前 言

本刊主要收录Web of Science核心合集数据库有关体教融合、体医融合、奥林匹克教育、冰雪运动、体育工程、反兴奋剂、文化与新闻传播领域的最新研究成果。

Web of Science核心合集包括Science Citation Index Expanded (SCIE)、社会科学引文索引(SSCI)、艺术和人文引文索引(A&HCI)、Emerging Sources Citation Index (ESCI)、Conference Proceedings Citation Index (CPCI)、Book Citation Index (BKCI)等，是科学及学术研究的全球原创引证索引。其涵盖超过250个自然科学、社会科学、艺术和人文学科。

本刊旨在利用Web of Science核心合集平台为广大师生提供有关目前热点的最新研究内容。检索出的数据采用书目共现分析系统（Bicomb V2021）对文献信息进行提取，包括期刊、关键词、标题、发文年份等，相同含义的字段去重且批量合并，同时去除没有实质意义的字段，对所提取的字段进行频次统计，形成高频矩阵，并使用社会网络分析软件Ucinet绘制成知识图谱，进行共词聚类分析。

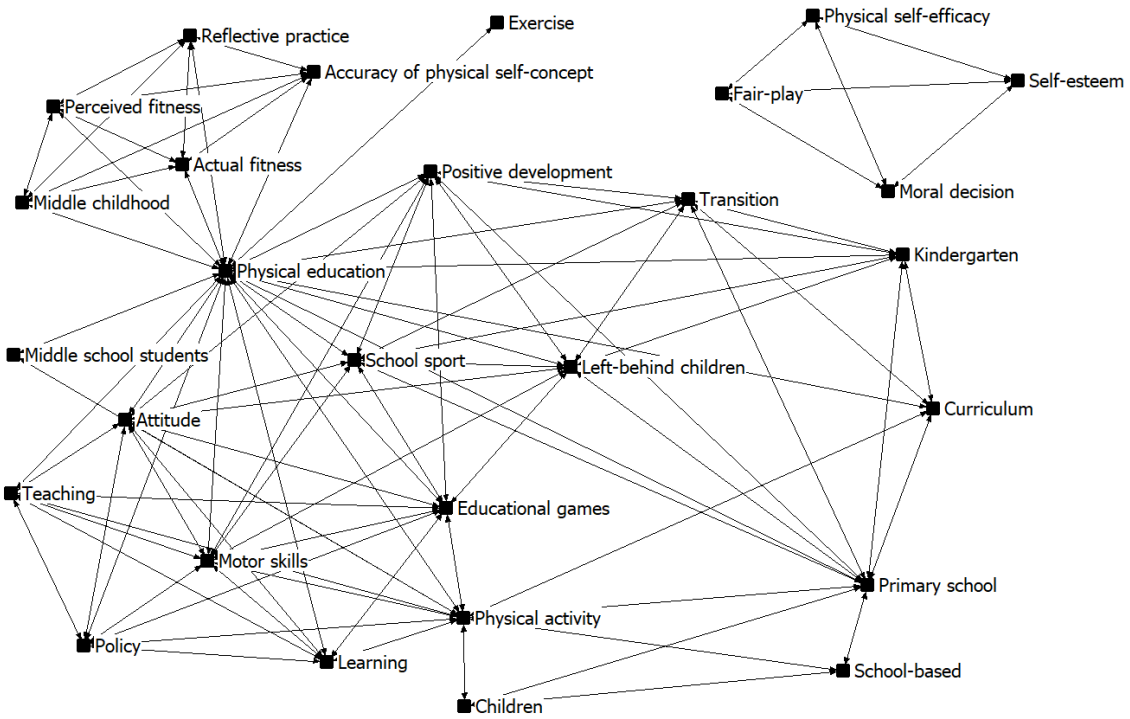
本期选录体教融合方面的文献16篇，体医融合方面的文献17篇，冰雪运动方面的文献12篇，体育工程方面的文献19篇，反兴奋剂方面的文献19篇。

目 录

责任编辑：马赛迈

体教融合

本期体教融合学术研究共检索到英文相关文献273篇，研究热点主要集中在体育课程对学业以及学生成长方面的积极影响、体育教育的课程设置、以及如何更好地引导学生参与体育等方面。检索结果如下：1）关键词共词分析。提取关键词139个，经过数据清洗后关键词为130个，词频为2及以上的关键词有28个，累计百分比为46.29%，高频关键词有体育教育、体育活动、小学、课程、政策等，生成可视化知识图谱（见下图）。2）来源期刊分析。涉及期刊27种，其中载文4篇及以上的期刊有5种，所载文献累计百分比为51.16%，刊载体教融合第一位的期刊分别为：Sport Education and Society（JCR学科分区Q1、Q2）。3）学科交叉分析。引用文献总计1615篇，最多的频次为4次，文献分别为：*Reflecting on reflexive thematic analysis*、*Meaningful Experiences in Physical Education and Youth Sport: A Review of the Literature*、*Using thematic analysis in psychology*、*Global trends in insufficient physical activity among adolescents: a pooled analysis of 298 population-based surveys with 1.6 million participants*。4）学术关注度分析。文献级别用量最多的是13次，排名前两位的文献分别为：*The paradox of experience: generational analysis of AI integration in physical education using the iTPACK framework*、*Effect of teacher autonomy support on student engagement in physical education classrooms in a blended learning environment: the mediating role of performance expectancy and academic self-efficacy*。



Becerra-Fernández C, Guijarro-Romero S, Mayorga-Vega D. The Avengers in action: A gamified-based intermittent teaching unit in the Physical Education setting to promote physical activity and its psychological mediators in secondary education students [J]. Psychology of Sport and Exercise, 2025, 79.

ABSTRACT

The purpose of the present study was to examine the effects of a gamified-based intermittent teaching unit in the Physical Education setting, combined with behavior modification strategies and following an autonomy-supportive teaching style, on secondary education students' physical activity (PA) psychological mediators and objective weekly PA levels. A sample of 142 secondary education students (50 % females; 14-16 years) from six classes were clustered randomly and assigned to Avengers (n = 79) or Control (n = 63) groups. The Avengers group students performed a gamified-based intermittent teaching unit using only the first 15 min of each session twice a week for eight weeks. Based on the Trans-Contextual Model of autonomous motivation in education, the intermittent teaching unit was performed by behavior modification strategies such as goal-setting, activity wristband, educational counselling, reminders, diary, motivational messages, and incentives. Students' self-reported PA psychological mediators were assessed by validated psychometric questionnaires before and after the intervention. Moreover, objective weekly PA was assessed by the students wearing a Xiaomi Mi Band 5 activity wristband before and during the last week of the intervention. The Multilevel Linear Model results showed that the gamified-based teaching unit produced a statistically significant improvement in all Avengers group students' PA psychological mediators ($p < 0.05$; $d = 0.29$-1.52) and objective weekly PA levels ($p < 0.001$; $d = 1.17$). A gamified-based intermittent teaching unit in Physical Education combined with behavior modification strategies seems to be effective for enhancing secondary education students' PA psychological mediators and weekly PA levels.

Bian S, Hooper O, Sandford R. Leaving no child behind? Exploring the developmental potential of physical education and school sport for left-behind children in China [J]. Sport Education and Society, 2025.

ABSTRACT

In China, left-behind children are broadly defined as those under the age of 16 whose parent(s) have moved from rural to urban areas for better economic opportunities, leaving their children behind in the care of others. Some research has suggested that being left-behind can pose challenges for individuals, leading to calls for greater attention to be paid to how to best support the holistic development of this youth population. Despite much research espousing how physical education (PE) and school sport can support the positive development of marginalised youth populations, limited research has been undertaken with left-behind children, rendering

them a hidden group in this space. This conceptual paper sought to examine the context of left-behind children in China and consider the potential of PE and school sport to support their positive development. It highlights that while much research has been conducted on left-behind children in China, this has tended towards a deficit perspective, positioning these young people as in some way 'lacking'. This paper critically examines the persistence of the deficit perspective and seeks to challenge this prevailing narrative, advocating for a shift towards a strengths-based perspective. With consideration of research on PE and school sport specifically, this paper argues that whilst PE and school sport have been recognised as valuable contexts for fostering strengths among for marginalised youth broadly, there is a dearth of literature on left-behind children's experiences. As such, further research on the PE and school sport experiences of left-behind children in China is urgently needed.

Braksiek M, Pahmeier I. Promoting the veridicality of physical self-concept through self-assessment: an intervention study in primary school physical education [J]. Physical Education and Sport Pedagogy, 2025.

ABSTRACT

Background: Fostering children's physical self-concept (PSC) - understood as the perception of their own physical abilities - is a key objective in physical education (PE), as PSC is associated with physical activity, fitness, and well-being. However, recent research suggests that not only the level of PSC but also its accuracy - referred to as veridicality of the PSC - is important. Children, particularly in primary school, often overestimate their physical abilities. Self-assessment methods have been shown to foster self-regulated learning and shape PSC. However, little is known about their effects on PSC, fitness, and PSC veridicality in primary school PE. Purpose: This study examined the effects of learning journals as a form of self-assessment on PSC, physical fitness, and PSC veridicality in primary school PE. Additionally, the study investigated whether improvements in veridicality were driven by changes in PSC, physical fitness, or both. Methods: A quasi-experimental design was used with 198 third- and fourth-grade students from rural schools (intervention group: n = 106; control group: n = 92). The intervention consisted of an eight-lesson track and field unit. The intervention group used learning journals to monitor their progress and reflect on their performance, while the control group received the same content without self-assessment. PSC was measured using a validated questionnaire, and fitness was assessed with standardized motor tests (e.g. endurance, speed, strength, coordination, flexibility). PSC veridicality was calculated as the difference between PSC and performance. Data were analyzed using linear mixed models. Results and Discussion: There was no evidence of an intervention effect on dimensions of PSC, except for coordination, where the intervention group caught up with the control group due to lower pre-test values. Both groups improved their fitness, likely reflecting practice effects, but the intervention group showed significantly greater gains in coordination, strength and

speed. PSC veridicality improved in strength and speed for the intervention group among overestimators. These improvements resulted from both reduced PSC and greater fitness gains, with the latter having a stronger influence. The results suggest that learning journals fostered self-reflection and individual progress monitoring, likely enhancing students' motivation and effort during practice. This explains the stronger fitness improvements in the intervention group. For overestimators, self-assessment may have triggered a desire to align perceived and actual fitness, leading to greater physical improvement and more realistic self-perceptions. Conclusion: Integrating self-assessment into PE has the potential to improve both fitness and veridicality in primary school children. The results also provide a strong argument for the inclusion of cognitive phases - such as structured reflection and self-assessment - in PE lessons, as they appear to complement physical practice and enhance learning processes. Future research should explore the motivational processes underlying these effects and examine the applicability of self-assessment across various PE content areas.

Carl J, Goss H, Lundvall S, et al. Compatibility of physical education curricula with physical literacy across 40 European countries [J]. Journal of Curriculum Studies, 2025.

ABSTRACT

Although the student-centred concept of physical literacy (PL) has been emphasized by UNESCO, knowledge about its adoption/implementation into PE remains scant. Therefore, the goal of this study was to evaluate and compare the compatibility of PE curricula with PL in Europe. We collaboratively gathered a panel of experts encompassing 40 European countries. In the first step, the experts were invited to freely specify the compatibility of country's PE curricula with PL. The reports were subjected to six-step reflexive thematic analysis. In the second step, we theoretically derived, psychometrically explored, and descriptively analysed 15 curricular-didactical items, each containing a spectrum of statements with high versus no/insufficient PL compatibility. We synthesized both data sources following an explanatory sequential mixed-methods design. While few PE curricula explicitly adhered to PL in Europe, most documents exhibited content and aims marking elements of PL. However, we registered large differences in PL-compatibility between four European regions for the deep structure of the curricula (eta 2=.27, p=.01). While the quantitative survey suggested no differences in PL compatibility between anglophone versus non-anglophone countries, the qualitative material revealed conceptual and terminological challenges across Europe. The European countries have hesitantly followed the UNESCO call to align PE with the holistic PL concept.

Chanal J, Paumier D. The specificity hypothesis in physical education: Investigating differentiation of motivational regulations across activities and their links to self-concept [J]. Psychology of Sport and Exercise, 2025, 80.

ABSTRACT

This study tested and extended the Specificity Hypothesis to the physical domain (i.e., in physical education), examining how motivational regulations, as depicted by Self-Determination Theory, differ across various physical activities (i.e., football, athletics, and gymnastics). Using a sample of secondary school students, we measured autonomous (intrinsic motivation, identified regulation) and controlled (positive and negative introjected and external regulation) motivations across these activities. Findings broadly supported the Specificity Hypothesis, indicating that autonomous motivations exhibit greater activity-specificity than controlled motivations. Additionally, football demonstrated the highest specificity, followed by gymnastics and athletics, offering a new research avenue for the Specificity Hypothesis. Additional analyses showed that the pattern of correlations between students' self-concept and motivation closely aligned with the specificity pattern of motivational regulations found, with football yielding the strongest correlations, followed by gymnastics and athletics. This study contributes to recent developments related to the Specificity Hypothesis and enhances our understanding of how motivation varies across different activities, providing actionable insights for educators seeking to foster motivation in physical education. Discussion on why differences in activity-specificity for autonomous and controlled motivation occur offers various directions for further research on the development of specificity in physical education contexts.

Chen L, Shen B, Yin Z, et al. Valuable yet costly: Exploring students' perceived costs in physical education [J]. European Physical Education Review, 2025.

ABSTRACT

Although physical education (PE) potentially fosters holistic development across physical, cognitive, affective, and social domains, its unique physical and social demands can render it valuable yet costly. These costs, however, remain underexplored, limiting our understanding of their effects on motivation and impeding efforts to design effective curricula and teaching strategies. Grounded in situated expectancy-value theory, this study investigates perceived costs, their causes, and implications for middle school PE curriculum and instructional practices. Qualitative data were collected from 30 students (aged 12-14 years, M = 13, SD = 0.61, 50% male, 50% female) in three middle schools in China through focus groups and individual interviews. Thematic analysis of the transcripts led to the construction of four themes that capture students' perceived costs in PE, encompassing physical and physiological, psychological, opportunity, and social cost. These findings indicate that students' perceived costs are potentially driven by the predominant emphasis on

the physical domain in the PE curriculum. This highlights the need to reform high school PE entrance examinations, restructure the curriculum using a constructivist approach, and implement models-based practice to help mitigate perceived costs by emphasizing the long-overlooked affective and social domains. Given the significance of cost in PE, recognizing it as a distinct motivational factor can inform the creation of more inclusive and engaging PE experiences, thereby potentially fostering sustained participation and holistic growth.

Consterdine A, Dhanda I. An uphill struggle: an exploration of parents', carers', and support workers' impressions of inclusivity for pupils with learning disabilities in Physical Education [J]. Physical Education and Sport Pedagogy, 2025. 1–17.

ABSTRACT

Background: Universal access to inclusive Physical Education (PE) is a fundamental right for all children, including those with special educational needs and disabilities (SEND). However, children with learning disabilities have much lower participation levels in PE, experience prejudice from peers, and encounter societal pressures that adversely affect their PE experience. Barriers to inclusivity range from teachers' expectations of inclusivity and degree of difficulty to attain, inadequate teacher training and professional development, limited school resources and school support, and prejudiced social attitudes. Purpose: We explored parents', carers', and support workers' impressions of inclusivity for pupils with learning disabilities in school PE. Our aim was to privilege the voices of this underreported group in an attempt to add to the body of knowledge around both barriers to participation and recommendations for schools. Method: Eight parents/carers/support workers with links to Mencap, took part in semi-structured interviews. Interviews were automatically transcribed and manually checked for accuracy. We took an interpretivist approach to accommodate inter-subjectivities and multiple social realities in the generation of co-constructed knowledge. The dataset was analysed using Reflexive Thematic Analysis (RTA).Findings: Our analysis resulted in four inter-related themes that demonstrated participants' lack of faith in the PE environment being inclusive for pupils with learning disabilities. Concerns clustered around the type of school and teachers' approach, perceived impressions of teacher and peer attitude towards SEND pupils, the macro-cultural context focused on teacher training and curriculum breadth, and finally, recommendations to school governing bodies and educational professionals about how their concerns could be addressed with realistic suggestions for future consideration. These encompassed developing the quality of professional learning, improving knowledge and empathy towards SEND pupils, and inculcating allyship and making inclusivity more viable. Conclusion: This paper prompts reflection of the social complexity and lived perceptions of inclusivity from the perspective of parents/careers and support workers of children with intellectual learning difficulties. Attaining inclusive PE for all pupils requires further insight and new application to reduce the risk of continuing to

alienate pupils who exist outside the 'mainstream' further. This has connotations for lifelong physical activity engagement. By addressing concerns of parents/careers/support workers who routinely care for children with learning disabilities, education in general could benefit from their contributions. Schools, teachers and PE professionals need to improve the quality of inclusive PE provision to ensure that they meet the diverse needs of every child. This could be realised with future research being extended to participants from other organisations, including the perspectives of SEND pupils themselves, and differentiating between primary and secondary education.

Craig D, Lanza K, Pfledderer C, et al. Using the R = MC^2 heuristic to assess whole-of-school physical activity implementation in elementary schools: a cross-sectional study [J]. International Journal of Behavioral Nutrition and Physical Activity, 2025, 22(1).

ABSTRACT

Background: Schools are recommended to use a whole-of-school (WOS) approach to promote physical activity opportunities before, during, and after school. Yet, the barriers and facilitators to implementing a WOS approach successfully are not well understood. The R = MC^2 heuristic, which defines readiness for implementation as a combination of an organization's motivation and capacity to implement, can enhance our understanding of implementation in the school setting. This study examines associations between constructs from the R = MC^2 heuristic and schools' implementation of a WOS approach. Methods: We conducted a secondary analysis of cross-sectional data from U.S. elementary schools participating in the NFL PLAY60 FitnessGram Project during the 2022-23 school year. From surveys administered to school staff, we created a WOS index (range = 0-12) comprising six physical activity practices: physical education, recess, before and after-school programs, classroom-based approaches, and active transport. We also assessed how six constructs from the R = MC^2 heuristic (i.e., culture, implementation climate, leadership, priority, resources utilization, resource availability) impact physical activity implementation using a series of questions measured on a 5-point Likert scale. We used linear regression models to determine associations between R = MC^2 constructs (independent variables) and WOS index scores (dependent variable), controlling for school-level characteristics (student enrollment, percentage of race/ethnicity and economically disadvantaged students served) and state-level clustering. Results: The analytic sample consisted of 132 schools across 18 states. On average, school staff rated leadership (mean = 4.1, range = 1.5-5) and organizational culture (mean = 4.0, range = 2.25-5) the highest. The mean WOS index score was 6.1. Partially adjusted models indicated significant positive associations between each R = MC2 construct and WOS index scores. Fully adjusted regression models revealed priority (b = 0.88; p = 0.010; 95% CI = 0.19-1.56) and implementation climate (b = 0.69; p = 0.047; 95% CI = 0.07-1.32) were positively and significantly associated with WOS index scores. Conclusions: Our study provides insights into key implementation constructs associated with

providing school-based physical activity opportunities. These findings can support the development of resources and implementation strategies which, in turn, can help schools address implementation-related disparities. This will help schools improve the quality and accessibility of opportunities for physical activity provided to students across the United States.

Eskil K, Gökyürek B. Examining the effect of educational games on middle school students' attitudes towards physical education and sports lessons and their motor skills [J]. Bmc Sports Science Medicine and Rehabilitation, 2025, 17(1).

ABSTRACT

Aim: The aim of this research is to examine the changes in children's motor skills and attitudes towards the lesson through the use of 12-week educational games as an addition to the existing physical education and sports curriculum and the elective sports and physical activity course. Methods: The study was conducted with 5th and 6th-grade students from & Scedil;ehit Yakup & Ccedil;& imath;nar Middle School in Sincan district, Ankara during the 2022-2023 Academic Year. The sample group was determined using the simple random sampling method. The experimental group consisted of 136 students, while the control group comprised 127 students. During the 12-week period, the experimental group received a total of 4 class hours per week of additional physical education and sports lessons and elective sports and physical activity classes within their regular school schedule, where educational games were incorporated. On the other hand, the control group did not receive any additional program beyond the regular curriculum. Data collection instruments included a Personal Information Form containing information regarding participants' gender and grade, the Motor Skill Measurement Tests, and the Physical Education and Sports Scale for Secondary School Students to measure their attitudes towards physical education and sports lessons. Pre-test and post-test measurements were conducted for both the control and experimental groups to assess the impact of the educational games. Statistical analysis was performed using SPSS 25.0 software. Skewness and kurtosis values (-1.5 and +1.5) were examined for normality distribution. The paired samples t-test was used to determine the differences within the control and experimental groups in the pre-test and post-test data. Additionally, the independent samples t-test was used for intergroup comparisons between the experimental and control groups. Results: The findings revealed that the 12-week educational games applied to the 5th and 6th-grade students had a significant positive impact on the experimental group regarding flamingo balance, flexibility, 30-second sit-ups, and attitudes. However, there was no significant difference between the groups in the standing long jump and 20-meter sprint parameters. Conclusions: As a result, the findings revealed that the 12-week educational games applied to the 5th and 6th-grade students had a significant positive impact on the experimental group regarding flamingo balance, flexibility, 30-second sit-ups, and attitudes. However, there was no significant difference between the groups in the standing long jump and 20-meter sprint parameters.

Fogliata A, Gamberini C, Mazzella M, et al. Enhancing Adolescent Attention through Specific Physical Education in the Digital Era [J]. Mind Brain and Education, 2025.

ABSTRACT

This study explores how a personalized physical activity program can enhance adolescents' motor and cognitive functions. The program, based on the Sincrony methodology and embodied cognition theory, aims to counteract negative effects of excessive digital device use. Conducted in Italy with 64 girls aged 11-13, participants were randomly divided into three groups: a control group (general coordination exercises), a peripheral vision group (added peripheral vision stimuli), and a breathing group (focused on diaphragmatic breathing). Over 6 months, participants followed tailored training protocols. Results showed significant improvements in sustained attention ($p < .005$) and peripheral vision ($p < .001$), particularly in the peripheral vision group. The breathing group also exhibited moderate attention improvements. These findings suggest incorporating targeted physical education programs in schools to mitigate screen time effects and enhance cognitive and motor skills. Further research is needed to validate these results across diverse populations.

Gjesdal S, Jordalen G, Bjorndal C. Norwegian student-athletes' motivation for choosing lower secondary sport schools: exploring latent profiles and their relationships with outcomes [J]. International Journal of Sport and Exercise Psychology, 2025.1-23.

ABSTRACT

Quality of motivation, as reflected in someone's underlying motivational regulations, plays a pivotal role in shaping the overall experience and outcomes of engagement. A highly relevant context for examining key motivational factors is specialised sport schools at the lower secondary level. Within this unique educational setting, student-athletes face the dual challenge of excelling in both sport and academics, all while navigating the crucial period of adolescent identity development. Success in this demanding environment necessitates high-quality motivation. Surprisingly, there has been a dearth of research investigating the motivation for choosing such specialised schools. To address this, the present study employed a person-centred approach, seeking to identify distinct motivational profiles among students at specialised sport schools. A total of 521 student-athletes (mean age = 13.87, SD = .85), participated in this study. Latent profile analysis revealed the existence of three distinct motivational profiles, which were labelled highly motivated, motivated and unmotivated, respectively. Notably, student-athletes classified within the highly motivated profile exhibited greater levels of enjoyment, vitality and perceived performance when compared to their peers in the other two profiles. The findings reflect positively on specialised sport schools, suggesting that the vast majority of student-athletes who enrol in these institutions do so with a high degree of motivation, a motivation which is also multifaceted. This study contributes valuable insights into student-athletes' motivation underlying their decision to enrol in specialised sport schools.

Korkmaz N, Çoruh H. Time to Move: A 4-Week Gamified Mobile Application Intervention to Promote Physical Activity in Secondary School Students [J]. European Journal of Sport Science, 2025, 25(8).

ABSTRACT

This study aimed to help children and adolescents achieve their daily goal of 10,000 steps and daily exercise goals using the T2M (Time to Move) mobile gamification application. This study was a single-blinding cluster-randomised controlled trial conducted in a secondary school, including a control group (CG) and an experimental group (EG). The study consisted of a 1-week familiarisation, 4-week intervention and impact assessment session. Twenty-five students aged 12-14 years (CG, n = 13 am EG, n = 12) participated. T2M mobile application was developed to track the students' daily step counts and exercises and increase their physical activity levels. Newfeel Onwalk One Plus pedometer was chosen to track the number of steps. In EG, gamification elements (badges, points and leaderboards) were used for students to achieve the goals, whereas in CG, these elements were not included. 40% of those in the control group completed the step goals and 15% completed the exercise goals. In comparison, 65% of the experimental group completed the step goals ($p = 0.043$ and $d = 0.40$) and 68% completed the exercise goals ($p = 0.0001$ and $d = 0.77$). Furthermore, the PAQ-C scores were higher in the experimental group ($p = 0.0114$ and $d = 0.51$). As a result of the impact assessment session, it was determined that 70% of the students in the experimental group and 27% of those in the control group continued to exercise. It is observed that the experimental group completed more of the 10,000 steps per day and daily exercise goals. These findings suggest that T2M mobile-based gamification application can increase the physical activity level of children and adolescents.

Russo G, Paganelli V, Ceciliani A. Building respect, fairness, and collaboration through physical education: A primary school intervention [J]. Acta Psychologica, 2025, 258.

ABSTRACT

This study evaluates the effectiveness of a primary school intervention designed to foster fair-play, respect, and inclusion through physical education. Grounded in social learning theory and structural-developmental teaching, the program aimed to enhance students' moral decision-making, social behavior, and physical activity levels. Sixty-four students (aged 9-10 years) participated in the seven-month intervention, which integrated classroom lessons and physical activities. Mixed-methods data collection included validated questionnaires (PAQ-C, FPPEQ, AMDM-Q, RSEQ, PSE) and interviews with students and teachers. Findings revealed significant increases in physical activity levels, particularly in non-active students, alongside enhanced respect, collaboration, and self-esteem. Teachers noted improvements in emotional regulation, self-regulation, and rule adherence. Despite occasional inappropriate behaviors, this study highlights the potential of combining physical education with social-emotional learning strategies to support

psychosocial development in primary school children. These results underscore the importance of integrating such programs into educational curricula.

Tan M, Wang K, Zhang L. Cultural capital, physical activities and school adaptation: evidence from the China education panel survey [J]. Sport Education and Society, 2025.1-18

ABSTRACT

The phenomenon of cultural omnivores facilitates students with different cultural capital backgrounds to participate in similar physical activities (PAs) at school. It is still vague whether maintaining exercise habits contributes to narrowing students' school adaptation gap by improving their informal knowledge valued in the educational system. Using hierarchical models and two-way fixed effect models to investigate the panel data from the China Education Panel Survey, this study concludes three major findings: (1) Routinely engagement in PAs benefited students' school social adaptation. (2) The benefits students derive from participating in PAs vary according to their level of cultural capital. (3) Participation in PAs primarily assists upwardly mobile students in school adaptation with the condition that the differences in cultural capital are limited. This research suggests that the influencing mechanism of maintaining PAs depends on the extent of differences between individual – and school-level cultural capital.

Teksum T, Moen K, Gerdin G. From kindergarten to primary school - Physical education as a support for students' transition [J]. European Physical Education Review, 2025.

ABSTRACT

The transition from kindergarten to primary school is a significant event in children's education, garnering increasing political and social attention in Norway and globally. With the growing focus on educational transitions and continuity, this study examines the role of physical education (PE) in facilitating students' transition into primary school in Norway. The study was conducted across four Norwegian primary schools, utilising semi-structured interviews with 16 first- to fourth-grade teachers, observations of PE lessons and school environments, and field notes from school visits. A reflexive methodology and an abductive approach were employed to analyse the data, drawing on the concepts of continuity and discontinuity (Dewey, 1938; Hogsnes and Moser, 2014). The findings indicate that PE in the early school years can play a supportive role in students' transition from kindergarten to primary school through socialisation processes and bridging approaches in PE, thereby enhancing continuity in the transition process. Based on these findings, we argue that primary PE's emphasis on movement, play and social interaction offers valuable opportunities to support young students during this transition. To conclude, we suggest that PE can contribute meaningfully to students' adjustment to school by balancing both stability and adaptation in the shift to formal schooling.

Walker R, House D, Porter A, et al. The complexity of promoting physical activity in English state primary schools: an in-depth qualitative analysis of the role of social context [J]. Bmc Public Health, 2025, 25(1).

ABSTRACT

Background: Primary schools present an opportunity to equitably promote physical activity. To date, school-based interventions have had limited success. Contextual differences between schools could be a key factor that contributes to this lack of impact. However, the elements that constitute a school's social context (i.e. the organisational, political, cultural, and sociodemographic characteristics) and how they might impact on primary school physical activity are unclear. The aims of this study were to conduct an in-depth qualitative analysis of state primary school social context related to physical activity and, using this analysis, provide recommendations for policy and practice. Methods: We conducted one-to-one semi-structured interviews with 33 state primary school staff in Southwest England between November 2023 and January 2024. Staff roles included headteachers/principals (n = 5), deputy headteachers/principals (n = 5), class teachers (n = 7), Physical Education (PE) subject leads (n = 8), dedicated PE teachers (n = 4), teaching assistants (n = 2), and one Parent Teacher Association chair. Staff were recruited from 19 purposively-sampled schools with a range of school sizes and sociodemographic characteristics. We used reflexive thematic analysis. Results: Five themes were generated that highlighted: (1) the impact of regulatory systems and curriculum pressures created an environment where physical activity was difficult to prioritise; (2) schools with high pupil needs experienced increased pressure, which sometimes impacted staff motivation and wellbeing; (3) senior leadership priorities were key to promoting pupil physical activity, influenced by their personal interests/background/values, regulatory inspections, curriculum pressures, and pupil needs; (4) limited PE training during teacher training impacted teacher confidence that, when combined with curriculum pressures, led many schools to outsource PE to external enterprise; and (5) "passionate" individual staff members who dedicated their own time were important to drive physical activity in the pressured school environment. Conclusion: Revisions to school regulatory systems and policies are needed to enable schools to prioritise physical activity so it is not dependent on "passionate" individuals. Senior leadership plays a key role in prioritising physical activity in the high pressure state primary school environment. It is important that practitioners and researchers consider these diverse and challenging social contextual factors within English state primary schools in intervention design.

Zha H, Ding X, Li W. Innovative approaches in physical education: leveraging cognitive activation to boost student outcomes [J]. Frontiers in Psychology, 2025, 16.

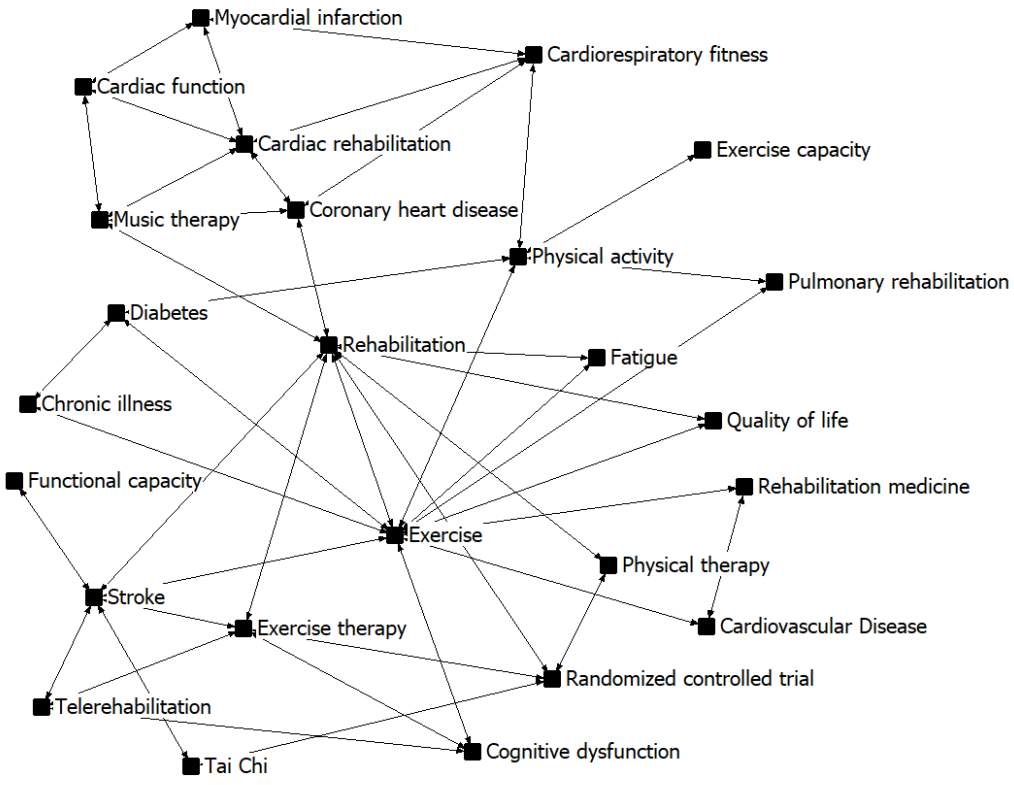
ABSTRACT

Introduction: Physical education (PE) often struggles with suboptimal student engagement, which impedes

the development of physical competence and lifelong health habits. This challenge is especially acute in under-resourced areas like Southwest China. Cognitive Activation Teaching Strategies (CATS), which promote higher-order thinking, offer a potential solution. This study, therefore, aimed to investigate the impact of CATS on primary school students' physical performance and health behaviors, specifically examining the mediating roles of classroom engagement, self-efficacy, motivation, and emotional regulation. Methods: A mixed-methods sequential explanatory design was employed. First, quantitative data were collected from a stratified sample of 929 primary school students and their parents in Southwest China using validated questionnaires. The hypothesized mediation model was then analyzed using Structural Equation Modeling (SEM). Following this, qualitative data were gathered through semi-structured interviews and non-participant classroom observations with 12 purposively selected "high-CATS" teachers to provide deeper insight into the classroom mechanisms at play. Results: The SEM results indicated that CATS significantly and positively predicted students' physical performance and health behaviors. This relationship was strongly mediated by classroom engagement, PE motivation, and particularly, PE self-efficacy. Conversely, the pathway from CATS to emotional regulation was not statistically significant, and emotional regulation did not significantly predict health behaviors. The qualitative findings corroborated the quantitative data, revealing that teachers' use of goal-setting, progressive challenges, and feedback created a "productive struggle," which visibly enhanced students' intrinsic motivation and collaborative engagement. Discussion: This study provides robust evidence that cognitive activation is a highly effective pedagogical approach in PE. By fostering self-efficacy and motivation, CATS directly enhance in-class engagement and physical performance. The findings suggest that designing PE tasks to be cognitively challenging is crucial for improving student outcomes. However, the limited impact on emotional regulation and out-of-class health behaviors indicates that CATS alone may be insufficient. Educational programs should therefore integrate CATS to boost classroom success while also developing comprehensive, multi-faceted interventions to cultivate emotional skills and promote the transfer of healthy habits beyond the school setting.

体医融合

本期体医融合学术研究共检索到英文相关文献139篇，研究热点主要集中在身体活动对冠心病、糖尿病、慢阻肺等疾病的影响及远程运动康复指导的效果等方面。检索结果如下：1）关键词共词分析。提取关键词287个，经过数据清洗后关键词有283个，词频为2及以上的关键词有26个，累计百分比为30.66%，高频关键词为运动、康复、身体活动、中风等，生成可视化知识图谱（见下图）。2）来源期刊分析。涉及期刊65种，其中载文2篇及以上的期刊有8种，累计百分比为32.3%，刊载体医融合前三的期刊为：Scientific Reports（JCR学科分区Q1）、BMC Sports Science Medicine and Rehabilitation（JCR学科分区Q1）、BMJ Open（JCR学科分区Q2）。3）交叉学科分析。引用文献总计3312篇，最多的频次为8次，排名前三的文献分别是：*World Health Organization 2020 guidelines on physical activity and sedentary behavior*、*Quantity and Quality of Exercise for Developing and Maintaining Cardiorespiratory, Musculoskeletal, and Neuromotor Fitness in Apparently Healthy Adults: Guidance for Prescribing Exercise*、*Physical Activity and Exercise Recommendations for Stroke Survivors A Statement for Healthcare Professionals From the American Heart Association/American Stroke Association*。4）学术关注度分析。文献级别用量最多的是11次，排名前三位的文献分别为：*Exploring the exercise experiences of lung transplant recipients during the waiting list period: A qualitative study*、*Baduanjin Exercise Training for Elderly Chronic Obstructive Pulmonary Disease Patients with Mild Cognitive Impairment: A Feasibility Clinical Trial*、*Combined network pharmacology and metabolomics reveal that Rubia cordifolia L. ameliorates exhaustive exercise-induced myocardial injury in rats via the BCAA degradation pathway*。



Ahmadi M, Mundell H, Sutherland G, et al. Physical activity, genetic predisposition, and incident cardiovascular disease: Prospective analyses of the UK Biobank [J]. Journal of Sport and Health Science, 2025, 14.

ABSTRACT

Background: It is unclear whether physical activity can benefit participants with high genetic predisposition to cardiovascular disease. We examined the joint associations of intensity-specific physical activity and genetic predisposition (based on polygenetic risk score) with incident coronary heart disease (CHD), stroke, and atrial fibrillation (AF). Methods: This prospective cohort study included 303,950 adults (age = 56.4 8.0 years, mean SD; 52.5% females) from the UK Biobank with physical activity and disease-related genotypes. Moderate-to-vigorous physical activity (MVPA) and intensity-specific activity was classified according to volume (e.g., MVPA was classified as none, low, medium, and high). Genetic predisposition for CHD, stroke, and AF were classified as low (Quintile 1), intermediate (Quintiles 2-4), and high (Quintile 5). Results: During 11.6 2.1 years of follow-up: 19,865 CHD, 7907 stroke, and 16,688 AF events occurred. Compared to the no MVPA and high genetic risk group, we observed lower CHD risk for increasing levels of MVPA over and above genetic risk groupings. These associations were primarily driven by vigorous-intensity activity. For example, in the high genetic risk group, those with low vigorous-intensity activity levels (compared to none) had a hazard ratio (HR) of 0.78 (95% confidence interval (95%CI): 0.72-0.86) compared to an HR of 0.92 (95%CI: 0.86-0.99) for low moderate-intensity activity levels. For stroke incidence, we observed a protective association for MVPA across genetic risk groups that was mostly driven by moderate-intensity activity volume. Among the high genetic risk group, low moderate-intensity had an HR of 0.77 (95%CI: 0.66-0.90), whereas low vigorous-intensity had no association (HR = 0.95, 95%CI: 0.82-1.09). We did not observe a consistent joint association of MVPA and AF genetic predisposition. Conclusion: We observed lower CHD and stroke risk for low to high MVPA among participants with high genetic predisposition. The associations of moderate- and vigorous-intensity activity volume differed considerably across cardiovascular disease sub-types. Overall, our findings suggest vigorous-intensity activity may mitigate genetic predisposition for CHD while moderate intensity activity may be associated with similar effects for stroke. Joint associations were less consistent across AF genetic predisposition groups. Our results inform precision medicine approaches and future lifestyle modification interventions by quantifying the potential benefits of physical activity among at-risk individuals.

Bahls M, Kavousi M, Bakker E, et al. Physical activity and mortality: towards healthspan-oriented metrics and outcomes. A Scientific Statement from the European Association of Preventive Cardiology (EAPC) of the ESC [J]. European Journal of Preventive Cardiology, 2025.

ABSTRACT

The current guidelines for cardiovascular disease prevention by the European Society of Cardiology highlight the undisputable benefits of exercise and a physically active lifestyle for cardiovascular risk reduction. In addition to the health benefits of physical activity, observational data suggest that regular physical activity lowers all-cause mortality. However, this was not confirmed by Mendelian randomization studies and randomized controlled trials. We argue that limitations of observational data (e.g. recall and recruitment bias, Hawthorne effects, and/or potentially reverse causation) and controlled trials (e.g. healthy volunteer bias and short follow-up) may compromise effects for exercise and physical activity on mortality. In addition, medical care in modern countries guarantees longer survival despite a high incidence for cardiovascular disease, which further reduces the potential impact of exercise and physical activity on lifespan. Healthspan, as a concept, focuses on life years in good health, as opposed to mere lifespan or mortality, which focuses solely on longevity. We propose using different measures of healthspan as an outcome to quantify the effects of exercise and physical activity. We outline the different dimensions of healthspan and how these could be measured at the population level using scalable, reliable, valid, and non-invasive assessments. Specifically, we propose physical function, mental and cognitive health, chronic disease prevention, and quality of life as appropriate measures. These measures may help to better understand physical activity and exercise-related benefits that contribute to a healthier life and to implement interventions that have the potential to increase healthspan across populations.

Baytok E, Gueclue M, Kol B, et al. Oxygen consumption chronotropic response to maximal exercise and physical activity level in patients with post-COVID-19 and pulmonary involvement [J]. Physiotherapy Theory and Practice, 2025.

ABSTRACT

Background: Pulmonary involvement due to coronavirus disease 2019 (COVID-19) is common. Pulmonary involvement may affect pulmonary function. Moreover, structural alterations in the lungs may impair the extrapulmonary functions. Purpose: This study compared respiratory functions, peripheral muscle strength, maximal exercise capacity, chronotropic incompetence (CI) (< 80% of maximal heart rate), physical activity level, and dyspnea in patients with post-COVID-19 who had lung involvement and healthy controls. Methods: Forty-seven patients and 60 healthy controls were compared. Pulmonary function (spirometry), respiratory muscle strength (maximal inspiratory-expiratory pressures - MIP, MEP) and endurance, peripheral muscle

strength (dynamometry), exercise capacity (cardiopulmonary exercise test - CPET), CI, physical activity(metabolic holter), and dyspnea (modified Borg Scale) were evaluated. Results: Pulmonary function test parameters, MIP, MEP, respiratory muscle endurance, peripheral muscle strength, oxygen consumption, CI during CPET, total and active energy expenditures, daily physical activity duration, metabolic equivalents, and the number of steps were significantly lower in patients compared to controls ($p < .001$). In contrast, lying down duration ($p = .027$) and dyspnea on exertion ($p < .001$) were significantly higher in patients compared with controls. The diffusing capacity for carbon monoxide (DLCO) was 77.2% in patients, indicating mild diffusion impairment. Conclusion: Respiratory functions, peripheral muscle strength, exercise capacity, and chronotropic response are considerably impaired in patients with post-COVID-19 with pulmonary involvement. The majority of patients demonstrate sedentary lifestyle and reported higher levels of dyspnea during daily living activities. Therefore, these outcomes need to be evaluated in patients with pulmonary involvement, and patients should be referred to comprehensive pulmonary rehabilitation to prevent long-term impairments.

Burstein D, Tompkins C, Lansing A, et al. Understanding Pediatrician Perspectives on Physical Activity for Children with Special Health Care Needs [J]. Pediatric Cardiology, 2025.

ABSTRACT

To assess pediatric clinician knowledge of physical activity recommendations, their approach to physical activity counseling, and their interest in a structured academic fitness program for children and youth with special health care needs (CYSHCN). Electronic questionnaire was developed by cardiovascular, psychology, and exercise physiology collaborators at an academic children's hospital. Regional pediatric clinicians across an urban and rural catchment area were anonymously surveyed. Subgroup differences were assessed using Student's t test, Fisher's exact test, and logistic regression. Survey response rate was 22% (78/351), including 60 general and 18 subspecialty clinicians, half of which (49%) are in rural practice. Over 80% reported general knowledge of physical and psychological benefits of physical activity, although only 49% were aware of specific physical activity recommendations for CYSHCN. Most (90%) perceive that CYSHCN participate in physical activity less than age-matched peers but only 55% routinely discuss physical activity recommendations. Clinicians who report exercising >= 4 days per week are more likely to discuss physical activity with their patients (OR 2.74, 95% CI 1.06-7.13; $p = 0.038$). Nearly, all (95%) clinicians supported development of a dedicated academic cardiometabolic exercise program for CYSHCN. Clinicians identified time commitment (89%), transportation (84%), insurance (79%), and differing interest levels of patients/families (43%) as potential participation barriers. While most clinicians are aware that physical activity benefits CYSHCN, clinical knowledge gaps exist regarding appropriate recommendations and counseling. Physical activity practices of healthcare professionals may be associated with frequency of

patient counseling. Development of structured physical activity programs for CYSHCN should seek to improve knowledge and counseling, include clinicians as physical activity role models, and limit participation barriers.

Choi Y, Jee H. The protocol for developing health and disease prevention services: An exercise-based prediction model integrating genomic test results [J]. Plos One, 2025, 20(7).

ABSTRACT

Background: Cancer is a leading cause of mortality worldwide, with approximately 19.6 million new cases and 10 million deaths reported in 2020. Exercise interventions have demonstrated positive effects on physical and mental health in cancer patients, yet there is limited evidence on the efficacy of tailored, high-intensity exercise programs designed using genomic data. This protocol outlines a study aimed at integrating genomic analysis and personalized exercise interventions to improve health outcomes and reduce cancer-related risk factors. This study aims to evaluate the feasibility and potential impact of a personalized exercise intervention delivered through the EXESALUS mobile application. The program integrates genomic information to tailor exercise regimens for cancer prevention, muscle strength improvement, and quality-of-life enhancement. Methods: This is a protocol for a 3-month, parallel-group, randomized controlled trial involving 500 participants, including 100 cancer patients undergoing treatment or rehabilitation and 300 non-cancer participants with elevated disease risk. Participants will engage in the EXESALUS program, which includes low-, moderate-, and high-intensity exercise tailored to genomic profiles, supported by exercise counseling and wearable device feedback. Biospecimens (blood, urine, and oral epithelial cells) will be collected at baseline, 6 weeks, and 3 months to assess genomic variations and physiological changes. Primary outcomes include physical performance (SPPB), muscle strength (1RM and peak power), and skeletal muscle mass (DXA). Secondary outcomes will evaluate mental health indicators such as fatigue (FACIT-F), resilience, anxiety, depression, and quality of life. Discussion: This study will provide a detailed framework for implementing ICT-based personalized exercise interventions that incorporate genomic analysis. The EXESALUS program is expected to highlight the potential of tailored high-intensity exercise as a preventive and therapeutic strategy for cancer patients and individuals at risk of chronic diseases. The findings of this protocol will contribute to the development of precision medicine approaches for cancer prevention and management, emphasizing the scalability and utility of ICT-based solutions in health promotion.

Domingues W, Oliveira M, Silva P, et al. Barriers and factors associated with physical activity in patients with chronic venous insufficiency [J]. Phlebology, 2025.

ABSTRACT

Background: Personal and environmental barriers can make it difficult to engage in physical activity. In people with chronic venous insufficiency (CVI), these barriers may exacerbate physical inactivity, but it is not known whether they are independently associated with physical activity levels in addition to clinical and sociodemographic factors. Objective: To analyze the barriers and factors that are associated with the level of physical activity in patients with CVI. Methods: This cross-sectional study included 97 participants, CVI patients with Clinical-Etiology-Anatomy-Pathology (CEAP) C3 to C6 (69.1% women 58.9 +/- 10.7 years; 51.5% C5-C6 in CEAP classification). Personal and environmental barriers to physical activity were assessed by questionnaire. Objective time spent in physical activity was measured using a triaxial accelerometer. Sociodemographic and clinical characteristics were self-reported. Simple and multiple logistic regression was used to examine the association of age with measures of functional capacity, adjusting for sociodemographic, behavioral, clinical, and anthropometric factors. Statistical significance was accepted at $p < 0.05$.Results Older people with chronic venous insufficiency had greater personal barriers (lack of time and exercise-induced pain) and environmental barriers (unfavorable climate and lack of green spaces) to physical activity ($p < 0.05$). After adjustment, physical activity showed a negative association with age (beta = -0.022; 95% CI: -0.041 to -0.004) and the absence of a companion (beta = -0.001; 95% CI: -0.002 to 0.000), and a positive association with the presence of another health condition (beta = 0.001; 95% CI: 0.040 to 0.209). and anthropometrics. Conclusion: Our results showed that older patients with CVI face greater personal and environmental barriers to physical activity, such as pain, lack of time, unfavorable weather, and lack of green space. In addition, older age and the absence of a companion were associated with lower levels of physical activity.

Güven G, Koyuncuoglu N, Çelik A, et al. Upper extremity functional exercise capacity, muscle oxygenation, respiratory muscle strength, and physical activity levels in patients underwent pneumonectomy for lung cancer: a cross-sectional study [J]. Supportive Care in Cancer, 2025, 33(8).

ABSTRACT

Purpose: Anatomical and physiological changes impair pulmonary function, respiratory muscle strength, and physical activity in patients who underwent pneumonectomy for lung cancer (LC). No study investigated upper extremity exercise capacity and muscle oxygenation in these patients. The main objective of the study was to compare the long-term upper extremity exercise capacity and muscle oxygenation; the secondary objective was to assess pulmonary function, respiratory muscle strength and endurance, and physical activity levels in patients who underwent pneumonectomy for LC and healthy individuals. Methods: Nineteen patients who underwent pneumonectomy for LC and 19 healthy controls were included. Pulmonary function

(spirometry), upper extremity functional exercise capacity (6-min pegboard and ring test (6-PBRT)), muscle oxygenation (near-infrared spectroscopy), respiratory muscle strength (maximal inspiratory (MIP) and expiratory (MEP) pressures) and endurance (incremental threshold loading), and physical activity (activity monitor) were evaluated. Results Patients' pulmonary function, 6-PBRT score, muscle oxygen saturation (SmO2), MIP, MEP, and respiratory muscle endurance were lower ($p < 0.05$) than controls. While the patients' deltoid muscle resting and recovery SmO2 decreased, the total hemoglobin levels were similar in groups. Patients' total active energy expenditure, physical activity duration, average METs, and number of steps were lower than controls ($p < 0.05$). Conclusion: Upper extremity functional exercise capacity and muscle oxygenation are impaired in patients who underwent pneumonectomy for LC. Pulmonary function and physical activity levels are decreased. Inspiratory and expiratory muscles are weakened, and respiratory muscle endurance is reduced. It is crucial to evaluate patients in the early postoperative period and to incorporate cardiopulmonary rehabilitation to improve these severe impairments. It is recommended that the effects of upper extremity exercise training be investigated.

Joisten C, Hirschmülier A, Bauer P, et al. Sports Preparticipation Evaluation for Healthy Adults: A Consensus-Based German Guideline [J]. Sports Medicine, 2025, 55(8): 1827-51.

ABSTRACT

The benefits of physical activity are undisputed. However, adverse events can occur in rare cases, particularly during high-intensity or prolonged exercise. During physical activity, at-risk patients can experience major cardiac events, whereas adverse events affecting the musculoskeletal system are more common but less severe. A sports preparticipation evaluation (PPE) for apparently healthy adults is designed to detect at-risk individuals and prevent potentially fatal events. This guideline for conducting PPEs was developed by consensus among 16 medical societies and sports associations and is based on previously published guidelines and consensus papers. Sports medicine physicians and potential participants were also surveyed to assess the recommendations' content, feasibility, and implementation. On the basis of the 20 recommendations developed and agreed upon by the abovementioned entities, PPE comprises individuals' personal, family, and sports histories, as well as a physical examination. The need for additional examinations (e.g., laboratory parameters, echocardiograms, or stress tests) is determined on the basis of the PPE findings. This approach's feasibility in various regions, including resource-limited settings, and the extent to which it prevents adverse or potentially fatal events, should be examined in future research.

Keating S, Wilkinson S, Macdonald G, et al. Exercise prescription in the management of chronic disease falling through an evidence-practice gap: Perspectives of doctors and nurses in specialist settings [J]. Journal of Health Services Research & Policy, 2025, 30(4): 270-81.

ABSTRACT

Objectives: Exercise is a frontline therapy for the management of chronic cardiometabolic disease, however traditional tertiary health care service models do not include exercise physiology. We aimed to explore professional roles, practices, and services regarding exercise care in chronic cardiometabolic disease from the perspectives of specialist doctors and nurses. Methods: Using a qualitative description design, semi-structured individual interviews were conducted with 32 doctors and 26 nurses involved in the care of relevant patients with liver, kidney, or cardiac disease, or diabetes, across hospital and community settings in a Queensland metropolitan health service. Interviews were audio-recorded, transcribed verbatim and analysed using thematic analysis. Results: Four overarching themes were identified. Despite universal acceptance of the multifactorial benefits of exercise, there was a lack of confidence in patients' capabilities to exercise and safety concerns due to complex comorbidities. Interviewees considered themselves 'promotors not prescribers' of exercise. There was no structured exercise history taken outside of cardiac rehabilitation units with significant variability in advice provided. Access to exercise specialist services was limited and disease-specific, with inconsistent and fragmented referral pathways. General Practitioners were considered responsible for facilitating exercise specialist involvement in ongoing care, with onus placed on patients to initiate. Conclusions: There is an evidence-practice gap between the established benefits of exercise for chronic disease management and access to exercise professionals and services, resources, and knowledge. This deprioritises exercise as a frontline therapy with patient care implications. This study identified a need to transform the way that exercise care is accessed and delivered in tertiary settings.

Kim H, Park S, Oh Y, et al. Changes in physical activity before and after the diagnosis of dyslipidemia and the risk of atrial fibrillation: a population-based study in South Korea [J]. Preventive Medicine Reports, 2025, 57.

ABSTRACT

Objective: While physical activity is known to influence atrial fibrillation risk in the general population, evidence is limited among patients newly diagnosed with dyslipidemia. This study aimed to evaluate the association between changes in physical activity before and after dyslipidemia diagnosis and atrial fibrillation risk. Methods: Using the Korean National Health Insurance Service database, we identified 441,509 Korean adults newly diagnosed with dyslipidemia between 2011 and 2015, free of atrial fibrillation at baseline and with complete data. Metabolic equivalent tasks (METs)-min/week were calculated before and after

dyslipidemia diagnosis. Participants were followed up until atrial fibrillation, death, or December 31, 2021. Results: During 3,164,996 person-years of follow-up, 6003 patients developed atrial fibrillation. Increasing physical activity from inactive to >= 1000 MET-min/week was associated with reduced atrial fibrillation risk (adjusted hazard ratio [aHR], 0.85; 95 % confidence interval [CI], 0.81-0.90), compared with inactive. Conversely, decreasing physical activity from >= 1000 MET-min/week to inactive was associated with increased atrial fibrillation risk (aHR, 1.23; 95 % CI, 1.15-1.31). These results were consistent regardless of statin use, hypoalphalipoproteinemia, and hyperlipidemia status. Conclusions: Encouraging newly diagnosed dyslipidemia patients to increase their physical activity levels may help reduce their risk of atrial fibrillation.

Kyriakoulakou E, Skouras A, Tsolakis C, et al. Knowledge and Education on Physical Activity Health Benefits and Prescription Principles Among Greek Medical Students [J]. Behavioral Sciences, 2025, 15(7).

ABSTRACT

Physical activity (PA) is widely recognized as a therapeutic intervention for numerous non-communicable diseases. This study assessed Greek medical students' knowledge and education on PA across seven medical schools. A structured questionnaire was distributed electronically to all medical schools across Greece, with 135 students responding (67.4% female). Among respondents, 78.5% reported being taught about PA benefits, and 77.8% felt prepared to discuss them with patients. However, 30.2% had received less than two hours of formal PA education. Only 25.2% were aware of the World Health Organization (WHO) and Greek Central Board of Health (KESY) recommendations, while 81.5% expressed the need for additional education on PA and its role in health. Students who were taught about PA were more likely to address exercise physiology (42.5% vs. 17.2%, $p = 0.013$, OR = 16.4), cardiopulmonary exercise testing (52.8% vs. 24.1%; $p = 0.006$, OR = 3.5), and PA benefits (89.6% vs. 34.5%; $p < 0.001$, OR = 3.5). Although most medical students have been taught about PA's health benefits, only a small proportion have sufficient knowledge for effective prescription.

Lee J, Yoon Y. Links between Korean baby boomers' physical activity and health outcomes: a community health survey study [J]. Bmc Public Health, 2025, 25(1).

ABSTRACT

Background: This study aimed to explore the association between physical activity (PA) levels and major health issues (obesity, hypertension, and diabetes mellitus) and mental health factors (depression, stress, suicidal thoughts, and cognitive impairment) among South Korean baby boomers (BBs) to help improve national health policies. Given the global trend of aging populations and the increasing burden of non-

communicable diseases, understanding the role of PA in promoting healthy aging has become a critical public health issue not only in South Korea but also worldwide. Methods: Using 2022 Community Health Survey data, we analysed PA levels (low, moderate, and high) and their associations with health outcomes in BBs aged 59-67 years. PA was assessed using the metabolic equivalent of task of the International Physical Activity Questionnaire. Health outcomes were evaluated based on obesity, hypertension, diabetes, mental health issues, and stress levels. Complex sample logistic regression was used to evaluate the interrelation between PA and health outcomes, adjusting for household income, marital status, and educational level. Results: In men, moderate and high-intensity PA was associated with lower obesity and diabetes rates compared with low-intensity PA, with only moderate PA levels showing consistent links to reduced obesity. In women, both moderate and high PA levels were associated with reduced obesity, hypertension, and diabetes rates. For mental health, PA at both levels was associated with lower odds of all outcomes in both sexes, with moderate PA showing stronger associations than high PA for stress, suicidal thoughts, and cognitive impairment in women. Conclusions: PA is meaningfully associated with health issues and mental well-being among South Korean BBs. These findings underscore the relevance of tailored PA recommendations and community-based strategies that reflect population characteristics. Further research is warranted to explore the effects of different types of physical activities and their impact on health risk factors.

Luo G. Governing for sustainable health: institutional pathways in China's sport and health policy (1949-present) [J]. Frontiers in Public Health, 2025, 13.

ABSTRACT

Introduction: Since 1949, China's sport and health policies have evolved from mass-mobilization campaigns centered on "strengthening physical fitness" to a data-driven framework emphasizing "weight management" and cross-sectoral collaboration under the Healthy China 2030 strategy. However, the institutional processes underpinning this transition remain insufficiently understood and rarely subjected to systematic analysis. Methods: Guided by historical institutionalism, this study conducts a discourse analysis of 15 national policy documents issued between 1949 to present. Python-based text segmentation and keyword frequency and co-occurrence analyses were used to trace shifts in governance instruments and institutional layering. Results: Findings reveal a three-stage trajectory: (1) an initial stage of ideological mobilization (1949-1995) characterized by centralized fitness directives; (2) a second stage (1996-2015) featuring chronic disease prevention, performance-based targets, and provincial pilot programs; and (3) a current stage (2016-present) focused on obesity control, digital health platforms, and real-time multi-level coordination. Discussion: This path-dependent layering-from campaign rhetoric to target-based planning to data-enabled governance-demonstrates how embedding new health objectives within entrenched institutional routines, while incrementally integrating cross-sectoral data systems, can foster sustainable policy adaptation. These insights

offer a practical and transferable model for other middle-income countries pursuing scalable, evidence-informed health governance.

Rocliffe P, Whiston A, Mahony A, et al. The adaptive physical activity programme in stroke (TAPAS): protocol for a process evaluation in a sequential multiple assignment randomised trial [J]. Bmj Open, 2025, 15(9).

ABSTRACT

Introduction: Participation in physical activity (PA) is a cornerstone of the secondary prevention of stroke. Given the heterogeneous nature of stroke, PA interventions that are adaptive to individual performance capability and associated co-morbidity levels are recommended. Mobile health (mHealth) has been identified as a potential approach to supporting PA post-stroke. To this end, we used a Sequential Multiple Assignment Randomised Trial design to develop an adaptive, mHealth intervention to improve PA post-stroke - The Adaptive Physical Activity programme in Stroke (TAPAS) (Clinicaltrials.Gov NCT05606770). As the first trial in stroke recovery literature to use this design, there is an opportunity to conduct a process evaluation for this type of adaptive intervention. The aim of this process evaluation is to examine the implementation process, mechanism of change and contextual influences of TAPAS among ambulatory people with stroke in the community. Methods and analysis: Guided by the Medical Research Council Framework for process evaluations, qualitative and quantitative methods will be used to examine the (1) implementation process and the content of TAPAS (fidelity adaptation, dose and reach); (2) mechanisms of change (participants' response to the intervention; mediators; unexpected pathways and consequences) and (3) influence of the context of the intervention. Quantitative data will be presented descriptively, for example, adherence to exercise sessions. Qualitative data will be collected among TAPAS participants and the interventionist using semi-structured one-to-one or focus group interviews. Transcribed interviews will be analysed using reflexive thematic analysis. Key themes and sub-themes will be developed. Ethics and dissemination Ethical approval has been granted by the Health Service Executive Mid-Western Ethics Committee (REC Ref: 026/2022) (25/03/2024). The findings will be submitted for publication and presented at relevant national and international academic conferences.

Vitorino M, Corrêa H, CUNHA V, et al. Clock Gene Expression Modulation by Low- and High-Intensity Exercise Regimens in Aging Mice [J]. International Journal of Molecular Sciences, 2025, 26(17).

ABSTRACT

The circadian rhythm controls the sleep/wake cycle and a wide variety of metabolic and physiological

functions. Clock genes regulate it in response to both external and endogenous stimuli, and their expression may change because of aging, leading to an increased risk of health problems. Despite the well-described benefits of physical exercise as a circadian synchronizer, there is a lack of literature regarding the role of chronic exercise intensity in clock gene expression during aging. This article aims to analyze the differential expression of genes that regulate the biological clock under the effects of variable-intensity aerobic swimming training in aging mice, determining whether these exercise regimens interfere with the genomic regulation of the circadian rhythm. For this purpose, the mice were exposed to low- and high-intensity exercise and had their heart and gastrocnemius tissues molecularly analyzed by cDNA synthesis and qPCR to determine the expression levels of the selected genes: Clock, Arntl, Per1, Per2, Cry1, Cry2, and Nr1d1. The results showed that low-intensity exercise, performed at workloads below the anaerobic threshold, significantly changed their expression in the gastrocnemius muscle ($p < 0.05$), while high-intensity exercise had no statistically significant effects ($p > 0.05$), with the heart being immune to exercise influence except when it comes to the Per1 gene, for which expression was increased ($p = 0.031$) by low-intensity exercise. Additionally, both body weight and lactate thresholds had no change during the experiment ($p > 0.05$), while the maximum supported workload was maintained for high-intensity exercise ($p > 0.05$) and increased for low-intensity exercise ($p < 0.01$), with the control group experiencing a decay instead ($p < 0.05$). Thus, the present study highlights the importance of chronic exercise in modulating clock genes and opens exciting possibilities for circadian medicine, such as improvements in exercise capacity, heart condition, and lipid metabolism for subjects of low-intensity regimens.

Yang Y, Ku E, Ko S, et al. Physical activity for prevention of cardiovascular disease: consensus statement of Korean Society of Cardio-cerebrovascular Disease Prevention [J]. Korean Journal of Internal Medicine, 2025, 40(5): 696-709.

ABSTRACT

Cardiovascular disease (CVD) remains the leading cause of mortality worldwide, highlighting the need for effective preventive strategies. This consensus statement emphasizes the critical role of regular physical activity, including aerobic and muscle-strengthening exercises, in reducing key CVD risk factors such as hypertension, dyslipidemia, obesity, and insulin resistance. Recommendations are provided for the general adult population as well as specific subgroups, including older adults, pregnant and postpartum women, individuals with CVD, and those with physical limitations. The importance of reducing sedentary behavior and integrating physical activity into daily life is also addressed. Recommendations should focus on tailored interventions, supportive environments, and evidence-based policies that encourage active lifestyles. Further research specific to the Korean population will enhance the development of evidence-based, population-tailored guidelines for more effective CVD prevention in Korea.

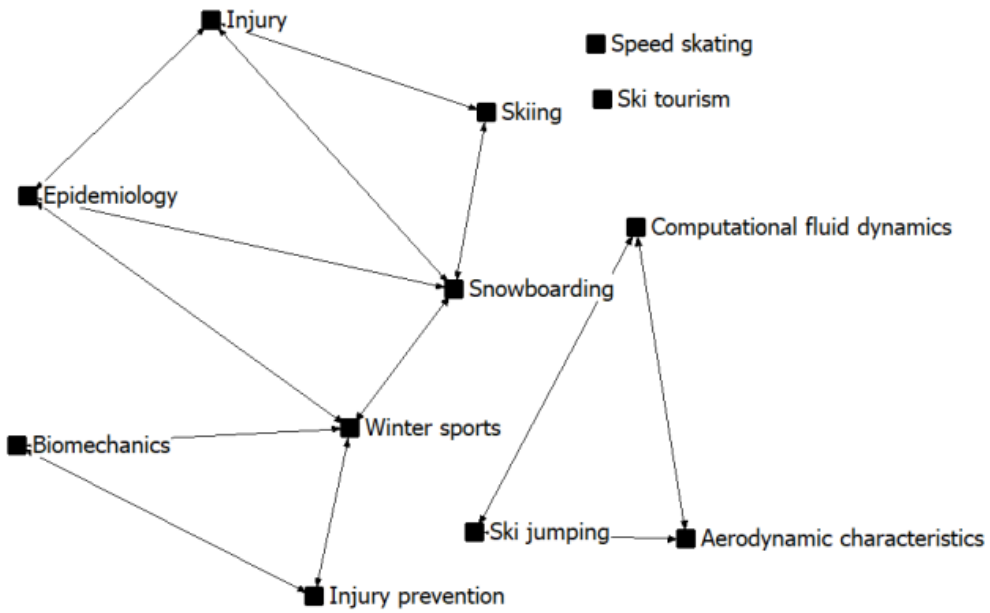
Young H, Billany R, Graham-Brown M, et al. Physical activity in kidney disease: evidence and implementation [J]. Nature Reviews Nephrology, 2025.

ABSTRACT

Despite over 30 years of research and guidelines promoting physical activity for people living with chronic kidney disease (CKD), widespread implementation of physical activity in routine care remains low worldwide. Consequently, the population with CKD remains highly inactive across all stages of the disease. Randomized controlled trials in people with CKD, people on dialysis and kidney transplant recipients consistently show that structured exercise is safe and can improve physical function, cardiorespiratory fitness, muscle strength and aspects of quality of life. However, these trials are of variable quality with modest sample sizes in some groups, and a need exists for larger, implementation-focused studies. Evidence generation in CKD has often been disconnected from service development, limiting workforce skills, resources and pathways for delivery. To achieve meaningful change, research must be designed with implementation in mind, using frameworks that consider context, sustainability and stakeholder involvement. Digital solutions and approaches targeting 24-h movement behaviours may extend the reach of physical-activity interventions, but barriers such as health-professional training, patient capability and system-level prioritization must be addressed. Embedding physical activity in clinical care offers a clear opportunity to improve outcomes and quality of life for people living with CKD.

冰雪运动

本期冰雪运动学术研究共检索到英文相关文献188篇，研究热点主要集中在冬季运动中的伤病防护与表现优化，尤其关注滑雪、滑冰等项目的生物力学机制与装备工程改进。同时，另有部分研究集中在旅游文化与智能监测技术。检索结果如下：1）关键词共词分析。提取关键词117个，经过数据清洗后关键词有114个，词频为2及以上的关键词有12个，累计百分比为22.22%，高频关键词为越单板滑雪、冬季运动和受伤等，生成可视化知识图谱（见下图）。2）来源期刊分析。涉及期刊23种，其中载文2篇及以上的期刊有2种，累计百分比为23.81%，排名第一的期刊是Scientific Reports（JCR学科分区Q1）、Frontiers in Bioengineering and Biotechnology（JCR学科分区Q1、Q2）。3）交叉学科分析。引用文献总计883篇，最多的频次为2次，近三年排名前三的文献分别是：*Aerodynamic investigation of the inrun position in Ski jumping*、*'Where to ski?': an ethnography of how guides make sense while planning*、*Coupling coordination evaluation of economic development, ecological environment, and the tourism industry in ski resorts*。4）学术关注度分析。文献级别用量最多的是18次，排名前三位的文献分别为：*Tailoring an economic-ecological-tourism coupling framework for arid-region ski resorts: A PSR model-based case study of Xinjiang, China*、*Perceived quality symbols in short-video social media drive ski tourism behavior*、*On two consequences of CH established by Sierpiński. II*。



Bitner B, Kafle S, Abello E, et al. Comparative Study of Craniofacial Injuries in Skiing Versus Snowboarding: A NEISS Database Study [J]. Journal of Craniofacial Surgery, 2025, 36(5): 1497-501.

ABSTRACT

Introduction: Skiing and snowboarding are popular winter sports which are rising in popularity. There is a lack of detailed data in the literature regarding skiing and snowboarding head and neck injuries, especially the rate of concussions with helmet use. Methods: The authors queried the National Electronic Injury Surveillance System (NEISS) database to characterize patient demographics, injury types, subsite injured, and ED disposition associated with skiing and snowboarding-related head and neck injuries between 2009 and 2020 in the US. Results: An estimated 87,994 head and neck-related ski and snowboarding injuries were reported from 2011 to 2020 nationally. Ski-related and snowboard-related injuries comprised 51.9% and 48.1% of injuries, respectively. Ski-related injuries accounted for the majority of admissions (69.2%). Head injuries were the most common (68.3%), followed by injuries to the face (15.3%) and neck (12.2%). Concussions (57.7%) were the most common overall injury type and comprised 49.2% of admissions. Concussions were more common in snowboarding injuries (65.6% versus 50.3%, P<0.001), whereas lacerations (11.1% versus 14.4%), contusion/abrasions (6.7% versus 11.1%), and fractures (2.9% versus 7.0%) were more common in ski-related injuries. Cases with negative helmet status were associated with a greater proportion of concussion injuries (79.8% versus 70.9%, P<0.001). Conclusions: Patients presenting with skiing or snowboarding injuries require a thorough head and neck examination. A comprehensive history and physical should be performed with a focus on helmet use and evaluation for concussion, lacerations, and fractures. Helmet use is strongly recommended to prevent the risk of head injury.

Chen X, Yuan Z, Gao X, et al. Assessment of synergy-assisted EMG-driven NMSK model for upper limb muscle activation prediction in cross-country sit-skiing double poling [J]. Frontiers in Bioengineering and Biotechnology, 2025, 13.

ABSTRACT

Introduction: Cross-country sit-skiers are often individuals with spinal cord injuries, cerebral palsy, or lower limb disabilities, relying heavily on upper limb strength to generate propulsion during skiing. However, frequent shoulder joint movements significantly increase the incidence of shoulder joint disorders. Therefore, quantifying muscle forces during movement is crucial for understanding upper limb force generation patterns. Currently, electromyography (EMG)-driven neuromusculoskeletal (NMSK) models are the predominant method for calculating muscle forces and joint moments. However, this approach heavily depends on the quality and quantity of EMG data. Surface electrodes are typically used to collect activity data from superficial muscles, but during dynamic movements, factors such as skin stretching, sweating, or friction

may cause electrode detachment or poor contact, leading to EMG signal acquisition failures or data loss. In this study, we propose a synergy-assisted EMG-driven NMSK model to predict the activation patterns of missing muscles for cross-country sit-skiing double poling. Methods: This method is based on individualized EMG-driven NMSK models constructed for each participant, incorporating data from 10 muscles. By utilizing the activation data of 9 known muscles, the model predicts the activation of one missing muscle through synergy analysis. For synergy method selection, we systematically compared four approaches: Non-negative Matrix Factorization (NMF), Principal Component Analysis (PCA), Independent Component Analysis (ICA), and Factor Analysis (FA). Results: The results demonstrated NMF's superior performance at 5 synergies, accurately predicting any missing muscle activation among 10 muscles (r = 0.79 +/- 0.25 vs. 0.14 +/- 0.60-0.45 +/- 0.63 for alternatives, $p < 0.05$), with lower errors (RMSE: 0.21 +/- 0.11, $p < 0.05$ vs. ICA/FA, $p < 0.1$ vs. PCA; MAE: 0.17 +/- 0.09, all $p < 0.05$). Conclusion: This finding validates the effectiveness of the proposed method in predicting upper limb muscle activation during coupled shoulder and elbow joint movements.

Chen Y, Chen J, Cao Y, et al. Peak performance characteristics and key competition factors of elite speed skaters based on longitudinal data [J]. Scientific Reports, 2025, 15(1).

ABSTRACT

This study aimed to investigate the peak performance characteristics of world elite speed skaters and the key competition factors involved in the journey towards achieving better peak performance. Data from 651 elite skaters (361 males and 290 females) across the 2003/2004 to 2022/2023 seasons were collected from the international skating Union database. Individual quadratic trajectories were used to track progression to peak performance. K-means clustering grouped competitive feature variables, and key competition factors were analyzed through a binary logistic regression model, with the odds ratio (OR) indicating whether a factor was favorable (OR > 1) or unfavorable (OR < 1). Differences ($P < 0.01$) in the peak age between medalists and non-medalists were noticed, while no differences ($P > 0.05$) were noticed between sexes or distances. Differences ($P < 0.05$) were observed between sexes, as well as between medalists and non-medalists in the peak-performance window. Binary logistic regression revealed that medium (OR = 8.070) or high (OR = 28.242) first participation performance, high first major competition performance (OR = 4.818), medium (OR = 10.661) or early (OR = 51.592) first major competition age, medium career-best performance age (OR = 40.333), participation frequency above 2.8 times/year in phase-3 (2.8-4.7 times/year: OR = 5.132; 4.8-8.0 times/year: OR = 8.171), and a career length of 9 years or more (9-13 years: OR = 2.538; 14-21 years: OR = 4.647) were favorable factors for achieving better peak performance. In conclusion, peak age range for world elite speed skaters was 25-28 years, with a duration of peak performance lasting 4-5 years. Certain competition factors were key conditions for world elite speed skaters to enhance their peak performance.

Koga A, Bai X, Jia Y, et al. Lower limb biomechanical differences between jumps with different number of rotations in youth figure skaters [J]. Frontiers in Bioengineering and Biotechnology, 2025, 13.

ABSTRACT

Objective: The purpose of this study was to examine the differences in the lower-limb muscle activities and kinematics between figure skating Axel type jumps with different number of rotations in youth figure skaters. We hypothesized that skaters would exhibit increased lower limb flexion during jump propulsion phase, lower limb extension at take-off and greater muscle activation levels as jump rotation increases. Methods: Eleven youth figure skaters (age: 12 +/- 4.29 years; height: 146.82 +/- 17.71 cm; body mass: 37.02 +/- 14.47 kg) performed Waltz Jump (0.5 rotations), Single Axel Jump (1.5 rotations), and three of them additionally performed Double Axel Jump (2.5 rotations). Lower-limb kinematics were recorded using two high-speed cameras. Muscle activities of Rectus Femoris, Long Head of Biceps Femoris, Tibialis Anterior, Lateral Gastrocnemius, and Medial Gastrocnemius of both legs were measured. The differences between the jumps were compared using paired samples t-test. Comparison of EMG data between different muscles parts was performed by One-way ANOVA. Due to limited data, Double Axel jump was compared with descriptive analysis. Results: More difficult Axel type jump had higher jump height, shorter jump distance, faster jump take-off vertical velocity, and greater hip flexion during propulsion phase. The RMS and iEMG values of the left medial and lateral gastrocnemius and right tibialis anterior increased as the jump difficulty increased. Moreover, there were significant differences between different muscle parts RMS values and iEMG values in both Waltz jump and Single Axel jump ($p < 0.01$). Biceps femoris and rectus femoris indicated to have the highest RMS values and iEMG values in Waltz jump and Single Axel jump. Conclusion: More difficult Axel type jumps require greater hip flexion during propulsion phase and greater activities in hamstrings, quadriceps and tibialis anterior before jump take-off. Youth figure skaters can improve jump height, take-off vertical velocity and overall qualities of jumps by enhancing multi-joint movement, muscle coordination and take-off leg strength. These findings provide insights into the lower-limb biomechanical characteristics of figure skating jumps, and potentially leading to refinement of training programs for the youth figure skaters to optimize jump performances and to reduce potential lower extremity injuries.

Kural B, Çaglar E, U çar M, et al. Isokinetic Knee Strength as a Predictor of Performance in Elite Ski Mountaineering Sprint Athletes [J]. Medicina-Lithuania, 2025, 61(7).

ABSTRACT

Background and Objectives: This study aims to investigate the relationship between isokinetic knee strength and competition performance in elite male ski mountaineering sprint athletes and to identify strength parameters

that predict performance and contribute to injury prevention. Materials and Methods: Thirteen male athletes participating in the Ski Mountaineering Turkey Cup final stage were included. Isokinetic knee flexion (FLX) and extension (EXT) strength of dominant (DM) and non-dominant (NDM) legs were measured at angular velocities of 60 degrees/s and 180 degrees/s using the DIERS-Myolin Isometric Muscle Strength Analysis System. Competition performance was evaluated using the ISMF scoring system. Data were analyzed using SPSS 26.0 with Pearson correlation and multiple regression analyses after normality, linearity, and homoscedasticity checks. Results: Strong positive correlations were found between hamstring strength at high angular velocities (180 degrees/s) and performance (DM FLX: r = 0.809; NDM FLX: r = 0.880). Extension strength showed moderate correlations at low velocities (60 degrees/s) (DM EXT: r = 0.677; NDM EXT: r = 0.699). Regression analysis revealed that DM FLX at 180 degrees/s and DM EXT at 60 degrees/s explained 49% of performance variance (Adj. R2 = 0.498). For NDM legs, only 180 degrees/s FLX was a significant predictor (beta = 1.468). Conclusions: High-velocity hamstring strength plays a critical role in ski mountaineering sprint performance, particularly during sudden directional changes and dynamic balance. Quadriceps strength at low velocities contributes to prolonged climbing phases. Moreover, identifying and addressing bilateral strength asymmetries may support injury prevention strategies in elite ski mountaineering athletes. These findings provide scientific support for designing training programs targeting explosive hamstring strength, bilateral symmetry, and injury risk reduction, essential for optimizing performance in the 2026 Winter Olympics sprint discipline.

Li Y, Yao Y, Gao Y, et al. Morphological and Strength Parameters of Chinese Young Freestyle Skiing Aerials Athletes [J]. International Journal of Morphology, 2025, 43(4): 1301-6.

ABSTRACT

This study analyzed the body shape, strength parameters, and characteristics of young Chinese freestyle skiing aerials athletes and proposed corresponding training strategies. Twenty athletes participating in the China freestyle skiing Aerialses U-sercompetition were selected as the subjects. The test indexes included height, weight, body fat percentage, lower limb length percentage,illes Achtendon length, waist circumference, Quetelet index, bench press and squat maximum strength, power clean, depth jump, knee jointric isomet strength, and hip joint muscle strength. Awarded athletes were taller and heavier, had a lower body fat percentage, a more significant percentage of lower limb length, and a greater Quetelet index than non-awarded athletes. The results of bench press, squatuteabsolstrength, power clean, and depth jump are better, which indicates that the base strength of upper and lower limbs, explosive powernkandoftrulower limbs, and synergy among them are the key strength qualities that affect the competitive performance of young aerials Chinseathletes. youth aerials athletes generally have the primary joint flexor, extensor muscle group, left and right muscle group power imbalance problem, which should strengthen the athlete's trunk fast

flexor, extensor muscle group, knee joint fast concentric and eccentricandforce, hamstring muscle strength, and optimize the balance of left and right side strength.

Mulder E, Holmberg H, Supej M. A perspective on competitive freeride skiing and snowboarding [J]. Frontiers in Physiology, 2025, 16.

ABSTRACT

Freeride skiing and snowboarding-collectively termed competitive freeriding-have evolved from niche extreme sports into formally recognized disciplines under the International Ski & Snowboard Federation (FIS). Unlike traditional alpine or freestyle events, competitive freeriding emphasizes creative line selection, technical execution, fluidity, style, and aerial maneuvers on natural, ungroomed mountain terrain. Athletes descend complex slopes based solely on visual inspection, without practice runs, facing unique physical and psychological challenges. This perspective article outlines the competition format and judging system, identifies key physiological and biomechanical demands, and reviews essential equipment and safety considerations. Despite growing popularity and institutional recognition, scientific research remains limited-primarily focused on avalanche risk and injury incidence-while other dimensions, such as psychological resilience, creative expression, and environmental connectedness, remain underexplored. Physiologically, competitive freeriders require high levels of eccentric and explosive strength, core stability, reactive control, and anaerobic endurance to navigate variable terrain and absorb impact during aerial maneuvers. Lower-extremity injuries-particularly anterior cruciate ligament (ACL) ruptures-are a major concern. Technological advances in drone-based filming, athlete monitoring, and protective equipment are reshaping freeride competition and broadcasting. As the sport moves toward potential Olympic inclusion, the central challenge lies in embracing innovation without compromising the core values of freedom, improvisation, and connection to the mountain environment.

Petrella D, Ellenberger L, Gilgien M. Accuracy evaluation of smartphone-based GNSS position and speed tracking for ski-slope and safety management [J]. Plos One, 2025, 20(8).

ABSTRACT

Smartphones with integrated global navigation satellite system (GNSS) functionality are increasingly used in various apps beyond communication, including positioning, navigation, and tracking. This study explores the potential of smartphone GNSS data to improve ski slope safety through motion data analysis. Apps such as iSKI, Skitude, Slopes, and Strava measure speeds, distances, and altitude differences, generating valuable data on skiers' movements. These data help ski resorts in planning and accident prevention by identifying high-risk areas based on movement patterns. We compared the accuracy of position and speed data from four

apps across four smartphone models (two Android and two iOS) against a differential GNSS (dGNSS) reference system. Data were collected at two ski resorts during the winter of 2022/23, with smartphones recording at 1 Hz and dGNSS at 50 Hz. Analysis focused on downhill runs, excluding initial recording phases and vertical position data. Accuracy was assessed by calculating the Euclidean distance between the time-synchronized smartphone data and dGNSS reference data. High-end smartphones provided more accurate position data, with an average error of approximately 4 m, compared to 6 m for low-end models. Speed data were reliable across all devices, with an average error <1.9 km/h. However, accuracy diminished with increasing speeds and varied based on location-specific environmental factors. Thus, although smartphone position data can evaluate non-exact position-dependent parameters, such as slope utilization and user density, more precise systems, such as dGNSS, are necessary for exact position-dependent evaluations. Speed data derived from cleaned position data are reliable for estimating skier speeds, and data from different apps can be combined if consistent calculation methods are used. Future advances in smartphone technology are expected to enhance data accuracy. Recommendations include using smartphone data in open terrain for better accuracy and exercising caution when interpreting absolute position data for accident prevention or other context-specific analyses.

Pikkemaat B, Steiger R, Schönherr S. Beyond size: Uncovering customer insights from small ski areas [J]. Journal of Outdoor Recreation and Tourism-Research Planning and Management, 2025, 51.

ABSTRACT

This study emphasizes customer decision-making processes associated with small ski areas, a sector increasingly affected by climate change, evolving customer preferences, and intensified market competition. While prior research has primarily concentrated on larger ski resorts, this study addresses a critical gap by focusing on the distinctive characteristics and challenges faced by smaller ski areas. Adopting a two-phase methodology, the research combines a preliminary quantitative survey with an in-depth qualitative exploration conducted in Austria. Through a choice experiment with skiers and interviews with visitors of small ski areas, the study identifies the key factors that shape customer preferences. Although larger ski areas are often perceived as more attractive due to their extensive facilities and greater perceived utility, smaller ski areas have distinct advantages, including ease of access, affordability, and a more relaxed, uncrowded atmosphere. These attributes are of particular value to day-trippers, who appreciate affordable lift ticket prices, less crowded slopes, and natural snow conditions, which can create a more intimate and enjoyable skiing experience. This study highlights the emotional bonds and sense of community that skiers often establish with smaller ski areas, thereby offering a more nuanced perspective to existing studies on ski area choice. These findings offer practical insights for small ski area operators, emphasizing the importance of leveraging their unique strengths to enhance customer satisfaction and sustain competitiveness in a challenging and evolving market. By addressing these

dynamics, this study contributes to the broader understanding of customer behavior within the skiing industry and offers a foundation for targeted strategic initiatives. Management implications: Small ski areas, often overlooked in market strategy, can boost competitiveness by leveraging their unique attributes-accessibility, affordability, and reduced crowding. Operators should target day-trippers and price-sensitive segments with flexible pricing, local partnerships, and authentic, low-stress experiences. Emotional place attachment and community ties are critical levers-fostering loyalty beyond size or infrastructure. Strategic investments in snow management, service quality, and regional pass integration can further enhance appeal and resilience in a climate-challenged and cost-sensitive environment.

Sandberg J, Hinder G, Holmberg H, et al. Influence of Load and Position of Center of Mass on COF in Cross-Country Skiing [J]. Tribology Letters, 2025, 73(3).

ABSTRACT

Cross-country skiers employ various techniques, where the ski is exposed to different forces during the motion. This study utilized a novel sled tribometer to investigate the combined effects of load and positioning of the skier on the coefficient of friction (COF) between the skis and snow. Three different loads (40 kg, 80 kg and 120 kg) were applied to the sled, and the center of mass was systematically varied between three positions behind the binding position: 70mm (leaning forward), 140mm (centered) and 210mm (backward). A variety of skis were used, including different models of skate skis and one classic-style ski with grip wax. The results consistently demonstrated that increasing the load on the sled reduced the COF by up to 15% (from the lowest to highest load), regardless of the position of the center of mass. The position of the center of mass had a minimal effect on COF in most tests. An exception was observed when using grip wax, where a forward-leaning position combined with a heavy load significantly increased the COF (similar to 8%) compared to what is expected without grip wax. This load-dependent reduction in the COF was observed across different skis and test sessions. The ski camber profile was measured for all skis in all configurations. In general, increasing the load increases the glide zone length but at the same time increasing the average pressure. The position of the center of mass has little to no effect on the rear glide zone but slightly alters the length and position of the front glide zone. While the mechanisms of friction are discussed, a complete understanding of these mechanisms has not yet been reached.

Tang C, Han Y, Jiang L. Ecological security evaluation and early warning of ski tourism destinations [J]. Journal of Geographical Sciences, 2025, 35(9): 1953-78.

ABSTRACT

To address the contradiction between the rapid development of ski tourism and effective protection of the ecological environment, this study constructed the DPSIR-EES (Drive-Pressures-State-Impact-Response-Environment-Economy-Society) model and Ski Tourism Destination Ecological Security System (STDESS) framework system. They form an integrated methodology system based on the "entropy weighting-hierarchical analysis-gray correlation projection" composite weighting method that can be used to clarify the intrinsic mechanism of ecological security in ski tourism destinations. Taking Chongli as a case study, this study evaluated the evolution of its ecological security from 1995 to 2023, predicted the ecological security early warning levels from 2024 to 2050, and analyzed the mechanism of influences on regional ecological security. The findings indicate that the ecological security of ski tourism destinations shows a significant "stepped leap-dynamic equilibrium" evolutionary path. The dynamic response mechanism of the subsystems is characterized by significant heterogeneity. The ecological security early warning system revealed the temporal and sequential differentiation of risk transmission. The factors influencing ecological security show the significant dual dominance of policy and climate. This paper enhances the applicability of ecological security systems within ski tourism contexts by analyzing their evolutionary characteristics, predicted future changes and impact factors, and it provides an effective case study for ecological improvement.

Triplett A, Post E, Anderson T, et al. Injury and illness: an analysis of team USA athletes at the 2024 winter youth olympic games [J]. Injury Epidemiology, 2025, 12(1).

ABSTRACT

Background: Injury and illness surveillance is essential for understanding the relative risks of sports participation to develop effective strategies to optimize athlete health, wellness, and performance. Epidemiological studies examining injuries and illnesses among Team USA youth athletes are limited, particularly among athletes competing in Winter sports. The purpose of this study was to characterize the injury and illness incidence rate among Team USA athletes participating in the 2024 Winter Youth Olympic Games (YOG).Methods: Injuries and illnesses among 101 Team USA youth athletes (40.6% female; age, 17 +/- 1 years) were prospectively documented. Injury and illness prevalence, and incidence rate (IR) per 1,000 athlete-days (AD), and incidence rate ratios (IRR) were calculated with accompanying 95% confidence intervals ([95% CI]).Results: Nineteen (18.8%) Team USA athletes reported at least one injury during the 2024 Winter YOG (38.0 [26.1, 53.3] injuries per 1,000 AD). Injury IR was highest among athletes competing in bobsled (166.7 [54.1, 388.9] injuries per 1,000 AD), and overuse was the most common mechanism of

injury (17.3 [9.7, 28.5] injuries per 1,000 AD) among all athletes. There were no differences in injury IRs between male and female athletes (IRR [95%CI], 1.6 [0.7, 3.3]), but female athletes reported all time-loss injuries. Ten (9.9%) athletes reported at least one illness (15.0 [8.0, 26.5] per 1,000 AD), with respiratory illness (6%) being the most common type (6.9 [2.5, 15.0] per 1,000 AD).Conclusion: This study highlights the need for focused efforts for injury and illness prevention for youth female athletes and athletes participating in high-risk sliding sports. Additionally, consideration for implementation of respiratory illness mitigation measures and load management strategies at and leading up to future competitions for youth athletes is key.

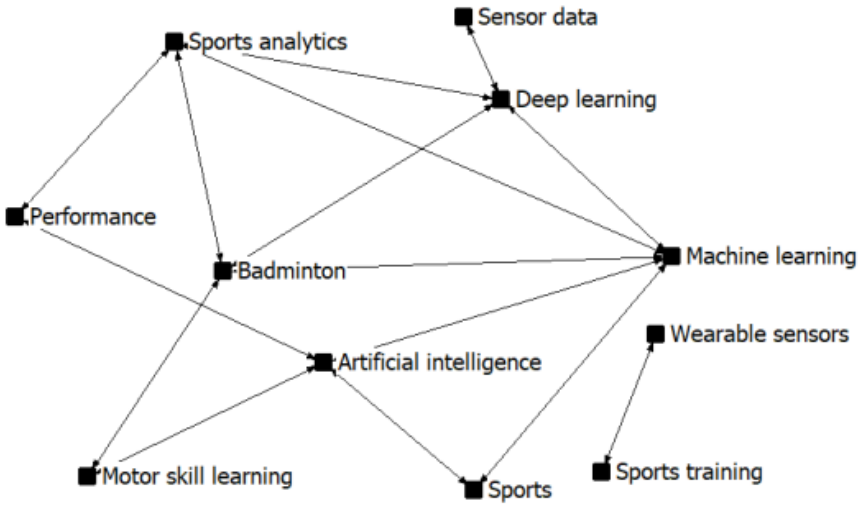
Wang F, Cui J, Wu Y, et al. Research on Injury Risk of Elite Male Athletes in Racing Ice Sports based on Blood Indexes [J]. International Journal of Sports Medicine, 2025, 46(11): 840-9.

ABSTRACT

This study aims to explore the relationship between blood biochemical indexes and injury risk for elite male athletes in racing ice sports. The study compared the demographic indexes, monthly injuries, and longitudinal tracking data for the athletes. The non-linear relationship was analyzed using an unrestricted cubic spline. Generalized estimating equations were used to estimate the relative risk (OR) of injury occurrence. Receiver operating characteristics and the area under the curve determined diagnostic accuracy. In the snow sledding group, when creatine kinase rises to 489.46 u/L or testosterone decreases to 41.32 ng/ml, the risk increases by 1.70 times (OR=1.70, p<0.001) and 1.69 times (OR=1.69, p<0.001) with statistical significance. The creatine kinase (OR=1.01, P=0.007) and testosterone (OR=1.00, P<0.001) were included in the injury prediction model. The model exhibits excellent discrimination, with sensitivity and specificity of 82.8% and 86.5%, respectively. In the ice skating group, when creatine kinase rises to 467.00 u/L, the risk increases by 2.56 times with statistical significance (OR=2.56, p<0.001). Creatine kinase (OR=1.01, P<0.001) was included in the predictive model. The model demonstrates good discrimination, with sensitivity and specificity of 90.5% and 66.7%, respectively. Creatine kinase and testosterone are the risk predictors of injury in elite snowmobile male athletes. Creatine kinase is an independent risk factor for injury in elite speed skaters.

体育工程

本期体育工程学术研究共检索到英文相关文献248篇，研究热点主要集中在人工智能的应用、可穿戴传感器、计算机智能算法等在体育方面的应用。检索结果如下：1）关键词共词分析。提取关键词209个，经过数据清洗后关键词有207个，词频为2及以上的关键词有12个，累计百分比为18.18%，高频关键词为人工智能、机器学习、深度学习、体育等，生成可视化知识图谱（见下图）。2）来源期刊分析。涉及期刊39种，其中载文2篇及以上的期刊有5种，累计百分比为43.59%，刊载体育工程前三位的期刊分别为：Scientific Reports（JCR学科分区Q1），Applied Sciences-Basel（JCR学科分区Q3、Q2、Q3、Q3），International journal of sports science&coaching（JCR学科分区Q3、Q3）。3）交叉学科分析。引用文献总计1798篇，最多的频次为3次，排名第一的文献是：*Artificial intelligence and Machine Learning approaches in sports: Concepts, applications, challenges, and future perspectives*。4）学术关注度分析。文献级别用量最多的是39次，排名前三位的文献分别为：*SDeep learning-assisted piezoresistive pressure sensors with broad-range ultrasensitivity for wearable motion monitoring*、*Self-powered wearable triboelectric nanogenerator based on MXene/ chitosan/carbon nanotube layered composite film*、*Artificial intelligence assisted wearable flexible sensors for sports: research progress in technology integration and application*。



Aydemir B, Aydogan M, Boz E, et al. Validity and Reliability of a Novel AI-Based System in Athletic Performance Assessment: The Case of DeepSport [J]. Sensors, 2025, 25(17).

ABSTRACT

This study aimed to examine the validity and reliability of the AI-based DeepSport application by comparing its outcomes with those from the reference device, OptoJump. The primary dependent variables measured were jump height and anaerobic power during vertical jump assessments. Twelve elite male basketball players voluntarily participated in the study (age = 21.53 +/- 1.14 years; sports experience = 6.47 +/- 1.01 years). DeepSport uses AI-based image processing from standard cameras, while OptoJump uses optical sensor technology. Both DeepSport and OptoJump systems were utilized to assess participants' Countermovement Jump (CMJ) and Squat Jump (SJ) performances. A G*Power (version 3.1.9.7) analysis determined the required sample size, adopting a 95% confidence level, 90% test power, and an effect size of 0.25. Validity assessments were conducted using Bland-Altman plots and ordinary least products (OLP) regression analysis, while reliability was evaluated through intraclass correlation coefficient (ICC), coefficient of variation (CV), standard error of measurement (SEM), and smallest detectable change (SDC) analyses. DeepSport showed excellent reliability in CMJ and SJ tests with ICC values > 0.90, and CV ranged between 2.12% and 4.95%. Results were consistent with OptoJump, showing no significant differences according to t-test results ($p > 0.05$). Bland-Altman analyses indicated no systematic bias and random distribution. These findings confirm that both DeepSport and OptoJump devices demonstrate high reliability and consistency, suggesting their validity and reliability for use in athlete performance assessments by coaches and athletes.

Bucea-Manea-Tonis R, Vasile L, Trusca A, et al. Harnessing Artificial Intelligence in Sports Training: Evidence from Romanian Professionals Using SEM Analysis [J]. Applied Sciences-Basel, 2025, 15(16).

ABSTRACT

Digital technologies, including artificial intelligence (AI) and machine learning (ML), are reshaping the landscape of athletic training and performance assessment. Despite growing global interest, empirical research on AI adoption in sports remains limited in Central and Eastern Europe. This study investigates how Romanian sports professionals perceive and integrate AI-based applications and digital technologies into their training practices, and how these tools influence performance outcomes. Data were collected through a structured questionnaire distributed to 293 athletes, coaches, and sports academics. Using Partial Least Squares Structural Equation Modeling (PLS-SEM), we found that perceived AI benefits significantly predict the use of AI applications (beta = 0.211, $p < 0.001$), which in turn strongly predicts the adoption of digital sports technologies (beta = 0.708, $p < 0.001$). The use of digital technologies was positively associated with

higher self-reported performance outcomes (beta = 0.268, $p < 0.001$). Group comparisons using ANOVA revealed significant differences in AI adoption by sport (football > basketball, $p < 0.05$) and education level ($p = 0.007$). These findings contribute to the literature on sports technology adoption by offering one of Eastern Europe's first empirical, model-based studies. The study provides practical insights for coaches, policymakers, and sports technologists aiming to foster AI integration and digital innovation in high-performance athletic environments.

Chang C, Chang T, Kuo M, et al. Low-Backward Radiation Circular Polarization RFID Reader Antenna Design for Sports-Event Applications [J]. Electronics, 2025, 14(18).

ABSTRACT

This paper presents the design of a circularly polarized RFID ground mat antenna for UHF-band sports-event applications. Considering a practical sports-event timing system, the ground-based mat antenna with characteristics of a low-backward radiation and circular polarization is proposed. A multilayer square patch antenna using an acrylic dielectric substrate with a wideband branch-line coupler feeding network is employed to improve overall radiation efficiency, which, in turn, provides two excitation port with a phase difference of 90 degrees. Thus, right-hand circular polarization can be obtained. Instead of a conventional FR4-air-FR4 structure, the proposed FR4-acrylic-FR4 composite configuration is adopted to substantially increase the antenna's mechanical strength and durability against external pressure from runners. The antenna's performance is attributed to the use of an effective composite dielectric constant and an optimized design of its parameters. Additionally, the patch antenna's low-backward radiation characteristic helps reduce multipath interference in real-world applications. The measured results are in good agreement with the simulated data, validating the proposed antenna design. In order to further assess the practical performance of the antenna, outdoor measurements are carried out to validate the estimated reading distances derived from controlled anechoic chamber tests. The measured return loss remained below -10 dB across the frequency range of 755-990 MHz, exhibiting a slight discrepancy compared to the simulated bandwidth of 800-1030 MHz. For the characteristic of the circular polarization, the measured axial ratio is below 3 dB within the range of 860-920 MHz. While a more relaxed criterion of an axial ratio below 6 dB is considered, the operating frequency range extends from 560 MHz to 985 MHz, which falls within the frequency band relevant for RFID reader applications.

Cui Y. Research on the Application of Intelligent Motion Data Analysis Algorithm in High-Performance Sports Training Platform [J]. International Journal on Artificial Intelligence Tools, 2025.

ABSTRACT

The incorporation of smart motion data analysis in sports training has transformed the way athletes maximize their performance while reducing the risk of injury. The evolution of motion capture technologies and wearable sensors has made real-time data analysis a valuable resource for both coaches and athletes. This paper introduces a new sports motion analysis approach based on a hybrid model that integrates the AlexNet and TabNet architectures. The method utilizes high-performance motion capture data, including joint angles, acceleration, and body posture, acquired via wearable sensors and processed using sophisticated feature extraction methods, such as wavelet transforms. The Lyrebird Optimization Algorithm (LOA) is used to select features, ensuring that only the most relevant data are utilized in the analysis. Our experimental outcomes demonstrate that our hybrid AlexNet-TabNet model achieves 98.85% accuracy, accompanied by equally high precision (98.60%) and sensitivity (98.61%), making it highly efficient for assessing sports performance. This study is significant in that it demonstrates the capabilities of integrating artificial intelligence, motion capture technology, and wearable sensors to provide athletes with accurate, actionable information, which can be used to create customized training programs that enhance performance and reduce injuries.

Davies G, Webb L, Dinnie A. Formula for success: Using an accreditation to excel data literacy in early-career sport performance analysts [J]. International Journal of Sports Science & Coaching, 2025.

ABSTRACT

Whilst frameworks for the applied practice of Sport Performance Analysis (SPA) are established, a framework for the development of competencies in early-career analysts remains unexplored. Student perceptions on integrating the Microsoft Office Specialist (MOS) Excel accreditation into a first-year SPA university module were gathered to assess the value of professional accreditations for curriculum design. Ten focus groups centred as unstructured forums involving 1st or 2nd year students were held to gather honest reflections on e-lessons, peer-review feedback and the professional accreditation embedded into the module. Following transcription of audio files, thematic analysis was performed collaboratively utilising an inductive approach to identify themes before refining codes deductively. Analysis revealed SPA students enjoyed self-regulating the pace of learning with online resources however not in place of face-to-face sessions. Face-to-face sessions provided a collaborative environment making feedback and support easier to gain, which boosted engagement and learning. Further findings highlighted the importance of accreditation content reflecting industry demands including time constraints and data used. Therefore, as a foundation to

developing a competency framework, early-career analysts should prioritise accreditations to objectively demonstrate skill competency. Organisations can use accreditations to validate recruitment processes and continue the development of employees.

Erilli N, Dalar A. Estimating the peak age of chess players through statistical and machine learning techniques [J]. Scientific Reports, 2025, 15(1).

ABSTRACT

Because chess is played in formal tournaments and competitive environments, it requires physical and mental endurance. This endurance declines as the years progress and can decrease the player's performance. As the player's age increases, elements such as strategic thinking, game analysis, and psychological endurance come to the fore. In chess, age is the most important variable, although it is not the sole determinant of a player's abilities and achievements. In this study, the age at which Grandmaster level chess players reach the highest ELO levels and the 2,700 ELO threshold was predicted. For this purpose, 12 forecasting models were created using 11 machine learning methods with various variables. The model results were interpreted and the age at which some promising young players reached the 2,700 ELO level was determined. This study finds that the average peak ELO age for Grandmasters is approximately 30.65, with variations based on factors such as early attainment of the GM title and gender differences. To enhance the reliability of prediction results, the percentile bootstrap method was employed across all machine learning models. This approach allowed for the calculation of confidence intervals, providing a more reliable interpretation of the predicted values. These results provide insights into the career trajectories of chess players at the highest levels. This study provides a good alternative for the calculation of classification scores in sports that are uncertain and difficult to predetermine.

Fernandez-De-Osso A, Sánchez-Trigo H. Artificial intelligence in padel performance assessment: A comparative study of result-based and computer vision-derived rankings [J]. International Journal of Sports Science & Coaching, 2025.

ABSTRACT

Background: Accurate evaluation of non-professional padel players is essential for optimizing training and ensuring fair competition. Traditional result-based ranking systems, often reliant on self-assessment, can be biased. In contrast, AI-driven methods utilizing computer vision and deep learning promise objective, real-time performance evaluations. Methods: In this study, evaluation scores for 180 players were derived from three sources: a self-assessed result-based system (Playtomic), an AI-based system (AIball), and expert coach assessments, which served as the benchmark. AIball is a computer-vision-based evaluation system that

automatically extracts key performance metrics. Data were collected from 50 matches across 9 clubs in Spain. Statistical analyses-including Pearson correlation, Intraclass Correlation Coefficient (ICC), Lin's Concordance Correlation Coefficient (CCC), paired t-tests, Bland-Altman analysis, and error metrics (mean squared error [MSE], root mean squared error [RMSE], and mean absolute error [MAE])-were employed to assess the reliability, agreement, and classification accuracy of the evaluation systems. Results: AIball demonstrated a strong positive correlation with coach evaluations (r = 0.7769; CCC = 0.7144) and yielded lower error metrics (MSE = 0.6689; RMSE = 0.8178; MAE = 0.6678) compared to Playtomic. Bland-Altman plots revealed that AIball's scores were more closely aligned with those of the experts, and pairwise comparisons showed a slightly higher classification accuracy for AIball (74.27%) relative to Playtomic (73.74%). Conclusion: The findings indicate that the AI-based evaluation system (AIball) offers a more reliable and objective assessment of non-professional padel players than traditional self-assessed methods. This approach has significant implications for enhancing training programs, standardizing player rankings, and promoting fairness in competitions.

Guo J, Zhang G, Zhang Y. AI-Powered Assessment of Motor Development: Using Platforms Like KineticAI to Analyze Fundamental Movement Skills in Children [J]. Perceptual and Motor Skills, 2025.

ABSTRACT

The aim of this study is to examine the precision, dependability, and relevance of AI-based evaluations in contrast to conventional human evaluations. In all, 200 7-8-year-old students from urban and suburban schools participated in the study. Based on movement speed, accuracy, and smoothness, KineticAI's assessment of their motor skills divided them into three categories: proficiency, developing, and emerging. A thorough examination of KineticAI's validity and reliability was ensured by evaluating its psychometric qualities using COSMIN criteria. Furthermore, AI-generated scores and human evaluator ratings were compared using TGMD-3 as a standard. Mean Absolute Error (MAE), Intraclass Correlation Coefficients (ICC), and Bland-Altman plots were among the statistical techniques used to evaluate the degree of agreement. With an ICC of 0.94, the results show that KineticAI achieves great accuracy and dependability, showing strong consistency with human judgments. With running (3.8), jumping (4.2), hopping (5.1), and balancing (4.9) points, the AI system demonstrated a negligible mean absolute error (MAE) across motor skills, thereby proving its accuracy. Disparities in motor proficiency were also found by gender and school, with suburban girls scoring the lowest and urban boys the highest. These results highlight how crucial it is to provide everyone with fair access to organized physical activity programs to close developmental gaps. The study indicates that KineticAI offers a scalable, objective, and efficient alternative to traditional motor assessments. It is a valuable tool for use in schools, rehabilitation clinics, and sports training programs.

Lin K, Cai W, Ko C. A study of using mobile phone application in badminton teaching and learning process based on deep learning and auto-feedback-based WISER model [J]. Etr&D-Educational Technology Research and Development, 2025.

ABSTRACT

Badminton is one of the most popular student sports, but it is challenging to increase learning efficiency by observing learners using the naked eye without assistive tools. Therefore, this study proposes an auto-feedback badminton teaching app integrated with an auto-feedback-based WISER model. Learners could conduct self-learning with the functions of the badminton teaching app, including automatic grading, automatic feedback, and professional player demonstration videos. This study adopts a quasi-experimental design. The proposed App and model were applied in the experimental group, while the control group used traditional teaching and mobile devices with a video recording function. Both groups of learners learned serve and clear skills for 6 weeks each. The increase in post-test scores of the experimental group was significantly higher than that of the control group, though post-test scores of both groups were significantly higher than pre-test scores. The proposed method demonstrates its efficiency for self-learning, as confirmed by interviews. Future work can apply the integration of motion recognition and the auto-feedback-based WISER model across diverse educational disciplines to personalize students' learning.

Manescu D, Manescu A. Artificial Intelligence in the Selection of Top-Performing Athletes for Team Sports: A Proof-of-Concept Predictive Modeling Study [J]. Applied Sciences-Basel, 2025, 15(18).

ABSTRACT

Featured Application: This proof-of-concept predictive modeling study shows how artificial intelligence can be used to estimate athletic performance in team sports, providing a controlled, accessible method for athlete evaluation and selection. Abstract: Accurate and scalable evaluation in team sports remains challenging, motivating the use of artificial intelligence models to support objective athlete assessment. This study develops and validates a predictive model capable of calibrated, operationally tested classification of team-sport athletes as high- or low-performance using a synthetic, literature-informed dataset (n = 400). Labels were defined a priori by simulated group membership, while a composite score was retained for post hoc checks to avoid circularity. LightGBM served as the primary classifier and was contrasted with Logistic Regression (L2), Random Forest, and XGBoost (v3.0.5). Performance was evaluated with stratified, nested 5 x 5 cross-validation. Calibrated, deployment-ready probabilities were obtained by selecting a monotonic mapping (Platt or isotonic) in the inner CV, with two pre-specified operating points: screening (recall-oriented; precision >= 0.70) and shortlisting (F1-optimized). Under this protocol, the model achieved 89.5% accuracy and ROC-AUC 0.93. SHAP analyses indicated VO2max, decision latency, maximal strength, and reaction

time as leading contributors with domain-consistent directions. These results represent a proof-of-concept and an upper bound on synthetic data and require external validation. Taken together, the pipeline offers a transparent, reproducible, and ethically neutral template for athlete selection and targeted training in team sports; calibration and pre-specified thresholds align the approach with real-world decision-making.

Qian F, Shi Z, Yang L. AI-Assisted Multidimensional Optimization of Thermal and Morphological Performance in Small-to-Medium Sports Buildings [J]. Applied Sciences-Basel, 2025, 15(18).

ABSTRACT

With the advancement of China's "dual-carbon" strategy, optimizing the thermal performance of small-to-medium-sized sports buildings-key contributors to urban energy consumption and carbon emissions-has become a critical area of green building research. This study conducts a systematic literature review following the PRISMA framework, analyzing 96 high-relevance articles sourced from Web of Science, ScienceDirect, and CNKI. The review focuses on four key dimensions: building morphology, envelope thermal performance, eco-friendly material application, and thermal comfort strategies. Findings indicate that building geometry significantly influences natural ventilation and solar gain; optimizing the envelope system can enhance energy efficiency by 12-18%; and incorporating sustainable materials contributes to lifecycle carbon reduction. Furthermore, effective thermal comfort regulation requires the integration of climate-responsive strategies with intelligent control systems. The growing use of AI-assisted technologies-such as fuzzy logic, reinforcement learning, and real-time environmental feedback-is facilitating a shift from single-dimensional energy-saving approaches to multidimensional coupled optimization. This review establishes a comprehensive theoretical and practical framework for low-carbon design in small-to-medium sports buildings and highlights the urgent need for empirical validation and integrated design approaches across diverse climate zones.

Schlimm J, Breuer C. Understanding the factors that drive AI adoption among sports consumers - an extended TAM perspective [J]. International Journal of Sports Marketing & Sponsorship, 2025.

ABSTRACT

Purpose: This paper explores the factors driving the adoption of artificial intelligence (AI) in the sports industry from a passive sports consumer perspective. Grounded in an extended Technology Acceptance Model, the study investigates how perceived benefits and perceived ease of use affect sports consumers' intention to use AI. The study also examines social influence, personal innovativeness in IT (PIIT) and team identification as antecedents of perceived benefits and perceived ease of use. Design/methodology/approach: A survey-based quantitative research design was employed, gathering responses from 639 sports consumers

aged 18-60. Data were analyzed using structural equation modeling. Findings: The study finds that perceived benefits and ease of use are key drivers of consumers' intention to use AI. While social influence and PIIT both influence perceived benefits and perceived ease of use, PIIT also has a direct impact on intention to use AI. Team identification impacts perceived benefits and moderates the link between ease of use and intention to use AI. Findings also indicate generational differences. Research limitations/implications: A primary limitation of this study lies in the broad and evolving scope of AI. AI encompasses a diverse range of technologies and applications, which makes it difficult to anticipate all possible future uses in the context of consumer engagement in sports. This research focused on a specific subset of AI-powered tools, including virtual assistants, chatbots, match predictions, information retrieval systems, content personalization and statistical analysis aimed at enhancing consumer knowledge. Practical implications: AI applications should be both beneficial and easy to use, offering personalized content and intuitive interfaces to appeal to mainstream and less tech-savvy users. Social influence plays a key role, so embedding AI tools within trusted supporter communities can boost acceptance. Tailored strategies should also account for preferences of different target groups. Crucially, AI tools must reinforce emotional team connections while respecting traditional fan experiences to foster engagement, loyalty and broad-based adoption. Originality/value: This study contributes to contemporary research by assessing AI adoption in the sports industry from a consumer perspective, integrating their psychological attachment into the TAM. Practically, the results provide sports organizations with tailored strategies to enhance consumer engagement through intuitive, personalized and socially endorsed AI applications.

Shan S, Rasool N. Technostress and innovation in sports education: the mediating role of technological self-efficacy and moderating role of perceived innovation importance [J]. International Journal of Sport and Exercise Psychology, 2025.

ABSTRACT

In the rapidly evolving landscape of sports education, the integration of technology has become both a source of innovation and a potential stressor for coaches, educators, and athletes. This study draws insights on the social cognitive theory and investigates the relationships between technostress and innovation in sports education through the mediating role of technological self-efficacy and the moderating role of perceived innovation importance. Using a lagged research design, we collected data from a diverse sample of sports educators, coaches, and athletes. Data are examined by employing multivariate analytical techniques to determine the predictive relevance of the hypothesised model. Our findings indicate that technostress deteriorates innovation in sports education. Nevertheless, technological self-efficacy buffers the adverse effects of technostress in diminished innovation outcomes. Moreover, perceived innovation importance acts as an individual's psychological predisposition that underpins the influence of technological self-efficacy on

innovation, ultimately weakening the link between technostress and innovation in sports education. The study illuminates the significance of nurturing technological self-efficacy among stakeholders and emphasises the role of perceived innovation importance as a crucial factor in shaping responses to technostress. These insights offer practical implications for educators, coaches, and athletes seeking to harness technology effectively in the pursuit of excellence within the realm of sports education.

Simonelli C, Trecroci A, Formenti D, et al. Prediction of Subjective Fatigue in Professional Soccer Players: A Data-Driven Method to Optimize Training Approach to the Match [J]. Research Quarterly for Exercise and Sport, 2025.

ABSTRACT

In soccer, predicting players' fatigue experienced immediately before a training session or match can help design training programs and optimize performance. This study aimed to identify the most important predictors of daily and match-day fatigue in six Italian professional soccer teams during a competitive season using a framework of big data analytics. Every morning, the players rated fatigue, sleep quality, muscle soreness, stress, and mood. After each training session or match, the session Rating of Perceived Exertion was obtained and multiplied by duration to calculate the training load (TL). A framework of four machine learning models (Decision Tree classifier, XGBoost classifier, Random Forest Classifier, and Logistic regression) was trained and tested on 30.211 examples (one full season of six teams) to assess their ability to predict the players' match-day fatigue. The machine learning models accurately predicted the players' subjective fatigue (models' range accuracy 70-82%). Specifically, in the prediction of match-day fatigue, stress, and mood of the previous day were the most influential factors. Mediation analysis unveils the relationship between TL of the day before the match and the perception of match-day fatigue, also mediated by mood and muscle soreness. Sport scientists and coaches can apply this framework to simulate the effects of different training programs, thus maximizing players' readiness and mitigating potential drops in performance associated with match-day fatigue in a real-world scenario.

Wang Z, Kang K. Adaptive temporal attention mechanism and hybrid deep CNN model for wearable sensor-based human activity recognition [J]. Scientific Reports, 2025, 15(1)

ABSTRACT

The recognition of human activity by wearable sensors has garnered significant interest owing to its extensive applications in health, sports, and surveillance systems. This paper presents a novel hybrid deep learning model, termed CNNd-TAm, for the recognition of both basic and complicated activities. The suggested approach enhances spatial feature extraction and long-term temporal dependency modeling by integrating

Dilated convolutional networks with a modified temporal attention mechanism. Data from accelerometer and gyroscope sensors in the UTwente dataset, encompassing 13 activities and 10 people, underwent preparation that included filtering, normalization, and the selection of diverse time periods according to the activity type. Experimental findings demonstrate an accuracy of 99.4% in identifying intricate behaviors, such as conversing and consuming coffee, surpassing earlier hybrid deep learning models. This model represents a significant advancement in the development of efficient Human Activity Recognition systems by solving deficiencies in the recognition of intricate activities.

Yan M, Liu D. Real-time Sports Fatigue Monitoring Using LSTM-based Neural Networks and Wearable Technology [J]. Journal of Circuits Systems and Computers, 2025.

ABSTRACT

With the wide application of surface electromyography (sEMG) in the field of exercise fatigue monitoring, the existing studies are facing the dual challenges of data quality and classification accuracy. The original electromyography (EMG) signal is susceptible to noise, data imbalance, and individual differences, which makes it difficult for traditional classification algorithms to accurately capture the characteristics of muscle activity, while deep learning methods have the ability of sequence modeling, but their generalization performance in complex physiological signal scenarios still needs to be improved. Aiming at real-time state monitoring of athletes in the process of sports to prevent excessive fatigue and sports injuries, protect health, and prevent accidents, this paper focuses on wearable sports fatigue monitoring technology, hoping to achieve real-time sports state monitoring through noninvasive detection technology and identification of sports fatigue. Through real-time monitoring of electrocardiograph (ECG) signals and EMG signals on related muscles during human exercise, some necessary filtering and preprocessing of the collected body surface bioelectric signals are carried out to extract strong fatigue-related feature indicators. Then, recurrent neural network (RNN) based on logarithmic short-term memory (LSTM) is applied to the classification and recognition of fatigue degree and state during exercise. The experimental results show that during exercise, the fatigue degree of exercisers is determined by exercise intensity and time, and the subjective fatigue degree also increases. At the same time, it affects the values of heart rate, high- and low-frequency power (HF), root mean square (RMS), and mean power frequency (MPF), which can be used as indicators of exercise fatigue state recognition. For the experiment of fatigue recognition during sports state, the experimental results show that LSTM neural network can use historical information to mine the effective information of physiological signal features, which can be used to improve the accuracy of the sports fatigue state classification. Compared with the traditional support vector machines (SVM) algorithm, the time domain of LSTM model is 82.67%, the frequency domain is 76.58%, and the time-frequency domain is 90.63%. It effectively overcomes the interference caused by data noise and feature complexity and provides a reliable scheme for high-precision motion fatigue monitoring.

Yang J, Qin S, Ren D. Artificial intelligence coaches on the sidelines: Evaluating readability and quality of soccer training plans from six generative models [J]. International Journal of Sports Science & Coaching, 2025.

ABSTRACT

Background and Objectives: Generative Artificial Intelligence shows increasing promise for developing personalized training programs in sports science. While previous research has demonstrated its utility in aerobic and resistance training, its effectiveness in generating structured, sport-specific plans for technically demanding, high-contact team sports like soccer remains underexplored. This study aims to assess the readability and quality of soccer training programs generated by six leading generative AI (GAI) models-GPT-4o, GPT-4.5, GPT-o1, GPT-o3-mini, and DeepSeek-R1 and DeepSeek-V3-to assess their feasibility for practical use. Methods: Each model was prompted to create a 30-day soccer training plan following exercise prescription principles. Three expert raters assessed its quality using a ten-point custom rubric covering key exercise prescription components. Readability was evaluated using Flesch-Kincaid metrics. Visualizations were generated in RStudio, and inter-rater reliability was assessed via intraclass correlation coefficients (ICCs). Results: All models produced structured, soccer-specific programs with varying narrative styles and recovery protocols. DeepSeek-R1 yielded the most accessible text (Grade Level 8), while ChatGPT-o3-mini produced the most complex (Grade Level 12). ChatGPT-o1 was the most verbose. Quality scores from raters demonstrated consistency (ICC = 0.79), ranging from 6.00 to 7.00. ChatGPT-o1 received the highest rating, followed by DeepSeek-R1. All models shared common limitations, including the absence of citations and lack of individualized health screening protocols. Conclusion: GAI models demonstrate strong potential for generating soccer training plans, though trade-offs exist. However, the outputs require human oversight to ensure safety, individualization, and scientific rigor. Future research should explore context-aware prompt engineering, multilingual applications, and real-world implementation through coach- and athlete-centered trials.

Yeung C, Ide K, Someya T, et al. OpenSTARLab: open approach for spatio-temporal agent data analysis in soccer [J]. Complex & Intelligent Systems, 2025, 11(8).

ABSTRACT

Sports analytics has become both more professional and sophisticated, driven by the growing availability of detailed performance data. This progress enables applications such as match outcome prediction, player scouting, and tactical analysis. In soccer, the effective utilization of event and tracking data is fundamental for capturing and analyzing the dynamics of the game. However, there are two primary challenges: the limited availability of event data primarily restricted to top-tier teams and leagues, and the scarcity and high cost of

tracking data, which complicates its integration with event data for comprehensive analysis. Here we propose OpenSTARLab (Open Spatio-Temporal Agent Research Lab), an open-source framework designed to democratize spatio-temporal agent data analysis in sports by addressing these key challenges. OpenSTARLab includes the Pre-processing Package that standardizes event and tracking data through Unified and Integrated Event Data and State-Action-Reward formats, the Event Modeling Package that implements deep learning-based event prediction, alongside the RLearn Package for reinforcement learning tasks. These technical components facilitate the handling of diverse data sources and support advanced analytical tasks, thereby enhancing the overall functionality and usability of the framework. To assess OpenSTARLab's effectiveness, we conducted several experimental evaluations. These demonstrate the superior performance of the specific event prediction model in terms of action and time prediction accuracies and maintained its robust event simulation performance. Furthermore, reinforcement learning experiments reveal a trade-off between action accuracy and temporal difference loss and show comprehensive visualization. Overall, OpenSTARLab serves as a robust platform for researchers and practitioners, enhancing innovation and collaboration in the field of soccer data analytics.

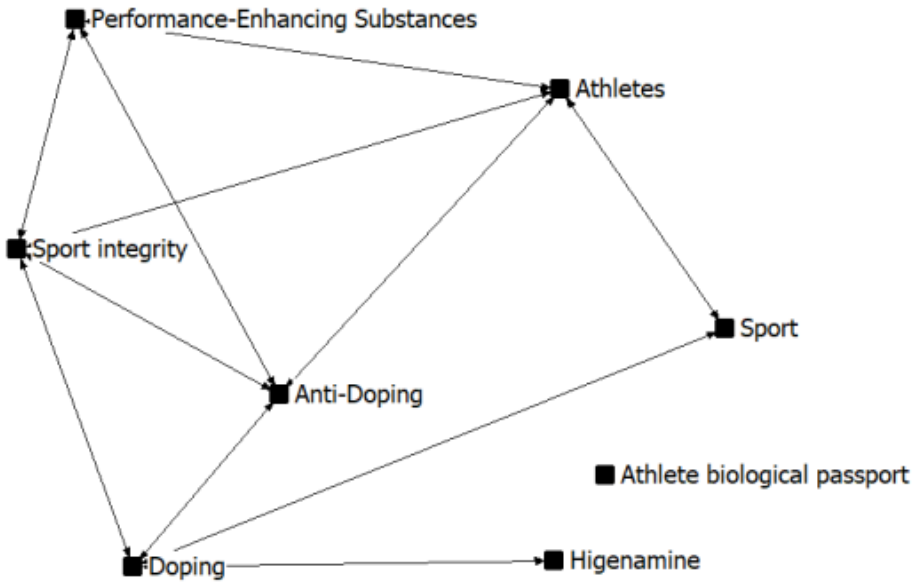
Zheng C, Zhou Y. Multi-modal IoT data fusion for real-time sports event analysis and decision support [J]. Alexandria Engineering Journal, 2025, 128: 519-32.

ABSTRACT

With the rapid development of Internet of Things (IoT) technology, real-time sports event analysis and decision support face challenges arising from the integration of multi-source spatiotemporal data. To address this issue, this paper proposes a real-time sports event analysis and decision support model based on multi-modal IoT data fusion-ST-TransBay. This model combines Spatiotemporal Graph Convolutional Networks (ST-GCN), Transformer, and a Bayesian optimization module to enhance the efficiency and accuracy of decision support systems in dynamic sports environments. To validate the effectiveness of the model, we conducted experiments using the UCI HAR and WISDM datasets. Evaluation metrics include accuracy, recall, F1-score, and inference time. The experimental results show that ST-TransBay achieved an accuracy of 95.4% and 94.6% on the two datasets, with inference times as low as 5.2 ms and 6.1 ms, respectively. These results demonstrate the model's potential in real-time sports event analysis and provide valuable insights for decision support systems in related fields.

反兴奋剂

本期反兴奋剂学术研究共检索到英文相关文献55篇，研究热点主要集中在反兴奋剂的检测、及其新技术平台、法律与伦理框架、心理-社会动因以及反兴奋剂工作的全球治理与政策改进等方面。检索结果如下：1）关键词共词分析。提取关键词94个，经过数据清洗后关键词有89个，词频为2及以上的关键词有8个，累计百分比为23.40%，高频关键词为兴奋剂、反兴奋剂、去甲乌药碱等，生成可视化知识图谱（见下图）。2）来源期刊分析。涉及期刊23种，其中载文2篇及以上的期刊有29种，所载文献累计百分比为26.09%，刊载反兴奋剂研究第一位的期刊分别为：Drug testing and analysis（JCR学科分区Q3、Q2、Q3）。3）学科交叉分析。引用文献总计1475篇，最多的频次为2次，近两年排名并列第一的文献分别为*Multiplex Nontargeted Framework Enables Tracking Metabolic Profile of Oxymetholone and Methasterone In Vivo at Nanogram Level by GC-Orbitrap-HRMS for Antidoping Purpose*、*Screening anabolic androgenic steroids in human urine: an application of the state-of-the-art gas chromatography-Orbitrap high-resolution mass spectrometry*。4）学术关注度分析。文献级别用量最多的是21次，排名前三位的文献分别为：*A SERS aptasensor based on Au@Ag bimetallic nanostars-magnetic covalent organic composites for rHuEPO-α detection*、*High-throughput multiplexed gene and cell doping analysis through CRISPR-Cas12a system integrated with blood direct PCR*、*Building a Bridge Between Ambient MS and LC-MS by Non-Exhaustive Microdesorption*。



Andersen A, Oliveira J, Loria F, et al. mRNA Biomarkers in Dried Blood Spots May Improve Detection of Autologous Blood Micro-Transfusions Using an Individualized Approach [J]. Drug Testing and Analysis, 2025.

ABSTRACT

Autologous blood transfusions (ABTs) are prohibited by the World Anti-Doping Agency (WADA), yet detecting autologous blood micro-transfusions (ABMTs) remains a challenge. Due to smaller transfused volumes, ABMTs cause attenuated biomarker changes, limiting detection sensitivity within the Athlete Biological Passport (ABP). This study assessed whether mRNA expression of 5-aminolevulinic acid synthase (ALAS2) and carbonic anhydrase 1 (CA1), measured from dried blood spots (DBS), could serve as sensitive biomarkers of ABMT. In a randomized, placebo-controlled design, 47 trained individuals (24 female; mean VO(2)peak 56 +/- 7 mLmin(-1)kg(-1)) were allocated to an ABMT group (n = 23; female = 12) or placebo group (n = 24; female = 12). The ABMT group donated 450 mL of blood and received a 130 mL packed red blood cell reinfusion 4 weeks later. Blood sampling occurred regularly before and after both donation and reinfusion. ALAS2 and CA1 mRNA expression from DBS, and reticulocyte percentage (RET%) from venous blood, were analyzed. Following blood donation, ALAS2, CA1, and RET% increased by 270%, 200%, and 150%, respectively. However, no consistent group-level changes were observed after ABMT. Individualized analysis identified more outliers for ALAS2 than for CA1, and blinded interpretation of individual mRNA profiles achieved > 95% sensitivity and specificity for detecting ABMT. These findings suggest that ALAS2 mRNA expression, assessed via minimally invasive DBS sampling, is a promising biomarker for identifying ABMT. This approach may enhance current anti-doping strategies by improving sensitivity to small-volume autologous transfusions that evade detection through traditional ABP biomarkers.

Creanga E, Ott C, Nicolae A, et al. Roxadustat as a Hypoxia-Mimetic Agent: Erythropoietic Mechanisms, Bioanalytical Detection, and Regulatory Considerations in Sports Medicine [J]. Current Issues in Molecular Biology, 2025, 47(9).

ABSTRACT

Roxadustat (ROX) is an orally active inhibitor of hypoxia-inducible factor prolyl hydroxylase (HIF-PHI) that exerts erythropoietic, cardioprotective, and metabolic regulatory effects. Approved for the treatment of anemia associated with chronic kidney disease, ROX promotes endogenous erythropoietin production and improves iron homeostasis, providing a non-injectable alternative to conventional erythropoiesis-stimulating agents (ESAs). Its ability to enhance oxygen transport and facilitate muscle recovery has, however, led to its misuse in sports, where it is classified as a banned substance by the World Anti-Doping Agency. This review provides a comprehensive overview of the pharmacological properties of ROX, its approved and

investigational clinical applications, and its chemical synthesis strategies. Particular emphasis is placed on the analytical methodologies employed for ROX detection in anti-doping settings. Techniques such as liquid chromatography-tandem mass spectrometry (LC-MS/MS), ultraviolet-visible (UV-Vis) spectroscopy, Fourier-transform infrared spectroscopy (FT-IR), and high-performance thin-layer chromatography (HPTLC) are critically assessed for their efficacy in detecting ROX and its metabolites in biological matrices. Given the increasing incidence of ROX misuse among athletes, ongoing optimization of detection protocols and longitudinal monitoring approaches, are essential to uphold both sports integrity and public health.

Cui S, Wang S, Chen R. Advanced microscale separation and mass spectrometry approaches for next-generation anti-doping in sports [J]. Microchemical Journal, 2025, 215.

ABSTRACT

Background: Clean sport increasingly depends on analytical tools able to outpace evolving clandestine doping tactics. Approach: We systematically reviewed >300 peer-reviewed studies (2014-2025) and World Anti-Doping Agency (WADA) technical documents on microscale separation techniques-capillary and microchip electrophoresis, nano- and micro-flow liquid chromatography (PLOT, UHPLC, HILIC, LC x LC) and lab-on-a-chip workflows-and their hyphenation to modern mass-spectrometers (triple-quadrupole, Orbitrap/QTOF, ion-mobility, GC-combustion-IRMS). Key advances: Microscale formats reduce solvent and sample use by >90 %, boost peak capacity, and, when coupled with dried-blood-spot or volumetric microsampling, enable minimally invasive, high-frequency testing. Online pre-concentration, active LC x LC modulation and sheathless nano-ESI now deliver sub-pg mL(-1) limits of detection for anabolic steroids, selective androgen receptor modulators (SARMs), and peptide hormones, while collision-cross-section values resolve isomeric interferences. Implications: These developments give anti-doping laboratories faster, greener and more sensitive assays, extend detection windows, and strengthen the Athlete Biological Passport with multiplexed peptide and metabolite read-outs-providing a proactive defence against emerging doping threats.

Di Giorgi A, Daziani G, Tini A, et al. Chlorthalidone in vitro metabolite identification for documenting exposure in doping [J]. Journal of Analytical Toxicology, 2025.

ABSTRACT

Diuretics are commonly used in doping because they can conceal the presence of performance-enhancing substances in an athlete's urine through dilution and promote rapid weight loss. As a result, these substances are prohibited in sports by the World Anti-Doping Agency (WADA) under the S5 category ("Diuretics and Masking Agents"). Chlorthalidone, a thiazide-like diuretic, is medically used as an antihypertensive agent

and is prescribed for conditions such as heart failure and liver cirrhosis. However, it is also misused in doping. The detection of chlorthalidone or its metabolite markers in an athlete's urine is essential to prove consumption. Therefore, the aim of the study was to assess the metabolism of the substance in humans. For this purpose, chlorthalidone metabolites were predicted with GLORYx (Hamburg University, Germany) to identify the transformations that may occur with higher probability; the compound was incubated with 10-donor-pooled human hepatocytes to simulate hepatic metabolism; and the incubates were analyzed by liquid chromatography-high-resolution tandem mass spectrometry (LC-HRMS/MS) and software-aided data mining. In silico simulations predicted 11 Phase II metabolites, with N-acetylation at the sulfonamide group being the predominant transformation (88% probability score); other major reactions included O-glucuronidation, O-sulfation, and glutathione conjugation, with probability scores lower than 70%. Two metabolites were identified in in vitro hepatocyte incubates and presented a reduction or a hydroxylation at the phthalimidine moiety. To the best of the authors' knowledge, these metabolites are specific to chlorthalidone and can be targeted as markers for analytical screening in anti-doping controls.

Gómez-Tagle A, Bressan C, Ventura R, et al. Biosynthesis and Identification of Clenbuterol Metabolites in Urine and In Vitro Microsome Incubation Samples Using UHPLC-Q-Exactive Orbitrap Mass Spectrometry: A Comparison Between Human and Bovine Metabolism [J]. Drug Testing and Analysis, 2025.

ABSTRACT

Clenbuterol (Clb) is a beta 2-agonist drug included in the list of substances prohibited during and out of competition by the World Anti-Doping Agency (WADA-AMA). Several adverse analytical findings have been detected by accredited WADA laboratories, but athletes often claim that results are due to dietary contamination. In this contribution, bovine microsomal incubation and the excretion of bovine and human urinary metabolites of Clb were analyzed and compared using liquid chromatography electrospray Q-Exactive-Orbitrap mass spectrometry to determine differences in Clb metabolism. Urine samples were processed by solid-phase extraction prior to electrospray analysis in both the positive and negative ion modes. MS/MS experiments were obtained by parallel monitoring reaction (PRM) triggered by an inclusion ions list. The strategy for metabolite identification involved the search for typical biotransformation based on accurate mass shifts using diagnostic fragment ions from the parent drug. This approach successfully identified eight metabolites, including a novel N-methylated form of Clb, reported here for the first time. Additionally, four metabolites found exclusively in bovine urine offer significant potential for further research aimed at distinguishing unintentional doping.

Hsu C, Kadheem M, Kanjariya P, et al. Recent advances of optical and electrochemical (bio)sensors for doping agents detection in sport [J]. Journal of Industrial and Engineering Chemistry, 2025, 150: 134-58.

ABSTRACT

The illicit use of doping substances has led to numerous ethical and health issues. Therefore, to have a healthy sports community, continuous doping control is essential. Accurate and rapid quantitative detection at the ng/mL level in complex matrix (blood, urine, and other biological matrices) is crucial for reliable judgments about anti-doping analysis in athletes. Enhancing the efficacy of traditional classical analytical techniques and developing innovative analytical methods, such as bioassay technology, is essential. In this review, a comprehensive study of optical and electrochemical biosensors for anti-doping detection is presented. We examine various classes of recently developed optical and electrochemical (bio)sensors for the determination of banned substances in anti-doping contexts. In the near future, these optical and electrochemical (bio)sensors could be commercialized and potentially replace traditional anti-doping control techniques, such as chromatographybased methods.

Kintz P, Alvarez J, Gheddar L. Testing for Meldonium, a Doping Agent, in Human Hair [J]. Drug Testing and Analysis, 2025.

ABSTRACT

Meldonium has been developed in the 70s in Latvia and is currently used in a limited number of countries for heart-related diseases, such as heart attack, failure, or angina pectoris. Due to its metabolic properties (decrease of lactate production, increase of glycogen use, and protective action again oxidative stress), meldonium has been abused by numerous athletes to enhance their performance. The drug has been prohibited by the World Anti-Doping Agency since 2016 and is on the S4.4.3 list (metabolic modulators) of the prohibited substances at all times. As athletes can challenge their anti-doping violation involving meldonium, there is an interest in testing for it in hair in order to document their pattern of exposure. Such hair application can be complicated to develop, as meldonium has a chemical formula close to an amino acid and presents an ionized fraction, which are limiting factors for drug incorporation into hair. Liquid chromatography coupled to tandem mass spectrometry was used. The drug was extracted from hair after methanol incubation in an ultrasound bath and separation on a BEH HILIC column. Linearity was verified from 0.5 to 100 pg/mg (R 2 = 0.9943). The limit of detection was 0.1 pg/mg. Although their meldonium regimen was unknown, the drug was identified in the proximal hair segment (0 to 1 cm) of three consumers at 0.7, 6.1, and 17 pg/mg, highlighting for the first time the incorporation in hair of this molecule.

Krombholz S, Korsmeier L, Thevis M. Transdermal Uptake of Substances Banned in Sports and Its Relevance for Doping Controls [J]. International Journal of Sports Medicine, 2025.

ABSTRACT

Transdermal drug delivery has emerged as an area of significant interest in both pharmaceutical sciences and antidoping research. This narrative review explores the implications of transdermal uptake of substances banned in sports, emphasizing its relevance for doping control analysis. The human skin's complex role as both a barrier and a site of drug absorption is examined, alongside studies investigating the transdermal administration of substances on the World Anti-Doping Agency Prohibited List, including approved transdermal formulations and drug candidates. Recent cases demonstrate that (unintentional) dermal exposure of athletes to substances banned in professional sports, e.g., clostebol, can lead to an adverse analytical finding in doping controls. Consequently, studies investigating the detectability and metabolism of transdermally administered doping substances, which might even support identifying the route of exposure, are becoming increasingly important. This review emphasizes the relevance of addressing the skin as a pathway for both intentional doping and unintentional contamination, outlining critical implications for global antidoping efforts and future research priorities.

Krumm B, Lewis L, Morkeberg J, et al. Estimation of Plasma Volume by Machine Learning to Improve the Interpretation of the Athlete Biological Passport [J]. Drug Testing and Analysis, 2025.

ABSTRACT

The identification of confounding factors related to plasma volume (PV) fluctuations is crucial for appropriate qualitative interpretations of Athlete Biological Passport (ABP) profiles. As part of ongoing efforts to remove PV variance from the concentration-based biomarkers such as hemoglobin concentration ([Hb]), a new machine learning model for blood volume (BV) estimation using a single complete blood count analysis was applied within the ABP framework. Forty existing ABP profiles from elite athletes and healthy control subjects were used. PV was estimated using a machine learning model trained on a previous dataset. First, a visual display of the estimated PV shift was added in overlay of individual profiles. Alternatively, individual [Hb] thresholds were adjusted in a new graphical profile to account for PV variations. Finally, a set of ABP profiles with PV estimations was presented to ABP experts to assess the model's relevance in interpreting hematological data. A moderate correlation was found between measured and estimated PV in both men ($r = 0.40$, $p < 0.0001$) and women ($r = 0.39$, $p < 0.0001$), supporting the validity of the estimation model. In addition, ABP experts favorably assessed the available PV information, particularly the visual representation of PV. This novel estimation model offers distinct advantages (e.g., same biomarkers currently analyzed from routine ABP analyses) and could therefore be of particular interest. Further application of this model in the presence of specific and transient confounding factors may allow to confirm these results.

Kühnle F, Reich L, Mayer J, et al. Structural dynamics of whistleblowing on doping in sport: Empirical findings of a qualitative mixed methods approach [J]. International Review for the Sociology of Sport, 2025.

ABSTRACT

While anti-doping organisations, state authorities and investigative journalists increasingly rely on information from whistleblowers, little is known about the social conditions influencing athletes', coaches' and other insiders' decision to blow the whistle on doping. To address characteristic shortcomings and blind spots of previous research, we introduce theoretical considerations and the qualitative mixed methods approach of a sociological research project (WBS study) specifically designed to observe actual whistleblowing, adopting an amoral perspective and identifying the social conditions of the decision-making process. In the main section, we present findings on structural dynamics underlying the decision to report doping, focusing on four key analytical levels: public, organisation, team/group and intimacy. Our results demonstrate that whistleblowers do not act autonomously or heroically; rather, they are driven by the dissolution of the spiral of silence and broken image effects in the public discourse; organised hypocrisy and the abolition of the back stage in dealing with convicted dopers; changing group affiliation, an asymmetry of dark secrets and escalating conflicts in deviant groups; love as a catalyst and the reversing of intimacy in intimate relationships of dopers. The observed dynamics help to identify sensitive phases marked by an increased willingness to report doping and are thus highly relevant for anti-doping policy.

Muwonge H, Lubega S, Zavuga R, et al. Ugandan athletes' and coaches' experiences and perceptions on the effectiveness and legitimacy of the doping control process [J]. Bmc Sports Science Medicine and Rehabilitation, 2025, 17(1).

ABSTRACT

Background: Doping undermines competitive integrity and endangers athlete health, with performance-enhancing substances linked to severe adverse effects. While the World Anti-Doping Agency (WADA) provides standardized testing protocols, developing countries such as Uganda face significant enforcement challenges. This study aimed to explore Ugandan athletes' and coaches' experiences and perceptions of the doping control process, emphasizing its effectiveness and legitimacy. Methods: A mixed-methods cross-sectional study was conducted, including a survey of 346 Ugandan athletes using a modified WADA questionnaire to evaluate perceptions on test accuracy, detection likelihood, and enforcement seriousness. Additionally, 196 coaches participated in 12 focus group discussions (FGDs) across four regions of Uganda to provide deeper insights. Results: Athlete participants had a mean age of 24 years (+/- 6); 82% were male, and only 19% had ever been tested for doping. 56% believed doping tests were more likely during competitions compared to 39% for out-of-competition testing, with 55% confident they could evade detection. Approximately half considered anti-

doping procedures fair and transparent. Only 17% felt that "NADO-Uganda" treated athletes equally, with 58% uncertain, indicating limited knowledge rather than a definitive view of unfairness. Coach participants, with a mean age of 32 years (+/- 14), reinforced the quantitative findings, emphasizing infrequent doping tests and persistent concerns about procedural transparency and fairness, which undermined trust and perceived legitimacy. Conclusion: There are significant gaps in doping control in Uganda, where infrequent testing and ambivalence regarding enforcement transparency diminish anti-doping measures. Strengthening Uganda's anti-doping framework requires increased testing frequency, culturally tailored education to bridge knowledge gaps, and enhanced procedural transparency and consistency. These measures are essential to establish a credible anti-doping system that supports clean sport values despite resource constraints.

Oja S, Lehtonen K. Strengthening the status quo: moral regulation of anti-doping policy [J]. Journal of the Philosophy of Sport, 2025.

ABSTRACT

For the legitimacy of anti-doping policy, it is essential to reinforce the negative attitudes of various stakeholders towards doping in sports. In this article, the authors utilize the theoretical framework of moral regulation to examine how the ethos and identity of clean sport are produced and normalized within anti-doping activities. Their specific focus is on the Clean Win programme, coordinated by the Finnish Center for Integrity in Sports (FINCIS). Based on their analysis of social media content and training material, the programme can be characterized as a moral regulation project involving a diverse group of actors, where anti-doping is portrayed as a shared and collective responsibility. Theoretically, their article emphasizes the comprehensive nature of moral regulation rather than the elimination of deviant behaviour, as well as the targetlessness of moral regulation projects.

Ren X, Shi Y, Xiao B, et al. Gene Doping Detection From the Perspective of 3D Genome [J]. Drug Testing and Analysis, 2025, 17(9): 1475-89.

ABSTRACT

Since the early 20th century, the concept of doping was first introduced. To achieve better athletic performance, chemical substances were used. By the mid-20th century, it became gradually recognized that the illegal use of doping substances can seriously endangered athletes' health and compromised the fairness of sports competitions. Over the past 30 years, the World Anti-Doping Agency (WADA) has established corresponding rules and regulations to prohibit athletes from using doping substances or restrict the use of certain drugs, and isotope, chromatography, and mass spectrometry techniques were accredited to detect doping substances. With the development of gene editing technology, many genetic diseases have been effectively treated, but enabled by the same technology, doping has also the potential to pose a threat to sports in the form of gene doping.

WADA has explicitly indicated gene doping in the Prohibited List as a prohibited method (M3) and approved qPCR detection. However, gene doping can easily evade detection, if the target genes' upstream regulatory elements are considered, the task became more challenging. Hi-C experiment driven 3D genome technology, through perspectives such as topologically associating domain (TAD) and chromatin loop, provides a more comprehensive and in-depth understanding of gene regulation and expression, thereby better preventing the potential use of 3D genome level gene doping. In this work, we will explore gene doping from a different perspective by analyzing recent studies on gene doping and explore related genes under 3D genome.

Sakamoto S, Osaki K, Abe H, et al. Metabolism of coclaurine into the WADA-banned substance higenamine: a doping-relevant analytical evaluation of Kampo extracts [J]. Journal of Natural Medicines, 2025, 79(5): 1140-53.

ABSTRACT

Higenamine, a beta 2-agonist, has been listed as a prohibited substance by the World Anti-Doping Agency (WADA) since 2017, poses a doping risk through the use of traditional herbal formulations. In Japan, Kampo medicines, composed of multiple crude drugs, are widely used, raising concerns about the unintentional intake of banned substances. In this study, urinary excretion of higenamine was observed in mice following coclaurine administration, and higenamine formation was confirmed in human liver microsomes, indicating a potential risk associated with coclaurine-containing herbs. Therefore, 128 Kampo extract products were analyzed to identify crude drugs containing higenamine and/or coclaurine using lateral flow immunoassay (LFA), enzyme-linked immunosorbent assay (ELISA), and liquid chromatography-tandem mass spectrometry (LC-MS/MS) analysis. Consequently, fourteen crude drugs were identified to contain higenamine and/or coclaurine. Notably, six crude drugs-including Magnolia bark, Japanese Zanthoxylum peel, Jujube seed, Magnolia flower, Cimicifuga rhizome, and Coptis rhizome-were newly confirmed to contain higenamine, while nine-including Cinnamon bark, Magnolia bark, Euodia fruit, Asiasarum root, Japanese Zanthoxylum peel, Cimicifuga rhizome, Jujube, Processed Aconite root, and Phellodendron bark-were newly identified as containing coclaurine. These results underscore the potential risk of doping violations associated with coclaurine, which may be metabolized into higenamine, although coclaurine is not currently classified as a prohibited substance. Our findings highlight the need for regulatory consideration to mitigate unintentional doping risks among athletes using Kampo medicine.

Vesic Z, Stojicevic J, Rancic N, et al. Differences in anti-doping knowledge among Serbian professional athletes [J]. Frontiers in Public Health, 2025, 13.

ABSTRACT

Objectives: The aim of this study was to examine the impact of anti-doping education among professional

athletes on anti-doping knowledge. Methods: A prospective cohort study was conducted on differences in knowledge toward doping among 404 professional athletes in relation to their education about doping. Results: Participants who underwent education answered correctly significantly more often on most of the questions compared to participants without education [difference of about 20-30% in the rate of correct answers is in favor of participants with education on every question; 8.49 (SD 2.75) vs. 11.04 (SD 1.89); $p < 0.001$]. The majority of participants in the group with prior education against doping answered 10 or more questions correctly out of a total of 13, while the group without prior education against doping most commonly had 7 to 11 correct answers ($p < 0.001$). The most significant predictors of correct answers are gender, number of years of training, type of sport (individual or team sport), and prior education about doping. The largest contribution to this model comes from the variable "prior education against doping," followed by the type of sport. Conclusion: Our research shows that prior anti-doping education is effective and has the essential contribution on athletes' knowledge about doping.

Voss S, Schwenke D, HempelJ, et al. Determining the Compliance of the Sysmex XR-1000 Haematology Analyser With WADA Athlete Biological Passport Specifications [J]. Drug Testing and Analysis, 2025.

ABSTRACT

The athlete biological passport (ABP) has been established as an anti-doping tool based on the statistical analyses of an athlete's biological variables over a period of time. It was introduced in 2007. An important aspect to ensure interlaboratory comparability was to use only one analytical platform-the Sysmex XT-2000. When the new Sysmex XN-1000 platform replaced the XT-2000i in 2019, there was a bias for the reticulocyte percentage. Although clinically insignificant, it interfered with interpreting athletes' haematological profiles for anti-doping purposes; therefore, it was necessary to adjust the haematological module. With the introduction of the new Sysmex XR-Series in 2023, an implementation of this new instrument could become necessary in the future. While the analytical performance of the XR-Series for clinical purposes has been evaluated previously, data in the context of ABP requirements, which are defined in WADA's technical documents, are not available. Therefore, our goals were to compare the XR-series with the XN-1000 and to evaluate their performance within an anti-doping context. Over 300 samples were analysed on the two instruments following WADA's technical document TD2021BAR, which defines the analytical requirements. The results for all ABP parameters including the calculated OFF-Score (OFF-hr) and the Abnormal Blood Profile Score (APBS) showed excellent interplatform comparability. In conclusion, our study demonstrates that the Sysmex XR meets WADA's requirements for haematological analysis. It can confidently replace the Sysmex XN in anti-doping laboratories without compromising the integrity of WADA's ABP longitudinal profiles.

Yi J, Choi H, Kim M, et al. High-throughput multiplexed gene and cell doping analysis through CRISPR-Cas12a system integrated with blood direct PCR [J]. Science Advances, 2025, 11(28).

ABSTRACT

Advancements in gene and cell therapies introduce "gene and cell doping," requiring efficient and sensitive detection methods. Here, we report a high-throughput multiplexed gene and cell doping analysis (HiMDA) using CRISPR-Cas12a system integrated with blood direct polymerase chain reaction (PCR). Blood direct PCR enables simultaneous amplification of multiple exogenous genes directly from whole-blood samples. Coupled with sequence-specific DNA recognition and fluorescence reporter system, HiMDA achieves multiplexed, on-target detection of doping genes and cells. Our results demonstrate HiMDA's feasibility with only 5 microliters of blood required for the entire 90-minute process. HiMDA exhibits exceptional sensitivity, detecting as few as 2.5 copies of doping target genes from blood-four times more sensitive than current anti-doping standards-and identifying in vivo doping up to 10 days. These findings highlight HiMDA's robust high-throughput, multiplexed capabilities, satisfying the sensitivity and selectivity demands of anti-doping research. HiMDA offers a flexible solution to meet future doping detection challenges.

Zhang S, Boardley I, Liu J, et al. The 'selves' in doping and its psychosocial mechanisms: harmonised multi-country evidence from high-performing athletes in the UK, US, and China [J]. Harm Reduction Journal, 2025, 22(1).

ABSTRACT

Background: Doping remains an ongoing threat to clean competition. To date, global preventive initiatives have not addressed critical psychosocial antecedents of doping thoroughly due to the scarcity of knowledge regarding its psychosocial mechanisms from a harmonised cross-country perspective. We, therefore, conducted a multi-country investigation testing the interplay of two important yet overlooked attributes, namely narcissism and self-compassion, and examined their psychosocial mechanisms underpinning doping. Methods: Using a sample of 499 high-performing athletes (80% competing at national level or above) from the UK, US, and China, we performed a series of multi-variate multi-group moderation models to test the narcissism x compassion interaction on doping and examined potential psychosocial mechanisms underlying such effects. In all analyses, we applied cluster control to adjust for coach-/team-level confounds and compared fixed vs. random effects models for cross-country comparisons. Results: We found an identical interaction across study countries showing self-compassion alleviates narcissism-related doping willingness (especially that vulnerable narcissism drives). Grandiose narcissism's protective effect on vulnerable narcissism-related doping moral disengagement was invariant across countries. Resilient coping appears to be a consistent mechanism across study countries that explains narcissism-related risk and compassion-related protection. Fear of failure manifested varied mechanistic effects in different study countries, inferring potential cross-cultural differences. Conclusion:

Vulnerable narcissism is a critical person-level correlate of doping. Grandiose narcissism, in the presence of self-compassion, can alleviate such risk thanks to enhanced resilient coping. Future education and interventions should tackle these important person-level attributes for anti-doping.

Zheng S, Ge Y, Fang X, et al. Characterization and metabolic profiling of oxymetholone and methasterone metabolites studied with human liver S9 model using GC-Orbitrap-HRMS for anti-doping purposes [J]. Analytical and Bioanalytical Chemistry, 2025.

ABSTRACT

In vitro metabolic models provide a means to circumvent the ethical concerns associated with human administration research, allowing for preliminary predictions of human metabolism while generating high concentrations of metabolites for characterization. As S1.1-class anabolic androgenic steroids on the World Anti-Doping Agency (WADA) Prohibited List, oxymetholone and methasterone have consistently appeared in the top 20 substances identified in adverse analytical findings (AAFs) in recent years, reflecting their persistent abuse patterns in sports. Given their exogenous nature, the metabolites of these steroid hormones fall within the scope of doping control, making metabolic studies a crucial aspect of anti-doping research. In this study, human liver S9 fractions were employed as a model for the characterization and metabolic profiling of oxymetholone and methasterone via gas chromatography-orbitrap-high-resolution mass spectrometry (GC-Orbitrap-HRMS). The full scan mode of GC-Orbitrap-HRMS was utilized to detect free and two conjugated fractions of metabolites, comparing these with control groups to confirm the metabolites during in vitro incubation. Possible metabolite structures were inferred from EI mass spectra, and the metabolic pathways for both drugs were discussed. In vitro, three oxymetholone and five methasterone metabolites were identified, and among them, two metabolites, OMT-M3 (2 alpha,17 alpha-methyl-5 xi-androstan-3 alpha,6 beta,17 beta-triol) and MTS-M3 (2 alpha,17 alpha-dimethyl-5 xi-androstane-3 alpha,12 xi,16 xi,17 beta-tetrol), were characterized as novel metabolites based on recent human in vivo metabolic studies. These metabolites exhibited diverse metabolic pathways, and their structures were corroborated through complementary in vitro and in vivo metabolic analyses. This study provides a comprehensive evaluation of the applicability of the human liver S9 model in the metabolic studies of anabolic steroids in vitro, verifying novel human metabolites and providing valuable insights for future research in this field.