

Review of Multi-Sport Participation on Injury Risk and Musculoskeletal Health Among Adolescent Football Players

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Abstract: *Multi-sport participation during adolescence has received increasing attention as a potential strategy for promoting physical development while reducing the risks associated with early sport specialization. Adolescent football players are exposed to substantial mechanical and physiological demands because football involves repeated sprinting, acceleration, deceleration, jumping, kicking, rapid changes of direction, and physical contact. These demands may contribute to acute injuries as well as overuse and gradual-onset musculoskeletal problems, particularly when training volume is high and recovery is inadequate.*

Keywords: Multi-Sport Participation, Injury Risk, Musculoskeletal Health, Overuse Injury, Training Load, Neuromuscular Development.

I. INTRODUCTION

Adolescence is a critical period for physical, biological, and motor development, and participation in organized sport can contribute substantially to strength, fitness, coordination, confidence, and healthy physical activity patterns. Football is one of the most physically demanding team sports for young athletes because players repeatedly perform high-speed running, acceleration, deceleration, cutting, jumping, landing, kicking, and contact-related movements. Consequently, adolescent football players may experience a range of musculoskeletal problems involving the ankle, knee, thigh, hip, groin, lower leg, and foot. Injury risk during this period is influenced not only by the characteristics of football itself but also by growth and maturation, previous injury, training volume, fatigue, recovery, physical preparation, and movement quality. A systematic review of youth soccer injury risk factors identified altered neuromuscular control, maturation, fatigue, poor recovery, previous injury, high external workload, playing position, and sport specialization among relevant factors.

Against this background, multi-sport participation has emerged as an important alternative to early specialization. Multi-sport participation refers to involvement in two or more sports during the same developmental period, whereas specialization generally involves intensive participation in one sport while limiting participation in other sports.

The rationale for multi-sport participation is that different sports expose young athletes to different movement patterns, physical demands, skills, and loading characteristics. Such variation may help develop a broader physical foundation and potentially reduce repetitive stress on the same anatomical structures. A systematic review and meta-analysis involving youth athletes aged 7–18 years found that sport samplers had lower injury risk than sport specialists, although the authors also emphasized the need to interpret the evidence in the context of available research limitations.



II. MULTI-SPORT PARTICIPATION AND EARLY SPORT SPECIALIZATION

Early sport specialization has become increasingly common among young athletes seeking advanced performance opportunities. However, specialization may result in repeated exposure to similar technical movements and comparable mechanical loads throughout much of the year.

A systematic review and meta-analysis found that highly specialized youth athletes had greater risk of overuse injury than athletes with low specialization. Earlier systematic evidence similarly reported associations between specialization and overuse injuries, although the evidence base was described as relatively limited and predominantly retrospective.

For adolescent football players, this issue is particularly relevant because football training repeatedly loads the lower extremities. Kicking, sprinting, cutting, jumping, landing, and rapid changes in direction can place recurring stress on muscles, tendons, ligaments, and joints. Multi-sport participation may provide opportunities to develop complementary physical qualities while temporarily reducing exposure to identical football-specific movement patterns.

Importantly, however, participating in several sports does not necessarily reduce total training load. If an adolescent participates intensively in several sports without adequate recovery, cumulative workload may remain high. Therefore, the potential benefit of multi-sport participation depends on how activities are scheduled, their intensity, the athlete's developmental stage, and recovery practices.

III. EFFECTS ON MUSCULOSKELETAL HEALTH

Musculoskeletal health includes the condition and functional capacity of muscles, bones, joints, tendons, ligaments, and related structures. During adolescence, these tissues are developing alongside changes in height, body mass, strength, coordination, and neuromuscular control. Participation in different sports can stimulate diverse movement patterns and physical capacities. Running-based sports may develop speed and cardiovascular capacity, jumping sports may stimulate power and landing control, while activities involving balance and rotational movements may challenge coordination and proprioception.

From a developmental perspective, diversified movement experiences can contribute to a broader physical skill base. This does not mean that every multi-sport athlete will necessarily experience fewer injuries.

Instead, multi-sport participation can be considered one possible component of a comprehensive approach involving appropriate workload management, strength training, recovery, technical development, and injury-prevention exercise. Evidence from football injury-prevention research indicates that structured exercise-based programs can reduce overall and several site-specific injury outcomes among football players.

IV. RELATIONSHIP BETWEEN MULTI-SPORT PARTICIPATION AND INJURY RISK

The central argument supporting multi-sport participation is that exposure to different sporting activities may reduce excessive repetitive loading associated with specialization. The evidence generally shows an association between greater specialization and higher injury risk. The 2020 systematic review and meta-analysis of youth athletes found a significantly higher injury risk among sport specialists compared with sport samplers. Similarly, evidence focused on overuse injuries indicates greater risk among highly specialized athletes.

Research specifically examining youth football has also identified substantial specialization. In one study of youth football participants, highly specialized athletes were more likely to report gradual-onset injuries, and greater weekly and annual participation volume was also associated with gradual-onset injury. These findings are particularly relevant because gradual-onset injuries may develop through accumulated physical stress rather than through one clearly identifiable traumatic event.

V. ROLE OF TRAINING LOAD AND RECOVERY

Training load is a major factor that must be considered when evaluating multi-sport participation. An adolescent who plays football, basketball, and another sport may obtain movement diversity, but if the combined weekly workload is excessive, the potential protective effects of diversification may be reduced. Training load includes not only formal



practice sessions but also matches, competitions, strength training, physical education, recreational activity, and other forms of exercise.

Recovery is equally important. Inadequate sleep, insufficient rest between training sessions, repeated competition, and high physical demands may increase fatigue and impair movement quality. Research on youth soccer identifies fatigue and poor recovery as contributors to overuse injury. Therefore, multi-sport programs should be designed around appropriate periods of rest and recovery rather than simply increasing the number of sports played.

VI. NEUROMUSCULAR DEVELOPMENT AND MOVEMENT VARIETY

One potential advantage of multi-sport participation is exposure to different movement environments. Adolescent athletes can develop a broader range of motor skills through running, jumping, landing, throwing, catching, balancing, rotating, and changing direction. These experiences may contribute to neuromuscular adaptability and movement competence.

This is relevant to football because effective football performance depends on coordinated control of the trunk and lower extremities during high-speed and unpredictable movements. Poor neuromuscular control, limb asymmetry, and dynamic knee valgus have been identified as relevant intrinsic risk factors in young soccer players. Thus, diversified sporting experiences may contribute indirectly to musculoskeletal health by developing complementary physical and motor abilities. Nevertheless, direct causal evidence linking specific multi-sport combinations to particular reductions in football injuries remains limited.

VII. COMPARISON OF MULTI-SPORT AND SPECIALIZED PARTICIPATION

Aspect	Multi-Sport Participation	Single-Sport Specialization
Movement exposure	Broad and varied	More repetitive
Physical development	Multiple physical qualities may be developed	Highly sport-specific
Repetitive loading	Potentially distributed across activities	Greater repetition of similar movements
Overuse injury concern	May be lower when workload is appropriately managed	May increase with high specialization and volume
Neuromuscular experience	Diverse movement challenges	More sport-specific movement patterns
Training load	Can be high if multiple sports overlap	Can be high due to intensive single-sport training
Recovery requirement	Requires careful coordination between sports	Requires careful management of intensive sport-specific training
Skill development	Broad motor-skill development	Greater early specialization in technical skills
Football-specific practice	May be comparatively lower	Usually higher
Overall implication	Potentially supports diversified physical development	May increase repetitive-load exposure
Main limitation	Cumulative workload may still become excessive	Repetitive exposure and specialization may increase overuse risk

VIII. EVIDENCE SUMMARY

Study/Evidence	Population/Focus	Main Finding	Relevance to Review
Fabricant (2016)	Youth athletes	Reviewed evidence linking specialization with musculoskeletal	Provides early evidence regarding specialization and



		injury	injury
Bell (2018)	Athletes ≤ 18 years	High specialization was associated with increased overuse-injury risk	Supports concern regarding repetitive loading
Carder (2020)	7–18-year-old athletes	Sport sampling was associated with lower injury risk than specialization	Directly supports diversified participation
Youth football study (2022)	Youth football players	Higher specialization and participation volume were associated with gradual-onset injury	Provides football-specific evidence
Youth soccer injury-risk review (2023)	Young soccer players	Identified workload, fatigue, maturation, previous injury and specialization as relevant factors	Highlights multifactorial injury risk
Obërtinca (2023)	Footballers of different ages	Multi-component exercise-based prevention programs reduced injury risk	Supports combining diversified participation with structured prevention
Recent meta-analysis (2026)	Youth athletes	Found an overall association between specialization and greater injury odds	Provides updated evidence while noting heterogeneity

IX. INJURY PREVENTION IMPLICATIONS

The literature suggests that injury prevention among adolescent football players should move beyond a narrow focus on football-specific training. Strengthening, balance exercises, neuromuscular training, appropriate warm-up routines, movement-quality exercises, gradual workload progression, and adequate recovery can complement multi-sport participation. Evidence from a recent systematic review and meta-analysis indicates that structured injury-prevention programs can reduce overall injury incidence in young football players, including lower-limb, knee, and ankle injuries. Consequently, multi-sport participation should preferably be incorporated into a broader athletic-development model rather than treated as a standalone injury-prevention intervention.

X. RESEARCH GAP

Although evidence increasingly supports diversified youth sport participation, several research gaps remain. First, many studies examine youth athletes across multiple sports rather than adolescent football players specifically. Second, studies frequently classify athletes according to specialization status without adequately examining the exact combination, intensity, duration, and sequencing of sports. Third, there is limited longitudinal evidence examining whether multi-sport participation produces lasting changes in musculoskeletal health among football players. Fourth, maturation status, sex, playing position, previous injury, socioeconomic environment, coaching quality, sleep, and total weekly workload may modify the relationship between multi-sport participation and injury risk. Finally, more prospective studies are needed to distinguish the effects of sport diversity from the effects of total training exposure.

XI. DISCUSSION

The reviewed literature indicates that adolescent football players should be considered within a developmental rather than exclusively performance-oriented framework. Early specialization may expose young athletes to repetitive sport-specific movements and accumulated workloads, while multi-sport participation may provide greater movement diversity.

Evidence from systematic reviews and meta-analyses generally associates sport specialization with increased injury risk, particularly overuse injuries. Football-specific evidence also indicates a relationship between specialization, participation volume, and gradual-onset injury. However, the relationship is complex. Multi-sport participation can itself create substantial cumulative workload if sports are scheduled without adequate recovery. Therefore, the key



issue is not simply the number of sports an adolescent plays but the balance among sport diversity, total exposure, intensity, recovery, physical preparation, and biological maturation.

XII. CONCLUSION

The review suggests that multi-sport participation has potential relevance for reducing repetitive loading and supporting broader physical and neuromuscular development among adolescent football players. Available evidence consistently raises concerns about high levels of sport specialization and overuse injury in youth athletes, while sport sampling has been associated with lower injury risk in several studies. Among youth football players, specialization and greater participation volume have also been associated with gradual-onset injury.

Nevertheless, multi-sport participation should not be considered a guaranteed protective factor. Effective musculoskeletal-health management requires integration of diversified movement experiences with appropriate training-load monitoring, strength and neuromuscular conditioning, injury-prevention exercises, adequate recovery, and consideration of individual maturation and previous injury. Future longitudinal research should specifically examine adolescent football players and determine how the type, frequency, intensity, and timing of additional sports influence injury incidence and long-term musculoskeletal health.

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