional vulnerability could not be assessed during admission.

Malnutrition or "undernutrition" denotes a condition in which the intake of energy and nutrients is lower than the rate of their consumption and which, over a certain period, leads to changes in organs and organ systems or changes in certain functions. According to Croatian and regional data, the incidence of malnutrition in the hospital population ranges from 20 to 50%. This data is consistent with data from Europe and the US, and varies depending on the method used for the assessment and the population under consideration. Incidence is particularly high in patients with gastroenterological diseases and in patients with malignancies as well as in the elderly.

When malnutrition is used in the narrow sense of the term, it signifies "undernutrition". However, both obesity and lack of one or more micronutrients are also considered a form of nutritional disorder. Nowadays we differentiate between various forms of malnutrition, such as protein-energy malnutrition, tumour cachexia syndrome, and sarcopenia (progressive loss of muscle mass and strength) which is encountered in elderly patients.

Nutritivni status u zdravlju i bolesti

Prof. dr. sc. Darija Vranešić Bender

Nutritivna anamneza obuhvaća određivanje prehrambenih navika, uvid u relevantne elemente načina života i prehrane, kliničke podatke i povijest bolesti te mjerenje odabranih antropometrijskih i biokemijskih parametara koji odražavaju nutritivni status organizma. Nutritivni status važan je čimbenik koji utječe na zdravstveni status pojedinca te na ishod i oporavak od bolesti ili ozljede. Njegova procjena može olakšati dijagnostiku i procjenu težine bolesti te omogućiti uspješnije liječenje.

Određivanje prehrambenih navika provodi se uz pomoć dijetetičkih metoda koje služe za procjenu energetske unosa te unosa makronutrijenata i mikronutrijenata, kao i za utvrđivanje prehrambenih navika i ponašanja. Dijetetičke metode koje se koriste u te svrhe najčešće su dnevnik prehrane, 24-satno prisjećanje, upitnik o učestalosti unosa namirnica (FFQ) te intervju o prehrambenim navikama. Mjerenje antropometrijskih parametara obično se odnosi na tjelesnu masu i visinu, indeks tjelesne mase, debljinu kožnog nabora (područje bicepsa, tricepsa, subskapularno, suprailijakalno) i obujam nadlaktice nedominantne ruke u sjedećem položaju te mjerenje opsega struka i bokova. Biokemijski parametri koji se najčešće određuju jesu kompletna krvna slika, opća biokemija, lipidogram, ukupni proteini i odabrani vitamini i mineralne tvari u serumu.

Prilikom pristupanja procjeni nutritivnog statusa bolesnika prvotno se provodi kratak probir uz pomoć neke od validiranih metoda, a potom se kod bolesnika kod kojih je prepoznat nutritivni rizik provodi sveobuhvatna opsežna procjena nutritivnog statusa. Metode za procjenu pojedinih sastavnica nutritivnog statusa dijele se na dijetetičke, antropometrijske i biokemijske metode te klinički pregled. Svrha je probira otkriti pothranjenost, a potom, ako je potrebno, uključiti nutritivnu potporu. Ishod je nutritivne potpore prevencija i poboljšanje gubitka mentalne ili tjelesne funkcije, smanjenje broja komplikacija vezanih za bolest ili njezino liječenje, skraćeno vrijeme liječenja i oporavka te smanjenje troškova.

Pregledom dosadašnjih studija uočava se izrazito nesuglasje u upotrebi metoda za procjenu nutritivnog statusa. Najčešće korištena i spominjana metoda u europskoj literaturi jest NRS-2002. Ta je metoda validirana u različitim kliničkim situacijama te je preporučuje Europsko društvo za kliničku prehranu i metabolizam (ESPEN). Ova je metoda korisna za procjenu stanja bolesnika starije dobi pri primitku u bolnicu. Osim brzog otkrivanja nutritivno ugroženih osoba, ta metoda omogućuje i procjene mogućeg daljnjeg pogoršanja stanja ovisno o pratećim bolestima te ponovnu evaluaciju bolesnika u kojih se pri primitku nutritivna ugroženost nije mogla procijeniti.

Malnutricija ili pothranjenost jest stanje organizma u kojem je unos energije i hranjivih tvari manji od njihova utroška, pa u određenom razdoblju dovodi do promjena organa i organskih sustava ili promjena pojedinih funkcija. Prema hrvatskim podacima i podacima iz zemalja regije, učestalost pothranjenosti među bolničkom populacijom kreće se od 20 do 50 %. Ti se podaci podudaraju s podacima iz Europe i SAD-a, a variraju ovisno o metodi koja se upotrebljava za procjenu i populaciji koja se razmatra. U bolesnika s gastroenterološkim bolestima te u oboljelih od malignih bolesti i gerijatrijskoj populaciji ta je učestalost osobito visoka.

Kada se govori o malnutriciji u užem smislu, misli se na pothranjenost. Međutim, i pretilost kao i nedostatak jednog ili više mikronutrijenata smatra se oblikom nutritivnog poremećaja. Danas poznajemo različite oblike malnutricije, poput proteinsko-energijske malnutricije, sindroma tumorske kaheksije i sarkopenije (progresivnog gubitka mišićne mase i snage) koju susrećemo u bolesnika starije životne dobi.

In order to optimise treatment, patients suffering from various diseases require early nutritional intervention to prevent nutritional imbalance that would adversely affect the course and treatment of the disease. Nutritional status and overall health affect the patient's ability to withstand therapy or the prescribed treatment method. In addition, the prognosis, quality of life and functional status can be improved by adequate nutritional support and maintaining an adequate nutritional status, thus improving response to and tolerance of therapy.

Anorexia-cachexia syndrome

Prof. Alessandro Laviano, PhD

During acute and chronic diseases, a protective metabolic and behavioural programme is activated to enhance the chances of survival. This programme is broadly termed as "sickness behaviour", and represents a large syndromic umbrella under which different clinical conditions are grouped. The anorexia-cachexia syndrome is classified under the umbrella of "sickness behaviour", and it pertains specifically to the nutritional consequences of chronic diseases, including cancer, chronic obstructive pulmonary disease, chronic renal failure, etc. Although the phenotype of the anorexia-cachexia syndrome is mainly described by weight loss, the nutritional derangement is more complex. In fact, weight loss is accompanied by profound changes of body composition. In particular, muscle wasting is the key feature of this syndrome. Consistent clinical evidence obtained in cancer, respiratory, renal and liver patients show that muscle loss (also referred to as "sarcopenia") is related to worse clinical outcome and reduced quality of life. More recently, a contribution to poor survival has been also described for adipose tissue loss in cancer patients. Muscle quantitative loss is not the only derangement observed by analysing body composition of patients with chronic diseases. In cancer patients, it has been described a progressive fat infiltration of muscle mass leading to "myosteatosis". Interestingly, myosteatosis and sarcopenia may occur independently, or they are associated in the same patient. Also, myosteatosis appears to represent an independent negative prognostic factor for cancer patients undergoing surgery.

The pathogenesis of the anorexia-cachexia syndrome is complex and multifactorial. From the clinical point of view, the anorexia-cachexia syndrome could be described as a syndrome with a variable combination of reduced food intake and/or deranged metabolism (in particular, protein metabolism), which is scarcely responsive to standard nutritional support. From the pathogenic point of view, the main trigger of the syndrome is the increased inflammatory response secondary to the onset and progression of the underlying disease and the therapeutic interventions adopted. In particular, increased inflammatory response either blunts the activity of the prophagic hypothalamic neuronal pathways or activates anorexigenic emergency neuronal circuitry. Simultaneously, pro-inflammatory mediators, including cytokines, directly and indirectly increase catabolic activity within muscle fibres, without a compensatory increase of the intra-muscular anabolic pathways.

Of great clinical interest is the hypothesis that the anorexia-cachexia syndrome may recognise different pathogenic mechanisms during the clinical journey of chronic patients, while its phenotype remains quite stable. In other words, progressive weight and muscle loss could be secondary to different mechanisms over the course of the disease. In this regard, the therapeutic approach to the anorexia-cachexia syndrome should be targeted to the varying pathogenic effects in order to be effective.

U cilju optimizacije liječenja, bolesnici oboljeli od različitih bolesti trebaju ranu nutritivnu intervenciju kako bi se spriječio nutritivni disbalans koji negativno utječe na tijek i liječenje bolesti. Nutritivni status i cjelokupno zdravstveno stanje utječu na sposobnost bolesnika da podnese terapiju odnosno propisan način liječenja. Štoviše, adekvatnom nutritivnom potporom i održavanjem adekvatnog nutritivnog statusa moguće je utjecati na prognozu, kvalitetu života i funkcionalni status, poboljšavajući odgovor i podnošljivost terapije.

Sindrom anoreksije i kaheksije

Prof. dr. sc. Alessandro Laviano

Tijekom akutnih i kroničnih bolesti aktivira se zaštitni metabolički i bihevioralni program da bi se povećalo izgleda za preživljavanje. Ovaj se program općenito naziva „bolesničko ponašanje” i predstavlja široku kategoriju sindroma pod koju se grupiraju različita klinička stanja. Sindrom anoreksije i kaheksije svrstava se u općenitu kategoriju „bolesničkog ponašanja” i odnosi se poglavito na prehrambene posljedice kroničnih bolesti, uključujući maligne bolesti, kroničnu opstruktivnu bolest pluća, kronično zatajenje bubrega itd. Iako fenotip sindroma anoreksija-kaheksija uglavnom označava gubitak tjelesne mase, prehrambeni je poremećaj složeniji. U stvari, gubitak težine popraćen je korjenitim promjenama sastava tijela. Ključno je obilježje ovog sindroma poglavito gubitak mišićne mase. Dosljedni klinički dokazi dobiveni u bolesnika s karcinomom te respiratornim, bubrežnim i jetrenim bolestima pokazuju da je gubitak mišićne mase (koji se naziva i „sarkopenija”) povezan s lošijim kliničkim ishodom i smanjenom kvalitetom života. U novije vrijeme opisano je i da gubitak masnog tkiva doprinosi lošijem preživljenju oboljelih od karcinoma. Kvantitativni gubitak mišića nije jedini poremećaj utvrđen analizom sastava tijela bolesnika s kroničnim bolestima. U bolesnika s karcinomom opisana je progresivna masna infiltracija mišićne mase koja dovodi do „miosteatoze”. Zanimljivo je da se miosteatoza i sarkopenija mogu pojaviti neovisno jedna o drugoj ili međusobno povezane u istog bolesnika. Također, čini se da miosteatoza predstavlja neovisni negativni prognostički čimbenik za bolesnike s karcinomom koji se podvrgavaju kirurškom zahvatu.

Patogeneza sindroma anoreksije i kaheksije složena je i multifaktorijska. S kliničkog stajališta, sindrom anoreksija-kaheksija mogao bi se opisati kao sindrom s promjenjivom kombinacijom smanjenog unosa hrane i/ili poremećenim metabolizmom (osobito metabolizmom proteina), koji slabo reagira na standardnu prehrambenu potporu. S patogenetskog stajališta, glavni okidač sindroma jest pojačani upalni odgovor sekundaran nastupu i napredovanju osnovne bolesti i usvojenoj terapijskoj intervenciji. Točnije, pojačani upalni odgovor ili blokira aktivnost profagičnih hipotalamičkih neuronskih puteva ili aktivira anoreksogeni neuronski krug za hitne slučajeve. Proupalni medijatori, uključujući citokine, istovremeno izravno i neizravno povećavaju kataboličnu aktivnost unutar mišićnih vlakana, bez kompenzatornog povećanja intramuskularnih anaboličkih puteva.

Od velikog je kliničkog interesa hipoteza da sindrom anoreksije i kaheksije može prepoznati različite patogene mehanizme tijekom kliničkog puta kroničnih bolesnika dok njegov fenotip ostaje poprilično stabilan. Drugim riječima, progresivni gubitak težine i mišića može biti sekundaran različitim mehanizmima tijekom bolesti. Stoga, da bi terapijski pristup sindromu anoreksije i kaheksije bio učinkovit, trebao bi biti usmjeren na različite patogene učinke.

Refeeding syndrome

Dina Ljubas Kelečić, MPharm

Refeeding Syndrome (RFS) is defined as a serious and potentially fatal shift in electrolytes (potassium, magnesium and phosphate) and fluids resulting from metabolic abnormalities in malnourished patients receiving artificial refeeding, whether through oral, enteral or parenteral administration. The Refeeding syndrome (RFS) was first described after the Second World War during reintroduction of nutrition in starved, undernourished prisoners who exhibited cardiac abnormalities leading to their deaths. Today, the pathophysiology of RFS is well documented and understood, involving metabolic changes due to the transition from catabolism to anabolism. RFS-related complications affect multiple organ systems, particularly the cardiovascular and neurological systems, and may result in death if not recognised on time. Hypophosphataemia is a main feature of RFS, usually occurring between the second and the fourth day after the introduction of nutritional support. Furthermore, the deficiency of thiamine (vitamin B1) in malnourished patients during "refeeding" may lead to serious neurological complications such as Wernicke encephalopathy, Wernicke-Korsakoff syndrome, and lactic acidosis as a lesser known complication, due to its essential role in carbohydrate metabolism and branched-chain amino acids.

The prevalence of RFS among different patient populations has been reported to range from 0.43% to 54%, depending on whether hypophosphataemia or malnutrition is identified as a major risk factor for incidence of RFS. Although the use of glucose with parenteral nutrition is often cited as the most common cause of RFS in literature, according to some studies, the frequency of refeeding hypophosphataemia is higher in patients receiving enteral than parenteral feeding. Risk factors for the occurrence of RFS are malnutrition, unintentional weight loss, minimal or insufficient oral nutritional intake over a longer period of time and initial low serum concentrations of potassium, phosphate or magnesium before feeding. Other diseases (chronic alcoholism, anorexia nervosa, tumours, chronic dysphagia, depression in elderly patients, etc.) and conditions (recurrent vomiting or diarrhoea, failure or inflammation of the digestive tract, etc.) which result in a decreased intake, loss and/or absorption of nutrients are a potential risk for developing RFS.

Gastrointestinal Physiology

Prof. Alastair Forbes, MD, PhD

The gastrointestinal tract mainly comprises a tubular structure running from the mouth to the anus totalling some 7 to 8 metres in length, with key contributions to its functions from biliary and pancreatic secretions and an important interaction with the liver.

Metabolism and digestion are predominantly in the proximal small bowel while net absorption of fluid and electrolytes is distal. The initial proximal responses are almost always secretory, and absorption of water and electrolytes is predominantly an active process; the Na/K pump handles sodium and water transport, and the cystic fibrosis transmembrane conductance regulator handles chloride transfer. Fluid flux across the intestine is in excess of 8L in 24 hours.

Digestion is intraluminal and at the mucosal surface in the brush border and is followed by incorporation into the cells for delivery via the portal vein (most nutrients) or the lymphatics (long chain fats). The stomach contributes to digestion with acid and pepsin but has an arguably more important role in sorting nutrients for timely exit into the small intestine (clear fluids first and fats last).

Amylases from the salivary glands and the intestine address polysaccharides, proteases from stomach, pancreas and intestine address proteins while lipases are much more restricted to pancreatic secretions. Bile is needed to create micelles for lipid absorption.

„Refeeding” sindrom

Dina Ljubas Kelečić, mag. pharm.

„Refeeding” sindrom (RFS) definira se kao ozbiljan i potencijalno fatalan poremećaj elektrolita (kalija, magnezija i fosfata) i tekućina koji nastaje uslijed metaboličkih abnormalnosti u pothranjenih bolesnika nakon ponovnog uvođenja prehrane, bilo da se radi o oralnom, enteralnom ili parenteralnom putu primjene. RFS se prvi puta opisuje nakon Drugog svjetskog rata u pothranjenih zarobljenika koji su umrli od zatajenja srca kada su nakon dugotrajnog gladovanja ponovno počeli jesti. Danas je patofiziologija RFS-a dobro razjašnjena, a podrazumijeva metaboličke promjene uslijed prelaska organizma iz katabolizma u anabolizam. Komplikacije RFS-a zahvaćaju različite organske sustave, osobito kardiološki i neurološki sustav, a ako se na vrijeme ne prepoznaju, mogu dovesti i do smrtnog ishoda. Hipofosfatemija je glavno obilježje RFS-a, a obično nastaje između drugog i četvrtog dana od uvođenja nutritivne potpore. Nadalje, deficit tiamina ili vitamina B1 kod pothranjenih bolesnika tijekom „refeedinga” može izazvati ozbiljne neurološke komplikacije kao što su Wernickeova encefalopatija, Wernicke-Korsakoffljev sindrom te laktatna acidoza kao manje poznata komplikacija zbog neizostavne uloge u metabolizmu ugljikohidrata i aminokiselina razgranatog lanca.

Prevalencija RFS-a u različitim bolničkim populacijama iznosi od 0,43 % do 54 %, ovisno o tome gleda li se hipofosfatemija ili pothranjenost kao glavni čimbenik rizika za nastanak RFS-a. Iako se primjena glukoze uz parenteralnu prehranu u literaturi navodi kao najčešći uzrok nastanka RFS-a, prema nekim radovima učestalost „refeeding” hipofosfatemije veća je kod enteralnog nego kod parenteralnog hranjenja. Čimbenici rizika za nastanak RFS-a jesu pothranjenost, nenamjeran gubitak tjelesne mase, minimalan ili nedovoljan peroralni unos hrane tijekom duljeg vremenskog razdoblja te inicijalno niske serumske koncentracije kalija, fosfata ili magnezija prije uvođenja nutritivne potpore. Možemo reći da različite bolesti (kronični alkoholizam, anoreksija nervoza, tumori, kronična disfagija, depresija u starijih bolesnika i dr.) i stanja (protrahirano povraćanje ili proljev, zatajenje ili upala probavne cijevi i dr.) kod kojih dolazi smanjenog unosa, gubitka i/ili apsorpcije nutrijenata imaju potencijalni rizik za nastanak RFS-a.

Fiziologija probavnog sustava

Prof. dr. sc. Alastair Forbes, dr. med.

Gastrointestinalni sustav sastoji se poglavito od cjevaste strukture koja se proteže od usta do anusa, ukupne dužine od otprilike 7 do 8 metara. Ključan doprinos njegovoj funkciji pružaju žučne i gušteračne izlučevine te bitna interakcija s jetrom.

Metabolizam i probava poglavito se odvijaju u proksimalnom tankom crijevu, dok se neto apsorpcija tekućine i elektrolita odvija na distalnom dijelu. Početne proksimalne reakcije gotovo su uvijek izlučivanje, a apsorpcija vode i elektrolita većinom je aktivan proces. Natrij-kalij pumpa odgovorna je za prijenos natrija i vode, a transmembranski regulator propusnosti cistične fibroze odgovoran je za prijenos klorida. Protok tekućine duž crijeva veći je od 8 l tijekom 24 sata.

Probava se odvija u lumenu i na mukoznoj površini u četkastoj prevlaci. Nakon toga slijedi inkorporacija u stanice za dovod putem portalne vene (većina hranjivih tvari) ili limfatičkog tkiva (masti dugog lanca). Želudac doprinosi probavi s pomoću kiseline i pepsina, ali ima možda još i važniju ulogu u razvrstavanju hranjivih tvari za pravovremeni izlazak iz tankog crijeva (najprije čiste tekućine i zatim masti).

Amilaze iz žlijezda slinovnica i crijeva razgrađuju polisaharide, proteaze iz želuca, gušterače i crijeva razgrađuju bjelancevine, dok su lipaze znatno više ograničene na izlučevine iz gušterače. Žuč je potrebna za stvaranje micela za apsorpciju lipida.

Appetite is controlled by central responses to locally released hormones. Ghrelin increases appetite, while cholecystokinin (CCK), leptin and peptide PYY (released in response to eating) reduce it.

CCK (perhaps the single most important hormone) stimulates release of bile and pancreatic secretions and is inhibited by somatostatin and products of digestion. Somatostatin secreted proximally when food arrives also inhibits acid secretion and gastrointestinal motility.

Luminal digestion is from the large molecules present in diet to tri- and disaccharides and small peptides which are preferentially absorbed (better than amino acids), but lipids are mainly absorbed into micelles still in the form of long-chain triglycerides. Only medium-chain triglycerides are accepted into the portal circulation.

The small bowel requires glutamine as a nutrient while the colon has a similar dependency on short chain fatty acids which it obtains from bacterial fermentation of non-absorbed polysaccharides.

Only in the distal ileum are vitamin B12 or bile salts absorbed. Loss of the distal ileum therefore has specific uncompensatable effects.

The gut-liver axis is important in maintaining liver health and in ensuring normal absorption of fats, fat-soluble vitamins and of some electrolytes.

Much evidence exists to demonstrate that enteral nutrition (including food) is always to be preferred because of clear physiological advantages.

The role of microbiota in health and diseases

Prof. Donatella Verbanac, PhD

The microbial communities that reside in the human gut and their impact on human health and disease are one of the most exciting new areas of research today. Namely, the human body is home to a large number of distinct microbial communities, with the thickest population in the distal gut – representing the gut microbiota. The gut microbiota is considered an organ within our body composed of ten trillion microorganisms with the mass of almost 2.5 kilos. Microbiota is mostly acquired at birth and during early childhood and exhibits beneficial roles when it is in perfect balance or in eubiosis. The vast array of gene products provided by resident microbes is known to diversely supplement the host's own metabolic processes. This includes the extraction of energy from dietary components, an association that is, for example, essential with regard to polysaccharides and lipids. Further influences of the gut microbiota include modulation of neuro-hormones and gut-derived lipids, short-chain fatty acids, triglyceride clearance, vitamin biosynthesis and mucosa-associated immunity. Evidence from experimental animal models and human subjects indicate that changes in the gut microbiota (with prebiotics and/or probiotics) may participate in the control of the development of metabolic diseases associated with obesity and chronic degenerative diseases.

Diet is a key player when it comes to preserving our gastrointestinal health, since through eating and digesting we nourish our gut microbiota, and in this way influence its diversity and composition. Although a disrupted microbial equilibrium can have many causes (e.g. infectious pathogens and/or use of antibiotics), the role of our daily food and lifestyle is crucial. Thus, the maintenance of our gastrointestinal health is to a considerable extent in our own hands because when the microbiota balance is disturbed, it might result in a number of disorders. These include functional intestine disorders, inflammatory bowel diseases and other immune mediated diseases, such as celiac disease and certain allergies. In addition, metabolic conditions, such as type 2 diabetes, and recently even behavioural disorders, such as autism and depression, were reported to be linked to gut microbial imbalances. Excess sugary and salty snacks, foods with high amounts of animal fat, as well as of greasy and fried foods are not recommended, while a diet rich in

Apetitom upravljaju reakcije središnjeg živčanog sustava na lokalno otpuštene hormone. Grelin potiče apetit, a smanjuju ga kolekistokin (CCK), leptin i peptid PYY (koji se otpušta kao reakcija na hranjenje).

CCK (možda čak i najvažniji hormon) potiče otpuštanje žuči i izlučevina iz gušterače, a inhibiraju ga somatostatin i proizvodi probave. Somatostatin koji se proksimalno izlučuje kada stigne hrana također inhibira lučenje kiseline i gastrointestinalni motilitet.

Luminalna probava počinje od velikih molekula u hrani do trisaharida, disaharida i malih peptida koji su bolji za apsorpciju (od aminokiselina). Međutim, lipidi se prvenstveno apsorbiraju u micide dok su i dalje u obliku triglicerida dugog lanca. Samo se trigliceridi srednjeg lanca odvođe u portalnu cirkulaciju.

Tankom je crijevu potreban glutamin kao hranjiva tvar, dok debelo crijevo na sličan način ovisi o masnim kiselinama kratkog lanca, koje dobiva iz bakterijske fermentacije neapsorbiranih polisaharida.

Vitamin B12 ili žučne soli apsorbiraju se isključivo u distalnom ileumu. Stoga gubitak distalnog ileuma uvijek ima specifične posljedice koje nije moguće kompenzirati.

Osovina crijeva-jetra važna je za održavanje zdravlja jetre i osiguranja normalne apsorpcije masti, vitamina topivih u mastima i nekih elektrolita.

Postoji mnogo dokaza u prilog tome da je uvijek poželjnija enteralna prehrana (uključujući hranu) zbog nedvojbenih fizioloških prednosti.

Uloga mikrobiote u zdravlju i bolesti

Prof. dr. sc. Donatella Verbanac

Zajednice mikroba koje nastanjuju ljudsko crijevo i njihov utjecaj na ljudsko zdravlje i bolest jedno su od najzбудljivijih novih područja u istraživanju današnjice. Naime, ljudsko tijelo dom je velikom broju različitih zajednica mikroba s najširoom populacijom u distalnom crijevu – koja predstavlja crijevnu mikrobiotu. Crijevna mikrobiota smatra se organom unutar našeg tijela koji se sastoji od deset bilijuna mikroorganizama s masom od gotovo 2,5 kilograma. Mikrobiota se većinom stječe nakon rođenja i tijekom ranog djetinjstva te ima korisnu ulogu kada je u savršenoj ravnoteži ili u eubiozi. Poznato je da veliko mnoštvo genetskih proizvoda koje proizvode rezidentni mikrobi različito nadopunjuje vlastite metaboličke procese domaćina. To uključuje ekstrakciju energije iz prehrambenih sastojaka, vezu koja je, na primjer, neophodna s obzirom na polisaharide i lipide. Ostali utjecaji crijevne mikrobiote uključuju modulaciju neurohormona i lipida iz crijeva, masnih kiselina kratkog lanca, klirens triglicerida, biosintezu vitamina i imunost povezanu sa sluznicom. Dokazi iz ispitivanja na eksperimentalnim životinjskim modelima i ljudskim ispitanicima pokazuju da promjene u mikrobioti crijeva (prebioticima i/ili probioticima) mogu sudjelovati u kontroli razvoja metaboličkih bolesti povezanih s pretilošću i kroničnih degenerativnih bolesti.

Prehrana je ključni igrač u očuvanju našeg gastrointestinalnog zdravlja jer jelom i probavom njegujemo crijevnu mikrobiotu i na taj način utječemo na njezinu raznolikost i sastav. Iako poremećena mikrobna ravnoteža može imati mnogo uzroka (npr. infektivni patogeni i/ili uporaba antibiotika), ključna je uloga naše svakodnevne hrane i životnog stila. Stoga je održavanje vlastitog gastrointestinalnog zdravlja u velikoj mjeri u našim rukama, jer poremećena ravnoteža mikrobiote može dovesti do brojnih poremećaja. To uključuje funkcionalne poremećaje crijeva, upalne bolesti crijeva i druge bolesti posredovane imunošću, kao što su celijakija i određene alergije. Osim toga, utvrđeno je da bi metabolička stanja kao što je dijabetes tipa 2, a nedavno čak i poremećaji ponašanja kao što su autizam i depresija, mogli biti povezani s neravnotežom crijevnih mikroba. Ne preporučuje se prekomjeran unos slatkih i slanih grickalica, hrane s visokom količinom životinjske masti kao i masne i pržene hrane, dok je dokazano da je prehrana

olive oil, vegetables, salads and fruits, rich sources of bio- and polyphenols has proven to be beneficial to maintaining health. The same applies to fermented dairy products containing pro- and prebiotics.

Probiotics are defined by the World Health Organization (WHO) and the United Nations' Food and Agriculture Organization (FAO) as live organisms which, when ingested in adequate amounts, confer a health effect on the host. Probiotic as supplementation may change the microbiota of the digestive tract and modulate the immune defences and nutritional performance. Additionally, probiotics and prebiotics (mainly, indigestible food ingredients that stimulate the growth and maintenance of abeneficial gut microbiota) as supplementation, may strengthen the immune system by stimulating immune mechanisms inside and outside the gut, helping to regulate the gut motility, and acting as anti-inflammatory compounds in the gut, with an impact beyond the gut itself. A generally important ability of probiotics that affects various digestive disorders consists in improving the gut's microbial composition and preserving its stability. Recent findings on how diet and dietary supplements (probiotics, prebiotics and vitamins) support the health of our microbiota will be discussed during the lecture.

bogata maslinovim uljem, povrćem, salatama i voćem, bogatim izvorima bio- i polifenola, korisna za održavanje zdravlja. Isto vrijedi i za fermentirane mliječne proizvode koji sadrže pro- i prebiotike.

Svjetska zdravstvena organizacija (SZO) i Organizacija Ujedinjenih naroda za prehranu i poljoprivredu (*engl. United Nations' Food and Agriculture Organization, FAO*) definirale su probiotike kao žive organizme koji, kada se unesu u odgovarajućim količinama, imaju učinak na zdravlje domaćina. Probiotik kao dodatak prehrani može promijeniti mikrobiotu probavnog trakta i modulirati imunosnu obranu i nutritivnu učinkovitost. Osim toga, probiotici i prebiotici (uglavnom neprobavljivi sastojci hrane koji stimuliraju rast i održavanje korisne crijevne mikrobiote) kao dodaci prehrani mogu ojačati imunosni sustav stimulacijom imunosnih mehanizama unutar i izvan crijeva, pomažući reguliranje pokretljivosti crijeva i djelujući kao protuupalni spojevi u crijevima, s utjecajem koji nadilazi sama crijeva. Općenito važna sposobnost probiotika koja djeluje na različite probavne smetnje sastoji se u poboljšanju mikrobnog sastava crijeva i očuvanju njegove stabilnosti. Tijekom predavanja raspravljat će se o najnovijim saznanjima o tome kako prehrana i dodaci prehrani (probiotici, prebiotici i vitamini) sudjeluju u održavanju zdravlja naše mikrobiote.

Basics of enteral nutrition

Prof. Željko Krznarić, MD, PhD

Clinical nutrition in a narrow sense refers to medical nutrition therapy or, more commonly, to nutritional support that integrates administration of oral enteral formulas, enteral feeding via tube, and parenteral nutrition. Enteral and parenteral nutrition have traditionally been called artificial nutrition.

Orally administered enteral formulas are considered oral nutritional therapy or, more frequently, oral nutritional support (ONS). They are used when the function of the digestive system is preserved and nutrition via tube is not necessary. Enteral formulas provide high energy and nutrient density in a small volume and are available as liquid formulas, creams (altered texture formulas) or as powders which are diluted with water in a particular ratio. In English-language literature, oral administration of enteral formulas is also called "sip feeding". The clinical benefits of using these formulations, as well as their economic viability, have been proven by numerous studies.

Polymer formulations are used as basic commercial enteral formulas in hospitals, but also as home enteral nutrition, seeing as they are best tolerated. Commercial enteral formulas have many advantages compared to preparations made in hospital kitchens or at home, because the type or amount of individual ingredients in them cannot be determined with certainty, they are more often exposed to bacterial contamination and at the same time are more likely to cause cramps and diarrhoea, and sometimes they can also be difficult to administer by way of enteral tubes.

Polymer formulas contain intact proteins, carbohydrates in the form of glucose polymers, and lipids as long-chain triglycerides (LCTs), or LCTs and medium-chain triglycerides (MCTs). These solutions also contain standardised amounts of minerals, oligoelements and vitamins. Such standard formulas can be nutritionally complete (meaning they can be used as the sole source of food for the patient) or used as supplements to other types of diet. The osmolarity of polymer formulas is generally low (about 300 mOsm/L), and they usually have a palatable taste, which is why they can also be administered orally. Most polymer formulas have 1-2 kcal/mL. It is increasingly common to enrich them with a mixture of soluble and insoluble dietary fibre. Diets consisting of polymer formulas have an acceptable percentage of side effects, are well-accepted by patients, and their price justifies daily use in indicated situations and entities. They are considered an appropriate choice for more than 80 % of patients.

Oligomeric preparations contain hydrolysed proteins, i.e. peptides, carbohydrates in the form of partially hydrolysed maltodextrins of starch, simple sugars, polymers of glucose or starch and fat in the form of LCT or a combination of LCT and MCT. They have a significantly higher degree of osmolarity than polymer formulas. These formulas are indicated for patients with impaired digestive capacity, food allergies, maldigestion, exocrine pancreatic insufficiency, short bowel syndrome, inflammatory bowel diseases and intestinal fistulae.

In patients who are in critical condition, failure to tolerate standard enteral formulas can present a challenge due to intestinal failure as one component of multiple organ failure. Up to 64 % of patients in critical condition can have some form of GI dysfunction, which can lead to difficulty in feeding and inadequate nutrient intake.

Special formulas include numerous polymer and oligomeric formulations adapted to the needs of particular pathological conditions, such as hereditary metabolic disorders or specific diseases involving single organ dysfunction or a specific population, like the elderly, as well as clinical conditions such as acute and chronic renal failure, chronic obstructive pulmonary disease, liver disease, decubitus ulcers and chronic wounds, sarcopenia, tumour cachexia, glucose intolerance and numerous other clinical situations.

Enteral nutrition can also be administered through a tube or an opening for feeding (stoma) directly into the digestive system. The tube can be inserted through the nasal cavity as a nasogastric, nasojejunal or naso-post-pyloric tube,

Osnove enteralne prehrane

Prof. dr. sc. Željko Krznarić, dr. med.

Klinička prehrana u užem smislu odnosi se na medicinsku nutritivnu terapiju ili češće na nutritivnu potporu koja objedinjuje primjenu oralnih enteralnih pripravaka, enteralnu prehranu putem sonde i parenteralnu prehranu. Enteralna i parenteralna prehrana tradicionalno se nazivaju artifičijelnom prehranom.

Oralno primijenjeni enteralni pripravci smatraju se oralnom nutritivnom terapijom ili češće oralnom nutritivnom potporom (engl. *oral nutritional support* – ONS). Primjenjuju se kada je funkcija probavnog sustava očuvana i nije potrebna prehrana putem sonde. Enteralni pripravci osiguravaju visoku gustoću energije i nutrijenata u malom volumenu i dostupni su kao tekući pripravci, kreme (pripravci promijenjene teksture) ili u obliku praškastih pripravaka koji se razrjeđuju vodom u zadanom omjeru. U anglosaksonskoj literaturi oralna primjena enteralnih pripravaka naziva se i „sip feeding“. Klinička dobrobit primjene ovih pripravaka kao i ekonomska opravdanost dokazani su brojnim studijama.

Polimerni pripravci primjenjuju se kao temeljne komercijalne enteralne formule u bolnicama, ali i za kućnu enteralnu prehranu, s obzirom na to da se najbolje podnose. Komercijalne enteralne formule imaju brojne prednosti naspram pripravaka koji se pripremaju u bolničkim kuhinjama ili kod kuće jer se njima ne može sa sigurnošću odrediti vrsta ni količina pojedinih sastojaka, češće su izloženi bakterijskoj kontaminaciji, češće uzrokuju grčeve i proljeve, a ponekad ih je teško aplicirati kroz enteralne sonde.

Polimerni pripravci sadrže intaktne proteine, ugljikohidrate u obliku polimera glukoze i lipide kao dugolančane trigliceride (engl. *long-chain triglycerides* – LCT) ili LCT i srednjelančane trigliceride (engl. *medium-chain triglycerides* – MCT). Istodobno se u otopini nalaze i standardizirane količine minerala, oligoelemenata i vitamina. Ovakve standardne formule mogu biti nutritivno cjelovite (što znači da se mogu upotrebljavati kao jedini izvor hrane za pacijenta) ili se primjenjuju kao dodaci nekom drugom vidu prehrane. Osmolarnost polimernih pripravaka uglavnom je niska (oko 300 mOsm/l), a najčešće su i prihvatljiva okusa, pa se mogu primjenjivati i peroralno. Većina polimernih pripravaka ima 1 – 2 kcal/ml. Sve su češće obogaćeni mješavinom topivih i netopivih prehrambenih vlakana. Polimerne dijete imaju prihvatljiv postotak nuspojava, bolesnici ih dobro prihvaćaju, a njihova cijena opravdava svakodnevnu upotrebu u indiciranim situacijama i entitetima. Smatra se da predstavljaju odgovarajući odabir u više od 80 % pacijenata.

Oligomerni pripravci sadrže proteine u hidroliziranom obliku, odnosno peptide, ugljikohidrate u obliku parcijalno hidroliziranih maltodekstrina škroba, jednostavnih šećera, polimera glukoze ili škroba i mast u obliku LCT ili kombinacije LCT i MCT. Imaju značajno veću osmolarnost u odnosu na polimerne pripravke. Ovi pripravci indicirani su u bolesnika s narušenim probavnim kapacitetom, alergijama na hranu, kod maldigestije, egzokrine insuficijencije gušterače, sindroma kratkog crijeva, upalnih bolesti crijeva i intestinalnih fistula.

Kod bolesnika koji se nalaze u kritičnim stanjima, nepodnošenje standardnih enteralnih pripravaka može predstavljati izazov zbog zatajenja crijevne funkcije, jedne od komponenti višestrukog zatajenja organa. Čak do 64 % bolesnika u kritičnim stanjima mogu imati neki od oblika GI disfunkcije, što može dovesti do poteškoća u hranjenju i neadekvatnog unosa nutrijenata.

U specijalne pripravke ubrajaju se brojni polimerni i oligomerni pripravci prilagođeni potrebama u posebnim patološkim stanjima, kao što su nasljedni metabolički poremećaji ili specifične bolesti koje uključuju disfunkciju pojedinog organa ili specifičnu populaciju, poput gerijatrijske, te klinička stanja poput akutne i kronične bubrežne insuficijencije, kronične opstruktivne bolesti pluća, bolesti jetre, dekubitalnih ulkusa i kroničnih rana, sarkopenije, tumorske kaheksije, intolerancije glukoze i brojnih drugih kliničkih situacija.

Enteralna prehrana može se primjenjivati i putem sonde ili hranidbenog otvora (stome) izravno u probavni sustav. Sonda se može umetnuti kroz nosnu šupljinu kao nazogastrična, nazojejunalna ili nazopostpilorična sonda ili putem

or via a stoma that is endoscopically placed into the stomach (percutaneous endoscopic gastrostomy, PEG), with a possible jejunal extension (PEG-J), or into the jejunum (percutaneous endoscopic jejunostomy, PEJ). Furthermore, the stoma can also be surgically placed, for example as a gastrostomy or jejunostomy, or by using a radiological approach.

Full enteral nutrition refers to a situation when all nutrients are provided through a feeding tube, without significant contribution from oral intake or parenteral nutrition.

Supplemental enteral nutrition is given to patients whose oral food and fluid intake is insufficient and does not meet the target intake of energy and nutrients.

When enteral nutrition is administered outside the hospital, it is called home enteral nutrition. It can be administered as full or supplemental enteral nutrition.

Basics of parenteral nutrition

Dina Ljubas Kelečić, MPharm

Parenteral nutrition (PN) is intravenous feeding which includes water, protein (amino acids), non-protein energy (glucose and lipids) and micronutrients (vitamins and trace elements) provision to patients in whom oral or enteral nutrition is impossible or inadequate to ensure daily energy and protein requirements. Parenteral nutrition admixtures, all-in-one (AiO) are sterile parenteral infusions containing up to 50 individual components aseptically manufactured or compounded by the well-trained staff under pharmacist supervision in a hospital pharmacy. The goals of parenteral nutrition are the prevention or correction of nutritional deficiencies and malnutrition syndrome in cases of inadequate digestive system function. Indications for PN in different clinical situations and appropriate use of PN will depend partly on the availability of local knowledge and experienced multidisciplinary nutrition support team (NST).

Depending on the spectrum and the amount of nutrients delivered, parenteral nutrition may be supplemental (SPN), for example in patients who can't meet their daily nutritional requirements via enteral nutrition, or total (TPN) when all nutrients are covered intravenously. Parenteral nutrition is administered via a central or peripheral placed line as continuous (for 24 hours) or cyclic infusion (e.g., within 15 hours). Complications of parenteral nutrition range from metabolic, infective, central venous catheter related, traumatic and thrombotic. Most common early PN complications include electrolyte and fluid disorders, hypo and hyperglycemia, refeeding syndrome, catheter-related sepsis while late PN complications include hepatobiliary complications and bone disease. Regular monitoring and clinical supervision are important factors in determining efficacy, sufficiency and safety of PN and consequentially preventing complications. Furthermore, catheter-related sepsis can be minimized with strict aseptic protocols and education of the medical staff in hospital and patients requiring long-term PN or home parenteral nutrition (HPN).

From a pharmaceutical point of view, parenteral nutrition as a multicomponent admixture/preparation with high potential of interactions between components and/or other medications prescribed to the patient, stability issues and other, is probably the most complex therapy today.

stome koja se postavlja endoskopski u želudac (perkutana endoskopska gastrostoma – PEG), s mogućom jejunalnom ekstenzijom (PEG-J), ili u jejunum (perkutana endoskopska jejunostoma – PEJ). Nadalje, stoma može biti postavljena i kirurški, primjerice kao gastrostoma ili jejunostoma ili radiološkim pristupom.

Potpuna enteralna prehrana odnosi se na situaciju kada se svi nutrijenti osiguravaju putem sonde za hranjenje, bez značajnog doprinosa oralnog unosa ili parenteralne prehrane.

Dodatna enteralna prehrana daje se bolesnicima čiji je oralni unos hrane i tekućine nedostatan, pa ne ispunjavaju ciljni unos energije i nutrijenata.

Kada se enteralna prehrana primjenjuje izvan bolnice, naziva se kućna enteralna prehrana. Može se davati kao potpuna ili dodatna enteralna prehrana.

Osnove parenteralne prehrane

Dina Ljubas Kelečić, mag. pharm.

Parenteralna prehrana (engl. parenteral nutrition, PN) je intravenozno hranjenje koje uključuje davanje vode, proteina (aminokiselina), neproteinske energije (glukozu ili lipide) te mikronutrijenata (vitamina i elementa u tragovima) u bolesnika u kojih oralna ili enteralna prehrana nije moguća ili nije dostatna za osiguravanje dnevnih potreba za energijom i proteinima. Otopine za parenteralnu prehranu sterilne su parenteralne infuzije koje sadrže do 50 različitih pojedinačnih sastojaka proizvedenih industrijski (standardizirani pripravci) ili u aseptičnim uvjetima pod nadzorom farmaceuta u bolničkoj ljekarni (individualizirani pripravci). Ciljevi su parenteralne prehrane prevencija ili korekcija nutritivnih deficita i malnutricije u slučajevima neodgovarajuće funkcije probavnog sustava. Indikacije za PN u različitim kliničkim situacijama i odgovarajuća primjena PN-a ovisit će dijelom o dostupnosti lokalnog znanja i iskusnog multidisciplinarnog nutritivnog tima (engl. Nutrition Support Team, NST).

Ovisno o spektru i količini primijenjenih nutrijenata, parenteralna prehrana može biti suplementarna, na primjer u bolesnika koji ne mogu zadovoljiti svoje dnevne potrebe enteralnim putem, ili totalna odnosno kojom se pokrivaju svi potrebni nutrijenti. Parenteralna prehrana primjenjuje se putem centralnog ili perifernog venskog puta u obliku kontinuirane (24 sata) ili cikličke infuzije (npr. unutar 15 sati). Komplikacije parenteralne prehrane sežu od metaboličkih, infektivnih, onih povezanih s centralnim venskim kateterom, traumatskih do trombotskih. Najčešćije rane komplikacije parenteralne prehrane uključuju poremećaje elektrolita i tekućine, hipo- i hiperglikemiju, refeeding sindrom i sepsu povezanu s primjenom katetera, dok kasne komplikacije parenteralne prehrane uključuju hepatobilijarne komplikacije i metaboličku bolest kostiju. Redovito praćenje i klinički nadzor važni su čimbenici u određivanju djelotvornosti, dostatnosti i sigurnosti PN-a te posljedično u sprječavanju komplikacija. Nadalje, sepsa povezana s primjenom katetera može se umanjiti strogim aseptičkim protokolima i edukacijom zdravstvenog osoblja u bolnicama te bolesnika u kojih je potrebna dugotrajna primjena PN-a kao što je kućna parenteralna prehrana (engl. home parenteral nutrition, HPN).

S farmaceutskog gledišta, parenteralna prehrana predstavlja vjerojatno najsloženiju terapiju s obzirom da se radi o otopinama/pripravcima koji zbog velikog broja različitih supstanci koje sadrže imaju visoki potencijal interakcija međusobno i/ili s drugim lijekovima te ograničenu stabilnost.

Micronutrients: Clinical Applications

Prof. Alastair Forbes, MD, PhD

Assessment for and correct provision of micronutrients is difficult as there are frequent diagnostic uncertainties and when it comes to intervention a surprising lack of therapeutic flexibility.

Spontaneous nutrition

Fortunately in spontaneous nutrition, micronutrients are not a major issue for most people. Although many micronutrients have limited stores in the body - with the exception of vitamin D - vitamin and trace elements are generally well maintained. This extends even to most cases of starvation and most illnesses, and deficiency is rarely conveyed to the fetus (nb folate).

Geographical risks exist and although iodine deficiency is mainly historic population selenium depends on the staple cereal source (low in European wheat).

Disease-related micronutrient deficiency is not usually caused by non-gastrointestinal disease; although non-specific effects of illness/anorexia may provoke specific micronutrient deficiency more usually there is a global picture of disease-related malnutrition.

Gastrointestinal disease causes micronutrient deficiency usually via a diffuse multinutrient defect as in small bowel disease. Gastric or ileal disease can of course be responsible for isolated vitamin B12 deficiency, and pancreatobiliary disease can compromise all fat-soluble vitamins. Bariatric surgery may be problematic but is unpredictable.

Artificial nutrition: Enteral Nutrition

Micronutrients are not a major issue in most cases. Standard enteral feeds all contain a balanced range of vitamins and trace elements. European law requires manufacturers to include RDA for all micronutrients in the volume of feed that provides 1500kcal. Where additional supplements are needed it is because of underlying disease/prior deficit.

Artificial nutrition: Parenteral Nutrition (PN)?

Much PN is used for short periods in relatively healthy people (pre-morbid state). Trace elements (deficiency or excess) then rarely a big problem, and vitamin excess is unlikely to be a problem. However, vitamin deficiency may be a big problem even in short-term care.

Our knowledge of pathophysiology and our opportunities to assay effectively are limited. A pragmatic approach is thus necessary and is generally based on using commercially available "baskets" of vitamins and of trace elements.

Specific micronutrients to be addressed in more detail in the talk

- ▶ Zinc - important in enzyme systems & gene expression and often low in disease
- ▶ Copper - component of many enzyme systems; deficiency rare but toxicity is seen
- ▶ Manganese - component of many enzyme systems; toxicity common with long-term PN
- ▶ Vitamin D and Vitamin K present special problems but have their own literature
- ▶ Vitamin C - strong antioxidant cofactor for many enzymes, deficiency was common
- ▶ Thiamine - major metabolic roles in handling of carbohydrates, malnourished patients often thiamine deficient, glucose load of PN exacerbates problem by increasing demand; many and often irreversible problems. Note link with lactic acidosis.

Mikronutrijenti: klinička primjena

Prof. dr. sc. Alastair Forbes, dr. med.

Procjena potrebe za mikronutrijentima i njihova ispravna primjena zahtjevne su zbog učestalih dijagnostičkih neodređenosti te iznenađujućeg manjka terapijske fleksibilnosti ako je potrebna intervencija.

Spontana prehrana

Srećom, u većine ljudi mikronutrijenti ne predstavljaju velik problem u spontanoj prehrani. Iako mnogi mikronutrijenti imaju ograničene zalihe u tijelu – uz iznimku vitamina D – vitamini i elementi u tragovima uglavnom se dobro održavaju. To uključuje čak i većinu slučajeva gladovanja i većinu bolesti, a deficijencije se rijetko prenose na fetus (n.b. folat).

Postoje rizici povezani s određenim geografskim područjem te iako je nedostatak joda uglavnom bio problem za određene populacije u povijesti, selen u populaciji ovisi o izvoru iz glavnih žitarica (nizak je u europskoj pšenici).

Nedostatak mikronutrijenata povezan s bolesti obično nije uzrokovan bolestima koje nisu gastrointestinalne. Iako nespecifični učinci bolesti/anoreksije mogu izazvati specifične nedostatke mikronutrijenata, češće se viđa opća slika malnutricije vezane uz bolest.

Gastrointestinalna bolest uzrokuje nedostatak mikronutrijenata obično putem difuznog poremećaja više nutrijenata, kao kod bolesti tankog crijeva. Naravno, bolest želuca ili ileuma može biti odgovorna za izolirani nedostatak vitamina B12, a pankreatobilijarne bolesti mogu ugroziti sve vitamine topive u mastima. Barijatrična operacija može biti problematična i nepredvidiva.

Umjetna prehrana: enteralna prehrana

Mikronutrijenti u većini slučajeva ne predstavljaju velik problem. Svi standardni enteralni pripravci sadrže uravnotežene udjele vitamina i elemenata u tragovima. Europski zakon zahtjeva od proizvođača da navedu preporučeni dnevni unos (engl. *Recommended Dietary Allowances* – RDA) svih mikronutrijenata u količini pripravka od 1500 kcal. Veća potreba za dodacima javlja se uslijed prilježne bolesti ili ranijeg nedostatka.

Umjetna prehrana: parenteralna prehrana?

Veliki udio parenteralne prehrane upotrebljava se tijekom kratkih razdoblja u relativno zdravih osoba (premorbidno stanje). Elementi u tragovima (njihov nedostatak ili višak) rijetko predstavljaju značajan problem, a ni višak vitamina vjerojatno neće biti problematičan. Međutim, nedostatak vitamina može biti veliki problem čak i kod kratkotrajne njege.

Naše poznavanje patofiziologije i mogućnosti učinkovitog testiranja su ograničene. Stoga je nužan pragmatičan pristup i obično se temelji na upotrebi komercijalno dostupnih kombinacija vitamina i elemenata u tragovima.

Specifični mikronutrijenti o kojima će detaljnije biti riječ u predavanju

- ▶ Cink – važan je u enzimskim sustavima i ekspresiji gena te je često nizak u bolesti
- ▶ Bakar – sastojak mnogih enzimskih sustava; nedostatak je rijedak, ali se može uočiti toksičnost
- ▶ Mangan – sastojak mnogih enzimskih sustava; toksičnost je česta prilikom dugotrajnog parenteralnog hranjenja
- ▶ Vitamin D i vitamin K predstavljaju posebne probleme, ali postoji posebna literatura o njima
- ▶ Vitamin C – jak antioksidans, kofaktor za mnoge enzime, nedostatak je nekada bio čest
- ▶ Tiamin – bitne metaboličke uloge u metabolizmu ugljikohidrata, neuhranjeni pacijenti često imaju nedostatak tiamina, a glukozno opterećenje parenteralne prehrane pogoršava problem povećanjem potražnje; mnogi i često nepopravljivi problemi. Primijetite vezu s laktacidozom.

Pharmaconutrients and conditionally essential nutrients in clinical nutrition

Prof. Željko Krznarić, MD, PhD

An essential nutrient is one that “serves an indispensable physiologic function, but cannot be synthesized endogenously at an adequate rate by healthy subjects.” If a nutrient is essential, a deficiency syndrome will emerge as signs and symptoms of impaired growth, function, biochemical alterations, or symptoms of illness become apparent. On the other hand, conditionally essential nutrients are those that can usually be synthesized in adequate amounts endogenously, but in some clinical situations may require exogenous supplementation. These increased requirements can be a result of impaired absorption (e.g. additional fat-soluble vitamins in malabsorption syndromes), increased anabolic requirements (e.g. sarcopenia of aging, pregnancy, and lactation), and increased metabolic demand (e.g. proteins and aminoacids in critical illness, burns).

Carnitine, taurine, arginine, cysteine, glycine, choline, branched chain amino acids are all generally recognized as conditionally essential nutrients.

Immunonutrition is defined as modulation of immune system activity or modulation of consequences of immune system activation with nutrients or special ingredients in preparations which are given in amounts more than normally present in diet. The biological effects of n-3 fatty acids or fish oils during illness is related to their ready incorporation into inflammatory cell membrane phospholipids, often at the expense of n-6 arachidonic acid. Consequently, n-3 fatty acids antagonize the production of proinflammatory eicosanoids from n-6 arachidonic acid (e.g. leukotriene B₄, thromboxane A₂, prostaglandin E₂), and are precursors for less inflammatory eicosanoids (e.g. thromboxane A₃, prostaglandin E₃, leukotriene B₅) resulting in anti-inflammatory effects. Enteral nutrition (high-protein, high-energy, polymeric formula with increased intake of EPA, 2.2g/day) is the first choice in nutritional support for the majority of oncological patients presenting with pre-cachexia or cachexia.

The amino acid glutamine has many essential metabolic functions. It plays a central role in nitrogen transport within the body, is a fuel for rapidly dividing cells (particularly lymphocytes, enterocytes, and colonocytes), is the most important substrate for renal ammoniogenesis, and is a precursor to glutathione. Glutamine is considered a conditionally essential amino acid in catabolic disease. The total body consumption of glutamine is higher because of increased requirements of immune cells, intestine and liver and insufficient endogenous supply in spite of excessive breakdown of muscle protein for increased glutamine synthesis and inter-organ flux. Glutamine production cannot balance its increased consumption and becomes depleted sustaining the catabolic state, therefore glutamine becomes conditionally essential. Although controversial, the application of glutamine in ICU and post-surgical patients is still a matter in clinical interest.

Physiologically, older adults may develop resistance to the positive effects of dietary protein on synthesis of protein, a phenomenon that limits muscle maintenance and accretion. This condition is termed anabolic resistance. Nevertheless, evidence continues to build in favor of increasing recommendation for optimal protein intake to 1.0-1.2 g/kg body weight/day for adults older than 65 years. Furthermore, in sarcopenia of aging and anabolic resistance there is a higher need for vitamin D, a nutrient recognized for pleiotropic effects with special benefits for bone and muscle of elderly patients.

Farmakonutrijenti i uvjetno esencijalni nutrijenti u kliničkoj prehrani

Prof. dr. sc. Željko Krznarić, dr. med.

Esencijalni nutrijent jest onaj koji se koristi u neophodnoj fiziološkoj funkciji, no u zdravih se osoba ne može endogeno sintetizirati u odgovarajućoj količini. Ako je nutrijent esencijalan, pojavit će se sindrom nedostatka u obliku znakova i simptoma oslabljenog rasta, funkcije, biokemijskih promjena ili očitovanja simptoma bolesti. S druge strane, uvjetno esencijalni nutrijenti oni su koji se obično mogu endogeno sintetizirati u odgovarajućim količinama, no u nekim kliničkim situacijama može biti potrebna egzogena suplementacija. Ove povećane potrebe mogu biti posljedica oslabljene apsorpcije (npr. dodatni vitamini topivi u mastima u sindromima malapsorpcije), povećanih anaboličkih zahtjeva (npr. sarkopenija starenja, trudnoća i laktacija) i povećanih metaboličkih zahtjeva (npr. proteini i aminokiseline u kritičnim bolestima ili opeklinama).

Karnitin, taurin, arginin, cistein, glicin, kolin i aminokiseline razgranatog lanca obično su prepoznati kao uvjetno esencijalni nutrijenti.

Imunonutricija se definira kao modulacija aktivnosti imunskog sustava ili modulacija posljedica aktivacije imunskog sustava hranjivim tvarima ili posebnim sastojcima u pripravcima koji se daju u količinama većim od uobičajenih u prehrani. Biološki učinci n-3 masnih kiselina ili ribljeg ulja tijekom bolesti povezani su s njihovom brзом ugradnjom u fosfolipide staničnih membrana upalnih stanica, često na štetu n-6 arahidonske kiseline. Kao posljedica toga, n-3 masne kiseline antagoniziraju proizvodnju protuupalnih eikozanoida iz n-6 arahidonske kiseline (npr. leukotriena B₄, tromboksana A₂, prostaglandina E₂) i prekursori su za manje upalne eikozanoide (npr. tromboksan A₃, prostaglandin E₃, leukotrien B₅), što dovodi do protuupalnih učinaka. Enteralna prehrana (polimerna formula s visokim udjelom proteina i energije te s povećanim unosom kiseline EPA, 2,2 g dnevno) prvi je izbor u prehranbenoj potpori za većinu onkoloških bolesnika u prekaheksiji ili kaheksiji.

Aminokiselina glutamin ima mnoge esencijalne metaboličke funkcije. Ona igra središnju ulogu u transportu dušika u tijelu, gorivo je za brzo dijeljenje stanica (osobito limfocita, enterocita i kolonocita), najvažniji je supstrat za bubrežnu amoniogenezu i prekursor je glutaciona. Glutamin se smatra uvjetno esencijalnom aminokiselinom kod kataboličke bolesti. Ukupna tjelesna potrošnja glutamina veća je zbog povećanih potreba imunskih stanica, crijeva i jetre te nedovoljne endogene opskrbe usprkos prekomjernoј razgradnji mišićnih proteina za povećanu sintezu glutamina i protok između organa. Proizvodnja glutamina ne može nadoknaditi njegovu povećanu potrošnju te se on troši održavajući katabolično stanje, čime glutamin postaje uvjetno esencijalan. Iako je kontroverzna, primjena glutamina u JIL-u i u bolesnika nakon operacija još je uvijek pitanje od kliničkog interesa.

U fiziološkom pogledu starije osobe mogu razviti otpor prema pozitivnim učincima prehranbenih proteina na sintezu proteina, te ova pojava ograničava održavanje i rast mišića. Ovo se stanje naziva „anabolička rezistencija”. Ipak, sve je više dokaza u korist povećane preporuke za optimalni unos proteina na 1,0 – 1,2 g/kg tjelesne težine dnevno za odrasle starije od 65 godina. Nadalje, kod sarkopenije starenja i anaboličke rezistencije postoji veća potreba za vitaminom D, nutrijentom poznatim po pleiotrofnim učincima, s posebnim koristima za kosti i mišiće starijih bolesnika.

Vitamin D in Disease Prevention and Therapy

Prof. Darija Vranešić Bender, PhD

Vitamin D is an essential micronutrient belonging to the fat-soluble vitamin group. It is often called the “sunshine” vitamin, and its steroid structure and specific characteristics make it more akin to a hormone than a vitamin. Unlike other vitamins that can be introduced into the body solely through diet or dietary supplements, vitamin D can be synthesised in the body, more specifically in the skin, from endogenous cholesterol (7-dehydrocholesterol) under the influence of UVB radiation. After conversion to previtamin D in the skin, it turns into 25-hydroxy vitamin D in the liver and is then converted into the active form of calcitriol or $1,25(\text{OH})_2$ vitamin D in the kidneys (but also in other tissues in the body). Even though the physiological role of vitamin D is primarily related to maintaining the musculoskeletal system, the biological properties of this relatively simple compound go far beyond maintaining the homeostasis of calcium and phosphorus. The most interesting effects of vitamin D outside of the skeletal system are related to the functions of the immune, endocrine, cardiovascular and neurological systems.

It is estimated that more than 1 billion people around the world have low vitamin D levels, which is why it is justified to speak of an “epidemic” of vitamin D deficiency and to consider the serious consequences of this condition for public health. In addition to the well-known protective effect it has on the musculoskeletal system, nowadays the focus is on the pleiotropic effects of vitamin D, and its beneficial effects on the immune, nervous, endocrine and cardiovascular systems have been recognised. Vitamin D is also considered as a preventive and supportive form of therapy for many diseases, while a timely identification of its deficiency and proper supplementation are essential for successful therapy.

Vitamin D status in the body is determined by measuring the concentration of 25-hydroxy vitamin D (25(OH)D) in the blood. An adequate concentration of vitamin D (25(OH)D) is ≥ 75 nmol/L. Concentrations between 50 and 75 nmol/L are thought to indicate a low level of vitamin D (insufficiency). Values of 25(OH)D < 50 nmol/L are considered a vitamin D deficiency and have a clear negative effect on bones. Values of 25(OH)D < 30 nmol/L are considered a severe deficiency of vitamin D, while values of 25(OH)D < 20 nmol/L cause severe impairment of bone metabolism (rickets or osteomalacia) and myopathy.

Risk groups for hypovitaminosis D include people with insufficient sun exposure (especially infants) as well as people living in areas of greater latitude (above 40° latitude) and in cities with higher concentrations of smog. Lack of exposure to sunlight due to objective or subjective reasons is the most common cause of vitamin D deficiency. Wearing sunscreen with an SPF of 30 reduces vitamin D synthesis by more than 95%. Furthermore, people with a dark skin tone need to be exposed to the sun for 3-5 times longer in order to produce the same amount of vitamin D as light-skinned people.

There are various guidelines provided by endocrinological societies around the world that recommend calcium and vitamin D intake. These guidelines are based on meta-analyses and systematic reviews, and generally point to a daily intake of 800-1200 mg of calcium (from food and dietary supplements) and 800-2000 IU of vitamin D for postmenopausal women with osteoporosis. Maximum doses are more often administered for the first three months, after which maintenance doses are given, usually 800-1600 IU a day. It is also recommended that at least half of the needed amount of calcium be supplied through food.

Vitamin D u prevenciji i terapiji bolesti

Prof. dr. sc. Darija Vranešić Bender

Vitamin D esencijalan je mikronutrijent iz skupine vitamina topivih u mastima. Često ga nazivamo „sunčanim vitaminom“, a steroidna struktura i specifična obilježja čine ga više hormonom nego vitaminom. Za razliku od ostalih vitamina koji se u organizam mogu unositi isključivo prehranom ili dodacima prehrani, vitamin D može se sintetizirati u organizmu, točnije u koži, iz endogenog kolesterola (7-dehidrokolesterola) pod utjecajem UVB zračenja. Nakon pretvorbe u previtamin D u koži, u jetri se pretvara u 25-hidroksi vitamin D i potom se u bubrezima (ali i u drugim tkivima u tijelu) pretvara u aktivni oblik kalcitriol ili $1,25(\text{OH})_2$ vitamin D. Iako je fiziološka uloga vitamina D poglavito vezana za održanje muskuloskeletnog sustava, biološka svojstva ovog relativno jednostavnog spoja sežu puno dalje od održanja homeostaze kalcija i fosfora. Najzanimljiviji izvanskeletni učinci vitamina D odnose se na funkcije imunskog, endokrinog, kardiovaskularnog i neurološkog sustava.

Procjenjuje se da više od 1 milijarde ljudi diljem svijeta ima niske razine vitamina D, zbog čega se s pravom govori o „epidemiji“ hipovitaminoze D te se razmatraju ozbiljne posljedice tog stanja na javno zdravstvo. Osim dobro poznatog zaštitnog učinka na muskuloskeletni sustav, danas govorimo o pleiotrofnim učincima vitamina D, a prepoznati su povoljni učinci na imunosni, živčani, endokrini i kardiovaskularni sustav. Vitamin D razmatra se kao prevencija i potporna terapija brojnih bolesti, a pravovremeno prepoznavanje nedostatka tog vitamina te pravilna nadomjesna primjena esencijalni su za uspješnost terapije.

Status vitamina D u organizmu određuje se mjerenjem koncentracije 25-hidroksi vitamina D ($25(\text{OH})\text{D}$) u krvi. Adekvatnom koncentracijom vitamina D ($25(\text{OH})\text{D}$) smatra se koncentracija ≥ 75 nmol/L. Koncentracije između 50 i 75 nmol/L smatraju se manjkom (insuficijencijom) vitamina D. Vrijednosti $25(\text{OH})\text{D} < 50$ nmol/L smatraju se nedostatkom (deficitom) vitamina D i imaju jasan negativan učinak na kosti. Vrijednosti $25(\text{OH})\text{D} < 30$ nmol/L smatraju se teškim nedostatkom vitamina D, dok vrijednosti $25(\text{OH})\text{D} < 20$ nmol/L uzrokuju ozbiljan poremećaj metabolizma kosti (rahitis ili osteomalaciju) i miopatiju.

Rizične skupine za pojavu hipovitaminoze D uključuju osobe s nedovoljnim izlaganjem suncu (osobito dojenčad) i osobe koje žive na prostorima veće zemljopisne širine (iznad 40° geografske širine) te u gradovima s većom koncentracijom smoga. Neizlaganje suncu iz objektivnih ili subjektivnih razloga najčešći je razlog nedostatka vitamina D. Upotreba sredstava za zaštitu od sunca sa zaštitnim faktorom 30 smanjuje sintezu vitamina D za više od 95 %. Nadalje, osobe s tamnom puti moraju se izložiti suncu tri do pet puta dulje da bi proizvele istu količinu vitamina D kao i svjetlopute osobe.

Postoje razne smjernice endokrinoloških društava diljem svijeta koje preporučuju unos kalcija i vitamina D. Smjernice se temelje na metaanalizama i sustavnim pregledima te uglavnom upućuju na dnevni unos 800 – 1200 mg kalcija (iz hrane i dodataka prehrani) te 800 – 2000 i.j. vitamina D za žene u postmenopauzi s osteoporozom. Češće se primjenjuju maksimalne doze prva tri mjeseca, a kasnije se daju doze održavanja koje obično iznose 800 – 1600 i.j. dnevno. Također, preporuka je da se barem polovica potrebe za kalcijem osigura putem hrane.

Intestinal Failure

Gut Function Compromised by Health and Health Compromised by Gut Function

Prof. Alastair Forbes, MD, PhD

ESPEN definition of intestinal failure:

Condition where normal fluid and nutritional balance can be achieved only by administration of intravenous support

- ▶ Intestinal function compromised by non-gastrointestinal disease
- ▶ Intestinal function compromised by impaired access
- ▶ Intestinal function compromised by impaired appetite
- ▶ Intestinal function compromised by oedema
- ▶ Intestinal function compromised by ischaemia
- ▶ Intestinal function compromised by psychology
- ▶ Short bowel syndrome

Adaptation

- ▶ Spontaneous increases in protein, DNA, villous height, crypt depth, surface area
- ▶ Up-regulation of Na⁺/glucose transporters, cation exchangers and digestive enzymes
- ▶ Hypertrophy and hyperplasia
- ▶ Adaptive hyperphagia

The colon in short bowel

- ▶ Retained colon (>half) compensates ~50cm small intestine in adults
- ▶ Value mainly in fluid balance
- ▶ Some nutritional gain from fermentation

Variability

- ▶ <50cm to stoma certain to need PN
- ▶ 50-100cm (even with no colon) not automatically dependent
- ▶ Some patients with >150cm dependent
- ▶ Only partial explanation from anatomy and health of remaining intestine

Intestinal failure without Short Bowel

- ▶ When intact intestine is dysfunctional because of severe inflammation or disorders of motility (including fibrosis)
- ▶ Inflammation (usually but not always associated with anatomical defect)
- ▶ Truly functional disorders with no objective markers of disease

Pseudo-obstruction

- ▶ Different challenges from SBS
 - Unable to eat at all
 - Complete intolerance of enteral feeding
 - Involvement of other systems
 - Particularly urological
 - Autonomic disturbances

**Gut Function Compromised by Health and Health Compromised by Gut Function.
Yes indeed, but understanding remains poor and much more work to be done.**

Zatajenje crijevne funkcije

Funkcija crijeva ugrožena zdravljem i zdravlje ugroženo funkcijom crijeva

Prof. dr. sc. Alastair Forbes, dr. med.

ESPEN-ova definicija zatajenja crijevne funkcije:

Stanje u kojem se normalna ravnoteža tekućina i nutrijenata može postići samo primjenom intravenske potpore

- ▶ Funkcija crijeva ugrožena negastrointestinalnim bolestima
- ▶ Funkcija crijeva ugrožena otežanim pristupom
- ▶ Funkcija crijeva ugrožena oslabljenim apetitom
- ▶ Funkcija crijeva ugrožena edemom
- ▶ Funkcija crijeva ugrožena ishemijom
- ▶ Funkcija crijeva ugrožena psihološkim razlozima
- ▶ Sindrom kratkog crijeva

Adaptacija

- ▶ Spontano povećanje proteina, DNK, visine resica, dubine kripti, površine
- ▶ Povećani izražaj prijenosnika Na⁺/glukoza, izmjenjivača kationa i probavnih enzima
- ▶ Hipertrofija i hiperplazija
- ▶ Adaptivna hiperfagija

Kolon u sindromu kratkog crijeva

- ▶ Sačuvani dio kolona (> pola) nadoknađuje ~50 cm tankog crijeva u odraslih
- ▶ Značenje uglavnom u ravnoteži tekućine
- ▶ Nešto nutritivne koristi od vrenja (fermentacije)

Varijabilnost

- ▶ < 50 cm do stome određena potreba za PP-om
- ▶ 50 – 100 cm (čak i bez kolona) nisu automatski ovisni
- ▶ Neki bolesnici s > 150 cm ovisni
- ▶ Samo djelomično objašnjenje prema anatomiji i zdravlju preostalog crijeva

Zatajenje crijeva bez sindroma kratkog crijeva (SKC)

- ▶ Kad je neoperirano crijevo disfunkcionalno uslijed teške upale ili poremećaja pokretljivosti (uključujući fibrozu)
- ▶ Upala (obično, no ne i uvijek, povezana s anatomskim defektima)
- ▶ Stvaran funkcionalni poremećaj bez objektivnih biljega bolesti

Pseudoopstrukcija

- ▶ Različiti izazovi u odnosu na SKC
 - Nisu sposobni jesti uopće
 - Potpuna intolerancija enteralnog hranjenja
 - Uključenost drugih sustava
 - Osobito urološkog
 - Autonomne smetnje

Funkcija crijeva ugrožena zdravljem i zdravlje ugroženo funkcijom crijeva.

Da, uistinu, no razumijevanje je slabo i još mnogo toga tek treba napraviti.

Nutrition support in cancer

Prof. Alessandro Laviano, MD, PhD

The clinical journey of cancer patients is characterized by the frequent development of paraneoplastic syndromes, which exert a significant impact on outcome. Progressive deterioration of nutritional status, as a consequence of the development of the anorexia-cachexia syndrome, has been repeatedly demonstrated to negatively impact on cancer patients' survival and quality of life. Prevention and treatment of nutritional wasting during cancer are therefore key elements of the multimodal approach to patients.

Weight loss may occur because of reduced intake of nutrients and/or increased energy expenditure. Based on this central tenet, nutrition support in cancer should aim at filling the gap between what the patient is able to eat and what the patient should eat, while simultaneously modulating deranged metabolism. The nutritional and clinical efficacy of nutrition support is particularly evident in those patients not able to meet daily energy and protein requirements (i.e., head & neck cancer patients). In this clinical scenario, the use of artificial nutrition (i.e., oral nutritional supplement, enteral nutrition or parenteral nutrition) has been shown to restore nutritional status and improve clinical outcome. Also, enhancing intestinal digestion and absorption by using pancreatic enzymes may counteract progressive weight loss. However, patients with insufficient energy and protein intake and signs of increased inflammatory response (i.e., increased C-reactive protein, IL-6, TNF) represent a more challenging scenario.

Increased inflammatory response characterizes the whole clinical course of a cancer patient. However, therapeutic interventions (i.e., chemotherapy, surgery, radiotherapy) may acutely increase the circulating levels of pro-inflammatory mediators. Inflammation reduce the anabolic efficacy of nutrients, resulting in limited synthesis of muscle fibers. This condition, also termed as "anabolic resistance", limit the efficacy of nutritional support. Recent experimental and clinical results suggest that the use of higher dose of high-quality proteins, as well as the supplementation of pharmacological doses of nutrients with anti-inflammatory properties (i.e., polyunsaturated omega-3 fatty acids) may restore, at least in part, anabolic capacity and improve outcome.

The therapeutic tools now available to fight cancer progression significantly extended the survival of cancer patients, particularly of those with advanced disease on diagnosis. Therefore, many patients survive for years and may experience different therapeutic options, from surgery to chemotherapy, from radiotherapy to immune therapy. Consequently, the clinical journey of the average advanced cancer patient is filled with "catabolic episodes" (i.e., surgery, chemotherapy, etc.) and recovery phases. It is becoming evident that nutritional support of cancer patients should extend beyond the limited period of the catabolic episodes, and provide adapted nutritional counselling also in the recovery phase. This approach, aiming at minimizing the losses during the catabolic phases and enhancing recovery during the intervals, may significantly extend survival and quality of life of cancer patients with advanced disease.

Nutritivna potpora u malignim bolestima

Prof. dr. sc. Alessandro Laviano, dr. med.

Klinički tijek u oboljelih od karcinoma obilježen je učestalim razvojem paraneoplastičnih sindroma, koji imaju značajan utjecaj na ishod. Više je puta dokazano da progresivno pogoršanje prehranbenog statusa, kao posljedica razvoja sindroma anoreksije-kaheksije, negativno utječe na preživljenje i kvalitetu života oboljelih od raka. Stoga su prevencija i liječenje prehranbenih gubitaka u karcinomu ključni elementi multimodalnog pristupa oboljelima.

Gubitak tjelesne težine može se javiti uslijed smanjenog unosa hranjivih tvari i/ili povećane potrošnje energije. Na temelju ovog središnjeg načela, prehranbena potpora u oboljelih od raka trebala bi biti usmjerena na premošćivanje jaza između onoga što je pacijent u stanju jesti i onoga što bi pacijent trebao jesti, istodobno modulirajući poremećeni metabolizam. Prehranbena i klinička učinkovitost prehranbene potpore osobito je očita u onih bolesnika koji nisu u stanju zadovoljiti dnevne potrebe za energijom i proteinima (tj. bolesnici s karcinomom glave i vrata). U ovom kliničkom scenariju dokazano je da primjena umjetne prehrane (tj. dodataka prehrani za oralnu upotrebu, enteralne prehrane ili parenteralne prehrane) oporavlja prehranbeni status i poboljšava klinički ishod. Također, poboljšanje crijevne probave i apsorpcije primjenom enzima gušterače može suzbiti progresivni gubitak težine. Međutim, pacijenti s nedovoljnim unosom energije i proteina te znakovima povećanog upalnog odgovora (tj. povećani C-reaktivni protein, IL-6, TNF) predstavljaju izazovnijiji scenarij.

Pojačani upalni odgovor obilježava cijeli klinički tijek bolesnika s karcinomom. Međutim, terapijske intervencije (tj. kemoterapija, operacija, radioterapija) mogu naglo povećati koncentraciju proupalnih medijatora u krvi. Upala smanjuje anaboličku učinkovitost hranjivih tvari, što dovodi do ograničene sinteze mišićnih vlakana. Ovo stanje, koje se naziva i „anabolički otpor“, ograničava učinkovitost prehranbene podrške. Nedavni eksperimentalni i klinički rezultati sugeriraju da se upotrebom veće doze visokokvalitetnih proteina, kao i suplementacijom farmakoloških doza nutrijenata s protuupalnim svojstvima (tj. polinezasićenih omega-3 masnih kiselina) barem djelomično može obnoviti anabolički kapacitet i poboljšati ishod.

Terapijski alati koji su sada dostupni za borbu protiv progresije karcinoma značajno su produžili preživljavanje u oboljelih, osobito onih koji u vrijeme postavljanja dijagnoze imaju uznapredovalu bolest. Stoga mnogi bolesnici preživljavaju godinama i mogu doživjeti različite terapijske mogućnosti, od operacije do kemoterapije ili od radioterapije do imunoterapije. Prema tome, klinički tijek u prosječnog bolesnika s uznapredovalim karcinomom ispunjen je „kataboličkim epizodama“ (tj. operacijama, kemoterapijom itd.) i fazama oporavka. Sve je očiti da bi se nutritivna potpora oboljelima od karcinoma trebala proširiti izvan ograničenog razdoblja kataboličkih epizoda i osigurati prilagođeno prehranbeno savjetovanje i u fazi oporavka. Ovaj pristup, čiji je cilj umanjiti gubitke tijekom kataboličkih faza i poboljšati oporavak u intervalima, može značajno produžiti preživljavanje i povećati kvalitetu života oboljelih od karcinoma s uznapredovalom bolešću.

The role of nutrition in the therapy of metabolic syndrome and obesity

Prof. Darija Vranešić Bender, PhD

Since 1975 the incidence of obesity in the world has tripled. It is estimated that there are 1.9 billion overweight people in the world, of whom 650 million are obese. The causes of excess weight are multifactorial and involve a complex interaction of genetic, social, nutritional, metabolic, cultural, endocrinological, psychological and economic factors. Moreover, in recent years the focus of research has expanded to the relationship between the composition of microbiota and excess weight, and the focus of interest has been on the neuropharmacological and neurobiological studies of addictive behaviour in relation to particular types of food. In addition, nowadays we talk about an obesogenic environment in which humans are continually driven to a sedentary lifestyle and exposed to numerous obesogenic substances.

Metabolic syndrome is described as a cluster of symptoms, i.e. the presence of three risk factors such as abdominal obesity (increased waist circumference), elevated blood concentration of triglycerides, decreased concentration of HDL cholesterol, elevated blood pressure, and elevated blood sugar levels. The exact aetiology of metabolic syndrome is still unclear, but it is known that it involves a complex interaction of genetic, metabolic and environmental factors. Among the environmental factors, adequate nutrition is of great importance in the prevention and treatment of this condition. Nutritional therapy of metabolic syndrome is aimed at improving insulin sensitivity as well as preventing and alleviating associated metabolic and cardiovascular abnormalities. The lifestyle change approach also includes weight loss and maintenance of body mass, physical activity, and an adequate nutritional model. In recent years, there has been increasing evidence that Mediterranean diet has a beneficial effect on metabolic syndrome. Also, choosing foods with a low glycaemic index can improve beta cell function in people with impaired glucose tolerance.

Nutritional intake is considered one of the most important components in the treatment of obesity. Adhering to a prescribed diet plan can be a challenge, and therefore an individually tailored approach is very important, i.e. the use of structured nutrition plans with precisely prescribed macronutrient and energy ratios. In clinical practice, regarding weight loss, body fat distribution, biochemical parameters, blood pressure and simplicity of diet monitoring, the diet-cognitive-behavioural treatment based on the principles of Mediterranean diet has proved to be particularly effective.

The first step in counselling patients on nutrition is taking a comprehensive nutritional history to determine the nutritional status and dietary habits of the patient. Taking a nutritional history in practice involves an initial interview with the patient lasting at least 30-40 minutes to gather all the necessary anamnestic data and derive basic guidelines for changes to be implemented. The diet plan and the administration of dietary supplements should be coordinated with pharmacotherapy and individually adjusted for each patient. After that it is necessary to arrange periodic check-ups, which are usually scheduled once a month and include monitoring the changes in anthropometric parameters and the success of implementing and conducting the prescribed diet plan.

Healthy weight loss planning involves expert approach and supervision by a nutritionist or a dietitian. It is very important to tailor the diet according to individual needs, preferences and eating habits. It is necessary to measure or calculate the energy needs of an individual and subtract 500-1000 kcal per day from this value to obtain the caloric deficit necessary for achieving medically acceptable weight loss. In this way the diet is set so that the patient could lose ½ to 1 kg a week. In doing so, it is also important to adequately represent nutrient ratios and to choose nutrient-dense foods.

Uloga prehrane u liječenju metaboličkog sindroma i debljine

Prof. dr. sc. Darija Vranešić Bender

Od 1975. do danas utrostručila se učestalost debljine u svijetu. Smatra se da je na svijetu 1,9 milijardi osoba s prekomjernom tjelesnom masom, a od toga je 650 milijuna pretilih. Uzroci debljine jesu multifaktorski, a uključuju složenu interakciju genetičkih, socijalnih, nutritivnih, metaboličkih, kulturoloških, endokrinoloških, psiholoških i ekonomskih čimbenika. Štoviše, posljednjih se godina fokus istraživanja proširio i na povezanost sastava mikrobiote i debljine, a u žarište interesa došla su neurofarmakološka i neurobiološka istraživanja adiktivnog ponašanja ljudi u odnosu na pojedine vrste hrane. Povrh toga, danas govorimo o obesogenom okolišu u kojemu je čovjek kontinuirano usmjeren na sjedilački način života i izložen brojnim obesogenim tvarima.

Metabolički sindrom opisuje se kao klaster simptoma, odnosno prisutnost tri čimbenika rizika kao što su abdominalna pretilost (povišene vrijednosti opsega struka), povišena koncentracija triglicerida u krvi, smanjena koncentracija HDL kolesterola, povišeni krvni tlak i povišena razina šećera u krvi. Točna etiologija nastanka metaboličkog sindroma još uvijek je nejasna, no poznato je da uključuje kompleksnu interakciju genetičkih i metaboličkih čimbenika te čimbenika iz okoliša. Među čimbenicima iz okoliša veliku važnost u prevenciji i terapiji ovoga stanja ima adekvatna prehrana. Nutritivna terapija metaboličkog sindroma ciljano je usmjerena na poboljšanje osjetljivosti na inzulin te prevenciju i ublažavanje pridruženih metaboličkih i kardiovaskularnih nepravilnosti. Pristup promjenama načina života uključuje i smanjenje i održavanje tjelesne mase, tjelesnu aktivnost te adekvatan prehrambeni model. Posljednjih godina sve više potvrđuje povoljno djelovanje na metabolički sindrom ima mediteranska prehrana. Također, odabir namirnica s niskim glikemijskim indeksom može poboljšati funkciju beta-stanica kod osoba s narušenom tolerancijom glukoze.

Prehrambeni unos smatra se jednom od najbitnijih komponenti u terapiji pretilosti. Pridržavanje propisanog plana prehrane može biti izazov i stoga je vrlo važan individualan pristup, tj. upotreba strukturiranih planova prehrane s točno propisanim udjelima makronutrijenata i energije. U kliničkoj praksi, s obzirom na gubitak tjelesne mase, distribuciju tjelesnih masnoća, biokemijske parametre, krvni tlak i jednostavnost praćenja dijete, posebno efikasnim pokazalo se dijetno-kognitivno-bihevioralno liječenje koje se temelji na principima mediteranske prehrane.

Prvi korak u savjetovanju bolesnika o prehrani jest uzimanje sveobuhvatne nutritivne anamneze kako bismo utvrdili nutritivni status i prehrambene navike bolesnika. Uzimanje nutritivne anamneze u praksi podrazumijeva inicijalni razgovor s bolesnikom koji traje najmanje 30 – 40 minuta kako bi se prikupili svi potrebni anamnestički podaci i dale osnovne smjernice za promjene koje treba uvesti u prehranu. Plan prehrane i primjenu dodatka prehrani potrebno je uskladiti s farmakoterapijom i prilagoditi individualno za svakog bolesnika. Nakon toga potrebno je dogovoriti i periodične kontrolne preglede koji se obično održavaju jednom mjesečno, a obuhvaćaju motrenje promjena antropometrijskih parametara i uspješnost implementacije i provođenja propisanog plana prehrane.

Planiranje zdravog mršavljenja podrazumijeva stručan pristup i nadzor nutricionista ili dijetetičara. Vrlo je važno dijetu krojiti prema individualnim potrebama, preferencijama i navikama u odabiru hrane. Potrebno je izmjeriti ili izračunati energetske potrebe pojedinca i od te vrijednosti oduzeti 500 – 1000 kcal dnevno kako bi se postigao kalorijski deficit potreban za ostvarivanje medicinski prihvatljivog smanjenja tjelesne mase. Na taj se način dijeta postavlja tako da se gubi ½ do 1 kg tjedno. Pritom omjeri hranjivih tvari trebaju biti adekvatno zastupljeni, a valja birati hranu visoke nutritivne gustoće.

Nutrition in diabetes

Asst. Prof. Ivana Rumora Samarin, PhD

Diabetes mellitus is a complex, chronic, progressive disease characterised by a disorder in insulin secretion and/or action, with hyperglycaemia as a consequence. Insulin is an essential hormone produced in the pancreas gland of the body. It transports glucose from the bloodstream into the body's cells where glucose is converted into energy. The classification and diagnosis of diabetes are complex but it is widely accepted that there are three main types of diabetes, type 1 diabetes, type 2 diabetes and gestational diabetes.

Diabetes can be diagnosed according to fasting plasma glucose levels; plasma glucose levels after oral glucose load or random plasma glucose levels, and by determination of HbA1c (glycosylated haemoglobin A1c).

Nowadays, diabetes is one of the leading public health problems worldwide and it is estimated that over 420 million people are suffering from this disease, which makes every 11th adult. In Croatia, the situation is similar with more than 304 thousand people suffering from diabetes, with the assumption that more than 40% of cases are undiagnosed.

Diabetes as a disease requires continuous medical care with multifactorial risk-reduction strategies beyond glycemic control, because if left uncontrolled, hyperglycaemia can cause damage to various body organs, leading to the development of health complications such as cardiovascular disease, neuropathy, nephropathy and eye disease, leading to retinopathy and blindness. These complications can be prevented if appropriate management of the disease is achieved, with emphasis on appropriate nutrition, regular physical activity, patient self-management of the disease and pharmacological treatments when necessary.

From 2011 in Croatia, there are guidelines for managing type 2 diabetes, the most common type of diabetes (more than 90% of all cases). It is important to point out that there is no single therapeutic approach suitable for everyone and that an individual approach is needed. Along with the basic principles of diabetes treatment, the main emphasis during the lecture is given to education on appropriate nutrition, taking into account the basic components of a diet plan – energy intake, meal number and distribution throughout the day, nutrient composition of the diet (with special emphasis on carbohydrate intake), and a meal planning system. Other therapeutic approaches to the disease have also been explained. The main goal of all treatments is to achieve acceptable blood glucose concentrations and reduce the occurrence of chronic complications.

Prehrana u šećernoj bolesti

Doc. dr. sc. Ivana Rumora Samarín

Diabetes mellitus složena je kronična, progresivna bolest koju obilježava poremećaj izlučivanja i/ili djelovanja inzulina s hiperglikemijom kao posljedicom. Inzulin je ključan hormon koji proizvodi žlijezda gušterača i koji omogućava prijenos glukoze iz krvotoka u stanice tijela gdje se glukoza pretvara u energiju. Klasifikacija i dijagnoza šećerne bolesti složene su, no opće je prihvaćeno da postoje tri osnova tipa šećerne bolesti: tip 1 (inzulin ovisan), tip 2 (inzulin neovisan) i gestacijska (trudnička) šećerna bolest.

Šećerna bolest može se dijagnosticirati na temelju koncentracija glukoze u plazmi natašte, koncentracija glukoze u plazmi nakon oralnog testa opterećenja glukozom ili nasumičnim uzorkovanjem koncentracija glukoze u plazmi te određivanjem HbA_{1c} (glikozilirani hemoglobina A_{1c}).

Danas je šećerna bolest jedan od vodećih javnozdravstvenih problema diljem svijeta te se procjenjuje da više od 420 milijuna ljudi boluje od ove bolesti, što znači svaka 11. odrasla osoba. U Hrvatskoj je situacija slična i od šećerne bolesti boluje više od 304 tisuće ljudi, uz pretpostavku da više od 40 % slučajeva nije dijagnosticirano.

Šećerna bolest kao oboljenje zahtijeva kontinuiranu zdravstvenu skrb sa strategijama smanjenja multifaktorijalnih rizika koje nisu ograničene samo na kontrolu glikemije. Ako se ne kontrolira, hiperglikemija može oštetiti različite tjelesne organe i dovesti do razvoja zdravstvenih komplikacija kao što su kardiovaskularne bolesti, neuropatija, nefropatija i bolesti oka, dovodeći do retinopatije i sljepoće. Ove se komplikacije mogu spriječiti ako se postigne odgovarajuća kontrola bolesti, s naglaskom na odgovarajućoj pravilnoj prehrani, redovitoj tjelesnoj aktivnosti, samokontroli bolesti i farmakološkoj terapiji ukoliko je potrebna.

Od 2011. u Hrvatskoj postoje smjernice za liječenje šećerne bolesti tipa 2, najučestalijeg tipa šećerne bolesti (više od 90 % svih slučajeva). Važno je istaknuti da ne postoji jedinstveni terapijski pristup koji bi odgovarao svima te da je svakom bolesniku potrebno pristupiti individualno. Tijekom predavanja glavni naglasak među temeljnim načelima liječenja šećerne bolesti stavlja se na odgovarajuću edukaciju o pravilnoj prehrani, uzimajući u obzir osnovne sastavnice plana prehrane – energetske unos, broj obroka i raspodjela kroz dan, sastav hranjivih tvari u prehrani (s posebnim naglaskom na unos ugljikohidrata) i sustav planiranja obroka. Objasnjeni su i ostali terapijski pristupi ovoj bolesti. Osnovni je cilj svih pristupa liječenju postići prihvatljive koncentracije glukoze u krvi i smanjiti pojavu kroničnih komplikacija.

Introduction to intellectual property (IP) protection in nutrition

Prof. Donatella Verbanac, PhD

modified from: <http://www.dziv.hr/en/>

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Particular aspects or characteristics of a product may be protected by one or several different forms of intellectual property, supplementing each other. The new solution of a technical problem is protected by a patent, the new outer shape or appearance of a product is protected by an industrial design, and a sign serving to distinguish products or services from similar products and/or services on the market is protected by a trademark.

The results of intellectual creativity can be protected by different forms of intellectual property, depending on the field of the activity. A brief overview of the basic principles in IP and IP rights (IPR) will be presented during the lecture.

Uvod u zaštitu intelektualnog vlasništva u nutricionizmu

Prof. dr. sc. Donatella Verbanac

prilagođeno prema: <http://www.dziv.hr/>

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