MATCH LOAD, POSITIONS, FORMATIONS, AND INJURY SUSCEPTIBILITY IN COLLEGIATE MEN'S SOCCER

ETHAN BYRNES, MAREN CLARK, REBECCA DOWNEY, DPT, AND ERIN CHOICE, PHD, CSCS, CPSS

INTRODUCTION

Strength and conditioning program design for competitive soccer is multifaceted. Match load, position played, formation used, and injury susceptibility should all be considered. The purpose of this article is to summarize key considerations for the strength and conditioning coach to design an effective holistic program for collegiate men's soccer.

Soccer is a physically demanding sport requiring National Collegiate Athletic Association (NCAA) Division I (DI) male athletes to run between 7 – 12 km (4.3 – 7.5 mi) per match (10,32). External load metrics (e.g., total distance and sprint distance covered) are a common way to track the physical demands placed on a soccer athlete. Match load refers to the external load of one soccer match, which lasts 90 min (10). Not all athletes play every minute of a match, especially in the NCAA, given the unlimited substitutions rule.

Throughout the season, the tactical formation (athlete arrangement) used on the field may remain consistent or may change depending on the strategies of the soccer coach (Figure 1). Tactical formation has not been considered in much of the recent external load research in elite men's soccer (2,9,11,18,23,25); however, it is one variable that can impact overall match load (19,33,36,37). Match loads vary by position, formation, and role type. Ultimately, match load influences injury risk, which is of importance to the performance team members who work with these athletes (strength and conditioning coaches, soccer coaches, athletic trainers, sport scientists) (1,10,12,18,19,21,22,35).

High weekly cumulative loads of total distance, high-speed running distance, and number of accelerations and decelerations all increase the risk of injury (28). Additionally, reserves have a higher risk of injury due to spikes in workloads when they are required to play more minutes than their typical match average (5). Ultimately, there is a relationship between match loads, position, formation, and injury susceptibility. Understanding the dynamics between these variables is critical for strength and conditioning coaches because they can directly inform decisions relating to exercise program design, volume and intensity of training, match play readiness, recovery strategies, and the overall wellbeing and performance of the soccer team.

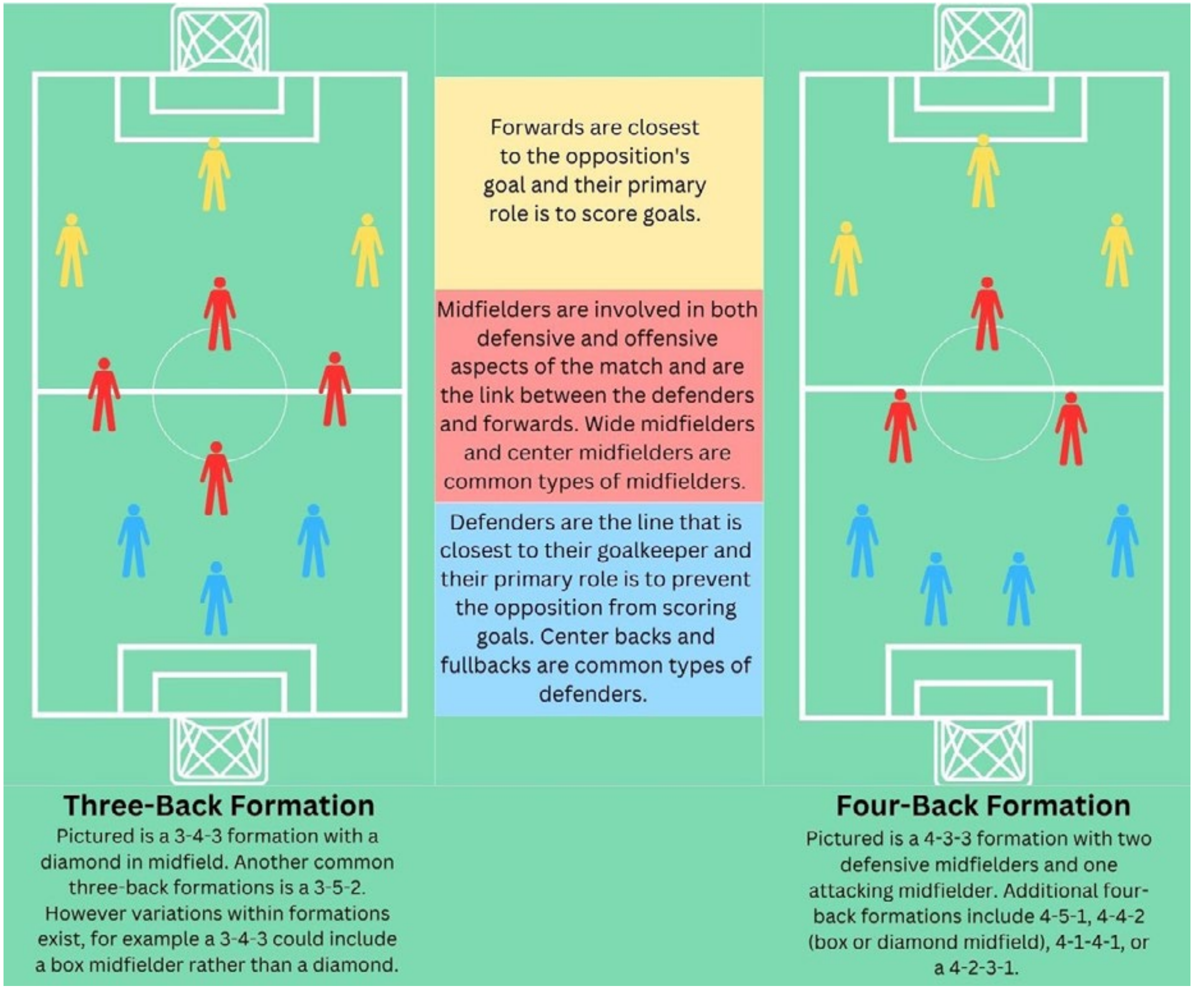

FIGURE 1. THREE-BACK VS. FOUR-BACK FORMATION

MATCH LOAD

Match load in soccer is typically gathered via Global Positioning System (GPS) microtechnology (inertial measurement units) worn within lightweight vests. Data collected may include: total distance covered, sprint distance covered, number of sprints, accelerations, decelerations, speed, and changes of direction (2,10,12,26,35). Athletes will accumulate different match loads based on role classification (starter or reserve), position played, formation used, and positional differences existing regardless of formation (3,6,7,10,13,14,15,19,35).

Positional differences in match load can vary by team, but there are some general findings that can assist the strength and conditioning coach with a better understanding of match load based on position played. For instance, the center back position has been shown to spend less time running and sprinting, and they typically cover the least total distance compared to other positions (3,6,13,15,35). Fullbacks also spend relatively lower amounts of time running and sprinting compared to other positions and have been shown to complete more high-intensity running compared to central defenders (3,7). Central midfielders and wide midfielders have been shown to cover the greatest total distances, but differences exist within the midfielder positions (3,7,14). Wide midfielders have been shown to cover more total distance and high-intensity running than central midfielders and completed the most high-intensity accelerations and decelerations compared to other positions (6,10,15). These specific positional differences highlight the need for specificity of training between positions and within position groups, especially when manipulating volume, intensity, and recovery.

Not only are positional differences in match load of importance, but differences in match load between halves can also help the performance team understand how to improve training and recovery strategies. A study by Slater et al. found that one NCAA DI men's team ran more in the first half compared to the second half (35). The higher workload seen in the first half may be due to lack of fitness to complete higher workloads in the second half. The NCAA rule of unlimited substitutions does not eliminate fatigue, as seen by decreased running and increased walking times in the second half of a match (35).

Additionally, different match loads are seen between starters and reserves, and no consensus exists in the literature regarding classification of an athlete as a starter and a reserve across a competitive season (1,12). During an NCAA match, unlimited substitutions allow any athlete to receive substantial minutes regardless of their classification. Match loads vary between starters and reserves due to the differences in number of minutes played, which supports the need for supplemental training for reserves (12,18). The performance team should implement position-specific load management strategies and ensure that the gap between starters' and reserves' loads is not significant. Ultimately, one of the primary benefits of monitoring and understanding match load is the ability to relate it to workload management strategies, including acute to chronic workload ratios, and implementation of appropriate recovery strategies to target injury prevention (22).

FORMATIONS

Coaches use formations to optimize their own team's strengths and weaknesses, as well as their opponent's strengths and weaknesses, and to achieve the best possible performance. Formation dictates the number and specific role of defenders, midfielders, and forwards on the field. Formation categories include three-back and four-back formations, and both require positions to occupy different amounts of area on a field, impacting match load (Figure 1).

Different formations used on the field can impact match loads on the athletes, but the specific differences in external load vary between teams and position type (19,33,36,37). Center backs have been shown to cover longer sprint and total distances, and achieve higher metabolic load per minute, longer distances of high-speed running, and a greater number of decelerations in a three-back compared to a four-back formation (19,25). On the contrary, Zhang et al. found that center backs accumulated lower total running distances in a three-back formation compared to a four-back formation (37). Fullbacks have been shown to accumulate more total distance, more moderate-speed running distance, and greater sprint distance in a three-back compared to a four-back formation (19,37). Wide midfielders have been shown to travel greater total and high-intensity distances in a four-back compared to three-back formation, and complete longer sprints in a four-back formation (19,36,37). Central midfielders displayed minimal differences between formations (19,33,36); however, Zhang et al. reported higher total distances traveled by central midfielders in a three-back and greater high-intensity load rates in a four-back formation (37). Forwards' external loads were also similar between formations (19,33,37). Vilamitjana et al. found that forwards covered greater high-speed running distances in a four-back compared to a three-back formation (36). Ultimately, the degree to which formation impacts match load is team and position dependent (19,33,36,37). This information supports the use of GPS microtechnology in collegiate soccer to obtain and use athlete-specific external load data.

Information about formation provides valuable insight to the performance team about how the physical demands placed on athletes may differ based on the formation and tactical strategies used. For instance, a soccer coach may choose to use a three-back formation if fullbacks on the team can sustain a high chronic workload across a competitive season, as this formation requires fullbacks to travel greater total distances and sprint distances (19,37). A strength and conditioning coach may periodize team training in a way that plans for these appropriate match loads, including positional differences, to prepare athletes for the intended style of play and to provide supplemental conditioning, load management suggestions, and recovery strategies (22).

INJURY

Injuries in soccer can occur in a variety of ways: contact, non-contact, and overuse injuries. The most common injuries in male soccer athletes occur at the hamstring, ankle, knee, and groin, and include sprains and strains (17,20,29,31). A six-year study with Major League Soccer (MLS) found midfielders experienced the highest number of injuries (37.6% of all injuries), followed by defenders (34.1%), forwards (17.8%), and goalkeepers (10.5%) (20). This is relevant to strength and conditioning coaches because typically midfielders experience the highest total distances compared to other positions, placing emphasis on the need to prioritize load management strategies for midfielders in order to mitigate overuse and preventable injuries (3,7,14). Additionally, mean time missed for injury in the MLS is 15.8 days, and 55.8% of all injuries led to at least one day missed (20). Ultimately, athletes missing matches could influence the success or failure of a team.

Rapid increases in training volume are associated with increased injury risk, and this is commonly seen during short pre-season timelines in the collegiate setting (22). Additionally, a systematic review by Jiang et al. investigated the relationship between workload and injury risk of professional male soccer athletes and showed that short-term schedule congestion (i.e., several games in a short time period) leads to an increase in incidence of match injuries (28). During one NCAA DI men's soccer season, athletes play 2 – 3 matches per week for approximately 13 weeks, totaling 18 – 24 matches (i.e., a congested schedule). High cumulative external loads increase the risk of injury, which is especially relevant to workload management strategies for starters who accumulate the highest number of minutes and highest match loads (28).

When starters become injured because of their higher chronic workloads, the coaching staff must rely on reserves, rapidly increasing reserve's match loads (28). Reserves are not exposed to the high workloads that starters accumulate during match play, making reserves less physically ready for the demands of match play (11,12,18). For English Premier League soccer athletes, non-contact injury risk was highest when chronic load exposure was low and a spike in workload was required (5).

PRACTICAL APPLICATIONS

Knowledge of match load for certain positions and formations can lead the performance team to make objective decisions regarding the athlete's load management strategies and recovery strategies. Starters experience high external loads during matches; therefore, their practice volume should be decreased before and between matches. During a men's collegiate soccer season, there is often a 42 – 48-hr window between matches during the week, due to scheduling. The performance team should make decisions that optimize team recovery and match preparedness within the given schedule. Optimization of team recovery may actually look like prioritizing the recovery of the starters with the highest match loads (requiring active recovery, cold water immersion, protein supplementation, and glycogen restoration), while requiring training sessions (small-sided competitions) for those who played less match minutes to ensure they receive enough volume each week to mitigate undesirable acute to chronic workloads (5).

One strategy to enhance overall team recovery can be to include an active recovery between matches. Active recovery involves low-intensity work to facilitate recovery while not placing excessive loads on athletes. Active recovery assists the body in removing metabolic waste products, which accumulate due to intense exercise (16,27). An active recovery for soccer athletes could include a 7 – 12-min low-intensity jog, foam rolling, stretching, and light ball skills work immediately post match. The low-intensity jog promotes blood flow to muscles which aids in the repair and recovery of muscle tissues (24). Foam rolling can alleviate muscle soreness and tension through increased delivery of oxygen and nutrients to the targeted areas (34). Stretching should incorporate dynamic stretches of all major muscle groups used when playing soccer and common sites for injury.

Because recent research has shown that different formations alter the match load of positions, strength and conditioning coaches should consider formation selection, positional demands, starter verses reserve, and schedule, when designing recovery sessions (19,33,36,37). For example, if the performance team knows that the soccer coach will primarily use a three-back formation and that defenders cover greater total and sprinting distances in a three-back formation based on athlete-specific GPS data, recovery strategies and training can be planned accordingly.

The NCAA only allows for approximately two weeks of pre-season training and the performance team should consider that physiological adaptations and improvement in aerobic fitness probably will not be realized until later in the season (11). There are also recommendations to increase workload slowly after a period of low activity to decrease risk of injury with a rapid increase in workload, which poses a great challenge to the two-week NCAA soccer pre-season (8). Strength and conditioning coaches should look at preemptive measures like educating their athletes about rapid spikes in training loads and associated injury risk, which can increase buy-in to complete summer strength and conditioning sessions before reporting for pre-season team training (5).

Ultimately, there has been a large increase in soccer external load research over the past ten years, and one identified gap is the influence of formation on position-specific match loads (2,11,23,25). Sport scientists continue to investigate known gaps; however, the strength and conditioning coach should utilize available evidence holistically, rather than zooming too far into one known gap. Figure 2 has been designed to assist the strength and conditioning coach with a comprehensive program design example for collegiate soccer. Even though formation can influence match loads, there are many other foundational variables that must be considered when it comes to program design and recovery strategies, including general athlete needs, sport-specific needs, and position-specific needs. A holistic approach to program design and recovery addresses the interplay between match load, position, formation, and injury susceptibility. Figure 2 has been created to assist the strength and conditioning coach with program design and recovery strategies based on evidence and hierarchy specific to collegiate men's soccer.

CONCLUSION

Athlete-specific external load data via GPS microtechnology is recommended for collegiate soccer. Differences in match load exist due to position and formation used. Recovery and training strategies in NCAA soccer should consider the congested schedule, positional demands, formations used, and starter versus reserve match loads. Recovery efforts based on match load values can translate to load management strategies that effectively consider multiple aspects of recovery in relation to overuse and preventable injuries.

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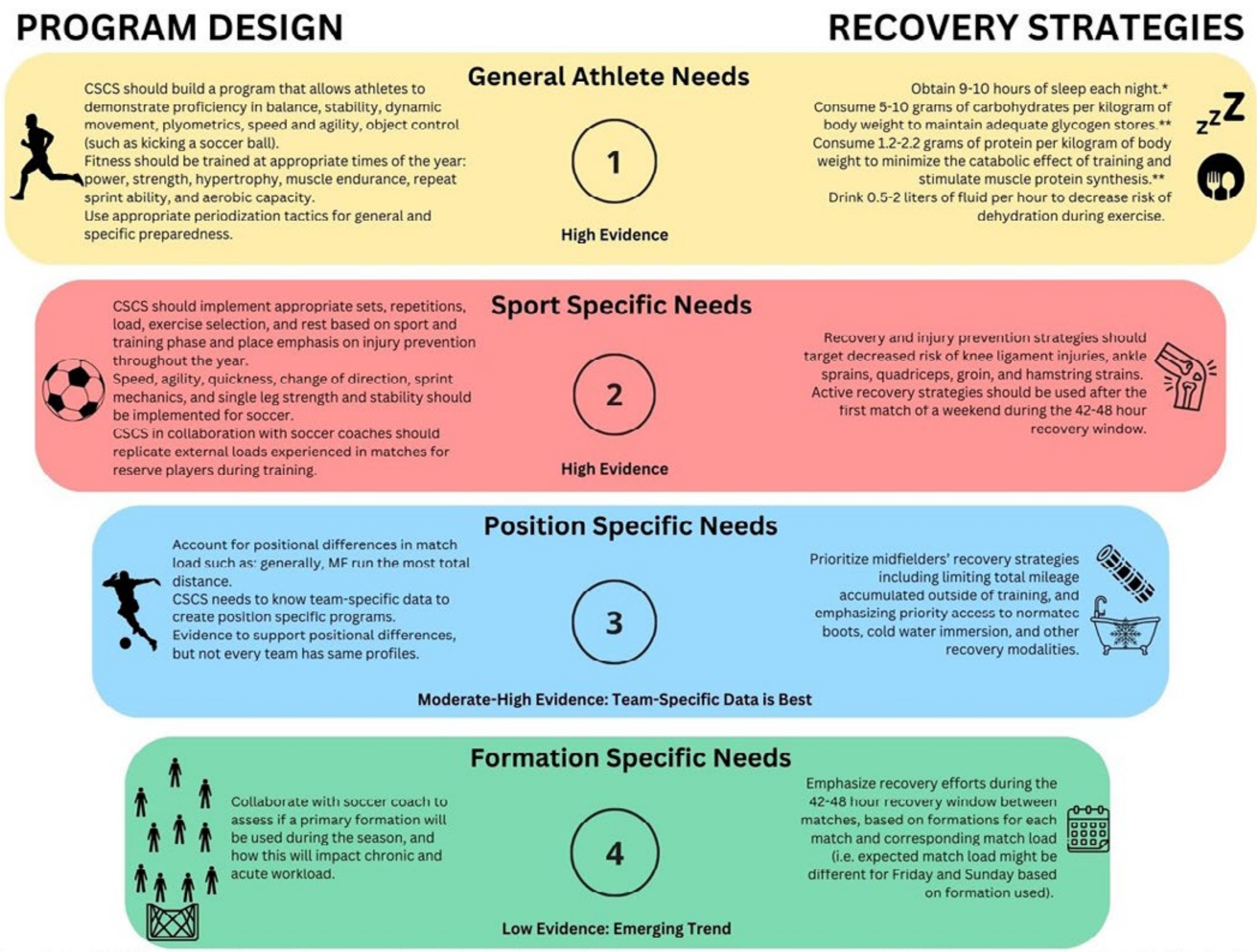

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FIGURE 2. HOLISTIC PROGRAM DESIGN AND RECOVERY STRATEGIES FOR COLLEGIATE MEN'S SOCCER

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ABOUT THE AUTHORS

Ethan Byrnes received his Bachelor of Science degree in Health and Exercise Science from Regis University in 2024, and is currently pursuing a Graduate Certificate in Data Science, also from Regis University. Byrnes has been a collegiate soccer athlete from 2020 – 2024.

Maren Clark received her Bachelor of Science degree in Health and Exercise Science from Regis University in 2023, and is currently pursuing an Master of Science degree in Applied Health and Exercise Science from Concordia University Chicago. Clark is an American College of Sports Medicine (ACSM) Certified Personal Trainer (ACSM-CPT) and was a collegiate soccer athlete from 2020 – 2023.

Rebecca Downey is a current Assistant Professor in the School of Physical Therapy at Regis University. Downey is a practicing physical therapist who earned her Doctor of Physical Therapy and is a Board Certified Cardiovascular and Pulmonary Specialist.

Erin Choice is a current Assistant Professor in the School of Physical Therapy at Regis University and is the Program Director for Health and Exercise Science. She earned her PhD in Health and Human Performance from Concordia University Chicago. Choice is also a Certified Strength and Conditioning Specialist® (CSCS®) and a Certified Performance and Sport Scientist® (CPSS®) through the National Strength and Conditioning Association (NSCA).