

1. BASIC INFORMATION

Course	Module 4: Sports nutrition I. Fundamentals of nutrition, assessment of body composition, control and monitoring of diet through new technologies
Degree program	Master's Degree in Sports Training and Nutrition
School	Escuela Universitaria Real Madrid – Universidad Europea / Faculty of Medicine, Health and Sports
Year	First
ECTS	6
Credit type	Compulsory
Language(s)	English
Delivery mode	Face
Semester	Annual
Academic year	2025-2026
Coordinating professor	Mr. Guillermo Muñoz Andradás / Mrs. Krizia Radesca Fabiano / Mrs. Rebeca Benítez Valero / Mr. Martín Alejandro Festino

2. PRESENTATION

The module of Sports Nutrition IV. Fundamentals of nutrition, assessment of body composition, control, and monitoring of diet through new technologies' aims to lay the foundations on dietetics and nutrition addressing biochemical and metabolic that allows the student to understand the function of different macro- and micronutrients. Likewise, students will be trained to assess body composition rigorously and objectively through different methodologies and the operation of different technologies and software that allow the monitoring of personalized diet will be introduced.

The qualification of this module is composed of practices in the laboratory, group work, and test type exams.

3. COMPETENCIES AND LEARNING OUTCOMES

Core competencies:

- CB1. Possess and understand knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, often in a research context.
- CB3. That students can integrate knowledge and face the complexity of making judgments based on information that, being incomplete or limited, includes reflections on the social and ethical responsibilities linked to the application of their knowledge and judgments.

Cross-curricular competencies:

- CT4. Influential leadership. Influence others to guide and direct them towards specific goals and objectives, considering their points of view, especially in situations arising from volatile, uncertain, complex, and ambiguous (VUCA) environments of today's world.
- CT6. Critical analysis. Integrate analysis with critical thinking in a process of evaluating different ideas or possibilities and their potential for error, based on evidence and objective data that leads to effective and valid decision making.
- CT8. Ethical-social competence. Show ethical behaviors and social commitment in the performance of the activities of a profession, as well as sensitivity to inequality and diversity.

Specific competencies:

- CE3. Research and evaluate scientific documentation related to the areas of human performance and sports nutrition.
- CE4. Interpret research and apply new technologies in the field of training and sports nutrition.
- CE5. Manage and discriminate the methodology and procedures of scientific research in the field of training and sports nutrition applied to all ages and levels of performance.
- CE9. Design training programs and nutritional advice applicable to different sports specialties and performance levels, diagnosing the level of physical condition, motor ability and nutritional status.

Learning outcomes:

- RA1: Analyze the ways of transmitting and producing energy from food and the human organism
- RA2: Perform an analysis of the body composition and somatotype of the athlete based on the taking of folds, registration of body weight, measurement of different heights, diameters and perimeters
- RA3: Describe the most appropriate combinations of nutrients, in quality and quantity, for the recovery of endocrine-metabolic and immune balance altered in response to sports practice at different levels of intensity
- RA4: Use new technologies to improve work capacity and outcomes, as well as to create or generate ideas to improve outcomes in the field of sports nutrition

The following table shows the relationship between the competencies developed during the course and the learning outcomes pursued:

Competencies	Learning outcomes
CB1, CB3, CT4, CT6, CT8, EC3, EC4, EC5, EC9	RA1
CB1, CB3, CT4, CT6, CT8, EC3, EC4, EC5, EC9	RA2
CB1, CB3, CT4, CT6, CT8, EC3, EC4, EC5, EC9	RA3
CB1, CB3, CT4, CT6, CT8, EC3, EC4, EC5, EC9	RA4

4. CONTENT

- Anatomy and physiology of the digestive system
- Macronutrients: carbohydrates, lipids and proteins
- Micronutrients: vitamins and minerals
- Food analysis and food technology
- Sports endocrinology: hormone-nutrient-exercise interactions
- Sports immunology

5. TEACHING-LEARNING METHODOLOGIES

The types of teaching-learning methodologies used are indicated below:

- Master class
- Case method.
- Problem-based learning.
- Learning based on workshop teachings.
- Simulation environments

6. LEARNING ACTIVITIES

Listed below are the types of learning activities and the number of hours the student will spend on each one:

Campus-based mode:

Learning activity	Number of hours
Master classes (face-to-face modality)	30
Case analysis (face-to-face modality)	4
Problem solving (face-to-face modality)	6
Preparation of reports and writings (face-to-face modality)	26
Activities in workshops and/or laboratories (face-to-face modality)	6
Self-employment (face-to-face modality)	50
Debates and colloquiums (face-to-face modality)	8
Tutoring (face-to-face modality)	18
Knowledge tests (face-to-face modality)	2
TOTAL	150

7. ASSESSMENT

Listed below are the assessment systems used and the weight each one carries towards the final course grade:

Campus-based mode:

Assessment system	Weight
Face-to-face knowledge tests (face-to-face modality)	60-60%
Reports and writings (face-to-face modality)	5-20%
Case/problem (face-to-face mode)	5-20%
Notebook of laboratory practices (face-to-face modality)	10-20%

When you access the course on the *Campus Virtual*, you'll find a description of the assessment activities you must complete, as well as the delivery deadline and assessment procedure for each one.

7.1. First exam period

To pass the course in the first exam period, you must obtain a final course grade of at least 5 out of 10 (weighted average).

7.2. Second exam period

To pass the course in the second exam period, you must obtain a final grade of at least 5 out of 10 (weighted average).

The student must deliver the activities not successfully completed in the first exam period after having received the corresponding corrections from the professor, or those that were not delivered in the first place.

8. SCHEDULE

This table shows the delivery deadline for each assessable activity in the course:

Assessable activities	Deadline
Face-to-face knowledge tests	February
Reports and writings	October/November
Case/problem	October/November
Notebook of laboratory practices	February

This schedule may be subject to changes for logistical reasons relating to the activities. The student will be notified of any change as and when appropriate.

9. BIBLIOGRAPHY

The bibliographic search is part of the autonomous work of the student on the theme of the seminar. The teacher will be able to guide the student in this search.

1.Alvares TS, Conte-Junior CA, Silva JT, Paschoalin VM. Acute L-Arginine supplementation does not increase nitric oxide production in healthy subjects. *Nutr Metab (Lond)*. 2012;9(1):54.

2.Álvares TS, Meirelles CM, Bhambhani YN, Paschoalin VM, Gomes PS. L-Arginine as a potential ergogenic aid in healthy subjects. *Sports Med*. 2011;41(3):233-48.

3.Alway SE, Bennett BT, Wilson JC, Edens NK, Pereira SL. Epigallocatechin-3-gallate improves plantaris muscle recovery after disuse in aged rats. *Exp Gerontol*. 2014;50:82-94.

4.Alway SE, Bennett BT, Wilson JC, Sperringer J, Mohamed JS, Edens NK, et al. Green tea extract attenuates muscle loss and improves muscle function during disuse, but fails to improve muscle recovery following unloading in aged rats. *J Appl Physiol (1985)*. 2015;118(3):319-30.

5. Alway SE, McCrory JL, Kearcher K, Vickers A, Frear B, Gilleland DL, et al. Resveratrol enhances exercise-induced cellular and functional adaptations of skeletal muscle in older men and women. *J Gerontol A Biol Sci Med Sci*. 2017.
6. Andre TL, Gann JJ, McKinley-Barnard SK, Song JJ, Willoughby DS. Eight Weeks of Phosphatidic Acid Supplementation in Conjunction with Resistance Training Does Not Differentially Affect Body Composition and Muscle Strength in Resistance-Trained Men. *J Sports Sci Med*. 2016;15(3):532-9.
7. Angeli G, Barros TLD, Barros DFLD, Lima M. Investigation of the effects of oral supplementation of arginine in the increase of muscular strength and mass. *Revista Brasileira de Medicina do Esporte*. 2007;13(2):129-32.
8. Antonio J, Uelmen J, Rodriguez R, Earnest C. The effects of Tribulus terrestris on body composition and exercise performance in resistance-trained males. *Int J Sport Nutr Exerc Metab*. 2000;10(2):208-15.
9. Bailey SJ, Blackwell JR, Lord T, Vanhatalo A, Winyard PG, Jones AM. L-Citrulline supplementation improves O₂ uptake kinetics and high-intensity exercise performance in humans. *J Appl Physiol* (1985). 2015;119(4):385-95.
10. Ballak SB, Jaspers RT, Deldicque L, Chalil S, Peters EL, de Haan A, et al. Blunted hypertrophic response in old mouse muscle is associated with a lower satellite cell density and is not alleviated by resveratrol. *Exp Gerontol*. 2015;62:23-31.
11. Bang HS, Seo DY, Chung YM, Oh KM, Park JJ, Arturo F, et al. Ursolic Acid-induced elevation of serum irisin augments muscle strength during resistance training in men. *Korean J Physiol Pharmacol*. 2014;18(5):441-6.
12. Barillaro C, Liperoti R, Martone AM, Onder G, Landi F. The new metabolic treatments for sarcopenia. *Aging Clin Exp Res*. 2013;25(2):119-27.
13. Beis L, Mohammad Y, Easton C, Pitsiladis YP. Failure of glycine-arginine- α -ketoisocaproic acid to improve high-intensity exercise performance in trained cyclists. *Int J Sport Nutr Exerc Metab*. 2011;21(1):33-9.
14. Bennett BT, Mohamed JS, Alway SE. Effects of resveratrol on the recovery of muscle mass following disuse in the plantaris muscle of aged rats. *PLoS One*. 2013;8(12):E83518.
15. Bescós R, Sureda A, Tur JA, Pons A. The effect of nitric-oxide-related supplements on human performance. *Sports Med*. 2012;42(2):99-117.
16. Blancquaert L, Everaert I, Missinne M, Baguet A, Stegen S, Volckaert A, et al. Effects of Histidine and β -alanine Supplementation on Human Muscle Carnosine Storage. *Med Sci Sports Exerc*. 2017;49(3):602-9.
17. Blum A, Cannon RO, Costello R, Schenke WH, Csako G. Endocrine and lipid effects of oral L-arginine treatment in healthy postmenopausal women. *J Lab Clin Med*. 2000;135(3):231-7.
18. Boebel KP, Baker DH. Comparative utilization of the alpha-keto and D- and L-alpha-hydroxy analogs of leucine, isoleucine and valine by chicks and rats. *J Nutr*. 1982;112(10):1929-39.
19. Bond P. Phosphatidic acid: biosynthesis, pharmacokinetics, mechanisms of action and effect on strength and body composition in resistance-trained individuals. *Nutr Metab (Lond)*. 2017;14:12.
20. Brown GA, Vukovich MD, Martini ER, Kohut ML, Franke WD, Jackson DA, et al. Endocrine responses to chronic androstenedione intake in 30- to 56-year-old men. *J Clin Endocrinol Metab*. 2000;85(11):4074-80.
21. Brown GA, Vukovich MD, Sharp RL, Reifenrath TA, Parsons KA, King DS. Effect of oral DHEA on serum testosterone and adaptations to resistance training in young men. *J Appl Physiol* (1985). 1999;87(6):2274-83.
22. Bucci L, Hickson JF, Pivarnik JM, Wolinsky I, McMahon JC, Turner SD. Ornithine ingestion and growth hormone release in bodybuilders. *Nutrition Research*. 1990;10(3):239-45.
23. Buford BN, Koch AJ. Glycine-arginine-alpha-ketoisocaproic acid improves performance of repeated cycling sprints. *Med Sci Sports Exerc*. 2004;36(4):583-7.
24. Knight B, Gleason RE, Wurtman RJ. Plasma amino acid concentrations in healthy elderly men and women. *Am J Clin Nutr*. 1991;53(5):1249-52.
25. Cai X, Zhu C, Xu Y, Jing Y, Yuan Y, Wang L, et al. Alpha-ketoglutarate promotes skeletal muscle hypertrophy and protein synthesis through Akt/mTOR signaling pathways. *Sci Rep*. 2016;6:26802.

- 26.Campbell B, Roberts M, Kerksick C, Wilborn C, Marcello B, Taylor L, et al. Pharmacokinetics, safety, and effects on exercise performance of L-arginine alpha-ketoglutarate in trained adult men. *Nutrition*. 2006;22(9):872-81.
- 27.Campbell BI, La Bounty PM, Roberts M. The ergogenic potential of arginine. *J Int Soc Sports Nutr*. 2004;1(2):35-8.
- 28.Candow DG, Chilibeck PD, Burke DG, Davison KS, Smith-Palmer T. Effect of glutamine supplementation combined with resistance training in young adults. *Eur J Appl Physiol*. 2001;86(2):142-9.
- 29.Cardoso GA, Salgado JM, Cesar MeC, Donado-Pestana CM. The effects of green tea consumption and resistance training on body composition and resting metabolic rate in overweight or obese women. *J Med Food*. 2013;16(2):120-7.
- 30.Castillo L, Ajami A, Branch S, Chapman TE, Yu YM, Burke JF, et al. Plasma arginine kinetics in adult man: response to an arginine-free diet. *Metabolism*. 1994;43(1):114-22.
- 31.Chilosi A, Casarano M, Comparini A, Battaglia FM, Mancardi MM, Schiaffino C, et al. Neuropsychological profile and clinical effects of arginine treatment in children with creatine transport deficiency. *Orphanet J Rare Dis*. 2012;7:43.
- 32.Cho YH, Lee SY, Kim CM, Kim ND, Choe S, Lee CH, et al. Effect of Loquat Leaf Extract on Muscle Strength, Muscle Mass, and Muscle Function in Healthy Adults: A Randomized, Double-Blinded, and Placebo-Controlled Trial. *Evid Based Complement Alternat Med*. 2016;2016:4301621.
- 33.Chromiak JA, Antonio J. Use of amino acids as growth hormone-releasing agents by athletes. *Nutrition*. 2002;18(7-8):657-61.
- 34.Church DD, Schwarz NA, Spillane MB, McKinley-Barnard SK, Andre TL, Ramirez AJ, et al. L-Leucine Increases Skeletal Muscle IGF-1 but Does Not Differentially Increase Akt/mTORC1 Signaling and Serum IGF-1 Compared to Ursolic Acid in Response to Resistance Exercise in Resistance-Trained Men. *J Am Coll Nutr*. 2016;35(7):627-38.
- 35.Clarkson PM, Rawson ES. Nutritional supplements to increase muscle mass. *Crit Rev Food Sci Nutr*. 1999;39(4):317-28.
- 36.Collier SR, Collins E, Kanaley JA. Oral arginine attenuates the growth hormone response to resistance exercise. *J Appl Physiol* (1985). 2006;101(3):848-52.
- 37.Curi R, Newsholme P, Procopio J, Lagranha C, Gorjão R, Pithon-Curi TC. Glutamine, gene expression, and cell function. *Front Biosci*. 2007;12:344-57.
- 38.Curis E, Nicolis I, Moinard C, Osowska S, Zerrouk N, Bénazeth S, et al. Almost all about citrulline in mammals. *Amino Acids*. 2005;29(3):177-205.
- 39.Cusi K, Cukier S, DeFronzo RA, Torres M, Puchulu FM, Redondo JC. Vanadyl sulfate improves hepatic and muscle insulin sensitivity in type 2 diabetes. *J Clin Endocrinol Metab*. 2001;86(3):1410-7.
- 40.Cutrufello PT, Gadowski SJ, Zavorsky GS. The effect of L-citrulline and watermelon juice supplementation on anaerobic and aerobic exercise performance. *J Sports Sci*. 2015;33(14):1459-66.
- 41.Cynober L. Ornithine alpha-ketoglutarate as a potent precursor of arginine and nitric oxide: a new job for an old friend. *J Nutr*. 2004;134(10 Suppl):2858S-62S; discussion 95S.
- 42.Demura S, Yamada T, Yamaji S, Komatsu M, Morishita K. The effect of L-ornithine hydrochloride ingestion on human growth hormone secretion after strength training. *Advances in Bioscience and Biotechnology*. 2010;1:7-11.
- 43.Dhatariya KK, Greenlund LJ, Bigelow ML, Thapa P, Oberg AL, Ford GC, et al. Dehydroepiandrosterone replacement therapy in hypoadrenal women: protein anabolism and skeletal muscle function. *May Clin Proc*. 2008;83(11):1218-25.
- 44.Domínguez R, Hernández Lougedo J, Maté-Muñoz JL, Garnacho-Castaño MV. [Effects of β -alanine supplementation on athletic performance]. *Nutr Hosp*. 2014;31(1):155-69.
- 45.Dukes A, Davis C, El Refaey M, Upadhyay S, Mork S, Arounleut P, et al. The aromatic amino acid tryptophan stimulates skeletal muscle IGF1/p70s6k/mTor signaling in vivo and the expression of myogenic genes in vitro. *Nutrition*. 2015;31(7-8):1018-24.

- 46.Dutt V, Gupta S, Dabur R, Injeti E, Mittal A. Skeletal muscle atrophy: Potential therapeutic agents and their mechanisms of action. *Pharmacol Res.* 2015;99:86-100.
- 47.Evain-Brion D, Donnadiou M, Roger M, Job JC. Simultaneous study of somatotrophic and corticotrophic pituitary secretions during ornithine infusion test. *Clin Endocrinol (Oxf).* 1982;17(2):119-22.
- 48.Evans M, Guthrie N, Pezzullo J, Sanli T, Fielding RA, Bellamine A. Efficacy of a novel formulation of L-Carnitine, creatine, and leucine on lean body mass and functional muscle strength in healthy older adults: a randomized, double-blind placebo-controlled study. *Nutr Metab (Lond).* 2017;14:7.
- 49.Fang Y, Vilella-Bach M, Bachmann R, Flanigan A, Chen J. Phosphatidic acid-mediated mitogenic activation of mTOR signaling. *Science.* 2001;294(5548):1942-5.
- 50.Fawcett JP, Farquhar SJ, Walker RJ, Thou T, Lowe G, Goulding A. The effect of oral vanadyl sulfate on body composition and performance in weight-training athletes. *Int J Sport Nutr.* 1996;6(4):382-90.
- 51.Forbes SC, Bell GJ. The acute effects of a low and high dose of oral L-arginine supplementation in young active males at rest. *Appl Physiol Nutr Metab.* 2011;36(3):405-11.
- 52.Fraser WM, Tucker HS, Grubb SR, Wigand JP, Blackard WG. Effect of L-tryptophan on growth hormone and prolactin release in normal volunteers and patients with secretory pituitary tumors. *Horm Metab Res.* 1979;11(2):149-55.
- 53.Garcia JM, Boccia RV, Graham CD, Yan Y, Duus EM, Allen S, et al. Anamorelin for patients with cancer cachexia: an integrated analysis of two phase 2, randomised, placebo-controlled, double-blind trials. *Lancet Oncol.* 2015;16(1):108-16.
- 54.Gleeson M. Dosing and efficacy of glutamine supplementation in human exercise and sport training. *J Nutr.* 2008;138(10):2045S-9S.
- 55.Glenn JM, Gray M, Jensen A, Stone MS, Vincenzo JL. Acute citrulline-malate supplementation improves maximal strength and anaerobic power in female, masters athletes tennis players. *Eur J Sport Sci.* 2016;16(8):1095-103.
- 56.Glenn JM, Gray M, Stewart RW, Moyen NE, Kavouras SA, DiBrezzo R, et al. Effects of 28-Day Beta-Alanine Supplementation on Isokinetic Exercise Performance and Body Composition in Female Masters Athletes. *J Strength Cond Res.* 2016;30(1):200-7.
- 57.Glenn JM, Gray M, Wethington LN, Stone MS, Stewart RW, Moyen NE. Acute citrulline malate supplementation improves upper- and lower-body submaximal weightlifting exercise performance in resistance-trained females. *Eur J Nutr.* 2017;56(2):775-84.
- 58.Goldman A, Basaria S. Adverse health effects of androgen use. *Mol Cell Endocrinol.* 2017.
- 59.Gonzalez AM, Sell KM, Ghigiarelli JJ, Kelly CF, Shone EW, Accetta MR, et al. Effects of phosphatidic acid supplementation on muscle thickness and strength in resistance-trained men. *Appl Physiol Nutr Metab.* 2017;42(4):443-8.
60. Hammarqvist F, Wernerman J, Ali R, von der Decken A, Vinnars E. Addition of glutamine to total parenteral nutrition after elective abdominal surgery spares free glutamine in muscle, counteracts the fall in muscle protein synthesis, and improves nitrogen balance. *Ann Surg.* 1989;209(4):455-61.
- 61.Hays NP, Kim H, Wells AM, Kajkenova O, Evans WJ. Effects of whey and fortified collagen hydrolysate protein supplements on nitrogen balance and body composition in older women. *Journal of the American Dietetic Association.* 2009;109(6):1082-7.
- 62.Hickner RC, Tanner CJ, Evans CA, Clark PD, Haddock A, Fortune C, et al. L-citrulline reduces time to exhaustion and insulin response to a graded exercise test. *Med Sci Sports Exerc.* 2006;38(4):660-6.
- 63.Hoffman JR, Ratamess NA, Faigenbaum AD, Ross R, Kang J, Stout JR, et al. Short-duration beta-alanine supplementation increases training volume and reduces subjective feelings of fatigue in college football players. *Nutr Res.* 2008;28(1):31-5.
- 64.Hoffman JR, Stout JR, Williams DR, Wells AJ, Fragala MS, Mangine GT, et al. Efficacy of phosphatidic acid ingestion on lean body mass, muscle thickness and strength gains in resistance-trained men. *J Int Soc Sports Nutr.* 2012;9(1):47.
- 65.Isidori A, Lo Monaco A, Cappa M. A study of growth hormone release in man after oral administration of amino acids. *Curr Med Res Opin.* 1981;7(7):475-81.

- 66.Jackson JR, Ryan MJ, Alway SE. Long-term supplementation with resveratrol alleviates oxidative stress but does not attenuate sarcopenia in aged mice. *J Gerontol A Biol Sci Med Sci*. 2011;66(7):751-64.
- 67.Jacobs PL, Goldstein ER, Blackburn W, Orem I, Hughes JJ. Glycine propionyl-L-carnitine produces enhanced anaerobic work capacity with reduced lactate accumulation in resistance trained males. *J Int Soc Sports Nutr*. 2009;6:9.
- 68.Joy JM, Gundermann DM, Lowery RP, Jäger R, McCleary SA, Purpura M, et al. Phosphatidic acid enhances mTOR signaling and resistance exercise induced hypertrophy. *Nutr Metab (Lond)*. 2014;11:29.
- 69.Katashima CK, Silva VR, Gomes TL, Pichard C, Pimentel GD. Ursolic acid and mechanisms of actions on adipose and muscle tissue: a systematic review. *Obes Rev*. 2017;18(6):700-11.
- 70.Keller J, Couturier A, Haferkamp M, Most E, Eder K. Supplementation of carnitine leads to an activation of the IGF-1/PI3K/Akt signalling pathway and down regulates the E3 ligase MuRF1 in skeletal muscle of rats. *Nutr Metab (Lond)*. 2013;10(1):28.
- 71.Keller J, Ringseis R, Koc A, Lukas I, Kluge H, Eder K. Supplementation with L-carnitine downregulates genes of the ubiquitin proteasome system in the skeletal muscle and liver of piglets. *Animal*. 2012;6(1):70-8.
- 72.King DS, Sharp RL, Vukovich MD, Brown GA, Reifenrath TA, Uhl NL, et al. Effect of oral androstenedione on serum testosterone and adaptations to resistance training in young men: a randomized controlled trial. *JAMA*. 1999;281(21):2020-8.
- 73.Kokubo T, Maeda S, Tazumi K, Nozawa H, Miura Y, Kirisako T. The Effect of L-Ornithine on the Phosphorylation of mTORC1 Downstream Targets in Rat Liver. *Prev Nutr Food Sci*. 2015;20(4):238-45.
- 74.Koulu M. Re-evaluation of L-tryptophan-stimulated human growth hormone secretion: A dose-related study with a comparison with L-dopa and apomorphine tests. *Journal of Neural Transmission*. 1982;55(4):269-75.
- 75.Kraemer WJ, Spiering BA, Volek JS, Ratamess NA, Sharman MJ, Rubin MR, et al. Androgenic responses to resistance exercise: effects of feeding and L-carnitine. *Med Sci Sports Exerc*. 2006;38(7):1288-96.
- 76.Kraemer WJ, Volek JS, French DN, Rubin MR, Sharman MJ, Gomez AL, et al. The effects of L-carnitine L-tartrate supplementation on hormonal responses to resistance exercise and recovery. *J Strength Cond Res*. 2003;17(3):455-62.
- 77.Kreider RB, Ferreira MP, Greenwood M, Wilson M, Almada AL. Effects of conjugated linoleic acid supplementation during resistance training on body composition, bone density, strength, and selected hematological markers. *J Strength Cond Res*. 2002;16(3):325-34.
- 78.Kunkel SD, Elmore CJ, Bongers KS, Ebert SM, Fox DK, Dyle MC, et al. Ursolic acid increases skeletal muscle and brown fat and decreases diet-induced obesity, glucose intolerance and fatty liver disease. *PLoS One*. 2012;7(6):E39332.
- 79.Kunkel SD, Suneja M, Ebert SM, Bongers KS, Fox DK, Malmberg SE, et al. mRNA expression signatures of human skeletal muscle atrophy identify a natural compound that increases muscle mass. *Cell Metab*. 2011;13(6):627-38.
- 80.Lang CH, Pruznak A, Navaratnarajah M, Rankine KA, Deiter G, Magne H, et al. Chronic α -hydroxyisocaproic acid treatment improves muscle recovery after immobilization-induced atrophy. *Am J Physiol Endocrinol Metab*. 2013;305(3):E416-28.
- 81.Le Bricon T, Coudray-Lucas C, Lioret N, Lim SK, Plassart F, Schlegel L, et al. Ornithine alpha-ketoglutarate metabolism after enteral administration in burn patients: bolus compared with continuous infusion. *Am J Clin Nutr*. 1997;65(2):512-8.
- 82.Lin Y, Chen F, Zhang J, Wang T, Wei X, Wu J, et al. Neuroprotective effect of resveratrol on ischemia/reperfusion injury in rats through TRPC6/CREB pathways. *J Mol Neurosci*. 2013;50(3):504-13.
- 83.Ma Y, Guo Z, Wang X. Tribulus terrestris extracts alleviate muscle damage and promote anaerobic performance of trained male boxers and its mechanisms: Roles of androgen, IGF-1, and IGF binding protein-3. *Journal of Sport and Health Science* 2015;12:1-8.
- 84.Mattison JA, Wang M, Bernier M, Zhang J, Park SS, Maudsley S, et al. Resveratrol prevents high fat/sucrose diet-induced central arterial wall inflammation and stiffening in nonhuman primates. *Cell Metab*. 2014;20(1):183-90.

- 85.Meador BM, Mirza KA, Tian M, Skelding MB, Reaves LA, Edens NK, et al. The Green Tea Polyphenol Epigallocatechin-3-Gallate (EGCg) Attenuates Skeletal Muscle Atrophy in a Rat Model of Sarcopenia. *J Frailty Aging*. 2015;4(4):209-15.
- 86.Mero AA, Ojala T, Hulmi JJ, Puurtinen R, Karila TA, Seppälä T. Effects of alfa-hydroxy-isocaproic acid on body composition, DOMS and performance in athletes. *J Int Soc Sports Nutr*. 2010;7:1.
- 87.Mobley CB, Hornberger TA, Fox CD, Healy JC, Ferguson BS, Lowery RP, et al. Effects of oral phosphatidic acid feeding with or without whey protein on muscle protein synthesis and anabolic signaling in rodent skeletal muscle. *J Int Soc Sports Nutr*. 2015;12:32.
- 88.Moinard C, Nicolis I, Neveux N, Darquy S, Bénazeth S, Cynober L. Dose-ranging effects of citrulline administration on plasma amino acids and hormonal patterns in healthy subjects: the Citrudose pharmacokinetic study. *Br J Nutr*. 2008;99(4):855-62.
- 89.Mok E, Eléouet-Da Violante C, Daubrosse C, Gottrand F, Rigal O, Fontan JE, et al. Oral glutamine and amino acid supplementation inhibit whole-body protein degradation in children with Duchenne muscular dystrophy. *Am J Clin Nutr*. 2006;83(4):823-8.
- 90.Molfino A, Amabile MI, Rossi Fanelli F, Muscaritoli M. Novel therapeutic options for cachexia and sarcopenia. *Expert Opin Biol Ther*. 2016;16(10):1239-44.
- 91.Morales AJ, Nolan JJ, Nelson JC, Yen SS. Effects of replacement dose of dehydroepiandrosterone in men and women of advancing age. *J Clin Endocrinol Metab*. 1994;78(6):1360-7.
- 92.Müller EE, Brambilla F, Cavagnini F, Peracchi M, Panerai A. Slight effect of L-tryptophan on growth hormone release in normal human subjects. *J Clin Endocrinol Metab*. 1974;39(1):1-5.
- 93.Nagaya N, Itoh T, Murakami S, Oya H, Uematsu M, Miyatake K, et al. Treatment of cachexia with ghrelin in patients with COPD. *Chest*. 2005;128(3):1187-93.
- 94.Nagaya N, Moriya J, Yasumura Y, Uematsu M, Ono F, Shimizu W, et al. Effects of ghrelin administration on left ventricular function, exercise capacity, and muscle wasting in patients with chronic heart failure. *Circulation*. 2004;110(24):3674-9.
- 95.Neychev VK, Mitev VI. The aphrodisiac herb *Tribulus terrestris* does not influence the androgen production in young men. *J Ethnopharmacol*. 2005;101(1-3):319-23.
- 96.Novak F, Heyland DK, Avenell A, Drover JW, Su X. Glutamine supplementation in serious illness: a systematic review of the evidence. *Crit Care Med*. 2002;30(9):2022-9.
- 97.Pérez-Guisado J, Jakeman PM. Citrulline malate enhances athletic anaerobic performance and relieves muscle soreness. *J Strength Cond Res*. 2010;24(5):1215-22.
- 98.Pinkoski C, Chilibeck PD, Candow DG, Eslinger D, Ewaschuk JB, Facci M, et al. The effects of conjugated linoleic acid supplementation during resistance training. *Med Sci Sports Exerc*. 2006;38(2):339-48.
- 99.Prosser JM, Majlesi N, Chan GM, Olsen D, Hoffman RS, Nelson LS. Adverse effects associated with arginine alpha-ketoglutarate containing supplements. *Hum Exp Toxicol*. 2009;28(5):259-62.
- 100.Quesnele JJ, Laframboise MA, Wong JJ, Kim P, Wells GD. The effects of beta-alanine supplementation on performance: a systematic review of the literature. *Int J Sport Nutr Exerc Metab*. 2014;24(1):14-27.
- 101.Qureshi A, Naughton DP, Petroczi A. A systematic review on the herbal extract *Tribulus terrestris* and the roots of its putative aphrodisiac and performance enhancing effect. *J Diet Suppl*. 2014;11(1):64-79.
- 102.Rathbone CR, Booth FW, Lees SJ. Sirt1 increases skeletal muscle precursor cell proliferation. *Eur J Cell Biol*. 2009;88(1):35-44.
- 103.Riedel E, Nündel M, Hampl H. alpha-Ketoglutarate application in hemodialysis patients improves amino acid metabolism. *Nephron*. 1996;74(2):261-5.
- 104.Roaiah MF, El Khayat YI, GamalEl Din SF, Abd El Salam MA. Pilot Study on the Effect of Botanical Medicine (*Tribulus terrestris*) on Serum Testosterone Level and Erectile Function in Aging Males With Partial Androgen Deficiency (PADAM). *J Sex Marital Ther*. 2016;42(4):297-301.
- 105.Rogerson S, Riches CJ, Jennings C, Weatherby RP, Meir RA, Marshall-Gradisnik SM. The effect of five weeks of *Tribulus terrestris* supplementation on muscle strength and body composition during preseason training in elite rugby league players. *J Strength Cond Res*. 2007;21(2):348-53.

- 106.Saunders B, Elliott-Sale K, Artioli GG, Swinton PA, Dolan E, Roschel H, et al. β -alanine supplementation to improve exercise capacity and performance: a systematic review and meta-analysis. *Br J Sports Med.* 2017;51(8):658-69.
- 107.Segura R, Ventura JL. Effect of L-tryptophan supplementation on exercise performance. *Int J Sports Med.* 1988;9(5):301-5.
- 108.Shad BJ, Smeuninx B, Atherton PJ, Breen L. The mechanistic and ergogenic effects of phosphatidic acid in skeletal muscle. *Appl Physiol Nutr Metab.* 2015;40(12):1233-41.
- 109.Shen CL, Chyu MC, Yeh JK, Zhang Y, Pence BC, Felton CK, et al. Effect of green tea and Tai Chi on bone health in postmenopausal osteopenic women: a 6-month randomized placebo-controlled trial. *Osteoporos Int.* 2012;23(5):1541-52.
- 110.Song HJ, Grant I, Rotondo D, Mohede I, Sattar N, Heys SD, et al. Effect of CLA supplementation on immune function in young healthy volunteers. *Eur J Clin Nutr.* 2005;59(4):508-17.
- 111.Stehle P, Zander J, Mertes N, Albers S, Puchstein C, Lawin P, et al. Effect of parenteral glutamine peptide supplements on muscle glutamine loss and nitrogen balance after major surgery. *Lancet.* 1989;1(8632):231-3.
- 112.Stensrud T, Ingjer F, Holm H, Strømme SB. L-tryptophan supplementation does not improve running performance. *Int J Sports Med.* 1992;13(6):481-5.
- 113.Stevens BR, Godfrey MD, Kaminski TW, Braith RW. High-intensity dynamic human muscle performance enhanced by a metabolic intervention. *Med Sci Sports Exerc.* 2000;32(12):2102-8.
- 114.Strüder HK, Weicker H. Physiology and pathophysiology of the serotonergic system and its implications on mental and physical performance. Part I. *Int J Sports Med.* 2001;22(7):467-81.
- 115.Sun K, Wu Z, Ji Y, Wu G. Glycine regulates protein turnover by activating protein kinase B/mammalian target of rapamycin and by inhibiting MuRF1 and atrogin-1 gene expression in C2C12 Myoblasts. *J Nutr.* 2016;146(12):2461-7.
- 116.Tarnopolsky M, Zimmer A, Paikin J, Safdar A, Aboud A, Pearce E, et al. Creatine monohydrate and conjugated linoleic acid improve strength and body composition following resistance exercise in older adults. *PLoS One.* 2007;2(10):E991.
- 117.Temel JS, Abernethy AP, Currow DC, Friend J, Duus EM, Yan Y, et al. Anamorelin in patients with non-small-cell lung cancer and cachexia (ROMANA 1 and ROMANA 2): results from two randomised, double-blind, phase 3 trials. *Lancet Oncol.* 2016;17(4):519-31.
- 118.Thibault R, Flet L, Vavasour F, Lemerle M, Ferchaud-Roucher V, Picot D, et al. Oral citrulline does not affect whole body protein metabolism in healthy human volunteers: results of a prospective, randomized, double-blind, cross-over study. *Clin Nutr.* 2011;30(6):807-11.
- 119.Tischler ME, Desautels M, Goldberg AL. Does leucine, leucyl-tRNA, or some metabolite of leucine regulate protein synthesis and degradation in skeletal and cardiac muscle? *J Biol Chem.* 1982;257(4):1613-21.
- 120.Trexler ET, Smith-Ryan AE, Stout JR, Hoffman JR, Wilborn CD, Sale C, et al. International society of sports nutrition position stand: Beta-Alanine. *J Int Soc Sports Nutr.* 2015;12:30.
- 121.Tujioka K, Yamada T, Aoki M, Morishita K, Hayase K, Yokogoshi H. Dietary ornithine affects the tissue protein synthesis rate in young rats. *J Nutr Sci Vitaminol (Tokyo).* 2012;58(4):297-302.
- 122.Valayannopoulos V, Boddaert N, Chabli A, Barbier V, Desguerre I, Philippe A, et al. Treatment by oral creatine, L-arginine and L-glycine in six severely affected patients with creatine transporter defect. *J Inherit Metab Dis.* 2012;35(1):151-7.
- 123.van Someren KA, Edwards AJ, Howatson G. Supplementation with beta-hydroxy-beta-methylbutyrate (HMB) and alpha-ketoisocaproic acid (KIC) reduces signs and symptoms of exercise-induced muscle damage in man. *Int J Sport Nutr Exerc Metab.* 2005;15(4):413-24.
- 124.van Wijck K, Wijnands KA, Meesters DM, Boonen B, van Loon LJ, Buurman WA, et al. L-citrulline improves splanchnic perfusion and reduces gut injury during exercise. *Med Sci Sports Exerc.* 2014;46(11):2039-46.

- 125.Veldhuis JD. Aging and hormones of the hypothalamo-pituitary axis: gonadotropic axis in men and somatotrophic axes in men and women. *Ageing Res Rev.* 2008;7(3):189-208.
- 126.Villareal DT, Holloszy JO. DHEA enhances effects of weight training on muscle mass and strength in elderly women and men. *Am J Physiol Endocrinol Metab.* 2006;291(5):E1003-8.
- 127.von Haehling S, Ebner N, Dos Santos MR, Springer J, Anker SD. Muscle wasting and cachexia in heart failure: mechanisms and therapies. *Nat Rev Cardiol.* 2017;14(6):323-41.
- 128.Walberg-Rankin J, Hawkins CE, Fild DS, Sebolt DR. The Effect of Oral Arginine During Energy Restriction in Male Weight Trainers. *The Journal of Strength & Conditioning Research.* 1994;8(3):170-7.
- 129.Wang W, Dai Z, Wu Z, Lin G, Jia S, Hu S, et al. Glycine is a nutritionally essential amino acid for maximal growth of milk-fed young pigs. *Amino Acids.* 2014;46(8):2037-45.
- 130.Wang W, Wu Z, Dai Z, Yang Y, Wang J, Wu G. Glycine metabolism in animals and humans: implications for nutrition and health. *Amino Acids.* 2013;45(3):463-77.
- 131.Wax B, Kavazis AN, Brown SP, Hilton L. Effects of supplemental GAKIC ingestion on resistance training performance in trained men. *Res Q Exerc Sport.* 2013;84(2):245-51.
- 132.Wax B, Kavazis AN, Webb HE, Brown SP. Acute L-arginine alpha ketoglutarate supplementation fails to improve muscular performance in resistance trained and untrained men. *J Int Soc Sports Nutr.* 2012;9(1):17.
- 133.Wax B, Kavazis AN, Weldon K, Sperlak J. Effects of supplemental citrulline malate ingestion during repeated bouts of lower-body exercise in advanced weightlifters. *J Strength Cond Res.* 2015;29(3):786-92.
- 134.Wernerman J. Clinical use of glutamine supplementation. *The Journal of nutrition.* 2008;138(10):2040S-4S.
- 135.Wideman L, Weltman JY, Patrie JT, Bowers CY, Shah N, Story S, et al. Synergy of L-arginine and GHRP-2 stimulation of growth hormone in men and women: modulation by exercise. *Am J Physiol Regul Integr Comp Physiol.* 2000;279(4):R1467-77.
- 136.Wideman L, Weltman JY, Patrie JT, Bowers CY, Shah N, Story S, et al. Synergy of L-arginine and growth hormone (GH)-releasing peptide-2 on GH release: influence of gender. *Am J Physiol Regul Integr Comp Physiol.* 2000;279(4):R1455-66.
- 137.Wirén M, Permert J, Larsson J. Alpha-ketoglutarate-supplemented enteral nutrition: effects on postoperative nitrogen balance and muscle catabolism. *Nutrition.* 2002;18(9):725-8.
- 138.Wong RH, Howe PR, Buckley JD, Coates AM, Kunz I, Berry NM. Acute resveratrol supplementation improves flow-mediated dilatation in overweight/obese individuals with mildly elevated blood pressure. *Nutr Metab Cardiovasc Dis.* 2011;21(11):851-6.
- 139.Wu G, Wu Z, Dai Z, Yang Y, Wang W, Liu C, et al. Dietary requirements of "nutritionally non-essential amino acids" by animals and humans. *Amino Acids.* 2013;44(4):1107-13.
- 140.Yao K, Yin Y, Li X, Xi P, Wang J, Lei J, et al. Alpha-ketoglutarate inhibits glutamine degradation and enhances protein synthesis in intestinal porcine epithelial cells. *Amino Acids.* 2012;42(6):2491-500.
- 141.Yen SS, Morales AJ, Khorram O. Replacement of DHEA in aging men and women. Potential remedial effects. *Ann N and Acad Sci.* 1995;774:128-42.
- 142.Zdzieblik D, Oesser S, Baumstark MW, Gollhofer A, König D. Collagen peptide supplementation in combination with resistance training improves body composition and increases muscle strength in elderly sarcopenic men: a randomised controlled trial. *Br J Nutr.* 2015;114(8):1237-45.

10. EDUCATIONAL GUIDANCE AND DIVERSITY UNIT

From the Educational Guidance and Diversity Unit we offer support to our students throughout their university life to help them reach their academic achievements. Other main actions are the students' inclusions with specific educational needs, universal accessibility on the different campuses of the university and equal opportunities.

From this unit we offer to our students:

1. Accompaniment and follow-up by mean of counselling and personalized plans for students who need to improve their academic performance.
2. In terms of attention to diversity, non-significant curricular adjustments are made in terms of methodology and assessment for those students with specific educational needs, pursuing an equal opportunity for all students.
3. We offer students different extracurricular resources to develop different competences that will encourage their personal and professional development.
4. Vocational guidance through the provision of tools and counselling to students with vocational doubts or who believe they have made a mistake in their choice of degree.

Students in need of educational support can write to us at:

orientacioneducativa@universidadeuropea.es

11. ONLINE SURVEYS

Your opinion matters!

The Universidad Europea encourages you to participate in several surveys which help identify the strengths and areas we need to improve regarding professors, degree programs, and the teaching-learning process.

The surveys will be made available in the “surveys” section on virtual campus or via e-mail.

Your assessment is necessary for us to improve.

Thank you very much for your participation.