Injury Prevention in Track and Field

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29.1 Introduction

The practice of track and field leads to a risk of injuries [1]. During a track and field season, about two-third of athletes occur an injury [2–4]. During an international championships, about 10% of athletes occur an injury [5–9]. The consequences of injury will depend on the injury location, type, and severity according to the track and field disciplines, but injury has always a negative impact on practice, because it can decrease training participation, decrease performance, and lead to pain [10]. Even if the injury is a minor anatomical lesion or leads to minor resounding on practice, there will be at least an impact on the musculoskeletal and psychological aspects, and can also negatively impact other domains of the life (e.g., social, professional, family, school, financial) at the short- or long-term [1]. Therefore, the prevention of injuries in track and field represents an important area for athletes and all stakeholders, such as coaches, health professionals, family, sports scientists, managers, sponsors, as well as international and national govern bodies [1, 11–13].

29.2 Prevention: A Multisteps Challenge!

In order to reach this injury prevention challenge, Van Mechelen et al. [14] described a four-steps methodological sequence of evidence-based injury prevention (Fig. 29.1): (1) determine the extent of the problem in terms of the incidence, severity, and characteristics of the sports injuries; (2) determine the risk factors (intrinsic and extrinsic) and injury mechanisms that play a role in the occurrence of sport injuries; (3) develop preventive measures that are likely to reduce the future risk and/or severity of injuries, based in particular on the knowledge acquired during the second step; and (4) evaluate the effectiveness of prevention measures especially developed in the third step.

In 2006, Finch [15] proposed a new sports injury research framework: the Translating Research into Injury Prevention Practice framework (TRIPP). This model was based on the fact that only research that can, and will, be adopted by sports participants, their coaches and sporting

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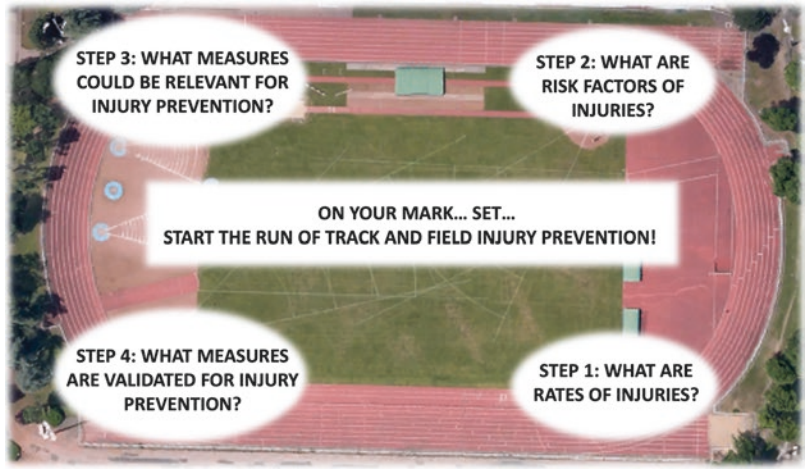

Fig. 29.1 The four-steps injury prevention sequence inspired from van Mechelen et al. [14]

bodies will reduce the occurrence of injuries. This means that studies on injury prevention should include information on key implementation factors (e.g., athletes' recruitment, reasons for use/nonuse the implementation). Based on the four-step sequence from Van Mechelen et al. [14], the TRIPP added two steps: (5) describe intervention context to inform implementation strategies; and (6) evaluate effectiveness of preventive measures in implementation context [15]. This proposed framework highlights that the use and thus the efficacy of an injury prevention measure in real life needs that the injury prevention measure should be developed by thinking and taking into account the acceptability, feasibility, and implementability in real life. The context of experimental research could be different than the context of the real life. There is thus a need to take into account the real life context and barriers from real life to develop injury prevention measure than will be use in practice.

In agreement with this proposed framework [15], Bolling et al. [16] recently revisited the first step of the "sequence of prevention" of sports injuries from Van Mechelen et al. [14]. Given the complex nature of the sports injuries, they suggested that the first step of the sequence should be improved by better understanding this complex nature by a more global approach. They proposed an alternative approach to explore and understand the context of the sports injuries at multiple levels, i.e., individual, sociocultural, and environmental [16]. Indeed, a better understanding of the context of the injury problem will guide more context-sensitive studies [16], and thus can improve implementation and use of the injury prevention measures.

Given the complex nature of sports injuries, the sports injury prevention measures should be appropriated to this complex nature and to the context of the sports injury in order to be efficient [17]. A step-by-step approach allows simplifying this complex challenge. This step-by-step approach aimed to understand and describe all components of the sports injury in order to build, develop, or create measures, strategies, and/or programs that can reduce the occurrence of injuries.

For track and field injury prevention, the magnitude of the injury problem was described in the chapter "The Burden and Epidemiology of Injury in Track and Field" of the present book, and there is now need to better understand the context of the track and field injuries as recommended by Bolling et al. [16]. For the second step, studies on track and field injuries reported that some factors seem to be associated with higher injury rates: a first episode of injury [4, 18–21], male sex [2–4, 6], increased age [2, 3, 7], participation in certain disciplines [5–9], training load [4], or maladaptive coping practice of self-blame [22]. However, work in this area should continue through specific studies on populations of athletes, taking into account the differences between disciplines

and the large variety of potential risk factors (intrinsic, extrinsic, physical, psychological, social…) [12, 13]. This information can help to propose some ideas for injury prevention in track and field described in the next paragraph, as well as the current knowledge on the steps three and four.

29.3 What Can we Do to Reduce the Risk of Injuries in Track and Field?

Unlike other sports [23–25], currently and to the best of my knowledge, there is no scientific published evidence proven by randomized controlled trials or other high-quality studies on the efficacy of injury prevention measure, program or strategy in track and field. This thus represents an important challenge and perspective for track and field injury prevention.

It is however to note that a 40-week prospective cohort study (level of evidence 2), was conducted by Edouard et al. [26], including 63 inter-regional and national-level athletes. Athletes were asked to regularly perform an athletics injury prevention program (AIPP) including eight exercises addressing core stability, hamstring, leg and pelvic muscles strengthening and stretching, and balance exercises. These exercises have been chosen to target the most common athletics injuries [1–5, 7, 8, 12, 13, 27]: hamstring muscle injuries, Achilles and patellar tendinopathies, low back pain, ankle sprains, while being time-efficient and feasible. The program was based on the literature on the epidemiology of athletics injuries, injury risks factors, and current evidence-based injury prevention programs. Exercises used successfully for primary and/or secondary prevention were selected: eccentric strengthening to prevent hamstring injuries [28, 29], Achilles tendinopathies [30], and patellar tendinopathies [31]; strengthening and neuromuscular control to prevent ankle sprains [32]; and core stability to guard against low back pain [33]. The AIPP included eight exercises with levels of progression: core stability (plank and side plank), postural control (one-leg balance), pelvic strengthening (lunges and hip abductor strengthening), hamstring exercises (stretching and isometric, concentric and eccentric strengthening), and lower leg exercises (stretching and eccentric strengthening). At 12 weeks of follow-up, performing the AIPP was associated with a significant lower risk of participation restriction injury complaint, with hazard ratio of 0.29 (95% CI: 0.12–0.73). After 40 weeks of follow-up, there was no significant association. These results are encouraging and are in favor of the use in practice of this program. However, they should be taken with caution before promoting its use, given some limitations of the study (e.g., it is not a randomized controlled trial leading to selection bias, there was a small sample size, the choice in performing the program or not can also influence the outcome) [26].

Therefore, a controlled randomized trial called PREVATHLE has been conducted during a 40-week period in a population of track and field athletes aged from 16 to 40 years. It was reviewed and approved by the Committee for the Protection of Persons (CPP Ouest II—Angers, number: 2017-A01980-53), and was registered at ClinicalTrials.gov (ClinicalTrials.gov Identifier: NCT03307434). It was aimed at including 880 athletes randomly divided into two groups: one control group continuing its usual training and one intervention performing the AIPP at least two times a week in addition to its usual training. We expect that the results of this PREVATHLE controlled randomized trial will help to define whether the AIPP is relevant to help reducing the occurrence of injuries in track and field.

According to these results, this athletics injury prevention program can be considered as a first step in the development of an exercise-based injury prevention program. One way of improvement can be to individualize the program to the sex and the disciplines of athletes. Indeed, since injury characteristics varied according to sex and disciplines [8], it seems relevant to adapt the selection of exercises of the injury prevention program in order to target the main injuries incurring for a discipline and by sex. For example, the main injuries in female long-distance runners

will be different than in male sprinters [8]. Consequently, it is logical to think that exercises included in an exercises-based program, which can help to reduce the occurrence of these injuries, will be different. Thus, the next step when reflecting at an injury prevention program will be to adapt it to the discipline and sex. After that, another next step will be to individualize it to the individual characteristics of each athlete. This can be reached by individual screening of athlete's deficiencies [34], in order to develop exercises-based injury prevention program appropriate to discipline, sex, and individual characteristics.

In addition, the preventative approach should not only consider exercises aiming at improving strength, flexibility, neuromuscular control. The preventative approach should be global, multimodal, and multifactorial. Since there is no scientific published evidence proven by randomized controlled trials or other high-quality studies on the efficacy of injury prevention measure, program or strategy in track and field, injury prevention measures could be proposed based on evidence-based approach combining evidences from other sports and expert experience in track and field. In this way, Edouard et al. [12, 13, 35] proposed, based on a nonexhaustive review and brainstorming between the coauthors, some measures that may help for injury prevention:

1. Physical conditioning of athletes for improvement of sensorimotor control by, for instance stretching, muscular strengthening particularly eccentric, proprioceptive, balance, increased resistance to fatigue.
2. Technical movement and biomechanics improvements to avoid technopathies and/or technical mistakes that may result in injury.
3. Sports equipment and rules (e.g., modification of rules to improve safety, changes in competition schedules according to weather conditions, the circadian cycle).
4. Lifestyle (e.g., improved recovery, sleep, and/or nutrition).
5. Psychological approach (e.g., mental preparation, mental imagery, psychological follow).
6. Coordinated and consistent medical care of athletes (e.g., medical staff, early and correct care of injury, athletes' health monitoring).
7. Systematic and sustained approach by all stakeholders: the top management of national and international athletics federations should support injury prevention and safety promotion initiatives.

Finally, as for the general injury and illness prevention at major athletics championships, the 10 tips "PREVATHLES" proposed by Edouard et al. [36] could be relevant to help to reduce the occurrence of injuries in track and field:

1. When there is a travel, it is important to anticipate and prepare it (e.g., medical checking, vaccine, time-zone, jet lag, culture, food habits).
2. As stated above, it is relevant to respect athlete characteristics and discipline specificity when developing injury prevention program or strategy (e.g., sex, endurance/explosive).
3. Education of athletes and their entourages is important to make them actively participate in athlete's health protection and athlete's injury prevention; being vigilant of painful symptoms and subclinical illness markers.
4. Prevent illness can limit new injuries, so avoiding infection risk by, for instance washing hands, safe food and drink, avoid contact with sick people, could be of help.
5. Train appropriately and optimally (not too much and not too less), including for instance physical conditioning, technical training, load management, psychological preparation.
6. Taking into account the health status (e.g., history of previous injuries, well-being in the month before championships) seems relevant to individualize injury prevention strategies.
7. Improving lifestyle is relevant to reduce the risk of injuries, e.g., good sleep, regular hydration and nutrition with safe water/food, regular fruits and vegetables, improve recovery strategies.
8. It seems relevant to take into consideration the environmental conditions (e.g., heat, cold, air cleaning, changes or climatic conditions).

9. Finally, it is important to have a safety practice and lifestyle (e.g., equipment, rules, own-practice in athletics and extra-sport activities).

29.4 Conclusions

Given the risk of injuries lead by the track and field practice, the prevention of injuries in track and field represents an important area for athletes and all stakeholders, such as coaches, health professionals, family, sports scientists, managers, sponsors, as well as international and national govern bodies. Using a step-by-step approach that aims to understand and describe all components of the sports injuries seems relevant to develop measures, strategies, and/or programs that can reduce the occurrence of injuries. Unlike other sports, currently and to our knowledge, there is no scientific published evidence proven by randomized controlled trials or other high-quality studies on the efficacy of injury prevention measure, program or strategy in track and field. Injury prevention approach should thus target the main injuries, taking into account the specific injury characteristics by disciplines and sex, and if possible, of each individual athlete's characteristic. In addition, the preventative approach should be global, multimodal, and multifactorial, including but not limited to, improvements of physical conditioning, technical movement and lifestyle, psychological approach, adaptation of sports equipment and rules, coordinated and consistent medical care of athletes, and systematic and sustained approach by all stakeholders to support and promote injury prevention and safety practice.

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