

24TH INTERNATIONAL STUDENT SCIENCE CONFERENCE

Hungary, Budapest
24-27 April 2024



HUNGARIAN UNIVERSITY
OF SPORTS SCIENCE
BUDAPEST

24TH INTERNATIONAL STUDENT SCIENCE CONFERENCE



EMBERI ERŐFORRÁSOK
MINISZTERIUMA



Nemzeti
Tehetség Program

FOREWORD

Dear Participants,

it is with great pleasure and excitement that I welcome you to the 24th International Student Science Conference (ISSC) organized by the Hungarian University of Sports Science (HUSS).

This esteemed event marks a significant milestone in our tradition of academic excellence and scholarly exchange. With over 80 presentations from more than 23 universities, this conference shows our commitment to fostering international collaboration and advancing knowledge in the field of sports science.

For decades, the ISSC has served as a keystone of our academic calendar, providing a platform for students to showcase their latest findings, engage in meaningful discussions, and network with peers and experts in their scientific fields. With a long history of this conference, it continues to uphold its reputation as a premier gathering for aspiring academics and researchers.

As you immerse yourself in the vibrant atmosphere of ISSC and explore Budapest, the historic and culturally rich city, I encourage you to include the opportunity for learning, collaboration, and personal growth.

May your stay in this wonderful city be marked by intellectual discovery, meaningful connections, and nice memories.

Wishing a great meeting and enjoy your days in Budapest!

Dr. habil Zsuzsanna Kneffel
Chair of ISSC

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Prof. Dr. László Tóth
Prof. Dr. Miklós Tóth
Dr. Margita Utczás
Kristóf Világi

PROGRAM

Day 1 – Wednesday, 24 April 2024

9.00–15.00 **Registration:** main entrance reception, K1 Building

9.30-11.30 **Pre-conference meeting** (Athens lecture hall, K1 Building)

Athlete's Heart: Adaptation, Prevention and Rehabilitation. Moderator: Prof. Dr. Miklós Tóth

- **Prof. Dr. Dimenico Cianflone**, Vita-Salute San Raffaele University, Milan, Italy: The Athlete's Heart
- **Prof. Dr. Hajnalka Vágó**, Semmelweis University, Hungary: Athlete's heart: characteristics and differential diagnostics
- **Prof. Dr. Ákos Koller**, Hungarian University of Sport Science, Hungary: Adaptation of coronary circulation to exercise: role of local mechanisms
- **Prof. Dr. Gábor Pavlik**, Hungarian University of Sport Science, Hungary: The role of regular physical activity in the prevention of cardiac risks
- **Prof. Dr. Hashbullah Ismail**, University Teknologi, Malaysia: Exercise and Cardiac Rehabilitation

11.30-12.00 **Honoris causa celebration** (Prof. Dr. Lee Chee Pheng)

12.00–13.00 **Lunch** (on your own, area restaurants, university cafeteria)

13.00-14.30 **Opening ceremony** (Athens lecture hall, K1 Building)

- Opening speech: **Prof. Dr. Tamás Sterbenz**, Rector, Conference Patron
- Opening Keynote: Understanding and Promoting a Growth Mindset in Physical Education - **Dr. Christopher Spray**, Loughborough University, School of Sport, Exercise and Health Sciences
- Opening Keynote: Exercise is a Medicine – **Prof. Dr. Lee Chee Pheng**, Chief Executive Officer of the Asia College of Exercise Medicine

14.30-16.00 **Welcome reception**

15.00-17.00 **Social program** - Sightseeing tour, meet at registration area

16.00-18.00 **Social program** - Boat tour on river Danube, meet at registration area

Day 2 – Thursday, 25 April 2024

Classroom C001 Paris, K1 Building

8.00–15.00 **Registration:** main entrance reception, K1 Building

8.00-10.00 **Session: Nutrition and metabolism.** Chairs: Prof. Dr. Csaba Nyakas, Dr. Margita Utczás

10.00-10.15 Coffee break

10.15-12.15 **Session: Biomechanics.** Chairs: Prof. Dr. József Tihanyi, Dr. Bence Kopper

12.30-14.00 Lunch break (University restaurant)

14.00-16.00 **Session: Exercise in youth.** Chairs: Prof. Dr. Gábor Pavlik, Dr. Leonidas Petridis

Classroom C002 London, K1 Building

8.00-10.00 **Session: Sports in society.** Chairs: Dr. Nikoletta Sipos-Onyestyák, Dr. Bontond Csuka

10.00-10.15 Coffee break

10.15-12.15 **Session: Sport experience.** Chairs: Dr. Tamás Dóczi, Prof. Dr. László Tóth

12.30-14.00 Lunch break (University restaurant)

14.00-16.00 **Session: Psychological aspects of sport.** Chairs: Dr. Judit Boda-Ujlaky, Prof. Dr. István Soós

Classroom C102, K1 Building

14.00-16.00 **Session: Aging.** Chairs: Prof. Dr. Lee Chee Pheng, Dr. Tímea Téglás

16.00-18.00 **Social program:** Buda Castle walking tour, meet at registration area

Aula, K1 building

19.00–22.00 **Social program:** Quiz night (fun & knowledge with HUSS students')

Day 3 – Friday, 26 April 2024

Room C001 Paris, K1 Building

8.00–12.00 **Registration:** main entrance reception, K1 Building

8.00-10.00 **Session: Sport and Performance.** Chairs: Prof. Dr. Miklós Tóth, Dr. Sándor Sáfár

10.00-10.15 Coffee break

10.15-11.30 **Plenary session.** Moderator: Prof. Dr. Zsolt Radák, Presenters: Dr. János Négyesi, Prof. Dr. Mojca Doupona, Kristóf Világi

12.30-14.00 Lunch break (University restaurant)

14.00-16.00 **Session: Prevention and rehabilitation.** Chairs: Dr. Zsombor Lacza, Dr. Leila Seres

Room C002 London, K1 Building

8.00-10.00 **Session: Physical activity.** Chairs: Prof. Dr. Gábor Gécz, Dr. Gyöngyvér Lacza

10.00-10.15 Coffee break

12.30-14.00 Lunch break (University restaurant)

14.00-16.00 **Session: Sport management, organizations and media.** Chairs: Prof. Dr. Mojca Doupona, Prof. Dr. Tamás Sterbenz, Bálint Dolnegó

Athens Lecture Hall, K1 Building

17.00-18.30 **Closing ceremony.** Speech: Prof. Dr. Zsolt Radák Vice-Rector for Science and Innovation

Paulaner Restaurant in MOM Mall

19.00-24.00 Closing banquet

SESSIONS

THURSDAY, 25 APRIL 2024

Room C001 Paris, K1 Building

8.00-10.00 **Session: Nutrition and metabolism.** Chairs: Prof. Dr. Csaba Nyakas, Dr. Margita Utczás

- **Henrietta Bartha:** The acute effects of combined supplementation of L-arginine and citrulline-malate on the Wingate Anaerobic test
- **Dávid Csala:** miRNA Profile of Distinct Extracellular Vesicles in Response to Nutrient Timing and Chronic Resistance Exercise
- **Georgina Simkó:** Effects of a weight loss intervention on type 2 diabetes risk and subjective quality of life
- **Máté Demcsik:** Short-term effects of “Citrulline Malate” on the circulatory and metabolic systems in male, athletic university students
- **Qian Yu:** Exercise Inhibits Hcc Tumor Growth and Modulates Lipid Metabolism Reprogramming In Time And Downregulates AMPK Pathway
- **Sarolta Tóth-Farkas:** Effects of extreme psychological stress on serum lactate-level
- **Soroosh Mozaffaritarab:** PGC-1 α activation boosts exercise-dependent cellular response in the skeletal muscle
- **Zoltán Borbás:** Effects of time-restricted eating on the changes of body composition and visceral fat

10.15-12.15 **Session: Biomechanics.** Chairs: Prof. Dr. József Tihanyi, Dr. Bence Kopper

- **István Gnyálin:** The relationship between readiness and external load parameters in elite youth soccer players
- **Máté Csányi:** Relationship the Stretch-Shortening Cycle Efficiency with Sprint and Change-of-Direction Speed in Academy Soccer Players
- **Rodrigo Silva Sousa:** Effect of an ACL prevention programme on dynamic knee valgus in female football
- **Wenlong Li:** The effects of tai chi on lower limb biomechanics in patients with knee osteoarthritis: a scoping review
- **Xiangli Gao:** Exploring Biomechanical Variations in Ankle Joint Injuries Among Latin Dancers with Different Stance Patterns: Utilizing OpenSim Musculoskeletal Models
- **Yilin Zhong:** A Comparison of the Biomechanical Effects of Stair Descent in Chronic Ankle Instability Patients and Healthy Individuals under Cognitive Tasks and Visual Deprivation Conditions
- **Zhifeng Zhou:** Chronic Ankle Instability patients adopt an altered movement pattern during unanticipated landing task

14.00-16.00 **Session: Exercise in youth.** Chairs: Prof. Dr. Gábor Pavlik, Dr. Leonidas Petridis

- **Aliz Hajós:** Comparison of anthropometric parameters, body composition and somatotype in female youth and adult basketball, volleyball and handball players
- **Diána Führer:** Associations between energy intake, eating behaviour and mental health in youth female handball athletes
- **Mengchen Ji:** Mixed Intervention Comparison of Sagittal Vertebral Column Bend Change Induced by Backpacks in School-aged Children and Adolescents: Systematic Review and Network Meta-analysis
- **Mengchen Ji:** The Effect of Backpack Waist Belt and Elastic Shoulder Strap Design on Shoulder Impact Forces in Children during Walking and Running
- **Min Ye:** The correlation between hand strength, flexibility and cognitive function in rhythmic gymnasts aged 6-8 years old
- **Petra Halmi:** Effect of motor development training with a paper roll on the visuo-motor coordination of 5-6-year-old preschoolers
- **Sakura Ogawa:** The effect of prolonged caloric restriction with endurance exercise training on skeletal muscle in young female rats: Implication for autophagy

Room C002 London, K1 Building

8.00-10.00 **Session: Sports in society.** Chairs: Dr. Nikoletta Sipos-Onyestyák, Dr. Bontond Csuka

- **Airnel Abarra:** Power Dynamics from Coaching Experiences of Female Bodybuilders vis-a-vis On-Site and in a Virtual Environment
- **Bence Kelemen:** Prominent Hungarian coaches in the development of distance running training methodology: Mihály Iglói and László Híres
- **Bettina Gáspár:** Optimizing Anti-Doping Regulations through Fuzzy Logic Modeling of Economic and Legal Dimensions.
- **Ceren Temiz:** Mind maps in physical education: Cognitive and psychomotor domain development
- **Dorottya Borbála Rafáczné Gerics:** Make some noise for the electric racing – The involvement of athletes of electric motorsport series in sports diplomacy
- **Janice Juaban:** Morphing the Body: Narratives of an Amateur Bodybuilder
- **Orsolya Bogdány:** Contemporary Media Representations of Romanian and Hungarian Sport Relations through Ice Hockey

10.15-12.15 **Session: Sport experience.** Chairs: Dr. Tamás Dóczy, Prof. Dr. László Tóth

- **Anna Fanni Gaál:** The migration and the motivational factors of the Hungarian figure skaters
- **Giuseppe Coppola:** Sport and War: the impact of the crisis on the performance of the Palestine national football team

- **Hajnalka Eszter Selmecci:** More than just dogs - Psychological aspects of dog sports
- **Jázmin Szikora:** Yoga is the new flow? -The relationship between self-knowledge and the flow experience through yoga practice
- **Lilla Dorka Limburger:** The societal and sports-related impacts regarding body image among aesthetic athletes.
- **Luca Bakos:** Post-injury mental disorders among handball players
- **Veronika Fülöp:** The appearance of homonegativity and discrimination in physical education and sport among university students
- **Zhang Qingyuan:** Mixed Strategy in Elite Fencing - Using Sabre as an Example

14.00-16.00 **Session: Psychological aspects of sport.** Chairs: Dr. Judit Boda-Ujlaky, Prof. Dr. István Soós

- **Anna Ferencz:** Influences of achievement goals and motivational climate towards the Hungarian athletes' performance at the 2023 World Championships in Budapest
- **Bhavya Chhabra:** Passion, Perfectionism, and Sports Commitment as Predictors of Exercise Addiction
- **Borbála Bernadett Zala:** Effect of mental training on adolescent artistic swimmers
- **Lilla Szabó-Gurisatti:** Attention training in the development of ice hockey players
- **Liza Komáromi:** Psychological Aspects of Motocross Racing Considering Expected, Perceived, and Actual Performance
- **Olivér Szabella:** E-sport performance measurement with physical activity intervention
- **Renátó Tóth:** Inside the Athlete's Mind: The Dominance of Irrational Beliefs and their effect on Competitive Anxiety

Room C102 Barcelona, K1 Building

14.00-16.00 **Session: Aging.** Chairs: Prof. Dr. Lee Chee Pheng, Dr. Tímea Téglás

- **Beáta Katula- Csizmadia:** Effects of Resistance Training on Muscle-Tendon Function and Cost of Transport in Older Adults
- **Marta Skurewicz:** Impact of High-Intensity Interval Exercise on Executive Performance and Prefrontal Cortex Activation in the Elderly: A Pilot Investigation
- **Mehmet Akman:** Effects of Achilles Tendon Stiffness on Gait Mechanics and Force Production in Older Adults
- **Mohamed Emam:** Effects of Short and Longer Duration Eccentric and Concentric Resistance Training on Muscle-Tendon, Balance, and Gait Function in Older Individuals
- **Oskar Poniewski, Maciej Frukacz:** The association between physical fitness, body composition, blood lipid profile, and cognitive function among the elderly
- **Zbigniew Jost:** Acute aerobic and resistance high-intensity interval trainings affect tryptophan metabolism among the elderly
- **Zhou Lei:** The effect of long-term lactate and high-intensity interval training (HIIT) on brain neuroplasticity of aged mice

- **Zsófia Bábszky:** DNA methylation-based aging clocks of 59 Olympic Champions: Are they younger or older than their chronological age?

FRIDAY, 26 APRIL 2024

Room C001 Paris, K1 Building

8.00-10.00 **Session: Sport and Performance.** Chairs: Prof. Dr. Miklós Tóth, Dr. Sándor Sáfár

- **Dávid Aurél Petz:** Effect of music to athletes' performance
- **Emil Imre:** Data analyzing in short track speed skating
- **Márton Horváth:** Incline-dependency of the power-duration relationship in cross-country skiing
- **Péter János Tóth:** Effects of offensive and defensive playing strategy conditions on external loads in elite junior tennis players

10.15-11.30 **Plenary session.** Moderator: Prof. Dr. Zsolt Radák. Presenters: Dr. János Négyesi, Prof. Dr. Mojca Doupona, Kristóf Világi

14.00-16.00 **Session: Prevention and rehabilitation.** Chairs: Dr. habil. Zsombor Lacza, Dr. Leila Seres

- **Aojie Zhu:** Effect of Foot-Shaped Bionic shoes on Ground Reaction Forces at Various Running Speeds
- **Gábor Kiss:** The short-term effects of foam rolling on ankle mobility compared to static stretching
- **Jiongxiang Zhao:** The effect of short-term neuromuscular training on ankle bio-mechanics in individuals with functional ankle instability

Room C002 London, K1 Building

8.00-10.00 **Session: Physical activity.** Chairs: Prof. Dr. Gábor Géczí, Dr. Szilvia Perényi

- **Lina Takruri:** Physical Activities level of Jordanian female adults regarding the traditions and the modern society
- **Michubu Jonah Karwamba:** Variations in Physical Activity Awareness and Motivation between Users and Non-users of Physical Activity Movement Tracking Devices
- **Milena Mitrović:** Physical activity of female students of the University of Montenegro
- **Mirjana Đukić:** Healthy Lifestyle Habits Among Female University Students
- **Narges Ghazvini:** Differences in physical activity levels among female students in Iran and Hungary
- **Tereza Viplerová:** Evaluation of the Quality of Supporting Activities at Charles University

14.00-16.00 **Session: Sport management, organizations and media.** Chairs: Prof. Dr. Mojca Doupona, Prof. Dr. Tamás Sterbenz

- **Alana Richardson:** The Matilda effect: Analysis of the Australian media coverage and impact of the 2023 Women's World Cup
- **Edina Krár:** Ultras in the stands: The cheering as lifelong lasting engagement
- **Eszter Fekésházy:** Impact of Major Sporting Events on Sport Participation in the Host Country: Focusing on leading international swimming competitions held in Hungary
- **Ferenc Szóllósi:** The positive effect on the hungarian cycling and tourism by the bigger races. Like Giro d'Italia and Tour de Hongrie
- **Leny Keo:** Exploring the Element of Sports and Recreation on Tourist Motivation in Cambodia
- **Nikola Sarkovic:** Athlete's attitudes about Commercial Sports Brand Sponsorship and Brand Knowledge in the international tennis table event
- **Veronika Krause:** Evaluating football clubs using ORESTE and AGREPREF

ABSTRACTS

PLENARY SPEAKERS

Socio-Cultural Practices in Soccer: Unveiling the Role of Coaches' Capital and Organizational Culture

Mojca Doupona, University of Ljubljana, Faculty of Sport

The fact is that the global structures of soccer cannot develop independently of the overall social context of modern society. Sport is shaped by social processes and is otherwise changed, formed and maintained in relation to society. Modern soccer is subject to many changes, and the political environment and socio-economic processes of society also have a major influence on the development of soccer. Soccer today is particularly interesting to study from a socio-economic point of view.

The basic theoretical concept of culture consists of values. Sport in particular, as a microcosm of society, reflects the values of every society. The coaches, who represent a particular subcultural group in society, occupy a special position in society. It is the coach who demonstrate the embodied cultural values of the respective society to the outside world, due to the high level of publicity. However, it is important to emphasize that the coach's value dimensions shape the criteria for the athlete's social behaviour during their active sports career.

Sociological factors are often insufficiently considered in the study of organizational culture, although we know that the environment in which a young soccer player grows up is crucial for his or her future sporting career.

The aim of the study, which was conducted on a sample of 800 Slovenian soccer coaches, is to investigate the social and cultural capital of soccer coaches in relation to the organization of the club environment and personnel management. With this study we try to understand the multidimensional complexity of soccer coaches' activities. Bourdieu's theory of cultural and social capital and his concept of „embodied cultural capital” will help us to do so.

In the study, we will analyze the influence of social and cultural capital of soccer coaches. This will allow us to define the factors that are important for the successful work of a soccer coach. Furthermore, we will try to investigate how the organizational culture of the club affects the successful performance of coaches. We will pay special attention to possible club strategies, taking into account the different age groups and genders of male and female athletes as well as the organizational culture of clubs when transferring young athletes.

Are we RIGHT when we say that this research field is still LEFT in uncertainty? The effects of laterality and its underlying mechanisms in both healthy and clinical populations

János Négyesi, Hungarian University of Sports Science

Ninety percent of healthy adults are right-hand dominant and, therefore, perform fundamental manual motor tasks with the right hand. The nature of side-dominance is a consequence of 1) the evolutionary specialization of the left hemisphere for skilled motor activities, and 2) brain lateralization through complex motor control processes. The lateralization of the human brain also presents in motor control and adaptation processes, including fine motor control and proprioception. Moreover, it seems that task complexity interacts with brain lateralization so that the nature of the differences in hemispheric asymmetry between left- and right-side dominant individuals might be related to the level of task complexity. Overall, considering that left-handers have lower brain lateralization than right-handers, i.e., some cognitive and motor functions of left-handers are distributed more evenly across the left and right cerebral hemispheres, it is possible that left- vs. right-side dominant people's hemispheric asymmetry is predictive of cognitive status. Consequently, hemispheric asymmetry could be a potential index to detect morphological variations in MCI patients with a high risk of conversion to AD. Our ongoing research aims to answer this working hypothesis for a more comprehensive understanding of the influence of asymmetries on disease development.

Artificial Intelligence and sport: opportunities and AI adoption in sport organisations

Kristóf Világi, Hungarian University of Sports Science

Data-driven analyses and the efficient use of new information are crucial in sports on all levels. To maximize the advantages of the new methods provided by digitalization in sports, organizations, and decision-makers are facing new challenges (and opportunities). In some cases, specialised sports analytics/sports performance analysis teams have been formed. Moreover, the rapid development and spread of artificial intelligence-based tools and services present a new way to learn more about the complex background of sports performance improvement.

STUDENT PRESENTATIONS

Power Dynamics from Coaching Experiences of Female Bodybuilders vis-a-vis On-Site and in a Virtual Environment

Airnel Abarra, Hungarian University of Sports Science; **Sheena Hunter Sheffield**, University of Maine; **Janice Juaban**, Hungarian University of Sports Science
Supervisor: Dr. Tamás Dóczi

Bodybuilding and Fitness is a sport discipline that involves a strict training and nutrition regimen and requires total trust in coaches and the athlete's immediate community. While there are relevant studies that focus on bodybuilding and fitness, there is very little discussion of the dynamics of coaching across virtual and on-site environments. The purpose of this study is to investigate the coaching experiences of female bodybuilders both in online and onsite platforms and how the relationship and power dynamics between the athlete and coach is manifested in on-site and online environments. Qualitative methods such as interviews, field observations, and social media thematic analysis were employed to gain insight into athlete perspectives on three types of coaching relationships: 1) self-coaching; 2) coaching by immediate partners; and 3) coaching by a professional coach. Results revealed the unique power dynamics between athletes and coaches, especially during training and competitions where the athletes both assert and negotiate their spaces. It was also observed that athletes are dependent on their coaches in both environments, thus providing the discussion on how bodybuilding can be a paradoxical activity on empowerment and subservience. This study provides an understanding of how female bodybuilders find space and empowerment in their industry through their coaching experiences; additionally, it explores how these athletes can be both empowered by and dependent on their coaches and other influencers.

Keywords: identities, bodybuilding, gender

The Matilda effect: Analysis of the Australian media coverage and impact of the 2023 Women's World Cup

Alana Richardson, German Sport University
Supervisor: Dr. Ansgar Molzberger

Soccer in Australia has a rich multicultural history. Although it is the second most participated sport in 0-14 year old boys, and the fifth most for girls of the same age, the sport has

not experienced the same cultural kudos as other footballing codes such as Australian Rules or Rugby. Until the 2023 Women's football world cup where unprecedented numbers of spectators, more than ever recorded, tuned in to watch Australia's most successful women's world cup campaign. This research explores the meteoric rise of the Matilda's into household names and national heroes. This article analyses media coverage from each of the world cups that the Matildas have participated in, and compares what was different about this one. Besides the interest in a home world cup, Australian media has shown that if female athletes are represented fairly and respectfully then attitudes towards them can significantly shift. While great progress has been made in the visibility of women's sports, it is yet unclear whether this is going to have tangible impacts on the position of the women's game and moving towards gender equality in the sport. Even though the reporting was better, it certainly was not perfect and the Matildas were not completely spared of sexist reporting. Ultimately though, this seems like a positive step forward for women's sport in Australia and time will tell whether the momentum from the world cup has been leveraged to produce better outcomes for women and girls at all levels of Australian sport.

Keywords: *soccer, women, media*

Comparison of anthropometric parameters, body composition and somatotype in female youth and adult basketball, volleyball and handball players

Aliz Hajós, Hungarian University of Sports Science
Supervisor: Katinka Utczás

Introduction: Certain sports tend to have distinguished physical requirements, such as ideal anthropometric parameters, body composition and somatotype. These requirements can be present in early ages, however sometimes they don't become dominant until adulthood, due to selection and sport-specific training. The goal of our research was to compare female athletes of three sports (basketball, handball and volleyball), and to determine the age where these sports start to differentiate in anthropometric parameters, body composition and somatotype.

Material and methods: 621 adult and underage athletes participated in the research, from which 329 were handball players, 178 were basketball players, and 114 were volleyball players. Anthropometric parameters were assessed using standard devices and methods. Somatotype was determined using the InBody 720 device, with recording the following parameters: body fat percentage (BF%), body fat mass (BF), skeletal muscle mass (SMM)

and bone mineral content (BMC). Furthermore, we calculated the ratio of skeletal muscle mass to body mass (SMM%) and body height (SMMI). Somatotype was determined using the Heath-Carter method. Among the basic statistical indicators, the average and standard deviation values were shown. The comparison of the groups was carried out using a one-way analysis of variance (Tukey's post hoc test). The significance level was set at $p < 0.05$.

Results: Regarding the anthropometric dimensions, we found that basketball players were significantly taller and had longer limbs compared to the other two sports, from as early as the age of 13. Starting from the 15 year old group, handball players exceeded basketball players in circumference measurements (upper arm and forearm circumference). In body composition, there were no significant differences identified among the athletes of all ages in the body fat parameters. However, from the age of 16 we found several differences in the muscle parameters, primarily in SMMI. Normalized for body height, handball players had a significantly higher muscle mass than basketball and volleyball players. Handball players also started separating from the other two sports in somatotype, starting at the age of 15. They tend to have a mesomorph-endomorph (4,5-4,0-2,5) body type, while basketball (3,5-3,0-3,5) and volleyball (4,0-3,0-3,0) players were the central type. From the age of 17, significantly lower ectomorphy and higher mesomorphy values describe the handball players.

Summary: Based on the results of the research, it can be established that basketball players seem to differ from the other two sports in length, while handball players differ regarding their circumference dimensions. Handball players also separate from basketball and volleyball players in somatotype, which can mainly be observed in their lower ectomorphy values. Overall it can be concluded that these three sports do not differ significantly in the examined age groups.

Keywords: *body composition, somatotype, youth*

Influences of achievement goals and motivational climate towards the Hungarian athletes' performance at the 2023 World Championships in Budapest

Anna Ferencz, Hungarian University of Sports Science
Supervisors: Dr. Noémi Gyömbér; Dr. Krisztina Kovács

Introduction: This study qualitatively examined the motivational environment and attitude of task of participated Hungarian athletes in the World Athletics Championships in Buda-

pest based on the 3x2 Achievement Goal Theory (Elliot et al., 2011, Lochbaum et al., 2016, Sommet & Elliot, 2016). The research sought to answer the main question of what determinants are necessary for the successful performance of Hungarian (runner) athletes at the 2023 World Championships. The theoretical background (underlying the research is based on) focused the athletes' types of goals (task-approaching, task-avoiding, self-approaching, self-avoiding, other-approaching and other-avoiding goals (Elliot et al., 2011, Lochbaum et al., 2022), the motivational environment (Blumenfeld, 1992, Harwood et al., 2015, Reinboth, 2004), the task attitude (Lochbaum et al., 2016) and the effect of the mapped environment (Ames, 1992, Harwood et al., 2008).

Objectives: In our research, we sought to answer the questions: What is the appropriate goal orientation for the Hungarian (runner) athletes participating in the World Championships in Budapest? How does the type of goal orientation affect their attitude towards the World Championships? How is their motivation they set to achieve their goals modified by the environment around them?

It was hypothesized that reinforcing certain types of goals in elite athletes would lead to a more effective attitude towards the task and thus their ability to achieve higher performance (Dweck, 2019) and the athletes' environment would also be a major contributor to this (Lochbaum et al., 2016, 2022, Lundqvist & Raglin, 2015, Vanteekiste et al., 2014).

Methods: 28 Hungarian runners (13 men, 15 women) (aged between 18 and 43), were interviewed 1-8 weeks before the World Championships. The participation was voluntary, the sample covered 90% of the total number of participants (total number of the Hungarian runner competitors of the track athletes were 31). The research was conducted using semi-structured interviews and the interviews were conducted using reflective thematic analysis (Braun & Clarke, 2019).

Results and discussion: The results are discussed on the basis of the Achievement Goal Theory (Elliot et al., 2011), the content analysis of the interviews revealed the impact of the World Championships on the motivation of the athletes (goal retention, goal modification, goal rejection), whether the athletes' goal orientation changed due to the performance situation (home audience, high performance expectations) and whether the athletes' environment influenced the performance situation. Strategies are proposed for improve athletes' goal orientation and motivation, and to help coaches and athletes' environments to provide effective support to individual athletes in their preparation and competition prior to the international competitions.

Keywords: *achievement goals, motivational climate, athletics*

The migration and the motivational factors of the Hungarian figure skaters

Anna Fanni Gaál, Hungarian University of Sports Science
Supervisor: Dr. habil. István Soós

In Budapest, due to the higher level of urbanisation, sports facilities and programmes offer a wider range of chances for people and athletes. As the quality of life, sporting opportunities, financial situation and future career prospects are important factors in motivation, Budapest has become a sport centre for Hungarian figure skaters. As a result, there has been an increasing number of domestic migrations from rural skating clubs and, to a lesser extent, foreign migration.

This raises the question: how do coaches in rural areas can create an optimal environment for their athletes so that they do not have to move to Budapest or abroad to continue their education and training?

The aim of my dissertation is to investigate the relationship between motivational factors of Hungarian figure skaters and athlete migration using a questionnaire.

The research is based on the ecological model and the achievement goal theory. N=78 figure skaters participated in the research, 4 male and 74 female athletes. The criteria for completing the online questionnaire were being over 12 years old and having a history of skating. The research includes demographic questions, validated motivation tests and research questions on migration.

The statistical results show that athletes who have moved for skating have settled in Budapest or in countries where the conditions for skating are more favourable than in Hungary. In terms of motivation, the athletes are task and achievement goal oriented. They have been motivated to move by the attraction of coaching, better training conditions and the opportunity to skate in stronger championships.

Keywords: *sport migration, motivation, achievement goal theory*

Effect of Foot-Shaped Bionic shoes on Ground Reaction Forces at Various Running Speeds

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Supervisor Prof. Dr. Yaodong Gu

Background: Modern shoes provide good protection for the feet, but some types of shoes can also cause certain damage to the lower limbs. There is a biomechanical correlation between footwear and running-related injuries. Most existing studies primarily focus on traditional footwear, with limited research on biomechanical shoes. **Aim:** This study aims to investigate the changes in three-dimensional ground reaction forces (GRFs) between bionic shoes and control shoes at different speeds. **Methods:** A statistical analysis of the foot shapes of a large number of Asian males wearing size 41 shoes was conducted. The biomechanical shoes used in this experiment were designed based on the statistical analysis of foot structure. In comparison to the control shoes, these biomechanical shoes feature a midsole with concave areas that closely match the foot shape, (8mm drop at the first metatarsal, 3mm drop at the fifth metatarsal, and 10mm drop at the heel bone). The experiment involved 10 male runners with an average weekly running distance exceeding 80 kilometers. They wore biomechanical shoes and control shoes while running on a 10-meter track at random speeds of $2.8 \pm 5\%$ m/s, $3.3 \pm 5\%$ m/s, and $3.9 \pm 5\%$ m/s. Speed was controlled using a timing gate system. Kistler force plates were utilized to collect kinematic data. A two-way ANOVA was employed to test for differences, the alpha level was set at 0.05. **Results:** The bionic shoes showed a lower peak propulsive force ($p=0.043$) and a higher peak braking force ($p=0.027$) compared to the control shoes at the same speed, while a decrease in peak propulsion force during running is associated with a safer running incline. Additionally, SPM1d analysis of three-dimensional GRFs indicated that the bionic shoes demonstrated superior propulsion performance during high-speed running and improved cushioning during the propulsion phase of low-speed running. **Conclusion:** The bionic shoes hold promise in improving propulsion performance and maintaining safe body posture, ultimately reducing the risk of running-related injuries.

Keywords: *bionic shoes, ground reaction forces, running injuries*

The acute effects of combined supplementation of L-arginine and citrulline-malate on the Wingate Anaerobic test

Henrietta Bartha, Hungarian University of Sports Science
Supervisors: Katinka Utczás; Dr. Leonidas Petridis

The acute and long-term effects of L-arginine and citrulline-malate have been studied previously, however data on the combined consumption are limited. It is assumed that using L-arginine and citrulline together may enhance the beneficial effects on athletic performance than compared to the use of only one supplement. Both supplements have vasodilator effects resulting in relaxing the smooth muscles and thus increasing blood flow and in

turn athletic performance. The purpose of this study was to examine the acute effects of the combined use of L-arginine and citrulline-malate on the anaerobic performance in healthy, physically active men.

Using a randomized, double-blinded design we examined the effects of the supplementation on the same participants on two different days, once receiving supplementation and once placebo with 5-7 days in-between and with no strenuous physical activity during this period. 17 individuals volunteered to participate (mean±sd age: 28.9±7.3 years, body height: 177.8±5.9 cm, body mass: 82.9±12.1 kg, percent body fat: 16.8±7.7%; muscle mass: 39.2±5.0 kg). L-arginine and citrulline-malate were the examined supplements mixed in 300 mL liquid at a dosage of 0.1 g/body mass for citrulline-malate and 0.15 g/body mass for L-arginine). After a standardized warm-up participants performed a 30-s all-out cycling on a bike ergometer (Monark Ergomedic 894E) against external loading corresponding to 7.5% of their body mass. During testing, heart rate and oxygen saturation of m. vastus lateralis and m. gastrocnemius medialis were measured.

There were no differences between supplementation and placebo for peak and mean power and for maximal heart rate. Maximal revolutions per minute (RPM) showed a slight increase (placebo: 142.7±11.2 vs. supplement: 146.5± 9.7 watt; p=0.061; g=0.48), whereas the time at peak power decreased significantly (placebo: 2813±1394 vs. supplement: 1687±764 ms; p=0.015; g= 0.65) after consuming the supplements.

The lack of changes in peak and mean power implies that the acute combined consumption of L-arginine and citrulline-malate do not affect anaerobic performance. Yet, differences in the time at peak power and in maximal RPM may indicate a moderate effect on the anaerobic alactacid energy pathway, however, this assumption warrants further investigation.

Keywords: *supplements, anaerobic performance*

Effects of Resistance Training on Muscle-Tendon Function and Cost of Transport in Older Adults

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Supervisor: Prof. Dr. h. c. Tibor Hortobágyi

Background: Normal aging is characterized by declines in neuromuscular and mobility functions, including reductions in maximal voluntary force generation and muscle volume, leading to sarcopenia. Additionally, aging affects tendon properties, with decreased stiffness being

a common observation. Such changes could affect walking economy. The decrease in walking economy has extensive implications: an older vs. younger individual requires approximately 20% more metabolic energy to walk. Despite successful walking training interventions in older adults, reducing the age-related increase in metabolic cost remains unexplored.

Resistance training, particularly with an eccentric overload, shows promise in mitigating age-related declines in muscle-tendon function. Furthermore, to our knowledge, there is no study that has examined the impact of such resistance training on functional outcomes, especially in tasks primarily characterized by a specific type of muscle contraction (concentric or eccentric).

Objectives: This study aims to investigate the effects of resistance training comprising concentric and eccentric loads on muscle-tendon function and associated changes in the cost of transport during walking in older adults. Unlike previous studies, this research incorporates examination of both muscle and tendon elements and evaluates functional outcomes.

Methods: Participants are randomly assigned to three groups focusing on concentric overload, eccentric overload and an active control group. Resistance training sessions over three months, three times per week will apply. Before and after the intervention, muscle strength, tendon properties, body composition, and metabolic cost of transport during walking, will be assessed. Statistical analyses will determine intervention-induced changes, with the primary outcome being the cost of transport.

Expected Result: The central hypothesis is that eccentric overload resistance training will positively impact muscle-tendon properties, thereby reducing the metabolic cost of transport during walking.

Conclusion: Findings from this study could provide valuable insights into effective strategies for maintaining mobility and functional independence in aging populations. This comprehensive investigation addresses gaps in the literature and underscores the importance of resistance training in healthy aging.

Keywords: *cost of transport, resistance training, aging*

Prominent Hungarian coaches in the development of distance running training methodology: Mihály Iglói and László Híres

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Supervisors: Prof. Dr. László Tóth, Dr. habil. Ottó Benczenleitner

This study aims to examine the life, work, training methods and influence of two of the most successful Hungarian distance running coaches, Mihály Igló and László Híres, on contemporary Hungarian distance running. The research was mainly based on a literature review, document analysis and interviews. Mihály Iglói (1908-1998) achieved several world records with his Hungarian competitors (Iharos, Rózsavölgyi, Tábori) in the mid-1950s and later successes in the United States (Bob Schul) and Greece. He developed a unique training system. His runners completed 13 to 14 weekly runs, mainly in short, relaxed intervals at different sub-maximal speeds with active rests. Or, in preparation for races, longer, more intense sessions. The training plan was adapted daily in an intuitive way according to the condition of the runners. László Híres (1917-2008) made his mark over several decades from the 1950s onwards. His competitors held national records between 800 and 10,000 metres and competed successfully in international championships. His training method was much more planned and organized, with a linear periodization and a more prominent alternation of light and heavy workload days. His regime included all the tools of modern distance running training: longer aerobic endurance sessions (800-1000 metres, with active recovery), long runs and shorter anaerobic endurance work (200-400 metre intervals), with also a strong emphasis on strengthening and plyometric exercises. The work of these two coaches affects Hungarian distance running today. Their students still use their methods today, and in the 1980s and 2000s, they set several national records.

Keywords: *sports history, distance running, training theory*

Optimizing Anti-Doping Regulations through Fuzzy Logic Modeling of Economic and Legal Dimensions

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Supervisors: Prof. Dr. Gábor Géczi, Dr. Diána Szekeres

Introduction: In the realm of sports, doping emerges as a significant concern amidst intensifying competitive environments and performance pressures. This challenge necessitates the development of effective anti-doping regulations, addressing sports law, ethics, and economics. The evolving nature of doping methods, coupled with the complexity of economic factors, demands that regulations adapt flexibly to new challenges.

Methodology: Our research is grounded in the analysis of international and domestic anti-doping regulations, alongside a comparative study of doping cases and related sanctions databases. Incorporating fuzzy logic allows for the modeling of complex interactions among legal and economic factors, as well as human factors, such as athletes' and coaches' attitudes.

Results: Our investigation delves into the legal and economic aspects of the anti-doping regulatory framework, laying the groundwork for the implementation of fuzzy logic modeling. Findings highlight the substantial financial investment required by anti-doping organizations in anti-doping measures, and the negative impact of scandals on revenues, threatening the financial stability and sponsorship support of sports disciplines. It underscores the necessity of bolstering legal and ethical frameworks, alongside prioritizing educational and communication initiatives. The study advocates for the development of adaptive regulatory frameworks and the active engagement of stakeholders. Introducing fuzzy logic can refine anti-doping regulations, thereby augmenting their effectiveness.

Conclusion: Enhancing anti-doping regulations and safeguarding sports integrity crucially depends on a profound understanding of the legal and economic dimensions. The application of fuzzy logic opens avenues for more precise and dynamic evaluations of doping offenses, contributing to the efficacy of the anti-doping effort, the protection of athletes, and the preservation of sports integrity. Our recommendations emphasize the importance of considering the perspectives and experiences of athletes, coaches, and sports administrators, as well as economic factors such as return on investment and the assessment of sponsorship agreements. This multidisciplinary approach aims not only to improve regulatory efficiency but also to strengthen the ethical and economic foundations of sports, thereby facilitating the realization of doping-free sports.

Keywords: *doping, sports law, fuzzy logic, ethical standards*

Passion, Perfectionism, and Sports Commitment as Predictors of Exercise Addiction

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Supervisor: Prof. Dr. Attila Szabó

Objectives: The study of exercise addiction parallels that of other behavioural addictions; however, it lacks specific diagnostic criteria primarily because of the incomparable etiologies observed in dysfunctional cases. Current research relies on a presumed risk assessment that may not necessarily manifest as a dysfunction. Scalar measurements of the risk of exercise addiction (REA) demonstrate considerable variance shared with traits such as passion, perfectionism, and sports commitment. However, the extent to which their subdomains jointly determine the REA is unknown. Therefore, this study aimed to address this gap by evaluating the possible group differences (gender, competition status, and individual versus team sports), emphasizing the necessity of controlling these covariates to prevent erroneous conclusions drawn from simple group comparisons.

Methods: An international sample of 1,003 regular exercisers (46.86% males) completed validated instruments to assess the REA, its predictors, and exercise characteristics.

Results: While all measures exhibited medium to strong correlations with REA, a bootstrapped hierarchical regression identified six predictors (exercise volume and intensity, harmonious and obsessive passion, rigid perfectionism, and constrained commitment), explaining 42.7% of the variance in REA. Three bootstrapped univariate tests revealed differences in REA among gender, competition status, and sports forms when predictors were not included as covariates in the model. However, these group disparities dissipated when the predictors were controlled.

Discussion: The findings suggest a conceptual oblivion between current conceptualizations of REA and its covariates.

Conclusion: A focus on covariates may obscure the true impact of REA, highlighting the need for the development of more specific assessment tools to discern exercise addiction as a potential dysfunctionality.

Keywords: *behavioural addiction, exercise dependence, team*

Effect of mental training on adolescent artistic swimmers

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Supervisor: Prof. Dr. László Tóth

Mental training programs have been used for decades to increase athlete performance (Wolframm and Micklewright, 2011), as mental training facilitates successful performance and improves athletes' sense of personal well-being (Vealey, 2007). Aim of our research was to examine the effect of a mental training program in artistic swimming on junior age group athletes (16-18 years). The impact assessment was conducted in a single-case experimental design (Barker, McCarthy, Jones, & Moran, 2011). Six junior athletes from a successful synchronized swimming division participated in the research. Independent variables in the arrangement were six suitable mental training interventions, while dependent variables were somatic and cognitive anxiety of athletes and their self-confidence connected with racing.

Intervention was based on a mental training program developed by Selk (2009). It included opportunities for self-confidence, relaxation, cognitive techniques, imagination, and goal setting. Comparing results of basic level and intervention measurements, all athletes had

at least a moderate (2 athletes) or a large effect (4 athletes) of cognitive anxiety. After intervention, athletes coped more easily with their negative thoughts, more successfully using the positive internal speech technique in a competitive situation. When examining somatic anxiety and situation-specific self-confidence, effectiveness of sessions was not clear, as in case of both factors only on half of the study sample (3 athletes) had at least a moderate effect.

Keywords: *sport psychology, self-confidence, artistic swimming*

Mind maps in physical education: Cognitive and psychomotor domain development

Ceren Temiz, Hungarian University of Sports Science
Supervisor: Dr. habil. István Soós

Mind Map, originally designed for notetaking, are useful for creative thinking and problem-solving. Mind map is based on making both hemispheres of the brain active at the same time and creating a balanced learning environment. The study aimed to measure the success of teaching volleyball subject in the physical education course with the mind map. The study employed a quasi-experimental pre-posttest design with an experimental (EG) and a control group (CG). The population of the study consisted of 11-12 years old students. The study completed with 66 students (50-50% EG & CG). A pre-test was administered to the EG and the CG in order to explore students' cognitive and psycho-motor skill levels of the relevant subjects before teaching volleyball subject. The EG, was trained using the mind map with 40min courses a week for 9 weeks. Meantime, the CG was trained using conventional teaching methods. At the end of 9 weeks period, tests were again administered to groups. To collect data, a Volleyball Skill Test and a Psychomotor Observation Form were used. The data were analyzed with SPSS 20 software package. The post-tests results showed that levels of cognitive domain and overhead pass and bump pass were higher on behalf of the EG. In the comparisons of the cognitive & psychomotor skill levels of the two groups, a statistically significant difference was found in favor of the EG in the cognitive & psychomotor domains. Mind map can be utilized to understand game rules, comprehending the series of skills between movements.

Keywords: *teaching methods, mind map, physical education*

miRNA Profile of Distinct Extracellular Vesicles in Response to Nutrient Timing and Chronic Resistance Exercise

Dávid Csala, University of Pécs
Supervisor: Prof. Dr. Márta Wilhelm

The aim of the present study was to investigate the effects of physical exertion on conventional physiological parameters and profiles of miRNAs transported in extracellular vesicles (EVs). 20 voluntary males participated (age: 22±2 years) in a 5 weeks resistance training program with timed nutrient intake (maltodextrin, whey protein). Participants were divided into three groups based on the timing of nutrient intake relative to exercise. Nutrient intake occurred immediately after exercise (EU), 3 hours post exercise (EU3), or not at all (CTRL). Compared to the baseline, skeletal muscle mass in EU ($p=0.001$), EU3 ($p=0.028$), and quadriceps femoris strength in EU ($p=0.032$) significantly increased, while body fat percentage decreased in all three groups: EU ($p=0.005$), EU3 ($p=0.024$), CTRL ($p=0.005$). Among groups, EV concentration and miRNAs transported in EVs showed a different expression profile. In EU, 39 miRNAs, while in EU3 and CTRL, 13 miRNAs exhibited different expression compared to the baseline. Let-7d-5p, hsa-miR-181b-5p, hsa-miR-222-3p, and hsa-miR-324-5p differentially expressed between EU and CTRL. Skeletal muscle mass significantly increased in EU and EU3 groups, confirming that the exercise program and consumed macronutrients contributed to changes in body composition. Based on our data, the timing of nutrient intake is closely related to the effectiveness of exercise, as observed in changes in body composition and quadriceps femoris strength. The miR-181 family is an important regulator of angiogenesis, while miR-222-3p and -324-5p may play a role in the mTOR pathway, important in hypertrophy. miRNAs transported in EVs may contribute to understand the differences observed between groups.

Keywords: *exosome, resistance training*

Effect of music to athletes' performance

Dávid Aurél Petz, Hungarian University of Sports Science
Supervisor: Dr. Irina Kalabiska

This scientific study serves as a foundational exploration for my future research. Costas Karageorghis, a renowned professor of sport and exercise psychology at Brunel University London, has been instrumental in shaping my studies. Based on Professor Karageorghis' extensive research spanning the past two decades, I have studied scholarly journals to ex-

plore the impact of music on athletes' performance. Throughout his career, Professor Karageorghis has addressed various inquiries, including the effects of music on both recreational and professional athletes' brain function, oxygen consumption, and its impact on heart rate, based on psychological and physiological processes. The aim of my research is to comprehensively analyze and review the effects of music on athletes, elucidating the benefits and drawbacks it may provide for mastering various forms of physical activity.

Materials and Methods: Utilizing the National Library of Medicine (NIH) search page, I surveyed a collection of 20 scientific articles authored by Professor Karageorghis pertaining to the intersection of music and sports. The majority of these articles focus on psychological and psychophysical dimensions: four delve into brain mechanisms, three examine synchronous and asynchronous music, another three explore the effects on intense training and recovery, while two delve into virtual reality and rhythm.

Results: The integration of audio-visual stimuli elicited psychosomatic changes. The combination of music and video demonstrated increased advantages for low and high workout intensities among professional athletes. Supported by studies on 400 meters' runners, exercising with motivational synchronous music resulted in notable enhancements in endurance parameters ($p < 0.01$) ($F_{1,24, 42, 19} = 10.54$, $p < 0.001$, $\eta^2 = 0.24$), and it also alleviated lower limb discomfort during maximum muscle strain. Oxygen consumption was lower while listening to music by 1.0%-7%. The vital maximum loading time was 18.1% and 19.7% longer. Additionally, the audiovisual stimulation in virtual reality elicited a potent affective response, characterized by heightened levels of perceived activation, an increased occurrence of dissociative thoughts, and enhanced enjoyment of the experience. In case of 22 pro athletes the motivational audiovisual stimulus partially blocked the effect of fatigue in the nerve system and based on EMG results, the investigated participants were able to maintain or increase the nerve activation of muscles. Furthermore, the decrease of theta waves was observed in the right frontal regions of the brain (F8), while it increased the amplitude of beta waves in the central region of the cortex (C3 and C4). Participants' attention partially shifted from associative thoughts to dissociative thoughts (factors unrelated to the task), which resulted in enhanced performance. Better conditions were observed in 19 healthy participants during isometric exercise. The slow and calming music provided greater benefits to female athletes during recovery and regeneration processes, while high-intensity workouts were associated with accelerated recovery of the cardiovascular and respiratory systems when accompanied by music.

Conclusion: The study "Ready Exerciser One: Effects of Music and Virtual Reality on Cycle Ergometer Exercise," published in 2020, suggests that health psychologists and sports professionals should recognize virtual reality as a valuable tool. While the stimulating audiovisual stimuli of VR environments proved beneficial initially, in the long run, internal motivation should strengthen. Given the high dissociative function of music, I hypothesize that music offers an advantage primarily in monotonous physical activities, while it may pose

a disadvantage in tasks demanding higher levels of concentration. The question still stands regarding how music can aid in mastering movement forms that require high concentration, such as those involving difficulties in balance, movement complexity, or additional challenges and requirements for concentration, particularly in individuals with attention disorders. Addressing this inquiry will constitute the next phase of my scientific research.

Keywords: *music, Costas Karageorghis*

Associations between energy intake, eating behaviour and mental health in youth female handball athletes

Author(s): **Diána Führer**, Hungarian University of Sports Science

Supervisor: Zsófia Kosik-Sziráki

Introduction: The elite sport performance could be influenced by nutrition. The inadequate quantity and quality of food intake can have negative effects on the function of the body, the individuals's mental health and the control of the body weight. All of these could be related to the unwanted decrease of sports performance. The aim of this study was to explore the relationship between the nutrition intake and the psychological characteristics of the youth female elite athletes.

Method: In our research, we involved (N=74, age: 15.6±1.7) youth elite female handball players. To assess the eating habits and estimate food intake we used the validated semi-quantitative Food Frequency Questionnaire (SMFFQ) - analysing by Nutricomp-SQFFQ software, and the questionnaire package included psychological tests (SWLS, CD-RISC-10, MHC-SF, SAS-2, TFEQ-21) both. In addition during the survey, there were also questions regarding sociodemographic characteristics and physical activity, as well as antropometric parameters. The statistical analysis was performed with the IBM Statistics 29.0 program. To explore the relationships between variables we used correlations. Significance level p0.05.

Results: Statistically significant positive correlations were detected between the Uncontrolled Eating subscale of the 21-item Three-Factor Eating Questionare (TFEQ-21) and all three subscales of the Sport Anxiety Scale (SAS-2), the Somatic Anxiety (p=0.006), Worry (p=0.044) and Concentration Disruption subscale (p=0.004). In addition we found significant positive correlation between Uncontrolled Eating subscale (TFEQ-21), all three subscales of the Sport Anxiety Scale (SAS-2) and the daily total energy intake [kcal] (p0.01), as well as the particular kind of macronutritions [g], such as fat (p0.01), protein (p0.01), carbohydrate (p0.01), and sugar (p0.05).

Conclusion: By examining the associations between nutritional and the psychological characteristics of adolescent elite athletes, it is possible to find relationships that may also be important in their performance. Using these results there is the opportunity to help preserve the psychically well-being and to minimalise the chance to decrease the sports performance, by giving targeted treatments, specialize development for example healthy diet presentations and stress management. Last but not least, these results can serve as a basis for the importance of cooperation between dietitians and psychologists.

Keywords: *energy intake, mental health, youth athletes*

Make some noise for the electric racing – The involvement of athletes of electric motorsport series in sports diplomacy

Dorottya Borbála Rafáczné Gerics, Hungarian University of Sports Science
Supervisor: Dr. Tamás Dóczy

My work examines electric racing series, which are emerging in international motorsports, focusing on the alleged sport diplomatic role of athletes in this innovative environment which reflects on a number of today's problems outside of sport. I examine the extent to which the competitors in these electric racing series can be seen as sports diplomats, representing the innovative aspirations and environmental awareness of motor sports, which are known to be polluting, to sports fans and those less affected by the sport.

My research focused on four internationally popular championships in electric racing: Formula E, Extreme E and the eTouring Car World Cup (ETCR) for race cars, and MotoE for motorcycles. Analysing of the public communication of the series and their drivers, I examined the social media platforms of the drivers and riders competing in the 2022 in the series and reviewed their interviews that gained bigger publicity. In addition, I conducted in-depth interviews with 6 drivers from the series, 2 mentors and the team principal of the team that won the first ever season of ETCR, to get to know their experiences and motivations.

I found that most competitors only participate in the mandatory programmes that their championships or sponsors ask them to attend, but these programmes do not give the opportunity for much international publicity, typically the participants do not even share them on their social media platforms. Although series and manufacturers try to link the message of electric racing with sustainable development and electric transportation, the drivers are partners only to a limited extent and do not support these efforts beyond the

mandatory activities. Nor do they highlight the electric nature of the series and its contribution to sustainability in their communication about racing and racing series.

Overall, although they are in a position to represent the interests of the championship at international level and to help achieve the federation's and the sector's objective of raising public awareness of the need for sustainable development, they do not take up this opportunity. And when some do stand out at centrally organised events, these commitments are not decisive, they disappear into the background of other marketing activities linked to the championships.

Keywords: *motorsport, sports diplomacy, electric racing*

Ultras in the stands: The cheering as lifelong lasting engagement

Edina Krár, Hungarian University of Sports Science
Supervisor: Dr. Szilvia Perényi

In sport we attribute an important role to spectators and fans; this is especially true in football. The atmosphere in a stadium is mostly created by the ultras. But what motivates someone to accompany their team to every match and cheer them on? The aim of this research is to explore motivations and habits through the attendance of supporters at matches; to assess active and indirect sport consumption patterns; to understand sport-related and non-sports-related tourism patterns; and to interpret the results in the light of the social characteristics of ultra supporters. The research objectives were explored through content analysis, questionnaire survey and interviews. The total size of the study population was 70, of which 50 completed the questionnaire, a 71% completion rate. The results obtained are of limited generalisability, however, seem to indicate that both friendship and loyalty to the club are important among ultras. Being an ultra is a specific way of life, members are in close contact with each other in their everyday lives and see being a supporter as an important part of their identity.

Ultra fans' attendance at matches is not influenced by the expected match result; they also follow other sports (handball, ice hockey); most of them (86%) also watch sports broadcasts; and 64% do physical exercise such as boxing. The members of the fan base have higher cultural and economic capital than expected; they are over-represented in terms of job market activity. The group is also characterised by a relatively higher proportion of female members; and by semi-openness to external environment as new members may join only on a recommendation basis. Overall, there are studies exist on fans in Hungary, however, motivations and sport consumption patterns have only been studied among spectators, and

limited knowledge available on ultra groups. Therefore, future direction for our research could be to further investigate and possibly compare the ultra-supporters of different teams.

Keywords: *football, supporters, RBD, ultra, identity*

Data analyzing in short track speed skating

Emil Imre, Hungarian University of Sports Science

Supervisor: Gábor Túróczy

A well-organized and successful sport team can't work or improve without data analyses and performance diagnostics anymore. The short track speed skating makes no difference in this sense too. However, a smart coach's team are using as many opportunities as possible and diagnoses, tools, and applications to prepare individualized, performed, and high-quality training plans, equipment's, and selections between the athletes if that is necessary to.

Keywords: *short track speed skating, sport profile, performance diagnostics, endurance, protocol, special sport equipment's, body composition, OSEI, WOOP*

Impact of Major Sporting Events on Sport Participation in the Host Country: Focusing on leading international swimming competitions held in Hungary

Eszter Fekésházy, Hungarian University of Sports Science

Supervisor: Bence Molnár

Major sporting events, including the Olympic Games, are often seen as catalysts for positive societal change, promoting lasting sports participation legacies. This literature review synthesizes research on the complex connection between major sporting events and sport participation. Spanning specific cases like London 2012 and Tokyo 1964 to broader scoping reviews, the analysis critically examines quantitative and qualitative studies. Focusing on major international swimming competitions held in Hungary, the research evaluates the impact on competitive sports by scrutinizing the post-event increase in athletes affiliated with swimming clubs. It also explores the effects of the events on the popularity of swimming in the country. By synthesizing diverse datasets, the study offers valuable insights into the broader implications of hosting major sporting events on a nation's sports culture. This

review aims to discern patterns, identify key factors, and address gaps in understanding, contributing to discussions on societal impacts and informing future event planning and policy development.

Keywords: *major sporting events, sport participation, international swimming competitions, competitive swimming*

The positive effect on the hungarian cycling and tourism by the bigger races. Like Giro d'Italia and Tour de Hongrie

Ferenc Szöllösi, Hungarian University of Sports Science
Supervisor: Tibor Fülöp

The purpose of my research was to analyse the methods, special equipment and applications, performance diagnostics results of the Hungarian National Short Track Speed Skating Team (16 person).

Keywords: *cycling, cycling events, hungarian tourism, cycling tourism*

The short-term effects of foam rolling on ankle mobility compared to static stretching

Gábor Kiss, Hungarian University of Sports Science
Supervisor: Dr. Leonidas Petridís

Introduction: The aim of the research was to investigate the effects of foam rolling (self-myofascial release - SMR) on ankle dorsiflexion compared to static stretching. SMR is a self-massage technique which improves the muscle-connective tissue unit (myofascia), by increasing blood supply and flexibility of the muscles. Despite its increasing popularity and widespread use, we assume that the SMR techniques are less effective in increasing the range of motion of the ankle dorsiflexion compared to the traditional static stretching exercises.

Methods: The study involved 24 recreational athletes. 13 men (mean±sd age: 37.6±12.4 years, body height: 181.0±4.4 cm, body mass: 82.1±14.4 kg) and 11 women (mean±sd age: 36.8±6.5 years, body height: 168.5±3.5 cm, body weight: 72.2±13.4 kg). Partici-

pants underwent a six-week training program aimed at developing ankle joint mobility. Training sessions included foam rollings on one leg and static stretching on the other leg three times a week for one minute for each leg per session. Ankle dorsiflexion was measured with a tape measure. Participants had to kneel unilaterally (both legs were tested in a randomized order) in front of a wall barefoot, while keeping their heels on the ground and their knees touching the wall. Then, they had to slowly slide their foot backwards on the ground until their knee is separated from the wall or their heel is lifted off the ground. Before the knee is detached from the wall or the heel is lifted off the ground, the distance between the wall and the big toe was measured with a tape measure. Three out of the 24 participants did not meet the minimum requirements of the training program (>80% training completion), so the data of 21 participants were included in the statistical analyses. The mobility values of both legs before the training program were examined with an independent sample t-test, while the values before and after the program were examined with a paired sample t-test (Hedges' g effect size).

Results: There was no difference in initial mobility values between the two legs (roller: 11.2 ± 2.2 cm vs. stretching: 10.9 ± 2.3 cm; $p > 0.05$). Both methods significantly increased ankle mobility after the training program. In men, stretching training resulted in a 9.0% change, while rolling training in a 3.4% change ($p < 0.01$; Hedges' $g = 1.7$ and 1.2 respectively), while in women, stretching resulted in a 13.0% change while rolling in a 6.1% change ($p < 0.05$; Hedges' $g = 2.4$ and 1.0 respectively).

Conclusion: Foam rolling is a popular technique among athletes, and its use is recommended as part of warm-up and cool-down routines. Confirming the results of previous research, the use of rolling increased ankle mobility. However, the magnitude of change was less than that achieved with static stretching, with the latter method achieving more than two-fold increase in relation to the rolling method. It seems, therefore that rolling cannot replace stretching-type exercises, and the use of both techniques is recommended in conjunction. It was also interesting to note that the magnitude of change with either methods was greater in women than in men.

Keywords: foam roller, mobility, stretch

Effects of a weight loss intervention on type 2 diabetes risk and subjective quality of life

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Introduction. Today, 537 million people worldwide have diabetes, 61 million of whom live in Europe (IDF Diabetes Atlas, 2021). In Hungary, the number of adult diabetics per 100 inhabitants has tripled in 20 years (KSH 2020). Type two diabetes (T2D) accounts for 90% of all cases and is associated with complications such as premature mortality and health care costs. Overweight is a major contributor to T2D. Genetic predisposition contributes to the risk of T2D, but the development of the disease is strongly associated with overweight and lifestyle factors, including diet and inactivity (Penn L et al, 2013). Low health-related quality of life (HRQoL) is significantly and directly associated with an estimated risk of developing T2D (Väättäinen et al., 2016). Changes in HRQoL are associated with increases in physical activity level (Florez et al., 2012). The aim of our study was to investigate the effect of a 12-week weight loss intervention on T2D risk, HRQoL and body composition.

Material and methods. The 12-week lifestyle programme was fulfilled by 30 healthy Hungarian overweight women. Body composition was assessed using the InBody 720 device and diabetes risk was evaluated with the Hungarian version of the Finnish Diabetes Risk Questionnaire. Quality of life scores were assessed using the EQ-5D-5L questionnaire. Statistical analyses were performed using TIBCO Statistica 13.40.14. All statistical tests were performed at 5% significance level.

Results: The mean age of the participants was 33.4 ± 4.28 years and all of them were overweight or obese. Regarding the risk of T2D we found a significant difference between the baseline and final score (8.36 ± 2.51 vs. 6.96 ± 2.48). There was also a significant change in the mean HRQoL score (73 ± 15.08 vs. 83 ± 11.10). No significant differences were found in body weight (79.16 ± 9.46 kg vs 76.26 ± 9.87 kg) and BMI (28.09 ± 3.25 kg/m² vs 26.89 ± 3.38 kg/m²) but the number of participants who reached the recommended physical activity (minimum 30 minutes of moderate-intensity activity/day) increased significantly (8 vs 21).

Conclusion: Based on this study, we conclude that the risk of T2D evaluated within 10 years can be modified in a 12-week long weight loss program. Our results suggest that T2D is preventable through lifestyle intervention. Additionally, a 12-week intervention in the areas of nutrition and physical activity can lead to better subjective quality of life promoting healthier behaviors and health-conscious lifestyles.

Keywords: *weight loss, FINDRISC, EQ-5L*

Sport and War: the impact of the crisis on the performance of the Palestine national football team

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Supervisor: -

War-affected communities suffer both physical and psychosocial consequences that can generate complications for their well-being status as stress and anxiety disorders. The importance of sociopsychosocial well-being in elite athletes in sport has gained increasing attention in recent years. About the concept of well-being it has been shown that aspects such as anxiety and stress can have an impact on sports performance among elite athletes.

Objectives: The aim of the study is to compare the performance analysis in the 2024 Asian Cup of the Palestine national football team after the recent war in Gaza Strip with past performances to highlight changes and differences.

Methods: Secondary data collected from the Wyscout platform analysed through Jamovi software.

Results: Through an initial data analysis, an increase in the performance of the Palestine National Football Team in the group stage of the recent edition of the 2024 Asian Cup was found. The increase concerns the offensive statistics of the national team compared to previous editions of the event.

Discussion: The Palestine national football team played in the group stage of the AFC Asian Cup after five years. A noticeable increase was found in offensive statistics not confirmed by the other team statistics: for this reason it deserves to be investigated in deep.

Conclusion: Despite the emotions generated by the war that can impact on sports performance, the Palestine national team recorded an increase in its performance analysis. An in-depth qualitative study could be useful to investigate the contribution of the socio-psychological aspect to sports performance.

Keywords: *sport, well-being, performance analysis*

More than just dogs - Psychological aspects of dog sports

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Introduction. Nowadays, the different kinds of dog sports are becoming increasingly popular., the most popular being agility (Niewiadomska, 2018). Although dog sports are getting more and more attention, it is interesting that the people participating in it are mainly in their middle ages (Gillespie et al., 2002; Riemer & Thomas, 2005) and predominantly female (Gillespie et al, 2002; Riemer & Thomas, 2005). On the one hand,

some findings suggest, that doing agility can serve as a „gateway”, and thus people can become more motivated to be more physically active (Farrell et al., 2015). On the other hand, an other existing theory suggests, that participating in agility might decrease a person’s motivation to do other sports, because they believe that agility is entiring enough (Koze-Keadle et al., 2014). Farrell et al. (2015) suggests that taking part in agility helps the owners to strengthen their connection with their dogs, and it helps to develop a strong, mutual bond, which is psychologically beneficial for both human and dog.

Objective and hypotheses. Our research’s goal is to study the differences in certain psychological characteristics of dog owners who participate in agility and those who don’t. We hypothesized that dog owners who do agility are more motivated to be physically active than those owners who don’t do agility. Furthermore, we assumed that agility participants would report a stronger emotional connection with their dog’s than those owners who don’t take part in agility.

Sample and methods. The participants of this study were people aged 18 and older (N = 729, Mage = 37.04, SD = 12.06). The subjects were asked to answer sociodemographic questions, questions regarding number of owned dogs and participation in agility, and to fill in two questionnaires (MDORS, DD-PSDQ).

Results. There was no significant difference between the percentage of male owners (40,6%) and female owners (41,6%) who take part in agility. There was also no significant difference between people how partake in agility and people who don’t regarding participation in other sort of physical activity, 57.1% of owners who do agility also do some sort of exercise without their dogs, and 55% of people who don’t participate in agility take part in some other form of physical activity. We found a significant difference in the mean points of the MDORS Dog-Owner Interaction subscale ($t(728) = 2.851, p = .004$), owners who do agility scored higher points on this subscale than owner’s who don’t.

Summary. Our findings are interesting because we found that women aren’t more enthusiastic about taking part in dog sports than men, and that owners who do agility aren’t necessarily physically more active than dog owners who don’t do agility. However, our finding does support the theory which suggests that agility helps humans and dogs to strengthen their connection.

Keywords: *agility, exercise, emotional connection*

The relationship between readiness and external load parameters in elite youth soccer players

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Supervisor: Dr. János Matlák

Introduction: Fatigue monitoring and the planning of training loads is already high priority in soccer at youth level because the long and demanding competition periods are associated with limited recovery times which can lead to reduced performance and increased risk of injury. The countermovement jump (CMJ) is a widely used test method to monitor neuromuscular fatigue, and its reliability and sensitivity have been demonstrated and verified by several studies (Franceschi et al., 2023).

Purpose: In our study we investigated whether the readiness scores of the players change significantly from Tuesday morning to Friday morning in a week with a high training load and if so, which external load parameters show a significant relationship with changes in the readiness variables of the CMJ test.

Materials and methods: Players ($n = 15$, 16.4 ± 0.2 years, 67.3 ± 7.0 kg, 178.5 ± 5.1 cm) of the U17 age group from a Hungarian soccer academy were participating in our study. Readiness testing was conducted continuously throughout the season from July 2023, with players performing CMJ tests at the same time each week on Monday afternoon, Tuesday and Friday morning, preceded by a standardised warm-up protocol. Three jumps were performed each time and the average values of the jumps were used in the study. Jumps were measured using a force platform (Vald Performance, Newstead, Australia) and external load parameters were monitored using a GPS system (Catapult, Melbourne, Australia).

The chosen interval was 3-6 October, when players were scheduled to participate in a high load training week. Data normality was tested using the Shapiro-Wilk test. Paired t-test and Wilcoxon test were used to measure the difference between the readiness parameters on Friday and Tuesday. Pearson's and Spearman's correlation coefficients were calculated to see the correlation with the external load parameters (summed absolute load values of the three days). The significance level was set at $p < 0.05$.

Results: Between the Friday and Tuesday readiness values we found a significant decrease in the eccentric mean deceleration force (EMDF) with a small effect size, while for the modified RSI and the jump height we found a non-significant negative trend with a small effect size.

In the correlation analysis no relationship was found between EMDF change and external

load parameters, but a strong ($r=-0.601$ and $r=-0.568$) and significant negative correlation was found with sprint distance and number of sprint actions for the modified RSI change.

Conclusion: Our research demonstrates that external load can affect the readiness of youth soccer players during a training week, but this component is only one of many so in addition to the team-level analyses, there is still a need to monitor individual-level readiness. In our study there were also large differences in readiness changes within the team.

Keywords: *readiness, neuromuscular fatigue, external load parameters, soccer*

Morphing the Body: Narratives of an Amateur Bodybuilder

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Supervisors: Dr. habil. István Soós, Dr. Győző Molnár

Introduction: Becoming a female bodybuilder may not correspond to the ordinary expectations directed towards women. The strictness of the discipline demand total commitment in terms of lifestyle, nutrition, training, and standards towards a more muscular body. Through the course of my personal experience in this field, I discovered essential components of my journey in bodybuilding. I particularly emphasize on the emotional and other forms of options that is the integral element of achieving a muscular body whilst maintaining my socio-cultural status as a woman. I connect my experience both internal and external conflicts in building a muscular physique and re-assessing the challenges that I encounter as a woman in a male-dominated subculture of bodybuilding. This project focuses on a two-year journey beginning in the second semester of my PhD studies and is informed by my first European competition in the Figure Division.

Methods: Autoethnography will be utilized as the primary approach of gathering data. Through these personal accounts, data will be examined using a discourse analysis (DA) framework.

Expected results and conclusions: By sharing my narrative account on bodybuilding, my aim is to explore the different hurdles that women encounter despite shared motivation and love for the activity, akin to that of men, yet do not receive equal acceptance and status.

Keywords: *bodybuilder, autoethnography method, motivation*

Yoga is the new flow? -The relationship between self-knowledge and the flow experience through yoga practice

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Nowadays, in the process of individualization, self-knowledge is gaining more and more importance and space, which means the conscious experience of the self and the need to develop it (Szöke-Milinte, 2015). Regular exercise has a number of psychological benefits and yoga is a popular activity for mental balance. It has preventive value and health promoting effects on physical and mental health, and personality development effects in terms of self-esteem and self-efficacy. (Kulkarni, Murali, & Patki, 2017). Yoga increases subjective well-being and improves attention and concentration. (Kelley, 2009). The flow experience is an important element for the fulfilment of our personality, with two determining factors being the balance between challenges and skills (11 item) and absorption in the activity (9 item). (Magyaródi és mtsai., 2013). Yoga as a mindfulness technique can increase athletes' sense of flow (Kanaujia és mtsai., 2023), However, little attention has been paid to the relationship between yoga and the flow state.

Our aim is to assess the different aspects of self-knowledge among regular yoga practitioners and its relationship to yoga and the flow experience. Our hypothesis is that yoga practice is related to the need for, quality of, and development of self-knowledge. Furthermore, the state of flow can be related to the level of experience and the quality of self-knowledge.

Sample and method: We surveyed people over 18 years of age who regularly practise a type of yoga (N=57, Mage=47.46; SD=12.84). In addition to demographic and self-knowledge-related questions, subjects completed the Flow Status Questionnaire on an online platform, which took approximately 15 minutes.

Results: Absorption in the activity and challenge-skill balance scales show equally significant positive weak-medium relationship with perceived fitness level ($r=.352$ -,469, $p<0.01$), perceived health status ($r=.338$ -,337, $p<0.05$) and self-knowledge development through yoga ($r=.442$ -,431, $p<0.01$). However, there was no significant difference in the two scales and the self-knowledge quality scale between those who sought professional help for self-knowledge development and perceived influencing or limiting circumstances in their daily movement than those who did not.

Summary: Our results point out that persistent practice of yoga and protection of one's health can lead to the experience of flow, so a level of skill and competence already developed is necessary for flow to occur. And experiencing flow can help to develop the quality of our self-knowledge, but it does not depend on whether one seeks the help of a professional to do so.

Keywords: *yoga, flow, self-knowledge*

The effect of short-term neuromuscular training on ankle bio-mechanics in individuals with functional ankle instability

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Supervisor: Prof. Dr. Yaodong Gu

Functional ankle instability (FAI) results from multiple ankle sprains, causing a perceived sense of joint instability due to muscle and ligament imbalances. Neuromuscular training (NMT) is employed to enhance ankle stability in individuals with FAI. The study included 24 male university students with FAI, who underwent ankle NMT on three surfaces. OpenSim musculoskeletal model analyzed the effects on ankle muscle activity, kinetics, and kinematics. Utilizing repeated measures analysis of variance (ANOVA) and one-dimensional statistical non-parametric mapping (SNPM1d) to identify distinctions between training surfaces. NMT on foam cushion (FC) significantly enhanced tibialis anterior (TA) and gastrocnemius medial (GM) activation during walking compared to level-ground (LG) and artificial turf (AT) ($p < 0.05$). However, no differences observed for peroneus longus (PL), gastrocnemius lateral (GL), and peak ankle plantarflexion (PF). During jogging and fast running, post FC training increased TA, PL, GM, GL activation, and peak ankle PF moment ($p < 0.05$). Additionally, post FC training, subtalar mobility was significantly reduced ($p < 0.05$), and ankle joints exhibited greater dorsiflexion (DF) angles during jogging and fast running ($p < 0.05$). Consequently, selecting FC for short-term ankle NMT proves more advantageous in enhancing ankle stability among individuals with FAI, yielding a more positive impact on FAI improvement.

Keywords: *functional ankle instability, neuromuscular training, ankle biomechanics*

Exploring the Element of Sports and Recreation on Tourist Motivation in Cambodia

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The travel motivation to a destination is important for destination management marketing strategies. It supports the perception of an individual on the purpose of why he/she should travel to a destination whether it is for various reasons such as relaxation, curiosity, experience, adventure, or to increase knowledge on a particular topic but without the help of an individual itself, travel motivation will not exist in the first place.

This research paper aimed to identify travel motivation by push and pull factors that affected the decision-making of international tourists in selecting Cambodia as their destination choice. Results of data analysis also revealed that tourists are willing to experience recreation and sports activities when they visit Cambodia and that local activities proposed in hotels and resorts are well offered as activities during holidays.

The findings of this study suggest that sport tourism has the potential to be a major driver of economic growth and development in Cambodia. By understanding the motivations and expectations of sports tourists, and by developing policies and programs to support sport tourism, the Cambodian government and sports tourism operators can attract more visitors and create new jobs. In conclusion, this paper was presented and some recommendations are suggested to tourism marketers to promote local activities and recreation in the tourism product mix.

Keywords: *travel Motivation, sport management, visitors' experience, push and pull factors*

Attention training in the development of ice hockey players

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Supervisor: Prof. Dr. László Tóth

The development of Hungarian ice hockey players is world-class from a physical perspective, although in mental preparation, there is still room for improvement. The research topic for our research group is how does attention training fit in the sports development process. Based on the literature and semi-structured interviews, a viable solution could be a sport psychologist doing the attention training, if a specialized professional is not available. Attention training is done in personal or small group settings, in close cooperation with the coach of the team. The researchers identified three main tasks, providing the structure of the attention training process: 1. searching for information sources and choosing the most informative one, 2. an appropriate quiet-eye fixation on the chosen information source, 3. processing the information from the source, and presenting the adequate response. It is the training of attention, which may enable Hungarian ice hockey players to be more accepted internationally through being mentally fit as well.

Keywords: *ice hockey, mental development, training of attention*

The societal and sports-related impacts regarding body image among aesthetic athletes

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Supervisor: Dr. Krisztina Kovács

Background: Athletes face intense physical demands and criticism regarding both functional and aesthetic aspects. Numerous studies highlight higher rates of eating disorders among competitive athletes, especially in aesthetic sports, compared to non-athletes (Flatt et al., 2021; Martinsen & Sundgot-Borgen, 2013; Torstveit et al., 2008). Petrie and Greenleaf's (2012) theoretical model proposes that societal and sport-related pressures on athletes' body appearance, eating behaviors, and performance, can lead to increased dissatisfaction with physical appearance.

Objective: The present study aimed to investigate the internalization of societal and sport-specific pressures and its consequential influence on their body perception and eating attitudes.

Method: The research enlisted active elite athletes specializing in rhythmic gymnastics, gymnastics, aerobics, and aerial gymnastics (N=8; Mage=23.63; SD=5.57). The semi-structured interviews were analyzed using reflexive thematic analysis (Braun & Clarke, 2006), guided by Petrie and Greenleaf's (2012) theoretical framework.

Results: A central theme emerged, elucidating the cognitive facet of internalization, with two distinct sub-themes: Machiavellian thinking and Cognitive bias. The latter proved to be the predominant sub-theme, encompassing Dichotomous thinking, Emotional reasoning, Catastrophizing, and Hindsight bias.

Conclusion: Petrie and Greenleaf's (2012) framework highlights how societal and sport-related pressures influence the internalization of body dissatisfaction. Our results emphasize the role of external influences, particularly regarding body and sport-specific expectations, in shaping cognitive biases in athletes' self-perception. This research enhances our understanding of the complex interplay between environmental pressures and athletes' cognitive processes, especially in aesthetic sports. The implications suggest a need for targeted interventions addressing cognitive bias.

Keywords: *aesthetic sport, internalization, cognitive bias*

Physical Activities level of Jordanian female adults regarding the traditions and the modern society

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Introduction: It is evident today that social environment determines women's health and life-style, which has been supported by the achievements of researchers. Followed by the environmental model, this study analyzed the elements that might affect women's health and quality of life of those living in the capital city of Jordan. Due to the wide spread of inactive lifestyles and poor nutrition, a higher obesity rate was measured compared to the data in the last century.

Methods: A content analysis was carried out in 2023 using several databases and publications which are relevant to the selected topic. The sources of the dataset were taken from Jordanian governmental statistics departments, statistical websites and World Health Organization reports. To this review publications were taken between the years 2000-2023 that focused on: 1) environmental influence on women's lifestyle, 2) sociodemographic barriers and facilitators to women's physical activity, and 3) the impact of culture and traditions on women's physical and recreational activities.

Results: According to the literature analysis, there are disparities between male and female populations regarding the level of physical activity and obesity rates which might be influenced by traditional and cultural norms which is more of a concern than religion. Also, household duties, social safety, aesthetic requirements, access to natural and infrastructural issues (facilities) are responsible for healthy lifestyle.

Conclusion: The findings highlight the need for more advertised and supported activities, safer places and better access to active programs for women. The analysis has shown clearly that more detailed subjective research needs to be investigated on Jordanian situation to prevent further negative trends among female population. Urban decision makers should create and implement strategic plans, supported by building facilities and organized events and nutrition campaign for women to decrease the obesity rates and contribute to healthy lifestyle.

Keywords: *Amman, women's health, social environment, socioeconomic influence, physical activity*

Psychological Aspects of Motocross Racing Considering Expect- ed, Perceived, and Actual Performance

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Introduction: Motocross is classified as a high-risk sport, posing high challenges and stress for riders; not surprisingly, it is also considered an extreme sport. But how do racers feel at the time of the race? Unfortunately, there is insufficient scholastic research to answer this question. Indeed, the immediate affective states before and after Motocross competition, particularly in comparison to expected and actual performance have not been studied to date. Therefore, this field research investigated the emotional states, perceived arousal, anxiety levels, positive affect (PA), and negative affect (NA) during the anticipatory and recovery race periods, exploring their connections to expected and perceived performance.

Methods: Twenty Motocross racers, comprising 19 men and one woman (mean age 27.55 ± 13.82 years), consented to participate in this study. The athletes' psychological state was evaluated immediately before and after the race. Assessments included the 10-item positive and negative affectivity schedule (PANAS), an 11-point 'feeling scale,' a 6-point 'arousal scale,' and three 10-point scales measuring anxiety, expected-, and perceived performance. The physical and mental fatigue were gauged using the 10-item Borg scale.

Results: Actual performance was unrelated to the psychological measures. Lower arousal (4.05 ± 1.28), anxiety (2.65 ± 1.98), and PA (19.50 ± 3.57) were observed after the race. Expected performance did not correlate with post-race measures, but the perceived performance was positively associated with PA post-competition ($\rho = .48$, $p = .05$) and pre- ($\rho = 0.56$, $p = .02$) and post-competition ($\rho = 0.58$, $p = .01$) feelings states. As expected, racers meeting or exceeding their expectations reported feeling better after the race compared to those performing below expectations ($Z = -1.41$, $p = .04$). Perceived mental effort (6.17 ± 1.86) was lower than the retrospectively appraised physical effort (7.06 ± 1.83); the difference was statistically significant ($Z = -1.933$, $p = .05$). Further, significant decreases were observed in four out of the 10 PANAS measures after the race: alert ($Z = -2.292$, $p = .015$, effect size [r] = .54), attentive ($Z = -1.930$, $p = .047$, $r = .45$), active ($Z = -2.455$, $p = .007$, $r = .58$), and afraid ($Z = -2.719$, $p = .002$, $r = .64$).

Conclusions: Objective performance appears to be independent of psychological measures monitored in this study. Arousal, anxiety, and PA have decreased after the race, indicating a decline in affective valence after the challenge. This finding suggests that PA might decrease due to the extinguishing of the excitement associated with racing, while the drop in arousal and anxiety might mirror the recovery from excitement. Expected performance did not correlate with post-race measures. However, perceived performance was related to feeling states, anxiety, and PA after the race and the feeling states before the race, which suggests that the post-race assessment captured the feelings associated with race while eradicating the pre-race affect. Participants meeting or exceeding expectations exhibited improved emotional states after the race than those falling short of expectations, an expected course of emotional reactions. Despite the one-point difference between perceived mental and physical effort, it is evident that Motocross is both a physical and mental sport.

Keywords: *exercise performance, exercise psychology, sport psychology*

Post-injury mental disorders among handball players

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Supervisors: Prof. Dr. László Tóth, Renátó Tóth

Objectives: The purpose of this study is to examine the mental health of handball players. There are plenty of studies on athlete's mental health where it is described that injured athlete often experiences mental disorders. Our aim is to find out what percentage of handball player suffer from mental disorders and the types of disorders that can occur during their careers and what help they seek to recover.

Methods: A total of 150-200 women and men handball players are taking part in our research. The physical injuries and mental health of the handball players were measured using the Hungarian version of the questionnaire, which will help us to see how the two are related and how much there is a need for professionals (sports psychologists) to work with the athletes.

Results: Our results indicate that a large proportion of handball players experience mental disorders (prevalent anxiety and mood disorders) and that there is a strong correlation between injuries and mental health. Our results so far also show that a higher percentage of handball players would seek professional help for their mental health problems if they had more opportunities.

Discussion: Handball is an injury-prone sport. Injuries are often accompanied by mental disorders that are difficult for athletes to deal with. These disturbances can affect the athletes' personal lives and performance and in many cases their mental recovery can take longer than 10 weeks.

Conclusion: Given our findings, the mental health of handball players should be addressed more by professionals (e.g. sports psychologists), because a much higher percentage of athletes experience mental disorders. With this change, more handball players' careers could be changed.

Keywords: *sport Injuries, mental disorders, sport psychology*

Impact of High-Intensity Interval Exercise on Executive Performance and Prefrontal Cortex Activation in the Elderly: A Pilot Investigation

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Supervisor: Dr. Sylwester Kujach

Objectives: Growing body of evidence suggests that engaging in physical exercise holds considerable promise in enhancing cognitive functions. Our previous research has shown that High-intensity interval exercise (HIE) can improve the physical fitness and cognitive function of young people, but the results of studies among seniors are still ambiguous. Several studies have revealed that exercise enhances human cognition via exercise-enhanced neurotrophins and catecholamine synthesis, which is known to mediate neural plasticity and energy metabolism in the brain. However, the neural mechanisms behind the post-exercise improvement of cognitive functions in seniors are still being sought. The purpose of the present study was to assess acute effect of HIE on executive function focusing on underlying neural substrates among older adults.

Methods: The study involves sixteen elderlies. The main experiment consisted of two sessions, control (CTL) and high-intensity interval exercise (HIE) separated by at least one week. Each trial was conducted in a randomized, counterbalanced manner, with half of participants starting with the HIE session. The HIE protocol consists of eight 60s cycling bouts at ~90% HRmax intensity and 30 s resting. Participants performed the Trial Making Test (TMT-A and TMT-B) before and after exercise bouts or control. Cortical activation has been measured applying functional Near-Infrared Spectroscopy (fNIRS).

Results: HIE contributed to a significant, shorter execution time in TMT-B test. Moreover, an increased prefrontal activation in left dorsolateral prefrontal cortex - DLPFC and in the middle frontal gyrus - MFG has been observed following acute bout of HIE.

Discussion: The aim of the present study was to assess acute effect of HIE on executive performance and prefrontal cortex activation among older adults. We found Stroop interference-induced brain activation in both hemispheres DLPFC and MFG. This activation was significantly increased in response to an acute bout of HIE, which coincided with cognitive abilities improvements.

Conclusions: The results suggest that the proposed HIE protocol can effectively improve executive function in the elderly, which can be attributed to increased activation in cortical areas relevant to cognitive functioning.

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Keywords: *high-intensity interval exercise, executive performance, prefrontal cortex activation*

Incline-dependency of the power-duration relationship in cross-country skiing

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Supervisor: Dr. Erik Andersson

This study aimed to investigate the influence of incline on power output and the power-duration relationship in cross-country skiing through a novel approach advanced from Morton's three-parameter critical power model.

Twelve trained male cross-country skiers (age: 32 ± 6 yrs) completed the identical exercise protocol both at 2° and 8° incline in a randomized order by utilizing the double-poling sub-technique. The protocol included an incremental maximum speed test and four constant work rate trials with target durations of 5, 20, 80 and 320 seconds, performed until volitional exhaustion.

Comparing 2° and 8° incline, participants reached significantly lower end speeds during the maximum speed tests while eliciting significantly higher mechanical power outputs at the 8° incline (both $p < 0.001$). Throughout the predictive trials, participants demonstrated 58-11% greater power outputs at 8° compared to 2° incline, with a trend of steadily declining difference as exercise duration increased. Regarding extracted model parameters, anaerobic work capacity significantly differed at 2° versus 8° incline (6.8 ± 1.6 kJ vs. 21 ± 7.5 kJ, $p < 0.001$). In contrast, critical power values exhibited a relatively small difference of 9% between the two setups ($p = 0.1$).

The results of our investigation indicate that anaerobic work capacity is incline-dependent but not critical power. Furthermore, they suggest that the increased power output during predictive trials at an 8° incline stems from the expanded availability of work above the critical power. The developed methodology shows great potential for extending the current screening protocols in cross-country skiing diagnostics.

Keywords: *critical power, anaerobic work capacity, cross-country skiing*

Relationship the Stretch-Shortening Cycle Efficiency with Sprint and Change-of-Direction Speed in Academy Soccer Players

Máté Csányi, Hungarian University of Sports Science

Supervisor: Dr. János Matlák

Introduction: The Squat Jump (SJ) and Countermovement Jump (CMJ) are well-known vertical jump tests, and variables calculated from results especially the Eccentric Utilization Ratio (EUR), are suggested as useful parameters for assessing the performance of athletes. Additionally, these variables are generally considered as indicators of the efficiency of the stretch-shortening cycle in muscles (McGuigan et al., 2003; 2006).

Purpose of study: The aim of this study was to investigate the relationship between calculated indicators from jumps (EUR) and the performance of soccer players in sprint and change-of-direction speed tests.

Methods: Forty-one youth academy soccer players (15.9 ± 1.2 years; 68.7 ± 8.5 kg; 176.9 ± 6.98 cm) participated in this study. Tests were conducted in August and September 2022, including vertical jump tests (SJ, CMJ) sprint tests (5-10-20-30 m) and modified 505 agility test. Jump measurements were taken using a force platform (Vald Performance, Nestead, Australia), sprint tests results were recorded with single-beamed photocells (Microgate, Bolzano, Italy). Data sets were tested for normality using the Shapiro-Wilk test. Pearson's and Spearman's correlation calculations were used to assess relationships among variables. The significance level was set at $p \leq 0.05$.

Results: No significant correlations were found between calculated variables and the results of sprint and modified 505 tests. However, basic variables measured during SJ and CMJ showed significant, negative correlations of varying strength with 5m, 10m, 20m, 30m sprints, and modified 505 test results. In the case of the modified 505 test only moderate correlations were observed with both absolute and relative basic variables.

Conclusion: Indicators calculated from various jump tests (jump height, absolute and relative power) did not show a correlation with field test results. Further research is recommended to explore the applicability of EUR efficiency indicators in the analysis of the field test, as their current utility in determining sports performance appears limited.

Keywords: *soccer, stretch-shortening cycle, field test*

Short-term effects of “Citrulline Malate” on the circulatory and metabolic systems in male, athletic university students

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Supervisor: Prof. Dr. Ferenc Ihász

The aim of this study was to investigate the short-term effects of “Citrulline Malate” on body composition, circulatory, respiratory and metabolic systems in young, physically active males. Healthy young subjects (n=21), aged (18–35) years were recruited via advertisements posted on the University campus to participate in this study. This study used a randomized, double – blind, crossover design to determine the effects of Citrulline Malate (CM) on CrossFit performance. The participants received either (6 mg×kg-1) CM tablet(s) or a placebo (placebo followed by CM: n= 21; CM followed by placebo (AE): n= 21). Before, during and after each workout, changes in the heart rate of the participant’s monitored Heart Rate and movement data were recorded using the Polar Team Pro® system: calculates time spent in different intensity zones (sec.), the Recovery time (h) and the Energy used (Kcal) and Heart Rate variability (HRV) is the variation in the time intervals between adjacent heartbeats (bpm). The hypothesis was partially confirmed as we found significant improvements in CrossFit performance in only a few characteristics following CM supplementation. As for the time spent in intensity zones four and five in the total and Sport1 groups, a significant difference was found between CM groups, in favour of zone four. This means that better performance was achieved at lower heart rates. This partly confirms the performance enhancing effect of CM.

Keywords: *short-term effects citrulline malate, circulatory and metabolic systems, heart rate zone, CrossFit performance*

Effects of Achilles Tendon Stiffness on Gait Mechanics and Force Production in Older Adults

Mehmet Akman, Hungarian University of Sports Science; **Mohamed Elshenawy**, Hungarian University of Sports Science; **Beáta Csizmadia**, Hungarian University of Sports Science

Supervisor: Prof. Dr. h.c. Tibor Hortobágyi

Introduction: Normal aging affects muscle-tendon functions. A hallmark of human tendon aging is the decrease in Achilles tendon stiffness. Reduced tendon stiffness is presumed to interfere with force transmission to the skeletal system. If so, the walking economy, which is extensively documented to be ~20% higher in older vs. younger individuals, could be related to impaired by Achilles tendon function. The purpose of this study is to determine the relationship between Achilles tendon properties and walking economy.

Method: Participants will be healthy individuals age 40-75. Achilles tendon stiffness will be examined at rest and during low level muscle contractions on a dynamometer while

seated. Ultrasound imaging will be performed to visualize the Achilles tendon and elastography will be used to quantify tendon stiffness. Walking economy will be evaluated while walking on a treadmill at -20%, -10%, 0%, +10%, and 20% relative to preferred walking speed (i.e., 0%). Walking economy will be expressed as ml/kg/m oxygen. Additionally, force production capabilities of the calf muscle complex will be characterized by measuring maximal voluntary contraction of the plantar flexor muscles.

Findings: We expect to find an age-related decline in walking economy and a decrease in Achilles tendon stiffness. Most importantly, we expect an association between walking economy and tendon properties. We predict that plantarflexor force production is covariate in the walking economy-tendon property relationship.

Discussion, Conclusions: These data have important implications for exercise prescription in aging, targeting walking economy, tendon and muscle properties.

Keywords: *achilles tendon*

Mixed Intervention Comparison of Sagittal Vertebral Column Bend Change Induced by Backpacks in School-aged Children and Adolescents: Systematic Review and Network Meta-analysis

Mengchen Ji, Ningbo University

Supervisor: Prof. Dr. Yaodong Gu

Background: Studies have investigated the effects of backpacks and their loadings on the physiological spinal curvature changes in school-aged children and adolescents. However, the dose-response relationship between varying backpack weights and changes in spinal physiological curvature remains unclear. Objective: The purpose of this systematic review is to explore the sagittal vertebral column bend change induced by backpacks in school-aged children and adolescents. Methods: Three relevant authoritative databases (PubMed, Scopus, and Web of Science) were searched. Indicators of vertebral column bend in the sagittal plane were selected as the outcomes. The extracted data were standardized, and the Cochrane Risk of Bias Assessment Tool and the website of Confidence in Network Meta-Analysis were used to evaluate the risk of bias and confidence ratings of results. Results: 4 trials were included within 244 potential studies. The results indicated a potential dose-effect relationship between backpack weight and sagittal vertebral column bend change: without backpack, 20% of body weight, with probabilities of 0.61, 0.25, 0.13, and 0.01, respectively. The results also indicated that there were no significant differences

in the effects on the sagittal vertebral column bend between the four backpack scenarios, in pairwise comparisons. Additionally, the results from the risk of bias assessment revealed that this review suffers from a lack of inclusion of high-quality studies. Conclusion: This review suggests a potential dose-effect relationship between backpack weight and sagittal vertebral column bend, with no significant differences across each head-to-head comparison. PROSPERO Number: CRD42023487919.

Keywords: *backpack, spine, systematic review*

The Effect of Backpack Waist Belt and Elastic Shoulder Strap Design on Shoulder Impact Forces in Children during Walking and Running

Mengchen Ji, Ningbo University
Supervisor: Prof. Dr. Yaodong Gu

The aim of this study is to determine whether the design of the waist belt and elastic shoulder straps on backpacks has an impact on shoulder impact forces during different states of motion. Ten children were recruited as participants and were instructed to walk and run while carrying six backpacks with different designs. Ground reaction force (GRF) and running speed (km/h) data were collected using Kistler force plates and photocells, respectively. Quantitative data analysis was conducted using Jamovi statistical analysis software (version 23.0, <https://www.jamovi.org>). Single-factor analysis of variance was employed with a significance level of $\alpha=0.05$ to compare the effects of waist belts and elastic shoulder straps on shoulder impact forces during walking and running. In this study, a Dynamic Time Warping (DTW) algorithm program was developed using Python language in Microsoft Visual Code Studio software (version 1.64.2, Microsoft Corporation, USA) to align the differently recorded data and explore the temporal feature differences in shoulder impact forces for different backpack designs. The results indicate that shoulder impact forces during running are significantly greater than those during walking. Both waist belt and elastic shoulder strap designs significantly reduce the impact forces on the shoulders.

Keywords: *bBackpack design, shoulder impact, dynamic time warping (DTW)*

Variations in Physical Activity Awareness and Motivation between Users and Non-users of Physical Activity Movement Tracking Devices

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Introduction: There is a growing use of wearable technology across the world, notably the use of physical activity tracking devices for monitoring steps taken, heart rate, calories burned and sleep pattern among other fitness parameters. The use of physical activity (PA) tracking devices can be associated with higher awareness and motivation toward participation in physical activity. However, there is need for evidence to ascertain the relationship between their use and physical activity awareness and motivation. This study will seek to establish the difference in motivation levels and physical activity awareness between users and non-users of physical activity tracking devices and provide a recommendation on effective use of wearable technology to achieve higher PA motivation levels.

Methodology: This study will use the survey design method. Three hundred (300) participants across Budapest city, Hungary, selected by random sampling will be recruited through physical contact and social media. Physical activity awareness will be measured using World Health Organization's (WHO) Global Physical Activity Questionnaire (GPAQ). This study will be based on Self Determination Theory (SDT). Behavioral Regulation in Exercise Questionnaire (BREQ-3) (Markland & Tobin, 2004), will be used to assess the six SDT motivation aspects on a 5-point Likert scale. Data will be analyzed using SPSS version 29.0.2.0 (20).

Expected results: Technology is expected to serve as an aid to participation and attainment of individual PA goals, which will reflect a higher awareness and additional motivation to the users of wearable technology.

Keywords: *physical activity, motivation, movement tracking devices*

Physical activity of female students of the University of Montenegro

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Supervisors: Prof. Dr. Dušan Stupar, Dr. Bojan Mašanović

Objectives: Physical activity is one of the most important aspects of a healthy lifestyle at any age. Despite this, the latest results presented by the WHO (2022) are extremely worrying. According to them, 28% of the world's adult population and even 81% of adolescents are not physically active enough. The main goal of this research is to determine physical activity in the weekly regime of the life cycle of students in Montenegro.

Methods: The sample of respondents consisted of 369 female students (18-24 years old) of undergraduate and master studies at the Faculty of Philosophy and Philology in Nikšić, University of Montenegro. The research instrument was a short version of the IPAQ questionnaire, which assesses physical activity in the last week. It was estimated, using the metabolic equivalent (MET minutes), how much time female students spend weekly performing total physical activity, intensive (MET min = minutes x 8), moderate (MET min = minutes x 4) and light physical activity (MET min = minutes x 3). Descriptive statistics (arithmetic mean, standard deviation) were used for data processing.

Results: The results show that female students of the University of Montenegro spend 702.91 ± 259.56 MET minutes per week performing physical activities. At the same time, female students mostly practice moderate physical activity (288.46 ± 87.12 MET minutes, 72 minutes/week), then light (160.65 ± 29.16 MET minutes, 53 minutes/week) and the least intense (253.80 ± 143.80 MET minutes, 30 minutes/week). Also, female students of the first year are more active compared to other years. When it comes to basic studies, physical activity decreases with age, and then increases in master's studies.

Discussion: According to the criteria proposed by the WHO, the activity of Montenegrin female students is at a moderate level. The reasons for this can be found in the lack of free time for physical activity due to studies, as well as additional obligations, academic stress, etc. also affect reduced physical activity. Comparing the results with the results of other researches, it can be noticed that the level of physical activity of female students is at the level of female colleagues from the region, but much lower than that of female students from Europe.

Conclusion: Given the importance of physical activity in all areas of life, it is necessary to take appropriate measures to improve the physical activity of female students through the introduction of regular physical education classes at faculties, organized exercise, etc. It is also necessary to conduct additional research that includes other faculties and a larger number of students, in order to obtain as precise results and conclusions as possible.

Keywords: *physical activity, female students, Montenegro*

The correlation between hand strength, flexibility and cognitive function in rhythmic gymnasts aged 6-8 years old

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Supervisor: Prof. Dr. Tatyana Solomonovna Lisitskaya

Objectives: To explore the relationship between hand strength, flexibility and cognitive function in rhythmic gymnasts aged 6-8 years.

Subjects: 12 girls from Moscow Sofia Rhythmic Gymnastics Club, (age 6.75 ± 0.95 y).

Methods: Measuring hand grip strength, count the number of flexibility test movements within 10 seconds, cognitive functions including visual search, working memory and mental arithmetic ability measured by the 5×5 square Schulte table.

Results: 1. Schulte square has a negative correlation with left ($r=-0.508$, $P0.05$) and right hand grip strength ($r=-0.813$, $P0.05$), and Age has a positive correlation ($r=0.683$, $P0.05$). 2. Age has a positive correlation with right hand flexibility ($r=0.499$, $P0.05$), and right hand grip strength ($r=0.631$, $P0.05$).

Discussion: As age increases, the development of the nervous system leads to improved cognitive function. The training load of rhythmic gymnasts exceeds the exercise load that children aged 6-8 years old can bear, resulting in excessive fatigue. As a result, the higher the grip strength, the weaker the cognitive function.

Hand flexibility and grip strength increase with age, which is in line with the growth and development patterns of children.

Conclusion: 1. Cognitive functions including visual search, working memory and arithmetic increase with age. 2. The growth of hand grip strength is related to age. 3. The training load for rhythmic gymnasts aged 6-8 years old should avoid excessive fatigue.

Keywords: *rhythmic gymnastics, grip strength, cognitive function*

Healthy Lifestyle Habits Among Female University Students

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Supervisor: Dr. Valdemar Štajer

Objectives: Physical inactivity, sedentary lifestyle, and poor nutrition contribute to obesity among both youth and university students as young adults. (Knežević & Jandrić-Kočić, 2023). This paper examines the lifestyle habits among students at the University of Novi Sad, Serbia. **Methods:** The research included female students (N = 121) from three faculties. They filled out a questionnaire to assess lifestyle habits using Health Promoting Lifestyle Profile II (HPLP-II). **Results/Findings:** The main findings indicated that students from the Faculty of Sport and Physical Education (FSPE) had significantly higher scores ($p < 0.001$) on the HPLP-II questionnaire compared with both the students from the Faculty of Medicine and the Faculty of Technical Sciences. No statistically significant differences were observed between the other two faculties. **Discussion:** The observed differences indicate that students from the FSPE have excellent lifestyle habits as indicated by the HPLP-II (Walker & Pender, 2009), while female students of the other two faculties have moderate to good lifestyle habits. **Conclusion:** By analyzing the lifestyle habits of students, we will have a better chance to evaluate their starting points, and the expected trajectory of improvement when we want to include them in some type of physical exercise program, in hopes of reducing physical inactivity and sedentarism.

Keywords: *healthy habits, physical activity, university students*

Effects of Short and Longer Duration Eccentric and Concentric Resistance Training on Muscle-Tendon, Balance, and Gait Function in Older Individuals

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Beáta Csizmadia, Hungarian University of Sports Science
Supervisor: Prof. Dr. h. c. Tibor Hortobágyi

Introduction: Normal aging leads to declines in neuromuscular and mobility functions, including a ~60% decline in maximal voluntary force by age 70, accompanied by a ~25% reduction in muscle volume and quality (sarcopenia). Aging also affects tendon properties, contributing to functional capacity reductions in walking speed and balance. Our study aims to determine the impact of resistance training, involving short and longer duration concentric and eccentric muscle contractions, on muscle-tendon function and associated changes in walking economy.

Methods: Participants: Approximately 100 individuals aged 40 and over (50 males) will participate in a three-year study, randomized into four groups based on the duration composition of lower extremity exercises. Group 1: 2-1-1 s (Concentric contraction - 2s, Iso-

metric transition - 1s, Eccentric contraction - 1s); Group 2: 4-1-1; Group 3: 1-1-2, and Group 4: 1-1-4. Exercises include bilateral seated leg press, knee extension, and ankle press under metronome control, and unilateral standing calf raise.

Measurements: We plan to measure before and after training: maximal voluntary force, passive elastic properties, muscle thickness, Achilles tendon thickness and stiffness, whole leg muscle content, metabolic cost of transport during walking, single leg calf-raise test, and whole-body kinematic and kinetic gait analysis.

Findings: We anticipate that longer-duration eccentric resistance training will positively impact muscle-tendon properties, potentially reducing the cost of transport during walking. This expectation is based on existing data suggesting that resistance training, especially eccentrically-biased training, improves tendon stiffness, facilitating more efficient force transfer and reducing the cost of transport during gait. Additionally, increased sliding capacity between adjacent Achilles sub-tendons may enhance biomechanical function during walking.

Discussion: The findings of this study hold significant implications for exercise prescription in aging. To reduce age-related declines in neuromuscular and mobility functions. Longer-duration eccentric resistance training emerges as a potential intervention to enhance muscle-tendon properties, thereby positively impacting walking economy. The observed improvements in tendon stiffness, facilitated by eccentrically-biased training, may contribute to a more efficient transfer of force during gait. This aligns with existing literature emphasizing the benefits of resistance training on muscle quality and functional capacity in older individuals. The potential association between improved measures of muscle-tendon function underlying improved walking economy provided novel options to prescribe exercise in aging and improve quality of life.

Keywords: *eccentric overload, muscle-tendon function, cost of transport*

Differences in physical activity levels among female students in Iran and Hungary

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Supervisors: Prof. Dr. Pál Hamar, Dr. habil. István Soós

Introduction: Physical activity (PA) is a beneficial health behavior; however, globally, 81% of adolescents aged 11-17 years were insufficiently physically active in 2022. Adolescent girls were less active than adolescent boys, with 85% vs. 78% not meeting WHO

recommendations of at least 60 minutes of moderate to vigorous intensity physical activity per day. This study aimed to compare the physical activity levels among female high school students in Iran and Hungary.

Methods: The study included a sample of 620 female students aged 13 to 15 from Iran and Hungary (Mean age = 13.97; SD = 0.83). Participants were selected from (wealthy, moderate-, and lower-income districts) They completed two questionnaires online: international physical activity questionnaire (IPAQ) and a general information and demographic data questionnaire. Ethical approval for the study was obtained from the research ethics committee of the Hungarian University of Sports Science. The IPAQ consists of seven questions, which assess the frequency and duration of physical activity in three different intensity levels: low-intensity, moderate-intensity, and vigorous-intensity. Data analysis was carried out using IBM SPSS v. 26 software, and descriptive statistics, including frequencies, means, and standard deviations, were reported. The independent T-test was used to determine differences between variables in Iran and Hungary. Additionally, the one-way analysis of variance (ANOVA) was used to assess the differences among PA levels in female students of Iranian and Hungarian.

Results: The results showed that there is no significant difference between Iranian and Hungarian female students in physical activity levels. However, there is a significant difference in PA levels among students of the two countries. (Low activity level = 8.8 %, Moderate activity level = 39.3%, Vigorous activity level = 51.9% in Iranian female students and Low activity level = 13.5 %, Moderate activity level = 28.3%, Vigorous activity level = 58.2% in Hungarian female students) ($p \leq 0.05$).

Discussion and conclusions: The results of this study indicate that the mean levels of physical activity among female students in both countries are high, and there is no significant difference in the levels of physical activity between the two groups. However, there is a significant difference in PA levels (low-intensity, moderate-intensity, and vigorous-intensity) among female students of the two countries. Considering the World Health Organization's report on the decline in physical activity and the high self-reported results of physical activity levels based on the IPAQ (self-reporting), it can be stated that when evaluating results obtained from the IPAQ, researchers should consider the increased reporting rate of physical activity levels.

Keywords: *physical activity levels, Iranian and Hungarian female students*

Athlete's attitudes about Commercial Sports Brand Sponsorship and Brand Knowledge in the international tennis table event

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Supervisor: Dr. Radenko Matic

Objectives: Sponsorship in sports is of enormous interest in sports management. Its effects are essential for sports event organizers and commercial or non-sport commercial brands that use sports events to obtain publicity. The paper examines the influence of athletes' attitudes toward commercial sports sponsorship regarding a brand's ability to recall memories or associate with a brand and its products. **Methods:** The research included elite tennis table athletes (N = 281) who competed in the 25th International Christmas GEWO tennis table sport event organized in Novi Sad (Serbia) in December 2022. The congruity effects of commercial brand sponsorship on brand knowledge were monitored through a conceptual model that considered the Event Image, Event Usage, Sponsor Brand Image, and Fit as independent variables, further Self-congruity with event image as mediator, and Brand Knowledge as the dependent variable. The statistical analysis included measurement and structural models. **Results/Findings:** The main findings indicated that the Sponsor's Brand Image directly influences athletes' brand knowledge. At the same time, self-congruity with the event image mediates the relationship between other independent dimensions and brand knowledge. **Discussion:** Sponsor brand image is vital in strategic marketing, emphasizing quality, brand personality, and better characteristics than competitors. Further, Self-congruity with the event image of athletes contributes a lot to transferring the impact of essential sports event characteristics to brand knowledge about commercial sports brands. **Conclusion:** The theoretical and applied value of these results is vital for sports marketers and managers regarding the organization of similar small-scale sports events settings.

Keywords: *sponsorship, athletes, table tennis, sport event, sports brand*

E-sport performance measurement with physical activity intervention

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Introduction E-sports are associated with sedentary lifestyle, with the most influential factors in performance being the cognitive functions (Leis and Lautenbach, 2020; Ding et al., 2018). Cognitive functions can be measured with an EEG device (Shou and Ding,

2013; Shen et al., 2008; Trejo et al., 2015; Chai et al., 2016) and can be affected with physical activity (American College of Sports Medicine, 2022). This experiment, which already has preliminary unique test results, looked for the answer to whether there is a demonstrable relationship between fitness (VO₂max) and brain waves, as well as the measurable performance of e-sports in-game and out-of-game.

Sample and method: A group of 12 volunteer, nationally and internationally active male e-sports competitors participated in a multi-step study. We assessed their absolute VO₂max capacity with Cosmed Omnia software and treadmill, Garmin HR monitor and “esport_test” protocol. We then performed a STROOP test using an EEG device. After at least 1 hour of rest, fresh air, walking and eating, we performed a specific e-sport performance test. Throughout the test, the players had an EEG monitor on their head, which measured Alpha, Beta, Gamma, Theta and Delta brain waves with a response time of 1ms. The participants completed the test twice. Once without a break (control), once interrupted by a physical activity intervention (PA). There was a 15-minute break between the control and PA tests. At the end of the study, they filled out a questionnaire with demographic, game-specific, IPAQ and subjective mental fatigue questions.

Results: The results of the preliminary measurements show that we were able to induce mental fatigue with a long e-sport game and positive changes can be observed in the e-sport performance elements after HIIT training and in the question of subjective mental fatigue as well.

Conclusions: Based on the preliminary results of the series of tests carried out on a small sample, we assume that physical activity has effects on the subjective feeling of fatigue (based on the questionnaire detail of the research) and on the brain wave graphs generated by the EEG, especially the low-spectrum (alpha, delta and theta) waves. We plan to repeat the research on a larger international sample of at least 100 people, with the same design as the current one.

Keywords: *e-sports, physical activity, EEG, VO₂max*

Contemporary Media Representations of Romanian and Hungarian Sport Relations through Ice Hockey

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Romanian-Hungarian diplomatic relations are infamously known for their gratuitously long history of rivalry and interethnic conflicts. These conflicts not only have irreversibly determined the quality of political, cultural and sport relations between the two countries, but also played a role in establishing the tone of the above connections. The sport diplomatic ties between Romania and Hungary have been tense up to the present day and have been further intensified from the start by the cyclic reoccurrence of interethnic scandals and political power struggles channelled through pivotal sport events in general and ice hockey games in particular. The case of ice hockey is very specific, as the Romanian central hub of the sport is in Szeklerland, a region with Hungarian inhabitants as the majority and a unique regional-ethnic identity.

The incidents and scandals in the sport have not been constructive in sparking meaningful conversations and in easing diplomatic tension, but proved to be a prolific tool in the hands of the Romanian and Hungarian press in building and deconstructing victimhood, accentuating the image of the other and producing mass influencing narratives of high scale interethnic conflicts. The paper aims to explore the image of ice hockey and players as presented through the Hungarian and Romanian sport outlets after some highly debatable international sport events that caused major diplomatic rifts between the two countries. The discursive elements highlighted in the findings are historical references, the image of the other and the victim motif, as they were presented in the media.

Keywords: *sport relations, media representation, ice hockey*

The association between physical fitness, body composition, blood lipid profile, and cognitive function among the elderly

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Supervisor: Dr. Sylwester Kujach

Objectives: A growing body of scientific evidence indicates the positive impact of physical activity on preserving and/or restoring cognitive functions in the elderly. Although several reports confirm the link between physical fitness, body composition, and cognitive function, the specific components of physical fitness and their level of influence on cognitive function are not well-established. This study aims to investigate the correlation between physical fitness, body composition, blood lipid profile as well as cognitive function among the elderly.

Methods: 87 older adults met the inclusion criteria for the study (n=87; 69.3 ± 3.1 years old; 66 women and 21 men). The participants were subjected to a battery of measurements and tests such as: anthropometric (body composition), blood (lipid profile assessment), physiological (aerobic capacity and muscle strength) and psychological (cognitive function). The statistical analysis had been done to determine the association between aforementioned factors. Correlations were considered as statistically significant while p0.05 value criterion was met.

Results: The body mass index (BMI), fat percentage (Fat %) and fat mass (FM kg) were positively correlated with the Stroop test (all p0.05). Interestingly, no statistically significant associations between the blood lipid profile, aerobic capacity, or muscle strength and cognitive function had been observed.

Discussion: The aim of the present study was to evaluate the association between physical fitness, body composition and cognitive function among elderly. We found that BMI and fat mass were positively correlated with cognitive function. Unexpectedly, other factors such as blood lipid profile, aerobic capacity, muscle strength and cognitive function were not correlated.

Conclusions: The study indicated an association between BMI, fat mass and cognitive function among the elderly.

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Keywords: *aging, body composition, cognitive functions*

Effects of offensive and defensive playing strategy conditions on external loads in elite junior tennis players

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Supervisor: Dr. Csaba Ökrös

INTRODUCTION: Tennis is an unpredictable individual sport, where the outcome of the matches can be influenced by the players' style, technical-tactical decisions, their state of readiness, the court surface, and the weather (Kovacs, 2006). Of all these, the style of play is one of the most decisive factors. In tennis, four types are distinguished (counterpuncher, aggressive baseliner, serve and volleyer, and all-court player), which are predominantly associated with an offensive or defensive strategy (Roetert and Kovacs,

2019). Examining amateur female tennis players, these two types of strategies have different technical-tactical actions, activity profiles, and external and internal loads (Hoppe et al., 2019, 2020). The present study aimed to examine the differences in the external loads between offensive and defensive playing strategy conditions in elite junior tennis players.

METHODS: Six junior male tennis players (age: 15.7 ± 1.0 years; height: 180.7 ± 6.5 cm; weight: 71.0 ± 10.8 kg) played points in two playing conditions (offensive vs. offensive, defensive vs. defensive) for 10 minutes each. To determine the external load volume parameters, micromovement data (accelerations, decelerations, change of directions, and jumps) were measured using portable micro-sensors (Catapult OptimEye S5, Catapult Sports, Melbourne, Australia) at a sampling frequency of 10 Hz for the GPS and 100 Hz for the tri-axial accelerometer, gyroscope, and magnetometer. In addition, we also assessed intensity indicators of each tennis shot with smart tennis sensors (Zepp Tennis 2 Sensor, Zepp Labs, USA) which we mounted on the end of players' rackets. Wilcoxon signed-rank tests were used to determine the differences between offensive and defensive playing strategy conditions. The significance level was set at $p < 0.05$.

RESULTS: There were statistically significant differences between the two conditions in the total player load ($T = 0.0$; $Z = -2.201$; $p = 0.031$; $r = -0.90$) and in the change-of-direction low right parameter ($T = 0.0$; $Z = -2.201$; $p = 0.031$; $r = -0.90$). Moreover, in the defensive playing condition, the tennis players hit the forehands ($T = 0.0$; $Z = -2.201$; $p = 0.031$; $r = -0.90$) and the backhands ($T = 0.0$; $Z = -2.201$; $p = 0.031$; $r = -0.90$) with more spin. No significant differences were found between the two playing strategies in other variables.

CONCLUSION: Overall, our results indicate that tennis players perform more accelerations in all three planes of motion during the defensive strategy condition, suggesting that a high level of speed endurance is needed for this strategy. In addition, the players hit the ball with a higher spin in this strategy to push the opponent back as much as possible and to avoid unforced errors.

Keywords: *tennis, strategy, external load*

Effect of motor development training with a paper roll on the visuo-motor coordination of 5-6-year-old preschoolers

Petra Halmi, Hungarian University of Sports Science
Supervisor: Zsolt Csirkés

Introduction: at the age of 5-7, the greatest emphasis should be placed on the development of fine motor skills, which includes smaller, coordinated movements of the fingers. Through the proper implementation of functional forms of movement, the child can reach the level of motor development that marks school maturity. Adequate level of visuo-motor coordination is an essential condition for learning to write. During motor development, it is important that the exercises are adapted to the age and maturity characteristics of the children. In addition to the well-known tools, a simple object, a paper roll, can also be used effectively to develop visuo-motor coordination of preschoolers.

Objective: A two-month motor training with a paper roll has a positive effect on the visuo-motor coordination of 5-6-year-old preschoolers.

Hypotheses:

- (1) I hypothesized that as a result of a two-month motor development, there would be a significant difference between pre and post tests of the experimental group.
- (2) I hypothesized that there would be no significant difference between pre and post tests of the control group.
- (3) I hypothesized that as a result of a two-month training, the experimental group would show a significantly greater improvement in visuo-motor coordination compared to their peers in the control group.

Methods: The study included two preschool groups. The experimental group (Bástya Óvoda, Budapest; n=16; mean age 5.21 ± 0.433) consisted of preschoolers involved in the two-month 2x45 minute visuo and fine motor development per week, while the control group (Református Óvoda, Balmazújváros; n=21; mean age 5.19 ± 0.392) was made up of preschoolers who did not attend the trainings. Before and after the motor development, the visuo-motor coordination of both groups was measured with the Bender "A" test (Torda, 1994). Motor skills were taught through exciting activities with a paper roll based on an already existing methodology booklet (Balázs, 2020).

Results: After the post test the experimental group showed a significant improvement compared to the pre test, while I found no significant differences between pre and post test scores of the control group.

Summary: As a result of a two-month 2x45 minute motor training session per week, a significant improvement was found in terms of visuo-motor coordination of the preschoolers in the experimental group. The area investigated in the research is of particular importance from the point of view of school readiness of preschoolers.

Keywords: *visuo-motor coordination, fine motor skills, preschoolers*

Exercise Inhibits Hcc Tumor Growth and Modulates Lipid Metabolism Reprogramming In Time And Downregulates AMPK Pathway

Qian Yu, ChengDu Sport University
Supervisor: Dr. Wang Chun

PURPOSE: To examine the impact of exercise intervention on hepatocellular carcinoma and its metabolic processes. **METHODS:** Male C57BL/6 mice were randomly assigned to either a sedentary group (Sed) or an exercise group (Ex). After a period of 6 weeks, all mice were subcutaneously inoculated with Hepa1-6 cells on their right back. The exercise group (Ex) continued their exercise regimen for an additional 4 weeks in order to observe tumor growth in vivo. Mouse tumor tissues were subjected to LC-MS non-target metabolome sequencing. The expression of FASN was assessed in both tumor and adjacent tissues of hepatocellular carcinoma patients. Furthermore, the expressions of FASN, CPT1, CD36, and Ki67 were measured. Finally, the triglyceride content in mouse tumor tissue was determined.

RESULTS: The tumor inhibition rate in the Ex group (475.23 ± 22.16) exhibited a 20% decrease compared to the Sed group (590.59 ± 54.29), and there was a decrease in the expression of Ki67 (0.67 ± 0.075 ; 1.22 ± 0.068 ; $P < 0.05$). KEGG enrichment analysis of different metabolites in the Ex group and Sed group revealed that the AMPK signaling pathway enrichment was the most significant ($P < 0.01$). ADP was significantly up-regulated in the Ex group (136.64 ± 3.95 ; 79.13 ± 49.03 ; $P < 0.05$), while AICAR was significantly down-regulated (164.59 ± 48.13 ; 254.69 ± 12.32 ; $P < 0.05$). The expression of FASN in clinical tumor samples (222.7 ± 16.46) was significantly higher compared to that in para-cancer liver tissues (165.2 ± 11.85) ($P < 0.05$). Additionally, in the 102.975 ± 12.97 group, the expressions of FASN, CPT1, and CD36 were significantly higher than those in the Sed group (350.276 ± 3.75 ; 24.807 ± 3.42 ; 183.789 ± 17.18) ($P < 0.05$). Moreover, there was a noticeable increase in the accumulation of lipid droplets in tumor cells.

CONCLUSIONS: Exercise has the potential to further restrict the energy supply of tumor cells through the inhibition of fatty acid uptake, oxidative degradation, and de novo synthesis.

Keywords: *running wheel, cancer, lipid metabolism*

Inside the Athlete's Mind: The Dominance of Irrational Beliefs and their effect on Competitive Anxiety

Renátó Tóth, Hungarian University of Sports Science
Supervisor: Prof. Dr. László Tóth

Objectives: The purpose of this study is to examine the irrational beliefs of athletes. Many studies have proven the harmful effects of irrational beliefs on mental health, and some research has examined this topic in the context of sports. We aim to reveal the most dominant irrational beliefs among athletes and examine their impact on one of the most studied and treated issues in sports psychology - competitive anxiety.

Methods: A total of 407 male and female athletes participated in our research. Irrational beliefs and competitive anxiety were measured using the Hungarian version of the questionnaires (iPBI, CSAI). To explore associations and influencing factors, we employed correlation and regression analyses with the IBM SPSS statistical program.

Results: Our results indicate that Hungarian athletes scored highest on the low frustration tolerance scale, while scoring lowest on the depreciation scale. Irrational beliefs significantly predict all three components of competitive anxiety (cognitive anxiety, somatic anxiety, self-confidence), with the strongest explanatory power observed for cognitive anxiety.

Discussion: Hungarian athletes may face challenges in handling unexpected stressors, influencing both their mental health and sports performance. Athletes with illogical, extreme, and rigid thought patterns (irrational beliefs) are more likely to experience higher cognitive and somatic anxiety and lower self-confidence.

Conclusion: Considering our findings, further investigations into the impact of irrational beliefs on mental health and sports performance, as well as the effectiveness of treatment modalities for irrational beliefs (e.g., REBT) within the sports population, would be extremely important.

Keywords: *irrational beliefs, competitive anxiety, sport psychology*

Effect of an ACL prevention programme on dynamic knee valgus in female football

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Supervisor: Dr. Míra Ambrus

Introduction: Knee injuries, prevalent in soccer, often result from high loads during landing or directional changes, leading to dynamic knee valgus (DKV). Excessive DKV heightens the risk of knee injuries, notably ACL injury, particularly in women's soccer, affecting players' careers. Well-designed prevention programs can improve joint stability and movement technique, thereby reducing the risk of injury. Preventing ACL injuries is crucial for female

soccer players' health and success. However, research on injury prevention primarily targets male athletes or other sports, underscoring the necessity to assess tailored programs for female soccer players.

Hypothesis/Objective: This study aims to assess a physiotherapy program's effectiveness in reducing DKV and preventing ACL injuries in female soccer players.

Methods: Eighteen young female soccer players (mean age = 15 ± 1.11) without lower limb injury history participated. DKV was measured using a Kinect camera before and after the program. Paired-samples t-tests compared DKV and squat depth pre- and post-intervention.

Results: Significant differences were found in DKV right ($p=0.02$) and squat depth on both sides ($p<0.001$) between pre- and post-tests. Meanwhile, there was no significant difference on the DKV left side ($p=0.50$). Players exhibited right-side dominance.

Discussion: This study assessed the program's effectiveness in reducing DKV on dominant side, thus may prevent ACL injuries in female soccer players. Tailored physiotherapy programs could mitigate DKV and lower ACL injury risks, urging coaches and sports health professionals to consider such interventions for injury prevention and performance optimization.

Keywords: *dynamic knee valgus, female football, ACL prevention.*

The effect of prolonged caloric restriction with endurance exercise training on skeletal muscle in young female rats: Implication for autophagy

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Supervisor: Dr. Toshinori Yoshihara

Objectives: This study aimed to investigate the effects of prolonged caloric restriction with endurance exercise training on skeletal muscle mass and autophagic regulation in young female rats.

Methods: Twenty-three 5-week-old female Wistar rats were assigned to sedentary control (SED), caloric restriction (CR), exercise training (EX), or caloric restriction with exercise training (CR + EX) groups ($n = 5-6$). The rats in the EX and CR + EX groups performed voluntary wheel running for 12 weeks. The rats in the CR groups were given 70% of the amount of food provided to the SED group. After 12 weeks, the soleus and plantaris mus-

cles were removed, and the levels of autophagic markers (LC3-I, LC3-II, and LC3-II/I levels) were determined by Western blotting.

Results and Discussion: There were significant interactions between caloric restriction and exercise on the body weights and the soleus and plantaris muscle weights, suggesting that the combination of prolonged caloric restriction and exercise training can reduce body weight and skeletal muscle mass. A significant interaction on LC3-II and LC3-II/I levels were observed in the plantaris muscle, and this was significantly greater in the CR + EX compared with the EX and CR groups. Furthermore, in the soleus muscle, the LC3-II/I level in the CR + EX group was significantly higher than that in the CR group. These data suggest that increases in LC3-II and LC3-II/I levels may explain the low energy availability-induced reduction in the skeletal muscle mass.

Conclusion: Our data indicate that prolonged caloric restriction with endurance exercise training decreases skeletal muscle mass in young female rats and that these effects may be partially mediated by upregulation of autophagy.

Keywords: *autophagic regulation, caloric restriction, proteolysis*

Effects of extreme psychological stress on serum lactate-level

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Supervisor: Prof. Dr. Miklós Tóth

Introduction: Psychological stress can stimulate the cardiovascular system and increase metabolism. Our aim was to investigate basic metabolic parameters in a model of extreme mental stress.

Materials and methods: After a brief psychological introduction (10 min), we exposed university students (N=110, 82 males, 28 females) to a simulated combat situation for 2-4 minutes. After an overnight fasting, students consumed 30 min prior to the intervention either 75 g glucose solution (G-group) or sweetener with equal taste (C-group). Capillary blood sampling and blood pressure measurement was done before, immediately after the intervention and 30 minutes later. ECG was recorded continuously.

Results: 51.8 % of the participants had higher fasting glucose levels than 5.5 mmol/l. In the G-group both males' (5.65 ± 0.42 vs. 8.97 ± 2.35 mmol/l) and females' (5.28 ± 0.39 vs. 9.91 ± 1.41 mmol/l) glucose levels increased in response to the intervention. Glucose levels were also elevated in the C-group (males: 5.57 ± 0.4 vs. 6.43 ± 0.55 mmol/l, females: 5.41

± 0.34 vs. 5.95 ± 0.36 mmol/l). Video recordings showed very little physical activity during the stress situation. Despite this, we found a significant increase in lactate levels (males: 1.41 ± 0.46 vs. 3.59 ± 2.06 mmol/l, females: 1.21 ± 0.38 vs. 2.24 ± 0.98 mmol/l). We have found the increase of the lactate level significant both in the case of males and females ($p < 0.01$). We did not find a significant difference between the G-group and the C-group. We have found a significant difference between males and females peak lactate level ($p < 0.01$). Interestingly, C-group lactate returned to the baseline level after 30 minutes, while the G-group had significantly higher restitution lactate levels ($p < 0.02$). Moreover in some cases peak lactate levels were higher than 10-12 mmol/l, similar to levels in elite athletes in response to a spirometry test executed to total voluntary exhaustion.

Conclusions: The elevation of the fasting blood sugar level is probably caused by a stimulated sympathetic nervous system already prior to the intervention. We have found a difference between male's and females' stimulated lactate levels. We have observed a higher lactate level at the stress model used by us than that in the literature. Oral glucose tolerance test did not influence the maximum value of the lactate, but it caused a prolonged high lactate level. The metabolic response to the few minutes of psychological intervention is remarkable and the explanation requires further research.

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Keywords: *extreme psychological stress, lactate, glucose, mental-tactical method*

PGC-1 α activation boosts exercise-dependent cellular response in the skeletal muscle

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Supervisor: Prof. Dr. Zsolt Radák

The role of Peroxisome proliferator-activated receptor-gamma coactivator alpha (PGC-1 α) in fat metabolism is not well known. In this study, we compared the mechanisms of muscle-specific PGC-1 α overexpression and exercise-related adaptation-dependent fat metabolism. PGC-1 α trained (PGC-1 α Ex) and wild-trained (wt-ex) mice were trained for 10 weeks, five times a week at 30 min per day with 60 percent of their maximal running capacity. The PGC-1 α overexpressed animals exhibited higher levels of Fibronectin type III domain-containing protein 5 (FNDC5), 5' adenosine monophosphate-activated

protein kinase alpha (AMPK- α), the mammalian target of rapamycin (mTOR), Sirtuin 1 (SIRT1), Lon protease homolog 1 (LONP1), citrate synthase (CS), succinate dehydrogenase complex flavoprotein subunit A (SDHA), Mitofusin-1 (Mfn1), endothelial nitric oxide synthase (eNOS), Hormone-sensitive lipase (HSL), adipose triglyceride lipase (ATGL), G protein-coupled receptor 41 (GPR41), and Phosphatidylcholine Cytidylyltransferase 2 (PCYT2), and lower levels of Sirtuin 3 (SIRT3) compared to wild-type animals. Exercise training increased the protein content levels of SIRT1, HSL, and ATGL in both the wt-ex and PGC-1 α trained groups. PGC-1 α has a complex role in cellular signaling, including the upregulation of lipid metabolism-associated proteins. Our data reveals that although exercise training mimics the effects of PGC-1 α overexpression, it incorporates some PGC-1 α -independent adaptive mechanisms in fat uptake and cell signaling.

Keywords: *exercise, mitochondrial function, lipid Metabolism*

Evaluation of the Quality of Supporting Activities at Charles University

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Supervisor: Dr. Jan Šíma

Contemporary educational institutions are no longer confined to offering academic study programs alone; they have expanded their scope to encompass a diverse range of supporting activities aimed at creating a conducive and holistic environment for students and other target groups. The success of these institutions is no longer solely dependent on the quality of education they provide but also on the perceived quality of the supplementary services they offer, which often surpass the demand for formal education. While academic program evaluations are legally mandated in the Czech Republic, the assessment of supporting activities remains understudied and underappreciated.

This research project focuses on addressing this gap by undertaking a comprehensive evaluation of the quality of supporting activities at Charles University, a prominent institution in the Czech Republic. The primary objectives are to gather information regarding student satisfaction with the various supporting activities available at the university and to formulate recommendations for enhancing student contentment. Additionally, the study aims to propose a methodological framework for systematically collecting data to evaluate the quality of supporting activities across all faculties at Charles University.

In the initial phase of the project, a preliminary study was conducted to understand stu-

dents' expectations from key supporting activities, namely the canteen, study room/library, and services provided by the study department. This preliminary research provides valuable insights into the baseline expectations of students. The subsequent phase, which is currently in progress, will focus on evaluating the extent to which these expectations have been met by assessing the perceived quality of the services offered.

The anticipated outcomes of this research include valuable insights into student satisfaction levels with the supporting activities at Charles University. The findings will serve as a foundation for making improvements in the supplementary services offered to students. Moreover, the proposed methodological approach can be adapted and applied to assess the quality of supporting activities in other educational institutions, thereby contributing to the enhancement of student experiences and overall educational quality. This study aligns with the ongoing efforts to foster excellence in Czech higher education and ensure that students receive a well-rounded and fulfilling educational experience.

Keywords: *quality, higher education, supporting activities*

The appearance of homonegativity and discrimination in physical education and sport among university students

Veronika Fülöp, Hungarian University of Sports Science
Supervisor: Dr. Noémi Gyömbér

Introduction: Negative attitudes and discrimination permeate many areas of life, including the sporting environment and physical education, with the academic environment and the field of competitive sport being no exception. The hierarchical structure, physical contact and authoritarian leadership in sport can create an atmosphere that can lead to abuse among athletes (Vertommen et al., 2018). A common basis for discrimination is sexual identity. Homonegativity is a broader concept than homophobia, which includes cognitive beliefs regarding homosexual persons (Hudson & Ricketts, 1980). Discrimination can have a negative impact on mental health (Coggen et al., 2003), academic achievement (Juvonen, 2010), and the love of sport (Jewett et al., 2019). Regarding mental health, the concept of resilience is receiving increasing attention as a protective factor (Keczei, 2019). Resilience is psychological flexibility or mental fortitude (Vargha et al., 2020), which helps restore mental health after difficult and challenging experiences, and reduces the negative effects of stress (Herrman et al., 2011).

Objective and hypotheses: Our research aims to investigate specific forms of prejudice and

discrimination among male university students and competitive athletes. Our study covers the manifestations of discrimination and its prevalence, as well as the extent of homonegativity and its relationship with mental health.

Sample and methods. The target population of the study was male university students aged 18 years and older (N=123; Mage=22.29; SD=5.20). In addition to demographic questions, subjects completed a test battery consisting of several questionnaires (Bogardus Social Distance Scale; Modern Homonegativity Scale; Mental Health Test) on an online platform, which took approximately 20 minutes.

Results: The discrimination experienced by respondents was most often reported in physical education classes (47.2%) and training sessions (29.3%), and most commonly related to sexual orientation and gender identity (31.7%). Heterosexuals were found to be significantly more homonegative than non-heterosexuals ($t=10.592$, $p<0.01$), as well as competitive athletes than non-competitive athletes ($t=1.742$, $p<0.01$). Greater social distance is held by heterosexuals and those who have not experienced discrimination. In terms of resilience, the results for those who experienced discrimination were significantly more negative ($p<0.001$).

Summary: In the light of our findings, we consider it important to draw attention to the fact that discrimination is often directed at sexual orientation, and it would be particularly useful to take steps to prevent it through psychoeducation, including resilience and mental health related aspects. Providing an appropriate environment and atmosphere before PE lessons and trainings can further enhance the already known positive effects of physical activity.

Keywords: *homonegativity, discrimination, mental health*

Evaluating football clubs using ORESTE and AGREPREF

Veronika Krause, Charles University
Supervisor: Dr. Jan Šíma

Understanding and evaluating the performance of football clubs is crucial for stakeholders ranging from fans to investors. Many researchers have created many approaches to evaluate their efficiency, usually using data envelopment analysis (DEA) (e.g. Badmus, 2019; Haas, 2003; Jardin 2009). Some researchers have constructed an econometric model (e.g. Baur and McKeating, 2009). There is no scientific consensus on how to evaluate their performance in a season, especially when it comes to selected criteria. According to Freyrer (1991), a football club has 3 goals – sporting, financial and social. Only few studies evaluate clubs based on all three areas.

In this study, we propose a comprehensive evaluation framework utilizing the ORESTE and AGREPREF methods, both of which are multi-criteria decision-making techniques. ORESTE is based on the ordinal order of variants and criteria. AGREPREF is based on pairwise comparisons of individual variants. Our sample comprises football clubs from the English Premier League during the 2018/19 season. The criteria were selected based on Šíma (2019) and Badmus (2019) approach. Both Šíma (2019) and Badmus (2019) used DEA to evaluate the efficiency of football clubs. They tried to focus on all three goals of football clubs. The selected criteria for the study were the number of points, revenue, increase of Facebook fans, wages, number of employees, and assets consumed. Every criterium was evaluated by points at the scale 1 to 20 and the weight was calculated based on the points allocated.

Analysis using the ORESTE method identifies Wolverhampton Wanderers, Watford, and Tottenham Hotspur as top performers. On the bottom, there were Manchester United and Arsenal. AGREPREF findings confirm the dominance of Wolverhampton and Watford, while also showcasing the strong performance of Manchester City. The worst results showed Fulham and Bournemouth. Both ORESTE and AGREPREF selected Wolverhampton as the winner, but the rest of the ranking is slightly different.

Keywords: ORESTE, AGREPREF, football club

The effects of tai chi on lower limb biomechanics in patients with knee osteoarthritis: a scoping review

Wenlong Li, Ningbo University
Supervisor: Prof. Dr. Yaodong Gu

Objective To systematically analyse the effects of tai chi on lower limb biomechanics in patients with knee osteoarthritis.

Methods A search was conducted for studies on tai chi on lower limb biomechanics in patients with osteoarthritis of the knee in the databases of CNKI, Wanfang database, VIP, Web of Science, PubMed, and Scopus from the time of database construction to 14 December 2023. After screening for inclusion and exclusion criteria, we extracted data on authors, publication dates, participant characteristics, interventions, and intervention outcomes. The quality of the papers was evaluated using the Mixed Methods Research Evaluation Tool.

Results Seventeen studies with 866 participants from China, the United States, and South Korea were included. The papers spanned from 2003 to 2022 and comprised 7 English and

10 Chinese papers. Of these, 12 were randomised controlled trials and 5 were quantitative non-randomised controlled trials. Participants were mainly middle-aged and elderly tai chi beginners in patients with initial, early, and intermediate osteoarthritis of the knee, and the interventions were mostly based on 24-form simplified tai chi and Sun-style tai chi, with no adverse events occurred except for soreness in the early stage of the exercise intervention. The assessment focused on the effects of tai chi on lower limb muscle strength, range of motion, plantar loading, and gait in patients with knee osteoarthritis.

Conclusion Tai chi reduces subjective pain in patients with osteoarthritis of the knee, improves muscle strength in the lower limbs, increases the range of motion of the joints, and has a high degree of safety.

Keywords: *tai chi, knee osteoarthritis, biomechanics*

Exploring Biomechanical Variations in Ankle Joint Injuries Among Latin Dancers with Different Stance Patterns: Utilizing OpenSim Musculoskeletal Models

Xiangli Gao, Ningbo University
Supervisor: Prof. Dr. Yaodong Gu

Background: Dancers represent the primary demographic affected by ankle joint injuries. In certain movements, some Latin dancers prefer landing on the Forefoot (FT), while others prefer landing on the Entire foot (ET). Different stance patterns can have varying impacts on dancers' risk of ankle joint injuries. The purpose of this study is to investigate the differences in lower limb biomechanics between Forefoot (FT) dancers and Entire foot (ET) dancers.

Method: A group of 21 MT dancers (mean age 22.3 (S.D. 1.5) years) was compared to a group of 21 FT dancers (mean age 23.3 (S.D. 1.2) years), performing the kicking movements of the Jive in response to the corresponding music. We import data collected from Vicon and force plates into OpenSim to establish musculoskeletal models for computing kinematics, dynamics, muscle forces, and muscle co-activation.

Result: In the sagittal plane: ankle angle (0% - 100%, $p = 0.001$), In the coronal plane: ankle angle (0% - 9.83%, $p = 0.001$) (44.34% - 79.52%, $p = 0.003$), (88.56% - 100%, $p = 0.037$), ankle velocity (3.73% - 11.65%, $p = 0.017$) (94.72 - 100%, $p = 0.031$); SPM analysis revealed that FT dancers depicted a significantly smaller muscle force than ET dancers

around ankle joint during the stance phase, and FT dancers revealed smaller co-activation than ET dancers around ankle joint during the descending phase.

Conclusion: This study biomechanically demonstrates that in various stance patterns within Latin dance, a reduction in lower limb stance area leads to weakened muscle strength and reduced co-activation around the ankle joint, and results in increased ankle inversion angles and velocities, thereby heightening the risk of ankle sprains.

Keywords: *latin dancers, ankle sprain, muscle force, biomechanics, stance Patterns*

A Comparison of the Biomechanical Effects of Stair Descent in Chronic Ankle Instability Patients and Healthy Individuals under Cognitive Tasks and Visual Deprivation Conditions

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Supervisor: Prof. Dr. Yaodong Gu

Background: Chronic Ankle Instability (CAI) is a prevalent ankle joint disorder characterized by factors such as structural ligament damage, proprioceptive deficits, and neuromuscular control impairments. Individuals with CAI may face an increased risk of ankle sprains during stair descent and dual-task scenarios. Understanding their motor impairments in these contexts is essential. Stair descent imposes higher demands on ankle joint stability and dynamic balance, with visual, vestibular, and somatosensory input playing crucial roles in gait control. Introducing cognitive tasks may impact motor control, especially in dual-task scenarios for individuals with CAI. This study aims to compare dynamic stability, kinematics, kinetics, and muscle activation during stair descent between CAI patients and healthy individuals, focusing on the influence of dual-task interventions. The research provides theoretical insights for enhancing safety during stair descent in daily activities.

Methods: Thirty male CAI patients and healthy males were recruited from Ningbo University. The experiment involved four stair descent conditions, varying visual input and cognitive task demands. Kinematic and kinetic data were collected using a Swiss Kistler force platform and a Vicon motion capture system, synchronously recording electromyographic (EMG) signals from eight lower extremity muscle groups. Data were processed using Visual3D software. Three-way ANOVA investigated the effects of different factors on stair descent gait. The analysis included main effects, interaction effects, and simple effects among subject types, visual input, and cognitive task conditions.

Results: Cognitive tasks and visual deprivation led to a statistically significant reduction in stair descent speed ($p = 0.001$), suggesting the adoption of a more conservative gait strategy for enhanced stability. Analysis of knee and ankle joint torques revealed a significant decrease in peak extension under these conditions ($p = 0.001$), indicating a notable impact on torque regulation. Dynamic stability measures, including Center of Mass (CoM) position, CoM velocity, and Margin of Stability (MoS), exhibited statistically significant alterations ($p = 0.003$), highlighting changes in dynamic balance during stair descent. Furthermore, knee joint angles during support phases were significantly influenced by visual conditions ($p = 0.040$), resulting in notable kinematic variations. Muscle activation patterns demonstrated statistically significant variations with visual conditions ($p = 0.020$), underscoring the crucial role of visual input and cognitive tasks in modulating muscle activation.

Conclusion: These findings illuminate the complex effects of cognitive tasks and visual deprivation on stair descent control mechanisms. Understanding the motor impairments in CAI patients emphasizes the need for interventions considering cognitive tasks and visual input to enhance safety and effectiveness during stair descent. This study offers empirical support for exploring the interactive relationship between cognition and vision in gait control, providing valuable references for future research and rehabilitation practices. The findings contribute to the field's knowledge, potentially facilitating successful submission to academic journals.

Keywords: *chronic ankle instability, sStair Descent, cognitive tasks, visual deprivation, biomechanics*

Acute aerobic and resistance high-intensity interval trainings affect tryptophan metabolism among the elderly

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Supervisor: Dr. Sylwester Kujach

Objectives: Tryptophan (Trp) metabolism is a well-understood metabolic pathway with diverse effects on tissues such as muscles, liver, and the brain. Trp metabolites have neurotoxic or neuroprotective effects, and their imbalance is observed, among others, in aging. Aging is associated in general with, but not limited to, the decreased physical activity levels. Hence, the search for exercise interventions that increase the level of neuroprotective metabolites and reduce neurotoxic: neuroprotective metabolite ratios in the elderly people are required.

Therefore, we propose acute high-intensity interval training (HIIT) as a potential modulator of Trp metabolism.

Methods: Single bout of HIIT was completed by 39 participants who were divided into two groups: aerobic HIIT (AHIIT; n=19; 69.3 ± 3.1 years old; 14 women and 5 men) and resistance HIIT (RHIIT; n=20; 69.7 ± 3.8 years old; 15 women and 5 men). AHIIT comprised 8 sets of 1-min exercise on a bicycle ergometer at 90% of maximal aerobic power with 1 min passive rest between sets. RHIIT consisted of performing 8 resistance exercises with their own body weight or using resistance bands, lasting 1 minute with a 1-minute passive rest between sets. All training procedures were preceded by a 5-minute warm-up and ended with a 3-minute cool-down. Blood samples from the cubital vein were collected before and immediately after acute AHIIT and RHIIT for the Trp metabolites analysis using the LCMS method.

Results: Trp levels decreased after acute exercise in the RHIIT group (p=0.04) and showed a decreasing tendency in the AHIIT group (p=0.09). No significant changes had been observed in metabolites such as kynurenine (KYN), kynurenic acid (KYNA), 3-hydroxykynurenine (3-HAA), 3-hydroxyanthranilic acid (3-HA), xanthurenic acid (XA) and quinolinic acid (QA) (all p>0.05). Interestingly, the combined results indicated a decrease in Trp concentration and (KYN+3HK):(KYNA+XA) ratio levels from pre to post HIIT (p=0.01 and p=0.04, respectively)

Discussion: Acute HIIT changes the metabolism of Trp towards increasing the concentration of neuroprotective metabolites. The decreased level of the neurotoxic: neuroprotective metabolite ratio expressed as (KYN+3HK):(KYNA+XA) is a promising direction of changes following HIIT. Hence, long-term (at least 12-week) exposure to AHIIT and RHIIT may be a sufficient stimulus to induce beneficial changes in Trp metabolism among the elderly.

Conclusion: Decreased Trp concentration and (KYN+3HK):(KYNA+XA) ratio levels in the blood following acute HIIT are promising changes for health among the elderly.

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Keywords: *kynurenine pathway, high-intensity interval training, aging*

Mixed Strategy in Elite Fencing - Using Sabre as an Example

Zhang Qingyuan, Hungarian University of Sports Science
Supervisors: Zhang Qingyuan, Prof. Dr. Tamás Sterbenz

Fencing is a combat sport in which two athletes use swords to attack and defend against one another with the aim of striking their opponent in order to score points. There are team competitions in fencing, but there will never be doubles, so fencing can also be called a person-to-person sport, and each different opponent leads to a change in the athlete's strategy. Such instability makes fencing a statistically difficult sport, so there is little research on mixed strategy model of fencing in the past literature. To understand the strategy probability distribution of the male elite sabre fencers, we use data from the top 10 male sabre fencers' matches during 2023 to provide an empirical test of the theory of mixed strategy equilibrium. We found that elite fencers' abilities in both attack and defend sides are awesome, but still have some differences and tendencies. This paper will show the rate of awarding hits when they use different strategies and how they choose and change their strategy, helping understand and explore the elite mixed strategy in sabre nowadays.

Keywords: *mixed strategy, fencing*

Chronic Ankle Instability patients adopt an altered movement pattern during unanticipated landing task

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Supervisor: Prof. Dr. Yaodong Gu

Background: Individuals with chronic ankle instability (CAI) demonstrated altered movement patterns during unanticipated landing compared to control individuals. Understanding the effects of muscle mechanics and energetics on individual movement patterns during landing could enhance motor control strategies for patients with ankle sprains. Therefore, the purpose of this study was to investigate the muscle mechanical and energetic characteristics of patients with chronic ankle instability (CAI) and control patients during unanticipated landings.

Method: Fifteen individuals with CAI (age: 21.8 ± 1.5 years; height: 177.4 ± 5.35 cm; weight: 78.2 ± 8.14 kg) and fifteen controls (age: 22.5 ± 1.2 years; height: 176.8 ± 4.82 cm, weight: 76.7 ± 7.68 kg) performed an unanticipated landing task as three-dimensional motion capture, ground reaction force (GRF), and muscle activation data were collected. A musculo-skeletal model was used to estimate muscle force and joint power among these two groups. The product of angular velocity in the sagittal plane and joint moment data represented joint power. Energy dissipation and generation by the ankle, knee, and hip joints were calculated by integrating regions of the joint power curve.

Results: Individuals with CAI demonstrated a greater force-generating capacity in the vastus muscles compared copers during the unanticipated landing task, while copers exhibited higher peak muscle forces in the medial gastrocnemius ($p=0.007$), lateral gastrocnemius ($p=0.002$), soleus ($p=0.004$), and peroneus longus ($p0.001$). In addition, joint power in CAI individuals during unanticipated landing shifted from the ankle to the knee and hip ($p0.001$).

Conclusion: These findings suggest that individuals with CAI exhibit a motion control strategy during unanticipated landing tasks. The differences in peak forces and force-generating capacities of proximal muscles may allow them to compensate for previously described deficits in distal muscles. Energy redistribution issues observed in CAI patients could contribute to the transition of coper patients towards developing CAI.

Keywords: *chronic ankle instability, copers, landing*

The effect of long-term lactate and high-intensity interval training (HIIT) on brain neuroplasticity of aged mice

Lei Zhou, Hungarian University of Sports Science; **Soroosh Mozaffaritabar**, Hungarian University of Sports Science
Supervisor: Prof. Dr. Zsolt Radák

Extensive research has confirmed numerous advantages of exercise for promoting brain health. More recent studies have proposed the potential benefits of lactate, the by-product of exercise, in various aspects of brain function and disorders. However, there remains a gap in understanding the effects of lactate dosage and its impact on aged rodents. The present study first examined the long-term effects of three different doses of lactate intervention (2000mg/kg, 1000mg/kg, and 500mg/kg) and high-intensity interval training (HIIT) on aging mice (20-22 months) as a pilot investigation. Subsequently, we investigated the long-term effects of 500mg/kg lactate intervention and HIIT on brain neuroplasticity in aged mice (25-27 months).

The results of the pilot study demonstrated that both HIIT and different doses of lactate intervention (500mg/kg and 2000mg/kg) positively impacted the neuroplasticity biomarker VEGF in the hippocampus of aging mice. Subsequently, the follow-up study revealed that long-term HIIT significantly improved the performance of mice in open-field, novel object recognition, and passive avoidance tests. However, lactate intervention did not significantly affect these behavioral tests. Moreover, compared to the control group, both HIIT and

lactate intervention positively influenced the angiogenesis signaling pathway (p/t-AKT/ENOS/VEGF), mitochondrial biomarker (SDHA), and metabolic protein (p/t-CREB, p/t-HSL, and LDH) in the hippocampus of aged mice. Notably, only lactate intervention significantly elevated the BDNF (PGC-1 α , SIRT1, and BDNF) signaling pathway and metabolic content (lactate and pyruvate). In the end, long-term HIIT and lactate intervention failed to change the protein expression of p/t-MTOR, iNOS, nNOS, HIF-1 α , SINAPSIN, SIRT3, NAMPT, CS, FNDC5 and Pan Lactic acid-Lysine in the hippocampus of aged mice.

In summary, the present study proved that long-term HIIT and lactate treatment have positive effects on the brain functions of aged mice, suggesting the potential usage of lactate as a therapeutic strategy in neurodegenerative diseases in the elderly population.

Keywords: lactate, exercise, aging, brain function, lactylation, hippocampus

Effects of time-restricted eating on the changes of body composition and visceral fat

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Introduction: Nowadays, obesity is a globally spread problem of healthcare. It significantly increases the risk of developing cardiovascular diseases and metabolic syndrome, thus creating an enormous financial burden on the healthcare systems worldwide. Multiple studies proved that there is a strong correlation between the so-called civilization diseases and abdominal obesity, which is associated with an increased amount of visceral fat. Recently, time-restricted eating diets have been becoming more popular due to their efficiency in weight loss. However, there is no sufficient data from human studies available to prove this correlation.

Objective: We examined the effects of time-restricted eating on the change of visceral fat quantity and body composition.

Materials and methods: We used an internet survey to find people to join our study. 154 non-competitive athletes, willing to lose weight adults completed it. People living with chronic illness and people categorized too lean according to their BMI or amount of visceral fat were excluded. Thirteen subjects (9 females and 4 males) completed the total twelve-week diet protocol. We chose one of the most widespread methods the time-restricted eating, which controls the consumption of the calorigen nourishment with a so-called time-window methodology. There were no restrictions in terms of nutrition during the

'eating-window'. Body composition and the amount of visceral fat were measured by the DEXA, type Lunar Prodigy instrument. To trace the changes in the body composition and the quantity of the visceral fat affected by the diet, we took the measurements right before the start and on the 13th week of the examination after the termination. In regards of the population of the study we did statistical analysis only with the group of females. In their case, we investigated the effects of the diet on the body composition with the Wilcoxon signed rank test. Our hypotheses were tested on 5% significancy-level.

Results: In case of 6 out of the 9 females, while in case of 3 out of 4 males, the amount of visceral fat decreased. We did not experience any changes related to body composition in case of 4 subjects. In the group of females, the largest amount of visceral fat decrease was 43%, while in the group of male subjects this type of fat loss was 66%. As a result of the diet, we saw in the female group a significant fat tissue decrease on the regions of the lower limbs, torso, android, gynoid and the whole body. There were no noticeable difference in any of the groups neither in the amount of absolute nor the relative muscle weight.

Conclusion: The results are promising in case of both groups. Twelve weeks of diet seems to be sufficient for measurable amount of visceral fat change. In two cases, the visceral fat loss even decreased into the healthy range. Our goal is to continue our studies, including further subjects.

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Keywords: *visceral fat, body composition, time-restricted eating*

DNA methylation-based aging clocks of 59 Olympic Champions: Are they younger or older than their chronological age?

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Objective: Because lifestyle, including exercise habits, are modulators of DNA methylation, we suggested that the DNA methylation-based aging clocks of Olympic champions would differ from the mean population.

Methods: Fifty-nine Olympic champions voluntarily participated in our study, which was approved by the National Center for Public Health (7147-6/2022EUIG). The control

group was a non-Olympic champion group. Blood samples were collected and stored in evacuated tubes containing EDTA as an anticoagulant for determination of erythrogram. Blood samples were centrifuged and stored at -80°C . Epigenetic clocks are considered highly promising molecular biomarkers of aging. The following epigenetic clocks were used: Hannum's blood-specific clock (Hannum et al., 2013), Horvath's pan-tissue clock (Horvath 2013), PhenoAge (Levine et al., 2018), GrimAge (McCrory et al., 2021), the DunedinPACE clock (Belsky et al., 2022), and DNAmFitAge (McGreevy et al., 2023). The telomere length was also evaluated by Horvath's software which estimates the telomere length from methylation (Pearce et al., 2022).

Results: The first-generation epigenetic clocks are associated with mortality risk Hannum and Horvath clocks, the second-generation clocks are the prediction of aging-related morbidity, disability, and mortality by DNAm biomarkers is enhanced by the incorporation of physiological data like PhenoAge, GrimAge, and DunedinPACE. DNAmFitAge is a third-generation epigenetic clock that is sensitive to the level of physical fitness. There is a relationship between chronological age and DNA methylation-based aging clocks, and except Hannum and DNAmFitAge Olympic champions epigenetic age is younger than their chronological age. When the age acceleration was examined again, Olympic champions had significantly decelerated DNA methylation-based aging, except Hannum and DNAmFitAge. We have calculated the telomere length from the methylation data, and telomere length decreases with aging and Olympic champions have significantly longer telomeres compared to non-champions.

Discussion: The DNA methylation-based aging clocks show that Olympic champions are younger than their chronological age, have decelerated aging clocks, have greater protection against lifestyle-related diseases, and have longer telomeres. It appears that not all epigenetic clocks came up with the same results. In the mentioned epigenetic clocks (Horvath clock, PhenoAge, GrimAge, DunedinPACE) Olympic champions' epigenetic age is younger than their chronological age.

Conclusion: It is advisable to conduct further investigations into other epigenetic clocks, as their results may vary. Aging is acknowledged as a multifaceted process. An epigenetic clock provides insights into this process from a singular perspective.

Keywords: *Olympic champions, epigenetics, DNAm biomarkers*

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