Football Goalkeeper Injuries

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Knowledge and research about football goalkeeper (GK) injuries are scarce, which prevents the development of evidence-based injury prevention programs. Fortunately, progress is evident in injury prevention strategies in outfield football players. However, a GK fulfills a unique role, and an injured GK can substantially impact a team. Thus, there is a need to clarify and summarize current knowledge concerning football goalkeeper pain and injuries.

Keywords: goalkeeper ; injury ; pain ; soreness ; football ; soccer ; muscle ; tendon ; fracture ; luxation

1. Introduction

1.1. Offensive Scenarios

Depending on the game, GKs' actions are between 60–80% offensive play [1][2][3][4][5]. A modern-day GK often uses their feet to play the ball to gain an advantage for his team or initiate counterattacks. GKs often make passes at the distances of 50 m or more in contrast to outfield players who more often pass at shorter distances [4]. GKs initiate offensive play by goal kicking, which is played only with the feet due to the rules. Offensive in action play constitutes 60% throwing and 40% passing with the feet in training game conditions [6]. Furthermore, effective GKs combine various abilities and characteristics, including explosive force, speed, and coordination with their high body height [7][8][3][4].

1.2. Defensive Scenarios

An essential skill of a GK's defensive gameplay is shot stopping. On average, GKs of the highest level perform about 23 different defensive actions per match [1]. For these games, there is a varying frequency of cross interceptions, one-to-one duels, and clear-outs [1][3][9]. There is approximately 6.2 ± 2.7 dives, 3.8 ± 2.3 jumps and 18.7 ± 6 very dynamic displacements (forward, sideways, and backward) per game [1]. Results from other studies confirm these findings (on average: 10 ± 1 dives, 15 ± 5 jumps, 8 ± 3 high speed changes of direction and 16 ± 3 explosive efforts) and add similar data characterizing goalkeeping training (on average 51 ± 11 dives, 43 ± 15, 34 ± 12 high speed changes of direction and 70 ± 18 explosive efforts) [10].

1.3. Distance Covered during a Match

GKs cover far shorter distance during gameplay than outfield players [4][6]. During 90 min gameplay, on average, elite outfield players cover a distance of 10 to 12 km [11][12][13][14][15][16][17][18]. This distance includes sprinting (approximately every 90 s), walking and long-distance running (about 60 m) [19]. In contrast, GKs cover shorter distances, ranging from 3.5 to 6.5 km during a match, with an average of 5.5 km. The majority of this distance is walking [3].

1.4. Risky Conditions and Situations

According to many authors [20][21][22][23] GKs get into a number of situations during training and matches which pose a high risk of injury. For GKs there are additional specific situations which can cause injury risks that are not present in the actions of field players. Such actions are crosses interceptions, 1v1 duels and shot stopping with diving techniques.

Non-contact injuries are caused by dynamic movements, including quick changes of direction, sprints, dives, jumps, throws, and kicks. Jumps and shot stopping, as well as diving saves, require large and rapid generation of forces at push-off [9][24][25][26] and include many diving techniques, which mostly end in hitting the ground [10]. Therefore, it is reasonable to anticipate that shot stopping training can lead to contusions, bruises, abrasions, wounds and even fractures [27]. Moreover, repetitive impact of diving saves may result in elbow and other upper extremity injuries. Additionally, some diving saves require the body to contort into extreme ranges of motion. The goal of deflecting the ball may cause muscle strain, tendon rupture, or joint sprains [23]. Shot stopping by catching is considered ideal as the opponent's attack ends and a possibility of rebound or second shot is reduced. However, catching powerful shots or deflecting the ball is not without risk. Such catches can cause sprains, dislocations and fractures of wrists, hands or fingers [28][29][30]. During

throwing, an excessive range of motion combined with a high level of dynamics can lead to injuries, especially in the dominant arm [31][32].

Contact (with an opponent or a teammate) injuries are caused by colliding with other players, being hit by the ball, falling on the ground and, in exceptional cases, even hitting a goal post. Passing under pressure or sweeping before a rival reaches the ball puts GKs at the risk of being kicked, hit or rammed by the opponent. Such situations can lead to bruises, abrasions, wounds, muscle strains, joint sprains and fractures. Similarly, aerial play and cross interceptions involve a high risk of colliding with another player [33]. At the same time, landing from aerial play can lead to joint sprains, muscle and tendon strains or ruptures. Additionally, 1 × 1 defensive situations often start dynamically and end in diving under opponents' feet, blocking the ball, or reaction saves.

A risk of trauma in the lower limbs is connected with running, kicking the ball, jumping, accelerating, decelerating, and changing directions both in GKs and in field players. In addition, kicking a ball and contact with other players challenging for a ball or making a tackle can result in trauma. Long passes demand dynamic movement with a lot of force production, leading to muscle and tendon strains, muscle attachments, avulsions (avulsion fractures) [34][35], or sprains—especially ankle sprains [36].

The factors described above, i.e., quick movements, excessive range of motion and impacts are apparent sources of pain and may cause injuries.

2. Injury Prevention Strategies

Injuries can lead to the cessation of participation in football activities including goalkeeping training, can slow down career development, as well as cause delayed effects after the end of football career. The injury hazard ratio increases with age, which makes it even more necessary to design preventing programs. The programs should be dedicated to GKs, implemented in training routines and evaluated. Studies on delayed effects of football goalkeeper training and playing should be conducted to describe the possible consequences.

The FIFA 11+ injury prevention program includes three stages with 15 different warm-up exercises performed in the exact order and a specific number of repetitions performed at least twice per week. A systematic review prepared by Sadigursky et al. (2017) revealed that the FIFA 11+ reduced the injury by 30% [37].

About one-third of shoulder injuries are severe and cause time loss over 28 days [21] which strongly justifies the implementation of a preventive program. The Fifa 11+ shoulder injury prevention program for GKs was designed on the basis of theanalysis of increasing incidence of upper limb and shoulder injuries [21]. Its effects, however, still need evaluation and assesment.

The injury prevention strategies should aim to decrease overuse and acute injuries rate, lower their burden and, in longer perspective, let preserve better health. It seems even more important for GKs who are reported to live 5–8 years longer than football players in other football positions [38].

3. Conclusions

A synthesis of the available literature suggests that football GKs have different injury patterns (type, localization, severity, mechanism, burden) due to their specific characteristics and conditions during game and training compared with outfield players. There are still some controversies whether GKs have the same or lower injury incidence compared to other positions. Still more scientific evidence is needed to prove whether GKs suffer more injuries in training than in matches, but it seems rational due to more goalkeeper-to-player interactions and more goalkeeping actions during training sessions comparing to matches.

The most frequent injuries of football GKs reported in the literature are fractures, luxations and dislocations in fingers, hands, and wrists, as well as muscle and tendon damage in the upper and lower limbs—especially the quadriceps femoris, and forearms muscles and tendons moving hands and fingers. There are also differences in incidence, risk and mechanisms of injuries due to overload-specific risk factors for GKs. The highest injury risk has been evaluated mainly for the upper limbs (shoulder, hand, wrist and fingers), because the most overloading and injury occur during diving saves, ball catches, and direct contact with other players. However, further precise research is needed for an absolute explanation.

3.1. Practical Applications and Recommendation

We provide some practical applications, which might be used by GK coaches, strength and conditioning coaches, athletic therapists, physical therapist, as well as by GKs themselves. First, the right ball size should be used during training in different age groups, i.e., up to 8 years old (size 3), from 9 to 12 years old (size 4) and from 13 years old and older (size 5). Therapeutic care should consider pain symptoms in the shoulder, wrist, hip, and groin and thigh early, because of high risk of overloading and injury during diving saves, catching and kicking the ball. Furthermore, pain symptoms should not be downplayed as part of the game and should be monitored instead. Such monitoring will allow players, coachers and therapists to understand the true duration and characteristics of pain symptoms.

3.2. Future Research Directions

Due to the identified knowledge gaps—injuries and pain in female GKs, young GKs, preventive program designs and their effectiveness, as well as particular injury locations considered to be crucial in field players—knee, groin, and shoulder injuries further research directions are suggested. There is also the lack of research on GK injuries of the head, neck and chest which can be very traumatic. Further research should be directed at the examination of gender and age-related differences in pain and injury mechanisms, based on the injury type and localization in football GKs. To obtain this effect, digital pain mapping can be used to replenish and enrich data assessing injury incidence. Preventive programs should be designed and their effectiveness assessed. Future research should coherently use definitions according to injury definitions described in the Consensus statement [39] to bring findings which would develop knowledge about football GK injuries and improve the prevention programs whose efficiency should be also scientifically evaluated. According to Bahr et al., analysis, not only of injury incidence, but also injury burden [40], is recommended.

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