HOW TO REDUCE THE RISK OF INJURIES IN TRACK AND FIELD?

CONTEMPORARY KNOWLEDGE ON INJURY EPIDEMIOLOGY, RISK FACTORS, AND PREVENTION STRATEGIES

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INTRODUCTION

Performance is a key shared goal in athletics (track and field). Injuries, however, often derail performance[1-4], and compromise athletes' short-, middle-, and long-term health[5,6]. Indeed, the sport of athletics is unfortunately and invariably associated with an increased risk of injury[5,7]. About two-thirds of athletes experience at least one injury per season[8-12]. And almost all athletes have experienced at least one injury after a few years of athletics practice[13]. Most key stakeholders agree, from both a performance and health perspective, on the need to reduce injury risk in athletics[14,15].

To reach this goal, we could use the injury prevention sequence[16]: establishing knowledge on injury epidemiology informs research on mechanisms and risk factors, as well as development of prevention strategies, whilst knowledge on mechanisms and risk factors could enlighten prevention strategies. However, athletics, although one sport, consists of several disciplines, each with its unique physical, mechanical, technical, and psychological demands, and therefore injury profile[17]. This complexity is a challenge for injury prevention. In addition, the potential efficacy of a prevention strategy, in the context of a scientific study, does not always translate to real-world effectiveness. Indeed, prevention strategies are not always used in practice, raising the challenge of adherence to the suggested measures.

This paper aims to narratively review injury prevention in athletics. We present contemporary knowledge on injury epidemiology, risk factors, and prevention strategies.

INJURY EPIDEMIOLOGY IN ATHLETICS: A STRONG BASIS TO INFORM INJURY PREVENTION STRATEGIES

Several peer reviewed epidemiological studies have spotlighted the extent of the injury problem in athletics in different contexts and populations—during international athletics championships; during the entire season; in different age categories (from youth to adult); and in the different athletics disciplines[18].

During an athletics season, about two-thirds of athletes had at least one injury, and the incidence was reported as 3-4 injuries per 1,000 hours of athletics practice[8-10,18]. During international athletics championships, about 100 injuries per 1,000 registered athletes have been reported, with variation according to sex[19] and disciplines[17] (Figure 1). In addition, about a third of

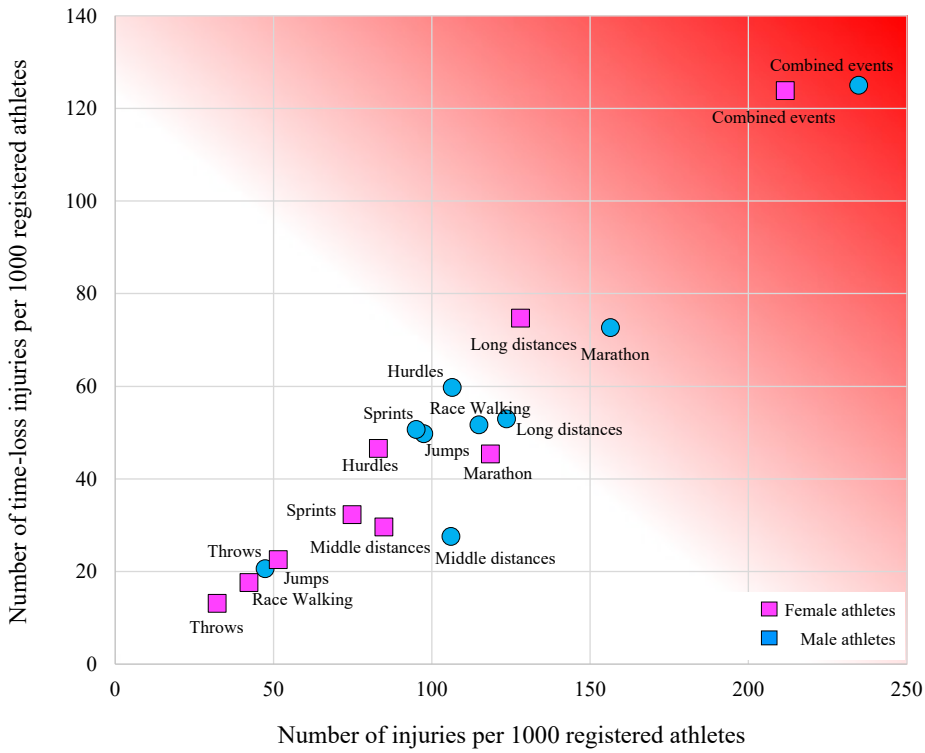

Figure 1: Number of injuries and time-loss injuries per 1000 registered athletes during international Athletics championships according to sex and discipline (inspired from Edouard et al[17]).

Table 1

Sprints	*Thigh/hamstring* *Achilles tendon* *Back*
Hurdles	*Thigh* *Lower leg*
Middle and long distance	*Lower leg* *Foot/ankle/Achilles tendon Hamstring* *Knee*
Jumps	*Thigh/hamstring* *Knee* *Back* *Achilles tendon*
Throws	*Back* *Upper extremity* *Ankle* *Knee*
Combined events	*Thigh* *Back* *Upper extremity* *Knee* *Foot/ankle/Achilles tendon*

Table 1: Summary of main injury location according to Athletics disciplines.

athletes reported having suffered from an injury during the four weeks before the championships[20].

Injury characteristics (location and/or diagnosis) reported in athletics epidemiological studies have been quite consistent, despite different injury definitions and classifications, and being mostly descriptive (no comparison)[8-10,21,22]. In Table 1, we present a summary of the main injury locations in the different athletics disciplines. These discipline-specific injury characteristics suggest that each discipline has its unique challenges and therefore injuries, irrespective of the circumstances and/or population[17].

In different studies with different contexts (e.g., age, level, country), some injury risk factors were associated with higher injury rates[8-10,19,20,23-27]. Table 2 presents the main reported risk factors. Less than a hand full of epidemiological studies in children's and youth athletics suggest a possible relationship between injuries and growth[24,28]. More work is needed in specific athletic populations, taking into account differences between disciplines and the large variety of potential risk factors (e.g. intrinsic, extrinsic, physical, psychological, social)[5,29].

Table 2

Intrinsic non modifiable risk factors	• *male sex*[8–10,19,23] • *female sex*[24] • *increased age*[8,9,25] • *a first episode of injury*[10,20,30] • *lifetime sexual and physical abuse*[27]
Intrinsic modifiable risk factors	• *maladaptive coping practice of self-blame*[26]
Extrinsic risk factors	• *participation in certain disciplines*[19,23,25] • *training load*[10,24] • *spikes in training*[24]

Table 2: Summary of the main injury risk factors in Athletics.

Despite this relatively substantial number of epidemiological studies to date, more high-quality studies are needed to better understand injuries in athletics. However, the current evidence-base is likely adequate to inform the development of various injury prevention strategies[18].

INJURY PREVENTION STRATEGIES

Current scientific evidence to reduce injury risk in athletics

Unlike other sports[31,32], only two randomised controlled trials[33,34] (to our knowledge) investigated the efficacy of injury prevention strategies in athletics.

Evaluation of a neuromuscular programme

One cluster randomised controlled trial, called PREVATHLE, was conducted during a 39-week period in a population of 840 athletes aged between 15 to 40 years. Athletes were randomly divided into two groups: (1) a control group who continued their usual training (n = 391), and (2) an intervention group (n = 449) who performed an Athletics Injury Prevention Programme (AIPP).

The AIPP included eight exercises, chosen to target the most common athletics injuries: hamstring muscle injuries, Achilles and patellar tendinopathies, low back pain, and ankle sprains. Whilst being time efficient and feasible for the athlete to complete, the eight exercises (addressing: core stability, hamstring, leg and pelvic muscles strengthening and stretching, and balance exercises) were performed in addition to the athletes' usual training at least twice a week (Figure 2)[33]. The AIPP was based on available literature on the epidemiology of athletics injuries, injury risk factors, and current evidence on injury prevention strategies[33]. Exercises used successfully for primary and/or secondary prevention were selected, including: eccentric strengthening to prevent hamstring injuries, Achilles and patellar tendinopathies; strengthening and neuromuscular control to prevent ankle sprains; and core stability to guard against low back pain[33]. Among the 840 included athletes, only 68 (15.1%) from the intervention group and 100 (25.6%) from the control group provided 100% of the requested information (weekly injury and participation in athletics training and competition) during the follow-up (39 weeks), and were included in the final analyses[33]. Furthermore, only 8.8% of athletes in the intervention group performed the intervention twice per week or more, as requested[33]. The proportion of athletes who had at least one injury complaint over the follow-up period was similar in the intervention (64.7%) and control groups (65.0%), with an adjusted odds ratio of 0.81 (95% CI 0.36 to 1.85)[33]. There were no between-group differences when separately comparing subgroups according to their different intervention compliance. In this randomised controlled trial, an AIPP did not reduce injury complaint risk[33]. However, the overall low response rate and intervention compliance could have contributed to the negative results. Notedly, a 40-week prospective cohort study (level 2 evidence) on 62 inter-regional and national-level athletes was conducted before the randomised controlled trial, asking the athletes to regularly perform the AIPP[35]. At 12 weeks follow-up, performing the AIPP was associated with a significantly lower risk of injury complaint, with a hazard ratio of 0.29 (95% CI: 0.12 to 0.73)[35]. However, after 40 weeks follow-up, there was no significant association[35]. More work is therefore needed to improve the AIPP itself, and importantly improve implementation and adoption of interventions more generally.

Evaluation of a digital health platform

A cluster randomized controlled trial involving young athletics athletes (aged 12 – 15 years) during a 4-month outdoor season in Sweden[34], employed a universal prevention approach. This form of prevention is delivered to large groups without prior screening and aims to reduce injury risk among asymptomatic populations[36]. The aim of the study was to investigate whether having access to athletics-specific training and health information—delivered through a digital health platform (Figure 3)—could reduce the incidence of injuries[34]. Digital health platforms—with well-aligned information that supports the development of safe sports practices—could efficiently engage grassroot-level stakeholders in a sport, particularly parents and coaches[37]. As the organisation of clubs varies considerably in Sweden (such as regarding coaching structure, e.g., employed, parents or older peers; or focusing on elite or youth athletes), the clubs were cluster randomised into intervention or control groups according to club size. Parents and coaches in the intervention group were given password-protected access to the digital health platform (Figure 3) and were encouraged

Figure 2: Exercises of the Athletics Injury Prevention Programme. For detailed information of the programme please see Edouard et al[33].

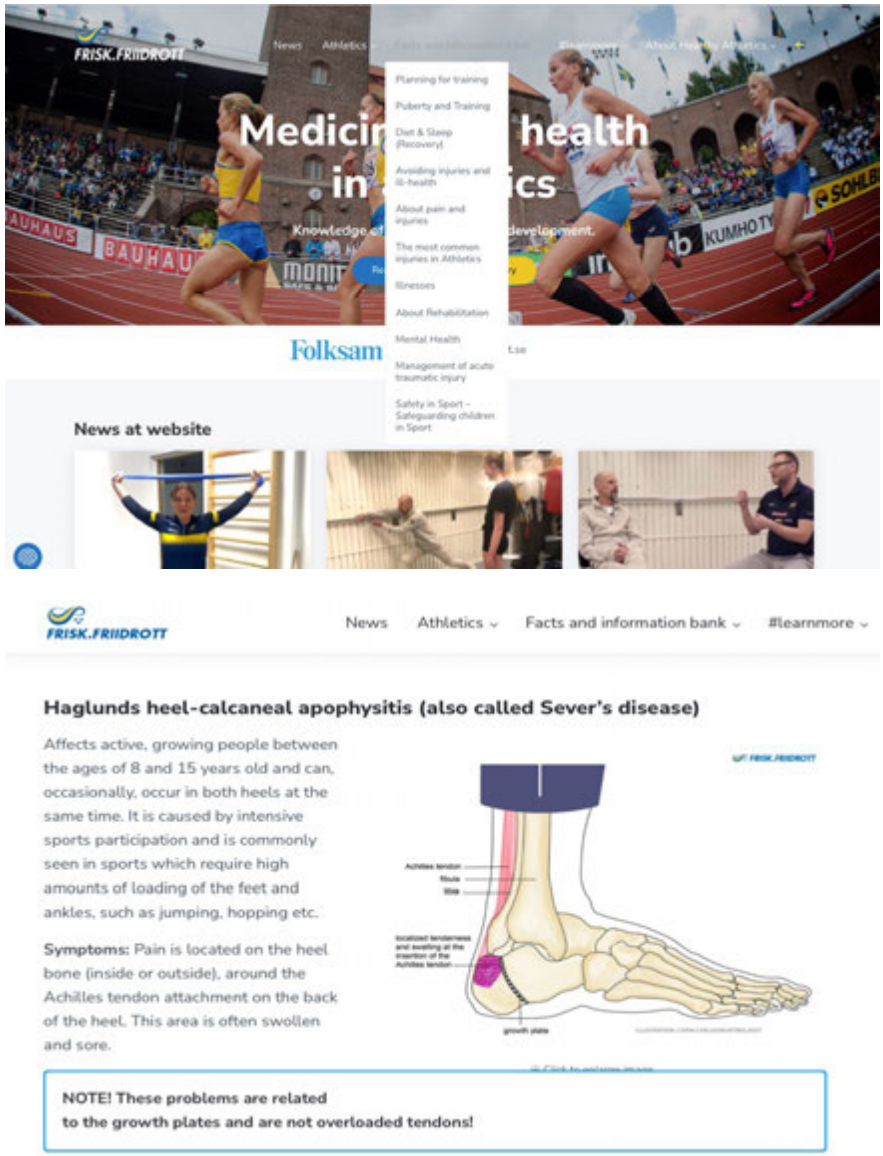

Figure 3: Screenshot of examples of some of the content on the digital health platform (up the welcome page, down a common injury in child/youth).

(four times during the 4-month period by e-mail alerts) to read and delve deeper into specific topics of the digital health platform[34]. The control group continued training according to their routine. Parents in both groups returned training and injury data every 2-weeks during the study period. Included in the analysis were 56 athletes in the intervention group and 79 athletes in the control group[34]. During the study, 85% of the athletes (together with parents) provided training reports. Compared to the control group, injury incidence was significantly lower ($p = 0.049$) (HR = 0.62; $\chi^2 = 3.865$; $p = 0.049$) among youth athletes in the intervention group[34]. This effect was amplified in larger clubs ($p = 0.049$). The median time to first injury was 16 weeks in the intervention group and 8 weeks in the control group. The authors concluded that an athlete's environment impacted individual risk of injury. However, as the study did not collect unique log-in data, inference on individual user patterns was not possible. Despite that, adherence with the intervention seems to have been good as the average time spent on the digital health platform was close to 5 minutes per log-in session. This study could inform development and implementation of injury prevention strategies in sports organisations and their grassroot networks (e.g., clubs). These multi-component social systems are dynamic; they interact and change along with the current societal environment[38].

We need more high-quality studies based on digital platforms to inform universal injury prevention in youth sports.

What else could be done?

Beside these two contemporary examples, we could suggest other prevention strategies; however, they are primarily based on the ideas and hypotheses of the article authors. Notedly, such prevention strategies should be global, multimodal, and multifactorial. They can include[5,29,39]:

- **Physical conditioning of athletes for improvement of sensorimotor control** by, for example: stretching-, muscular strengthening- (particularly eccentric), proprioceptive-, and balance exercises; exercises focussing on increased resistance to fatigue; and appropriate and optimal (not too much and not too less) training.
- **Improvement of technical movement and biomechanics** to avoid specific pathologies associated with a specific movement and/or technical mistakes that may result in injuries.
- **Sports equipment and rules**, for example: modification of rules to improve safety; changes in competition schedules according to weather conditions and the athletes' circadian cycle.
- **Lifestyle** for example, improved recovery, sleep, and/or nutrition, and being vigilant of painful symptoms.
- **Psychological approach** for example, mental preparation, mental imagery, regular psychological follow-up.
- **Coordinated and consistent medical care of athletes** for example, medical staff focussing on early and correct care of an injury, and athletes' health monitoring.
- **Education of athletes and their entourages** is important to make them actively participate in athlete's health protection and injury prevention[40];
- **Systematic and sustained approach by all stakeholders:** policy-level advocacy/change; national governing bodies and/or international federations prioritising "duty of care" for youth athletes; the top management of national and international athletics federations prioritising injury prevention and safety promotion initiatives[41,42].

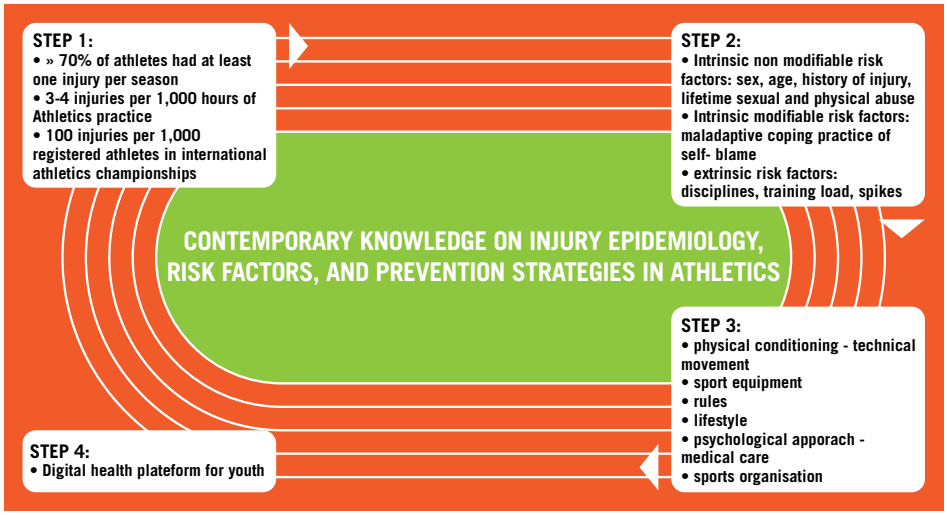

Figure 4: Summary of the contemporary knowledge on injury epidemiology, risk factors, and prevention strategies in Athletics.

The challenge of adherence and implementation

Injury prevention is logical and relevant—a notion shared by key athletics stakeholders[14,15]. However, injury prevention strategies are seldomly adopted[13,33]. In a recent online survey, less than one-third of 7,715 athletes self-declared having partially or fully adopted any injury prevention programme during their lifetime[13]. Furthermore, only 7.5% of athletes who participated in this study had completed an injury prevention programme during their lifetime[13]. In a randomised controlled trial in athletics[33], only 9% (6 of 68 intervention group athletes) declared to have fully complied with the injury risk reduction intervention (i.e., eight exercises two times a week). Although contexts are different (survey on a big sample of athletes with possible interpretation and recall bias, and experimental study), these results could indicate that injury prevention strategies are poorly adopted in athletics[33,43,44], similarly to other sports[45]. Indeed, compliance with injury prevention strategies are suboptimal in the context of scientific studies[43]. Equally, adherence to injury prevention strategies in applied practice has been disappointing[46,47]. The ideal to reduce sports injuries might never be realised if end-users do not properly use injury prevention strategies in practice[48-50]. Therefore, a better understanding of the beliefs and intentions of athletes who adopt or do not adopt an injury prevention strategy is likely to improve the implementation of such strategies. A recent online survey revealed that some athletes' characteristics could be associated with different levels of compliance with injury prevention strategies[13]. Characteristics such as competing at the highest level, presenting a larger number of past injuries, and sustaining a most-recent injury during the last or current season were positively associated with injury prevention programme adoption[13]. Higher scores of socio-cognitive determinants supported adopting an injury prevention programme in these categories of athletes[13]. Additionally, athletes who adopted an injury prevention programme during their career or the current season showed higher scores of socio-cognitive determinants than those who did not[13]. In the randomised controlled trial discussed earlier[33], no athletes' characteristics were associated with low compliance with the exercise-based injury prevention programme[44]. We should therefore continue to explore athlete characteristics that might explain adherence to injury prevention strategies. Such information could inform future strategies to improve injury prevention compliance[50].

CONCLUSION

Injury prevention in athletics is complex and challenging. In Figure 4, we present a summary of the contemporary knowledge on injury epidemiology, risk factors, and prevention strategies in athletics. Current knowledge on injury epidemiology and risk factors could inform prevention strategies. However, work should continue in collaboration with end-users (e.g., athletes, coaches, and healthcare professionals). Co-producing injury prevention strategies with end-users is crucial, not only because athletics is a diverse and complex sport, but also to bolster effective and efficient implementation.

References
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