

VAŽNOST PRAVILNE PREHRANE U ZAŠTITI MIŠIĆNO-KOŠTANOG SUSTAVA PRILIKOM MRŠAVLJENJA



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Na pretilost danas više ne gledamo kao isključivo estetski problem, već kao multifaktorijsku metaboličku i neuroendokrinu bolest koja sa sobom nosi višestruke zdravstvene probleme i rizike. Dosadašnje metode liječenja bile su ograničene na kombinaciju smanjenja kalorijskog unosa i povećanje potrošnje energije kroz tjelovježbu, ali takve metode su, zbog niske dugoročne adheencije, rijetko dovodile do željenih rezultata. Međutim, pojava novih skupina lijekova, prvotno korištenih u liječenju šećerne bolesti tipa 2, koji imaju pozitivan učinak na smanjenje tjelesne mase i pripadajuće komorbiditete, nameće se kao bitna terapijska opcija. GLP-1 agonisti oponašaju djelovanje endogenog humanog inkretina GLP-1 (glukagonu-sličan peptid-1, engl. *glucagon-like peptide-1*) koji, između ostalog, potiče postprandijalnu sekreciju inzulina i euglikemiju, usporava pražnjenje želudca i smanjuje apetit. Cilj ove studije bio je istražiti kako GLP-1 agonist liraglutid, uz intervencije u životnom stilu ispitanica, u vidu prehrane i tjelovježbe, utječe na crijevni mikrobiom ispitanica s prekomjernom tjelesnom masom. U ovom pilot ispitivanju sudjelovale su tri ispitanice srednje životne dobi (43, 49 i 55 godina) s indeksom tjelesne mase iznad 29 (jedna ispitanica) i iznad 30 (dvije ispitanice). Ispitanicama je uzorkovana krv, urin i stolica na početku i na kraju ispitivanja, koje je trajalo tri mjeseca. Za uvid u zdravstveno stanje i životne navike ispitanica korišten je standardizirani upitnik, koji su ispitanice ispunjavale prije intervencije. Prehrambene navike ispitanice su korištenjem upitnika o učestalosti konzumiranja hrane (engl. *Food Frequency Questionnaire*, FFQ). Crijevni mikrobiom analiziran je prije i nakon intervencije metodom sekvenciranja 16S rRNA gena pomoću Illumina MiSeq uređaja. Zdravlje crijevnog mikrobioma ispitanica prije intervencije, gledano kao opće stanje mikrobioma, bilo je kod svih ispitanica sniženo. Nakon intervencije, koja je uključivala primjenu liraglutida, uz prebiotik inulin kao dodatak prehrani i povećanje tjelesne aktivnosti, sve tri ispitanice pokazuju poboljšanje zdravlja mikrobioma i povećanje α -raznolikosti bakterija u uzorcima fecesa. Vidljiva je pozitivna korelacija poboljšanja zdravlja mikrobioma i trajanja intervencije, što najbolje opisuje dobivena eksponencijalna funkcija. Po pitanju funkcionalnosti crijevnog mikrobioma, liraglutid najvjerojatnije utječe na proizvodnju mucina kroz modulaciju udjela bakterija mukozalnog mikrobioma, ponajviše roda *Akkermansia*. Pretilost je povezana s disbiozom, u vidu smanjenja raznolikosti crijevnog mikrobioma. Higijensko-dijetetska intervencija koja uključuje lijek liraglutid, primijenjen uz druge promjene životnih navika (prehrane, tjelesne

aktivnosti, suplementacije, unosa pro- i prebiotika) ima pozitivan utjecaj na opće stanje i raznolikost crijevnog mikrobioma. U konačnici, ciljana farmakoterapija može ubrzati put prema gubitku tjelesne mase. Međutim, ništa ne može nadomjestiti temeljnu ulogu pravilne prehrane u očuvanju mišićnokoštanog sustava, jer hrana koju konzumiramo je početna linija obrane, a tek potom slijede lijekovi i suplementi. U predavanju, govorit će se i o današnjim trendovima u prehrani i osnovnim postulatima koji moraju biti zadovoljeni kada je riječ o mišićno-koštanom sustavu.

Ključne riječi

prehrana, mikrobiom, agonisti, GLP-1, debljina

THE IMPORTANCE OF PROPER NUTRITION IN PROTECTING THE MUSCULOSKELETAL SYSTEM DURING WEIGHT LOSS

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Today, obesity is no longer viewed merely as an aesthetic issue but as a multifactorial metabolic and neuroendocrine disease associated with numerous health problems and risks. Traditional treatment methods have been limited to reducing caloric intake and increasing energy expenditure through physical activity, but due to poor longterm adherence, these approaches have rarely achieved the desired outcomes. However, the emergence of new classes of medications—initially developed for the treatment of type 2 diabetes—that exert beneficial effects on reducing body weight and related comorbidities has positioned them as important therapeutic options. GLP1 agonists mimic the action of the endogenous human incretin GLP1 (glucagonlike peptide1), which, among other effects, stimulates postprandial insulin secretion and euglycemia, slows gastric emptying, and reduces appetite. In this respect, the aim of this study was to investigate how the GLP-1 agonist liraglutide, in combination with lifestyle interventions (diet and exercise), affects the gut microbiome in overweight subjects. In this pilot study, three middleaged female participants (aged 43, 49, and 55) with body mass indices above 29 (one participant) and 30 (two participants) were enrolled. Blood, urine, and stool samples were collected at the beginning and at the end of the threemonth study period. A standardized questionnaire, completed by the participants prior to the intervention, was used to assess their health status and lifestyle habits. Dietary habits were evaluated using a Food Frequency Questionnaire (FFQ). The gut microbiome was analyzed before and after the intervention, using 16S rRNA gene sequencing on an Illumina MiSeq platform. Before the intervention, participants' overall gut microbiome health was reduced in all cases. After the intervention—which included liraglutide, the addition of the prebiotic inulin, and increased physical activity—all three participants showed improvements in microbiome health and increased bacterial diversity in their fecal samples. A positive correlation between the duration of the intervention and the improvement in microbiome health was observed, best described by an exponential function. Regarding gut microbiome functionality, liraglutide most likely influences mucin production

by modulating the abundance of mucosal microbiome bacteria, particularly those of the genus *Akkermansia*. Obesity is associated with dysbiosis, characterized by reduced gut microbiome diversity. A hygienedietary intervention that includes liraglutide, used alongside other lifestyle modifications (diet, physical activity, supplementation, and intake of pro and prebiotics), has a positive effect on the overall condition and diversity of the gut microbiome. Ultimately, targeted pharmacotherapy can accelerate the path toward weight loss. However, nothing can replace the fundamental role of proper nutrition in preserving the musculoskeletal system, because the food we consume is our first line of defense, with medications and supplements following only thereafter. The lecture will also address current dietary trends and the essential principles that must be met for the musculoskeletal system.

Keywords

nutrition, microbiota, GLP-1, agonist, receptor, obesity

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