

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet: Fiziologija športa
Course title: Physiology of sport

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Kineziologija, 2. stopnja / Kinesiology, masters' study	Vse smeri /all study fields	1	1

Vrsta predmeta / Course type

Obvezen/obligatory

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
35	10	15			120	4

Nosilec predmeta / Lecturer:

Prof. dr. Helena Lenasi

**Jeziki /
Languages:**

**Predavanja /
Lectures:** slovenski, angleški /Slovene, English

Vaje / Tutorial: slovenski, angleški / Slovene, English

**Pogoji za vključitev v delo oz. za opravljanje
študijskih obveznosti:**

Ni pogojev

Prerequisites:

non

Vsebina:

Content (Syllabus outline):

Homeostaza

- Grafična analiza homeostatskega sistema
- Simulacija fizioloških sistemov
- Negativna povratna zveza - načela
- Negativna povratna zveza - analiza prehodnih pojavov med dvema stacionarnima stanjema
- Pozitivna povratna zveza: *circulus vitiosus* (začarani krog)

Celično dihanje

- Mitohondrij kot aparat za pridobivanje energije v oksidacijskih procesih
- Funkcionalna anatomija mitohondrija
- Sistem katabolnih procesov v mitohondriju
- Izbrane motnje v oksidacijskih sistemih za pridobivanje energije
- Izbrane motnje na ravni encimskih sistemov: pomanjkanje tiamina, nikotinske kisline, riboflavina, pantotenske kisline
- Odklopniki in inhibitorji dihalne verige

Glukostatični mehanizmi

- Uravnava glikemije
- Sladkorna bolezen tipa 1 in tipa 2
- Mehanizmi nastanka sladkorne bolezni
- Zmanjšana odzivnost na inzulin; njegovi učinki na tarčne celice
- Nezadostno izločanje inzulina
- Sladkorna bolezen v fiziologiji športa

Presnova in homeostaza kalija

- Osrednje mesto kalija pri prenašanju informacij po živčnih poteh in pri vzdražnosti mišičnih celic
- Mehanizmi prestopanja K⁺ med zunajceličnim in celičnim prostorom

Homeostasis

- Graphical analysis of the homeostatic system
- Simulation of physiological systems
- Negative feedback - principles
- Negative feedback - the analysis of transient phenomena between two stationary stanjema
- Positive feedback: *vicious vicious* (vicious circle)

Cellular respiration

- Mitochondria and apparatus for generating energy in the oxidation processes
- Functional anatomy of the mitochondria
- A system of catabolic processes in the mitochondria
- Selected disturbance in the oxidation systems for energy
- Selected to the disturbance level of enzyme systems: a lack of thiamine, nicotinic acid, riboflavin, pantothenic acid
- Circuit breakers and inhibitors of respiratory chain

Glucostatic mechanisms

- Regulation of the blood sugar
- Diabetes type 1 and type 2
- Pathological mechanisms of diabetes
- Reduced responsiveness to insulin, the effects on target cells
- Insufficient secretion of insulin
- Diabetes in the physiology of sport

Metabolism and potassium homeostasis

- The central place of potassium in the transmission of information via nerve pathways and muscle cell excitability
- Mechanisms of K⁺ crossing between

- Osnovni mehanizmi razvoja hipokaliemije
- Hipokaliemija zaradi premika K⁺ v celični prostor
- Hipokaliemija zaradi povečane izgube K⁺
- Hipokaliemija zaradi zmanjšane vnosa K⁺
- Znaki hipokaliemije
- Temeljni mehanizmi razvoja hiperkaliemije
- Hiperkaliemija zaradi premika K⁺ v zunajcelični prostor
- Hiperkaliemija zaradi nezadostnega izločanja K⁺ z urinom
- Hiperkaliemija zaradi povečanega vnosa K⁺
- Znaki hiperkaliemije

Izvor in reakcije prostih radikalov ter reaktivnih kisikovih zvrsti

- Razdelitev in temeljne kemične značilnosti prostih radikalov
- Reaktivne oblike kisika in njegove reaktivne spojine
- Nastajanje prostih radikalov v naravi
- Endogeno nastajanje superoksidnega aniona
- Delovanja prostih radikalov na celice različnih organskih sistemov in njihovi učinki
- Lipidna peroksidacija in njene posledice
- Ishemična poškodba in prosti radikali
- Zaščita celic in tkiv pred prostimi radikali; zaščitna funkcija nekaterih encimov; druge antioksidantne snovi

Hipotermija in hipertermija

- Temperatura telesnega jedra
- Pomembnost vzdrževanja telesne temperature za normalen potek življenjskih procesov

extracellular and cellular space

- Basic mechanisms of development of hypokalemia
- Hypokalaemia due to shift K⁺ into the cell space
- Hypokalaemia due to increased loss of K⁺
- Hypokalaemia due to decreased intake of K⁺
- Signs of hypokalemia
- Basic mechanisms of development of hyperkalemia
- Hyperkalaemia due to the shift of K⁺ in the extracellular space
- Hyperkalaemia due to inadequate secretion of K⁺ in the urine
- Hyperkalaemia due to increased intake of K⁺
- Signs of hyperkalemia

Origin and reactions of free radicals and reactive oxygen species

- Distribution and basic chemical properties of free radicals
- reactive forms of oxygen and its reactive compounds
- The formation of free radicals in the wild
- Endogenous superoxide
- effects of free radicals in cells of different organ systems and their effects
- lipid peroxidation and its consequences
- Ischemic damage and free radicals
- The protection of cells and tissues from free radicals, the protective function of some enzymes; other antioxidant substances

Hypothermia and hyperthermia

- The temperature of the body core
- The importance of maintaining body

- Termogeneza
- Termoliza
- Hipotermija in hipertermija v fiziologiji športa in pri različnih obolenjih

Nespecifični obrambni odziv organizma na stres

- Osvetlitev stresa v fiziologiji športa
- Neuro-endokrino-immunski odziv (simpatik, adrenalin, kortizol, citokini)
- Presnovni učinki citokinov
- Citokini in reaktanti akutne faze
- Stres kot sprožilec bolezni (patogeni dejavniki)
- Nagnjenost k prekomernemu odzivu na stres

Vnetje

- Kaj je vnetje in kako se razvija
- Endogeni mediatorji vnetne reakcije
- Aktivacija levkocitov, kemotaksa in fagocitoza
- Sistemske učinki vnetja
- Sindrom sistemskega vnetnega odziva in sepsa
- Delovanje nekaterih snovi, ki zavirajo vnetje

Uravnavanje telesne mase

- Normalna in idealna telesna masa
- Uravnavanje telesne mase
- Endogeni modulatorji vnosa hrane
- Gastrointestinalni peptidi in ješčnost
- Maščevje in uravnavanje vnosa ter porabe energije
- Funkcija hipotalama in neuropeptidov v kratkoročnem uravnavanju sitosti, apetita in lakote
- Hipotalamus in dolgoročno uravnavanje zalog energije

temperature to normal pattern of life processes

- Thermogenesis
- thermolysis
- Hypothermia and hyperthermia in the physiology of sport and in various diseases

Non-specific defense reaction of the organism to stress

- Exposure to stress physiology of sport
- Neuro-endocrine-immune response (sympathetic, adrenaline, cortisol, cytokines)
- Metabolic Effects of cytokines
- Cytokines and acute phase reactants
- Stress as a trigger disease (pathogenic factor)
- The tendency to over-reaction to stress

Inflammation

- What is the inflammation and how it develops
- Endogenous mediators of inflammatory reactions
- Activation of leukocyte chemotaxis and phagocytosis
- Systemic effects of inflammation
- Systemic Inflammatory Response Syndrome and Sepsis
- The performance of certain substances that suppress inflammation

Regulation of body weight

- Normal and ideal body weight
- Regulation of body weight
- Endogenous modulators of food intake
- Gastrointestinal peptides and appetite
- Fat intake and regulate energy consumption and
- Hypothalamic function and neuropeptides in the regulation of short-term satiety, appetite and hunger
- The hypothalamus and the long-term

Motnje uravnavanja telesne mase

- Vzroki za nastanek debelosti
- Genetski dejavniki
- Prebava, fermenti in presnova
- Motnje v delovanju hipotalama in hormonski dejavniki
- Psihosomatski dejavniki
- Nekatero motnje, povezane z debelostjo: sindrom hipoventilacije, presnovni sindrom....

Hidracija in motnje hidracije

- Porazdelitev telesnih tekočin
- Optimalna hidracija
- Vzroki za nastanek dehidracije in mehanizmi uravnavanja

regulation of energy reserves

Disturbance regulation of body weight

- The causes of obesity
- Genetic factors
- Digestion, fermented products and metabolism
- Faults in hypothalamic function and hormonal factors
- Psychosomatic factors
- Some of the disorders associated with obesity: hypoventilation syndrome, metabolic syndrome

Hydration and hydration disorders

- Distribution of body fluids
- Optimal hydration
- The causes and mechanisms of dehydration

Temeljni literatura in viri / Readings:

- Powers, Howley Exercise Physiology: Theory and Application to Fitness and Performance, 7th Edition.
- Tudor Hale, "Exercise Physiology: A Thematic Approach (Wiley Sport Text) Wiley, 2004.
- Mirjam Lasan - Stalnost je določila spremembo, FŠ Ljubljana, 2007.
- Brooks, G. A., T. D. Fahey, T. P. White, K. M. Baldwin. In *Exercise Physiology. Human Bioenergetics and its Applications*. 3rd edn. pp804-805. Mayfield Publishing Company, 2004
- Houston, M.,:«Biochemistry Primer for Exercise Science-3rd Edition«, Human Kinetics, 2006.

Cilji in kompetence:

- Študenti poznajo vzroke nastankov različnih neravnovesij v organizmu
- Študenti poznajo specifični odziv telesa (celični spomin) na telesni napor
- Študenti poznajo fiziološke spremembe, ki jih povzročajo najpogostejša kronična obolenja in njihove povezave s spremembami, ki jih povzročata telesna aktivnost
- Študenti razumejo, kako procesi za vzdrževanje stalnosti (homeostaze) ustvarjajo novo ravnovesje

Objectives and competences:

- Students know the causes of various imbalances in the body
- Students know the specific response of the body (cellular memory) on the physical effort
- Students know the physiological changes that cause the most common chronic diseases and their links with the changes caused by physical activity
- Students understand the processes to maintain continuity (homeostasis) to create a new balance
- Students know the interdependence of physiological processes, despite the apparent hierarchy in the processes of their management

- Študenti poznajo soodvisnost fizioloških procesov kljub navidezni hierarhiji v procesih njihovega upravljanja
- Študenti so sposobni povezovati spoznanja fiziologije športa z drugimi področji
- Študenti so sposobni komunicirati s strokovnjaki medicinske stroke na področju fiziologije kroničnih obolenj.

- Students are able to integrate knowledge of sports physiology and other areas
- Students are able to communicate with experts in the medical profession in the field of physiology of chronic diseases.

Predvideni študijski rezultati:

- Poznavanje in razumevanje temeljnih fizioloških mehanizmov pri telesnih aktivnosti in nekaterih kroničnih boleznih
- Poznavanje in razumevanje osnovnih konceptualnih vidikov fiziološkega ravnovesja v telesu
- Za razumevanje ostalih predmetov, ki zahtevajo poznavanje delovanja človeškega telesa (staranje, kronične bolezni, poškodbe gibalnega aparata)
- Pri načrtovanju vadbe za posebne skupine
- Uporaba principov, zakonitosti in modelov na posameznih primerih; povezovanje teorije s prakso; utemeljevanje in evalvacija ipd..
- Teoretično znanje prenesti v športno prakso ter njegova umestitev v kontekst metod in vsebin športne in telesne aktivnosti.
- Boljše razumevanje bioloških vidikov in aktivnosti povezanih z načrtovanjem vadbe za posebne skupine.
- Spretnost uporabe domače in tuje literature in drugih virov; zbiranja in interpretiranja podatkov.
- Uporaba različnih postopkov poročanja (ustno in pisno).
- Identifikacija in reševanje problemov.
- Kritična analiza, sinteza; pisanje člankov in refleksij na prebrano literaturo.

Intended learning outcomes:

- Knowledge and understanding:
- Knowledge and understanding of basic physiological mechanisms of physical activity and certain chronic diseases
 - Knowledge and understanding of basic conceptual aspects of the physiological balance in the body
 - To understand the other courses that require knowledge of how the human body (aging, chronic illness, injury motoric)
 - When planning training for specific groups
 - Application of principles, laws and models in some cases, linking theory with practice, reasoning and evaluation, etc. ..
 - Theoretical knowledge transfer in sports practice, and its placement in the context of methods and content of sports and physical activity.
 - Better understanding of biological aspects and activities related to planning, training for specific groups.
 - The ability to use domestic and foreign literature and other sources, collecting and interpreting data.
 - Use a variety of reporting procedures (verbal and written).
 - Identify and solve problems.
 - Critical analysis, synthesis, writing articles and reflections on the literature read.

Learning and teaching methods:

• predavanja , seminarske naloge in vaje

• Lectures, seminars and tutorials

Delež (v %) /

Načini ocenjevanja:

Weight (in %)

Assessment:

Izpit je pisni.

The exam is written.

Za vpis zaključne ocene mora biti seminarska naloga ocenjena z oceno opravi.

To enter the final grade must be assessed by coursework assessment task.

Reference nosilca / Lecturer's references:

LENASI, Helena, ŠTRUCL, Martin. Effect of regular physical training on cutaneous microvascular reactivity. *Med. sci. sports exerc.*, 2004, str. 606-612. [COBISS.SI-ID [19021785](#)]

LENASI, Helena, ŠTRUCL, Martin. Regular physical activity alters the postocclusive reactive hyperemia of the cutaneous microcirculation. *Clin. hemorheol. microcirc.*, 2010, letn. 45, št. 2/4, str. 365-374, doi: [10.1016/j.neuropsychologia.2010.08.005](#). [COBISS.SI-ID [27444953](#)]

LENASI, Helena, ŠTRUCL, Martin. The effect of nitric oxide synthase and cyclooxygenase inhibition on cutaneous microvascular reactivity. *Eur. j. appl. physiol. (Print)*. [Print ed.], 2008, letn. 103, št. 6, str. 719-726, doi: [10.1007/s00421-008-0769-8](#). [COBISS.SI-ID [24385497](#)]

LENASI, Helena. Postocclusive reactive hyperaemia of the cutaneous microcirculation : impact of endothelium and endurance training. V: 9th World Congress for Microcirculation in conjunction with the 19th EuroChap, European Chapter Meeting of the International Union of Angiology, September 26-28 2010, Paris, France. *Final program and abstract book*. [S. l.: s. n., 2010], str. 102. [COBISS.SI-ID [28396761](#)]

LENASI, Helena. Assessment of human skin microcirculation and its endothelial function using laser doppler flowmetry. V: ERONDU, Okechukwu Felix (ur.). *Medical imaging*. Rijeka: InTech, 2011, str. 271-296, ilustr. [COBISS.SI-ID [29192409](#)]