

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet: Višinska vadba v športu
Course title: Altitude training in sport

| Študijski program in stopnja Study programme and level | Študijska smer Study field | Letnik Academic year | Semester Semester |
|---|-------------------------------|-------------------------|----------------------|
| Študijski program prve stopnje – Športna vzgoja | - | 3. | 5., 6. |
| Študijski program prve stopnje – Kineziologija | - | 3. | 5., 6. |
| Kineziologija Študijski program prve stopnje – Športno treniranje | - | 3. | 5., 6. |

Vrsta predmeta / Course type

Splošni izbirni /selective

Univerzitetna koda predmeta / University course code:

| Predavanja Lectures | Seminar Seminar | Vaje Tutorial | Klinične vaje work | Druge oblike študija | Samost. delo Individ. work | ECTS |
|------------------------|--------------------|------------------|-----------------------|----------------------|----------------------------------|------|
| 15 | 0 | 30 | | | 45 | 3 |

Nosilec predmeta / Lecturer:

doc. dr. Tadej Debevec / prof. dr. Anton Ušaj

Jeziki /

Languages:

Predavanja /

Lectures:

slovenski /Slovene, angleški /English

Vaje / Tutorial:

slovenski /Slovene, angleški /English

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

Za pristop k predmetu ni posebnih pogojev.

Prerequisites:

No special requirements.

Vsebina:**Okoljski dejavniki v športu***Ključni dejavniki**Terminologija**Pogled v zgodovino***Višinska fiziologija***Vplivi velikih nadmorskih višin na človeka**Športnik na povečani nadmorski višini***Višinski trening in tekmovanja na povečani višini***Sodobni modeli višinskega treninga**Uporaba hiperoksije**Implementacija v trenažni proces**Tempiranje višinske vadbe glede na vadbene cikle**Strategije ob tekmovanjih na višini**Strategije ob tekmovanjih na nižini**Sodobne tehnologije za simulacijo nadmorske**višine***Vpliv okoljske temperature na športno****spodobnost v ekstremnih okoljih***Ključni termoregulacijski procesi v mrazu in vročini**Osnovne metode adaptacije na vročino/mraz**Implementacija v trenažni proces**Tempiranje vročinske vadbe glede na vadbene cikle**Vadbene/adaptacijske strategije ob tekmovanjih v**vročini**Vadbene/adaptacijske strategije ob tekmovanjih v**mrazu**Metode akutnega ogrevanja/ohlajanja v**mrazu/vročini**Tehnologija okoljskih komor***Vadba v onesnaženih okoljih***Onesnaženost zraka in športna sposobnost**Metode zmanjševanja negativnih vplivov**polutantov***Biološki ritmi in športna sposobnost***Vpliv fizioloških ritmov na športno sposobnost**Motnje ritmov kot posledica okoljskih dejavnikov***Content (Syllabus outline):****Environmental factors in sport***Key factors**Terminology**Historical overview***Altitude physiology***Physiological effects of high altitude**Athletes at moderate / high altitudes***Altitude training and competition***Contemporary altitude training models**Potential uses of hyperoxia**Implementation in training programmes**Timing of altitude training cycles**Strategies for competitions at altitude**Strategies for competitions at sea level**Modern technologies for altitude simulation***Effects of ambient temperature on sports****performance in extreme environments***Key thermoregulatory factors in the cold / the heat**Basic methods of heat/cold adaptation**Implementation in training programmes**Timing of heat training cycles**Training/adaptation strategies for competitions in**the heat**Training/adaptation strategies for competitions in**the cold**Contemporary acute warming/cooling methods**Technology of environmental chambers***Exercise in polluted environments***Air pollution and sports performance**Strategies to reduce pollutant-related negative**effects.***Biological rhythms and sports performance***Circadian rhythms and performance**Environmental-induced circadian rhythms**disturbances*

Temeljni literatura in viri / Readings:

Osnovna literatura / Main textbooks:

- Advanced Environmental Exercise Physiology; Cheung S.S. Human Kinetics, 2010.
- Physiological Bases of Human Performance During Work and Exercise; Editors: Nigel A.S. Taylor N.A.S and Groeller H. Elsevier, 2008.
- Exercise Physiology: Energy, Nutrition, and Human Performance. McArdle W.D., Katch F.I., Katch V.L., Lippincott Williams & Wilkins, 2010

Dodatna literatura / Additional reading/selected papers:

- Sotiridis A., Debevec T., Mekjavić I.B. Combined effects of hypoxia and heat: importance of hypoxic dose. American Journal of Physiology, Regulatory, Integrative and Comparative physiology. (2018)
- Debevec T., Pialoux V., Mekjavić I.B., Eiken O., Mury P. & Millet G.P. Moderate exercise blunts oxidative stress induced by normobaric hypoxic confinement. Medicine & Science in Sports & Exercise. (2014)
- Debevec T., Pialoux V., Saugy J., Schmitt L., Cejeuela R., Mury P., Ehrström S., Faiss R., Millet, G.P. Prooxidant/antioxidant balance in hypoxia: a cross-over study on normobaric vs. hypobaric "live high-train low". PLOS ONE. (2015)
- Debevec T., Mekjavić I.B. Sodobni trendi uporabe višinskega treninga v športu = Modern trends in the use of altitude training for sports. Šport: revija za teoretična in praktična vprašanja športa. (2009)

Cilji in kompetence:

Glavni cilj predmeta je študente usposobiti za uporabo različnih okoljskih vabnih metod (kot npr. višinski trening, adaptacija na vročino/mraz), ki preko različnih fizioloških mehanizmov lahko izboljšajo športno sposobnost. Predmet v tem pogledu nadgrajuje predmete s področja fiziologije športa in športnega treninga z namenom izboljšanja razumevanja adaptacije človeškega telesa na vadbo oziroma napor v različnih okoljih. Ključni cilji in pridobljene kompetence so navedene v nadaljevanju.

Cilji

- Nadgraditi znanja pridobljena pri predmetih Fiziologija športa in športnega treninga z vidika vplivov okoljskih faktorjev.
- Razumeti fiziološke mehanizme preko katerih različni okoljski dejavniki vplivajo na športno sposobnost in športni rezultat.
- Razumeti integrativne in povezane fiziološke odzive človeka na kombinirane okoljske dejavnike.
- Razumeti in znati uporabljati različne metode športne vadbe, ki zmanjšajo negativni vpliv različnih okoljskih dejavnikov.
- Znati implementirati metode okoljske vadbe (višinski trening itd.) v trenažni proces za izboljšanje športnega rezultata.

Objectives and competences:

Key objective of this course is to provide the students with the knowledge necessary to employ various environmental training strategies (i.e. altitude training, heat acclimation protocols) to enhance physical capabilities of athletes. This will be achieved by upgrading their understanding of sports physiology and training enable them to efficiently handle the athlete management in various environmental conditions. Key objectives and competences are outlined below:

Objectives

- To upgrade the understanding of exercise physiology and training in relation to environmental factors.
- To understand the key physiological mechanism related to environmental factors that influence exercise capacity and subsequent performance.
- To understand the integrative physiological responses related to combined environmental stressors.
- To understand and know how to utilize different exercise training approaches to reduce the potential negative effects of extreme environments.
- To be able to implement environmental training methods (e.g. altitude training) in the athletes'

- Pridobivati in kritično ovrednotiti strokovno literaturo na področju okoljske športne fiziologije.

Splošne kompetence

- Razumevanje integrativnega prepletanja fizioloških sistemov v mirovanju in med vadbo.
- Sposobnost iskanja novih in povezanih dejstev ter znanj.
- Sposobnost kritičnega preverjanja ter pridobivanja informacij.
- Usposobljenost za uporabo empiričnih in teoretičnih strategij v športu.

Specifične kompetence

- Poznavanje interaktivnih vplivov različnih okoljskih dejavnikov in človeka.
- Zmožnost analize vplivov okolja na vadbeni proces in tekmovalno sposobnost.
- Sposobnost implementacije okoljskih faktorjev v vadbeni proces z namenom izboljševanja športne sposobnosti.
- Zmožnost interdisciplinarnega povezovanja znanj in vadbenih metod s področji vezanih na okoljsko fiziologijo (kineziologija, fiziologija napora).

preparation with the aim of further performance improvement.

- To be able to obtain and critically assess scientific literature in the environmental exercise physiology field.

General competences

- Understanding the integrative nature of physiological responses during rest and exercise.
- Ability to utilize experimental and theoretical strategies in exercise physiology.
- Ability to identify and obtain important facts and new knowledge.
- Ability to obtain and critically assess crucial information.

Topic-specific competences

- Understanding the interactive effects of individual or combined environmental factors
- Ability to analyse the effects environmental factors might exert on training and competition capacity.
- Ability to implement the environmental stressors in the athletes' training in order to further enhance sport performance.
- Ability to employ interdisciplinary experimental approaches (related to kinesiology, sports physiology) to answer contemporary environmental exercise physiology issues.

Predvideni študijski rezultati:

- Študentje bodo poznali osnovne principe in fiziološke mehanizme, ki vplivajo na adaptacijo posameznika na različne okoljske dejavnike.
- Sposobni bodo kritično oceniti potencialne negativne in pozitivne učinke različnih okoljskih dejavnikov na športnika.
- Poznali bodo različne metode višinske in vročinske aklimatizacije ter bodo sposobni njihove implementacije v trenažni proces.
- Sposobni bodo pridobivati in kritično ovrednotiti literaturo na področju okoljske športne fiziologije.

Intended learning outcomes:

- Students will know and understand the basic physiological principles and mechanism governing adaptation of humans to various extreme environments.
- Students will be able to critically distinguish potential positive and negative effects of environmental factors on athletes.
- Students will understand and know how to utilize different methods of altitude and heat acclimation.
- Students will be able to critically evaluate the scientific literature covering the field of environmental exercise physiology.

Metode poučevanja in učenja:

Learning and teaching methods:

Predavanja, seminarji, seminarska naloga, vaje.

Lectures, seminars, coursework, tutorial.

Načini ocenjevanja:

Delež (v %) /
Weight (in %)

Assessment:

| Način (seminarski izpit, praktična izvedba) | | Type (coursework, practical examination): |
|---|-----|---|
| Seminar z zagovorom | 50% | Seminar presentation |
| Pisni izpit | 50% | Written exam |

Reference nosilca / Lecturer's references:

Doc. dr. Tadej Debevec je na Fakulteti za šport diplomiral leta 2006. Doktorat je leta 2011 pridobil na Mednarodni podiplomski šoli Jožefa Stefana za raziskovalno delo na področju učinkov višinske/hipoksične in hiperoksične vadbe na fiziološke adaptacije in športno sposobnost. V letih 2013/2014 je bil podoktorski raziskovalec na Univerzi v Cape Town, Faculty of Health Sciences Department of Human Biology, UCT/MRC Research Unit for Exercise Science and Sports Medicine. Njegovo raziskovalno delo obsega preučevanje adaptacijskih fizioloških mehanizmov na različne okoljske dejavnike tako pri zdravih posameznikih kot tudi v kliničnih populacijah. Leta 2015 je bil izvoljen v naziv docent za področje kinezioloških znanosti na Univerzi v Ljubljani in v naziv znanstveni sodelavec na Institutu "Jožef Stefan".

Dr. Debevec graduated from the Faculty of Sport, University of Ljubljana in 2006. He obtained his Ph.D. in 2011 for the work on different altitude/hypoxic & hyperoxic training modalities and their effects on athletic performance. During 2013/2014 he was a post-doctoral fellow at University of Cape Town, Faculty of Health Sciences Department of Human Biology, UCT/MRC Research Unit for Exercise Science and Sports Medicine. His research is primarily focused on investigating physiological adaptations of humans to different environmental stressors in health and disease. In 2015, he was elected as an Assistant Professor of Sport Science at the University of Ljubljana and to the position of Research Associate at the Jozef Stefan Institute (Ljubljana, Slovenia).

Izbrane publikacije / Selected publications

Sotiridis A., Debevec T., McDonnell A.C., Ciuha U., Eiken O. & Mekjavic I.B. Exercise cardiorespiratory and thermoregulatory responses in normoxic, hypoxic and hot environment following 10-day continuous hypoxic exposure. *Journal of Applied Physiology*. (2018) In press.

Sotiridis A., Debevec T., Mekjavić I.B. Combined effects of hypoxia and heat: importance of hypoxic dose. *American Journal of Physiology, Regulatory, Integrative and Comparative physiology*. (2018) 314: 228-229

Debevec T. Hypoxia-related hormonal appetite modulation in humans during rest and exercise: Mini review. *Frontiers in Physiology*. (2017) 8(366).

Kapus J., Mekjavić I.B., McDonnell A.C., Ušaj A., Vodičar J., Najdenov P., Jakovljević M., Jaki Mekjavić P., Žvan M. & Debevec T. Cardiorespiratory responses of adults and children during normoxic and hypoxic exercise. *International Journal of Sports Medicine*. (2017) 38(8): 627-636.

Debevec T., Millet G.P. & Pialoux V. Hypoxia-induced oxidative stress modulation with physical activity. *Frontiers in Physiology*. (2017) 8(84).

Debevec T., Simpson E.J., Mekjavić I.B., Eiken O. & Macdonald I.A. Effects of prolonged hypoxia and bed rest on appetite and appetite-related hormones. *Appetite*. (2016) 107: 28-37.

Debevec T., Pialoux V., Ehrström S., Ribon A., Eiken O., Mekjavić I.B. & Millet G.P. FemHab: The effects of bed rest and hypoxia on oxidative stress in healthy females. *Journal of Applied Physiology*. (2016) 120: 930-938.

Ušaj A. & Burnik S. The Influence of High-Altitude Acclimatization on Ventilatory and Blood Oxygen Saturation Responses During Normoxic and Hypoxic Testing. *J Hum Kinet*. (2016) Apr (13)50:125-133.

Debevec T., Pialoux V., Saugy J., Schmitt L., Cejeuela R., Mury P., Ehrström S., Faiss R., Millet, G.P. Prooxidant/antioxidant balance in hypoxia: a cross-over study on normobaric vs. hypobaric "live high-train low". *PLOS ONE*. (2015) e0137957-1-e0137957-14.

Debevec T., Bali T.C., Simpson E.J., Macdonald I.A., Eiken O. & Mekjavić I.B. Separate and combined effects of 21-day bed rest and hypoxic confinement on body composition. *European Journal of Applied Physiology*. (2014) 114(11): 2411-25.

Debevec T., Simpson E.J., Macdonald I.A., Eiken O. & Mekjavić I.B. Exercise training during normobaric hypoxic confinement does not alter hormonal appetite regulation. *PLOS ONE*. (2014) 9(6):e98874.

Debevec T., McDonnell A.C., Macdonald I.A., Eiken O. & Mekjavić I.B. Whole body and regional body composition changes following 10-day hypoxic confinement and unloading/inactivity. *Applied Physiology, Nutrition, and Metabolism*. (2014) 39(3):386-395.

Debevec T., Pialoux V., Mekjavić I.B., Eiken O., Mury P. & Millet G.P. Moderate exercise blunts oxidative stress induced by normobaric hypoxic confinement. *Medicine & Science in Sports & Exercise*. (2014) 46(1):33-41.

Debevec T. & Mekjavić I.B. Short intermittent hypoxic exposures augment ventilation but do not alter cerebral and muscle oxygenation during hypoxic exercise. *Respir Physiol Neurobiol*. (2012) 118(2): 132-142.

Debevec T., Amon M., Keramidis M.E., Kounalakis S.N., Pišot R. & Mekjavić I.B. Normoxic and hypoxic performance following 4 weeks of normobaric hypoxic training. *Aviat. Space Environ. Med*. (2010). 81(4): 387-393.