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HPSC 2025
Book of Abstracts

4th Research in High Performance Sports Colloquium 2025

in conjunction with

4th International Conference on Innovation and Technology in Sports 2025

30th September- 2nd October 2025

Renaissance Kuala Lumpur Hotel & Convention Centre

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30 September to 2 October 2025
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Session Chair: Professor Dr. Tang Yunqi (SUST)

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Venue: Inspire 1

Theme: Mind–body interactions in performance: From cognitive states and motivation to biomechanics and recovery

Session Chair: Associate Professor Dr Ler Hui Yin (TARUMT)

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11:45am-12:00pm	HPSC-18	The relationship between foot arch angle and individual stability
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Venue: Inspire 3

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Session Chair: Associate Professor Dr. Zulkarnain Jaafar (UM)

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Day 3 -2nd October 2025

Inspire 1

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Session Chair: Associate Professor Dr. Chan Kai Quin (TARUMT)

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HPSC POSTER PRESENTATION

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Time	Pitching & demo Venue: Inspire 3	
8:00am – 9:00am	Dedicated Time to Explore, Engage and Energise	
9:00am – 9:05am	**Opening Video SIC** Sports-Inno Challenge: Showcase	
9:05am – 9:20am	Presentation **FINALIST** 1 **Smart Proprioceptive Sleeve (SPS): Enhancing Upper Limb Rehabilitation & Performance** SmartRehabX Sultan Zainal Abidin University (UniSZA) MALAYSIA	
9:20am – 9:35am	Presentation **FINALIST 2** **AIVR-Box: An AI-Coached, Tactics-Aware VR Boxing Trainer** APU XR STUDIO Asia-Pacific University (APU) MALAYSIA	
9:35am – 9:50am	Presentation **FINALIST 3** **C-SPAR: Cybersickness-Preventive Adaptive Response for Virtual Reality in Combat Sports** VESTA MARA Institute of Technology University (UiTM) MALAYSIA	
9:50am – 10:00am	**Opening Speech (Advisor)** Dr. Thung Jin Seng Head of Injury Risk Management Research Cluster National Sports Institute MALAYSIA	
10:00am – 10:15am	**VR in Sports Application Challenges & Opportunities** Ass. Prof. Ts. Dr. Zulkifli School of Engineering UiTM MALAYSIA	
10:15am – 10:25am	**VR in Combat Sports** Audy Ooi Kheng Xing Director of Quint Fit MALAYSIA	
10:25am – 10:40am	**VProCycle2: Enhancing VR Cycling with Motion, Mixed Reality and Smart Connectivity Live Demo** Dr. Imran Mahalil Asia-Pacific University MALAYSIA	
10:40am – 12:25am	**Live Demo:** VR in Combat Sports	**Live Demo:** VR in Cycling

HPSC Oral Presentation

ID: HPSC-2

EFFECTS OF ACUTE MENTAL FATIGUE ON LEG STRENGTH QUALITIES AMONG NATIONAL ATHLETES

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Keywords: Mental Fatigue, Leg Strength Qualities, Rate of Force Development, Reactive Strength, National Athletes

Introduction: National-level athletes experience acute mental fatigue. Understanding its effects on strength and power is crucial to optimize performance and reduce the risk of injuries in these athletes. **Objective:** The study investigated the effects of acute mental fatigue (MF) on leg strength qualities [rate of force development (RFD) and reactive strength] among national-level athletes. **Methods:** Twenty-five national athletes (Age= 20.23 ± 3.33 year, Weight = 58.58 ± 9.66 kg; Height = 165.44 ± 8.38 cm) were recruited and randomly assigned to a high MF (n = 12, male = 5, female = 7) or a low MF group (n = 13, male = 6, female = 7). Baseline assessments and post-test included drop jump for reactive strength index and isometric mid-thigh pull for RFD, alongside mental fatigue measures using visual analogue scales for MF, lethargy, and drowsiness, the NASA-TLX workload measure, and a digit span forward test. A 30-minute incongruent Stroop task (high MF) or documentary viewing (low MF) was administered as a mental exertion intervention. **Results:** Results revealed significant within-group differences for the high MF group in MF, sleepiness, and lethargy scales ($p < 0.05$). Significant declines were corresponded in RSI, RFD200, RFD250, and peak force ($p < 0.05$). In contrast, the low MF group showed significant increases only in MF and sleepiness ($p < 0.05$), with no significant changes in physical performance. Additionally, between-group comparisons revealed significant differences only in the NASA-TLX temporal demand subscale and sleepiness scale in the post-test ($p < 0.05$). **Conclusion:** These findings suggest that mental fatigue may impair lower-extremity reactive strength, RFD, and peak force production among national-level athletes. Future research elucidating sex and sports-specific differences in MF susceptibility and its interaction with other aspects of maximal neuromuscular performance is warranted.

ID: HPSC-4

EFFECTS OF 4-DAYS SHORT-TERM ISOTHERMIC HEAT ACCLIMATION WITH PERMISSIVE DEHYDRATION ON RECREATIONAL FEMALE ENDURANCE RUNNERS

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Keywords: Isothermic Heat Acclimation; Short Term Heat Acclimation; Heat Adaptations; Female Runners

Introduction: Standard heat acclimation typically involves 60-90 minutes of heat exposure for more than five consecutive days. Optimizing the minimum effective duration and intensity of HA remains crucial. **Objective:** This study aimed to investigate the effects of a 4-day short-term isothermic heat acclimation (IHA) protocol, combined with permissive dehydration, on running performance. **Methods:** Seven recreational female runners (age: 25 ± 5.8 years old; weekly mileage: 20.3 ± 6.0 km; VO_2 max: 41.3 ± 6.8 ml/kg/min) completed four consecutive days of 90-minute IHA sessions (Tcore > 38.5 °C) with fluid restriction in hot, humid conditions (~40 °C, ~39% RH). Heat stress test (HST) was conducted before and after the intervention, consisting of 30 minutes of treadmill running at 65% VO_2 max, followed by a graded exercise test (GXT) to exhaustion in hot conditions (T_{amb}: 35.4 ± 0.3 °C; RH: $47.5 \pm 4.2\%$). **Results:** Following the IHA interventions, significant improvements were observed in TTE during GXT (Pre: 12.0 ± 2.1 min; Post: 13.7 ± 2.7 min; $p = 0.011$) under heat stress. Heart rate during 30-minute steady-state run was significantly lower post-intervention (Pre: 174 ± 16.4 bpm; Post: 164 ± 15.7 bpm; $p = 0.005$). Thermoregulatory adaptation included a significantly lower End-HST skin temperature ($p = 0.004$). Despite lower Tcore and higher sweat rate, no significant differences were revealed ($p > 0.05$). Among perceptual responses, only final thermal sensation during HST showed significantly cooler perception ($p = 0.047$). **Conclusion:** These findings support the feasibility of time-efficient heat acclimation strategies for recreational athletes preparing for hot environments.

ID: HPSC-16

EVALUATION OF THE VALIDITY AND RELIABILITY OF SPECIFIC AGILITY TESTS IN BADMINTON

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Keywords: 4 Corners Change of Direction*, Badcamp, Reactive Agility Test, Badminton, Validity, Reliability*

Introduction: Badminton demands rapid directional changes and explosive bursts of energy, making agility a critical determinant of performance. However, many existing agility tests lack specificity to the sport's movement patterns. **Objective:** To evaluate the reliability and validity of three agility assessments 4 Corners Change of Direction (COD), Badcamp, and Reactive Agility Test (RAT) among elite badminton players (EB; n=12), non-elite badminton players (NEB; n=15), and non-badminton athletes (NB; n=15). **Methods:** Participants completed the three tests over three sessions within three weeks (familiarisation, first test, second test). Each session began with a standardised warm-up and three progressive-effort trials (50%, 75%, 100%) before testing. After three minutes' recovery, participants performed 3 trials with 3 minutes recovery in between trials and tests; the fastest time was recorded. **Results:** Reliability was excellent in EB (COD: ICC=0.978; Badcamp: ICC=0.978; RAT: ICC=0.954), moderate to good in NEB (COD: ICC=0.826; Badcamp: ICC=0.662; RAT: ICC=0.462), and lower in NB (ICC=0.502–0.680). Strong inter-test correlations were observed in EB (COD–Badcamp: r=0.762; Badcamp–RAT: r=0.772) and NEB (all r>0.640, $p<0.05$), indicating measurement of similar agility constructs in trained populations. NB participants showed weak, non-significant correlations. **Conclusion:** The 4 Corners COD, Badcamp, and RAT demonstrate strong reliability and validity for assessing agility in competitive badminton players, particularly at elite level. These tests can serve as standardised tools for talent identification, performance monitoring, and designing targeted training programs to enhance on-court agility.

ID: HPSC-18

THE RELATIONSHIP BETWEEN FOOT ARCH ANGLE AND INDIVIDUAL STABILITY

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Keywords: Foot Arch, Clarke's Angle, Dynamic Stability, Y-Balance Test, Lower Limb Biomechanics

Introduction: Foot arch types are categorized into three forms: high, normal and flat. Each arch type can influence walking, standing and athletic performance. However, limited research has explored the relationship between foot arch structure and individual stability. **Objective:** This study aimed to examine the correlation between foot arch type and dynamic balance. **Methods:** Thirty participants (15 males and 15 females) mean aged 23.40 ± 0.894 years underwent two tests: the Clarke's angle Test and the Y-Balance Test. Clarke's Angle Test determined foot arch types, while the Y-Balance Test assessed dynamic stability in three directions: anterior, posterolateral and posteromedial. Pearson's correlation was used for statistical analysis. **Results:** A significant positive correlation was found between normal foot arch angles and Y-Balance scores in the posterolateral ($r = 0.638$, $p = 0.004$) and posteromedial ($r = 0.640$, $p = 0.004$) directions. **Conclusion:** In contrasts, high arch angles showed strong but statistically non-significant negative correlations in all directions. Flat arch angles showed no significant relationship with balance. These findings suggest individuals with normal arches may exhibit superior dynamic stability, while flat and high arch types require further investigation due to inconsistent trends.

ID: HPSC-24

PERFORMANCE INDICATORS OF WINNING AND LOSING TEAMS IN THE 2024 MALAYSIA SUPER LEAGUE

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Keywords: Match Analysis, Soccer, Performance Indicators, Performance, Malaysia

Introduction: Performance indicators in football are measurable metrics used to evaluate team or player performance during a match or season. Understanding differences between winning and losing teams is crucial for enhancing competitive strategies. **Objective:** This study aimed to compare the differences in performance indicators between winning and losing teams in the Malaysia Super League (MSL) 2024. **Methods:** A total of 143 professional soccer players (N=143) and thirteen teams (N=13) were involved during data collection. Twenty-six match data were recorded during the first round of MSL using a Sony HDR-CX405 camcorder and analyzed using LongoMatch software. Performance indicators examined included number of passes, ball possession, number of shots (on and off target), and goals. An Independent Sample T-Test was used to investigate the differences between winning and losing teams. **Results:** Significant differences were observed between the winning and losing teams in the number of passes (311 ± 0.96: 227 ± 0.71, $p = 0.018$), ball possession (6.5 ± 1.86: 3.72 ± 0.99, $p = 0.020$), and on-target shots (4.09 ± 1.24: 2.05 ± 0.55, $p = 0.014$). However, no significant differences were found in total shots (3.70 ± 2.02: 2.67 ± 1.17, $p = 0.083$), off-target shots (0.38 ± 1.02: 5.30 ± 2.40, $p = 0.0712$), and goals (0.52 ± 0.64: 5.1 ± 3.74, $p = 0.424$). **Conclusion:** The findings suggest that passing efficiency, ball control, and shooting accuracy are critical indicators of success in the MSL. These insights can assist coaches and analysts in improving team performance through data-driven strategies.

ID: HPSC-27

MATCH ANALYSIS OF PENCAK SILAT OLAHRAGA: IDENTIFYING PERFORMANCE INDICATORS IN SUKAN MALAYSIA ATHLETES

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Keywords: Silat, Performance Indicators, Combat Sport, Malaysia

Introduction: Match analysis is the systematic evaluation of athletes' actions during training and competition. In the growing field of Pencak Silat Olahraga (PSO), performance analysis plays a crucial role in guiding evidence-based strategies for athlete development and success. **Objective:** This study aimed to identify key performance indicators (PIs) among male PSO athletes at SUKMA 2024. **Methods:** A total of 27 matches, each comprising three rounds, were recorded using a Sony HDR-CX405 camcorder and analyzed with LongoMatch software. Descriptive statistics were used to identify PIs. In addition, a one-way ANOVA was conducted to examine differences in three techniques usage across the three rounds **Results:** The turning kick emerged as the most dominant technique (28%), followed by punches (17%), *Jatuhan* (16%), front kicks (15%), and other kicks (12%). Less frequently used techniques included *Anti-jatuhan* (8%), counterattacks (2%), and *Guntingan* (2%). Further analysis focused on the progression of kicking, punching, and *Jatuhan* across rounds. Kicks increased significantly from Round 1 (12 ± 1.1) to Round 3 (15 ± 1.7), with one-way ANOVA results confirming a significant difference, $F(2, 0) = 9.00$, $p < .05$. Tukey HSD post hoc test indicated that kicking in Round 3 was significantly higher than in Round 1. No significant changes were observed for punching or *Jatuhan* across rounds ($p > .05$). **Conclusion:** These findings highlight the turning kick as a critical component, making it a major factor in competitive success. The study offers useful insights for coaches, emphasizing the need for data-driven methods to improve athlete performance and tactical planning in PSO.

ID: HPSC-28

THE INFLUENCE OF BALL POSSESSION AND TOTAL PASSES ON MATCH OUTCOMES IN THE KUALA LUMPUR WOMEN'S SUPER LEAGUE 2023

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Keywords: Women, Football, Performance Analysis, LongoMatch.

Introduction: In modern football, performance analysis plays a crucial role in understanding the factors that contribute to a team's success. Among the key performance indicators, ball possession and total passes are often associated with control, dominance, and team effectiveness. **Objective:** This study aimed to investigate the relationship between ball possession and passes to match outcomes. The secondary objective is to compare the ball possession and passes differences between two groups (winning and losing games). **Methods:** A total of 28 matches from the Kuala Lumpur Women's Super League 2023 (KLWSL) were analyzed, including 20 group-stage matches, four quarter-finals, two semi-finals, a third-place play-off, and the final. Two hundred female (n=200) football players were investigated. Match recordings were captured using a Sony HDR-CX405 camcorder positioned at the center of the field. Recordings were analyzed using LongoMatch video analysis software to assess ball possession percentages and total passes. **Results:** PJ Kita Football Club recorded the highest average ball possession (56.9%), while Wangsa Maju City Football Club had the highest mean total passes (404.4 ± 61.8). Pearson Correlation showed a significant relationship between match outcome and ball possession (r=0.70, $p<0.05$), and total passes (r=0.44, $p<0.05$). Significant differences were found between winning and losing teams in ball possession ($55.1 \pm 5.1\%$; $4.8 \pm 5.1\%$, $p<0.05$) and total passes (367.7 ± 69.4; 300.4 ± 71.3, $p<0.05$). **Conclusion:** Teams with higher ball possession and more passes were more likely to win, suggesting that coaches should emphasize possession-based play and effective passing strategies to enhance match outcomes.

ID: HPSC-29

ANALYSIS OF TECHNICAL VARIABLES AND TACTICAL PLAY FOR BADMINTON WOMEN'S SINGLE PLAYER AN SE YOUNG

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Keywords: World Champion; Type of Shot; Court Zone Usage; Badminton World Federation

Introduction: An Se Young, 2024 Paris Olympic and 2023 World Champion, has dominated Badminton World Federation highest ranked player in Women's Singles for 108 weeks. As badminton success depends on technical and tactical skills, analysing the performance of the current most successful female single badminton player may provide valuable insight. **Objective:** This study examines tactical and technical differences in An Se Young's performances during two Super 1000 competitions and Paris Olympics 2024. **Methods:** Thirteen match videos were analysed, with five matches each from China Open 2023 and Indonesia Open 2024, and three from the Paris Olympics, covering early rounds until finals to analyse type of shots and usage of court zone. **Results:** The pushing shot emerged as the most frequently used stroke across all tournaments; China Open (70.00 ± 7.106), Indonesia Open (107.40 ± 32.145), and Paris Olympics (106.67 ± 47.920). Slight difference in clear shot usage was observed ($p = 0.049$), with no significant differences in other shot types ($p > .05$). Tactical analysis showed Zones 8 (21.15%), 5 (21.07%), 4 (14.79%), and 10 (12.02%) were most frequently targeted, while Zones 3 (1.11%), 6 (0.91%), and 12 (0.88%) were least used. No significant differences in court zone usage were found across tournaments ($p > .05$). **Conclusion:** This study highlights the type of shots and court zone usage that contributed to the winning performance of the current reigning women's singles badminton player. An Se Young's consistent success provides crucial insights for coaching strategies and training priorities in elite badminton.

ID: HPSC-31

EFFECTS OF CAFFEINE INGESTION ON 5-KM RUNNING PERFORMANCE AND PERCEIVED EXERTION IN MALE PALAPES CADETS

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Keywords: Caffein, 5-Km Run, Active Individual, PALAPES

Introduction: Caffeine is a well-known ergogenic aid that have positive effect for sports performance specifically endurance performance. **Objective**: This study investigated the effects of acute caffeine supplementation on 5-kilometer running performance and associated physiological and perceptual markers among PALAPES cadets. **Methods:** This study employed a randomized, repeated crossover design involving 16 male PALAPES cadets (22±1 years old, height=171±7.4cm, weight=65±8.5kg). They ran 5-km in the morning on an outdoor path with their own running pace approximately at the same time and condition with a minimum of 3 days in between sessions. During caffeine intervention (Caf), participants were given a caffeine tablet (200mg) 60 minutes prior to running time while another session is without supplementation (Pla). The heart rate and the rating perceived exertion (RPE) measurement were taken before and after the running session. Time to finish running was taken as performances outcome. **Results:** Mean running time was significantly ($p=0.049$) shorter during Caf (27:06±0.14 minutes) compared to Pla (28:26±0.13 minutes). Furthermore, Caf led to significantly ($p=0.024$) lower RPE compared with Pla (RPE Caf=4.5±1.3; RPE Pla=5.8±2.0). The heart rate showed no significant difference between Caf and Pla running sessions ($p=0.06$) suggesting that performance improvements were likely mediated by central nervous system effects rather than altered physiological stress. **Conclusion:** These findings suggest that acute caffeine supplementation is an effective strategy to enhance 5km running performance among active individuals, potentially by reducing perceived effort and allowing for a greater sustained output. This provides practical implications for recreational runners seeking to improve their race times.

ID: HPSC-32

EFFECTS OF PILATES-BASED EXERCISE ON BODY COORDINATION AND BALANCE ON YOUNG UNTRAINED FEMALES

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Keywords: Body Coordination, Balance, University, Pilates, Piloxing.

Introduction: Pilates helps improve muscle control, especially in the core, and boosts balance by training the body to work together through specific, multi-joint movements. Piloxing is a vigorous workout program with elements of Pilates, boxing, and dance and provides the dynamic and repeated motions involved in boxing. **Objective:** The purpose of the study is to investigate the effects of a four-week pilates-based exercise on body coordination and balance in young, untrained female university students. **Methods:** A total of 36 participants were randomly divided into two groups. The Piloxing group (PXG) (21.5 ± 0.80 years old) involved pilates – based exercise which combines pilates, boxing and dancing. All participants received a total of four weeks' intervention programme, 8 sessions of PXC, twice a week with 45 minutes per session. While the control group (CG) (20.7 ± 1.42 years old) received no exercise training. Both groups PXG and CG completed pre and post assessments which analysed body coordination and balance components include Hand Foot Coordination Test and Y Balance Test. **Results:** This study found that PXG did not result in significant differences in body coordination ($p=0.112$) and balance ($p=0.695$) compared to the CG. However, there were significant improvements in body coordination ($p<0.001$) and balance ($p<0.001$) over time. **Conclusions**: While no significant differences were observed between the PXG and CG, the results suggest that Piloxing may contribute to improvements in body coordination and balance. These findings highlight the potential benefits of Piloxing, but further research with extended periods or alternative protocols is needed to explore.

ID: HPSC-36

PHYSICAL FITNESS PROFILING OF THE NATIONAL U15 FOOTBALL TEAM: BASELINE DATA FOR LONGITUDINAL TALENT DEVELOPMENT

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Keywords: Youth Football, Anthropometrics, Aerobic Fitness, Talent Identification, Longitudinal Monitoring

Introduction: Physical fitness profiling is essential for talent identification in football, but national-level data for U15 players is scarce. This study provides the first comprehensive assessment of Malaysia's National U15 team, establishing benchmarks for player development and training. **Objective**: The study aimed to profile the team's anthropometric and physiological traits, including height, weight, body composition, and aerobic capacity, to guide training and monitoring. **Methods**: Forty-four male U15 players (age: 14.3 ± 0.5 years) were assessed during a training camp. Height, weight, and BMI were measured, while body composition (muscle mass, body fat) was analyzed using bioelectrical impedance (INBODY). Aerobic capacity (VO_2max) was tested via the Yoyo Intermittent Recovery Level 2 Test. **Results**: Key averages included height (169.0 ± 7.1 cm), weight (60.14 ± 8.3 kg), BMI (21.09 ± 2.3 kg/m²), body fat ($14.14 \pm 3.8\%$), muscle mass (29.25 ± 3.9 kg), and VO_2max (56.1 ± 3.2 mL/kg/min). VO_2max aligned with elite standards, while body fat varied (8.5–26.7%), indicating diverse conditioning needs. **Conclusion**: This study sets Malaysia's first U15 fitness benchmarks, aiding coaches in tailored training. Longitudinal tracking will assess long-term player progression, helping optimize future talent development.

ID: HPSC-37

EXPLORING FLOW STATE AND INTRINSIC MOTIVATION IN COGNITIVE TASK: COMPARING MODIFIED AND TRADITIONAL STOP SIGNAL TASK

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Keywords: Flow State, Intrinsic Motivation, Stop-Signal Task, Gamification, Cognitive Performance

Introduction: Flow and intrinsic motivation are key constructs in optimizing performance and engagement during cognitive tasks. The Stop-Signal Task (SST) is commonly used to measure inhibitory control. However, its traditional format may lack engagement. Emerging studies suggest that gamified or visually enhanced tasks may improve task engagement and induce flow states. **Objective:** This study aims to investigate how modified SSTs, incorporating visual gamification elements, influence flow state, intrinsic motivation, and cognitive performance in comparison to traditional SSTs, across athlete and non-athlete populations. **Methods:** A total of 21 participants (7 non-athletes, 7 competitive athletes, 7 elite athletes) completed both traditional and modified SST conditions in a randomized, cross-over design, with a 3-day washout period between sessions. Each SST session lasted approximately 15 minutes, and flow and intrinsic motivation were assessed immediately after each session using the Flow State Scale (FSS) and Intrinsic Motivation Inventory (IMI). The Stop-Signal Reaction Time (SSRT) was used to assess cognitive performance. Data was analyzed using repeated measures ANOVA and Pearson correlation. **Results:** No significant differences were found in flow state or intrinsic motivation between the traditional and modified SSTs ($p > 0.05$). However, during the modified SST, flow was positively correlated with intrinsic motivation ($r = .518$, $p = 0.016$). No significant relationship was found between psychological measures and SSRT. **Conclusion:** Although the modified SST did not significantly enhance flow or intrinsic motivation, the positive correlation between them suggests their interdependence. Findings support further research on gamification's psychological impacts in cognitive tasks with larger sample sizes.

ID: HPSC-38

AERODYNAMIC ANALYSIS IN BIOMECHANICAL OPTIMIZATION OF MARATHON RUNNERS BY USING COMPUTATIONAL FLUID DYNAMICS AND FINITE ELEMENT ANALYSIS

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Keywords: Aerodynamic, Drag, Biomechanics, Pacer, Airflow

Introduction: Aerodynamic analysis using computational fluid dynamics (CFD) and finite element analysis (FEA) modelling to improve athletic performance, it also highlights the prospective of Artificial Intelligence (AI) in augmenting methods in the future. The simulations optimize pacer formations and predict athlete-specific outcomes. **Objective:** This study aims to analyze the aerodynamic effects of different marathon running formations using FEA and CFD, evaluate drag forces under various formations and velocities, and identify pacer-runner arrangements that maximize efficiency through reduced resistance. **Methods:** The study used CFD and FEA in MIDAS NFX to simulate airflow patterns around marathon runners, focusing on Eliud Kipchoge's biomechanical body form. A precise 3D body model was created in Autodesk Fusion 360, and environmental factors like high-altitude air density were incorporated. Three pacer-runner formations were tested under various wind velocities, with defined boundary conditions and refined meshing. Steady-state simulations analyzed velocity, pressure, and airflow patterns to identify the formation and posture that best reduced drag and improved efficiency. **Results:** The simulations compared three pacer-runner formations under five running velocities. Formation 3 consistently produced the lowest, most stable airflow pattern and pressure. It provided optimal shielding for the runner. Formation 2 offered moderate benefits with some instability at higher speeds, while Formation 1 reduced drag on the runner but placed excessive aerodynamic load on pacers and showed turbulence issues. **Conclusion:** Although AI was not employed in this study, future integration with CFD and FEA holds promise for accelerating simulation workflows, personalizing athlete-specific models, and optimizing race strategies in real time.

ID: HPSC-39

TECHNICAL AND TACTICAL PERFORMANCE MODEL OF ELITE WOMEN'S TENNIS ON HARD COURTS

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Keywords: Analytic Hierarchy Process, Women's Tennis, Technical and Tactical Performance, Hard Court, Model

Introduction: Recent developments in women's competitive tennis highlight evolving technical and tactical demands, particularly on hard courts. Understanding these dynamics is essential for optimizing training strategies. **Objective:** To analyze key features of technical and tactical performance in elite women's hard-court tennis and provide theoretical guidance for evidence-based coaching. **Methods:** A technical-tactical indicator framework was developed through literature review and refined via two rounds of expert questionnaires. Using hierarchical analysis, weightings were assigned to 4 primary dimensions, 14 secondary, and 54 tertiary indicators. The model was validated through back-testing with real competition data. **Results:** The model revealed that backhand cross-court shots had the highest scoring efficiency (weight = 0.036), while forehand down-the-line shots had the lowest benefit value (0.024), indicating vulnerability in attacking stability. Over 70% of tactical weight was concentrated within the first five shots, with a sharp decline after the seventh shot (benefit value <0.01), confirming the tactical importance of early-rally dominance. Receiving games showed greater tactical value ($Z = 0.085$) than service games ($Z = 0.062$), challenging traditional serve-first strategies. Although net play had a high tactical presence (usage weight = 0.037), its scoring efficiency (0.015) was lower than baseline play (0.024), indicating limited net effectiveness. **Conclusion:** Technically, coaches should prioritize strengthening backhand cross-court control and reducing ineffective forehand down-the-line attacks. Tactically, emphasis should be on refining first-five-shot strategies, as improving break point conversion is more impactful than holding serve. Net approaches should be selective, seizing opportunities to move forward decisively when opponents hit shallow returns.

ID: HPSC-46

DIVE-START KINEMATICS AND BENCHMARKING: COMPARISON ACROSS FREESTYLE EVENTS IN YOUNG ADULT MALAYSIAN SWIMMERS

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Keywords: Aquatics, Dive Start Performance, Specificity, Youth

Introduction: Benchmarking dive-start performance serves not only competitive success but also guiding training solutions. **Objective:** This study compared dive-start kinematics across freestyle events (50m, 100m, 200m, 400m, 800m, 1500m) to support evidence-based coaching and guide young swimmers' development. **Methods:** Ninety-six top-performing freestyle swimmers (female: n = 48, mean age 17.13 ± 2.20 years; male: n = 48, mean age 17.54 ± 1.50 years) competing at the 21st Malaysia National Games (SUKMA XXI) were analyzed. KINOVEA 2023.1.2 software was used to extract six kinematic parameters, board time (BT), flight time (FT), flight distance (FD), underwater time (UT), swim to 15m (15mT) and total time (TT) from two 100fps still camcorders (Sony FDR-AXP55, Tokyo, Japan) placed at 5m and 15m perpendicular to pool deck where starter flash used as the start signal. Cameras were synchronized with LED lights for initial time adjustment. Perspective grid was used to align the starting wall and 5m pool landmarks for distance calibration. SPSS 26v ANOVA were used for statistical analysis, $p < 0.05$. **Results:** Among females, swimmers performed significantly better on shorter distance events over distance in BT ($p = 0.010$), UV ($p < 0.001$), S15mV ($p < 0.001$) and TT ($p < 0.001$). Among males, swimmers only showed advantages in FD ($p = 0.008$), UT ($p = 0.005$), UV ($p < 0.001$) and TT ($p < 0.001$). FT, FV, UD, S15mD, S15mT differences were not significant in either group. **Conclusion:** These findings highlight the need for tailored sex and event specific dive-start training to prevent unproductive training while optimizing performance in young athletes.

ID: HPSC-48

EFFECTS OF AN 8-WEEK HIGH INTENSITY INTERVAL TRAINING PROGRAM AND FOAM ROLLER APPLICATION ON FLEXIBILITY AMONG PRECISION SPORTS ATHLETES

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Keywords: Precision Sports, High Intensity Interval Training, Foam Roller, Flexibility, Sit and Reach Test

Introduction: Precision sports such as shooting, lawn bowling, and archery require a balance between stability and flexibility to sustain peak performance. **Objective:** The aim of the study was to determine the effect of high-intensity interval training (HIIT) and foam roller (FR) application on flexibility among precision sports athletes. **Methods:** Researchers randomly assigned a total of forty-eight participants, including male (n = 22) and female (n = 26) athletes from three different precision sports, into three groups. The HIIT + FR group (mean $\pm$ SD: age = 20.29 $\pm$ 1.61 years, height = 164.41 $\pm$ 6.37 cm, weight = 65.52 $\pm$ 15.81 kg) completed 8 weeks of HIIT and FR; the HIIT group (mean $\pm$ SD: age = 19.31 $\pm$ 1.40 years, height = 161.31 $\pm$ 7.54 cm, weight = 62.18 $\pm$ 10.71 kg) completed 8 weeks of HIIT; while the control group (mean $\pm$ SD: age = 21.46 $\pm$ 1.75 years, height = 164.88 $\pm$ 8.18 cm, weight = 70.51 $\pm$ 18.75 kg) received no intervention. Flexibility was measured using the Sit and Reach Test. **Results:** The findings showed significant improvements in flexibility for both the HIIT + FR group *(p=0.001)* and the HIIT group *(p=0.001)* after 8 weeks of intervention. However, no significant differences were observed between the groups *(p>0.05)*. **Conclusion:** The study found that precision sports athletes' flexibility improves after 8 weeks of HIIT, whether with or without FR. HIIT's intense movements may enhance flexibility, whereas FR helps regulate and recover muscles.

ID: HPSC-49

EFFECTS OF RESISTANCE BAND TRAINING ON BODY COMPOSITION AND MUSCULAR ENDURANCE IN FEMALE UNIVERSITY STUDENTS

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Keywords: Resistance Band, Exercise, Endurance, Female, Body Composition

Introduction: Resistance band training (RBT) is ideal for university students as it is affordable, portable and space-efficient for improving overall fitness level despite busy schedules and limited gym access. **Objective:** The aim of this study was to evaluate the effects of 6 weeks of RBT on body composition and muscular endurance in female university students. **Methods:** Twenty participants (n=20) with a mean age of 22 years old, height 160.4 $\pm$ 4.01 cm, and weight 57.92 $\pm$ 7.82 kg participated in the study. Body composition and muscular endurance (1-min sit-up and 1-min squat) were assessed at pre- and post-intervention. The program was implemented twice weekly for a duration of six weeks, with each session lasting approximately 60 minutes. Each session of RBT focusing on different muscle groups (squats, lunges, pull-apart, shoulder press, Russian twists and hip bridges). Pre- and post-intervention data were analysed using paired sample t-tests to determine significant differences, with the level of significance set at $p<0.05$. **Results:** The results showed that 6 weeks of RBT induced a significant increase in muscle mass ($p<0.05$), sit-up performance improved from 31.20 ± 7.87 to 35.35 ± 7.22 ($p<0.001$), and squat performance enhanced from 32.35 ± 4.44 to 36.50 ± 4.36 ($p<0.001$). However, no significant differences were observed in body weight, BMI, body fat percentage, visceral fat, or bone mass post 6-week. **Conclusion:** These findings illustrate the effectiveness of RBT in improving muscle mass and endurance, specifically in female university students, often face time constraints with restricted access to conventional gym resources.

ID: HPSC-55

ISOKINETIC NEUROMUSCULAR CAPACITYOF THE LOWER LIMBS BETWEEN SPRINTERS AND ENDURANCE RUNNERS: A COMPARATIVE ANALYSIS

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Keywords: Neuromuscular Capacity, Peak Torque, Hamstring-To-Quadriceps Ratio, Isokinetic Strength, Endurance Runners

Introduction: Sprinters and endurance runners undergo different neuromuscular adaptation based on event-specific demands. These may influence strength balance and injury risk. **Objective:** This study investigated the comparison of lower-limb isokinetic neuromuscular capacity for specifically quadriceps and hamstring peak torque and the H:Q ratio. **Methods:** Twelve male trained athletes (sprinters and endurance runners) aged 19 to 35 were assessed for concentric knee extension and flexion using an isokinetic dynamometer at $90°/s$. **Result**: Sprinters showed higher peak torque in the quadriceps (192.33 ± 26.87 Nm) and hamstrings (122.00 ± 32.92 Nm) compared to long-distance runners, although differences were not statistically significant ($p > 0.05$). The H:Q ratio was also higher in sprinters (0.63 ± 0.11) than in long-distance runners (0.53 ± 0.08). Despite non-significant p-values, large effect sizes suggest meaningful differences in neuromuscular strength between groups. Despite their contrasting physiological adaptations, which are fast-twitch fibre dominance in sprinters and slow-twitch endurance in distance runners for both groups had similar maximum strength capabilities. **Conclusion:** Sprinters' substantially larger H: Q ratio may indicate improved hamstring development for joint stability during high-speed running. These findings highlight differences in neuromuscular strength profiles between sprint and endurance athletes, reflecting their distinct physiological demands. Future research should include the surface electromyography and biomechanical analysis to deepen understanding of neuromuscular adaptations across running specializations. Aside from that, future studies can include some intervention and training to get more substantial results.

ID: HPSC-62

COMPARISON OF VOLUME MATCHED HIGH-LOAD RESISTANCE TRAINING WITH LOW-LOAD BLOOD FLOW RESTRICTION TRAINING ON PHYSICAL PERFORMANCE AMONG COLLEGE BASKETBALL ATHLETES

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Keywords: Blood Flow Restriction, High-Load Resistance Training, Basketball Performance

Introduction: High-load resistance training (HLRT) is widely recognized for its effectiveness in developing muscular strength, but its application in basketball may be complicated by associated mechanical stress and slower contraction velocities, which do not align well with the sport's explosive demands. In contrast, low-load blood flow restriction (LL-BFR) training offers a joint-friendly alternative by eliciting similar physiological adaptations through metabolic stress under lighter loads while also allowing faster contraction mode. **Objective:** This study aimed to compare the effects of volume-matched HLRT and LL-BFR on lower-body strength, vertical jump, sprint speed, and agility among trained college basketball athletes. **Methods:** Thirty-six male university-level basketball players were randomly assigned to either HLRT group (∼70% 1-RM) or LL-BFR group (∼30% 1-RM), both performing identical lower-body movement patterns twice weekly over six weeks, matched by volume (set x repetitions x load). Before and after the intervention, squat 1-RM, countermovement jump (CMJ), 10-meter sprint, and T-test agility were measured. **Results:** Statistical analysis using mixed-design ANOVA revealed significant interaction and time effects for squat 1-RM; and time effect on CMJ, sprint, or agility ($p<0.05$). Multiple comparison tests showed that both groups have improved in all parameters at post-test, but no significant difference between groups were detected. **Conclusion:** LL-BFR achieved comparable results to HLRT. These findings suggest that LL-BFR can be an alternative method for basketball players to improve strength, power, and agility. It will be of interest for future studies to also investigate how LL-BFR affects basketball-specific performance and musculature fatigue.

ID: HPSC-63

EXPLORING DETERMINANTS OF HERBAL SUPPLEMENT CONSUMPTION AMONG UNIVERSITY ATHLETES: A MULTIVARIATE ANALYSIS

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Keywords: Herbal Supplements, University Athletes, Health Belief Model, KAP, Behavioral Health

Introduction: Herbal supplements, derived from plant sources, are widely perceived as natural aids for performance enhancement and recovery. Their use is growing among university athletes, yet the factors influencing this behavior remain inadequately explored. **Objective:** To examine determinants of herbal supplement consumption among university athletes in Malaysia and China. **Method:** A cross-sectional survey was conducted with 396 university athletes across various sports disciplines, including 209 females and 187 males. The participants, aged between 16 and 31 years, included 230 Chinese citizens and 166 Malaysian citizens. Questionnaires based on the Health Belief Model and Knowledge, Attitude, and Practice (KAP) framework were administered. Data were analyzed using SPSS 27.0 with descriptive, correlation, and multivariate regression analyses. **Results:** Mean scores for knowledge, attitude, perceived benefits, perceived barriers, self-efficacy, and practice were 3.50 ± 0.98, 3.42 ± 1.01, 3.51 ± 0.99, 3.06 ± 1.13, 3.46 ± 1.04, and 2.87 ± 1.43, respectively. Practice differed significantly between Malaysian and Chinese athletes. Positive correlations were observed between practice and knowledge ($r=0.636$), self-efficacy ($r=0.585$), perceived benefits ($r=0.559$), and attitude ($r=0.552$), while perceived barriers correlated negatively ($r=-0.484$) (all $p<0.01$). Regression analysis identified knowledge ($\beta=0.439$), self-efficacy ($\beta=0.345$), attitude ($\beta=0.323$), and perceived benefits ($\beta=0.284$) as positive predictors, and perceived barriers ($\beta=-0.199$) as a negative predictor of consumption (all $p<0.001$). **Conclusion:** Targeted educational strategies that enhance knowledge, self-efficacy, and perceived benefits while reducing perceived barriers may promote informed, responsible consumption among university athletes.

ID: HPSC-66

EFFECTIVE OF VARIABLE RESISTANCE TRAINING ON PUNCH IMPACT FORCE IN YOUTH BOXING ATHLETES: A RANDOMIZED CONTROLLED EXPERIMENTAL STUDY

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Keywords: Variable Resistance Training, Boxing; Youth, Constant Resistance Training, Punch Impact Force

Introduction: Fast, powerful punch is correlated with lower body strength and power. While conventional resistance training that employs constant resistance (constant resistance training, CRT) can improve strength and power, a variable resistance training (VRT) features greater eccentric stimulus and faster concentric phase output by adjusting the resistance load. The VRT's characteristics is closer to demand of punching, and it would be of interest to investigate whether VRT is an effective resistance training method to improve strength and power. **Objective:** To compare the effects of 6-week CRT and VRT on lower body strength, power, punch impact (PI), and punch speed (PS). **Methods:** Forty boxers (males, age:15.7 ± 1.3) were randomly assigned to 6-week, volume-matched VRT or CRT groups. Back-squat 1-RM (BS1-RM), vertical jump (VJ), 10-m sprint, PI, and PS were tested before and after the intervention. **Results:** Mixed-design ANOVA shows significant interaction and time effects for BS1-RM, PI, and PS. Significant time effect was detected for VJ and 10-m sprint. Multiple comparison shows that both groups shown improvements in BS1-RM (VRT:156.7 ± 20.5kg to 170.7 ± 20.1kg; CRT:157 ± 17.2kg to 166.2 ± 17.1kg), VJ (VRT:50.6 ± 7.3cm to 54.2 ± 5.9cm; CRT:50.6 ± 6.1cm to 53.4 ± 5.8cm), PI (VRT:70.4 ± 11.8kg to 74.6 ± 11.4kg; CRT:70.4 ± 9.5kg to 71.6 ± 9.6kg), and PS (VRT:7.3 ± 0.7m/s to 8.4 ± 0.7m/s; CRT:7.2 ± 0.5m/s to 7.9 ± 0.6m/s); 10-m sprint (VRT:2.01 ± 0.4s to 1.98 ± 0.4s; CRT:1.88 ± 0.31s to 1.87 ± 0.31s) was only improved in VRT. In addition, PS was significantly faster in VRT compared to CRT at post-test. **Conclusions:** VRT has similar benefits to CRT in improving lower body strength, power, and punch impact but better improves power as seen in the PS and 10-m sprint results.

ID: HPSC-68

OUTCOME OF ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION: AN EXPLORATORY STUDY AT HOSPITAL TENGKU AMPUAN AFZAN

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Keywords: ACL, Reconstruction, Return to Sport, Recovery Delay Factors

Introduction: Anterior cruciate ligament (ACL) reconstruction is commonly performed in young, active individuals to restore knee stability and function. However, post-operative outcomes are often influenced by adherence to follow-up and rehabilitation. **Objective:** To explore ACL reconstruction outcomes in relation to age, injury morphology, and follow-up status at a tertiary hospital. **Methods:** A retrospective review on 28 patients who underwent ACL reconstruction between 2020 and 2024 was conducted. Variables included age, injury mechanism and morphology, grade of tear, concomitant injuries, follow-up adherence, return to activity, and patient satisfaction. Return to pre-injury activity was defined as resumption of the same level of pre-injury sporting activity for at least three consecutive months. **Results:** The majority of patients were under 30 years old (67.9%), with 75% having sport-related injuries: futsal being most common (46.7%). Complete ACL tears were found in 86.5%, and 78.6% had concomitant injuries. Left-sided involvements were slightly more common (57.1%). Post-operative follow-up compliance was poor, with 60.7% defaulting within 12 months. Among those completing follow-up (n=9), 88.8% achieved a limb symmetry index (LSI) ≥ 0.8 on the Single Leg Hop Test (SLHT) at 8 months, and 77.8% reached LSI ≥ 0.9 by 12 months. Return to pre-injury activity was reported in 57.1%. Mean satisfaction score was 4.36 ± 0.78 on a 5-point Likert scale. **Conclusion:** Patients adhering to follow-up generally demonstrated good functional recovery post-ACL reconstruction. However, high default rates may compromise long-term outcomes. Targeted strategies to improve follow-up engagement are essential to optimise rehabilitation success.

ID: HPSC-78

KNOWLEDGE, ATTITUDE AND PRACTICE OF SODIUM INTAKE AND ITS CORRELATION WITH SODIUM INTAKE, BLOOD PRESSURE AND NUTRITIONAL STATUS IN YOUNG (17-21 YEARS OLD) TERENGGANU FC FOOTBALLERS

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Keywords: Sodium Intake, Knowledge, Attitude and Practice, Blood Pressure, Nutritional Status, Football Players

Introduction: Football's high intensity demands make sodium management important for footballers, as excessive sodium intake can increase risk of hypertension and obesity. Proper electrolyte balance is essential for preventing dehydration, muscle cramps, and supporting overall performance and recovery. **Objective:** This study examined the correlation between knowledge, attitude, and practice (KAP) of sodium intake with sodium intake, blood pressure, and nutritional status in young (17-21 years old) Terengganu Football Club footballers. **Methods:** A cross-sectional study was conducted among 44 purposively selected players aged 17–21 years. Anthropometric data (height, weight, BMI, waist circumference) were obtained using standard tools. Sodium intake was assessed using a validated food frequency questionnaire, while KAP of sodium intake were measured using a validated questionnaire (MyCoss). Blood pressure was taken as an indicator of cardiovascular health. Data were analyzed using descriptive statistics [median (IQR)] and Spearman's rho ($p<0.05$). **Results:** Findings showed that although the footballers' KAP levels varied, all exceeded the recommended sodium intake 4884.34 mg/day (6213.76 mg/day). Systolic blood pressure was 121 mmHg (12 mmHg), diastolic blood pressure 64 mmHg (18 mmHg), waist circumference 71.13 cm (5.08 cm), and BMI 22.41 kg/m² (2.58 kg/m²). No significant correlation was found between KAP scores and sodium intake, blood pressure, or nutritional status ($p>0.05$). **Conclusion:** This study found no correlation between KAP and sodium intake, blood pressure, or nutritional status. The findings underscore the need for comprehensive evaluation of dietary patterns and implementation of strategies that promote healthier food choices, reduce sodium intake, and support both performance and long-term health.

ID: HPSC-80

DEVELOPMENT OF MULTI-SENSOR WOBBLE BOARD PROTOTYPE FOR POSTURAL SWAY ASSESSMENT; SENSOR ZONE UNIVERSAL – BALANCE EXERCISE ADAPTIVE NEURAL SYSTEM

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Keywords: Postural Sway, Wobble Board, Balance Assessment, Wearable Sensor Technology, Portable Rehabilitation Device

Introduction: Postural sway analysis is widely applied in rehabilitation and sports science to assess balance control, yet portable, cost-effective tools remain limited. This study introduces the Sensor Zone Universal Balance Exercise Adaptive Neural System (SenZU-BEANS), a wobble board prototype integrated with a Witmotion BWT901CL inertial measurement unit (IMU) for real-time sway quantification. The IMU was mounted at the centre of the wobble board to capture symmetrical movement, with a protective cushion layer added. **Objective:** This study aims to develop and evaluate the performance of SenZU-BEANS in measuring anterior-posterior and medio-lateral postural sway in healthy young adults. **Methods:** Ten participants (aged 18-20 years), without musculoskeletal injuries, neuromuscular conditions, or balance impairments, performed a 60-second double-leg static stance with feet shoulder-width apart and arms crossed over the chest. The IMU recorded tri-axial data at 100 Hz, with signals processed using a 5 Hz low-pass filter and moving-average smoothing. The X-axis was defined as anterior–posterior pitch and the Y-axis as medial–lateral roll, with positive X indicating plantarflexion and negative Y indicating ankle eversion. Processed data were exported to Microsoft Excel, where formulas computed minimum, maximum, and mean sway angles, and generated a polar plot to visualize sway distribution. **Results:** Sway angles ranged from $-5.757°$ to $8.405°$ (X-axis) and $-8.141°$ to $6.504°$ (Y-axis), with mean values of $0.824°$ and $-0.257°$, respectively. Quadrant analysis showed sway most frequently occurred in the anterior-right quadrant (41.9%). **Conclusion:** The SenZU-BEANS prototype effectively quantified directional sway and demonstrates potential as a portable, low-cost tool for balance assessment.

ID: HPSC-82

TALENT DEVELOPMENT ENVIRONMENT QUESTIONNAIRE IN MALAYSIA

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Keywords: Talent Development, Youth Football, Malaysia, Coaching, Athlete Development

Introduction: The talent development environment (TDE) is a critical factor for long-term athlete success. Although the Talent Development Environment Questionnaire (TDEQ-5) has been widely applied internationally, its use in Malaysia remains limited, particularly within football contexts. **Objective:** This study aimed to evaluate Malaysian youth football players' perceptions of their developmental environment and to validate the structure of the adapted TDEQ-5. **Methods:** A cross-sectional survey was conducted among 388 players from 77 football academies. The adapted questionnaire consisted of 25 items across five dimensions: long-term development, support network, communication, alignment of expectations, and quality preparation. Data were analyzed using descriptive statistics, exploratory and confirmatory factor analyses, and structural equation modelling to examine validity and reliability. **Results:** The adapted TDEQ-5 showed good internal consistency (Cronbach's α = 0.87) and acceptable model fit (CFI = 0.94, RMSEA = 0.07). Players reported strengths in support network and alignment of expectations, but lower scores in communication and long-term development strategy. **Conclusions:** The findings confirm the applicability of the TDEQ-5 to Malaysian youth football and highlight areas for improvement. Enhancing communication and implementing sustainable development planning may enhance the overall talent pipeline. This study provides empirical evidence to support the adaptation of talent development frameworks to local football contexts.

ID: HPSC-85

DISORDERED EATING BEHAVIOURS AMONG BODYBUILDERS AND POWERLIFTERS: THE ROLE OF AESTHETIC PRESSURE AND RAPID WEIGHT LOSS

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Keywords: Bodybuilding, Body Appreciation, Disordered Eating Behaviours, Rapid Weight Loss, Powerlifting

Introduction: Bodybuilding and powerlifting impose distinct demands, yet both may foster disordered eating behaviours (DEB) through aesthetic pressure, rigid dietary control, and rapid weight loss (RWL). Bodybuilding emphasises aesthetics, encouraging chronic dietary restraint, while powerlifting requires athletes to "*make weight*," often prompting RWL. **Objective:** This study examined the prevalence of DEB and its associations with dietary intake, RWL, and body appreciation among bodybuilders and powerlifters. **Methods:** A total of 131 athletes, bodybuilders (n = 67, 26.1 ± 4.3 years) and powerlifters (n = 64, 27.4 ± 5.1 years), were recruited through convenience and snowball sampling. Measures included the Eating Attitudes Test-26 (EAT-26), Three-Factor Eating Questionnaire-Revised 18 (TFEQ-R18), RWL Questionnaire (RWLQ), Body Appreciation Scale-2 (BAS-2), and a 24-hour dietary recall. Descriptive statistics, group comparisons, correlations, and hierarchical regression were conducted in the analyses. **Results:** Overall, 35% scored ≥20 on the EAT-26, indicating elevated DEB risk. Female bodybuilders showed the highest prevalence (45.8%), followed by female powerlifters (40.9%), male bodybuilders (39.5%), and male powerlifters (21.4%). Female bodybuilders exhibited the highest cognitive restraint (CR) (54.2%), whereas female powerlifters reported greater emotional eating (EE) (54.5%). Male powerlifters demonstrated elevated CR (42.9%). EAT-26 correlated strongly with CR (r = 0.833), moderate associations with uncontrolled eating (UE) (r = 0.549) and EE (r = 0.460). Regression confirmed CR as the strongest predictor (β = 0.649, $p < 0.001$), followed by UE (β = 0.167, $p = 0.028$). **Conclusion:** Both aesthetic and weight-class pressures contribute to DEB, with female bodybuilders most vulnerable. Screening and interventions should prioritise CR and UE as key predictors.

HPSC Poster Presentation

ID: HPSC-12

EXPLORING DEFENSIVE SKILL EXECUTION IN NETBALL USING A VIDEO-BASED CHECKLIST

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Keywords: Defensive Skills, Netball, Video-Based Checklist

Introduction: Limited informative feedback on defensive skill execution during real-game situations highlights the need for performance analysis to optimize netball performance. **Objective:** This study aimed to explore the defensive technical skills demonstrated during actual gameplay to gain a deeper understanding of player movements during the defensive phase. **Methods:** A Video-Based Checklist for Defensive Skills (V-bDSC) was developed and required both content verification and usability validation through the analysis of real-game footage. The V-bDSC was verified using defensive play from a 5-minute regional netball clip, offering sufficient exploratory insights without full match analysis. The analysis resulted in the inclusion of seven additional specific defensive skill items in the checklist (Inside Defensive, Outside Defensive, Double Defend, Front Position, Back Position, Off Ball Marking, Zone). The categorization of defensive skill execution into three action groups (Main Defence, Assist Defence 1 and Assist Defence 2) proved appropriate for capturing the complexity of defensive roles. **Results:** During centre pass defence, Main Defence players predominantly executed the Double Defence skills while Assist Defence 1 players employed Inside and Outside Defensive skills. After the centre pass was completed, Main Defence players frequently applied Marking and Zoning techniques. In contrast, Assist Defence 1 players favoured Off-Ball Marking, Off-Ball Zone and Front Position as primary defensive responses. **Conclusion:** Although the analysis was limited to a 5-minute video segment, this study provides valuable insights and lays the groundwork for further investigation into defensive skill execution in competitive netball.

ID: HPSC-13

CHALLENGES AND ROLES OF HEALTHCARE PERSONNEL AND COMMUNITY IN PARA SWIMMING CLASSIFICATION: A SCOPING REVIEW

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Keywords: Para-Swimming Classification, Physical Impairment Ins Sports, Health Care Professional, Classification Education

Introduction: Para-swimming is a competitive sport with various types of impairments - physical, visual, or intellectual. The classification rules are established by World Para Swimming and the International Paralympic Committee (IPC) Classification Code. Physical impairment classes are categorised from S1 to S10, with classifications determined by classifiers. Several gaps remain in the current classification system and dressing these challenges requires the involvement of healthcare professionals and the community. **Objectives:** 1) To understand the classification process, 2) To identify gaps within the existing system 3) To explore the roles of healthcare professionals and the community in supporting the classification process. **Methods:** This scoping review used a comprehensive search strategy across multiple electronic databases, including PubMed and Google Scholar. The review process followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework to ensure transparency and methodological rigor and a PRISMA flow diagram was used. A total of 27 studies met the predefined inclusion criteria and were included. **Result:** The gaps and corresponding interventions identified were categorised into classification-related and non-classification-related areas. Classification-related gaps called for improvements in assessment components, classifier training, and awareness of the classification process. Non-classification-related gaps primarily focused on enhancing recruitment efforts, resource sharing, and education. **Conclusion:** The paper highlights key challenges in classification, including inconsistent assessments, limited classifier training, lacking stakeholder awareness, gaps in resources, and education. Targeted collaboration between healthcare professionals and governing bodies with a standardised procedure, along with the community supports are essential to improve the quality of classification process.

ID: HPSC-15

MOTOR IMAGERY TRAINING IN SPORTS PSYCHOLOGY IMPROVES TENNIS SERVICE PERFORMANCE AMONG COMPETITIVE YOUNG TENNIS PLAYERS: A SCOPING REVIEW

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Keywords: Motor Imagery Training, Sport Psychology, Tennis Serve, Performance Enhancement, Young Tennis Player

Introduction: Tennis has gained significant popularity with global participation increasing by 25.6% among players and 13.6% among coaches between 2019 and 2024. The tennis serve is one of the most critical, and accounting 25% of match points. Tennis serve is influenced by accuracy, consistency and stroke velocity. To enhance performance, many coaches integrate sport psychology techniques, particularly Motor Imagery Training (MIT). **Objectives:** This scoping review aims to explore the impact of MIT on the serving performance of competitive young tennis players. This review aims to fill that gap by identifying, categorizing, and analysing the scope of current research on MIT's effectiveness. **Methods:** This scoping review used a systematic search of English-language studies, conducted across Scopus, Ovid MEDLINE and Google Scholar. Data were charted using a standardized form and analysed thematically to map the scope, characteristics, and key findings of the existing literature. **Results:** A total of 9 studies met the inclusion criteria. Findings indicate that Motor Imagery Training (MIT) is commonly associated with improved tennis serve performance, particularly in accuracy, consistency, and mental focus. The review is expected to map key intervention characteristics, performance outcomes, and methodological gaps in the current literature. **Conclusion:** While Motor Imagery Training (MIT) shows promising potential as a training tool to enhance tennis serve performance, its integration into coaching practices could provide athletes with mental strategy to improve consistency and focus. Beyond tennis, further research is needed to explore MIT's applicability across other tennis skills and wheelchair tennis.

ID: HPSC-19

TOE GRIP STRENGTH AND FALL PREVENTION IN THE ELDERLY THROUGH SPORT INSIGHTS

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Keywords: Elderly Falls, Postural Stability, Functional Mobility, Sport-Based Exercise, Balance Training

Introduction: Falls remain one of the leading causes of injury, disability, and loss of independence among older adults worldwide. Addressing both physical and functional risk factors is crucial for effective fall prevention. **Objective:** This pilot study is to investigate the potential association between toe grip strength and balance performance as indicators of fall risk, using balance and mobility tasks inspired by sport movements such as single-leg stance drills and weight-shift exercises. **Methods:** Four community-dwelling Malaysian older adults aged 60–69 years participated in the study. Toe grip strength was assessed using a toe grip dynamometer in both seated and standing positions. Static balance was evaluated through single-leg stance tests with eyes open and closed, measuring the time (in seconds) each participant could maintain balance. These tasks were modelled after common dynamic balance activities used in sport training, adapted for older adults. **Results:** Descriptive results revealed individual differences in toe grip strength (range: 4.2 kg to 6.8 kg) and corresponding balance times (eyes open: 6–22 seconds; eyes closed: 2–10 seconds). Preliminary analysis suggests a positive trend between higher toe grip strength and improved postural control. **Conclusion:** Despite the small sample size, this pilot study provides foundational insight into the role of toe grip strength in enhancing lower-limb stability. The findings support the inclusion of foot-focused strength training within community-based, sport-informed fall prevention programs aimed at improving dynamic stability and functional mobility in older adults.

ID: HPSC-21

PREVENTING INJURIES IN WHEELCHAIR TENNIS: THE ROLE OF STRENGTH TRAINING FOR PARA ATHLETES – A SCOPING REVIEW

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Keywords: Strength training, Wheelchair tennis, Para athletes, Injury prevention, Shoulder biomechanics

Introduction: Wheelchair tennis is a rapidly growing sport among para-athletes, and it imposes unique biomechanical demands, combining upper-limb propulsion with tennis-specific movements. Hence the high physical demands of the sport increase the risk of overuse injuries, particularly in the upper limbs. Strength training is recognized as a key component in injury prevention, yet region-specific evidence remains limited. **Objective:** This scoping review aims to map the existing literature on strength training interventions in wheelchair tennis with a focus on injury prevention and identifying effective modalities and their role in enhancing performance. **Methods:** Guided by PRISMA-ScR guidelines, a comprehensive search was conducted in PubMed, Scopus, SPORT Discus, and regional databases such as J-STAGE and Ind MED. Articles published between 2000 and 2025 were included. Both experimental and observational studies, were considered, along with grey literature and coaching guidelines. **Results:** A total of 21 studies met the inclusion criteria. Common strength training protocols included resistance band programs, upper-body conditioning, and functional movement exercises tailored to wheelchair mobility. Most studies reported reductions in shoulder and wrist injuries, improved muscular endurance, and enhanced performance outcomes. However, there was a lack of standardized protocols. **Conclusion:** Strength training plays a critical role in injury prevention for wheelchair tennis para-athletes. Integrating biomechanical assessments with individualized training and recovery strategies presents a promising path for improving both performance and long-term health outcomes. Future research should focus on culturally adapted, sport-specific training frameworks and promote cross-country collaboration to standardize preventive practices.

ID: HPSC-34

INHIBITORY CONTROL IN ATHLETES AND NON-ATHLETES: A COMPARATIVE STUDY USING THE STOP-SIGNAL TASK

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Keywords: Inhibitory Control, Stop-Signal Reaction Time, Open-Skill Sports, Cognitive Performance

Introduction: Inhibitory control the ability to stop inappropriate actions and adapt to changing situations is critical in open-skill sports such as football, futsal, and handball, where split-second decisions are required. While physical activity benefits cognition, the influence of different participation levels on inhibitory control remains unclear. The Stop-Signal Task (SST), which measures Stop-Signal Reaction Time (SSRT), enables precise comparisons among specific athletes, recreational athletes, and non-athletes. **Objective:** This study aimed to compare inhibitory control among trained athletes, recreational athletes, and non-athletes using the SST. **Methods:** Twenty-one male participants aged 19–24 were selected via purposive sampling and classified using the Participant Classification Framework. Athletes (n=14) were grouped as trained or recreational based on weekly training volume (>150 minutes) and competitive involvement in football, futsal, or handball. Non-athletes (n=7) engaged in <150 minutes/week of activity and reported no sport identification. All participants completed a computer-based SST to assess Go Reaction Time (GoRT) and SSRT. **Results:** A one-way ANOVA revealed significant group differences in SSRT ($F_{(2,18)} = 10.29$, $p = 0.001$), with non-athletes showing slower inhibitory control than both athlete groups. No significant differences were found in GoRT ($p > 0.05$), indicating similar basic response speed across groups. **Conclusions:** Regular participation in open-skill sports appears to enhance inhibitory control in young adults, independent of basic reaction speed. This improvement likely reflects more efficient decision-making and higher-level cognitive processing. Structured sport programmes may offer a practical approach to improving inhibitory control and overall cognitive performance in non-athletes.

ID: HPSC-38

AERODYNAMIC ANALYSIS IN BIOMECHANICAL OPTIMIZATION OF MARATHON RUNNERS BY USING COMPUTATIONAL FLUID DYNAMICS AND FINITE ELEMENT ANALYSIS

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Keywords: Aerodynamic, Drag, Biomechanics, Pacer, Airflow

Introduction: Aerodynamic analysis using computational fluid dynamics (CFD) and finite element analysis (FEA) modelling to improve athletic performance, it also highlights the prospective of Artificial Intelligence (AI) in augmenting methods in the future. The simulations optimize pacer formations and predict athlete-specific outcomes. **Objective:** This study aims to analyze the aerodynamic effects of different marathon running formations using FEA and CFD, evaluate drag forces under various formations and velocities, and identify pacer-runner arrangements that maximize efficiency through reduced resistance. **Methods:** The study used CFD and FEA in MIDAS NFX to simulate airflow patterns around marathon runners, focusing on Eliud Kipchoge's biomechanical body form. A precise 3D body model was created in Autodesk Fusion 360, and environmental factors like high-altitude air density were incorporated. Three pacer-runner formations were tested under various wind velocities, with defined boundary conditions and refined meshing. Steady-state simulations analyzed velocity, pressure, and airflow patterns to identify the formation and posture that best reduced drag and improved efficiency. **Results:** The simulations compared three pacer-runner formations under five running velocities. Formation 3 consistently produced the lowest, most stable airflow pattern and pressure. It provided optimal shielding for the runner. Formation 2 offered moderate benefits with some instability at higher speeds, while Formation 1 reduced drag on the runner but placed excessive aerodynamic load on pacers and showed turbulence issues. **Conclusion:** Although AI was not employed in this study, future integration with CFD and FEA holds promise for accelerating simulation workflows, personalizing athlete-specific models, and optimizing race strategies in real time.

ID: HPSC-42

EFFECTS OF SHORT-TERM COMBINED TRAINING ON SAGITTAL PLANE KINEMATICS AND BODY COMPOSITION DURING OVERHEAD SQUAT: A CASE STUDY

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Keywords: Overhead Squat, Short-Term Combined Training Program, Kinematics and Sedentary

Introduction: The overhead squat (OHS) is a functional assessment tool to evaluate mobility, stability, and neuromuscular control across the kinetic chain. Limited research has examined OHS adaptations in sedentary adults. **Objective:** To investigate the effects of four weeks of combined training on sagittal plane kinematics during the OHS and body composition in administrative staff. **Methods:** Six participants (three females, three males) completed a 4-week, 12-session muscular and cardiovascular endurance program of 10 exercises (3 sets; 40:20 work-to-rest ratio). Pre- and post-intervention assessments used two-dimensional motion analysis (Kinovea) to measure elbow, knee, and ankle joint angles during three OHS repetitions. Body composition (BMI, muscle mass, fat percentage) was assessed. Paired t-tests compared pre- and post-training values. **Results:** Statistical analysis using paired t-tests revealed no significant differences in BMI (pre: 29.98±4.57, post: 29.92±4.83, p=0.679), muscle mass (pre: 24.22±2.73, post: 24.33±2.62, p=0.315), or fat percentage (pre: 35.62±4.15, post: 35.28±4.14, p=0.166). Additionally, joint angles in the standing position remained unchanged post-intervention (elbow: p=0.91; knee: p=0.943; ankle: p=0.928). However, during the descending phase, a significant increase was observed in knee angle (pre: 52.25°±11.27, post: 68.67°±9.17, p=0.014), indicating a more extended knee posture and possibly a reduced squat depth post-training. **Conclusion:** This shift may reflect a compensatory strategy influenced by flexibility or strength limitations. However, given the small sample size and short training duration, these findings should be interpreted with caution. Future interventions should include more sessions targeting the quadriceps, hamstrings, and hip musculature to enhance lower limb mechanics and squat performance in non-athletic populations.

ID: HPSC-43

PRELIMINARY DATA OF AI-BASED INJURY RISK SCREENING: A COMPARATIVE ANALYSIS STUDY ACROSS AGE GROUPS

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Keywords: Artificial Intelligence, Injury Prevention, Health Assessment, Functional Movement

Introduction: Artificial intelligence (AI) in sports enhances performance analysis and injury prevention through real-time movement tracking and personalized training. However, AI-informed injury risk data across age groups remain limited. **Objective:** This study evaluated exercise-related injury risks across different age groups using AI-based functional movement screening. **Methods:** Fifty-five volunteers were categorized into four age groups: Children (C-A, 8–14 years, n=18), Youth (Y-A, 15–24 years, n=15), Adults (A-A, 25–44 years, n=10), and Middle-aged Adults (M-A, 45–53 years, n=12). Participants performed video-guided functional movement exercises using 3D biomechanical screening (HoloMotion, Beijing, China) during the SportExcel Swimming Circuit, Leg 1 (Malaysia, 2025). Demographic data were collected with informed consent. Injury risk scores were compared across age groups using Multivariate ANOVA (SPSS v27.0). **Results:** Children scored lower overall than adults (73.84 ± 5.51 vs. 77.88 ± 2.93) ($p=0.016$) and exhibited higher injury risk (17.66 ± 4.07 vs. 14.70 ± 2.08) ($p=0.015$). Adults achieved significantly higher symmetry scores than all other groups (C-A: $p=0.024$; Y-A: $p=0.043$; M-A: $p=0.035$). Children showed elevated risk of spinal disc herniation ($p=0.014$), anterior pelvic tilt ($p=0.014$), joint pain ($p=0.045$), ligament strain ($p=0.019$), and foot fractures ($p=0.037$) compared to adults. Middle-aged adults also demonstrated greater risk of joint pain ($p=0.047$) and foot fractures ($p=0.043$) relative to adults. **Conclusion:** Children and middle-aged adults exhibited the highest exercise-related injury risk which highlights the importance of age-specific screening and targeted injury prevention strategies.

ID: HPSC-44

RELIABILITY OF SPRINT TEST NORMS APPLICATION IN ASSESSING SPEED FITNESS AMONG RESERVE OFFICER TRAINING UNIT CADETS

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Keywords: Speed, Reliability, ROUT, Sprint Test, Norms

Introduction: Speed is a vital component of military fitness, directly influencing an individual's ability to perform effectively during field operations and missions. For Reserve Officer Training Unit (ROTU) cadets, short-distance sprinting not only demonstrates athletic proficiency but also indicates combat-adaptive performance. **Objective:** The present study aimed to assess the reliability of a sprint test norms application for evaluating physical speed training among ROTU cadets. **Methods:** A total of 60 male cadet officers from the National Defence University of Malaysia (NDUM) were recruited. The study employed the 30-metre sprint test battery as the research instrument, integrated into a digital application designed to provide normative standards for fitness assessment. A test–retest design was used to establish reliability, with participants repeating the sprint test seven days after the initial session under identical conditions. The availability of such smart applications allows individuals to measure and interpret their fitness levels easily and rapidly after physical activity. **Result:** The findings revealed a statistically significant correlation between the trials ($r = 0.95$, $n = 60$, $p < 0.001$), demonstrating a strong positive relationship and confirming the high reliability of the sprint test norms application. **Conclusion:** These results provide empirical evidence that digital fitness applications can be used as effective tools for evaluating speed performance in military trainees. In conclusion, the application offers a valid, quick, and practical method for assessing physical readiness. Its implementation has the potential to enhance training monitoring and performance evaluation within defence and security contexts in Malaysia.

ID: HPSC-47

MONITORING PLAYER READINESS AND TRAINING LOAD IN ADOLESCENT FOOTBALL PLAYERS DURING HIGH-INTENSITY HYBRID TRAINING: A PILOT STUDY

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Keywords: High Intensity Hybrid Training, Wellness Monitoring, Training Load, Youth Athletes

Introduction: Monitoring player readiness and training load is essential for optimizing performance and preventing overtraining in adolescent athletes. While wellness assessments provide insights into pre-training physical and mental states, the Rating of Perceived Exertion (RPE) quantifies internal training load. **Objective:** This pilot study examined the feasibility of High-Intensity Hybrid Training (HIHT) in adolescent football players and the relationship between pre-training wellness and post-training load. **Methods:** Ten male players (19.4 ± 0.4 years) completed four identical HIHT sessions (twice weekly) involving treadmill sprints (14 km/h, 1 min), strength exercises (3×10 reps at 65% 1RM), and bodyweight circuits to failure. Pre-training wellness (fatigue, sleep, soreness, stress, mood) determined player readiness, while post-training load was calculated as RPE $\times$ duration. Feasibility was assessed via adherence rates and post-session feedback. **Results:** HIHT elicited consistently high training loads (568 ± 56 AU) across sessions, with RPE scores 7 - 8. Player readiness varied 68 - 84% but showed only a modest inverse correlation with RPE ($r = -0.32$, $p = 0.12$), suggesting the fixed-intensity protocol may overshadow wellness-related fluctuations. Feasibility data indicated 92% adherence, with no adverse effects reported. **Conclusion:** Despite variable readiness, HIHT imposed uniformly high training loads. While wellness monitoring may help identify athletes requiring individualized adjustments, this pilot confirms HIHT's feasibility for adolescent footballers. Future studies should incorporate a control condition, such as traditional HIT, and larger samples to evaluate chronic adaptations.

ID: HPSC-51

TEST-RETEST RELIABILITY OF HOLOMOTION SYSTEM FOR FUNCTIONAL MOVEMENT AND INJURY RISK ASSESSMENT

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Keywords: Injury Risk Management, Artificial Intelligence, Motion Capture, Clinical Assessment, Lower Limb Evaluation

Introduction: The growing demand for non-invasive, rapid, and comprehensive movement screening tools has led to the development of 3D motion capture systems. Holomotion, a novel AI-powered system using depth camera technology, analyzes functional movements to identify potential injury risks across multiple body regions. Despite its potential, its reliability across time points remains underexplored. **Objective:** This study aimed to evaluate the within-day and between-day test-retest reliability of Holomotion in assessing physical performance metrics and injury risk factors. **Methods:** Twenty-eight healthy participants were recruited. Each underwent a familiarization session followed by three assessments: baseline, one hour post-test, and 48 hours later. The Holomotion system captured nine functional movements, generating 11 domain variables (DVs): physical total score, injury risk, mobility, stability, symmetry, neck pain, shoulder pain, scoliosis, pelvis alignment, ligament strain, and ankle pain. Intraclass correlation coefficients (ICCs) with 95% confidence intervals were calculated to determine reliability. **Results:** Within-day reliability was found to be excellent for mobility and pelvis (ICC > 0.90), and good for most other variables (ICC = 0.83–0.89), except for symmetry, neck pain, and shoulder pain, which showed moderate reliability. Between-day reliability was similarly good for most variables, but moderate for scoliosis and symmetry, and poor for shoulder pain (ICC = 0.304). **Conclusion:** The Holomotion system demonstrates good-to-excellent reliability for assessing most functional parameters, supporting its use in clinical and performance settings. However, caution is advised when interpreting results related to asymmetry and shoulder pain, which showed lower consistency over time.

ID: HPSC-54

EFFECTS OF RESISTANCE BAND TRAINING ON FOREHAND TOPSPIN ACCURACY IN MALAYSIAN YOUTH TABLE TENNIS PLAYERS

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Keywords: Resistance Band Training, Table Tennis, Forehand Topspin, Stroke Accuracy, Youth Athlete

Introduction: Forehand topspin is a fundamental stroke in table tennis, yet limited research has explored how physical conditioning affects its accuracy. This study addresses the gap by investigating the effects of resistance band training program that integrated with table tennis drills on enhancing forehand topspin accuracy and control in adolescent athletes. **Objective:** To investigate the effects of a six-week conventional resistance training (CRT) and resistance band training (RBT) program integrated with sport-specific drills on forehand topspin accuracy, grip strength, core stability, maximal push-ups, 1-min burpee. **Methods:** Thirty-four state-level players (10–15 y) were randomized to RBT (n=17) or CRT (n=17). Both groups trained 3×/week for 6 weeks with identical technical drills; RBT performed resistance band upper/lower body and core exercises (10–12RM), whereas CRT performed dumbbell upper/lower body and core exercises. Pre/post-tests: 60-ball forehand accuracy score (2 = target, 1 = in-table, 0 = error), dominant-hand grip strength, maximal push-ups, 1-min rotary core test (left/right), and 1-min burpees. **Results:** Mixed (2x2) ANOVA shown a significant ($p <0.05$) interaction, time, and group effects for accuracy and core stability; significant interaction and time effects for grip strength, maximal push-ups, and 1-min burpees. Post-hoc revealed that the RBT demonstrated significantly greater post-test score in RBT for forehand topspin accuracy, and core stability. **Conclusion:** RBT is more effective overall in enhancing stroke accuracy and physical performance metrics in adolescent table tennis players. Integrating such training with regular practice may support neuromuscular development and improve competitive performance during a critical stage of motor learning.

ID: HPSC-56

USING ARTIFICIAL INTELLIGENCE TO DETECT MOVEMENT ISSUES: HOW AGE AND GENDER AFFECT YOUR INJURY RISK

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Keywords: Artificial Intelligence, Musculoskeletal Screening, Injury Risk, Movement Quality, Age and Gender Differences

Introduction: Artificial intelligence (AI) is increasingly applied in musculoskeletal health assessment. HoloMotion, an AI-based screening tool, uses 3D depth-sensing and biomechanical modeling to evaluate movement quality and injury risk. Few studies have examined how age and gender affect physical health and clinical risk scores. **Objective:** To assess age- and gender-related differences in musculoskeletal function and injury risk using an AI-driven screening system. **Methods:** Forty-two adults (23 females, 19 males) were screened using HoloMotion and grouped by age: 25–40 years (n = 11) and 41–72 years (n = 31). Results included an Overall Physical Quality Score (mobility, control, balance), a Risk Index (posture, asymmetry, dysfunction), and eight condition-specific risk scores. Independent samples t-tests were performed ($p = 0.05$). **Results:** Participants ≤40 years old scored significantly higher in physical quality (77.48 ± 4.20) than older adults (74.34 ± 4.31; $p = 0.0406$) and had significantly lower injury risk classifications (Risk Index: 15.01 ± 3.01 vs 17.27 ± 3.15; $p = 0.041$). Males showed better physical performance (77.42 ± 3.27 vs 73.46 ± 4.57; $p < 0.001$) and lower risk scores (15.03 ± 2.34 vs 17.91 ± 3.34; $p < 0.001$) than females. Although stability and symmetry differences were not significant, mobility and condition-specific trends favored younger and male participants. **Conclusion:** These findings demonstrate clear age- and gender-related disparities in musculoskeletal performance and injury risk profiles. AI-based screening systems such as HoloMotion can offer valuable insights for targeted risk identification and personalized prevention strategies in both clinical and occupational health settings.

ID: HPSC-58

RELATIONSHIP BETWEEN MUSCLE CROSS-SECTIONAL AREA, THIGH CIRCUMFERENCE AND INTERNATIONAL KNEE DOCUMENTATION COMMITTEE AFTER ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION

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Introduction: Anterior cruciate ligament (ACL) reconstruction often results in persistent quadriceps weakness and proprioceptive deficits despite its role in restoring knee stability. While the International Knee Documentation Committee (IKDC) score is widely used, its subjectivity may not fully capture physiological recovery. Evidence directly linking objective measures such as muscle cross-sectional area (CSA) and thigh circumference with IKDC outcomes remains limited, which this study seeks to address. **Objective:** To investigate whether thigh muscle CSA and thigh circumference correlate with IKDC scores following ACL reconstruction. **Methods:** Nineteen patients (13 males, 6 females; mean age 27.1 ± 7.9 years; height 177.1 ± 10.0 cm; weight 75.3 ± 16.1 kg; BMI 23.8 ± 3.5) were evaluated for vastus medialis (VM), semitendinosus (ST), and biceps femoris (BF) CSA and thigh circumference at baseline, week 3, and week 6 post-ACL reconstruction. IKDC scores were recorded concurrently and additionally at 12-, 15-, 18-, and 24-week follow-ups. **Results:** Greater VM CSA at 6 weeks was moderately correlated with higher IKDC scores at week 18. BF CSA at baseline and 6 weeks demonstrated weak positive correlations with week 24 IKDC, whereas ST CSA at 6 weeks showed a weak negative correlation. Thigh circumference was not a consistent predictor and showed a weak negative correlation at week 15. **Conclusion:** VM and BF CSA provided limited but significant predictive value for functional recovery, while thigh circumference alone was unreliable. These findings highlight the clinical importance of integrating objective morphological and neuromuscular assessments to guide rehabilitation and optimize return-to-sport decisions.

ID: HPSC-59

EFFECTS OF A MULTI-INGREDIENT PROTEIN SUPPLEMENT ON MUSCULAR ENDURANCE IN ACTIVE FEMALE CLIMBERS

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Keywords: Climbing Performance, Muscular Endurance, Protein Supplementation, Female Athletes, Sports Nutrition

Introduction: Climbing places a unique demand on muscular endurance, particularly among female athletes, yet research on targeted supplementation for this group is limited. Much of the current literature focuses on other sports or general populations, leaving a gap in knowledge specific to climbing performance and recovery. This study explored the effects of a multi-ingredient protein supplement formulated to support muscular function during a structured climbing program **Objective:** To assess whether a four-week protein supplementation period improves muscular endurance in active female climbers. **Methods:** Fourteen female climbers between 18 and 35 years (M = 26.29, SD = 3.81), with an average of 2.32 years of climbing experience, were recruited. Participants followed a four-week training routine, which included 12 Minimum Edge Dead Hang sessions and at least 25 climbing route attempts. Each consumed either the supplement or a placebo within one hours after training. Muscular endurance was measured pre- and post-intervention using the Hangboard Endurance Test. **Results:** An Independent t-test showed no statistically significant differences in post-test between the supplementation group (60.86 ± 21.42 s) and the placebo group (72.71 ± 26.71 s), $t(12) = -0.92$, $p=0.38$. Despite including commonly studied ingredients like BCAA(2g), Curcumin(250mg), Collagen Peptides(250mg), Ashwagandha(100mg) and Whey protein (21.4g), the supplement did not lead to measurable gains within the study period. **Conclusion:** Although the supplement showed no short-term benefit, this research contributes to the limited data on nutritional strategies in climbing. Longer trials and more refined protocols may help clarify how supplements can support performance and recovery in sport-specific and recreational settings.

ID: HPSC-60

EFFECT OF 8 WEEKS BAREFOOT PLYOMETRIC TRAINING ON ANKLE STABILITY, AGILITY AND SPEED AMONG COMPETITIVE PLAYERS IN ULTIMATE FRISBEE

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Keywords: Barefoot, Plyometric, Stability, Agility, Speed

Introduction: Ultimate Frisbee is a high-intensity sport that places significant demands on the lower limbs, making ankle injuries common among players. Plyometric training can improve speed, agility, and stability, with barefoot variations potentially offering additional proprioceptive benefits. This study aimed to compare the effectiveness of 8 weeks of barefoot versus shod plyometric training on ankle stability, agility, and speed in competitive Ultimate Frisbee athletes. **Objective:** To compare the effects of 8 weeks of barefoot versus shod plyometric training on ankle stability, agility, and sprint performance. **Methods:** Thirty competitive Ultimate Frisbee players (mean age 25.07 ± 3.02 years) were randomly assigned to either a Barefoot Group (n = 15) or Shoes Group (n = 15). All participants completed pre- and post-tests including the Fall Risk Test, Postural Stability Test, Illinois Agility Test, and 20 m Sprint Test. Both groups performed the same 8-week plyometric training program (adapted from Ozbar et al., 2014; modifications in Table 2), differing only in footwear. **Results:** In the Shoes Group, significant improvements were seen in agility ($p < 0.01$) and 20 m sprint performance ($p = 0.02$), with no significant changes in fall risk ($p = 0.55$) and postural stability ($p = 0.09$). In the Barefoot Group, agility improved significantly ($p < 0.01$), but there were no significant changes in sprint performance, fall risk, and postural stability ($p < 0.05$). **Conclusion:** An 8-week plyometric training program improved agility in both groups, with sprint gains observed only in the shod group. Fall risk remained unchanged, suggesting a general training effect rather than footwear-specific benefits.

ID: HPSC-64

COGNITIVELY ENGAGING TENNIS INTERVENTION ENHANCES EXECUTIVE FUNCTION IN CHILDREN: THE MEDIATING ROLE OF PHYSICAL FITNESS

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Keywords: Executive Function, Tennis Intervention, Physical Fitness

Introduction: Executive function (EF) is vital for children's cognitive, academic, and self-regulatory development. Cognitively engaging physical activities may enhance EF. **Objective:** This study examined whether a cognitively engaging tennis intervention improves EF in school-aged children and whether physical fitness mediates this effect. **Methods:** A total of 121 students (aged 10–12) were randomly assigned to an intervention group (n = 61) or control group (n = 60). The intervention group received 12 weeks of structured tennis training (three 60-min sessions/week). The control group followed the standard school curriculum, including two 40-min physical education classes weekly, without additional structured exercise. EF was measured pre- and post-intervention via Flanker (inhibition), 1-back (updating), and More-Odd shifting (cognitive flexibility) tasks. Physical fitness—strength, speed, agility, flexibility, and endurance—was assessed. Structural equation modeling ($x^2 = 54.21$, df = 46, p = 0.18, CFI = 0.981, RMSEA = 0.038, SRMR = 0.041) with 5000 bootstrap resamples tested mediation. **Results:** Tennis group showed greater reaction time reductions in all EF tasks ($p < 0.05$) and accuracy gains for updating ($p < 0.01$) and shifting ($p = 0.05$). Strength, speed, agility, and flexibility improved, with speed and agility most strongly linked to EF gains. Physical fitness partially mediated the tennis–EF relationship ($\beta = 0.28$, 95% CI [0.14, 0.42]), explaining 32.1% of the total effect. **Conclusion:** A cognitively engaging tennis intervention can enhance EF in children, with speed and agility improvements contributing to effects. Causal claims regarding mediation should be cautious due to concurrent EF and fitness measurement.

ID: HPSC-67

LINKING UPPER BODY STRENGTH TO SPIKE BALL SPEED IN FEMALE VOLLEYBALL PLAYERS: INSIGHT FROM STRENGTH ASSESSMENTS

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Keywords: Volleyball, Spike Speed, Athletic Shoulder Test, Upper Body Strength, 3RM Bench Press

Introduction: The volleyball spike demands explosive upper body strength and power transfer. Identifying strength assessments that align with spike performance is essential for training optimization in female athletes. **Objective**: This study examines the relationship between upper body strength and spike ball speed in elite female volleyball athletes, providing insights performance-related assessments. **Methods:** Eighteen SUKMA 2024 female volleyball players (mean age 20.41 ± 1.37 years; height 169.91 ± 3.18 cm; weight 62.22 ± 5.25 kg; playing experience 10.71 ± 2.89 years) participated in this cross-sectional study. Upper body strength was assessed using two approaches: (1) the Athletic Shoulder (ASH) test in I, Y, and T positions, targeting isometric shoulder force, and (2) the three-repetition maximum (3RM) bench press, reflecting dynamic upper body strength. Spike ball speed was measured using a Stalker Sport radar gun across three spike types: standing, diagonal, and linear. **Results:** Pearson's correlation revealed significant positive correlations between spike ball speed and 3RM bench press (standing $r = 0.694$, $p = .002$; diagonal $r = .750$, $p = 0.001$; linear $r = .748$, $p = 0.001$). No significant correlations were found between spike speed and ASH test results in any position. **Conclusion:** The 3RM bench press demonstrated stronger associations with spike ball speed compared to the ASH test, underscoring the importance of dynamic, multi-joint strength in volleyball spiking. These findings suggest that dynamic strength measures may provide more meaningful insights into performance than isolated isometric assessments.

ID: HPSC-69

TIME INTERVAL AND FACTOR AFFECTING RETURN TO SPORT FOLLOWING ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION: A RETROSPECTIVE STUDY OF 27 PATIENT IN HOSPITAL TENGKU AMPUAN AFZAN

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Keywords: ACL Reconstruction, Return to Sport, Recovery Delay Factors

Introduction: Anterior cruciate ligament (ACL) injuries are prevalent among athletes and often require surgical intervention and significant rehabilitation before returning to sport. Delay in care may prolong recovery. Understanding the timeline from injury to return-to-play (RTP) and identifying barriers is vital for improving outcomes. **Objective:** This study evaluates the time intervals from injury to RTP following ACL reconstruction and identify contributing factors to delayed recovery. **Methods:** A retrospective review was conducted on 27 patients who underwent ACL reconstruction between January 2020 and January 2021. Data collected included time from injury to clinic visit, clinic to MRI, MRI to surgery, and surgery to RTP. RTP was defined as achieving >90% on the single leg hop test. Patients with MRIs from private centers (n=4) or post-operative complications (n=3) were excluded from specific analyses. Each patient was individually interviewed to identify reasons for delay, and responses were cross validated against clinical documentation. **Results:** Mean durations were injury to clinic visit, 9.53 ± 11.8 months; clinic to MRI, 3.13 ± 2.26 months; MRI to surgery, 8.30 ± 6.27 months; and surgery to RTP (n=20), 8.07 ± 3.29 months. The overall mean time from injury to RTP was 29.86 ± 16.28 months. Commonly reported barriers included financial constraints (40.9%), delayed presentation due to lack of awareness (36.4%), fear of surgery (22.7%), and belief the injury would self-resolve (22.7%). **Conclusions:** Significant delays in RTP following ACL reconstruction are driven by financial and awareness-related barriers. Targeted strategies addressing these issues may facilitate timelier recovery and improved outcomes.

ID: HPSC-72

JUVENILE DERMATOMYOSITIS MIMICKING EARLY SCLERODERMA IN AN ADOLESCENT ATHLETE: A CASE REPORT

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Key words: Athlete, Heliotrope Rash, Juvenile Dermatomyositis, Scleroderma, Sports

Introduction: Muscle pain and weakness in young athletes are often attributed to benign causes such as overtraining or mechanical strain. However, progressive proximal myopathy, especially when accompanied by periorbital rash or other systemic symptoms should raise suspicion for juvenile dermatomyositis (JDM). **Objective** To highlight that, in the rare instance, musculoskeletal pain can precede overt dermatomyositis. **Methods:** A 15-year-old competitive volleyball player presented with 3 months of low back pain, initially managed as mechanical in origin due to unremarkable lumbosacral imaging. She later developed bilateral periorbital rash, proximal muscle weakness, worsening back discomfort and skin tightening over both upper limbs, transiently relieved for a week by an intramuscular steroid. Examination revealed heliotrope rash, mild sclerodactyly and symmetrical proximal muscle weakness (MRC 4/5) without sensory deficits. Investigations showed raised CK (786 U/L), LDH (776 U/L), ESR (41mm/hr), and positive NXP-2 myositis-specific autoantibody. Skin biopsy demonstrated mild perivascular dermatitis with no significant dermal sclerosis. Electromyography indicated myopathic changes with reduced amplitudes and slowed velocities in proximal muscle. Co-managed by dermatology and rheumatology, she received intravenous methylprednisolone followed by oral prednisolone and methotrexate. **Results:** At 6 months, she achieved 80% improvement in muscle strength, complete rash resolution, and better 6MWT performance. She resumed light volleyball training. **Conclusion:** In adolescent athletes, proximal muscle weakness and vague low back pain should not be readily dismissed as mechanical. When accompanied by cutaneous or systemic signs, inflammatory myopathies such as JDM should be considered for timely diagnosis and management.

ID: HPSC-76

ATHLETIC IDENTITY AND SPORT INJURY: A SYSTEMATIC REVIEW AND META-AGGREGATION

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Introduction: Sports injuries may disrupt this identity, causing psychological and behavioral changes, making it important to understand for targeted rehabilitation. **Objective:** This study is to systematically review qualitative research examining changes in athletic identity following sports injuries. **Methods:** This review followed PRISMA 2020 guidelines. Comprehensive searches of Web of Science, Psychology & Behavioral Sciences Collection, PubMed, SPORTDiscus, and Scopus were conducted from database inception to November 20, 2024. Studies were eligible if they met the following inclusion criteria: (1) published in international peer-reviewed journals in English; (2) employed a qualitative research design (including but not limited to narrative, phenomenological, ethnographic, or grounded theory approaches); (3) examined athletic identity in the context of sports injury. Study quality was appraised using the Mixed Methods Appraisal Tool. Data extraction and synthesis followed Joanna Briggs Institute methodology, and the ConQual approach assessed confidence in findings. **Results:** Meta-aggregation synthesized the findings into two overarching themes: "loss" ($n = 17$) and "reestablishment" ($n = 7$). The "loss" theme indicated that sports injuries can lead to a reduction in athletic identity due to factors such as physical limitations, absence from competition, and psychological distress. The "reestablishment" theme reflected that some athletes reconstructed their identity by adopting new roles, including coaching, volunteering, or participating in alternative sports. **Conclusion:** Sports injuries may lead to identity loss for some athletes, while others rebuild new identities. Future research should refine measurement tools and explore strategies such as psychological support, fostering multidimensional identities, and career transition planning to aid recovery.

ID: HPSC-77

THE ATHLETE FEAR AVOIDANCE QUESTIONNAIRE AND FEAR OF RETURN TO SPORT SCALE: A CROSS-CULTURAL VALIDATION

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Keywords: Fear Of Reinjury, Psychological Readiness, Sports Injury, Cross-Cultural Adaptation, Return to Sport

Introduction: Sports injuries not only signify a temporary physical rest but also lead to negative emotional responses. **Objective:** This study aimed to translate the Athlete Fear Avoidance Questionnaire (AFAQ) and the Fear of Return to Sport Scale (FRESS) into Chinese (AFAQ-Ch and FRESS-Ch), and to evaluate their psychometric properties among injured Chinese athletes. **Methods:** The study was conducted in two phases. Phase 1 involved forward-backward translation. Phase 2 assessed internal consistency, test–retest reliability, and concurrent validity in a sample of 204 injured athletes. Concurrent validity was evaluated using the Chinese versions of the Tampa Scale for Kinesiophobia (SC-TSK) and the Injury-Psychological Readiness to Return to Sport Scale (I-PRRS-Ch). **Results:** No floor or ceiling effects were observed, meaning that less than 15% of participants' scores clustered at the lowest/highest possible values. The AFAQ-Ch and FRESS-Ch demonstrated acceptable internal consistency (Cronbach's α = 0.748 and 0.736, respectively). The AFAQ-Ch showed excellent test–retest reliability (Intraclass Correlation Coefficient [ICC] = 0.855), while the FRESS-Ch demonstrated good reliability (ICC = 0.729). Concurrent validity analyses indicated that the AFAQ-Ch and FRESS-Ch demonstrated expected moderate to strong correlations with related constructs. **Conclusions:** The AFAQ-Ch and FRESS-Ch are valid and reliable instruments for assessing fear-avoidance and fear of returning to sport in Chinese athletes. Future research could consider embedding these two questionnaires into AI-driven interactive tools. Given that psychological assessments of injured athletes are often subject to social desirability bias, AI-based approaches may provide a more effective way to identify and reduce such biases.

ID: HPSC-79

EFFECTS OF SODIUM CITRATE SUPPLEMENTATION ON ANAEROBIC PERFORMANCE IN FEMALE BASKETBALL PLAYERS: A RANDOMIZED CROSSOVER TRIAL

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Keywords: Anaerobic Performance, Sodium Citrate, Lactate, Dietary Supplement, Female Athletes

Introduction: Sodium citrate (SC) is an alkalinizing agent proposed to enhance high-intensity performance by buffering hydrogen ions and delaying fatigue. While evidence exists in male athletes, data on female basketball players remain limited. **Objective:** This study examined the acute effects of SC supplementation on anaerobic performance, and blood lactate clearance in recreational female basketball players. **Methods:** Nine participants (age: 21 ± 1.9 y; weight: 53.1 ± 10.5 kg; height: 158.2 ± 6.7 cm; body fat: $29.2 \pm 7.5\%$; skeletal muscle mass: 20.0 ± 3.5 kg; basketball experience: 4.8 ± 2.8 y) completed two experimental trials (SC and dextrose), separated by at least 7 days, in a double-blind, randomized crossover design. Each trial included heart rate monitoring, the Running-based Anaerobic Sprint Test (RAST), and blood lactate analysis. **Results:** Results showed no significant differences between SC and placebo for maximum power (445.9 ± 113.7 W vs. 437.6 ± 127.4 W; $p = 0.73$), and post-exercise blood lactate (10.2 ± 2.1 mmol·L^{-1} vs. 9.9 ± 2.4 mmol·L^{-1}; $p = 0.63$). **Conclusion:** Sodium citrate did not significantly alter anaerobic performance or lactate responses in female basketball players, suggesting limited acute ergogenic benefit under the tested conditions. This may relate to the lower lactate accumulation typically observed in females during high-intensity efforts. Future studies should recruit larger samples and use protocols that elicit greater metabolic acidosis to clarify potential effects.

ID: HPSC-81

EFFECTS OF RUNNING APP USAGE ON THE PHYSICAL HEALTH OF SEDENTARY COLLEGE STUDENTS: THE MEDIATING ROLE OF EXERCISE PARTICIPATION

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Keywords: Running Apps; Sedentary Behavior; College Students; Physical Health; Exercise Participation

Introduction: The study briefly explores the impact of running apps on the physical health and sedentary behavior of university students in Henan Province amid increasing use of electronic devices and analyzes the mediating role of exercise participation. **Objective:** The study examines influence of running apps on physical health among Sedentary college students, focusing on digital tools' role in improving their health outcomes. **Methods:** A survey was conducted among 928 sedentary college students ($\geq$ 6 hours/day) from six universities. SPSS 27.0 was used for basic statistics and correlation analysis, while AMOS 24.0 was employed to construct structural equation models for testing mediation effects. **Results:** Significant positive correlations were found between running app use and both physical health (r=0.43, $p < 0.001$) and exercise participation (r=0.49, $p<0.001$), with exercise participation strongly linked to health (r=0.58, $p<0.001$). The total effect of app use on health was 0.39 (direct=0.18, indirect=0.21 via exercise), with good model fit (x^2/df =2.14, CFI=0.964, RMSEA=0.040). **Conclusion:** The study concludes that running app usage significantly enhances students' physical health through increased exercise participation, suggesting that digital health tools can effectively promote student well-being.

ID: HPSC-83

A PRELIMINARY STUDY ON MECHANICAL TENSION AND METABOLIC STRESS: ACUTE EFFECTS OF CONTRAST TRAINING ON NEUROMUSCULAR FATIGUE IN TRAINED FOOTBALL PLAYERS

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Introduction: Contrast training, which combines heavy resistance exercises with explosive plyometric movements, is increasingly used in athletic conditioning to enhance power output and neuromuscular adaptation. However, its feasibility and acute effects on football players remain understudied. **Objective:** This study aimed to determine whether the protocol consistently induced fatigue, serving as a proxy for mechanical tension and metabolic stress. **Methods:** Ten male football players (mean age: 19.3 ± 0.4 years; height: 170.4 ± 4.7 cm; weight: 69.8 ± 3.9 kg) participated in four training sessions. Each session consisted of 1 set of 2 repetitions at 80% of their 1-repetition maximum (1RM) in the back squat, immediately followed by 10 repetitions of squat jumps. Squat jump height (cm) was measured before and after each session (post 1 minute) using the My Jump app. Post-test values were calculated as percentage reductions from baseline to quantify fatigue. Descriptive statistics and paired t-tests ($\alpha = 0.05$) compared pre-, and post-test jump performance across sessions. **Results:** The contrast training protocol consistently caused significant fatigue, with squat jump height decreasing by 29-32% after each session ($p < 0.001$). While all players showed reduced performance (range: 20-45% decline), the similar results across all four sessions confirm that the protocol reliably induces fatigue. **Conclusion:** This study shows that the contrast training protocol effectively induces acute fatigue in football players, demonstrating feasibility for triggering mechanical tension via heavy squats and metabolic stress through continuous squat jumps. Future research should examine long-term performance adaptations and compare this method to traditional training.

ID: HPSC-84

ACUTE EFFECTS OF HIGH-INTENSITY HYBRID TRAINING ON SQUAT JUMP PERFORMANCE IN YOUTH FOOTBALL PLAYERS: A PRELIMINARY STUDY

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Keywords: High-Intensity Hybrid Training, Neuromuscular Fatigue, Squat Jump, Youth Football, Acute Exercise Response

Introduction: High-Intensity Hybrid Training (HIHT) effectively combines strength and conditioning exercises. While its long-term benefits are known, the immediate effects on young football players' performance are less clear. Studying these acute impacts helps optimize training and recovery for developing athletes. **Objective:** This preliminary study aimed to quantify the acute effects of a standardized HIHT protocol on lower-body power output, as measured by squat jump performance, in competitive youth football players. **Methods:** Ten male youth football players (19.3 ± 0.4 years, 170.4 ± 5.6 cm, 70.3 ± 5.7 kg) completed four identical HIHT sessions over four weeks. Each session included high-intensity plyometric and resistance exercises. We measured squat jump height before and after training using the My Jump 2.0 app and analyzed results with paired t-tests and Cohen's d. **Results:** The HIHT protocol induced significant acute fatigue across all sessions ($p<0.001$), with mean squat jump height decreasing from 42.7 ± 0.9 cm to 27.9 ± 2.3 cm, representing a $34.7\pm4.3\%$ reduction in performance. Large effect sizes ($d>6.0$) throughout all sessions confirmed the substantial physiological demand of the training. Notably, the fatigue response remained consistent across sessions, with reductions ranging narrowly from 30.4% to 39.6%, demonstrating the protocol's reliability. **Conclusion:** The study showed that HIHT significantly reduces lower-body power in youth football players immediately after training. This consistent fatigue response from four series of training sessions demonstrates HIHT's effectiveness while emphasizing the need for proper recovery. These findings help coaches optimize preseason training programs. Future studies should examine the long-term effects of HIHT.

ID: HPSC-86

EFFECTS OF EXERCISE TIMING AND INTENSITY ON PHYSICAL FITNESS AND BODY COMPOSITION IN COLLEGE STUDENTS

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Keywords: Body Mass Index, Overweight, Moderate Intensity, Vigorous Intensity, Circadian Rhythms

Introduction: College students are at risk of declining fitness and weight-related health issues due to irregular lifestyles. Optimizing exercise timing and intensity may enhance training outcomes. **Objective:** To compare the effects of exercise timing (morning vs. evening) and intensity (moderate vs. vigorous) on physical fitness and body composition across BMI categories in college students. **Methods:** A quasi-experimental study was conducted with 480 Chinese students (aged 18–25; normal weight and overweight). Participants underwent a 12-week running program at different times of day and intensities, forming 16 groups. Exercise prescriptions included 3–5 sessions/week at moderate intensity or 2–3 sessions/week at vigorous intensity (150 min/week). Physical activity and sleep were monitored via the PAM app. Fitness was evaluated by endurance, strength, and flexibility tests, body composition by fat percentage and lean mass. **Results:** Morning exercise reduced BMI (-0.98 kg/m², $p < 0.05$), while evening exercise produced greater gains in performance: 50m sprint (-0.56s), 1000m run (-18.73s), long jump ($+0.21$m), and pull-ups ($+3.43$). Vigorous training outperformed moderate training for BMI reduction (-0.52 vs. $+0.63$ kg/m²,), sprint (-0.4s vs. $+0.47$s), endurance (-11s vs. $+12.96$s), long jump ($+0.13$m vs. -0.07m), and pull-ups ($+2.03$ vs. -0.6). Normal-weight students showed greater improvements than overweight peers, and males improved more in endurance and strength. **Conclusion:** Evening and vigorous exercise yield superior fitness and body composition benefits. Personalized prescriptions based on BMI and circadian rhythms may optimize outcomes, supporting the "Healthy China 2030" initiative and highlighting the role of digital tools in health promotion.

ID: HPSC-87

EFFECTS OF AEROBIC EXERCISE AND DIETARY GUIDANCE PROGRAM ON BODY COMPOSITION AND PHYSICAL FITNESS IN OBESE MALE COLLEGE FRESHMEN

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Keywords: Aerobic Exercise, Dietary Guidance, Physical Fitness, Body Composition, Obese Male College Students

Introduction: Obesity among male college freshmen has become a significant public health issue. Implementing structured aerobic exercise along with dietary intervention could serve as an effective strategy to improve body composition and physical fitness. **Objective:** This study aimed to evaluate the effects of a 12-week structured aerobic exercise and dietary guidance program on body composition and physical fitness in obese male freshmen. **Methods:** Sixty freshmen with a body mass index $\geq$ 28 and body weight > 100 kg were enrolled. Body composition and physical fitness indicators were measured before and after the intervention. **Results:** Significant improvements were observed in body weight ($p = 0.006$), BMI ($p = 0.001$), fat mass ($p = 0.005$), body fat percentage ($p = 0.003$), and trunk fat rate ($p = 0.005$). Physical fitness tests also demonstrated notable gains in seated forward bend (p = 0.026), standing long jump ($p = 0.031$), and 1000-meter run ($p < 0.001$). **Conclusion:** The combined 12-week aerobic exercise and dietary guidance program significantly enhanced body composition and physical fitness in obese male college freshmen. These findings support the integration of such interventions into university health promotion initiatives.

SIC Finalist 1: SmartRehabX

SMART PROPRIOCEPTIVE SLEEVE (SPS): ENHANCING UPPER LIMB REHABILITATION & PERFORMANCE

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Team leader
**Supervisor*

The Smart Wearable Proprioceptive Sleeve (SPS) addresses critical gaps in upper limb rehabilitation and performance enhancement. By integrating real-time biofeedback and immersive VR correction, it bridges the clinic-to-home divide, empowering athletes and patients to train safely, effectively, and independently. This innovation aligns with national priorities in health technology, sports performance, and tele-rehabilitation, positioning Malaysia as a leader in smart rehabilitation solutions.

SIC Finalist 2: APU XR STUDIO

AIVR-Box: An AI-Coached, Tactics-Aware VR Boxing Trainer

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AIVR-Box builds on the concept of VR boxing by using published action recognition (Stefański et al., 2024; Manoharan et al., 2025), boxing aware pose estimation (Lin et al., 2023) and AI driven tactical coaching (Jörke et al., 2025; Wang et al., 2024), to create a playable, multiplayer platform that considers physiological constraints. Through a combination of real-time analytics, mining opponent habits, providing personalised briefs and safe intensity levels, AIVR-Box situates itself in current literature, whilst responding to the desired needs of athletes and coaches. AIVR-Box arrives as an adaptive, playful, and believable means of developing boxing skills and tactical awareness inside a VR environment, while remaining commercially available, evidence-based and with reference to the best practice indicators of sports science.

SIC Finalist 3: VESTA

C-SPAR: Cybersickness-Preventive Adaptive Response for Virtual Reality in Combat Sports

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Cybersickness remains a critical obstacle hindering VR training effectiveness in demanding fields like combat sports. This project introduces a novel neurophysiological approach that shifts from reactive symptom management to proactive prevention by detecting vestibular conflict signals in real time and applying neuromodulation accordingly. If effective, this innovation could revolutionise VR training by permitting athletes to engage longer and more productively in immersive sessions. Moreover, it may establish a new standard for human-computer interaction in immersive environments.

SIC Participant: AquaIntelliX

HydraSync

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Team leader
Supervisor

The smart water bottle project demonstrates the feasibility and value of combining wearable sensor technology with personalized health metrics to revolutionize athletic hydration practices. Future enhancements may include integration with wearable fitness devices, advanced bioimpedance hydration sensing, and expanded environmental data incorporation. The convergence of innovative hardware and software in this project underscores its potential to become an indispensable accessory in the pursuit of athletic excellence and wellness.

SIC Participant: APU XR STUDIO

Improved vProCycle: Enhancing VR Cycling with Motion, Mixed Reality, and Smart Connectivity

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The upgraded vProCycle system is revolutionizing the virtual cycling experience by providing an immersive, interactive, and adaptable training experience through integrated Mixed Reality, continuous motion feedback, multiplayer VR, and compatibility with smart trainers while using the VZFit app on Meta Quest 3. Importantly, it solves one of the major limitations of traditional VR cycling, which cannot synchronize the feedback of the body with the virtual terrain, thus contributing to the realism, comfort, and precision of training. Meanwhile, the wireless, easy-to-use design and novel social features make it a great option for athletes, rehabilitation, and general fitness. This technological development also supports the advancement of technology, human performance, and digital health, based on measurable benefits in performance, well-being, and engaging and exciting use for a wide variety of applications.

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