10th INTERNATIONAL SCIENTIFIC CONFERENCE ON KINESIOLOGY

OPATIJA, CROATIA, SEPTEMBER 12-15, 2024

BOOK OF ABSTRACTS

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Dario Novak and Dario Škegro

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HAMSTRING FLEXIBILITY ASSESSMENT USING TWO UNILATERAL CLINICAL TESTS

Dalibor Kiseljak
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Introduction
The following four clinical tests are commonly used to assess the hamstring muscle length: Sit and Reach Test, Stand and Reach Test, Passive Knee Extension Test (PKE) and Active Straight Leg Raise Test (ASLR). However, the first two tests are not sufficient to differentiate between left and right sides since the results are based on simultaneous bilateral assessment.

The aim of this study was to perform two unilateral clinical tests – PKE and ASLR, to determine sex differences in hamstring flexibility and find out what the correlation of the tests is.

Methods
The sample consisted of 70 healthy participants (45 women and 25 men), with the average age of 23±3.6 years, ranging from 19 to 40 years.

For PKE, measurement was made bilaterally, using the digital goniometer. The kinematic features of ASLR were also evaluated bilaterally, starting on-site with the 2D method, using a HD camera, and then off-site using the Kinovea motion analysis software.

T-test for large independent samples was used to determine obtained differences. Pearson correlation coefficient (r) was calculated. The data were analyzed using Statistica 14 software package.

Results
In the PKE, men (n=50, M=144.92°) had a significantly smaller ($p<0.01$) passive range of extension of the lower leg in the knee, compared to women (n=90, M=152.8°). In the ASLR test, the difference was statistically significant ($p<0.05$) in the direction of better results for women (M=76.04°), compared to men (M=70.98°). In both tests, there were no significant differences ($p>0.05$) between the dominant and non-dominant leg.

A strong positive correlation (r=0.642) was found between the values of PKE and ASLR bilaterally (n=140; MPKE=149.99°±13.03°; MASLR=74.23°±13.33°), both for women; r=0.656 (n=90; MPKE=152.8°±14.56°; MASLR=76.8°±13.75°), and men; r=0.551 (n=50; MPKE=144.92°±8.17°; MASLR=70.98°±9.59°). Overall, correlation coefficients were r=0.648 for the left, and r=0.643 for the right lower extremities, respectively.

Conclusions: This research showed a strong positive correlation (r=0.642) between PKE and ASLR. Unexplained variance includes different sources of variability, e.g., ASLR as an active test, versus PKE which is passive, different tools (digital goniometer versus Kinovea), flexibility of the thoracolumbar fascia and/or contralateral hip flexor tightness/shortness affecting ASLR results. Men showed significantly lower hamstring flexibility.

Keywords: *examination, goniometry, Passive Knee Extension Test, Active Straight Leg Raise Test*

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RESEARCH PROGRESS ON THE EFFECTS OF DIFFERENT EXERCISE MODES ON THE SECRETION OF EXERCISES AFTER SPINAL CORD INJURY

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Purpose
Early treatment and clinical rehabilitation of spinal cord injury (SCI) remain a very challenging problem in today's medical field. Exercise training is a conventional treatment strategy throughout the entire treatment process for SCI patients. Planned, structured and repetitive exercise training has obvious beneficial effects on a series of functional recovery after SCI. Currently, exercise training methods for SCI patients mainly include aerobic exercise, endurance exercise, strength exercise, high-intensity interval training and physical and mental exercise, etc., which play a positive role in enhancing skeletal muscle function, inducing neuroprotection and regeneration, thereby affecting SCI patients. Neuroplasticity, improving limb spasticity, improving motor function and daily living abilities. However, the mechanism by which exercise training promotes functional recovery after SCI is still unclear, and there is no consensus on a unified and standardized exercise treatment plan. Different exercise methods may bring different benefits. After SCI, patients' physical activity levels decrease significantly due to factors such as motor dysfunction, which may be a key factor affecting changes in exercise factors. Motor factors will undergo dynamic changes due to exercise during SCI rehabilitation. Five different exercises: aerobic exercise (AE), endurance exercise (EX), strength exercise (RE), high-intensity interval training (HIIT), and physical and mental exercise There are differences in functional recovery between methods in the later stages of SCI, and this difference may be related to the secretion of different exercise factors. The secretion of motor factors in various tissues and organs may be a potential therapeutic target to promote functional recovery in SCI. The changes in motor factors of SCI patients caused by exercise training are an important and highly relevant and visual evaluation index, which may provide a new research direction for revealing the intrinsic mechanism by which exercise promotes functional recovery after SCI.

Methods
The literature method was used to search for relevant literature on Pubmed, Web of Science and EBSCO using "spinal cord injury", "aerobic exercise", "endurance exercise", "resistance exercise", "high-intensity interval training", "mind body exercise", "neurotrophin", "inflammatory factors", "myokines", "bioactive peptides" and their combinations as keywords. The long-term dynamic data of changes in common exercise factors (neurotrophic factors, inflammatory factors, myokines, bioactive peptides) after SCI were sorted out, and the effects of 5 types of exercise on the secretion of different exercise factors were summarized. From the perspective of exercise factors, the effects and mechanisms of different exercise methods on functional recovery after SCI were analyzed.

Results
AE promoted neuroplasticity and vascular injury repair and regeneration by affecting the expression of brain-derived neurotrophic factor and insulin-like growth factor 1. EX regulated the inflammatory response process by affecting the expression of interleukin-6 and interleukin-10. RE promoted muscle fiber regeneration by affecting the expression of insulin-like growth factor-1, irisin, and Apelin. HIIT promoted the improvement of the body's comprehensive ability by affecting the expression of brain-derived neurotrophic factor, interleukin-6, interleukin-10, irisin, and osteocalcin. Physical and mental exercise regulated emotions and inflammatory responses by affecting the expression of brain-derived neurotrophic factor, interleukin-6, and interleukin-10.

Conclusion
Different forms of exercise have different effects on the functional recovery of patients after SCI. The changes in exercise factors such as neurotrophic factors, inflammatory factors, myokines, and bioactive peptides induced by exercise can help to give a visual explanation for this. The study of exercise factors induced by exercise training after SCI provides a theoretical basis and data support for scientific exercise treatment programs after SCI, which is helpful to formulate more targeted SCI exercise rehabilitation strategies.

Keywords: spinal cord injury; exerkines; exercise training; neurotrophic factor; myokines

EFFECT OF HIGH-INTENSITY EXERCISE TRAINING ON FUNCTIONAL RECOVERY AFTER SPINAL CORD INJURY AND ITS MECHANISMS

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Introduction
Spinal cord injury (SCI) is a common neurological disorder with a high rate of disability and a progressively younger age group.SCI is classified into primary and secondary injuries.The majority of primary injuries are the result of blunt trauma due to acceleration-deceleration mechanisms resulting in shearing and tearing of spinal cord nerve fibers. In the vast majority of cases, primary injury consists of axonal injury, vascular disruption, and cell membrane disruption, while secondary injury is a cascade of responses to primary trauma, including inflammation, ischemia, vascular dysfunction, free radical formation, apoptosis, and necrosis. Currently, the main therapeutic approaches include surgical decompression, neural bridging, neurostimulation and neuromodulation, brain-computer interface and neuroprosthesis, and stem cell therapy. In the Central Nervous System (CNS), axons gradually lose their regenerative ability during development, and the mechanism of the CNS that ensures the stability of the physiological state can impede the regenerative repair of nerves after SCI, and there is a lack of effective treatments to allow patients with SCI to fully regain function. Currently, most SCI patients adopt a comprehensive treatment program, with postoperative exercise training as an important part of it. This treatment plays an irreplaceable role by virtue of the advantages of low cost, non-invasiveness, and small adverse reactions. Some studies have shown that the combination of stem cell transplantation and high-intensity exercise training is significantly more effective in promoting neuronal survival and axonal regeneration than the two treatments alone. Exercise training is developing towards the direction of comprehensive treatment combining multiple therapeutic methods.

METHODS
The main content of this paper is to review the effect of high-intensity exercise training on functional recovery after SCI, generally analyze the exercise protocols used in the current research (including SCI clinical and basic research, as well as some non-SCI studies), and point out the relevant research deficiencies and give suggestions while elaborating the advantages of high-intensity exercise training. In this paper, we searched relevant articles published in Wanfang, Zhi.com and PubMed databases, and the search terms in Wanfang and Zhi.com databases were "spinal cord injury, exercise training, exercise intensity, high-intensity exercise training", etc., and the search terms in PubMed database were "spinal cord injury, spinal cord trauma, high intensity exercise training". injury, spinal cord trauma, exercise training, high intensity exercise training", etc. A total of 90 studies (27 clinical studies, 27 animal experiments, and the rest were reviews or interviews) were included.

RESULTS
Exercise training is as effective as medication and is effective regardless of the level of injury to which it is applied. Exercise training utilizes residual muscle strength to drive the remaining muscles to move, and at the overall patient level, exercise training not only reduces fat and builds muscle, but also improves metabolism, regulates blood pressure, and enhances bone mineral density, and has its own unique contribution to improving patients' functional independence, mental health, and quality of life. However, it should be noted that SCI patients need to maintain a certain high level of exercise intensity to effectively improve function. Exercise intensity may produce limited beneficial physiological adaptations if it is too low, whereas higher intensities may have more positive feedback. High-intensity exercise training can produce greater physiological adaptations than moderate intensity, even when the total training volume is significantly reduced. In the literature cited in this article, most of the clinical studies measured heart rate or velocity, and high-intensity exercise training was determined as 75% to 100% of the patient's maximal heart rate or 70% to 90% of the maximal velocity, adjusted appropriately for individual differences. In animal studies, high-intensity exercise training was mostly defined as 70% to 85% of maximal walking speed or a self-defined greater walking speed and 80% to 85% of maximal heart rate.

CONCLUSION
High-intensity exercise training may promote the repair of spinal cord tissue structure and function, improve cardiorespiratory function, counteract CNS degeneration, control inflammatory response, and alleviate other systemic complications due to SCI by increasing the level of BDNF, promoting oligodendrocyte production, decreasing the level of pro-inflammatory factors, increasing the level of anti-inflammatory factors and Tregs, and promoting the improvement of some biomarkers of cardiac metabolic risks, and so on. system complications due to SCI. At the same time, it is necessary to

be alert to secondary injuries caused by excessive exercise intensity and always pay attention to the psychological state of patients. In the future, more studies are needed to further standardize the criteria for high-intensity training after SCI and to derive more effective exercise training methods to promote the recovery of more SCI patients.

Keywords: athletic training, spinal cord injury, exercise intensity, high-intensity training, functional recovery

ADVANCES IN THE EFFECT OF STEM CELL TRANSPLANTATION COMBINED WITH REHABILITATION THERAPY ON MOTOR FUNCTION AFTER SPINAL CORD INJURY

Xinyu Liu, Wendi Xu
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Introduction
Spinal cord injury (SCI) is one of the most serious diseases threatening human health today, which can cause severe sensory and motor dysfunction, loss of self-care and labor ability of patients. And because of its complex pathological mechanism, there is no treatment to cure it. Recently, studies have shown that stem cell transplantation is a potential method in the field of SCI therapy. The transplanted stem cells can promote the reconstruction and regeneration of nerve tissue at the injured site and the functional recovery of patients through the mechanisms of neuroprotection, immune regulation, axon regeneration and neuron relay formation. However, there are still many limitations such as the possibility of inconsistent neural structure repair and functional improvement, hidden dangers in safety, and unclear therapeutic ability in the chronic stage of SCI. Rehabilitation is suitable for different periods of the disease, and has the advantages of high safety, low invasions, flexible treatment cycle and obvious improvement effect on SCI function. Moreover, it can enhance the therapeutic effect of stem cell transplantation by regulating local stem cell microenvironment, affecting stem cell differentiation and mobilization, enhancing cortical plasticity, and promoting growth factor secretion. But its effect on neural structure repair is limited, and it may be difficult to play an important role in structural reconstruction. For the cases with higher injury segments and more serious loss of function, there is a lack of literature reporting that rehabilitation therapy can effectively improve the structure of spinal cord or nerve tissue. Above all, the development and therapeutic exploration of the combination of stem cell transplantation and rehabilitation therapy are worthy of further research. To explore the intervention effect and mechanism of stem cell transplantation combined with rehabilitation therapy on motor function after SCI.

Methods
Searched the relevant studies on the effects of stem cell transplantation and rehabilitation therapy on SCI from PubMed, CNKI, Wanfang Database and Web of Science from May 20, 2023, and the literature contents were extracted and reviewed.

Results
A total of 497 literatures were searched, and basic and clinical studies on the effects of stem cell transplantation combined with rehabilitation therapy on SCI were screened, excluding studies on duplication, no intervention, and inability to obtain full text. Finally, 19 literatures were included, including 9 in English and 10 in Chinese. The study design was randomized or non-randomized controlled trial, clinical case series study, etc. The research field mainly involves the intervention effect of the combination of stem cell transplantation and rehabilitation therapy on motor function after SCI.

Conclusion
Stem cell transplantation combined with rehabilitation therapy has a certain synergistic effect on the recovery of motor function after SCI, and may have certain potential for the treatment of SCI in the future. However, there is still a certain gap between the laboratory results and practical application, and there are still many problems and challenges to be solved in the combination of the two, and more in-depth scientific research is needed to support its clinical practice in the future.

Keywords: spinal cord injury, stem cell transplantation, rehabilitation, motor function, review

ANTHROPOMETRICAL PREDICTORS OF RUNNING WITH CRUTCHES PERFORMANCE IN LOWER LIMB AMPUTEES

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Introduction
Lower limb amputees face unique challenges in achieving optimal running performance, influenced by various anthropometric factors and functional capacities, including knee disarticulation force and scapula-humeral force. Understanding the relationship between these factors and running speed with crutches is crucial for tailoring training strategies and interventions to enhance performance outcomes in this population.

Methods
Anthropometric data, including age, weight, height, and BMI, were collected from a cohort of lower limb amputees. Participants (n=16) were all male. Running speed was assessed through a standardized 30-meter sprint test. Additionally, knee disarticulation force and scapula-humeral force tests were conducted to evaluate the functional capacity of the amputees. Statistical analyses, including Pearson correlation coefficients and point-biserial correlation coefficients, were performed to assess the relationships between anthropometric variables, knee disarticulation force, scapula-humeral force, and running performance.

Results
Significant correlations were observed between age, weight, BMI, knee disarticulation force, scapula-humeral force, and running speed. Older age and higher BMI were associated with slower running speeds (Pearson correlation coefficient: -0.541, $p < 0.05$; Point-Biserial correlation coefficient: 0.290). Weight showed a weak positive correlation with running speed (Pearson correlation coefficient: 0.194, $p < 0.05$; Point-Biserial correlation coefficient: 0.322), indicating that heavier lower limb amputees may exhibit slightly faster running speeds. Knee disarticulation force and scapula-humeral force were negatively correlated with running speed, indicating that lower force in these areas was associated with slower running speeds.

Conclusion
Our findings highlight the importance of considering anthropometric predictors, knee disarticulation force, and scapula-humeral force in predicting running performance among lower limb amputees. Tailored training regimens and interventions aimed at improving running performance should take into account these factors. Further research is needed to validate these findings in larger and more diverse samples and to explore additional factors that may influence running performance in lower limb amputees.

Keywords: Amputee, Anthropometry, Performance, Functional capacity, Mobility, Knee disarticulation force, Scapula-humeral force

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SEX-BASED DIFFERENCES IN THE OUTCOMES OF TOTAL HIP AND KNEE ARTHROPLASTY - SECONDARY ANALYSIS OF DATA FROM TWO RANDOMIZED CONTROLLED TRIALS

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Introduction
Women tend to have higher overall prevalence of osteoarthritis but orthopaedic surgeons are less likely to refer females to total joint arthroplasty (TJA) compared to males (Choong et al., 2021). This results that females are at more advanced stage of their disease when undergoing TJA with possible worse post-operative outcomes. This study aimed to investigate sex-based differences in the outcomes of total hip (THA) and knee arthroplasty (TKA) regarding quality of life, pain and functional outcomes.

Methods
This is a secondary analysis of the data from two randomized controlled trials investigating effects of rehabilitation on patients after THA and TKA (ACTRN12622001130752; ACTRN12618001782224) (Kokic et al., 2023; Sklempe Kokic et al., 2022). Two hundred participants which underwent TJA were included, 83 after THA, and 117 after TKA (mean age 66.7 ± 8; 59% TKA; 55% females). All participants were admitted to rehabilitation consisting of 21 days of therapeutic exercise, electrotherapy, and education. Outcome measures taken on 1st and 21st day of rehabilitation were the subscale Physical Function of the Western Ontario and McMaster Universities Arthritis Index (WOMAC-PF), numeric rating scale (NRS), 30s Chair Stand Test (CST), Timed Up & Go test (TUG), and visual analogue scale of the EQ-5D-5L questionnaire (EQ VAS).

Results
Both females and males improved in all outcomes after the rehabilitation ($p < 0.001$). However, females had higher baseline pain levels ($p=0.002$), and lower results in 30s CST ($p=0.001$) and TUG ($p<0.001$). After the intervention, females still had lower results in 30s CST and TUG ($p<0.001$). These differences persisted in both subgroups, both TKA and THA, while in TKA after the intervention females also had worse WOMAC-PF results ($p=0.046$). Significant differences were reported in the change of pain levels in favour of females ($p=0.012$), and improvement of 30s CST and TUG results in favour of males ($p=0.046$; $p=0.013$). In the subgroup of TKA, females had greater improvement of pain ($p=0.022$), but in the subgroup of THA, males had greater improvement of TUG results ($p=0.012$).

Conclusions
Women tend to have worse functional outcomes after TJA, along with smaller improvements in their functional outcomes in comparison to men.

Keywords: arthroplasty, outcomes, sex, total joint replacement

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LONG-TERM EFFECTS OF STRETCHING ON JUMPING ABILITY

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Introduction
The current research indicates that stretching may have negative effects on explosive neuromuscular performance, but we still lack sufficient understanding of its long-term consequences. While we have clear evidence of the acute negative impacts of stretching on jumping ability (Behm, Blazevich, Kay & McHugh, 2016), the scientific literature on its long-term effects remains unclear. Some studies propose that regular static stretching exercises could enhance muscle strength and power (Arntz et al., 2023), while many others recommend the need for more comprehensive research across multiple studies. The purpose of this systematic review was to research the current knowledge about the influence of chronic stretching on jump performance.

Methods
In this research, a systematic review of the literature was conducted in accordance with the official guidelines for creating systematic review papers and meta-analyses known as "PRISMA" statement (Page et al. 2020). Electronic databases Scopus and PubMed were searched. The search was conducted on December, 2023. In the literature review, articles were identified through a search combining terms in the advanced search engine – (stretching OR static stretching OR dynamic stretching OR PNF OR proprioceptive neuromuscular facilitation) AND (explosive strength OR jump*) NOT (acute). The assessment of methodological quality of selected studies was conducted based on a set of criteria detailed in *Study quality assessment tools*. The list of criteria with explanations can be found on the official website under the section *Quality Assessment of Controlled Intervention Studies*.

Results
Out of 15 studies, 8 showed that regular stretching helps improve jumping ability. Specifically, 6 studies favored Dynamic Stretching (DS), while 2 supported Static Stretching (SS). Interestingly, among the 7 studies that didn't find significant results, all used Static Stretching (SS), with 3 also including Dynamic Stretching (DS), and 2 involving Proprioceptive Neuromuscular Facilitation (PNF). Interestingly, none of the studies concluded that long-term stretching has negative effects on jumping ability.

Conclusions
This review finds that long-term DS has positive effects on jumping ability. It was effective across various vertical and horizontal jump tests. On the other hand, long-term SS did not show any statistically significant impact on jumping ability.

Keywords: Flexibility training, Stretch-shortening cycle, Dynamic Stretching, Static Stretching, PNF

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EFFECT OF FOOTWEAR ON STATIC BALANCE PARAMETERS IN WOMEN AGED 23-26 YEARS

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Introduction
The ability to maintain balance while standing upright is a crucial human characteristic essential for daily activities. Its level may be significantly influenced by many factors, eg. the type of shoes they wear (Borah et al., 2007; Paillard, 2012). Among females, popular are high-heeled shoes that can impair body balance and increase the risk of falls (Zhang et al., 2017).

Purpose
The purpose of this study was to assess the static balance of physical education female students and to investigate the influence of different types of footwear on basic parameters of balance.

Material
The study group consisted of 20 women aged 23–26, studying physical education at the Institute of Physical Culture Sciences University of Rzeszów.

Methods
The AMTI dynamometric platform was used to measure the postural stability of the subjects in static conditions. To assess the level of static balance, the Romberg test was used, which was performed in three conditions: barefoot, in sports shoes and high heels shoes.

Results
The balance level was assessed based on the parameters COP 95% confidence ellipse area, COP length of the path, and average COP velocity. In the case of the Romberg test with eyes open, the average values of all analyzed parameters were higher compared to those measured in the test without shoes. The analysis showed a statistically significant difference ($p < 0.05$) between the levels of COP 95% confidence ellipse area, COP length of the path, and average COP velocity depending on the conditions where the measurement took place.

Conclusion
The type of footwear statistically significantly differentiated the level of stability of the body posture of the subjects in statistical conditions. There was no statistically significant effect of sports footwear on the deterioration of the postural stability of the subjects compared to the measurement without shoes. The highest values of the analyzed parameters were determined for the attempt in high-heeled shoes, and the differences compared to measurements performed barefoot and in shoes were statistically significant in almost all cases. It can be concluded that wearing high-heeled shoes negatively affected the level of static balance in the study group.

Keywords: *postural stability, high heel shoes, Romberg test*

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THE COMPARISON OF LOWER LIMB JOINT KINETICS AND KINEMATICS BETWEEN SINGLE-LEG DROP LANDING WITH OR WITHOUT THE BALL CATCHING TASK

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Introduction
IntroductionThe lower limb joint kinetics and kinematics of single-leg landing are highly associated with the risk of injury such as the rupture of the anterior cruciate ligament. Meanwhile, landing with dual-tasking may potentially alter the lower limb biomechanics due to the increase of cognitive-motor interference. The current study aimed to compare the lower limb biomechanics between single-leg landing with and without the concurrent ball-catching task.

Methods
The cross-sectional repeated measures study included a total of twenty-six young adults (22 males and 4 females, age: 25.0 ± 5.3 years, body mass index: 23.1 ± 3.0, 13 jumping athletes and 13 non-athletes) without musculoskeletal conditions performing the single-leg drop landing (SLDL) task from a 30 cm platform with or without dual-tasking (DT). Participants performed SLDL and DT conditions for three trials in randomized orders. The DT condition was performed by passing a basketball with a regular size of 7 from 150 cm away from the platform manually. Participants had at least two familiarization trials before the actual data collection.

The kinematic data were collected by the inertial measurement unit sensors (APDM Wearable Technologies Inc., Porland, OR) at 128 Hz consisting of tri-axial linear accelerometers, gyroscopes, and magnetometers, attached to the foot, tibia, and lateral thigh according to Ajdaroski et al. (2000). The standard calibration pose was executed as initialization while all wifi signals from the mobile phones were switched off according to the instruction manual to minimize the drift influence. The kinetic data was measured by the force plate (ATMI at 1000 Hz). The vertical ground reaction force (vGRF) data was filtered using a fourth-order 100 Hz low-pass Butterworth filter and it was normalized with the body weight.

Results
The normality of data was assessed using Kolmorov-Smirnov test ($p>0.05$). The two-way repeated measure ANOVA showed a significant interaction effect between groups (jumping and non-athletes) and conditions (SLDL and DT) in vGRF ($p=0.03$) and hip adduction angle ($p=0.01$). Post hoc comparison demonstrated a significant increase in vGRF (3.32 N/kg ± 5.42; 95% CI [0.22, 6.42]; Effect size = 0.6) when jumping athletes changed from SLDL to DT conditions. For non-athletes, the peak hip adduction angle of non-athletes showed a significant increase from SLDL to DT (7.4 degrees ± 11.3; CI [0.94, 13.81]; Effect size = 0.7).

Conclusion
The jumping athletes in general exhibited lower vGRF and larger peak hip abduction degrees potentially indicating more optimal lower limb biomechanics and motor control in the drop landing. For non-athletes, DT using ball catching increased the hip adduction angle. Therefore, coaches may need to address hip and knee alignment in DT conditions for non-athletes or athletes with less training experience to prevent the risk of excessive hip adduction (or potentially dynamic knee valgus) in landing and ball-catching tasks performed concurrently.

Keywords: *IMU, Ground Reaction Force, Cognitive Motor Interference, Hip Adduction, Valgus Knee*

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COMPARISON OF UPPER LIMB'S BIOMECHANICS PARAMETERS IN TENNIS IN TERMS OF SPORTS LEVEL

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Introduction
The upper limbs play a crucial role in generating power and accuracy during various sports activities. Tennis, in particular, relies heavily on efficient upper-limb biomechanics for a successful serve. Studies have suggested that elite athletes exhibit distinct movement patterns compared to their lower-skilled counterparts (Elliot et al., 2003). However, a comprehensive understanding of how biomechanical parameters of the upper limbs differ across various skill levels in tennis serving is lacking. This study aims to investigate and compare the biomechanical parameters of the upper limbs during the tennis serve motion in athletes of varying skill levels (elite, advanced, and beginner). By analysing key movement patterns, we hope to identify specific biomechanical characteristics associated with different skill levels in tennis serving.

Methods
In the study, an eight-camera Optitrack system was employed to conduct a biomechanical analysis of the tennis serve among three players of varying skill levels (elite, advanced, and beginner). Participants, dressed in tight-fitting clothing, were equipped with 57 markers, allowing for precise movement tracking. The procedure began with a warm-up, followed by each player performing several serves. Data recorded by the Optitrack system was processed using the Motive software, then exported to SttInsight for detailed biomechanical analysis using a movement evaluation protocol specific to tennis players with a racket. Key moments in the serving technique were identified. Data were extracted for further analysis.

Results
The athlete classified at the elite level demonstrated a shoulder flexion/extension parameter of -10.63° during the 'trophy position', accompanied by minimal shoulder abduction/adduction values (-5.19° and -25.59°). Concurrently, dynamic elbow flexion was employed, ranging from 102.84° to 115.85°, decreasing to 32.71°, and concluding at 28.58°, to facilitate power generation. Conversely, the player at the advanced amateur level exhibited more pronounced negative shoulder flexion/extension values (-65.58°, -70.78°) and elevated shoulder abduction/adduction values (24°, 8.58°). However, this player displayed variable elbow flexion angles (119.43° to 114°), potentially impacting serve stability and power. For the beginner-level athlete, shoulder flexion/extension (-1.33°) and shoulder abduction/adduction (-1.33°, 3.12°) were noted, along with restricted elbow flexion ranges (100.33° to 121.14°), potentially resulting in diminished serve power.

Conclusion
Analysing the serving motion of elite, advanced, and beginner tennis players, this study revealed distinct biomechanical patterns in shoulder and elbow movements. Elite athletes exhibited more controlled shoulder motion and a wider range of elbow flexion compared to their lower-skilled counterparts. These findings support the study's aim, suggesting a link between efficient upper-limb coordination and powerful serves. Further research is needed to explore these relationships and inform training programs for improved serving performance.

Keywords: *individual sport, joints kinematics, skill level differentiation*

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DYNAMIC PLANTAR PRESSURE AND PLANTAR FORCE ASYMMETRY IN PARTICIPANTS WITH ANKLE DISTORTION

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Introduction
Uncontrolled inversion and eversion are critical movements, with 75% of these injuries involving an ankle distortion and sprain. Additionally, 40% of these injuries lead to chronic consequences and joint instability, highlighting the need for quality rehabilitation. Therefore, the aim of this study is to analyze asymmetries in dynamic plantar pressure and plantar forces in participants with ankle distortion.

Methods
We enrolled a gender-balanced group of 30 participants (age 24.02 ± 2.07 years; height 174.98 ± 8.98 cm; mass 68.16 ± 12.28 kg) divided into a group with ankle distortion (DG; N=15) and a healthy control group (CG; N=15). The plantar pressure (PP) and plantar force (PF) measurements were performed during a three-step gait protocol using the FootWork Pro® system (AMCube, France). To determine the differences between the two groups in asymmetry (left vs right leg), a Multivariate Analysis of Variance (MANOVA) and Univariate Analysis of Variance (ANOVA) were applied to the entire system of PP and PF variables at a statistical significance level of $p = 0.01$.

Results
The overall MANOVA result ($F = 22.53$, $\eta^2 = 0.878$) highlights substantial multivariate differences between the groups. The ANOVA analysis indicate that the DG exhibited notably higher asymmetry in step duration compared to the CG, with a significant F-value of 34.79 and a large effect size ($\eta^2 = 0.554$). Other significant findings include asymmetry in maximal step speed ($F = 5.85$, $\eta^2 = 0.173$), asymmetry in step area ($F = 17.78$, $\eta^2 = 0.388$), and asymmetry in center of force mean speed ($F = 31.72$, $\eta^2 = 0.531$), all indicating greater asymmetry in the DG. However, asymmetry in center of force maximal speed and mean acceleration did not show significant differences.

Conclusions
This study provides clear evidence of significant asymmetries in dynamic PP and PF parameters in participants with ankle distortion compared to healthy controls. These results underscore the necessity for targeted rehabilitation strategies to address these asymmetries and mitigate the long-term consequences of ankle sprains, thus improving joint stability and functional outcomes.

Keywords: *ankle sprain, gait analysis, asymmetry, rehabilitation, plantar biomechanics*

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EFFECT OF INCLINATION ON THE CHANGE OF SPATIOTEMPORAL PARAMETERS OF GAIT OF SPECIAL FORCES SOLDIERS

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Introduction
The purpose of the study was to determine the changes in the spatiotemporal parameters of special forces soldiers gait with increasing inclination. Characterizing changes in such parameters as stance phase, load response, single support, pre-swing, swing phase, double stance, stride length, stride time and cadence, could improve the training process and increase the effectiveness of military operations involving mountainous terrain.

Methods
The study was conducted using the h/p/cosmos gaitway 3D + 1D treadmill. Seventeen soldiers of the Polish special forces military unit "GROM" took part in the study. The testing protocol was conducted at four different inclinations: 0%, 5%, 10%, 15%. The soldiers' task was to perform a 20-second test at a speed of 5.5 km/h in each of the four incline conditions. In the statistical analysis, the Kruskal-Wallis test was performed, followed by a comparison of the different groups using the (DSCF) method.

Results
Statistically significant differences were observed for stance phase, load response, single support, pre-swing, swing phase, double stance at inclinations values: 0%, 10%, 15%. The study shows that a 5% inclination does not significantly alter the gait of special forces soldiers. No statistically significant differences were found for stride length, stride time and cadence.

Conclusion
Studies show that the gait of special forces soldiers changes under 10% and 15% inclinations. It is also noted that 5% inclinations represent too small a load to observe changes in the spatiotemporal parameters of gait. These indicators may point to the need to use a higher incline when training soldiers.

Keywords: *inclination, spatiotemporal parameters, soldiers, march*

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CASE STUDY: DIERS FORMETRIC 4D AND PEDOSCAN ANALYSIS OF DIFFERENT TYPES OF STANDING POSITIONS

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Introduction
The increase sedentary lifestyles from school age to working with digital technologies at PCs leads to the predominance of passive body. The purpose of this case study is to point out the differences during a routine standing examination in passive and active variants. Differences in examination can support more targeted recommendations for physical therapy by a pediatrician, rehabilitation doctor, or variability in sports training.

Methods
A 24 year old, healthy, regularly exercising man was part of our case study. For the first measurement, the participant was instructed to stand relaxed in his usual position with his arms hanging freely. It was followed by the start of data recording on Diers formetric 4D and pedoscan, which lasted 6 seconds. Then there was a 5-minute intervention for active standing with unlocked knees in the way of Mentastics® according to the Trager® approach. Following the intervention the 2nd measurement of active stand was started again. These 2 records were compared and evaluated.

Results
In the passive standing, 25° of external rotation was measured for the left foot and 16° of external rotation for the right foot. In the active standing, the parameters dropped to 10° of external rotation for both feet. The area of support of the left foot is 98 cm2 and the right foot is 82 cm2 in passive standing. In active standing this area increased by 30 cm2 on the right foot and by 12 cm2 on the left foot. The COP position of the feet during passive standing is defined by an asymmetry of 6°. The pelvic tilt is also 6 mm to the right. During active standing, COP asymmetry decreased to 0° as did pelvic tilt.

Conclusion
The results lead us to idea that the passive stance indicates the maximum ranges of motion that the tissue allows. In compensation, a system of levers connected to each other is created from the support points. In active standing, we discover new qualities most evident in the area of foot support. This probably leads to a different arrangement of movement segments. The change in their position and the quality of the integration the eccentric lengthening of the muscle is dependent on the length of education and the capacity of the nervous system for a new sensation from the knee joints.

Keywords: *standing examination, passive position, active position, standing variability, Diers formetric, pedoscan; unlocked knees, Trager approach, foot external rotation, area of support, COP, pelvic tilt, new quality, integration*

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ASSESSMENT OF THE LEVEL OF SPEED AND AGILITY ABILITIES OF POLISH SOLDIERS OF SPECIAL FORCES UNITS

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Introduction
In order to eectively perform combat tasks, military personnel need an adequate level of strength, endurance, power, agility and coordination. Agility consists not only of the speed of simple reaction, acceleration, deceleration, change of direction, but also includes perceptual abilities, among others, complex reaction to unexpected and variable stimuli occurring during a sports game or combat task.

The purpose of the study is to assess and compare the level of speed and agility abilities of Polish soldiers of special forces units of two combat teams that dier in the specics of the tasks.

Twenty soldiers of a military unit from a water combat team and 16 soldiers of a military unit from a land combat team participated in the study. Both teams belonged to a Polish special forces unit.

Methods
A 30-meter sprint was used to assess speed, with additional time measurements at 10 and 20 meters. Agility was measured using the T-test, Pro Agility test and Illinois test. A Microgate electronic measurement system with an accuracy of 0.01 econds was used to evaluate the time of the 30-meter sprint, T-test, Pro Agility test and Illinois test. In addition, planned agility was assessed using the Star Run and reactive agility was assessed using the 50m Random Run on the Skillcourt device.

Results
The analysis showed that for all agility and speed tests, no statistically significant differences were observed between the soldiers of the water combat team and the land combat team. In addition, correlation analysis showed statistically significant correlations between speed and agility tests T-test and Illinois test.

Conclusion
The level of speed and agility abilities is not determined by the specific tasks of each combat team. Moreover, the results prove that the level of training of soldiers of Polish Special Forces Units in both combat teams is similar. Soldiers of Special Forces Units have similar levels of speed and agility to handball players.

Keywords: *special forces, soldiers, agility, speed abilities*

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EFFECT OF MOTOR SKILLS ON KINEMATIC PARAMETERS IN DIFFERENT SHOOTING TECHNIQUES IN BASKETBALL

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Introduction
Over the years, the jump shot became a generally accepted technique of directing the ball towards the basket from greater distances (Hay, 1985) and important element for players success in basketball (Okazaki, 2015). However, considering its performance complexity, it is a commonly accepted fact that it requires a high level of development of the basic motor abilities which is necessary when starting to adopt it. During the initial training process among children another shooting technique is dominant, and that is the one-handed shot from the spot, which, due to its method of performance enables directing the ball towards the basket more easily, despite a less developed motor abilities. It is precisely the main goal of this research to determine whether there is a correlation between basic motor skills and the observed kinematic parameters in the afore-mentioned shooting techniques.

Methods
The sample of respondents in this research consisted of 29 U16 basketball players (15,88±0,69 years). The respondents were divided into two groups: G1=basketball players who perform the one-handed shot from the spot (N=15) and G2=basketball players who perform the jump shot (N=14). For the purpose of this research, 5 motor skills assessment tests were used. A total of 9 variables were used for the purpose of analysing kinematic parameters. The 94Fifty Smart Sensor Basketball ® system (InfoMotion Sports Technologies, Inc.) and the Xsens Awinda kinematic system (Xsens Technologies, The Netherlands) were used for measuring kinematic parameters.

Results
Regression analysis did not determine an effect of the regarded motor space set on the observed kinematic parameters in the mentioned shooting techniques, aside from the individual correlation between the variable for assessing explosive arm and shoulder girdle strength and ball release height (p=0,01).

Conclusion
The obtained results indicate the fact that each of the examined shooting techniques demonstrates certain biomechanical regularities, however, also that the level of motor skills development, if initially at a satisfactory level of development, does not directly affect at which moment a player starts using the jump shot technique.
Keywords: jump shot, xsens, motor abilities, motor knowledge, kinematic parameters

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EFFECTS OF STROBOSCOPIC GLASSES ON LOWER EXTREMITY BIOMECHANICS IN PEOPLE WITH CHRONIC ANKLE INSTABILITY DURING DROP LANDING

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Introduction
This study aimed to investigate the influence of stroboscopic glasses on lower extremity biomechanics during single-leg drop landing in people with CAI.

Methods
Eighteen adults with CAI were recruited (female: 6, age: 22.03±1.73 years, height: 1.72±0.11 m, body weight: 71.53±15.49 kg). Participants need to wear stroboscopic glasses with a flicker frequency of 10 Hz for 3 min before the start of the experiment. The participants executed three single-leg drop landings from a 20-cm platform before (pre) and after (post) stroboscopic glasses, respectively. The moment of landing was determined using a 20 N threshold in vertical ground reaction force. Kinematic and kinetic indicators, including angle, angular velocity, range of motion, net torque and joint power at the lower extremity. A paired-sample t-test was used to compare these indicators with and without stroboscopic glasses.

Results
There was a significant decrease in peak hip flexion angle (pre: 45.67 ± 11.90°, post: 43.23 ± 11.31°, $p = 0.03$) and abduction angular velocity at the hip decreased (pre: 245.70 ± 157.83°/s, post: 216.44 ± 139.83°/s, $p = 0.050$) after using the stroboscopic glasses. Peak ankle angular velocity at internal rotation significantly increased (pre: 178.27 ± 82.62°/s, post: 209.73 ± 91.01°/s, $p = 0.047$). In terms of kinetics, the hip external rotation moment significantly decreased (pre: 1.03 ± 0.50 Nm/kg, post: 0.88 ± 0.28 Nm/kg, $p = 0.046$), as did hip power at abduction and adduction (pre: 384.35 ± 154.11 W, post: 332.90 ± 122.42 W, $p = 0.002$) during drop landing.

Conclusion
Stroboscopic glasses induce short-term visual interference, primarily affecting the biomechanical characteristics of the hip, followed by the ankle during single-leg drop landing. Additionally, people with CAI adopt a conservative posture when wearing stroboscopic glasses to prevent the risk of injury.

Keywords: *chronic ankle instability, biomechanics, postural control, kinematics*

THE EFFECT OF LEG DRIVE ON THE WEIGHT AND KINEMATIC CHARACTERISTICS OF BARBELL DURING 1-REPETITION-MAXIMUM BENCH PRESS

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Introduction
To explore the effect of leg drive technique on maximum weight (1RM) bench press barbell weight, kinematic parameters such as motion trajectory and subject's ground reaction force.

Methods
12 young strength training enthusiasts were recruited as subjects. The changes in barbell weight, upward trajectory and subject's ground reaction force were tested using non-leg drive technique and leg drive technique for 1RM bench press.

Results
Compared with non-leg drive, the 1RM bench press barbell weight of the subjects using leg drive increased significantly ($P < 0.05$). The motion trajectory of the barbell lifting phase was closer to the shoulder. The peak ground reaction force increased significantly and the barbell relative vertical displacement at the peak force was smaller.

Conclusion
The use of leg drive technique in the 1RM bench press helps start and early acceleration of the barbell lifting phase. The motion trajectory of the barbell is closer to the shoulder for higher efficiency, thereby lifting heavier weights

Keywords: *Leg drive, Barbell bench press, 1RM, Kinematic characteristics, Trajectory*

ENHANCING PUBLIC HEALTH THROUGH SPORTS FEDERATIONS: A STRATEGIC APPROACH TO YOUTH WELLNESS IN ALBANIA

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Introduction
In the face of rising health challenges, the imperative role of sports federations in public health advocacy cannot be overstated. This comprehensive research delves into the multifaceted contributions of Albanian sports federations towards bolstering public health, particularly among the youth. By promoting an active lifestyle, these federations stand at the forefront of a national movement towards enhanced well-being.

Methods
The study commences with a thorough evaluation of Albania's current public health scenario, juxtaposed with an assessment of the nation's sports infrastructure. It scrutinizes the operational strategies of sports federations, identifying their strengths and potential areas for improvement. Through this analysis, the research highlights the pivotal influence of sports federations in shaping health-oriented behaviors and attitudes among young individuals.

Results
Central to the discourse are the evidence-based policy recommendations that emerge from the research findings. These recommendations advocate for strategic initiatives that underscore the economic advantages of nurturing an active society. By delineating the correlation between physical activity and reduced healthcare costs, the study underscores the long-term fiscal prudence of investing in sports programs.Furthermore, the research proposes actionable measures to optimize the efficacy of sports federations in public health promotion. It suggests the integration of health education into sports curricula, the development of accessible sports facilities, and the establishment of collaborative partnerships with educational institutions and healthcare providers.

Conclusion
In conclusion, the expanded role of sports federations as agents of public health is a testament to their capacity to engender a paradigm shift towards a healthier, more active Albania. The anticipated outcomes include improved health indicators, a reduction in lifestyle-related ailments, and a robust foundation for sustainable public welfare.

Keywords: *Sport, Public Health, Welfare, Active Lifestyle, Policy Recommendations, Economic Benefits*

FOSTERING PROFESSIONAL COMPETENCE: INTEGRATING DIGITAL LITERACY AND SOFT SKILLS IN SPORT AND TOURISM MANAGEMENT CURRICULA

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Introduction
In the contemporary professional landscape dominated by technology, the acquisition of digital competencies alongside basic soft skills is pivotal for transitioning into the labor market. This paper explores the intersection of digital literacy and soft skills, with an emphasis on their mutual significance for students graduating in sport and tourism management. It delineates digital literacy as not only the mastery of digital tools, but also the ability to communicate and adapt within digital contexts.

Methods
A mixed research study was conducted with the intention that the results of the qualitative part would be used to assist the development of the quantitative part. The integration is carried out relying on the construction strategy, which enables that the results of the semi-structured interviews with experts in education, sports and tourism industry are utilized to design the semi-structured questionnaire with graduates in Sports and Tourism Management.

Results
The data obtained underscore the importance of soft skills—such as communication, critical thinking, and creativity—in complementing digital competencies for a rounded professional profile. Statistical analysis using chi-square tests revealed significant relationships between the development of these skills and enhanced professional readiness, underscoring the critical interplay between digital and soft skills. Feedback supplied by experts in the field point to the need for a more comprehensive approach to curriculum design by integrating both digital literacy and soft skill development through tailored courses, introducing hands-on methodologies and industry collaborations.

Conclusions
By emphasizing the relationship between digital competencies and soft skills, the paper advocates for a shift in higher education paradigm to meet the evolving demands of the labor market in the digital age. It concludes with a call for broader adoption of integrated courses, aimed at nurturing students' digital literacy and soft skills proficiency, thereby boosting their readiness for dynamic professional environments in sports and tourism management, and beyond.

Key words: *digital skills, soft skills, curriculum design, hands-on methodologies*

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ATHLETES' ATTITUDES TOWARD COMMERCIAL SPORTS BRAND SPONSORSHIP AND PURCHASE INTENTIONS IN INTERNATIONAL TABLE TENNIS EVENT

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Introduction
Monitoring the financing system, subsidizing sports events, and maintaining their financial sustainability occupies an essential place in the theory and practice of management sports events. Evaluating sponsorship relations among sponsors and sports event organizers from the perspective of both sides is vital in sports marketing (Getz & Page, 2016). The study's main aim is to examine the influence of athletes' attitudes toward the effect of commercial sports sponsorship on purchase intentions.

Methods
This research was conducted at the International GEWO table tennis tournament, which was held in December 2022 in Novi Sad, Serbia. The respondents included athletes who completed the questionnaire about the characteristics of a sports event, sponsors, and their relationships (N=281). The structural model was run considering the event image, event usage, sponsor/brand awareness, and self-image congruence as independent variables and purchase intentions as the dependent variable.

Results
This model explained 65% of purchase intentions (R2=0.65). Findings revealed a significantly positive effect on event usage (β = 0.70) and sponsor brand awareness (β = 0.15) are essential in predicting purchase intentions (at level p=0.00). Discussion: Compared to similar events, the better characteristics of GEWO international table tennis events can contribute to increasing behavioral consumer intentions. Therefore, from one side, sports event organizers should strive to be competitive, which improves their position in looking for sponsors. On the other hand, it can help enhance the effects of sponsorship valuation from the sponsor's point of view.

Conclusion
These findings could be valuable in improving sponsorship strategy and recognizing the critical aspects of developing quality sponsorship relations on commercial sports brands and sports events from the lens of athletes.

Keywords: *sponsorship, brand, purchase intentions, athletes, table tennis*

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THE EFFECT OF AN EXERCISE PROGRAM ON GUT MICROBIOTA AND PHYSICAL FITNESS IN CHILD CANCER SURVIVOR

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Introduction
Gut microbial dysbiosis persists months after intensive cancer treatment in children and adolescents (Bielik et al., 2023). On the other hand, children who recover from acute lymphoblastic leukemia (ALL) typically get metabolic syndrome as a result of being overweight or obese and not getting enough exercise (Oeffinger et al., 2003). Exercise training is considered a safe and, at least partly, effective option for the improvement of overall health as well as for an increase in physical activity levels in child cancer survivors (Morales et al., 2020). The aim of this study was to determine the effect of an 8-week home-based exercise program on gut microbiota and physical fitness in child cancer survivors.

Methods
This study is focused on the effect of home-based exercise program on gut microbiota and physical fitness in child cancer survivors with ALL. Child cancer survivors who participated in this study were divided into two groups: a group that underwent an 8-week exercise program (EG, n=13) and a control group (CTRL, n=9). The fecal microbiota was categorized using specific primers targeting the V3–V4 region of 16S rDNA. Prior to and following an 8-week home-based exercise program, measurements were taken for the hand grip strength (HGS) test and the vertical jump (squat and countermovement jump).

Results
After an 8-week home-based exercise program, we observed a significant increase in the experimental group's hand grip strength (HGS) test ($p = 0.037$). There were no significant changes in the squat jump and countermovement jump. Also, we identified a significant increase in beneficial bacteria producing short-chain fatty acids (SCFA) in the bacterial species Blautia obeum ($p = 0.0397$) and Butyricicoccus faecihominis ($p = 0.0499$). However, we did not report the shift in microbial α-diversity.

Conclusion
The main findings from our study showed a modest effect of an 8-week home-based exercise program on the gut microbiota and physical fitness in child cancer survivors. However, the exercise program is a key tool for child cancer survivors to regain their physical fitness after medical treatment.

Keywords: *acute lymphoblastic leukemia, strength training, α-diversity, bacteria*

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THE EFFECT OF CHEMOTHERAPY AND A SUBSEQUENT ONLINE EXERCISE PROGRAM ON FITNESS AND BODY COMPOSITION IN ONCOLOGY PATIENTS

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Purpose
This study aimed to evaluate the impact of chemotherapy and a subsequent online exercise intervention program on body composition and cardiorespiratory fitness in oncology patients.

Methods
Participants (n=95) were oncology patients with prescribed adjuvant chemotherapy, randomly assigned to a control group (CO) or an experimental group (SAPA). Cardiovascular fitness was assessed using the six-minute walk test (6MWT), and body composition was determined on bioimpedance analysis InBody 230 device. The SAPA group participated in an online exercise intervention program comprising aerobic and resistance training, with three 60-minute sessions per week for 12 weeks, with intensity set individually at 60-80% VO2max (VO2peak). The CO group followed the standard regimen without intervention. Data were collected for both groups before chemotherapy initiation, after chemotherapy completion, and after the exercise intervention (SAPA) or after 12 weeks (CO).

Results
During chemotherapy, significant increases were observed in total weight (W) ($p<.001$), body mass index (BMI) ($p<.001$), total body water (TBW) ($p<.001$), and fat-free mass (FFM) ($p<.001$), while a decrease in percent body fat (PBF) was noted ($p=.066$). The 6MWT distance slightly increased after chemotherapy ($p=.109$). Twelve weeks post-chemotherapy decreases in W, BMI, and TBW were observed, with insignificant differences between groups. The 6MWT distance increased significantly for both SAPA (p.006) and CO ($p<.001$) groups. Similarly, for the VO2peak parameter, there was an increase in SAPA (p.005) and for CO ($p<.001$) group.

Conclusion
Chemotherapy negatively impacted the body composition of oncology patients, with improvements observed 12 weeks post-treatment, particularly in TBW and FFM parameters. The assessment of cardiorespiratory fitness yielded inconclusive results, with an insignificant increase in 6MWT distance after chemotherapy, potentially influenced by retest reliability. After an additional 12 weeks, both groups exhibited a significant increase in 6MWT distance and VO2peak.

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Keywords: *physical activity, cancer, cardiovascular fitness, body composition*

ATHLETE'S GUT: THE IMPACT OF PROBIOTICS AND PHYSICAL EXERCISE INTENSITY ON THE STRUCTURE AND FUNCTION OF INTESTINAL MICROBIOME

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Introduction
Recent research has indicated that physical exercise can inuence the composition and function of the gut microbiota.

However, the relationship between exercise intensity and its specic eects on the gut microbiota remains a topic of great interest and investigation.

Methods
Using multiparallel metagenomic sequencing of the V3–V4 region of the 16S rDNA gene from fecal samples, the gut microbiota of collegiate and elderly athletes, sedentary, and pediatric oncology patients was categorized. Nuclear magnetic resonance spectroscopy was used to characterize the concentrations of the selected metabolites in the serum and feces.

There were variations in the structure, intensity, duration, and weekly frequency of training interventions.

Results
We demonstrated that exercise signicantly aects the variety and make-up of gut microbiota in sedentary individuals(Hricet al., 2021), athletes (Bielik et al., 2022; Šoltys et al., 2021), and people with chronic illnesses (Bielik, Hric, SmahovA, et al., 2023). Exercise intensity seems to be a key factor inuencing these changes (Bielik, Hric, & Hammami, 2023). Additionally, our results demonstrated a positive correlation between fecal metabolites (acetate, butyrate, and propionate) and producers of short-chain fatty acids (SCFAs), thereby supporting the function of the gut microbiota (Kubánová et al., 2023).

Conclusion
Physical exercise, especially at higher intensities, exerts a profound inuence on the structure and function of gut microbiota. Increased microbial diversity, improved metabolic functions, reduction of body fat are observed outcomes of high-intensity exercise. It is important to note that the relationship between dierent types of bacteria in the human microbiome is complex and not fully understood.

Keywords: *Gut microbiota, physical exercise, exercise intensity, microbial diversity, metabolic effects, immune function, gut-brain axis, human health.*

The author declare that he has no conflict of interest.

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MOLECULAR TECHNIQUES FOR THE IDENTIFICATION OF GENETIC ASSOCIATION WITH SPORT PERFORMANCE TRAITS

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Introduction
Sports genomics and the use of genetic molecular techniques made an important contribution to the discovery of genetic associations with sports performance traits such as endurance, power, strength and the response to exercise and training. Hundreds of genes influence sport performance traits and condition the status of elite athletes [1, 2]]. The purpose of this study is to highlight the importance and contribution of these techniques in the discovery of genetic associations with general performance traits and those important in specific sports disciplines.

Methods
Publications of the last 10 years were searched in the main academic platforms using specific keywords strictly related to the focus of this review. Out of 67 publications collected, 31 full-text articles were selected, as more recent and focused on genetic associations with sport traits.

Results
The discovery of a high number of genetic polymorphisms associated with sport performance traits in the last ten years, happened also due to the introduction and effective use of the advanced molecular tools [1]. Powerful techniques such as the TGS, NGS, GWAS and others, have advanced the study of molecular genetic variants, responsible for pathways and systems associated with the elite athletes' performance and training adaptation [2, 3]. Nowadays, the total number of DNA polymorphisms reported as associated with athlete status exceeded 220, while 100 found significantly related to endurance, power and strength and 30 to sport injuries and muscle recovery [1, 3].

Conclusion
The results highlight the importance and power of molecular techniques in discovering the genes' polymorphisms linked to sports performance traits in sport and characteristics related with endurance and power traits in particular in elite athletes. However, the use of the genetic variants associated to traits necessary for talent identification remains a challenging issue.

Keywords: *sport genomics, SNPs, GWAS, sport performance, fitness/ training response*

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24-H MOVEMENT BEHAVIOURS, EXERCISE HABITS AND PHYSICAL FITNESS IN ADOLESCENTS WITH ATOPIC DERMATITIS: THE CRO-PALS STUDY

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Introduction
Physical activity and physical fitness are important elements of health in childhood and skin problems could preclude children from engaging in vigorous physical activity and result in low fitness. The main purpose of the study was to examine physical fitness, 24h movement behaviours and exercise habits in adolescents affected by atopic dermatitis (AD) and compared them to their unaffected peers.

Methods
This research was part of the Croatian Physical Activity in Adolescence Longitudinal Study (CRO-PALS), a prospective cohort study aiming to track lifestyle behaviours across four years of secondary school. This cross-sectional study involves 903 adolescents (49.3% girls) measured at baseline (at the age of 15 years). The 24 movement behaviours and exercise habits were assessed using SHAPES questionnaire while physical fitness was measured via several Alpha-fit test.

Results
In total, 2.7% of boys and 4.1% of girls were diagnosed with AD. The 24h movement behaviours did not significantly differ between adolescents without and with AD, irrespective of sex. Compared to their healthy peers, adolescents with AD exhibited similar level of active energy expenditure (AEE) (10.1 vs. 8.6 kcal/kg/day, $p = 0.189$), sedentary time (396 vs. 485 min/day, $p = 0.380$), screen time (281 vs. 303 min/day, $p = 0.796$), and sleep time (7.5 vs. 8.3 h/day, $p = 0.541$). Similar proportion of adolescents without and with AD was included in organised sports no differences in physical fitness components were observed. Also, no significant associations between adherence to 24h movement behaviours guidelines with the presence of AD were shown. A sub-analysis showed that girls with AD seemed to have a higher likelihood of not engaging in school sports (OR = 4.00; 95% CI 1.15 – 13.98), compared to their healthy peers.

Conclusion
The findings of this study show that there are no significant differences in 24h movement behaviours between adolescents without and with AD. This would imply that adolescents affected with AD have similar movement patterns, compared to healthy peers, suggesting that AD may not be a risk factor for meeting the 24h movement behaviour guidelines.
Keywords: atopic dermatitis, eczema, skin problems, high-school students, adolescents, physical activity, screen time, sleeping habits, performance, differences

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THE EFFECT OF EXERCISE PROTOCOL AND KINESIO TAPING ON IMPROVING BALANCE BASKETBALL WITH TALOCRURAL JOINT INSTABILITY. A PRECEEDING PROJECT

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Introduction
The talocrural joint is an essential component of the human anatomical system that enables a wide range of physical activities such as walking, running, vertical jumping, and maintaining balance. Talocrural instability can result from mainly lateral sprains that damage the neuromusculoskeletal system. Recurrent injuries can alter the biomechanics of the talocrural joint and play a significant role in the development of instability. This chronic condition can be a challenge in sports medicine as it can lead to deficits in balance, proprioception, muscle strength, joint amplitude, which can limit high-level sports performances.

Methods
The rehabilitation protocol will involve strength and balance exercises combined with kinesio taping. These exercises will be conducted for 35 minutes while kinesio taping will be held during the execution of the exercises. The balance will be assessed before the rehabilitation program begins and again after 6 weeks of treatment. The included subjects will be the students of Sports University and professional basketball players from national teams, all with a minimum of 2 years of training.

Results
By implementing this combined protocol, our aim is to improve the function of the talo-crural joint, strengthen the structures that support this joint, and improve postural control, proprioception, and balance. Kinesio taping plays a significant role in stimulating the proprioceptive system and this input helps players better control their movements, leading to improved balance and reduced risk of injury. By executing a consolidated exercise protocol and kinesio taping, athletes have the greatest probability of providing their maximum motor and physical potential while protecting the musculoskeletal system from frequent injuries that are an integral part of participating in various sports.

Conclusion
Through a rigorous review of the literature, our analysis concludes that the combined exercise protocol significantly improves two crucial components, balance, and proprioception, essential for the performance of basketball athletes and the prevention of talocrural injuries. Through rehabilitation and the added support of kinesio taping, talocrural instability improves, and sports performance increase.

Keywords: *talocrural instability, balance exercises, strength exercises, kinesio tape, balance, basketball*

THE EFFECTIVENESS OF DYNAMIC NEUROMUSCULAR STABILIZATION EXERCISES ON OVERHEAD ATHLETES SHOULDER JOINT. A PROCEEDING PROJECT

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Introduction
Repetitive overhead throwing generates enormous demands on the shoulder joint. Athletes performing overhead activities are at risk of both traumatic and overuse shoulder injuries. While performing complex movements, the human body works as "one" involving local and global muscle groups and joints at the same time. Any kind of muscle imbalance will increase the risk of trauma, overuse, reduced performance in sports. The purpose of this project is identifying the role of the dynamic neuromuscular stabilization exercises (DNS) protocol in improving mobility and stability of the shoulder joint in volleyball players.

Methods
The DNS exercise protocol, which is based on the healthy babies posture during the first year of life will be part of training protocol. The volleyball players will be part of personalized exercise program for eight weeks, 30 minutes, 3x/week, focusing on the activation of the trunk and muscles of the shoulder region, with the aim of improving ROM and muscle imbalances on the shoulder joint in volleyball players on dominat and non-dominat arms. The athletes included in the study will be students of the University of Sports of Tirana engaged for at least 12 months in volleyball.

Results
With the implementation of this project, we expect a significant improvement in range of motion (ROM), including external and internal rotation of the shoulder joint and the muscle strength of the rotator cuff and trunk. Also by following DNS exercises protocol, we expect an activation of kinetic chains, the core muscle that stabilize the spine and transfer the loads and power to upper extremities.

Conclusion
According to the results of different scientific studies about the effect of DNS on sports rehabilitation and the project's expected results, the DNS exercises protocol improves mobility and stability of the shoulder joint through the activation of muscle kinetic chains. Furthermore, adding DNS exercises to volleyball players as part of their training regimen can improve their performance.

Keywords: *overhead shoulder, volleyball players, kinetic chain, DNS, overuse*

THE EFFECT OF PROBIOTIC CAPSULES FROM BRYNDZA CHEESE ON GUT MICROBIOME IN YOUNG RUNNERS

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Introduction
In recent years, it has been found that physical activity and the use of probiotics have been shown to positively influence the composition of the gut microbiome, the production of metabolites, and overall physical and mental health. In addition, the gut microbiota, with it's ability to harvest energy, modulate the immune system and influence gastrointestinal health, it likely to play an important role in the health, well-being, and sports performance of athletes (Mohr et al., 2022). However, the natural sources of probiotics still remain in the background.

In our study, we investigated the effect of encapsulated sheep's milk product, on the gut microbiome of athletes.

Methods
The young runners with weekly mileage above 15 km were enrolled either in the experimental (n = 26) group consuming probiotics or the control group (n = 27).

We collected fecal samples before and after the 8-week intervention. Faecal microbiota were categorized using specific primers targeting the V3-V4 region of 16S rDNA.

Results
The most abundant lactic acid bacteria (LAB) in the Bryndza capsules were bacterial species: Lacticaseibacillus paracasei (>104 CFU/ml), Levilactobacillus brevis (>103 CFU/ml), Lactococcus lactis (>104 CFU/ml), Leuconostoc mesenteroides (>105 CFU/ml), Enterococcus faecalis (>105 CFU/ml), and Enterococcus faecium (>103 CFU/ml).

After 8 weeks of intervention, there were no changes in the body composition in either group. In the experimental group, the butyrate producers from the genera Anaerostipes ($p = 0,0204$), Faecalibacterium ($p = 0,0525$), and the butyrate producers from species Anaerostipes hadrus ($p = 0,0525$), Butyrivibrio hungatei ($p = 0,0271$), Eubacterium ventriosum ($p = 0,0151$), Faecalibacterium prausnitzii ($p = 0,0525$) increased significantly after the intervention.

Conclusion
Based on our study, we found that consumption of Bryndza cheese probiotic capsules by young runners had a positive effect on changes in the gut microbiome. Analysis of the gut microbiome confirmed a significant increase in butyrate-producing bacteria.

Keywords: *probiotics, gut microbiome, physical activity, butyrate producer*

Funding
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VIGOROUS VS. MODERATE EXERCISE SNACKING ON GLYCEMIC CONTROL, CARDIORESPIRATORY FITNESS, AND BODY COMPOSITION IN PATIENTS WITH TYPE 2 DIABETES MELLITUS: STUDY PROTOCOL

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Introduction
Type 2 Diabetes Mellitus (T2DM) is a major global health issue with significant mortality rates. Sedentary lifestyles in T2DM patients lead to various microvascular and macrovascular complications. Regular exercise is a key non-pharmacological strategy for managing T2DM, yet adherence is low due to time constraints and uncertainty about the most effective and tolerable exercise modalities. Traditional moderate-intensity continuous training (MICT) and resistance training (RT) may not suit all individuals while High-Intensity Interval Training (HIIT) and Sprint Interval Training (SIT), while beneficial for glycemic control, can cause high perceived exertion. "Exercise snacking," which involves brief, intense bouts of exercise throughout the day, offers an alternative to prolonged sessions and can be more easily integrated into daily routines. Thus, this study aims to examine the effects of vigorous vs. moderate exercise snacking on cardiometabolic health and cardiorespiratory fitness in T2DM patients.

Methods
Thirty sedentary patients with T2DM without additional diseases will be randomly assigned to HIITacc group (n = 10), MICTacc group (n = 10) and control group (n = 10). HIITacc group will perform three short sessions of 6×1 min of cycling at 90% of maximal heart rate (HRmax), MICTacc group will perform 3x10 min of cycling at 70% of HRmax. The intervention will last 12 weeks. Pre- and post-intervention assessments will include glycemic control, blood pressure, cardiorespiratory fitness, and body composition.

Results/Conclusion
The results of this randomized study have great potential to inform future public health efforts designed to improve glycemic control, increase exercise rates and affect overall health in individuals with T2DM.

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A SURVEY ON HEALTH HABITS AND BODY WEIGHT IN THE GENERAL ADULT POPULATION IN CROATIA

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Introduction
Excess body weight assessed by body mass index (BMI) is a serious medical problem, related to unfavorable health outcomes. The highest share of overweight adults in EU, according to Eurostat, live in Croatia. We aimed to understand the health habits and perceptions of body weight among the adult population.

Methods
The study was facilitated by SmartUp using computer-assisted web interviews, adhering to international standards and GDPR compliance. It involved 400 participants, representing a cross-section of the population with a ±4.4% confidence interval.

Results
Although most participants were familiar with BMI, only 21% accurately knew their own BMI, which averaged 26 kg/m^2. Notably, 55% of adults were classified as overweight (37%) or obese (18%). Awareness of being overweight was significantly lower than that of being obese ($p<0.05$).

The survey found a strong desire to lose weight. On average, participants wished to lose 11 kg, but this desire escalated to 22 kg among individuals with obesity ($p<0.05$). Regarding health information, 36% sought advice on BMI from forums (44% of women vs. 27% of men, $p<0.05$), while only 9% consulted medical professionals (13% of men vs. 6% of females, $p<0.05$). Physical activity patterns showed that only a third of the population engaged in regular exercise defined as 30-minute sessions five times a week. A significant 40% of participants were dissatisfied with their physical fitness, which correlated with higher BMI levels (31% of normal BMI vs. 36% overweight vs. 69% obese, $p<0.05$).

Regarding dietary habits, 41% expressed satisfaction, although dissatisfaction was higher among obese individuals compared to those overweight or of normal weight ($p<0.05$).

Healthwise, participants with normal BMI levels had significantly fewer chronic diseases. Conditions such as elevated blood pressure, hyperlipidemia, chronic pain, and diabetes were more prevalent among individuals with higher BMI ($p<0.05$).

Conclusion
Obesity is still not widely recognized as a medical issue in the general population, resulting in a lack of proactive health-seeking behavior, particularly among those who are merely overweight. This underscores the need for targeted health initiatives to address this gap in perception and encourage more active engagement in health management practices.

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THE RELATIONSHIP BETWEEN GUT MICROBIOTA AND CARDIORESPIRATORY FITNESS IN MULTIPLE SCLEROSIS PATIENTS

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Introduction
Recent studies have demonstrated a positive impact of physical activity on multiple sclerosis patients (MS) (Jeng et al., 2023), as well as the critical role of the gut microbiota in preserving their general health (Ratsika et al., 2023). Nonetheless, there is still a lack of data regarding the potential negative effects of reduced physical activity on gut microbiota and the relationship between gut microbiota and cardiorespiratory fitness in MS patients (Mokhtarzade et al., 2021). Thus, the aim of this research was to examine the relationships between gut microbiota and cardiorespiratory fitness in MS active women compared with healthy active women.

Methods
This study was conducted with 17 MS active women (MS) and 17 healthy active women (CTRL). The gut microbiota was classified by multiparallel metagenomic sequencing of 16S rDNA, and cardiorespiratory fitness was quantified by an incremental test on a bicycle ergometer.

Results
The significantly lower cardiorespiratory fitness (VO2max/kg) in MS compared to CTRL was detected. Additionally, significantly lower bacterial diversity, a lower relative abundance of short-chain fatty acid producers (e.g., Blautia spp., Coprococcus spp., Eubacterium spp.), and a lower relative abundance of bacteria linked to physical fitness (e.g., Veillonella spp.) were observed in MS compared to CTRL. Notably, a strong positive correlation was discovered between cardiorespiratory fitness and health-related bacteria.

Conclusions
Our study's primary conclusions included lower cardiorespiratory fitness and negative shifts in gut microbiota in MS relative to CTRL. Furthermore, our research unequivocally demonstrated a strong correlation between gut microorganisms and cardiorespiratory fitness. We think that boosting physical activity can help MS patients' gut microbiota adapt in ways related to their health.

FUNDING: This study was supported by the Grant No. APVV-22-0047 of the Slovak Research.

Keywords: *Multiple Sclerosis, gut microbiota, cardiorespiratory fitness*

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COMPARISON OF THE ACUTE EFFECTS OF LOW VS. HIGH ALTITUDE ON AUTONOMIC NERVOUS SYSTEM DURING 3000-M RUNNING AND RECOVERY IN ELITE YOUTH ATHLETES

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Purpose
The main aim of the present study was to compare the immediate recovery of RR values of HRV as well as HR subsequent and during 3000-m running in LA and HA in youth elite athletes.

Methods
Seventeen elite youth mid-distance athletes voluntarily participated in the study (mean ± SD; age 14.9 ± 1.3 years; height 164.1 ± 6.6 cm; weight 53.2 ± 8.6 kg). All athletes performed 2 different sessions (LA and HA) at the same time of day two weeks apart. The interventions were held in the racetrack regions of the Botanical Park (~155-m above sea level, 24°-26°) and Uludag Cobankaya (~1750-m, 16°-18°) in Bursa. Afterward, to determine the HR and the HRV of all athletes, a Polar H7 chest strap with a Polar V800 heart rate monitor was used.

Results
For HR values in LA, there was no significant correlation between the correlation of during 3000-m run and after 10-min recovery with time, respectively (r2 = .008, r2 = .096). In the HR values in HA, there was no significant correlation between the correlation of during 3000-m run and after 10-min recovery with time, respectively (r2 = .033, r2 = .008). There was no significant correlation between the correlation of during 3000-m run and after 10-min recovery with time, respectively in RR values in LA (r2 = .004, r2 = .087). In RR values in HA, there was no significant relationship between the correlation of during 3000-m run and after 10-min recovery with time, respectively (r2 = .024, r2 = .005).

Conclusion
For athletes, exercise training for oxygen levels at different altitudes may help to shorten the running time. Future studies should examine the cardiac autonomic long-term responses of elite runners in distance running at different altitudes about running time performance and try to examine and improve recovery processes.

Keywords: *Athletics, Autonomic Nervous System, High Altitude, Running*

INTENSIVE TRAINING PROGRAM AND NUTRITIONAL INTERVENTION TO IMPROVEMENT OF METABOLIC PARAMETERS IN PATIENTS WITH OBESITY

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Introduction
The complex management of obesity requires always intensive training program and nutritional intervention (ITNP). Therefore, our study aimed to monitor the effect of ITNP on cardiometabolic parameters in patients with obesity.

Methods
Six months intervention underwent 32 patients (18F/14M; mean age 33.1 ± 7.5 years, BMI 52.0 ± 8.3 kg/m2). Intervention program involved decreased caloric intake and 120 min daily of low/moderate exercise under the professional fitness trainer control). Before and after the intervention blood pressure and heart rate were measured as well as the metabolic parameters were analyzed (fasting plasma glucose (FPG), insulin, glycosylated hemoglobin (HbA1c), lipid profile as well as liver enzymes (aspartate transaminase (AST), alanine transaminase (ALT), and gamma-glutamyl transferase (GGT)).

Results
The mean weight loss after 6 months intervention was on average 10-25% of initial body weight and was associated with decreased blood pressure and heart rate, as well as a decrease in the plasma concentration of FPG ($p=0.02$), insulin ($p=0.003$), IR HOMA ($p < 0.001$) and HbA1c ($p < 0.001$). Total and LDL cholesterol and triglycerides ($p=0.002$; $p=0.03$, $p=0.003$ resp.), as well as a liver parameters AST, ALT and GGT ($p=0.008$; $p < 0.001$, $p=0.004$ resp.).

Conclusion
Our results indicate that intensive training intervention together with nutritional intervention leads to weight loss accompanied with improvement of cardiometabolic parameters in this group of patients with extreme obesity.

Keywords: *Intensive training program, nutrition, metabolic parameters, obesity*

Conflict of Interest: None Disclosed.

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ANAEROBIC PERFORMANCE OF FEMALE BASKETBALL PLAYERS 16-18 YEARS OLD

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Introduction
Scientific research indicates that basketball is a permanent intensity sport that primarily demands anaerobic metabolism. It is well established that basketball's anaerobic component is crucial for technical movements like throwing, jumping, blocking, passing, and three-stepping as well as for tactical maneuvers in attack and defense. This study investigates the anaerobic performance of female basketball players aged 16-18 years old. Anaerobic performance, crucial for quick bursts of high-intensity activity on the basketball court, is assessed through various measures including strength, power, speed, agility, and endurance. The study examines the impact of training regimens, physical conditioning, nutrition, and genetics on anaerobic performance in this demographic. Additionally, individual variability and factors influencing anaerobic performance are explored. Understanding the anaerobic capacity of female basketball players in this age group can inform training programs tailored to optimize performance and enhance overall athletic development.

Methods
This study aimed to assess the anaerobic performance of four female basketball teams (n = 60) split into four groups: in the Running Anaerobic Sprint Test (RAST). The test consists of six maximum sprints spaced ten seconds apart, and mathematical and visual models have been used to examine the variables. First measurement in October and second measurement in January have been completed.

Results
Tests performed both before and after the program was implemented showed that the females in the two experimental teams had an increase in anaerobic performance of 10% when compared to the females in the control teams.

Conclusion
All four teams' basketball players had poor anaerobic performance. In comparison to earlier research involving intermediate teams, our data demonstrated that the anaerobic performance measured in female athletes by the RAST test was lower. In order to attain an anaerobic performance, coaches must develop a work program that takes player position evaluation into consideration. Before the training program is put into action, its goals should be clearly stated.

Keywords: *anaerobic performance, fatigue index, hyper lactation, basketball*

THE IMPACT OF INTENSIVE TRAINING ON THE MORPHOLOGICAL AND FUNCTIONAL CARDIOVASCULAR ADAPTATION OF WATER POLO AND VOLLEYBALL PLAYERS

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Introduction
Intense exercise over a long period leads to morphological and functional changes in the heart, cardiovascular systems, lungs, and muscles. Endurance sports produce eccentric hypertrophy of the left ventricle (LV), an increase in the dimensions of all hearts cavities, and high fitness expressed in maximum oxygen consumption (VO2max), while strength sports lead to concentric hypertrophy of the LV without a significant increase in heart dimensions with a small increase in aerobic capacity compared to sedentary people.Objectives:This study aimed to compare anthropometric, echocardiographic, and functional parameters of cardiorespiratory fitness between professional water polo and volleyball players.

Methods
This study includes 97 professional male players divided in two groups: water polo (n1=58, aged 21.66±4.41years, body height 191.52±4.81cm, body weight 92.89±10.12kg) and volleyball (n2=39, aged 22.56±4.85years, body height 196.19±5.75cm, body weight 87.28±10.05kg). All players treining more then 10 years and more then 15 hours per week. Subjects underwent anthropometry,body composition,electrocardiography,echocardiography and ergospirometry test on a treadmill using Quark CPET Cosmed. Student's T-test was used for comparison of measured parameters.

Results
Water polo players train more hours per week, are shorter, heavier, have higher BMI, have higher systolic and diastolic blood pressure at rest, and more pronounced hypertrophy of the LV was registered in them: septum, posterior wall, left ventricle mass, left ventricle mass index ($p<0.001$ for all).In water polo players was observed the left ventricular dilation in absolute values and values standardized according to body surface area BSA: LV diastolic volume LVEDV ($p<0.05$), EDV/BSA, systolic volume SV, systolic volume index Si ($p<0.01$).In VO2max/kg we didn't notice any significant differences.

Conclusion
Both sports disciplines require a high level of aerobic fitness, but water polo leads to greater remodeling of the heart manifested in left ventricular dilation and hypertrophy.

Bearing in mind that water polo players achieve an equally high oxygen consumption even though they have a higher body weight on average compared to volleyball players, it can be indirectly concluded that water polo players have significantly higher absolute values of VO2 max and therefore higher absolute total work, which can explain the greater remodeling of the heart.

Keywords: *echocardiography parameters, left ventricle hypertrophy, water polo, volleyball*

APPLICABILITY OF THE CYCLING POWER PROFILE FIELD TEST FOR DETERMINING TRAINING ZONES

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Introduction
In road cycling, advanced monitoring of load and effort during training and competition is used extensively. Various laboratory and field tests are used to determine training zones in cycling. One common method is an incremental laboratory test to determine physiological thresholds that help predict performance. The protocol used depends on threshold being targeted, whether it's the lactate threshold or the ventilation threshold. In addition, training zones can be determined by analyzing the power profile, characterized by two key parameters: the critical power (CP) and the W', the latter representing the maximum power sustained above the CP and usually associated with anaerobic capacity.

Purpose
The study holds significant importance as it aims to evaluate the validity and reliability of a newly developed cycling field test protocol (1-5-15) to determine cyclists' training zones. In addition, the validity of this protocol will be compared with already established field test methods, particularly the field test protocol (12-7-3) and laboratory incremental test. Methods: The sample included 20 trained young competitive cyclists, consisting of 10 females (age:16.57±1.73 years; height:168.9±6 cm; body weight:60±5.5 kg; VO2max:57.3±6.9 ml/min/kg) and 10 males (age:17±1.7 years; height:179.4±6 cm; body weight:69.4±5.9 kg; VO2max: 69.4±3.4 ml/min/kg). A body composition analysis was performed before the start of experiment. Subsequently, the cyclists performed load tests, an established field test protocol on a bicycle to determine the "power profile" (12'-7'-3') and twice the new field test protocol on a bicycle to determine the "power profile" (1'-5'-15') on four different days at intervals of 2-3 weeks in random order.

Results
The study investigated the correlation between field tests used in cycling to determine training zones and exercise tests. Specifically, we found a strong relationship between the RC point in the incremental cycling test and the CP in the cycling field test (1'-5'-15').

Conclusion
With the increasing use of performance measurement devices and their availability, field tests are economically and organizationally more favorable. As established performance profile test 12-7-3 is quite demanding in motivation, we have also validated a new field test for the performance profile 1-5-15, in which the order of test duration is reversed (from shorter to longer) with a stronger anaerobic component.

Keywords: *cycling, laboratory tests, power field tests*

INFLUENCE OF RAPID WEIGHT LOSS ON HEMATOLOGICAL PARAMETERS IN NATIONAL-LEVEL WRESTLERS

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Purpose
Rapid weight loss (RWL) is well-known phenomenon amongst wrestlers. It is characterized by a reduction of ~5% of body weight during the last week before the competition, with the aim of increasing the probability of winning against a potentially lighter athletes. Along with traditional weight loss procedures, competitors usually attend high intensity sport-specific training (HISST) sessions to facilitate the weight reduction. The aim of this study was to determine the influence of RWL together with HISST and the impact of HISST without RWL on hematological parameters in wrestlers.

Methods
The sample consisted of 12 Greco-Roman wrestlers (mean body weight 73.48±4.52 kg, age 24.3±5.1 years, body height 175.22±3.68 cm). The investigation consisted of 3 phases: Initial measurement (IM), high-intensity sport-specific training combined with RWL of 5% (phase 1 – P1) and only high-intensity sport-specific training (phase 2 –P2). In P1 wrestlers used self-chosen procedures of weight cutting. After each phase blood sampling was performed to measure the changes in hematological parameters: red blood cells (RBC), hemoglobin (HGB), hematocrit (HCT), white blood cells (WBC) and platelet (PLT).

Results
All of the athletes reduced 5% of their body weight successfully. The number of RBC significantly decreased in P2 compared to IM ($p=0.030$). The values of this parameter were also lower during P2 compared to P1 ($p=0.009$). HGB content significantly decreased in the P2 compared to P1 ($p=0.012$). The HCT concentration significantly decreased in P2 compared to IM ($p=0.005$). Lower values of this variable were recorded during P2 when compared to P1 ($p=0.010$). A significant increase in the number of WBC was registered during P1 ($p=0.000$) and P2 ($p=0.000$) compared to the IM. The level of PLT increased significantly during P1 compared to MI ($p=0.003$), while in P2 recorded values were significantly lower compared to P1 ($p=0.001$).

Conclusion
The results of this study showed that weight loss of 5% when practiced both with and without HISST stimulated alterations in the examined parameters. Specifically, when RWL was combined together with HISST increase in considered variables was induced to a higher extent compared to the HISST performed alone, revealing a considerable impact of weight cutting procedures on hematological parameters.

Keywords: *wrestling, weight reduction, biochemistry*

PREHABILITATION IN COLORECTAL CANCER PATIENTS- IS THERE ROOM FOR MORE OUTDOOR?

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Introduction
Prehabilitation involves the active preparation of patients for surgical procedures and in between treatment episodes, such as chemotherapy cycles. It consists of three sets of interventions based on physical, nutritional, and psychological status evaluation. The time frame usually consists of two to three weeks between treatment episodes, which dictates the regimens.

Methods
In 2016, the Department of Surgical Oncology introduced the concept of preconditioning, starting with nutritional support only based on NSR2002 and biochemistry results. In 2018, we complemented the protocol with physical exercise through step targeting or bicycle sets. In 2019, we introduced breathing exercises in preoperative preparation and music therapy. Finally, in 2021, we joined the EU awareness protocol for detecting patients prone to neurological worsening after surgery.

Results
The interventions were well-received by the patients, as indicated by the positive feedback in the patient questionnaires. Despite the COVID interruption, we have observed a trend of lower morbidity rates after the interventions. It is worth noting that participation in the activities was voluntary, yet the uptake on protocols was over 70 percent, further highlighting the patients' acceptance and engagement.

Conclusion
As we continue to standardize surgical techniques, we have shifted our attention to other treatment components, such as prehabilitation, to improve outcomes. This approach has shown promise in increasing patient participation and reducing morbidity rates. However, there is still a need to define and implement stratified, tailored interventions. Identifying the patients who would benefit the most from such protocols is a crucial next step in our research.

Keywords: *Prehabilitation, cancer, physical activity, nutrition*

HOW DO YOU DO? GREAT - CREATINE THANK YOU!

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Introduction
Creatine is a dietary supplement widely used among athletes. A vast body of research on creatine is among athletes as well as in clinical settings. Creatine is stored in the body mostly in skeletal muscles, 95%, and the remaining 5% is distributed in the brain, liver, kidney, and testes. The aim of this paper was to identify how creatine and gunadinoacetic acid supplementation affect muscle volume and muscle mass after 8 weeks in men and women older than 65 years.

Methods
A total of 21 subjects participated in this trial (69.6±4.9 years; 162.7±7.7cm; weight 73.3±12.4kg, 13 women). Supplementation protocol lasted for 8 weeks as a double-blind placebo controlled crossover type of study. The experimental group ingested a combination of creatine (Cr) + gunidinoacetic acid (GAA) (4 gr) once a day before breakfast, diluted in water (250 mL); the placebo group consumed the equivalent of inulin (4 gr). The following measurements were performed pre- and post-supplementation: body composition using bioimpedance, muscle proton magnetic resonance spectroscopy, 5x Sit to Stand test, Timed-up and Go Test and 4-m Speed Gait Test.

Results
Significant differences between groups following supplementation were found for the 5x Sit to Stand test (at baseline 14.3±3.0s vs. Cr+GAA group 11.8±2.1s, control 12.1±2.4s; $p<0.001$), Timed-Up and Go Test (at baseline 10.4±2.0s vs. Cr+GAA group 9.1±0.0s, control 9.61±1.9s; $p<0.001$), Proton magnetic resonance spectroscopy of the vastus medialis muscle showed a significant increase in muscle creatine level (at baseline 28.1±7.0mM vs. Cr+GAA group 36.9±9.2mM; $p=0.002$) and significant sex differences (46.3±0.3mM vs. 30.7±4.6mM; $p=0.008$).

Conclusion
Creatine and GAA 8-week administration demonstrated positive effects on functional abilities of the elderly, having the potential to benefit particular components of health. Improvements in muscle tissue bioenergetics may lead to metabolism promotion, preventing diseases of older people.

Keywords: *creatine, muscles, older people, supplementation*

THE RELATIONSHIP BETWEEN BODY COMPOSITION AND PHYSICAL PERFORMANCE IN ADOLESCENT HANDBALL PLAYERS

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Introduction
Success in handball is determined by each player's physical performance, body composition, personality attributes, technical-tactical understanding, and mutual contacts (Vuleta et al., 2001; Moss et al., 2015). Certain body composition parameters are important in discriminating between elite and recreational female handball players (Moss et al., 2015). Therefore, the importance of the body composition and physical performance it is necessary to study them integrally. The aim of this study was to analyze the relationship between body composition and physical performance in adolescent female handball players.

Methods
Forty-five female adolescent handball players (age: 16.13 ± 0.89 years: body height 166.86 ± 5.68 cm; body weight 63.85 ± 8 .80 years) participated in the study. The parameters of body compositions: fat-free mass (FFM), fat mass (FM), and muscle mass (MM) were analyzed by Bioelectrical impedance Marlton Bioscan 920-2. The physical performance was tested for Sprint 0 - 10 m, Sprint 0 - 20 m, Sprint 0 - 30 m, Squat jump (SJ) and Countermovement jump (CMJ). The Pearson correlation coefficient was used for statistical analyses. The criteria for interpreting the strength of the r coefficients were as follows: trivial (< 0.1), small (0.1 – 0.3), moderate (0.3 – 0.5), high (0.5 – 0.7), very high (0.7 – 0.9), or practically perfect (> 0.9).

Results
The Pearson coefficient correlation shows a moderate relationship between FM (%) and physical performances (SJ (cm) r = -0.300, p = 0.05; CMJ (cm) r = - 0.323, p = 0.03; Sprint 0 - 20 m (s) r = 0.369, p = 0.01; Sprint 0 – 30 m (s) r = 0.347, p = 0.02). Likewise, a moderate relationship was found between FFM (%) and only two physical performances (Sprint 0 - 20 m (s) r = -0.377, p = 0.01; Sprint 0 – 30 m (s) r = -0.367, p = 0.01).

Conclusion
The body composition FF (%) and FFM (%) of female handball players in this age range has a moderate relationship with physical performances (jumping and sprinting). Coaches must develop both components to achieve the suitable results in competition games.

Keywords: *female athletes, jumping performance, sprinting performance*

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SEASONAL GLYCEMIC VARIATION IN PATIENTS WITH TYPE 1 DIABETES AND TYPE 2 DIABETES/PREDIABETIC

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Introduction
Glycemic control decreases significantly around the holidays, with the largest decline observed on New Year s Day. Severe hypoglycemia appears to occur more frequently in the cold season than in the warm season in patients with type 2 diabetes. The aim of the present study was to examine the seasonal glycemic variation in patients with type 1 diabetes and type 2 diabetes/prediabetic.

Methods
We retrospectively reviewed 85 ambulatory glucose profiles from over 28 days of continuous glucose monitor data from 63 patients with type 1 diabetes and 22 with type 2 diabetes/prediabetic, mean age of 43±15 years, 44 for the cold season and 41 for the warm season. A two-factor ANOVA with the Tukey's post-hoc test was used for determining the differences between the tested interactions of the factors (season and type of diabetes). The results were considered significant when $p<0.05$.

Results
There was a statistically significant difference between seasons and types of diabetes in the glycemic variability (both seasons and types of diabetes, cold season type 1 and warm season type 2/prediabetic), mean blood glucose (cold season type 2/prediabetic and warm season type 1), time above range (both seasons and types of diabetes, cold season type 2/prediabetic and warm season type 1), time in range (cold season and types of diabetes and cold season type 2 and warm season type 1). No significant differences between the two seasons and types of diabetes were found in the glucose management indicator, very low glucose, time below range, very high glucose.

Conclusion
A seasonal glycemic variation during cold and warm seasons occured in patients with both types of diabetes.
Keywords: seasonal variation, glycemic variation, type 1 diabetes, type 2 diabetes, prediabetic

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INJURIES IN WOMEN AND MEN HANDBALL PLAYERS, WHAT DO COACHES NEED TO KNOW? A COMPREHENSIVE ANALYSIS OVER 3 SEASONS AND 154 GAMES

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Introduction
Handball is a fast-paced Olympic ball game characterized by both defensive and offensive actions aimed at scoring goals. Performance in handball is influenced by a multitude of factors and it involves a range of actions including throws, passes, jumps, hits, blocks and runs. Athletes may experience muscle injuries such as strains and tears due to the rapid movements and accelerations during the game. Furthermore, collisions with opponents and physical contact can lead to traumas such as bruises, contusions and joint sprains. Handball players are also at risk of upper limb injuries, particularly to the hands and wrists, due to the fastball throws and passes. The aim of this study was to monitor number and details of injuries occurring during official Handball matches to enhance current knowledge, awareness and understanding for coaches and practitioners.

Methods
A total of 154 matches of women's (W) and men's (M) handball (across 3 seasons - 21/22, 22/23, 23/24) from the national league, national cup and Celtic league of Ireland were analyzed by two independent and experienced sport scientists. A comprehensive report of all injuries, regardless of severity was compiled for the three seasons according to injured body part/region or joint.

Results
The data collection yielded 58 recorded injuries. Despite logistical constraints, key findings reveal a 40% probability of injury during matches. Predominant injury locations include the knee (22.5%), ankle (19%), face (14%), neck (5%), and the face-neck-head complex (20%).
Sixty percent of injuries occurred in female players, indicating a lower incidence among males (21/22: 14W 8M; 22/23:19W, 10M; 23/24: 5W, 2M).

Conclusion
An evident gender disparity suggests a potential necessity for gender-specific physical preparation and awareness among players, coaches, and practitioners. Furthermore, this analysis underscores the importance of higher accuracy and consistency in reporting handball injuries, ideally through comparison with other European leagues and competitions.

Keywords: *handball, injuries, gender disparity*

POSTURAL DISORDERS IN ATHLETES

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Introduction
Postural disorders, a significant factor affecting athlete's performance, can lead to chronic symptoms that detrimentally affect the musculoskeletal system function. This study aims to identify the most prevalent postural disorders among a sample of gymnastics and athletics students at the University of Sports of Tirana.

Methods
The study included forty-eight students of gymnastics and athletics at the University of Sports of Tirana. These participants underwent a comprehensive examination of their posture status, breathing pattern, and the activation of the spinal stabilizer system through functional tests conducted according to the Dynamic Neuromuscular Stabilization (DNS) method. The postural assessment was carried out using the DIERS formetric 4D.

Results
48 athletes, 28 (58.3%) female and 20 (41.7%) male, mean age 20.93±2.77 years. The most frequent postural disorders identified were: lumbar hyperlordosis in 12 (25%), [the value of fleche lumbar was 59.16±8.39 mm (50-82 mm), and lordosis angle 49º±11.56º (31º-70º)]; scapular instability in 45 (93.75%); non-activation of the system deep stabilizer of the spine in 34 (70.83%); scoliosis in 20 (41.7%) (Cobb angle: 14.05º±4.16º); cervical kyphosis in 15 (31.2%) [(86.66% male), the kyphotic apex in T10 (n=4), T8 (n=5), and T9 (n=6), the value of fleche cervical was 82±7.13 mm (70-97 mm) and kyphotic angle 51.06º±4.19º (43º-61º)].

Conclusion
Postural disorders are common among athletes studying sports at university. Efforts should be made to identify posture disorders and to improve them through eligible programs. After evaluating the problems encountered, an individual therapeutic postural correction program can be implemented based on the principles of the DNS method. This method, having at the core of its principle the activation of the deep stabilizing system of the spine, the creation of support points by centralizing the articulations, and the creation of proper muscle balances and chains, will help these athletes achieve a proper posture, enhancing their performance and overall well-being.

Keywords: *posture, postural disorders, athlete, gymnast, DIERS, Dynamic Neuromuscular Stabilization (DNS)*

THE IMPACT OF CORE INTEGRATION TRAINING ON DYNAMIC STABILITY

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Introduction
Football is a high-impact sport that necessitates maintaining dynamic stability, balance, and power, which holds for both young and professional players. The physical demands of the sport on young players require them to exhibit the same physical attributes as their more experienced counterparts. Specifically, young athletes must cultivate dynamic stability and balance to minimize the risk of injury and execute movements with precision.

Methods
This study investigated the impact of a six-week core integration training program on the dynamic stability of under-15 football players with a mean weight of 60.3 kg and a mean height of 1.65cm. A total of 20 participants completed the program, which consisted of three weeks of core stability exercises, two weeks of core strength exercises, and one week of core power exercises. The program incorporated exercises to improve anti-rotation, anti-extension, lumbopelvic, and scapulothoracic stability, critical for maintaining balance and control during movements. The program's progressive design, which allowed for a gradual and safe increase in the athletes' training intensity, reassures the program's safety. Participants were tested for dynamic stability using the 'Drift Protocol', a measurement of dynamic stability in the Optojump system. The players were tested before and after the program.

Results
The study's results demonstrate a noteworthy improvement in the dynamic stability of young football players after participating in the core integration training program.

Conclusion
These findings have significant potential implications for football training and injury prevention, as the program has been found to reduce the risk of injuries and enhance performance effectively. These outcomes suggest that core integration training holds promise for improving young athletes' physical well-being and athletic ability. Also underscore the potential benefits of core integration training for young athletes and warrant further exploration of its effectiveness in improving athletic ability and physical well-being.

Keywords: *core integration, dynamic stability, youth training, Optojump system*

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AGILITY PERFORMANCE IMPROVES AFTER 12 -WEEK OF TRAINING PROGRAM FOCUSED ON PLYOMETRIC EXERCISES IN FEMALE PRE-ADOLESCENT VOLLEYBALL PLAYERS

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Abstract
If the volleyball players do not possess high level of agility to respond to the constantly changing game situation during the match, they will not be successful. In team sports, agility is one of the most important complicated motor abilities. Volleyball players should have the capacity to quickly change the direction, position themselves on the court for reaction to an attack or preparation for one. In most sports (particularly in volleyball) agility is a crucial skill. The aim of this study was to determine if a 12-week training program focused on plyometric exercises improved the performance of agility time in female pre-adolescent volleyball players. Methodology: Thirty female pre-adolescent volleyball players (aged 11 ± 1.3 SD) participated in the study. Fifteen participants completed a 12-week training program focused on plyometric exercises (other fifteen participants were part of control group). The 12-week training program includes 3 x week (15 min) plyometric exercises after warm up. Before and after the training period, participants' anthropometric measurements: Body Height (BH), Body Weight (BW), BMI % kg/m2, Agility T-test, Agility Cone Drill and Hexagon Agility Test performances were assessed. For Statistical Analysis were used descriptive statistic and ANOVA Analysis ($p<0.05$). All variable were significantly improved from pre- and post- testing periods. Results: The testing results show significant improvements in agility in the experimental group, particularly in the Agility Cone Test (Pre 13.53 ± 0.3 SD vs Post 12.21 ± 0.4 SD, $p < 0.02$), Agility T-test (Pre 16.99 ± 0.5 SD vs Post 15.31 ± 0.1 SD, $p < 0.01$) and Hexagon test (Pre 729 ± 0.2 SD vs Post 5.06 ± 0.2 SD, $p < 0.2$). Conclusion: In conclusion the results indicated that proper training program can improve the agility performance and enable the female pre-adolescent volleyball players to rapidly change and complete movements during a moving defense or attack.

Keywords: *volleyball, female pre-adolescent, agility, plyometric training program, filed tests.*

MOTOR PERFORMANCE OF PRESCHOOL CHILDREN - A CROSS SECTIONAL STUDY

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Introduction
It is common knowledge that the low dose of physical activity and the restrictions introduced in order to maintain self-isolation during the SARS Cov-19 pandemic may have led to a serious drop in the correct development of physical fitness, even among preschool children.

Methods
The study participants were comprised of 462 children (250 girls, 212 boys) aged 6 years from Poland. The research sample was selected randomly. Motor performance was assessed using tests from The EUROFIT. Physical activity and sedentary behavior of children was assessed based on a questionnaire addressed to children's parents. Differences between sexes were examined using t Student test or chi square test depending of type of variables.

Results
According parents children spent >1 hour watching TV, playing computer games (boys: 68.25 min/day; girls: 61.65 min/day;p=0.048), 20-35 minutes a day, walking during shopping. Girls also spent slightly more time than boys drawing, playing with blocks and listening to stories (respectively: 74.5 min/day vs. 69.6 min/day;p=ns). Children also spent 15-20 min/day on sport activity and 65.3min/day on spontaneous PA. Standing long jump, sit-up , hand grip and arms' hang tests were similarly in both sexes (respectively: boys: 98.79cm vs. girls: 96.23 cm; 10.39n/30sec vs. 10.04 n/30 sec; 8.17kG vs.7.77kG; 20.83 sec vs 20.16 sec). Results of shuttle run 10x5m test's was also statistically insignificant for sexes (respectively: boys: 26.14 vs girls: 26.1).

Conclusion
During the pandemic, preschool children showed different amounts of time spent on behaviors related to TV and computer games. However, the level of their spontaneous, organized and light activity declared by their parents and motor performance was similar. Probably the lockdown situation could have contributed to strengthening family ties and thus promoting active recreation and developing children's fitness. Due to the strong and negative links between sedentary behavior and obesity in later periods of life, parents should promote the child's active behavior and support them in making decisions related to physical activity for whole life.

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SECULAR TRENDS IN BODY SIZE IN LITHUANIAN CHILDREN AND ADOLESCENTS BETWEEN 1992 AND 2022

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Introduction
Normal body mass index is crucial for the overall well-being and development of schoolchildren (Morales et al., 2013). It is crucial for various activities in daily life and contributes to overall physical competence (Utesch et al., 2019). Trends in body mass are caused by trends in a network of environmental, social, behavioural, physical, psychosocial, physiological and other factors (Judice et al., 2017). BMI increase over the past half a century, suggesting that people are heavier for a given height and fatter. The purpose of the study is to analyse the differences in body size among 11-18 years-old Lithuanian boys and girls between 1992, 2002, 2012 and 2022 years.

Methods
Total of more than 18 000 secondary school children of 11-18 years-old participated in 1992, 2002, 2012 and 2022. Height and weight were self-reported, and body mass index (BMI) was calculated. Participants were divided into not-overweight (BMI ≤ 24.99) and overweight or obese (BMI > 25) groups according to overweight and obesity thresholds.

Results
In general, there is a tendency for body mass index among Lithuanian schoolchildren of 11-18 years old still increase. There are around 8 percent of overweight and 3 percent of obese schoolchildren as well as 30 percent of underweight. There is a higher prevalence of overweight and obesity in boys than girls.

Conclusion
Overweight and obesity can be predicted by older age, male gender, lower father's education, higher family financial status, high psychological distress, and not participating in after-school sports.

Keywords: Body mass index, schoolchildren

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DETERMINANTS OF HEALTH IN PRIMARY AND SECONDARY EDUCATION: PHYSICAL ACTIVITY LEVELS AND BODY COMPOSITION

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Introduction
Levels of physical activity (PA), body composition, and body mass index (BMI) are determining indicators of health status during adolescence (Jimenez Boraita et al., 2021). The objective of the study was to analyze the relationships between physical activity and body composition in young primary and secondary school students.

Methods
A descriptive, comparative and correlational cross-sectional study was carried out on a representative sample of 513 students from Primary and Secondary Education in Spain, with an average age of 11.92 ± 1.61. A total of 319 boys 11.9 ± 1.61 years old and 194 girls 11.9 ± 1.69 years old participated in the study. BMI and PA levels were assessed using the specific questionnaire for the child population, between 8-14 years old, the PAQ-C (Physical Activity Questionnaire for Children) (Kowalski et al., 1997). Subsequently, the BMI was calculated and categorized according to the references established by the WHO: normal weight, overweight and obesity (Onis et al., 2007). The Student's T test and Fischer's exact test were used to establish statistically significant differences between the variables.

Results
The results showed how 37.62% of the boys had a normal weight compared to 28.35% of the girls, with statistically significant differences being found. On the other hand, no differences were found between sex for those young people who were overweight (15.99% of boys and 15.98% of girls) nor for those who were obese (45.14% boys compared to 55.15% girls). Evidence was provided supporting the PAQ-C as a reliable and valid measure of children's overall physical activity levels during the school year. The mean activity score for girls was 2.85 (SD = 0.57) and 3.09 (SD = 0.6) for boys. Boys were significantly more active than girls with respect to PAQ-C mean scores, $t(213) = 5.15$, $p < .01$. The results showed a negative correlation between the studied variables BMI and PA levels ($r = -0.180$, $p = 0.001$).

Conclusion
The results of this study suggest that the practice of PA is related to low BMI indices. Most students are physically active, with children being superior. Given the influence of body composition and regular PA practice on the physical health of adolescents, more PA promotion strategies are needed.

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INTELLIGENT TECHNOLOGIES IN PHYSICAL EDUCATION FOR SCHOOL STUDENTS WITH VISION IMPAIRMENT OR BLINDNESS

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Introduction
Physical education (PE) is often perceived as an area with particularly diverse barriers to participation. Pupils with disabilities often experience themselves as not included, have a low activity level and delays in movement development. The group of students with blindness or vision impairment is particularly affected. The goal of our project is to promote their activity.

Methods
Difficulties and opportunities of pupils with blindness or vision impairment in PE-lessons were identified and possible improvements and future solutions collected (Meier et al., 2023). The findings were translated into a catalog of needs and requirements that was a used for the design and development of prototypes for assistance systems identified as necessary. In cooperation with students from schools for higher technical education and applying an agile development approach different prototypes were developed.

Results
Among others, the following functioning prototypes are available or will be so, shortly: a) A bell ball emitting acoustic signals not only when moving but also when stationary, which is based on integrated inertial sensors and a signal generator. b) Two different feedback systems to avoid collisions with the edge of the pool during swimming. One uses the potential of intelligent computer vision cameras to automatically track the swimmers, the other a compressed air system positioned below the surface of the water, which emits a steady stream of air bubbles to inform the swimmer of the approaching edge. c) An accessible app and thin soft floor mats equipped with a motion sensor that are designed to enable people with blindness and visual impairments to play various games. d) A system consisting of a metronome on the basketball hoop to recognize the position of the basketball hoop) and a light barrier mounted on the basketball hoop to detect whether the ball has landed in the basket.

Conclusion
A large range of needs of students with blindness or vision impairment can be met by cost-effective solutions.

Keywords: assistance systems; blindness and visual impairment; sports technology

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EVALUATING THE IMPACT OF COVID-19 ON UPPER-BODY AND CORE STRENGTH IN CZECH CHILDREN AGED 11-15

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Introduction
Schools have been closed and social isolation has been imposed during the COVID-19 pandemic, raising concerns about children and adolescents' physical and mental health (Dunton et al., 2020; Loades et al., 2020). These restrictions, although effective in controlling the virus, disrupted daily routines and potentially decreased physical activity, leading to possible health issues (Pietrobelli et al., 2020). Purpose: This study investigates how the pandemic affected upper-body and core strength in 11–15-year-old Czech children.

Methods
This cross-sectional study used data from the Czech Olympic Badge Programme, with a focus on children aged 11 to 15 in the pre-COVID-19 (2017/2018) and post-COVID-19 (2022/2023) academic years. Our cohort consisted of 15,503 participants. A battery of standardised physical tests was used to assess upper-body and core strength, such as the medicine ball throw, pull-ups, push-ups and sit-ups. Independent t-tests were used to compare pre- and post-pandemic performance, while Pearson's correlation coefficient was used to investigate the relationships between the physical tests.

Results
Significant declines were observed in the medicine ball throw, particularly in 14- and 15-year-olds ($p < .0001$, $d = 0.11$ and 0.13, respectively). Pull-up performance decreased across all age groups, with the most significant drop in 15-year-olds ($p < .0001$; $d = 0.11$). Push-up performance also declined, especially in 14- and 15-year-olds ($p < .0001$, $d = 0.18$ and 0.12, respectively). The sit-up test showed the largest decline in 15-year-olds ($p < .0001$, $d = 0.23$). Pre-pandemic test correlations were moderate and increased with age, while post-pandemic correlations showed a significant rise.

Conclusion
While older children exhibited declines in upper body and core strength, the modest effect sizes suggest resilience in their physical development. The decreases in medicine ball throw and pull-up performance point to reduced access to structured physical activity. However, the small effect sizes indicate potential adaptability through alternative activities or natural development. The minor decline in sit-up performance highlights disruptions in regular activity. Changes in physical fitness test interrelationships suggest a shift towards easier exercises during lockdowns, reflecting children's resilience in maintaining fitness under challenging conditions.

Keywords: Sars-CoV-2, cohort study, muscle power, physical fitness

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EXPECTATIONS FROM PARENTS OF CHILD ATHLETES

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Introduction
Parental involvement in a child's sport is a daily component that contributes to a child's positive development. Through support, motivation, encouragement and active participation, parents can significantly influence the sports experience and overall development of the child. Transportation, nutrition, financial and moral support are some of the forms of support that parents provide to their children in sports. Sharing advice and instructions, great emotional involvement are often part of parental involvement in sports. But do parents sometimes cross the unwritten line of behavior rules? Do they threaten their child's rights with their actions and expectations?

Methods
The goal of the conducted research was to show the expectations of parents from children athletes. The research was conducted in May and June 2024 through an anonymous survey. The results obtained from the questionnaire were entered and processed in the Statistica analytical program in order to obtain descriptive parameters for all variables used in the research.

Results
The authors confirmed through research that parents have high expectations of their children in sports. Parents punish children for bad results in such a way as to distance themselves emotionally from the child. The sample of respondents consisted of tennis players from Slavonia and Baranja aged 8-16.

Conclusion
Parental involvement in a child's sport can have numerous positive and negative effects. It is important that parents have realistic expectations and do not put too much pressure on the child. A harmonious and balanced approach to a child athlete is the key to a successful supportive parental relationship.

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THE LONG-TERM EFFECTS OF JUDO TRAINING ON PRIMARY SCHOOL CHILDREN

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Introduction
Most studies registered positive effects caused by judo training, as an organized physical activity for children (Kowalczyk et al., 2023). The purpose of our study was to evaluate the long-term effects of judo training on primary school children.

Methods
240 primary school children (median age 9 years, range: 6 – 15) who regularly participated in judo training (60 minutes, two-times per week), were included in the study. To assess the various motor skills five different tests were performed: shuttle and run (SR), to assess speed and agility; standing long jump (SLJ) for explosive strength; forward bend in narrow legs extension (BFN-LE) for flexibility; sit-ups (SU), to asses repetitive core strength; and to evaluate the coordination, ball rolling by a non-dominant hand (ROLLING) was performed. All tests were performed on three different occasions in 2019 (February, June, October). The non-parametric Friedman test for paired samples was used for statistical analysis. Statistical analysis was performed in MedCalc® Statistical Software version 22.014 (Ostend, Belgium). P values <0.05 were considered statistically significant.

Results
There were statistically significant differences between measurements in all performed tests. A significant improvement in measurements performed in February, compared to those performed in June and October, were observed for all performed tests ($P<0.001$). However, we observed no differences between June and October measurements for the following tests: SR, BFN-LE, and SLJ. A gradual significant improvement between all three measurements was observed in assessing core strength (SU), as well as coordination (ROLLING). There was a significant negative correlation between age and SR ($r=-0.520$, $P<0.001$), as well as with ROLLING ($r=-0.576$, $P<0.001$). A significant positive correlation of age and SU ($r=0.602$, $P<0.001$) and SLJ ($r=0.565$, $P<0.001$) was observed. BFN-LE did not correlate with age ($P=0.272$).

Conclusions
Compared to the initial measurement, a significant improvement in all measured test was observed within one year of systematic well-planned judo training. Lack of improvement between second and third measurements for some variables could be explained by a summer school break. However, although the motor performances of the children did not enhance in the October measurements, they also did not decline to a starting level.

Keywords: judo, children, long-term effects

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DAILY PHYSICAL ACTIVITY INTERVENTION IMPROVES MOTOR COMPETENCE IN PRESCHOOL CHILDREN

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Introduction
Lack of physical activity is a severe global public health problem. Gross motor competence is essential in growth, development, and opportunities that lead to a physically active lifestyle. Developing motor competence during childhood has been recognized as a primary factor for regular physical activity. Regular physical activity is imperative in enhancing children's motor skill competence early in life and health promotion across the lifespan. This study aimed to determine the effects of six months of daily physical activity intervention on motor competence in preschool children.

Methods
This randomized controlled trial was conducted in 14 kindergartens, and 164 (age 6.55±0.42 years; height 122.54±6.05cm; mass 24.34±4.33kg) children were randomly assigned to an experimental (EG; n=72; 36 boys) or control group (CG; n=92; 47 boys), respectively (7 kindergartens each). Children in the EG received a 6-month daily 45-minute physical activity session (5 times per week), while children in the CG followed their regular kindergarten educational program. Motor competence was evaluated with the Kiphard–Shilling body coordination test (KTK).

Results
After adjusting for age and gender, the univariate analysis of covariance ANCOVA results showed that the EG performed significantly better in all motor coordination tests than the CG. Significant differences between the two groups were observed in the tests walking backwards (f=15.22), moving sideways (f=36.92), and total KTK score (f=31.64). Minor but statistically significant differences were observed in tests hopping for height (f=4.64) and jumping sideways (f=4.84).

Conclusion
The findings suggest that daily organized physical activity interventions are necessary for improving preschool children's motor competence. Being physically active is an essential factor in preventing and treating overweight and obese children and reducing potential cardiovascular and metabolic diseases in later life. The research indicates that promoting various physical activities and movement experiences is essential for developing motor competence in preschool children, which supports their physical activity, fitness, and academic achievement as they grow older.

Keywords: motor competence, preschool children, physical activity intervention

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PHYSICAL FITNESS LEVEL OF POLISH PRESCHOOL CHILDREN IN 2016-2023

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Introduction
The research was carried out within the framework of local and national projects implemented by the "Mali wspaniali" Foundation. The main objective of the research was to assess physical fitness by measuring the basic motor skills of preschool children.

Methods
The project included randomly selected preschool establishments. A total of 46779 children were surveyed, including 22576 girls and 24203 boys from preschool institutions. The assessment of the physical fitness level of preschool children was carried out using the Wroclaw Physical Fitness Test (Sekita, 1989). The order in which the tests were performed was as follows: agility test - shuttle run, power test - long jump from a place, strength test - ball throw, speed test - 20m run. Measurements were taken in accordance with the protocol of the Wroclaw Physical Fitness Test, and the actual performance of the test was preceded by a short warm-up.

Results
The analysis of the summary fitness index showed that in the pre-pandemic period, children's fitness levels were characterized by an increase in fitness from year to year (2016 - 187.5 points; 2019 - 195.3 points). In the pandemic period (2020), the level of physical fitness deteriorated significantly (184.1 points). In the post-pandemic period, a slight increase in the level of fitness was observed, with the last survey (2023) showing that the total score of all tests was at a lower level than in the first year of the survey, at 186 points.

Conclusions
A comparative analysis showed that all analyzed physical fitness tests were within the centile norms (Przednowek et al., 2021). Based on the results, it can be seen, the significant impact of the COVID 19 pandemic on the fitness level of preschool children. In the years after the pandemic, fitness levels did not return to pre-pandemic levels. Juxtaposing the results of previous years, one notices a downward trend in the overall physical fitness of children between 2016 and 2023.

Keywords: preschool childrens, physical fitness, COVID 19

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VALIDATION OF A TOOL TO IDENTIFY ENERGY DEFICIENCY IN EXERCISING WOMEN: THE FEMALE ENERGY DEFICIENCY QUESTIONNAIRE (FED-Q)

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Introduction
Although chronic energy deficiency is prevalent in female athletes and linked to health and performance outcomes described by the Female Athlete Triad (De Souza et al., 2014), methods to identify energy deficiency with high sensitivity and specificity are lacking. Laboratory markers of energy deficiency e.g., ratio of actual to predicted metabolic rate (RMR ratio) are costly and time consuming. Alternatively, the development of questionnaires to accurately identify energy deficiency may be effective. The primary purpose of this study was to validate a risk-assessment tool for energy deficiency in young exercising women using disordered eating subscales and self-reported health-related information.

Methods
We conducted a retrospective analysis of seven data sets in exercising women (n=202, age 21.7±0.3 yrs, BMI 21.21±0.14 kg/m2). Participants completed questionnaires including the Three Factor Eating Questionnaire (TFEQ)(Stunkard & Messick, 1985), the Eating Disorder Inventory-3 (EDI-3)(Garner, 2004), and a general health and physical activity history survey. We measured serum total triiodothyronine (TT3) as a gold standard for energy status. Participants were categorized as energy deficient if TT3 < 73.2 ng/dL and energy replete if TT3 > 73.2 ng/dL. A defined set of variables were tested as predictors of low TT3. The dataset was divided into a model set (n=152) and a validation set (n=50). The model set was used to select significant predictors using logistic regression on 500 random iterations. Predictors included in at least 450 model runs were used in a final regression model and tested on the validation data set.

Results
Final predictors were BMI, number of menstrual cycles in the last 6 months, the dietary cognitive restraint scale score from the TFEQ, and a three-item body dissatisfaction index. The model yielded 84.2% sensitivity and 80.6% specificity to detect TT3 < 73.2 ng/dL.

Conclusions
The model yielded high accuracy to predict the probability of having energy deficiency, validated against a reliable physiological marker. The FED-Q may be applicable to exercising women and is the only questionnaire that has been validated against a biological marker of energy deficiency across a variety of sports.

Keywords: *energy deficiency; validated questionnaire; exercising women*

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DECODING DECEPTION: THE IMPACT OF ATHLETIC EXPERTISE AND PRIOR INFORMATION ON DECISION-MAKING THROUGH COMPUTATIONAL MODELING

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Introduction
This study aims to systematically investigate the impact of deceptive and genuine actions, athletic expertise, and prior information on sports decision-making processes. By combining comprehensive behavioral experiments and Drift Diffusion Model analysis, we seek to uncover the underlying mechanisms that differentiate decision-making performance in these contexts.

Methods
Participants included expert and novice athletes who performed decision-making tasks involving soccer dribbling actions under conditions with and without prior information. We used a 2 (Athletic Expertise: Expert vs. Novice) × 2 (Action Type: Genuine vs. Deceptive) factorial design. The behavioral data, including decision accuracy and reaction times, were analyzed alongside Hierarchical Drift Diffusion Model (HDDM) parameters such as decision threshold (a), drift rate (v), starting point (z), and non-decision time (t) (Ratcliff & McKoon, 2008).

Results
Deceptive actions significantly affected decision threshold, non-decision time, starting point, and drift rate, leading to longer reaction time and lower accuracy. While no overall accuracy or reaction time differences were observed between experts and novices, the impact of athletic expertise on the decision-making process was primarily reflected in non-decision time, suggesting deeper perceptual processing. Prior information improved accuracy for genuine actions but reduced it for deceptive ones by changing the starting point which induces initial uncertainty.

Conclusions
This study, serving as the first application of drift diffusion model in the domain of sports, provides new empirical evidence on the decision-making mechanisms in sports, highlighting the intricate complexities associated with deceptive actions. The findings emphasize the critical role of athletic expertise, as experts demonstrate a more efficient perception-action loop despite longer non-decision times. The dual impact of prior information underscores its context-dependent nature, aiding decision-making in genuine scenarios while complicating it in deceptive ones. These insights offer valuable implications for optimizing sports training and strategy development.

Keywords: *decision-making, drift diffusion model, deceptive action, expertise, prior information*

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VIRTUAL REALITY VS. REAL WORLD: 3D KINEMATIC ANALYSIS IN TABLE TENNIS

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Introduction/Purpose
This study aims to compare the kinematics of movement during the execution of selected strokes in table tennis in both conventional and virtual reality environments (Michalski at al., 2019). Specifically, it focuses on comparing the motion patterns of players when performing forehand and backhand topspin strokes in regular and virtual settings using 3D motion analysis.

Methods
Ten high-level table tennis players (sex: 8 male 2 female, age: 29,3 ± 5,7 yr, 10 years of racing experience at the level of the 1st and 2nd leagues in the Czech republic) participated in the study, utilizing Xsens MVN Awinda motion capture technology, VR goggles (Eleven table tennis) and a ball playback robot (He at al., 2020). They performed forehand and backhand topspin strokes in both real and virtual environments. Upper and lower limb kinematic data were collected and analyzed using Python. Selected data were compared between environments using the Wilcoxon test and substantive significance was expressed using the CLES parameter (Yang at al., 2021).

Results
When performing forehand and backhand topspin strokes, statistically significant differences ($p < 0.05$) were observed in the kinematics of lower and upper limb movements between real and virtual environments. Statistical differences were found in all types of strikes and related to the following monitored variables: range of motion, angle at the beginning and end of the strike phase, maximum velocity, maximum angular velocity. Specifically, the study found different movement patterns in the two environments, suggesting that virtual reality changes the way players perform these movements.

Conclusion
Based on the obtained results, we believe that there is no kinematic movement consistency in the movement of the upper and lower limbs between playing topspin shots in a regular and virtual table tennis environment. Therefore, we cannot recommend the use of virtual reality to competitive table tennis players as a suitable training tool for improving their technical level.

Keywords: *3D kinematic analysis, table tennis, virtual reality, Xsens MVN Awinda*

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A COMPARATIVE ANALYSIS OF PACKING-RATE KPI'S IN THE PREMIER DIVISIONS OF LEAGUES IN SOUTH AFRICA, ENGLAND, SPAIN, GERMANY AND UEFA CHAMPIONS LEAGUE

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Introduction
This study conducts a comparative analysis of packing rate key performance indicators across top football leagues in South Africa, England, Spain, Germany and the UEFA Champions League. Packing rate, a novel metric developed by Impect GmbH measures the effectiveness of player actions in bypassing opponent players, offering a deeper insight into the game into the match's dynamics (Goes, 2019). The research aimed to evaluate its comparative applicability across different leagues using packing rate metrics.

Methods
A large dataset of secondary data containing packing variables for 6310 matches were analysed. This quantitative study employed principal component analysis to reduce the datasets dimensions followed by analysis of variance (ANOVA) and a Turkey post-hoc tests to identify significant differences in packing rates across the leagues in all principal components analyzed.

Results
Based on the output, four out of the initial ten components were retained accounting for 74.184% of the total variance. The dimensions were organised into categories in which PC1 can be labelled as attacking efficiency, PC2 can be labelled as ball retention, PC3 can be labelled as defensive efficiency, and PC4 can be thought of in terms of adding or reducing the number of defenders. South African leagues packing statistics were significantly different from those in European leagues. Especially with regards to the adding and reducing the number of defenders.

Conclusion
These statistically significant variations underline the need for league-specific approach when employing packing rate as a predictive tool for football match analysis. The study suggests that while packing rate analysis can differentiate between leagues, it necessitates adjustment specific to each league to be effective. This research opens avenues for further exploration into backing rate analysis, emphasising its potential as an innovative and factual tool for football analytics and match outcome predictions.

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A PSYCHO-SOCIAL ASSESSMENT OF THE DOPING PHENOMENON IN ALBANIAN SPORT

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Introduction
The alarming increase in the use of doping substances remains the focus of scientific research in sport. The study of doping at the national level is almost all focused on physiological/medical or ethical aspects, thus it is necessary to address attention to psychological factors, considering doping above all as a social fact, as it is. The purpose of this study is the inclusion of psycho-social factors in the implementation of training/preventive programs for the issue of doping at the national level and the inclusion in them of all educational figures about the athlete.

Methods
The scientific instrument used is a structured interview, previously applied in a European project for the study of the doping phenomenon: LEGASPO. The participants are 112 athletes (60.18% men and 31.86% women, aged 18-33 years), who perform at a competitive level in 6 sports disciplines: volleyball, basketball, football, wrestling, boxing and weightlifting.

Results
Weightlifting turns out to be the sport where the doping phenomenon is most widespread; 80% of weightlifters know an athlete who takes doping in their sports circle, followed by wrestling with 40%. Boxing and basketball are the only sports disciplines that do not record recognition of other athletes doping. Over 60% of football players and wrestlers would not report a doping case in their sports circle, while basketball and volleyball are the two disciplines with the highest percentages of reports, respectively 55 and 43.75%.

Conclusion
Weightlifting is the discipline with the highest percentage of recognition of doping cases in the relevant sports circle, in which the use of doping substances has been recommended the most, mainly by other athletes and the doctor. Currently, it turns out that the two sports disciplines with the highest level of use of doping agents are: weightlifting and wrestling, where most of the athletes, the main weight of the blame for the use of doping falls on the athlete himself.

Keywords: *sports, doping, athletes, psychological factors*

GYMNASTICS COACHES' KNOWLEDGE ABOUT EATING DISORDERS

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Introduction
Despite the increasing prevalence of eating disorders (ED), it is still a taboo in sport which is considered a healthy activity. Certain sports have increased risk for ED development and athletes show more serious and resistant symptoms than the general population where the prevalence of ED is lower. Athletes from sports that require a lean body for better performance often show maladaptive behaviors such as strict diets, weight reduction, body image preoccupation, etc. Also, in early adolescence, maturation brings physical and hormonal changes, especially in girls, that can lead to overeating and food preoccupation, due to long-term restrictions. It can lead to increased weight which deteriorates sports performance and increases the risk of injury, besides psychological difficulties. Accordingly, gymnastic sports have increased risk for the development of ED. It is important to have competent coaches who can recognize and timely react to initial signs and who know preventive strategies and risk factors, including their feedback and leadership behaviors, that can contribute to the development of ED in athletes.

Methods
This study aims to assess gymnastics coaches' knowledge of ED symptomatology and investigate whether male and female coaches differ in it. The sample consisted of 65 (35 female) coaches, on average 38.17 years old (SD = 12.36). The data was collected before the psychological workshop via an online questionnaire. The ED questionnaire (Turk et al., 1999) consists of 30 true-false questions, with a higher result indicating better knowledge of ED symptomatology.

Results
Descriptive statistics showed that one participant solved the questionnaire with an accuracy higher than 90%, 6 participants between 80 and 89.5%, 19 between 70 and 79.5%, 17 between 60 and 69.5%, 16 between 50 and 59.5%, and 6 participants with accuracy between 40 and 49.5%. T-test ($t = -4.76$; $p < 0.01$) showed statistically significant sex differences in coaches' knowledge of ED symptomatology. Women ($M = 20.91$) showed a higher average number of correct answers than men ($M = 17.27$).

Conclusion
Although it's unclear which amount of coaches' knowledge about disordered eating and ED symptomatology has a protective function, Turk et al. (1999), emphasize the importance of further education for coaches who solved the questionnaire with an accuracy lower than 69.5%. One-third of participants in their study scored lower, compared to 60% of participants in the present sample. It indicates the need for education of Croatian gymnastics coaches regarding ED symptomatology for better and timely recognition of such problems in athletes.

Keywords: *sport, disordered eating, coaches, athletes*

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GENDER DIFFERENCES AND NATIONALIST DISCOURSE IN CROATIAN OLYMPIC COVERAGE: A MIXED-METHODS ANALYSIS OF THE 2024 PARIS OLYMPICS

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Introduction
Olympics have a substantial impact on shaping opinions about sportspeople (Organista et all, 2020) and they are also an opportunity for female competitors to present their skills since during the Olympics interest in women's sports is greater than usual (Billings, 2008).The lack of diversity in sports media coverage globally is evident, most routine coverage focuses on men's sports, while women's sports remain on the margins (Bruce, 2016). Sports associated with national pride and international success appear prominently during mega-events such as the Olympic Games.

The article presents differences in describing athletes during the last Olympic Games in Paris in terms of gender and nationality in Croatian newspapers. The goal of this research is to perform the quantitative and qualitative comparison of press materials from the last Olympics in Paris.

Methods
The research goals will be achieved by using quantitative (content analysis) and qualitative (critical discourse analysis) comparison of press materials from Olympic Games in Paris, 2024 (Jutarnji list, Večernji list and Sportske novosti). All texts published five days prior to, during, and five days after the events will be analysed. For quantitative part of the study content analysis will be used (chi square test of independence, z-test for proportions, student's t-test). The articles will be coded according to the length, author's gender, and sport discipline. For qualitative part of the study critical discourse analysis of three daily newspapers will be used.

Results
Attempting to combine the categories of nationality and gender in the analysis of reporting on major sporting events is important because, as Wensing and Bruce (2003) noted, during the Olympic Games, "national identity overrides all other identity markers such as gender". Our analysis will reveal representation of female athletes, differences in the description of rival competitors, representation of articles about Croatian representatives during the Olympics.

Conclusion
The authors indicate the validity of combining gender analysis and nationality in the context of the last Olympic Games.
Key words: gender, national identity, Olympic Games, Paris 2024, Croatian daily newspapers

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CHANCE MEETING WITH BULLYING AND ITS CONSEQUENCES FOR ADOLESCENCE: THE SCHOOL SPORTIVE AREA BACKGROUND

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Introduction
Bullying is a complex social phenomenon, recognized not only by the field researcher's specialist but also in the school context; however, we often encounter episodes of bullying, and the feeling of being returned to the same situation touches us, reminding that the concept and behavior have always existed in a long-life way. Bullying can be carried out by a group, or by one stronger individual; although usually considered in the context of pupil-pupil relationships, both teacher-pupil and pupil-teacher bullying may occur.

The purpose was a finding out encounter with bullying, school and sportive area context, on a private structure.

Methods
The research began as a pilot work initiative in one of the 9-years schools in the city of Durrës, where 319 students from V to IX grade participated in our survey (155 girls and 160 boys, 4 of them did not declare their gender). The ad hoc questionnaire distributed (Revised Olweus Bully/Victim Questionnaire (OBVQ-R)) helped us analyze the prevalence and characteristics from their demographic profiles to their school satisfaction and experiences of bullying, from the perspective of the age group (9 ≠15 years old).

Results
Participation in a sports course was one of the topics of research, and the findings reported that 42 of them were victims of bullying in different areas of sport participation.

Conclusion
The school community offers a relatively inclusive and satisfying environment for almost a very student but that little part of them, victims of bullying, needs active policies within schools such as active psychosocial listening and protective government policies.

Keywords: *bullying, sport, adolescence, school, protective government policy*

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A COMPREHENSIVE REVIEW OF THE HOME HANDEDNESS QUESTIONNAIRE AT THE SPORT UNIVERSITY OF TIRANA

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Purpose
Handedness, the predominant use of one hand over the other for various activities, has been extensively investigated over the decades. This review focuses on the application of factor analysis to the Home Handedness Questionnaire (HHQ) within the Unraveling Hand Preferences research project at the Sport University of Tirana. While various methodologies exist for assessing handedness, questionnaires are common tools, though traditional measures often overlook hand preference variations in different skill types, restricting the assessment to a single dimension. The HHQ, designed primarily for children, assesses handedness through unimanual actions and role-differentiated bimanual manipulation (RDBM). The primary objective of this study was to validate the HHQ's component structure in a sample of adults (N = 286) and to examine RDBM hand preference prevalence among adults.

Methods
This study utilized confirmatory factor analysis (CFA) to validate the HHQ's component structure and compared it to the Edinburgh Handedness Inventory (EHI) to corroborate findings. A sample of 286 adult participants/students was administered both the HHQ and EHI. The CFA aimed to confirm the two-factor structure of the HHQ and replicate the unidimensional solution of the EHI.

Results
The confirmatory factor analysis confirmed the HHQ's two-factor structure and replicated the EHI's unidimensional solution. Participants with higher EHI scores showed a strong preference for using their dominant hand in both unimanual and RDBM tasks, as assessed by the HHQ. Notably, a reduction in right hand dominance was observed for RDBM tasks compared to unimanual tasks on both the HHQ and EHI.

Conclusion
The HHQ proved to be a reliable and valid instrument compared to the EHI, offering researchers a versatile tool to investigate variations in manual dexterity and explore broader cognitive lateralization patterns. The findings indicate the HHQ's effectiveness in assessing handedness across different dimensions, particularly in unimanual and RDBM activities.
Key Words: Handedness, HHQ Questionnaire, Sport University Students, Patterns in cognition

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THE ROLE OF FAITH IN SPORT: THEOLOGICAL PERSPECTIVE

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Introduction
Fun and play are an integral part of the individual and collective life of a person (homo ludens). Although various forms of sports, known as sports games, have been known in all civilizations since the earliest days, sports theorists point out that the "globalization" of sports began with the Industrial Revolution. Today, the global impact of sports is undoubted. Many athletes express and practice faith. Considering the fullness of the requirements for the preparation of athletes, not only physical conditioning but also strengthening the spirit should be taken into account if we want to speak about sport from a holistic point of view.

Methods
From a Christian theological point of view, we aim to investigate to what extent faith is important for the practice of "good" sports. Why are there connections between religion and sports/athletes?

Results
Christian theology has long avoided the subject of sport. Today it is an essential and necessary subject, and there are at least two extremes: some still argue that sport is only a game, and no serious theological consideration is needed; and others raise sports to the level of religion and worship, and thus directly challenge the image of God, man, and religion's understanding. The integrity of a player's personal development should prepare him for the rise and fall. Especially personal faith can help overcome "falls" and recover. In doing so, a good understanding of faith is important. From a Christian theological perspective, faith is understood as a dynamic and not a static reality; it comes from a fortress, it is eager to go higher, and faith develops a habit of commitment, and it also includes a constant effort to transcend the limits of one's possibilities, through discipline, asceticism, determination, persistence, sacrifice.

Conclusion
From a biblical point of view, faith develops social aspects, because the Bible's faith requires people to develop the ethical principles of moral responsibility, which are also important to recognize good (in) sports and athletes. Faith influences a person's life, determines the meaning of a given life situation, understands events, and supports times of difficulty, effort, abandonment, and loss. We can assume that sport is more than simply a game. It is a "game" that can lead each person towards the highest reward, one of the virtues.

Keywords: *faith, sports, athletes, good sport, sport and spirit, sport and Bible, theology of sport*

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HOW TO PERSIST IN SENIOR SWIMMING?

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Introduction
The study was conducted on a sample of Croatian senior swimmers who are either finishing their high school education, are university students, or are employed. After junior age, Croatian swimmers often decide to stop competitive swimming, often due to the impossibility of balancing sports career and other obligations. Their careers start early and last for a long time, and in the process of sports preparation these swimmers face psychological, social, academic, financial, and result difficulties (Linnér et al., 2019) that often lead to dropouts. This study aimed to investigate the relationship between motivational variables, personality traits, drop-out attitudes and goal orientation regarding to age category (high school students, college students, and/or employed swimmers).

Methods
65 active senior swimmers, aged 18 to 32, participated in this study. Participation Motivation Questionnaire (PMQ, Gill et al., 1983)), HEXACO-PI-(R) (Ashton&Lee, 2007; Babarović& Šverko, 2013), Dropout Questionnaire (DQ, Nekić et al., 2018), Task and Ego Orientation in Sports Questionnaire (CTEOSQ, Barić&Horga, 2006), and general data questionnaire were used.

Results
The results showed a significant positive correlation between the age category and personality traits conscientiousness and openness; older swimmers are more conscientious and open than younger ones. Also, the age category was positively correlated with task orientation and with the external reasons for quitting sports. Older swimmers drop out more often due to external reasons such as injuries, love life, lack of peers, and publicity in sport.

Conclusion
The results indicate the importance of understanding the relationship between current age and obligations derived from it with persistence in senior sports, i.e. swimming. If we want to support the motivation for long-term sport participation the above results can serve as a starting point for the creation of a prevention program for dropout from swimming in senior age.

Keywords: *swimming, seniors, motivation, persistence, personality traits, dropout*

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WINTER OLYMPIC GAMES SARAJEVO 1984: FROM IDEA TO BID AND HOSTING THE GAMES

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With the organization of modern gymnastics and sports in the 19th century, the idea of reviving the Olympic competitions emerged. The idea of reviving was proposed by the Frenchman Pierre de Coubertin at the International Congress in Paris in June 1894. The Olympic competitions were uniform for the first decades and included skating and ice hockey, while the inclusion of skiing was discussed after the First World War at the IOC session in Lausanne in June 1921, when it was decided, that in the year of the Olympic Games in Paris (1924) the International Olympic Committee will sponsor the "Winter Sports Week" in Chamoniux, where athletes competed in figure and speed skating, skiing (cross-country skiing and ski-jumping), military patrol, bobsleigh, curling and ice hockey.

On the sixtieth anniversary of the first Winter Olympic Games in 1984, the Games were hosted by Sarajevo. Thus, in the sequence of two Olympics, two communist countries, SZ and Yugoslavia, hosted the Olympic Games. Politically, Yugoslavia was the central country of the non-aligned movement, and the Soviet Union of the Eastern military-political bloc. The Sarajevo Games also coincided with the appearance of the new president of the International Olympic Committee, J. A. Samaranch. In the national and sport memory Games were generally remembered fort the first Yugoslav - and indirectly Slovenian - Winter Olympic medal of the giant slalomist Jure Franko and also for the mascot Vučko (wolf). On the other hand, the important issue was the organization, preparation and execution of the Olympic competitions. After winning the candidacy, the Sarajevo organizers had to obtain wider professional support and cooperation of winter sports workers for the implementation of the games and, among other things, met with the Slovenian ones. After the constituation the Organizing Committee prepared an ambitious plan and projects for the preparation and implementation of the Games.

In our contribution, based on primary sources, i.e. the reports of the organizing committee, and secondary sources (newspaper sources), we will delve deeper into the idea of bid and organizing and holding the Winter Olympic Games Sarajevo 1984.

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ASSESSING ATHLETES' MENTAL HEALTH LITERACY

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Introduction
Athletes' mental health has become an increasingly important area of concern. Recent studies have highlighted a comparable or heightened vulnerability to mental health issues among athletes compared to the general population (Kegelaers et al., 2022). Mental health literacy has emerged as a pivotal factor influencing athletes' willingness to seek support during mental health challenges (Bu et al., 2020). This research assesses the reliability and validity of a novel, sports-specific brief tool designed to measure mental health literacy among athletes. Additionally, the study aims to evaluate athletes' mental health literacy alongside other mental health indicators.

Methods
The new sports-specific instrument for measuring athletes' mental health literacy consists of 12 items referring to the general knowledge of mental health and ill-health; knowledge and attitudes concerning mental health risks, resources, and help-seeking strategies; and stigmatising attitudes and belief. An online survey comprising this new tool, other instruments measuring mental health literacy and other mental health metrics was created for this study. A sample of 232 talented and elite athletes aged between 18 and 25 participated in the study. Data analysis encompassed testing the instrument's factorial structure, internal consistency, reliability, and validity.

Results
The recently created mental health literacy scale specific to the context showed sufficient reliability and validity in evaluating athletes' mental health literacy. Furthermore, athletes' mental health literacy scores were associated with their overall mental health status, suggesting lower literacy was linked to poorer mental health. In addition, some differences in mental health outcomes appeared between male and female athletes with female athletes showing higher levels of anxiety and depression.

Conclusions
This study demonstrated that the newly developed mental health literacy scale tailored to the sports context is an effective tool for evaluating athletes' mental health literacy. The findings about athletes' mental health outcomes add to the increasing understanding of mental health in sports and emphasize the importance of customized assessments for this particular group as well as interventions aiming to improve their mental health literacy.
Keywords: athletes, mental health, mental health literacy, validation study

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KINESIOLOGY FOR THE 21ST CENTURY (PARADIGM AND STRUCTURE SHIFT OF KINESIOLOGY)

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Introduction
Kinesiology, the science of movement and transformation processes, is undergoing significant changes as the world transitions into the fourth industrial revolution, characterized by digitalization, virtualization, and artificial intelligence. This era presents new challenges and opportunities for kinesiology, particularly in addressing the increasing sedentary lifestyles associated with screen use, especially among children. The rise of e-sports and the complexities of capitalist influences on traditional sports further exacerbate the need for kinesiology to adapt. This paper aims to re-examine and update fundamental kinesiological principles to ensure their relevance and effectiveness in promoting the well-being of young people in a rapidly changing world.

Methods
This study explores three fundamental principles of kinesiology: its subject of study, its development through a historical and future-oriented lens, and its structural breadth of possibilities. The research involves a comprehensive review of literature and historical documents to trace the evolution of kinesiological concepts and practices. Additionally, the study analyses current trends and issues, including terminological discrepancies across different languages, to identify areas needing modernization and harmonization.

Results
The analysis highlights the need for kinesiology to address the decline in physical activity due to increased screen time and sedentary behaviours, particularly among children. It also reveals the impact of e-sports and economic factors on traditional sports, emphasizing the importance of integrating contemporary digital and virtual trends into kinesiological practices. The study identifies critical areas for updating terminologies and standardizing concepts across languages to enhance global understanding and collaboration in kinesiology.

Conclusion
Kinesiology must evolve to meet the challenges posed by the fourth industrial revolution. By revisiting and upgrading its core principles, the field can better address modern lifestyle changes and promote the health and well-being of young people. Harmonizing terminology and concepts across different languages will facilitate more effective global collaboration and dissemination of kinesiological knowledge.

Keywords: *kinesiology, 21st century, modernization, kinesiological postulates*

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STUDENTS PHYSICAL ACTIVITY BEHAVIORS DURING THE COVID-19 PANDEMIC

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Introduction
The COVID-19 pandemic has disrupted students' familiar habits due to restrictive measures, such as lockdowns, to prevent the spread of the coronavirus. Therefore, we aimed to investigate whether students' physical activity (PA) levels have changed.

Methods
This cross-sectional study involved 449 students (mean age: 23.31 ± 1.91; male 49.9%, female 50.1%) from various academic disciplines at the University of Novi Sad. The field research was conducted between March and July 2022 in Serbia. The participants were also divided into two groups: Students of sports sciences (SSG, e.g. sport and physical education) n = 219 and students of other sciences (OSG, e.g. social, medical, natural sciences, etc.) n = 230. To measure the level of physical activity, we used the adapted version of the International Physical Activity Questionnaire – short form (IPAQ-SH), which covers three time periods: before the COVID-19 pandemic, during the I + II wave of the pandemic, and the period after (nowadays). The data was analyzed using the SPSS program (Mann-Whitney, Friedman tests).

Results
There was a significant difference in overall PA levels across the three time periods (pre-pandemic 4026.00 MET-min/week, during the I + II waves 2292.00 MET-min/week, and nowadays 3786.00 MET-min/week) $\chi 2$ (df = 2) = 188.05, p = .000. It appears that overall PA levels have not returned to pre-COVID-19 pandemic levels as students demonstrated lower activity levels. In addition, the SSG group had higher PA levels for each period: before the COVID-19 pandemic (U = 12830.50, p = .000), during the I + I wave (U = 14852.00, p = .000), and nowadays (U = 15361.50, p = .000).

Conclusions
Results indicate that PA levels have decreased over the past two years, particularly during the first and second waves of the COVID-19 pandemic. However, sports science students maintained a higher level than students of other study profiles.

Keywords: *students, physical activity, COVID-19 pandemic, IPAQ-SH*

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SKI SIMULATOR CAN BE USED BY RECREATIONAL SKIERS DURING PREPARATION PERIOD FOR ALPINE SKIING

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Introduction
Alpine skiing is a popular activity which can be classified as short-duration high-intensity exercise. Recreational skiers are advised to prepare before season, but activities that would mimic alpine ski movement both biomechanically and from the metabolic perspective are limited. Purpose of this investigation was to compare heart rate and blood lactate levels (bLA) after performing short turns of similar length, and duration during field skiing in Sappada, Italy (between 1300 and 1500 m above sea level), and in laboratory conditions on ski simulator Pro Ski Up. Matching number of springs, situated on a simulator basis, are attached to a cart on which subject is standing. Springs fasten the platform on wheels to the rails and ensure it regains resting position in the middle of the apparatus. There are six springs that represents levels of resistance, each matching the weight of an athlete.

Methods
We included 36 healthy recreational alpine skiers (mean age 23,34±2,65 years; 13 females and 25 males), with no injury of locomotor system. In both conditions, skiing duration was set at 90 seconds and duration of short turns was controlled using a metronome that was set to 76 beats per minute. Immediately after the testing we measured participants' heart rate (HR), while bLA was measured by Lactate meter sirius Lactate Scout+ (SensLab GmbH) 3 minutes after the test.

Results
Although mean vales of maximal bLA were higher after short turn performance on a ski slope (3.39 vs 3.06 mmol/L), and mean values of maximal HR were higher after a ski simulator (149.75 bpm vs 147.88 bpm), the differences were insignificant (all $p>0.05$).

Conclusions
From the energy point of view there are no differences in short term performance on a ski slope and ski simulator. Therefore, ski simulators can be a good option for preparation of recreational level alpine skiers for the skiing season.

Keywords: *recreational alpine skiing, physical preparation, laboratory testing, field testing*

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THE ASSOCIATIONS OF DIFFERENT DOMAINS OF SOCIO-ECONOMIC STATUS WITH PHYSICAL ACTIVITY AND SEDENTARY BEHAVIOUR IN CHILDREN

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Introduction
Physical activity (PA) is crucial for maintaining health, and ensuring a high quality of life. While it is well-documented that socioeconomic status (SES) affects physical activity levels in adults, its impact on younger populations remains unclear (O'Donoghue et al., 2018). We aimed to identify the relationship between different indicators of SES and PA in children.

Methods
We initially included 50 participants (11-13 years old); however, data from 45 children were analysed due to missing parental SES information or failure to provide sufficient PA data. To be included in the analysis, 2 weekdays and 1 weekend day with at least 8h of data were required. The children's activity levels were categorized as either active enough or not active enough according to the most recent WHO guidelines, and as being sedentary, if sedentary time was above the median levels of the sample, or not, if values were below median. Questionnaire based SES indicators included information on mother's and father's education, if a child has its own room, number of vehicles, travels for holidays outside of the country, bathrooms and computers. We fitted 7 different logistic regression full models for each outcome, with age and sex included as covariates in all models, while SES indicator differed between models.

Results
Higher level of father's education significantly increased the likelihood of a child being sufficiently physically active (OR = 5.48, 95% CI: 1.36-28.6, p = 0.025). On the other hand, having own room tended to decrease the odds of meeting PA guidelines. In contrast to PA, we did not observe a link between any SES indicator and high sedentary behaviour.

Conclusion
We identified associations between family SES and PA, but not sedentary time among children. Based on our results, higher levels of fathers' education showed the strongest associations with children's PA, so initiatives and policies aimed at narrowing the inequalities in children's PA levels should be focused on children that come from families where the father is not highly educated.

Keywords: *Children, Physical activity, Socioeconomic status*

Funding
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PHYSICAL ACTIVITY AMONG FEMALE UNIVERSITY STUDENTS

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Introduction
Physical activity (PA) aids in preventing numerous chronic diseases and improves many aspects of general and specific health-related physical fitness (Aditya, et al., 2023). This paper analyzes the differences between physical activity levels among female students at the University of Novi Sad, Serbia.

Methods
The subjects in this study were female (N = 121) students from three faculties at the University of Novi Sad. They filled out the International Physical Activity Questionnaire (IPAQ), to get information about their physical activity levels in the week prior.

Results
When looking at the IPAQ categorization, results show that female students from the Faculty of Sport and Physical Education (FSPE) had significantly higher ($p<0.05$) levels of PA based on the IPAQ compared to students from both the Faculty of Medicine and the Faculty of Technical Sciences. The PA levels between the students from these two faculties did not differ significantly. When looking at the average metabolic equivalent (METs) per week, students from the FSPE spend 5268 METs weekly, which is significantly higher compared to students from the Faculty of Medicine who spend 3446 METs weekly, and the students from the Faculty of Technical Sciences who spend 2677 METs weekly.

Conclusion
According to the results, we can see that female students from the FSPE have significantly higher levels of PA when analyzing IPAQ categories, and when looking at weekly METs, which is somewhat expected due to the nature of their classes. By examining the PA of students at the university level, we can guide them to be more active through university sports and recreation. Moreover, we would be able to monitor their progress throughout the semester or even their whole education in hopes of reducing sedentary behavior and promoting healthy lifestyle habits.

Keywords: *physical activity, sedentary lifestyle, physical inactivity, university students*

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EXPLORING BARRIERS TO SPORT AND EXERCISE PARTICIPATION IN CROATIA: A POPULATION-BASED STUDY

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Introduction
Understanding the barriers to physical activity is essential for designing effective promotion interventions and campaigns. Although physical activity barriers have been extensively researched in past years, there is limited knowledge about the relationships between barriers and specific types of physical activity. Theoretically, this knowledge could be used to target the most significant physical activity barriers in public health interventions and campaigns. Therefore, the aim of this study is to determine the relationships between sports and exercise participation and potential barriers within the Croatian population.

Methods
The sample comprised 1008 randomly selected Croatian citizens. Data were collected as a part of "Special Eurobarometer 525: Sport and Physical Activity" which included questions about: i) participation in sport and exercise and ii) the barriers for physical activity. Based on their sport and exercise participation, participants were categorized into two categories: "Inactive" (never or less often than once per month) and "Active" (at least once per month). Physical activity barriers were assessed using list of 10 potential reasons that currently prevent individuals from practicing physical activity more frequently, to which participants answered with "yes" or "no".

Results
The logistic regression analysis revealed that the only significant predictors of sport and exercise participation were "No infrastructure" and "Lack of motivation". Specifically, individuals who perceive their neighbourhood as unsuitable or lacking accessible sport infrastructure had lower likelihood of being active (OR = 0.48; 95% CI: 0.29-0.79, $p < 0.05$). Individuals who lack motivation or interest in sport also had lower likelihood of being active (OR = 0.30; 95% CI: 0.21-0.44, $p < 0.05$). The analysis was adjusted for age and gender. According to the McFadden pseudo-R, the model explained 29.6% of the variance.

Conclusion
Our findings indicate that improving access to sport facilities and infrastructure, as well as fostering motivation and interest in physical activity, should be prioritized in future physical activity promotion campaigns and interventions. Addressing the barriers of inadequate infrastructure and lack of motivation is essential for developing effective strategies to enhance physical activity participation of the Croatian population. Future research should explore effective motivation strategies to further support these efforts.

Funding
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Keywords: *physical activity, motivation, Croatian population, health promotion, motor activity.*

THE IMPACT OF TRADITIONAL DANCE ON HEALTH AND QUALITY OF LIFE: A SYSTEMATIC REVIEW

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Introduction
This systematic review examines the impact of traditional dance on the health and quality of life of participants. Traditional dance, a culturally enriching activity, has been practiced for centuries and is known for its physical, mental, and social benefits. The aim of this review is to analyze existing studies to identify the specific health outcomes associated with participation in traditional dance, including improvements in physical fitness, mental well-being, and social connectivity.

Methods
The methodology involves a comprehensive search and review of scientific papers, expert articles, and case studies that explore various health outcomes linked to traditional dance. The search was conducted using databases such as Kobson, Web of Science, PubMed, and Google Scholar. Key search terms included "Traditional dance," "Folk dance," "Health and Quality of life." Studies were selected based on their relevance to the topic and the quality of their methodologies in the period from 2004-2024.

Results
A total of 7 papers dealing with this topic were reviewed. The results show that regular practice of traditional dance can improve cardiovascular health, muscle strength, flexibility and balance. In addition, participation in traditional dance has been shown to improve mental health by reducing stress, anxiety and depression, while also promoting cognitive function and social interaction. The review emphasizes that traditional dance provides a sense of community and belonging, which positively contributes to general well-being and life satisfaction.

Conclusion
It is concluded that traditional dance is a multifaceted activity with significant potential for improving health and quality of life. The findings suggest that traditional dance can be an effective intervention for promoting physical and mental health. Further research is needed to quantify these benefits and explore mechanisms through which traditional dance exerts its positive effects. Future studies should focus on longitudinal outcomes and the development of standardized measures to assess the impact of traditional dance more precisely.

Keywords: *traditional dance, folk dance, health and quality of life*

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EMPOWERING HEALTH EDUCATION THROUGH HEALTHY LIFESTYLE NETWORK EUROPE: LEVERAGING DIGITAL PLATFORMS AND COMMUNITY SUPPORT FOR LIFELONG LEARNING

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Introduction
Healthy Lifestyle Network Europe (HLNE) is revolutionizing health education by integrating social networking principles with health education. This method, part of the 3-year (23-26) European Project "Healthy Lifestyle Network Europe (HLNE)," financed by ERASMUS Sport (n.º 101133533), aims to give a new perspective concerning health education by integrating social networking principles with health education. The aim of this method is to clarify the innovative approach of HLNE, using digital platforms, peer support, training, and data analytics to foster a dynamic learning environment. HLNE promotes knowledge sharing, holistic education, and community support by synthesizing online communities, educational content, and interactive challenges. Essential to this approach is the education of HLNE trainers and promoters, enabling personalized guidance and community outreach.

Methods
Implementation strategies within the HLNE encompass institutional support, technology integration, and continuous improvement through user feedback. Training programs for coaches and promoters cover the latest research, insights about a healthy lifestyle, mindset, and digital health tools. Digital platforms ensure accessibility, while robust data security fosters participant trust. Utilizing user-friendly interfaces, HLNE facilitates lifelong learning through personalized recommendations and community engagement.

Results
HLNE yields increased student engagement, enhanced accessibility to health and prevention information, and a comprehensive approach to well-being. Through the website platform, we reached 3343 individuals, with 827 registered from participating countries. Participants reported increased physical activity after engaging with outputs from the New Health 2022 project, with improvements primarily in recreational activities (41%), followed by balance exercises (32%), sports (27%), and muscle strength training (18%). Additionally, most consumers reported improved lifestyle, nutritional, and mindset changes. Longitudinal monitoring reveals positive behavioral changes and community-building within HLNE networks. Aggregated data informs targeted interventions and resource development, enhancing HLNE's efficacy. The involvement of several stakeholders in HLNE initiatives fosters collaborative knowledge exchange and empowers individuals to adopt healthier lifestyles.

Conclusions
HLNE represents a paradigm shift in health education, empowering individuals to control their well-being proactively. By integrating digital platforms, peer support, and personalized guidance, HLNE facilitates lifelong learning and community engagement. The transformative potential of HLNE extends beyond traditional education settings, revolutionizing health promotion on a societal scale.

Keywords: *European healthy lifestyle networking, HLNE, health education, digital platforms, community support, lifelong learning*

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THE EFFECTS OF BIOLOGICAL AND ENVIRONMENTAL FACTORS ON GROSS MOTOR SKILLS OF 9-12 YEAR-OLD CHILDREN: "THE WHOLE IS DIFFERENT FROM THE SUM OF ITS PARTS"

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Purpose
The objective of present study was to examine the effects of some biological and environmental factors on gross motor coordination (GMC) skills in children aged 9-12, based on a holistic approach.

Methods
The study was conducted in Bursa / Turkey during the fall semester of the 2023-2024 academic year. In total, 882 girls (n=412, age 11±0.89 years) and boys (n=370, age 11±0.90 years) children from 10 different schools voluntarily participated in the study. The subjects' age, gender, height, weight, BMI, biological maturation and BMI were determined. Gross Motor Coordination Test test was used to collect data. Additionally, an environmental factors information form was used to determine characteristics such as geographical region, school characteristics, and participation in out-of-school sports activities. The data were evaluated and compared using Independent T and One-Way Anova Tests in the SPSS for Windows 26 statistical package program. Cohen's d and partial Eta Squared (η_p^2) values were used to determine the effect size. This study was supported by the Scientific Research Projects Unit (BAP) of Bursa Uludağ University (SDK-2024-1576).

Results
Mean height, weight and BMI of boy and girl subjects were determined as: 145.9±9.7 cm and 147.5±19.2 cm, 40.3±10.9 kg and 39.7±10.2, 18.7±3.6 kg/m2 and 18.5± 8.3 kg/m2, respectively. KMK scores of boys and girls were determined as 123.3±45.3 points and 117.5±42.6 points, respectively. The statistically significant difference was found between the KMK scores of boys and girls (t=1.831, p<0.05).

Conclusion
It can be said that biological and environmental factors have a significant effect on the gross motor skills of 9-12 year old children. It is recommended, in the future some studies be carried out talent selection and identification in sport.
Keywords: motor development, gross motor development, biological maturation, environmental factors

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INVESTIGATION OF THE SPORTS SCIENCE STUDENTS' EVERYDAY LIFE DURING THE COVID-19 PANDEMIC

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Introduction
The COVID-19 pandemic transformed university students' everyday lives. The pandemic negative impact on physical activity, eating, and sleeping habits is well documented. This study intends to assess differences in sports science students' daily lifestyle behaviors across three pandemic waves.

Methods
The sample involves n = 24 students (AS=23 years, 45.8% male, 54.2% female) from the Faculty of Sport and Physical Education, University of Novi Sad (n=13), Serbia, and the Faculty of Health Sciences, University of Primorska (n=11), Slovenia. Their changes in everyday life were examined in semi-structured interviews (on average 68 minutes) in the domain of physical activity, sedentary behavior, eating and sleeping habits, social life, and organization of academic commitments. The students had to report retrospectively on their everyday life. The data collection was conducted from May to July 2022 and analyzed with QDA Miner Lite 3.0.

Results
Students reported various behavioral changes across the three waves. Although the curriculum of these students is linked to physical activity and they learn about its importance for health, 45.8% of them decreased their activity level. 87.5% of students led to a sedentary lifestyle as they had to follow online lectures and social distancing measures. Most students (66.7%) have improved their dietary behavior with variety and better-quality food. Sleeping habits remained the same for 54.2%, but in some cases (16.7%), sleep was drastically disrupted, changing daytime to nighttime. Social life with family remained the same for 58.3% of students, while friendships in 45.8% strengthened during these difficult times. Lastly, they reported fewer obligations for studies in 83.3% compared to the period before the COVID-19 pandemic.

Conclusions
The COVID-19 pandemic led to various changes in students' everyday lives. Revealing their behaviors can help to understand how sports science students coped with these difficult circumstances.

Keywords: *students, COVID-19 pandemic, everyday life, changes, interview*

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SOCIODEMOGRAPHIC AND BUILT ENVIRONMENT CORRELATES OF TRANSPORTATION PHYSICAL ACTIVITY OF THE COMMUNITY-DWELLING OLDER PERSONS IN THE ZAGREB AREA

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Introduction
It has been shown that built environment significantly influences older persons' physical activity (PA) level. Neighborhoods that are walkable and safe, with easily accessible services promote PA in older persons (Barnett et al., 2017). There is a lack of data on the relationship between built environment characteristics and daily mobility in the older population in Croatia. Therefore, the aim of this preliminary research was to investigate the correlation between sociodemographic and built environment characteristics and transportation PA in the community-dwelling older persons in the Zagreb area.

Methods
The study was conducted as part of the Fit-Old project, funded by the European Union [Grant Agreement No 622623-EPP-1-2020-1-DESPO-SCP]. The participants were older persons living in different parts of the city of Zagreb, Croatia (n=209; 180F/29M; age (mean±SD) 73.10±5.45 y). Data on the participants' sociodemographic characteristics (age, gender, education level, number of household members, family income) and characteristics of their neighborhoods (types of housing, distance to different public services) were collected by a questionnaire. The Croatian long version of IPAQ was used to assess the transportation PA (Pedišić et al., 2011). A Spearman's rank-order correlation was used to assess the relationship between the sociodemographic and built environment characteristics and the transportation PA.

Results
Self-reported transportation PA (1146.74±922.69 MET-min/week) was significantly negatively correlated with the distance from the older persons' homes to several services: supermarket (r_s=-.175, $p<.05$); local services such as a bank, post office or library (r_s=-.182, $p<.05$); and bus stop, tram, metro or train station (r_s=-0.181, $p<.05$). No significant correlation of transportation PA and sociodemographic factors (age, level of education, number of household members, family income) was found.

Conclusions
Availability of local services such as grocery stores, post offices or public transport stations within walking distance was significantly correlated with a higher level of self-reported active transport in older persons living in Zagreb. The findings are informative for health-related policymakers and urban planners, given the potential of the built environment in promotion of everyday activity in this age group.

Keywords: *active transport, urban environment, older age*

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THE POTENTIAL OF COMMUNITY WALKING: INVESTIGATING THE CROATIAN WALKING FESTIVAL – 'COME WALK WITH ME'

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Introduction
Walking continues to be one of the most appropriate physical exercises for lifetime. There is a need for more research into various methods that are promoting walking for everyone, especially festivals. There is an annual walking festival in the Gospic area of Croatia called 'Come Walk with Me.' This research will focus on this walking festival. The purpose of this research is to investigate the overall dynamics of this activity.

Methods
To this end, we chose the qualitative research method of participant observation. We chose to participate in two of these events. Research questions were: What is the observed impact of the walking on the participants? Also, what is the observed impact of the race on the surrounding communities? Information from the research questions were recorded within a journal. We will focus on two main questions: What is observed to be the impact of this festival on the participants? What is the impact on the community? (Jirasek, Roberson, and Jiraskova, 2019).

Results
There are three main findings as a result of observing and participating two times in the Walking Event based out of Gospic, Croatia. 1. There is obvious excitement and happiness shown among the walking participants. 2. The walking resulted in dynamic of interaction within the community seen by those living in the homes were coming outside, waving, participating, and urging us onward. 3. There is a newly developed comradery among walkers, previously strangers, now were easily speaking to one another and helping others if needed.

Adding to this, there are many benefits from walking (Roberson and Babic, 2009). Walking daily for minimum of 30 minutes has been shown to help with healthy eating as well as mental positive affect. We have uncovered urban areas which are aggressively advising citizens to take a walk! The benefits overall are obvious – less health care, happier people, and more reliable population.

Conclusion
Walking festivals are a positive way to promote public health as well as community. In addition this festival helps to promote awareness of sustainable practices of public health(Roberson, 2018). And the participant leaves the event with new friends, positive memories, and a renewed interest in personal health (Roberson and Babic, 2008).

Keywords: *Walking, festival, outdoor recreation, leisure*

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Information
https://www.croatiawalk.com/en/homepage/

IS CHILDREN PERCEPTION OF ENVIRONMENT ASSOCIATED WITH THEIR SEDENTARY BEHAVIOUR?

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Introduction

A prolonged time spent in sedentary behaviour (SB) is associated with higher risks of various noncommunicable diseases and an increase in overall mortality rates (Wu et al., 2023). Understanding the correlates of SB in children is essential for future intervention and policy development. The findings of previous studies on environmental factors and sedentary behaviour of youth were found to be scarce and inconsistent (Stierlin et al., 2015). Therefore, we conducted the research with the main goal to determine the association between objectively assessed sedentary behaviour and children's perception of potential environmental correlates of sedentary behaviour.

Methods

The sample consisted of 49 participants aged 11 to 13 years, and data were collected using Actigraph wGT3X-BT Activity Monitors. To be included in analysis, each participant needed to have at least 8 hours of data on 2 weekdays and 1 weekend day. Based on the median time spent in sedentary behaviour, respondents were categorized into two groups: sedentary and non-sedentary. Additionally, environmental correlates were assessed using a questionnaire on the home environment, neighbourhood, and safety.

Results

The logistic regression analysis results showed that the only significant predictor of SB was "home environment". Specifically, children who have a football goal, basketball hoops or volleyball net in their home/apartment, outside in the yard or in common areas, have a higher chance of being less sedentary (OR, 0,13; 95% CI, 0,02-0,73, $p < 0.05$) The McFadden pseudo R indicates that model has explained 22.3% of the variance.

Conclusion

Providing opportunities for physical activity at or around the home can play an important role in reducing sedentary behaviour among children. Future interventions and policies to reduce SB should promote the availability of sports equipment such as football goals, basketball hoops, and volleyball nets in residential areas, including common areas in apartment complexes and public spaces.

Keywords: *Sedentary behaviour, environment, child*

Funding

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DIFFERENCES IN THE QUALITY OF LIFE IN RELATION TO THE LEVEL OF PHYSICAL ACTIVITY AMONG HIGH SCHOOL AND UNIVERSITY STUDENTS

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Introduction

Quality of life represents a level of well-being derived from an individual's assessment across various domains of life, considering their impact on health, and depends on a multitude of factors. This study aims to determine if there is a statistically significant difference in the quality of life among respondents of different levels of physical activity across various age groups.

Methods

The study included 998 participants of both genders aged 18 to 24 years. The level of physical activity was evaluated utilizing the IPAQ questionnaire, whereas the quality of life was assessed through the WHOQoL questionnaire. Differences between groups and levels of physical activity of respondents were examined using the Kruskal-Wallis test. Additionally, LSD Post Hoc test was applied to determine differences among groups. Respondents were categorized into three groups based on their level of physical activity (low level of physical activity (less than 600 MET-min/week), moderate physical activity (600-3000 MET-min/week), high level of physical activity (>3000 MET-min/week)).

Results

Regarding the level of physical activity in the high school student group, differences exist in the domains of physical health (Sig. = .002) and mental health (Sig. = .001). In the university student group, differences exist in the domains of physical health (Sig. = .004), mental health (Sig. = .000), and social relationships (Sig. = .007).

Conclusion

Based on the obtained data, it can be concluded that both high school- and university students who are more physically active have higher average values in quality of life domains, including physical health, psychological health, and social relationships (in university students group). These results confirm that in this population group, the level of physical activity significantly impacts quality of life parameters, with the most active students showing the best outcomes in all measured domains.

Key words: *quality of life, students, exercise, health*

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URBAN/RURAL DIFFERENCES IN LIFESTYLE HABITS AMONG STUDENTS OF THE UNIVERSITY OF NOVI SAD

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Introduction
This study examines the differences in physical activity and health habits of students from the University of Novi Sad based on the demographic characteristics of their hometown. Understanding urban/rural differences in lifestyle habits is crucial, as these differences can influence overall student well-being and inform targeted health promotion strategies.

Methods
The study involved 107 respondents, of which 65.7% were male and 34.3% were female; 55.1% were from rural areas, and 44.9% were from urban areas. The chi-square test was used to analyze smoking and alcohol consumption habits. Additionally, self-assessments of physical activity, health status, and preventive health behaviors were evaluated. Differences based on the place of origin were assessed using the Mann-Whitney U test.

Results
The analysis shows that almost 90% of respondents do not smoke, with no significant differences based on their place of origin (χ^2 (2) = 0.575, p = 0.75). Regarding alcohol consumption, 60% of students drink alcohol, and 4% drink daily, with no significant differences between urban and rural students (χ^2(2) = 2.041, p = 0.36). Self-assessments suggest regular workouts 2-3 times a week, good health (average score 4), and infrequent preventive check-ups. The Mann-Whitney U test shows no significant differences in physical activity between urban and rural students (p > 0.05). Significant differences were found in physical fitness (U = 1116.0, p = 0.048) and bedtime (U = 809.5, p = 0.000), with rural students rating their fitness higher and going to bed earlier.

Conclusions
While differences in self-assessed fitness and bedtime habits were observed, the majority of health and physical activity behaviors among students do not show significant variation based on their hometown's demographic characteristics. Further research is necessary to gain a deeper understanding of these influences and to develop effective health promotion programs tailored to the needs of students from diverse environments.

Keywords: *physical activity, health habits, students, University of Novi Sad, demographic characteristics, rural areas, urban areas.*

ASSESSMENT SOME TECHNICAL PARAMETERS OF ELITE MALE TENNIS PLAYERS ACCORDING TO WORLD RANKINGS (ATP)

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Purpose
The objective of present study was to compare some technical parameters of male tennis players in the top 10 (G1) and 11-200 (G2) rankings in the last week of 2023 Association of Tennis Professionals (ATP).

Methods
Participants were 200 tennis players (1.-200.) in the ATP rankings by the end of 2023. Data on points from the tournaments, age, height, weight, left-right hand dominance, 1st ServeAVG, 2st ServeAVG, Serve Game Won % and Acematch were collected from official ranking and statistics websites (atptour.com and ultimatetennisstatistics.com). The variables were analyzed using the Independent t test. Cohen's d value was used to determine the effect size (d=0.2 small, d=0.5 medium, d=0.8 large effect).

Results
The number of matches played by tennis players in G1 and G2 groups was determined as 73.8±7.6 and 24.9±18.7, respectively ($p<0.05$, d=2.67). Height in G1 and G2 groups: 191.6±5.3 cm and 185.9± 6.6 cm ($p<0.05$; d=0.87), 1st ServeAVG 197.6±5.2 km·h−1 and 187.3±11.2 km·h−1 ($p<0.05$; d=0.94), 2st ServeAVG 156.8±5.3 km·h−1 and 154.2±11 km·h−1 ($p>0.05$; d=0.24), Serve Game Won was determined as 85.9±2% and 76.6±9% ($p<0.05$). Also, Acematch numbers of the G1 group were higher than the G2 group ($p>0.05$; d=0.64).

Conclusion
It can be said that the tennis players in the ATP top 10 are higher than others and more speed serve, service game winning rate and aces. It is recommended that young players who want to play tennis at elite level should improve serve and service game winning rates at early age.

Keywords: *Tennis, elite athlete, Match analyses*

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COACHES' KNOWLEDGE AND PERCEPTIONS OF EATING DISORDERS IN SPORT

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Introduction
The estimated prevalence of ED and/or disordered eating among athletes in range from 1% to 19% in males and 6% to 45% in females (Mancine et al., 2020) and is significantly higher than in non-athletes. Coaches play an integral role in an athlete's sporting life and are uniquely responsible for responding when an athlete is suspected of having issues related to ED or mental health in general (Moesch et al., 2018). Research shows that coaches often support the development of ED problems in their athletes, which can last for years (Moesch et al., 2018). This study aims to investigate coaches' perceptions of eating disorders in the context of sports, shedding light on their awareness, understanding, and strategies in dealing with athletes who may be at risk. The aim of the presentation is to raise awareness of the problem of ED in sport, results were obtained in project "Eating disorders in sport: Opening coaches' eyes" (EDS-OCE) supported by the European Commission.

Methods
A qualitative research with semi-structured interviews was employed. Participants were 20 experienced ski jumping and sports climbing coaches. Open-ended questions related to coaches' awareness and knowledge of eating disorders, experiences in identifying such issues within their athletes, as well as their attitudes and the strategies employed to support their athletes. Thematic analysis was applied to identify common patterns and unique perspectives in coaches' responses.

Results
The findings showed a spectrum of awareness among coaches regarding eating disorders in sports, ranging from limited recognition to a comprehensive understanding. Challenges in identifying and approaching athletes with eating disorders are evident, reflecting the complexity of the issue within the competitive sports environment.

Discussion
The results of this study emphasize the need for targeted coach education programs to enhance awareness and equip them with effective strategies for supporting athletes at risk of eating disorders. By addressing coaches' perceptions, behaviours, and knowledge gaps, it is possible to create a more supportive and informed environment for athletes, ultimately promoting their well-being and performance in sports.

Keywords: *eating disorders in sport, coach, coach education, mental health*

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ANALYSIS OF THE HANDBALL RULE 'ZERO STEP' IN OPEN AND CLOSED MOTOR PERFORMANCE PROGRAM

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Introduction
Handball is a dynamic team sport game in which a series of actions can take place in a short period of time and in a small space, without the human eye being able to follow it. The inertia of the human eye, in this case the referee's eye, can lead to numerous controversies related to the rules of the handball game. There are two referees on the field who distribute justice. In this paper, the 'zero step' in open (matches) and closed (training) motor performance program was analysed and an attempt was made to prove that it is not possible to simultaneously land on two feet, which significantly changes the application of rules of the handball game. The matches of the European Handball Championship 2024 held in Germany were analysed in the matches that ended in a draw, and whether referee errors related to unjudged steps during the performance of the 'zero step' could have affected the final result.

Methods
18 handball players from MRK Kozala, Rijeka, who compete in the 1st Croatian Handball League in the 2023/2024 season, average height (AS+/-SD) 186.11+/- 6 ,26 cm, average weight 88.89 +/- 8.98 kg, average BMI 25.60, while the average age is 20+/-2.59 years, participated in the research. For the purposes of the research, a motor task was composed, in the first phase, by a jump to the 'zero step' from a standing position (T1) and from a run-up (T2), and, in the second phase, both performed with given feint and a shot at the goal. Secondly, from the observed matches, the number of 'zero step' performances per match in total/per team were determined. An expert assessment was made for the correctness of the referee's decisions compliance with the rules of 'open' competitive performance of the 'zero step' version with both feet landing simultaneously. Besides descriptive statistics, the t-test for dependent samples was used to determine differences between variables T1 and T2, whilst Pearson correlation was used for determination of relations among anthropological characteristics and variables T1 and T2. Qualitative analysis was used to analyse the matches that ended in a draw, (awarded and non-awarded steps when jumping into the 'zero step' were recorded).

Results
Results have shown that no single player was able to jump and land on both feet at the same time - both from initial standing position (T1:AS±SD=0,28±0,24) and after the run-up (T2:AS±SD=0,17±0,09), with no statistically significant differences (t=1,84; p<0,08). A qualitative analysis of the matches of the European Championship in 2024, based on video inspection, support these findings (18 awarded and 8 non-awarded steps in draw matches produced different qualifying scenarios). Also, there is a statistically significant correlation among T1 and body height (r=0,73) and body weight (0,61).

Conclusion
Conclusion of this report is that the final outcome within preliminary rounds could have been different, if there were no refereeing errors during judgement of the precision in the performance of the zero step. Refereeing errors are determined by flaw full and unsustainable 'zero step' rule, therefore – it needs prompt modification.

Keywords: *handball, 'zero step', match, anthropometric characteristics, eye inertia*

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AN EXPLORATION OF THE SUPERIOR INHIBITORY CONTROL ABILITIES IN SOCCER ATHLETES: IDENTIFYING THE KEY DOMAINS OF MANIFESTATION

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Introduction
Inhibitory control is one of the core components of executive functioning and refers to the ability to control attention, behavior, thoughts, or emotions in order to overcome strong internal tendencies or external tendencies and thereby accomplish a goal task (Diamond, 2013). Although existing research has demonstrated the advantage of inhibitory control in soccer athletes, the approach of relying solely on a specific paradigm limits our understanding of the specific domains in which these advantages are manifested. To further explore in which aspects the inhibitory control abilities of soccer athletes are superior, a comprehensive selection of paradigms should be employed.

Methods
Integrating the representative paradigms previously summarized for the measurement of inhibitory control capabilities (Diamond, 2013), this study will select the stop-signal task, go/no go task, Flanker task, and Spatial Stroop task as the measurement paradigms. An independent samples t-test was conducted to compare the behavioral and event-related potential (ERP) differences between soccer athletes (n=23) and non-athletes (n=23) across these tasks, to investigate in which aspects the superior inhibitory control abilities of soccer athletes are manifested.

Results
Results showed that soccer athletes demonstrated a faster Stop Signal Reaction Time (SSRT) (165.49 ± 32.7ms) than non-athletes (200.62 ± 42.09ms, $p < 0.05$, Cohen's $d = 1.00$). No significant differences were observed in other behavioral indicators, nor were there any significant differences in ERP indicators.

Conclusion
The advantage in inhibitory control among soccer athletes is primarily evident in the stop-signal task, soccer athletes display a faster SSRT signifying an enhanced capacity to inhibit their responses with greater speed. The stop-signal task is thought to be related to the ability of action cancellation and adjustment of response strategies (Schachar et al., 2007; Verbruggen & Logan, 2008). Therefore, it can be inferred that the superior inhibitory control of soccer athletes is mainly reflected in the abilities of action cancellation and adjustment of response strategies.

Keywords: *Inhibitory control; Soccer experience; Event-related potentials*

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THE INFLUENCE OF VERTICAL JUMP PERFORMANCE ON CHANGE OF DIRECTION SPEED IN FEMALE FUTSAL PLAYERS

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Introduction

Vertical jump performance and change of direction speed are crucial attributes in futsal, essential for female players who frequently navigate rapid changes in direction during gameplay (Baena-Raya et al., 2021; Naser et al., 2017). These physical capabilities are pivotal for effective performance, influencing agility, maneuverability, and overall effectiveness on the field (Baena-Raya et al., 2021). This study explores the relationship between vertical jump performance and change of direction speed among female futsal players.

Methods

A total of thirteen female futsal players, with an average age of 19.69±2.84 years, a height of 164.14±6.73 cm, and a weight of 63.27±8.38 kg, were involved in the study. The vertical jump performance was assessed using the Squat Jump (SJ), Countermovement Jump (CMJ), and Vertical Jump (VJ) tests. The change of direction speed was measured using the Illinois Test (IT) and the 505 Test, with changes of direction executed using the left leg (505L) and right leg (505D). The normality of the distributions of vertical jumps and change of direction speed was tested using the Shapiro-Wilk test. The results indicated that the distributions were normal for all variables ($p > 0.05$). The correlation between vertical jump results and change of direction was examined through linear regression analysis.

Results

Linear regression analysis indicated a significant negative correlation between Vertical Jump results and the Illinois Test (Beta = -0.793, $p = 0.037$), as well as the Squat Jump results and the IT (Beta = -0.702, $p = 0.042$). No significant correlation was found between CMJ results and the IT. Additionally, vertical jump performance did not significantly impact the 505 Test results when executed with the left leg (505L) or the right leg (505D).

ConclusionThis study shows a significant negative correlation between vertical jump performance and change of direction speed (IT test). These results suggest that better performance in vertical jump can predict better performance in change of direction speed, which can help coaches optimize training for female futsal players.

Keywords: *vertical jump performance, change of direction speed, female futsal players*

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ARMS CONTRIBUTION AND THEIR POWERS ON PLAYER VERTICAL JUMP VOLLEYBALL TESTS PERFORMANCE

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Introduction
This study aimed to examine the effect of arms involvement on the validity of vertical jump volleyball tests, evaluated under field conditions. Backed in similarities to increase vertical jump height by about 10% compared to jumping without an arm swing. Estimate in this study based on Standing Reach with both arms swing versus Myotest accelerometric system with hands on hips. Projected to inspect their correlations with performance in block and spike as technical volleyball tests, with and without step involved at the beginning of the vertical jump tests.

Methods
For this, we collected the performance of our most skilled players in the national championship into the following criteria (Standing Reach - Myotest system - Vertical Jump Spike - Vertical Jump Test Block with and without arm swings).

Results
Based on Pearson correlation at ($p < 0.001$). Our outcomes confirmed Standing Reach as the most correlated test with volleyball tests used compared to Myotest accelerometric system. As well as its significant correlation with Myotest in estimating the maximum athletic height in vertical jump.

Conclusions
Based on the study design and arm swings test protocols used. We confirm the swing of the arms as a key factor in the evaluation of vertical jumps in technical or athletic volleyball tests. Admitted in this study by the arm swings investment in Standing Reach and their relations with the performance recorded by the players in the test Spike or Block. Opposite to their interrelationships with players' performances registered by the Myotest accelerometric system arms protocol. Suggested in this study as a key protocol problem, that must be taken by the Myotest system to assess the vertical jumps in volleyball tests.

Keywords: *hoop task, mass height, vertical jump, field tests, volleyball.*

DECISION-MAKING AND MOTOR SKILLS IN ELITE WRESTLERS

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Introduction
Decision-making is an important problem in modern sports psychology (Raab & Araújo, 2019). Time of decision-making is of great importance in combat sports (Korobeynikov et al., 2022).

Martial arts are characterized by the manifestation of complex motor skills in a competitive fight. The athlete must adequately perceive the opponent's activities and implement motor skills (Russo, Ottoboni, 2019).

The research aimed to study decision-making and motor control in elite wrestlers.

Methods
34 elite athletes were examined. The complex method of decision-making and the effectiveness of the motor skills of elite wrestlers were assessed. Computer equipment "Multipsychometer-05" was used. Sensorimotor reaction, balance of nervous processes, non-verbal intelligence, decision-making time, and time it took to implement specific skills are assessed.

Results
All athletes were divided into fast ability (18 persons) and low ability (16 persons) to decision-making.

The results showed that athletes with quick decision-making perceive non-verbal information faster and have better time and quality indicators for performing special skills.

In addition, fast decision-makers show greater impulsivity and a predominance of nervous system arousal. The speed of decision-making among elite wrestlers corresponds to an increase in arousal and impulsiveness. This contributes to better implementation of special motor skills.

Conclusions
The ability to make decisions contributes to the implementation of motor skills in elite wrestlers.

Keywords: *decision making, motor skills, elite wrestlers*

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LEVEL OF DISJUNCTIVE REACTION ABILITIES IN YOUTH SOCCER GOALKEEPERS

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Introduction
In terms of cognitive abilities, research in sport has mainly focused on attention
and its selected functional properties (intentionality, selectivity, concentration) and cognitive tempo (speed of stimulus processing and speed of response) (Pačesová et al. 2016). The speed of disjunctive reaction time could be one of the key factors that determines the success of interventions by soccer goalkeepers. Obetko et al. (2019) state that the speed of disjunctive reaction time should be one of the important criteria when selecting talented goalkeepers.

Methods
The aim of our research was to investigate and compare the level of disjunctive reaction abilities of youth soccer goalkeepers. Our research group consisted of youth goalkeepers of the football club ŠK Slovan Bratislava in the categories U19-U15 (n = 7) and youth goalkeepers of the football club FC Petržalka Academy also in the categories U19-U15 (n = 8). We did not assume significant differences in the level of disjunctive reaction abilities between goalkeepers at ŠK Slovan Bratislava and FC Petržalka Academy. We measured the level of disjunctive reaction abilities using two tests:
the response to rapidly generating visual stimuli (RGS) test and the response to slowly generating visual stimuli (SGS) test.

Results
We didn´t find significant differences in the RGS test between goalkeepers of ŠK Slovan Bratislava (M = 9.00; SD = 0.62) and goalkeepers of FC Petržalka Academy (M = 9.05; SD = 0.62), z = 0.23; p = 0.41; r = 0.03. We found significant differences in the SGS test between goalkeepers of ŠK Slovan Bratislava (M = 25.79; SD = 0.43) and goalkeepers of FC Petržalka Academy (M = 25.60; SD = 0.44), z = - 1.65; p = 0,049*; r = 0.25.

Conclusion
The level of disjunctive reaction abilities is similar in the youth goalkeepers of both teams. Although FC Petržalka Academy goalkeepers are better in the SGS test, it has only very close statistical significance. We consider the main reason for the very similar level of disjunctive reaction abilities to be the same performance level of the selected goalkeepers.

Keywords: *cognitive abilities, reaction time, diagnostics*

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DIFFERENCES IN MOTOR SKILLS BETWEEN DIFFERENT QUALITATIVE GROUPS OF GOALKEEPERS IN SCHOOL FOOTBALL

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Introduction
The aim of this research is to determine the differences in motor skills among different qualitative groups of goalkeepers in a football school. The study was conducted on 35 male participants from the Croatian football club Zadar, aged 7 to 18 years. The goalkeepers were grouped based on their technical and tactical abilities, as assessed by their coach (group:1,2,3,4). The results indicate a statistically significant difference in motor skills between the observed qualitative groups and individuals.

Methods
The research included 15 variables: Seniority (STA), Body Height (TV), Body Mass (TT), Age (DOB), Standing Long Jump (MFESDM), Single-Leg Triple Jump (MFETJN), Medicine Ball Throw (MFEBML), Agility on the Ground (MAGONT), Backside Polygon (MREPOL), Side Step (MAGKUS), Hand Taping (MBFTAP), Foot Taping (MBFTAN), Bench Lean (MFLPRK), Front Leg Raise from Lying (MFLPLK), and Foot Raise from Lying (MFLOLB). Data were processed using a statistical software package. The data processing methods included the calculation of descriptive statistical indicators, and multivariate analysis of variance (MANOVA) was used to determine differences between groups.

Results
The results of the descriptive statistics, divided into four qualitative groups, are presented. The findings show considerable variability in the variables BML (158.66), TJN (99.87), and SDM (27.63). It is evident that the groups differ statistically significantly in all the analyzed variables except for PRK 0.8261071*), PLK (0.2049861*) and LOLB (0.1916502*), which measure hip joint flexibility. This suggests that the groups do not differ significantly only in the flexibility variables. The results of the multivariate test indicate that the groups differ statistically significantly in the analyzed variables at a significant level (Wilks Lambda.1969526, Rao s R 3.028811, p-level .0002967. The lack of significant differences in flexibility variables may be due to the fact that all four groups follow the same flexibility development program. This hypothesis should be verified through additional research, and the flexibility program may need to be modified to maintain participants in specific qualitative groups over time.

Conclusion
Despite the selection of groups not being based on motor skill results, the findings demonstrate that there is a statistically significant difference in motor skills between the observed qualitative groups of goalkeepers and individuals, regardless of mage.

Keywords: *soccer, soccer school, goalkeepers, selection, motor skills.*

BONE MINERAL DENSITY IN ELITE MALE ATHLETES ACCORDING TO DIFFERENT SPORTS: A SYSTEMATIC REVIEW

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Introduction
Bone mineral density (BMD) is a critical indicator of bone health, reflecting bone strength and mineral content. Physical activity is crucial for maintaining bone health, but not all types of physical activity have the same effect. Different sports activities impose various mechanical loads and stresses on bones, leading to differences in BMD among athletes. This study investigates variations in bone mineral density among elite male athletes engaged in various sports activities.

Method
This study was conducted following the Preferred Reporting Items for Systematic Reviews (PRISMA) Statement. A literature search was performed in multiple databases, including PubMed, Google Scholar, Scopus, and Web of Science, for studies published between 2000 and 2024. Keywords used were: "bone mineral density", "BMD", "elite athletes", "exercise" and "sports activities" Inclusion criteria were peer-reviewed articles that assessed BMD using dual-energy X-ray absorptiometry (DXA) in male athletes aged 18 to 40 years who have been practicing a specific sport daily for a minimum of 10 years. Studies were excluded if they included youth or non-elite athletes. Data extraction and quality assessment were performed independently by two reviewers, with disagreements resolved by consensus.

Results
The inclusion criteria were met by 23 studies, which included a total of 278 elite male athletes from various sports disciplines, including weightlifting, gymnastics, swimming, basketball, soccer, and cycling. The review found significant differences in BMD across sports, with weightlifters and gymnasts showing the highest BMD values, particularly at high-load and high-impact sites such as the lumbar spine and femoral neck. Basketball and soccer players showed moderate BMD values, while swimmers and cyclists had the lowest BMD values. Factors contributing to these variations included the type and intensity of mechanical loading, training duration, and sport-specific biomechanics.

Conclusion
The results of this systematic review highlight that the type of sport significantly influences BMD in elite male athletes. Strenuous and high-impact sports are associated with higher BMD, underscoring the importance of including such activities in training programs to improve bone health. Further research is needed to investigate the long-term effects of different training regimens and the potential benefits of cross-training to mitigate the risk of osteoporosis and bone-related injuries in athletes.

Keywords: *bone mineral density, systematic review, elite athletes, sports activities, exercise, DXA*

RUNNING ECONOMY, MAXIMAL LACTATE STEADY STATE, AND VO2MAX IN HIGHLY TRAINED TURKISH DISTANCE RUNNERS

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Introduction
Running economy (RE), Maximal Lactate Steady State (MLSS), and maximal oxygen uptake (VO2max) are pivotal factors influencing endurance running performance. Purpose: This study aimed to evaluate RE, MLSS, and VO2max across varying submaximal and maximal speeds, employing both oxygen cost (ml/kg/km) and caloric unit cost (kcal/kg/km) metrics in a cohort of highly trained male distance runners. It was hypothesized that caloric unit cost would afford greater sensitivity to speed-induced changes in running economy than traditional oxygen cost measurements, owing to its capacity to account for substrate utilization disparities.

Methods
Five highly trained male distance runners (mean ± SD: VO2max 64.5 ± 5.6 ml/kg/min, body mass 66.9 ± 7.3 kg, height 176.6 ± 7.0 cm, age 23.6 ± 5.0 yr) participated in treadmill running sessions lasting 3 minutes each, with a 1% gradient, starting at 12 km/h, and subsequent incremental speeds, with 1-minute rest intervals between stages for blood lactate collection. Oxygen uptake was quantified using open-circuit calorimetry.

Results
Analysis revealed no significant difference in maximal VO2 among subjects ($P > 0.001$). However, discernible variations were observed in running economy and maximal lactate steady state ($P > 0.001$). Notably, the expression of running economy and MLSS in terms of caloric unit cost exhibited heightened sensitivity to speed alterations, suggesting its superior utility in characterizing running economy dynamics relative to oxygen uptake alone.

Conclusions
In conclusion, our findings underscore the importance of caloric unit cost as a more sensitive indicator of running economy and MLSS, offering valuable insights into the physiological underpinnings of endurance running performance.

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DIFFERENCES IN PSYCHOMOTOR ABILITIES AMONG PROFESSIONAL AND AMATEUR MALE HANDBALL PLAYERS

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Introduction
Handball is a dynamic and fast team sport characterized by high intensity. Therefore reaction and movement time become increasingly important, as also speed of decision-making during handball match situations [1]. Moreover, the ability of quick reaction and correct decision can cause an advantage over the opponent during handball actions [2,3]. This study presents an assessment of the selected psychomotor abilities among professional and amateur male handball players from the Orlen Super league and Central Division. The study included 70 handball players associated in Polish Handball Federation. The main purpose of the paper was to evaluate and compare selected psychomotor abilities of professional and amateur male handball players depending on the position on the court.

Methods
The research method was Test2Drive psychomotor computer tests. To measure the indicators of psychomotor abilities, 4 tests were used: Simple Reaction Test, Choice Reaction Time Test, Hand-Eye Coordination and Spatial Orientation Test. The parameters of reaction time, movement time, and parameters determining correct answers were evaluated.

Conclusions
The analysis of RT, MT and CR answers between the studied groups of male handball players showed statistically significant differences only in SPANT MT test. The study also showed that in all tests of MT were observed differences between the groups. In addition, comparing the players in each position, it was observed differences in MT and CR answers in benefit of the players from Orlen Super league.

Keywords: *handball players, reaction time, movement time, decision making*

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THE VALIDITY OF RATING OF PERCEIVED EXERTION TO PRESCRIBE HIGH-INTENISTY INTERVAL TRAINING IN PHYSICALLY ACTIVE ADULTS

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Introduction
Rating of perceived exertion (RPE) is a subjective measure of intensity often used for prescription of continuous endurance exercise. The RPE method also appears valid for prescription of high-intensity interval training (HIIT) in various populations. However, the time spent ≥90% maximal oxygen uptake (VO2max) or maximal heart rate (HRmax) were never used as validation criteria. Therefore, the aim of this study was to investigate the validity of RPE to prescribe HIIT in physically active adults using these two specific criteria.

Methods
Seventeen physical education students (5 females) (age: 24.2 ± 5 years; height: 181.3 ± 7.3; body mass: 77.5 ± 12.2 kg; %body fat: 14.5 ± 4.4%) volunteered to perform the incremental exercise test and three HIIT sessions. The sessions consisted of 3 × 3-min running at RPE intensities of 6, 7 and 8 from a Borg category-ratio-10 scale interspersed with 2-min passive rest. Cardiorespiratory parameters (Metamax 3b, Cortex Biophysik, Leipzig, Germany) and running speeds (StatSports APEX, Northern Ireland) were continuously monitored during HIIT sessions while blood lactate concentration (bLa) (Lactate Scout+, EKF Diagnostics, Cardiff, UK) was assessed within the first minute after exercise cessation. Analysis of variance (ANOVA) for repeated measures and Tukey *post hoc* test were used for testing differences between HIIT sessions and identification of individual significant interactions between conditions.

Results
Time spent ≥90% VO_{2max}, bLa and peak running speed were significantly ($p<0.001$) higher during HIIT performed at RPE 7 (469.7 ± 68.6 s, 12.3 ± 2.22 mmol/l, 17.2 ± 1.9 km/h) and RPE 8 (484.12 ± 67.3 s, 12.6 ± 2.8 mmol/l, 17.5 ± 2.2 km/h) in comparison to HIIT performed at RPE 6 (396.5 ± 87.5 s, 9 ± 2.5 mmol/l, 16 ± 2.1 km/h), respectively. The time spent ≥90% HR_{max} during HIIT performed at RPE 7 (573.5 ± 80.1 s) only tended to be significantly higher ($p=0.06$) than during HIIT performed at RPE 6 (502.1 ± 139.4) but did not differ from HIIT performed at RPE 8 (540.3 ± 137.4). There were no significant differences in either parameter between HIITs performed at RPE 7 and RPE 8.

Conclusion
Cardiorespiratory response is maximized when HIIT is executed at intensity of RPE 7. However, higher locomotor stress, caused by greater running speeds, in addition to the excessive metabolic response elicited during HIIT performed at RPE 7 implies that prescribing HIIT at intensity of 6 would provide the optimal overall physiological response.

Keywords: *acute cardiorespiratory response, metabolic stress, maximal oxygen uptake, Borg category-ratio-10 scale*

PRE-SEASON ENERGY STATUS IS ASSOCIATED WITH PERFORMANCE IN COMPETITIVE FEMALE LONG-DISTANCE RUNNERS

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Introduction
Although chronic energy deficiency is prevalent in female athletes and linked to health outcomes described as the Female Athlete Triad, the impact on performance in weight bearing sports has not been fully elucidated. The primary purpose of this study was to explore the potential association between key indicators of adaptations to energy deficiency, i.e., the ratio of actual to predicted resting metabolic rate (RMR ratio) and serum total triiodothyronine on run time performance and on VO2max in college age female long-distance runners. We hypothesized that indications of energy deficiency would be negatively associated with running performance in a 5K competitive time trial.

Methods
We conducted a longitudinal study in 38 collegiate female long-distance runners (17-25 yr; BMI 20.3±0.3 kg/m2) across 10-12 weeks. Energy status, body composition, and 5km time trial (measure of performance on an outdoor course) were assessed pre- and post-competitive season. Runners (n=38) were categorized at baseline based on pre-season RMR_{ratio}: metabolically suppressed (SUPP: RMR_{ratio} <0.92, n=12), and energy replete (NSUPP: RMR_{ratio} ≥0.92, n=26). We used repeated measures ANOVA and linear regression to test whether pre-season RMR ratio group and or pre-season TT3 concentrations were significantly associated with the change in run time performance over the competitive season.

Results
Twenty-one runners completed pre and post-season performance runs. Average body weight was 54.8+ 1.0 kg with 22.8+ 0.7% body fat and average VO2max was 59.7+ 1.2 ml/kg/min. SUPP runners had a slower 5km run times vs. NSUPP (Group effect; 22.5 vs 20.5 min, p=0.04) but the groups exhibited similar body mass, BMR, percent body fat, and percent lean body mass. There was also an effect of group*time for VO_2max, where the increase in VO2max was dependent on group such that the SUPP group demonstrated a smaller increase in aerobic fitness across the season compared to NSUPP group (p<0.001). Controlling for post-season VO_2max, pre-season TT_3 predicted post-season 5km times (R2=0.614, p=0.001).

Conclusion
Adaptations to chronic energy deficiency, defined as suppressed resting metabolic rate and or reduced TT3 are associated with poorer running performance and reduced improvements in VO2max across a competitive season.
Keywords: running performance; energy deficiency; exercising women; female athlete triad

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ENHANCING AEROBIC CAPACITY WITH FAR-INFRARED SPORTSWEAR MADE FROM GRAPHENE FIBER

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Introduction
Various clothing materials have been invented to enhance athletic performance or improve the conditions for exercise enthusiasts, thereby reducing sports injuries. Due to its superior properties that far surpass current sportswear materials, graphene fiber is expected to become the optimal material for the next generation of sports equipment. Therefore, to clarify its potential advantages in the field of sports, this study explores the effects of far-infrared (FIR) garments made from graphene fiber on aerobic capacity through maximal incremental exercise test.

Methods
A double-blind crossover trial was conducted with 15 male university students. Participants wore graphene far-infrared and control compression shirts for two maximal incremental exercise tests. The order of the experiments was randomly assigned, with a one-week interval between tests. Each test began at the same time of day. Metabolic indicators such as exercise duration, heart rate, and oxygen uptake were collected and recorded using the COSMED cardiopulmonary metabolic system.

Results
Compared to the control group clothing, subjects wearing graphene far-infrared compression garments exhibited significantly longer duration during the maximal incremental exercise test (38.4 seconds, $P < 0.001$). Additionally, the time to anaerobic threshold was significantly extended when wearing graphene far-infrared compression garments (37.7 seconds, $P < 0.001$), although there was no significant difference in VO2max. The maximum heart rate was lower when wearing the graphene compression garments (Graphene group: 198.8±7.8 vs. Control group: 200.3±7.5, $P < 0.05$). Furthermore, when comparing heart rates at the same exercise intensity, defined by the earliest appearance of the anaerobic threshold in both tests, the heart rate in the graphene far-infrared group (176.9±8) was significantly lower than that in the control group (179.8±7.8) ($P < 0.05$).

Conclusion
The use of graphene FIR compression garments can enhance exercise performance, primarily by improving aerobic endurance. Considering the recognized non-thermal properties of functional clothing, these effects may be achieved by improving peripheral blood circulation, lowering heart rate, enhancing metabolic conditions, and reducing cardiac load, thereby enhancing aerobic endurance. This study explores the impact of far-infrared sportswear made from graphene fiber on athletic performance, providing a solid theoretical basis for the application of graphene fiber in sportswear. Given the significant potential of graphene fiber far-infrared sportswear in enhancing the exercise environment, further research with larger sample sizes and more detailed investigations is necessary.

Keywords: *aerobic exercise, graphene fiber, far-infrared, maximal oxygen uptake, anaerobic threshold*

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