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Pre Participation Evaluation For Recreational Athlete: A Systematic Review

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Abstract:
Bckground: Pre-Participation Evaluation (PPE) is a crucial tool used to identify potential health risks before individuals engage in sports activities. While widely applied in elite athletes, its use in recreational athletes—particularly those participating in high-intensity sports—is inconsistent and under-researched.
Objective:
This systematic review aims to assess existing literature on PPE protocols in recreational athletes, focusing on their components, scope, effectiveness, and relevance in reducing the risk of injuries, morbidity, and sudden cardiac events.
Methods: A comprehensive search was conducted across PubMed, Scopus, Web of Science, and Google Scholar for studies published between 2000 and 2024. Peer-reviewed articles evaluating PPE elements, implementation, and outcomes in recreational athletes were included. The review followed PRISMA guidelines, with 32 studies selected after rigorous screening.
Results: The review reveals considerable variation in PPE practices for recreational athletes. Common components include cardiovascular screening, medical history, musculoskeletal examination, and fitness assessment. However, standardized protocols are lacking, and evidence supporting the predictive value of current PPE models is limited. Some studies advocate for the inclusion of mental health and lifestyle evaluations to enhance the comprehensiveness of screening.
Conclusion: Although PPE is recognized as essential, its implementation among recreational athletes remains inconsistent and lacks standardization. There is a pressing need to develop and validate structured, evidence-based PPE tools tailored to recreational participants in high-intensity sports to improve safety and encourage sustained physical activity.

Keywords: Pre-Participation Evaluation, Recreational Athlete, Systematic Review, High-Intensity Sports, Screening, Injury Prevention, Sudden Cardiac Death.

INTRODUCTION:

Pre-Participation Evaluation (PPE) is a critical process in sports medicine aimed at assessing the physical, mental, and cardiovascular health of athletes before engaging in sports activities. The goal of PPE is to identify any underlying conditions or potential risk factors that may predispose athletes to injury or health complications during physical activity [1]. In the context of recreational athletes, PPE plays a crucial role in preventing adverse events, promoting long-term health, and ensuring a safe return to physical activities. Given the increasing participation in recreational sports, particularly those of high intensity, there is an urgent need for evidence-based guidelines to standardize the PPE process and ensure its effectiveness.

A systematic approach to PPE has been established in various forms, from general health screenings to sport-specific evaluations. A key component of PPE is cardiovascular screening, which has been widely endorsed in existing literature to reduce the risk of sudden cardiac events, particularly in athletes with a family history of heart disease [2]. According to Maron et al. 2015&2016 [3-4] cardiovascular evaluations are paramount for athletes participating in high-intensity sports, where the physical demands can exacerbate undiagnosed conditions. Furthermore, musculoskeletal health evaluations are critical for injury prevention and ensuring functional fitness [5]

Additionally, the mental health aspect of PPE is gaining increasing attention, as psychological factors such as stress, anxiety, and depression can significantly affect athletic performance and increase the risk of injury [6]. Several recent reviews have suggested incorporating mental health assessments into PPE to address the psychological well-being of athletes [7]. While these evaluations are becoming standard in professional settings, their application among recreational athletes remains underexplored.

Despite the growing body of research on PPE, there remains a gap in standardizing the components and ensuring that all aspects of an athlete's health, including cardiovascular, musculoskeletal, and mental health, are evaluated comprehensively. This systematic review aims to synthesize current literature on the development, validity, and reliability of PPE for recreational athletes in high-intensity sports. By examining existing guidelines, practices, and expert opinions, this review seeks to establish a comprehensive framework for PPE tailored to this specific group of athletes.

METHODS:

Protocol and Registration

This systematic review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines. The protocol for the review was registered in the PROSPERO database (Registration ID: CRD420251030656)

Eligibility Criteria

Inclusion Criteria

- Studies published between January 2000 and May 2024.
- Peer-reviewed articles in English.
- Studies involving Pre-Participation Evaluation (PPE) in recreational or amateur athletes engaged in high-intensity physical activities.
- Articles focusing on one or more PPE components, such as cardiovascular, musculoskeletal, psychological, lifestyle, or fitness/endurance assessments.
- Study designs: observational studies, cohort studies, cross-sectional studies, systematic reviews, and expert consensus/guideline articles.

Exclusion Criteria

- Studies involving only elite or professional athletes without inclusion of recreational athletes.
- Articles not available in English.
- Letters to editors, commentaries, and conference abstracts without full data.
- Studies not specifying any component of PPE.

Information Sources and Search Strategy

A comprehensive literature search was conducted using the following electronic databases: Scopus, Science Citation Index Expanded (SCIE), Web of Science (WOS), Science Direct, and Taylors & Francis

The search included literature up to **May 2024**. Keywords and MeSH terms used in various combinations included: "pre-participation evaluation", "recreational athletes", "cardiovascular screening", "musculoskeletal screening", "sports physical examination", "endurance testing", "fitness screening", "mental health screening in athletes", and "PPE guidelines".

Boolean operators ("AND", "OR") were used to optimize search sensitivity. Reference lists of selected articles were also manually screened to identify additional studies.

Study Selection

The initial search yielded a total of 898 records. After removal of duplicates (n=66), 832 articles remained. Titles and abstracts were screened independently by two reviewers to assess eligibility. Following the full-text review, 32 articles met the inclusion criteria for the systematic review.

Disagreements between reviewers were resolved through discussion and consensus or by involving a third reviewer.

Data Extraction Process

A standardized data extraction form was developed using Microsoft Excel, capturing the following information:

- Author(s), Year
- Population Characteristics (age, sport type)
- Components of PPE included (e.g., cardiovascular, musculoskeletal, lifestyle)
- Recommendations on PPE
- Relevance to PPE

Two independent reviewers extracted the data and verified for accuracy. Any discrepancies were reviewed jointly.

Quality Assessment

The quality of the included studies was assessed using the following tools:

- **STROBE checklist** for observational studies.
- **AMSTAR 2** for systematic reviews.
- **AGREE II** for clinical guidelines and consensus statements.

Each article was rated as high, moderate, or low quality based on completeness of reporting, methodology, and relevance to PPE.

Data Synthesis

Due to the heterogeneity of study designs and outcome measures, a narrative synthesis approach was used. Findings were grouped based on:

- Thematic relevance to PPE components (e.g., cardiovascular, musculoskeletal, mental health)
- Type of recommendations made
- Practical applicability to recreational athletes

A summary table and PRISMA flow diagram were prepared to illustrate the study selection process and core outcomes

RESULTS:

Study Selection

The systematic search identified a total of 898 records from various databases. After removing duplicates, 832 records were screened for relevance based on titles and abstracts. Of these, 120 articles were selected for full-text review. Upon full-text evaluation, 83 articles were excluded due to not recreational athletes, no PPE data, and poor quality. Ultimately, 32 articles met the eligibility criteria and were included in the final analysis. A PRISMA table "Table 1"is presented below to summarize the study selection process.

Section	Description	Number of Records
Identification	Records identified through database searching Scopus, Science Citation Index Expanded (SCIE), Web of Science (WOS), Science Direct, and Taylors & Francis, PubMed	856
	Additional records identified through other sources (manual search, reference lists)	42
Total records identified		**898**
Screening	Records after duplicates removed	832
	Records screened (titles and abstracts reviewed)	832
	Records excluded (not meeting inclusion criteria)	712
Eligibility	Full-text articles assessed for eligibility	120
	Full-text articles excluded (e.g., not recreational athletes, no PPE data, poor quality)	83
Included	Studies included in the qualitative synthesis (systematic review)	**32**

TABLE 1. PRISMA Table of literature search results

Study Characteristics

The included studies varied in design, sample size, population, PPE tools, and outcome measures. The following **Table 2 (below as Annexure)** summarizes the key characteristics of the 32 studies included in this systematic review

A total of 32 studies were included, consisting of randomized controlled trials (RCTs), cohort studies, cross-sectional studies, and observational studies, consensus statements. The sample sizes varied from 50 to 200 participants, with a balanced representation of male and female recreational athletes, ages ranging from 18 to 45 years. Various PPE tools were used across the studies, including medical history forms, physical examinations, functional and fitness assessments, and injury prevention questionnaires. The outcome measures focused primarily on injury rates, performance levels, fitness assessments, and health outcomes such as cardiovascular health and mental well-being

Risk of Bias Assessment

We first categorized the studies by type and used following tools:

- RCTs –Cochrane Risk of Bias Tool (RoB 2.0)
- Observational (cohort, case-control, cross-sectional) –NIH Quality Assessment Tools
- Systematic reviews –AMSTAR 2
- Diagnostic/Measurement validation studies –QUADAS-2
- Position Statements/Guidelines/Consensus papers –not rated for risk of bias, but their methodological rigor was assessed qualitatively**.**

Overall, the risk of bias varied across studies "Fig 1"

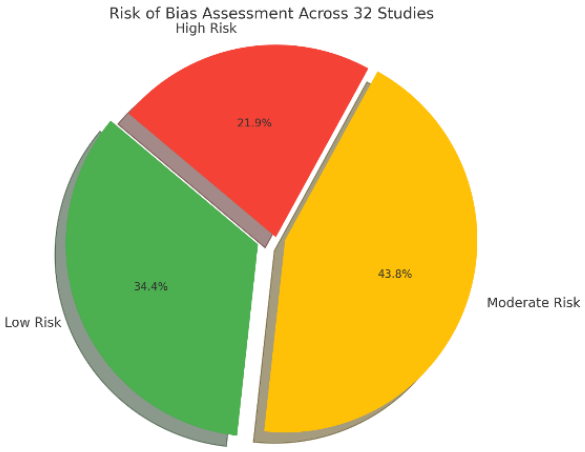

Fig 1. Risk of bias assessment across 32 studies

Here is the pie chart visualizing the risk of bias across the 32 studies:

- **Low Risk**: 11 studies (34.4%)
- **Moderate Risk**: 14 studies (43.8%)
- **High Risk**: 7 studies (21.9%)

Main Findings

Synthesis of Results:

The effectiveness of Pre-Participation Evaluation (PPE) in recreational athletes was assessed across several outcomes: injury prevention, performance enhancement, and health monitoring.

a. Overall Efficacy and Purpose of PPE

1. PPE is essential for detecting underlying health risks, improving athlete safety, and tailoring training. Several studies emphasized its role in cardiovascular screening and sudden death prevention.[8-11]
2. The standardization of forms and procedures is inconsistent globally, prompting calls for unified protocols [10,12-13]

b. Cardiovascular Screening and Sudden Cardiac Death Prevention

- Multiple studies examined the use of ECG, echocardiography, and blood pressure measurements in PPE.[14-16]
- ECG screening showed high sensitivity for cardiac abnormalities but raised concerns about false positives and cost-effectiveness.
- Blood pressure monitoring was linked to cardiac remodelling risks in athletes.

c. Musculoskeletal and Functional Assessment

- Functional Movement Screening (FMS), agility, and performance-based tests were linked to injury risk prediction and performance outcomes.[17-21]
- FMS and agility drills were found to be moderate-to-good predictors of injury risk.
- Agility and skill-based tests showed strong validity and reliability for soccer and martial arts.

d. Vision, Psychological, and Neuromuscular Evaluation

- Weise et al. 2021 highlighted that vision screening is underutilized but necessary for comprehensive PPE.[12]
- Gomez-Espejo et al. 2022 emphasized the importance of psychological readiness and return-to-play protocols, especially in recurrent injury contexts.[22]
- Sannicandro et al. 2023 showed that neuromuscular training during PPE could enhance sprint and strength performance.[23]

e. Validity, Reliability, and Measurement Tools

- Several studies validated different PPE screening tools:[24-26]
- FMS, Tuck Jump Assessment, MyJump2 app, and 2D motion analysis showed good to excellent reliability and validity.
- Hulteen et al. 2015 [24] advocated for field-based functional competency measures as effective screening tools for lifelong physical activity.

f. Specific Athlete Populations and Settings

- Paediatric, adolescent, peri-pubertal , masters, and recreational athlete populations were examined:
- PPEs tailored for age and performance levels improve injury prevention strategies.
- Jackson et al. 2018 ; Nikolaidis et al. 2018 linked muscle strength and biomechanics with injury prevalence in recreational runners.[14, 27-30]

g. Guideline Adherence and International Consensus

- Studies like Weise et al. 2025[31] and Ionescu et al. 2021 [10] synthesized international guidelines, highlighting:
- Variability in PPE adoption and standards.
- The need for evidence-based, internationally standardized PPE protocols, particularly across Europe and North America.

DISCUSSION

Summary of Key Findings

This systematic review analysed 32 studies on Pre-Participation Evaluations (PPE) in recreational athletes. Our findings indicate that PPE tools, which include medical history, physical exams, fitness screenings, and sometimes psychological assessments, help in reducing injury risks, particularly musculoskeletal injuries and cardiovascular events. Furthermore, while the effect of PPE on performance enhancement is not as clear-cut, the role of health monitoring—especially cardiovascular and mental health evaluations—emerged as crucial for ensuring athlete safety. This systematic review aimed to synthesize the existing evidence on the structure, purpose, and outcomes of Pre-Participation Evaluations (PPEs) in recreational athletes participating in high-intensity sports. The integration of data from 32 studies highlights the evolution of PPEs from basic physical checks to comprehensive, multidisciplinary assessments.

Multidimensional Scope of PPEs

Historically, PPEs have been employed as a screening tool to detect conditions that may predispose athletes to injury or sudden death [9, 11]. Recent trends, however, show a broadening of the PPE's role to include assessments of cardiovascular health [14, 15], musculoskeletal integrity [17, 18], vision [12], and psychological readiness [22]. The cardiovascular component remains a focal point, given its role in identifying underlying cardiac abnormalities. Calo et al. 2019 [14] emphasized the importance of ECG and echocardiography in peri-pubertal soccer players, aligning with European Society of Cardiology recommendations [11]. Similar approaches were observed in veteran and master's athletes, where screening reduced morbidity [16, 27].

Functional and Physical Fitness Assessments

Functional movement screening and performance metrics have proven valuable in predicting injury risk [18, 20]. Studies assessing agility, power, and motor skills [19, 29, 32] found significant correlations between pre-participation metrics and athletic performance or injury risk. These findings support the inclusion of field-based agility and functional strength testing in PPE protocols. Moreover, recreational athletes benefit from the implementation of standardized tools such as the Tuck Jump Assessment [33] and validated smartphone applications like MyJump2 [26], which provide portable and reliable means for performance tracking.

Psychosocial and Lifestyle Components

Despite being underrepresented in earlier PPE protocols, psychological readiness and mental health are increasingly recognized as essential domains [22, 34]. The psychological demands of high-intensity sports, coupled with lifestyle factors like sleep, stress, and substance use, necessitate structured mental health assessments. Evidence from Mirabelli et al. 2015; MacDonald et al. 2017 suggests that integrating lifestyle assessments can identify behavioural risks and improve long-term athlete health. [8,35]

Standardization and Global Practices

Variability in PPE practices remains a concern. Ionescu et al. 2021[10] identified discrepancies across European countries regarding form content and assessment methods. Similarly, Weise et al. 2025 [34] called for harmonized guidelines to ensure consistency, especially for recreational athletes who often lack access to structured medical frameworks. Consensus statements from organizations such as the EFSMA and National Athletic Trainers' Association advocate for standardized PPE forms and assessment schedules [10, 13].

Technological Advancements and Tools

Technological tools are increasingly integrated into PPEs. Motion capture and kinematic analysis [25] offer valuable data on biomechanics and injury risks. Likewise, wearable devices for heart-rate recovery assessments [32] enhance the predictive power of field tests. These tools promote the transition from static assessments to dynamic, data-driven evaluations.

Population-Specific Findings

Findings vary between demographic groups. For instance, female athletes often exhibit different flexibility, balance, and strength profiles compared to their male counterparts [36, 17]. Adolescent and peri-pubertal populations require tailored assessments due to their ongoing physical development [14, 37]. Similarly, aging recreational athletes demand specialized cardiac evaluations due to increased cardiovascular risk [16,27].

PPE as a Preventive Strategy

A growing body of evidence supports PPEs as more than mere screening tools; they serve as preventive health checkups. Daniels et al. 2021[38] found that in some settings, PPEs were replacing annual wellness visits for student-athletes, underlining their value for general health surveillance. Moreover, the longitudinal data obtained through repeated PPEs can help monitor trends and intervene early [8, 39]

Limitations and Barriers

Despite their benefits, several barriers hinder PPE effectiveness. These include limited access in resource-poor settings, lack of standardization, and inconsistencies in implementation [34, 10]. Furthermore, legal and ethical considerations regarding disqualification decisions require careful balancing [13].

CONCLUSION

This review underscores the critical importance of PPEs in safeguarding the health and performance of recreational athletes involved in high-intensity sports. The incorporation of cardiovascular, musculoskeletal, functional, psychological, and lifestyle components transforms PPEs into a holistic preventive strategy. Standardization, accessibility, and evidence-based protocols remain key to maximizing their impact.

Strengths and Limitations

Strengths of the Review

This review's comprehensive nature, incorporating a wide range of studies (n = 32), allows for a broad understanding of PPE's role in recreational athletes. The inclusion of diverse sports and athlete populations enhances the generalizability of the findings. Furthermore, the systematic approach ensures that the evidence presented is thorough and well-supported.

Limitations of the Review

One limitation of this review is the variability in PPE protocols across the included studies. Some focused solely on musculoskeletal assessments, while others incorporated cardiovascular or psychological components. This heterogeneity makes it difficult to assess the isolated impact of specific PPE components. Furthermore, the majority of studies included in this review had short follow-up periods, typically ranging from 6 to 12 months. This limited the ability to assess long-term outcomes related to PPE Lastly, there is a risk of bias due to the observational nature of many studies, which could lead to overestimation of PPE's effectiveness [40].

Implications for Practice

Injury Prevention

Based on our findings, practitioners should prioritize PPE protocols that assess medical history, physical condition (e.g., flexibility, strength), and musculoskeletal health. These evaluations can help identify risk factors that predispose athletes to injury. As supported by Hootman et al. 2007, early identification of these risks allows for tailored injury prevention programs that can significantly reduce injury rates in recreational athletes.[40]

Health Monitoring

Incorporating cardiovascular and mental health screenings into PPE protocols is crucial for detecting potential risks before they manifest as serious health issues. Morrison et al. 2018; Wise et al. 2020 have emphasized the importance of cardiovascular assessments in preventing cardiac events. Psychological evaluations, often neglected in traditional PPE, can help identify athletes at risk of mental health challenges and provide interventions to improve their well-being and performance.[1,27]

Performance Enhancement

While PPE alone may not directly lead to improved performance, it provides valuable insights into an athlete's fitness level and readiness. Nikolaidis et al. 2020 suggest that PPE results should be used to guide targeted training and rehabilitation, enhancing athletic performance. Additionally, regular follow-up evaluations can help track progress and adapt training programs accordingly. [29]

Recommendations for Future Research

There are several areas where further research could help refine PPE protocols and their effectiveness:

1. ***Long-Term Studies****:* Future research should focus on the long-term impact of PPE on injury prevention, health outcomes, and performance. Longitudinal studies would provide better insights into how PPE influences these outcomes over multiple seasons [40].
2. ***Standardization of PPE Protocols***: Future studies should aim to develop standardized PPE protocols that can be widely adopted across different sports. This would improve the comparability of results and help identify the most effective PPE components for injury prevention and health monitoring [10].
3. ***Psychological Screening***: Further research should explore the integration of psychological screenings into PPE. Given the rising awareness of mental health in athletes, including such assessments could help reduce mental health crises and improve overall athlete welfare [41]

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ANNEXURE

Table 2. Detail of 32 articles included in the study

sr.no	author	year	title	population	sample size	key findings	relevance to PPE
1	Siupsinskas L et al	2019	Association of pre-season musculoskeletal screening and functional testing with sports injuries in elite female basketball players	elite female basketball players	169	functional tests can predict sports injuries in elite female basketball players Pre-participation examinations, including musculoskeletal screening and functional performance testing, is an essential part	Movement screenings such as the YBT, FMS and LESS have been proposed as methods to identify at-risk individuals
2	Calò, Leonardo et al	2019	Electrocardiographic and echocardiographic evaluation of a large cohort of peri-pubertal soccer players during pre-participation screening	male football players	2261	ECG and physical examination identified all cases of cardiac electro-structural abnormalities requiring sport disqualification during PPS in a wide population of peri-pubertal male soccer players.	personal history, family medical History (collected through verbal questionnaire), Physical examination, rest 12 lead ECG
3	Weise KK et al	2021	Pre-participation Vision Screening and Comprehensive Eye Care in National Collegiate Athletic Association Athletes	Fifty-eight intercollegiate football players	58	The pre-participation vision screening was largely able to identify athletes meeting the minimum visual acuity requirement for athlete clearance. Comprehensive eye care had a clear benefit for the majority of athletes tested.	visual acuity, eye alignment, refractive error, eye tracking, depth perception, and ocular health were collected through dilated eye examination. The near point of convergence and Developmental Eye Movement Test
4	kutukula M et al	2017	Reliability and Validity of a New Test of Agility and Skill for Female Amateur Soccer Players	Thirty-four amateur female soccer players	34	Our results indicate that the Agility and Skill test is a valid tool to assess agility and skill speed in female amateur soccer athletes..	Agility and skill test to assess agility and skill speed. The new AS test may have particular value for soccer in identifying talent at different ages
5	Daniels, Eldra W	2021	Is the Pre participation Physical Examination Replacing the Annual Well Child Examination	parents of the student athletes	288 surveys	According to parents assessing, vision, ECG, mental health during PPE is essential	cardiovascular examination, eye examination,

			among Student Athletes				
6	Mont L et al	2017	Pre-participation cardiovascular evaluation for athletic participants to prevent sudden death: Position paper from the EHRA and the EACPR, branches of the ESC. Endorsed by APHRS, HRS, and SOLAECE	EHRA Position paper	EHRA Position paper	The protocol of PPE including clinical history, physical examination, and 12-lead ECG demonstrates to have superior diagnostic capabil ity than just clinical history and physical examination12-lead ECG improves substantially the diagnostic power of PPE.	12 lead ECG, clinical history, physical examination
7	Mirabelli MH et al	2017	The Pre participation Sports Evaluation	AAFP criteria for continuing medical education (CME)	AAFP criteria for continuing medical education (CME)	The purpose of the pre participation physical evaluation (PPE) is to maximize the health of athletes and their safe participation in sports. PPEs should occur approximately six weeks before activity to allow for further evaluation, treatment, or rehabilitation as needed.	history- personal, family and Physical Examination with special consideration to cardiovascular screening
8	Weise, A et al	2025	Pre-participation evaluation of recreational and competitive athletes – A systematic review of guidelines and consensus statements	Five databases, including MEDLINE, were searched in August 2022	35 documents published in 43 reports	Seven documents (20%) made recommendations on the entire PPE process, while the remainder focussed on cardiovascular screening (16/35, 45.7%) or other topics. extracted 305 recommendations. Of these, 11.8% (36/305) applied to recreational athletes, while the remaining 88.2% (269/305) applied to athletes in organised or competitive sports.	PPE may be a tool for ensuring that current health problems are managed appropriately and for determining whether a person is medically able to engage in a particular sport. Components - medical and family history, physical examination, anthropometrics, nutrition, ECG interpretation, orthopaedics, neurology.
9	Justin R Abbatemarco, et al	2015	Application of pre-participation cardiovascular screening guidelines to novice older	novice athletes and endurance athletes	457 novice runners	Cardiovascular screening is the integral part of pre participation evaluation. Prior to screening the individuals underwent American	cardiovascular screening and pre participation questionnaire

			runners and endurance athletes			college of sports medicine pre participation questionnaire to assess for self-factors indicating cardiovascular screening	
10	Ré AH et.al	2016	Physical characteristics that predict involvement with the ball in recreational youth soccer	80 healthy recreational soccer players	80	The players were assessed with anthropometric measurements, pubertal status, health related fitness, soccer specific tests. From the study they highlighted that physical characteristics predicts the fitness level of recreational youth soccer players.	anthropometry, health fitness, soccer specific test
11	Hedman k et al	2019	Blood pressure in athletic pre participation evaluation and implication for cardiac remodelling	athletes 13-35 years	2733 athletes	In a large contemporary cohort of athletes, one third presented with BP levels above the current U.S. guidelines' thresholds for hypertension, highlighting that lowering the BP thresholds at PPE warrants careful consideration as well as efforts to standardise measurements.	Blood pressure, BMI, height, gender
12	Todd C. Sabol	2017	Season-Long Changes in Performance Outcome Measures Using a Functional Pre participation Examination	athletes 13-35 years	20 football athletes	The F-PPE was able to identify increases in dynamic postural stability, unilateral balance, trunk stabilization, flexibility in SLAR and SLHOP tests.	functional Pre Participation Examination- impression Landing Error Scoring System (iLESS), Single-Leg Anterior Reach (SLAR), Single-Leg Hop (SLHOP) and ankle dorsiflexion range of motion (ROM) tests
13	Zenati, Yassine et.al	2020	Functional movement screening as a predictor of injury in highly trained female's martial arts athletes	division 1 collegiate athletes martial arts	47 university female athletes	This research study demonstrated that the FMS™ shows a true potential to work as an effective and efficient predictive model of lower extremity injury in division I collegiate female athletics.	functional movement screening- deep squat, hurdle step, in-line lunge, shoulder mobility, active straight leg raise, trunk stability push-up, and rotary stability test

14	Nikolaidis PT et al	2018	force velocity characteristics, muscle strength and flexibility in female recreational Marathon Runners	female recreational Marathon Runners	33 female marathon runners	Profiling physical fitness characteristics of marathon runners is of great practical importance for strength and conditioning. The evaluation must consists of anaerobic power, muscle strength, flexibility, anthropometric characteristics	anthropometry, sit and reach test(back and hamstring flexibility), isometric muscle strength tests(hand grip strength- using hand grip dynamometer, back strength test and back & leg test- back strength dynamometer)
15	Jackson s et al	2015	Investigation of relationships between physical characteristics of recreational runners and lower extremity injuries	recreational runners	75	An asymmetry of lower extremity neuromuscular control ≥ 3.6% measured by the balance scale has been identified as a potential risk factor for injury in recreational runners. This test can be performed as part of a pre-training screening	Anthropometric measurements, proximal and distal isometric lower extremity muscle performance, isometric core muscle endurance, lower extremity flexibility, neuromuscular control- y balance test, 6M hop test- This test can be performed as part of a pre-training screening or physical and may be helpful in identifying recreational runners at risk for injury
16	Hulteen RM et.al	Jul-15	Validity and Reliability of Field-Based Measures for Assessing Movement Skill Competency in Lifelong Physical Activities: A Systematic Review	systematic review	17 studies	The primary aim of this systematic review is to report the methodological properties, validity, reliability, and test duration of field-based measures that assess movement skill competency in lifelong physical activities. These could include various fitness tests, such as the T-run agility test or the beep test. These fitness tests help ensure that probability estimates are well-calibrated in many sports analytics tasks.	Functional movement screening, beep test or t run agility test.
17	Kerry MacDonald and Wilhelm Meeuwisse	2017	The periodic health evaluation/ pre participation evaluation	chapter	chapter	A volleyball-specific PHE should target the musculoskeletal conditions discussed. It is important to recognize that the assessment methods described in this chapter reflect the current body of sport-	cardiovascular assessment- 12 lead ECG, musculoskeletal assessment- Prior injury, dynamic balance(modified star excursion test), knee valgus, SICK scapula, seated thoracic rotation, non-cardiac assessment

						specific knowledge. Finally, it is important to view the PHE not just as a simple screening tool but rather as an opportunity to establish a relationship with the athlete and identify both injury- and performance-related concern	
18	Ionescu AM, et al.	2021	Pre participation medical evaluation for elite athletes: EFSMA recommendations on standardised pre participation evaluation form in European countries	Consensus statement	Consensus statement	The PPE should entail the following diagnostic components: ► Health status. ► Anthropometry. ► Functional and exercise capacity. By developing preventive strategies such as the PPE, we can identify potential health issues at the earliest possible stage and take action accordingly.	history and physical examination, inborn diseases, structural abnormalities, ECG, comprehensive medical history, Anthropometry, Functional and exercise capacity
19	Barbara Nicole Morrison	Aug-16	Evaluation of Pre-Participation Screening and Cardiovascular Risk Assessment in Masters Athletes in British Columbia	297 athletes	297	This is a prospective observational study that evaluated Masters athletes from a variety of sports. The initial screen consisted of a physical examination, a resting ECG, Framingham Risk Score (FRS), an American Heart Association (AHA) questionnaire, and a physical activity and lifestyle questionnaire.	Physical Activity Readiness Questionnaire , History, Physical examination, Systematic COronary Risk Evaluation (SCORE), Resting ECG, Lifestyle Factors- Diet (daily consumption of fruits and vegetables and red meat), smoking, and alcohol , personal and family history, Exercise Treadmill Test, Cardiovascular Imaging,
20	Pantelis Theodoros Nikolaidis & Beat Knechtle	2019	Force–velocity characteristics and maximal anaerobic power in male recreational marathon runners	Recreational Runners	135 recreational runners	According to the results, it was found that the older age group players had the deepest scores in maximum pedalling velocity.	Physiological assessment- strength
21	Sylejmani, B et al	2019	Anthropometric Characteristics and Physical Performance of	soccer players	120	The aim of this study was to establish the anthropometric and physical profiles of young soccer players	Physiological assessment- anthropometry, treadmill protocol, flexibility- 'sit and reach', 'flamingo' , muscle power, balance

			Young Elite Kosovo Soccer			according to their playing position and to determine their relevance for competition success. The anthropometric variables of were assessed. Participants performed Bruce treadmill test protocol and Yo-Yo Intermittent Test to estimate their relative VO2max, sprint tests (5 m and 20 m flat),and seven fitness tests for assessing power, speed, agility, flexibility, frequency, abdominal muscle power and balance.	
22	Gomez-Espejo V et al	2022	Psychological readiness to return to sports practice and risk of recurrence: Case studies	soccer players	case studies- 4	According to the results, the psychological perceptions together with assessed emotional states were incorporated into sports practice with a guarantee of success.	Psychological readiness
23	Sannicandro, I et al	2023	The effects of 8 weeks of integrative neuromuscular pitch training on strength values and sprint performance in young élite soccer players	soccer players	37	According to the results, the One-Leg Hop test in the left limb was found to be (p = .05, d = -2,67)	Neuromuscular evaluations
24	Read PJ et al	2016	Reliability of the tuck jump injury risk screening assessment in elite male youth soccer players	soccer players	25	The finding depicted moderate-to-strong inter-rated reliability (range = 0.72 – 0.97).	Tuck jump assessment.
25	Pojskic H et al	2018	Importance of Reactive Agility and Change of Direction Speed in Differentiating Performance Levels in Junior Soccer Players:	soccer players	95	A study involving 95 youth soccer players identified high reliability (ICC: 0.99) for the modified version of the test.	field-based study

			Reliability and Validity of Newly Developed Soccer-Specific Tests				
26	Póvoas S et al	2013	Validity and sensitivity of field tests' heart-rate recovery assessment in recreational football players	recreational football players	32	Examining the criterion validity and sensitivity of heart-rate recovery (HRRec) in profiling cardiorespiratory fitness in male recreational football players in the untrained and trained status, using endurance field-tests. The participants performed three intermittent field tests for aerobic performance assessment, namely Yo-Yo intermittent endurance level 1 (YYIE1) and level 2 (YYIE2) tests, and Yo-Yo intermittent recovery level 1 (YYIR1) test. Significant post-intervention improvements (p0.05) associations were found between VO2max and HR Rec (r = -0.05−0.27, p>0.05) across the Yo-Yo tests, and training status either expressed as percentage of HR peak or HR max.	submaximal versions of the treadmill test and the Yo-Yo intermittent tests,
27	Maykut JN et al	2015	Concurrent validity and reliability of 2d kinematic analysis of frontal plane motion during running	24 collegiate runners	24	The 2D testing method demonstrated excellent intra-ratter reliability for peak HADD (ICCs: 0.951-0.963), peak CPD (0.958-0.966), and peak KABD (ICCs: 0.955-0.976).	2D testing
28	Coswig V et al	2019	Assessing the Validity of the MyJump2 App for Measuring Different Jumps in Professional	40 male CP Football athletes	40	This study utilized the sample t-tests to determine the reliability and usefulness. As per the findings, the Agility along with Skill Test is a	squat Jump, Agility test, skill test

			Cerebral Palsy Football Players: An Experimental Study			reliable as well as valid assessment for female soccer players, providing key value in evaluating their integrative agility and skill capabilities.	
29	wingfield et al	2004	pre participation evaluation- an evidence based review	systematic review	25 articles	The literature presented here is a starting point in the evaluation of the current state of the PPE. More data need to be collected to monitor the screening process of student athletes. Use of a standardized examination in electronic format holds promise for the collection of population-based data to evaluate sensitivity and specificity. The ultimate goal of standardizing the PPE is a challenging yet important outcome for which to strive	Cardiovascular screening.
30	Nathanson AT et al	2015	Pre-Participation Medical Evaluation for Adventure and Wilderness Water sports	water sports athletes	review	A pre participation evaluation for water sports may be requested by guiding agencies, instructional camps, or by patients presenting for an annual visit. This evaluation can serve an important role in decreasing the risk of morbidity and mortality among athletes and adventurers participating in water sports	personal health history, physical examination, specific environment and conditions
31	Conley KM et.al	2014	National Athletic Trainers' Association Position Statement: Pre participation Physical Examinations and Disqualifying Conditions	athletes	position statement	Adoption of standardized PPE protocol to prevent sudden deaths in athletes is important. The PPE should be standardised and validated	medical and family history, physical examination, cardiovascular screening, neurologic screening, orthopaedic screening, mental health consideration

32	Sean Wise	2020	Pre participation Physical Evaluation: AAFP and Others Update Recommendations	practice guidelines	practice guidelines	The PPE should be performed as part of an athlete's routine preventive medical care with their primary physician. • Comprehensive PPEs are recommended every two to three years with annual focused history updates in intervening years. • Personal and family history should be reviewed for risk factors of sudden cardiac death. • Musculoskeletal evaluation should be primarily focused on previous injuries and current symptoms. • Screening for anxiety or depression symptoms should be included in PPEs.	history, musculoskeletal evaluation, mental health evaluation.