

## A Brief Review about Sport Injuries Focused on Environmental Factors

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### Abstract

This is a review about the history and evolution of sport injury factors selecting and analyzing different papers from 2000 up to the present. In this research, the author makes a critical interpretation about the treatment of the environmental factor taking into account the importance of this issue for the human development in this new century. In this study he established a detailed comparison among the authors and the way they assume etymologically the term and structural conception of sport injury factors. With this paper the author intends to reinforce the importance of the environmental factor as a component of the sport injury factor, but with a more integrated approach far from the traditional naturalistic held by most of the authors. It is an attempt to improve the theory and practice of the physical preparation in terms of sport injury factors and injury prevention.

**Keywords:** Review; Sport Injuries; Environmental Factors

### Introduction

Undoubtedly Sport is one of the most attractive public activities followed by human beings since early times. Even nowadays when Olympic Games are watched by millions of people all over the world, there is always a strategy behind a gold medal result, avoiding as much as possible any risk to the athlete's health. Worldwide, it is known the establishment of diverse programs which help athletes to get their top achievements, avoiding injuries as much as it can be previewed. Unfortunately, things like these happen unexpectedly, that's why it would be very convenient to consider a review about sport injuries and include it as a reference material for an integrated physical preparation. Considering this premise, the objective of this work is to present some of the criteria, taken by experts about sports injuries, recreated by the personal point of view of this author.

The purpose of this work is essentially to review the sport injury factors adopted by some authors who dedicate their works in this issue and establish an analytical comparison among their assets, their coincidences and differences, making a specific analysis in the environmental factor.

### Assuming a general definition

According to Wikipedia, sports injuries are a sort of injuries that occur during sport, athletic activities, or exercising. Despite this digital encyclopedia is not a scientific resource; it gives basic information to the reader about the meaning of a sport injury, its types and the ways to prevent this irregular upset for the sport movement and physical activity. These types of injuries are: soft tissue injuries, hard tissue injuries, overuse injuries, head and neck injuries and specifically connected to physical activity it is included the sports related musculo-skeletal Injuries. These types are widely explained in this site and it is also mentioned some of the risk factors leading to these injuries followed by its possible strategy of prevention. However, from the scientific point of view they haven't been exhaustively described. That's

why there comes up an obvious necessity to illustrate how this phenomenon is seen along different authors organized in a historic order, focusing the environmental factor as a crucial component of this century.

### Why is the environmental issue the focused factor in this work?

It said and done that this Century XXI is named the century of environment; the climate changes have shown to the current generations that the threatening to chaos and the extinction of many species, including the human race, can be reached soon if there is not an effective strategy on Earth. In sports as in most of social activities, organizing authorities must be aware of the environmental factors which also affect the athlete's performance and health condition. Unfortunately, this factor has not been considered and put into practice successfully, so the authors intend to reveal this limitation and present a different viewpoint.

### Following a historical evolution through factors of sport injuries

In 2000, the world counted on a study dealing with sport injuries which provided two definitions to this item. According to Gimeno and Chamorro [1] the first definition of (NAIRS) National Athletic Injury Registration System - EE.UU reads that sport injuries are those ones which affects sport participation (training/contest) at least a day after being produced. These injuries may be classified into light, moderate and critical. The second definition is given by the Europe Council and it declares that it is any injury, produced while participating in a sport whose effect leads to one or more consequences like these:

1. Reduction in amount or level of sport activity
2. It requires medical consult or multi factorial treatment
3. It yields social effects or undesirable economic impacts.

This first consulted literature unveils the prevailing internal and external factors which might lead sport injuries. Into the internal one are found:

1. The existence of a physical disorder
2. The physical condition of the individual
3. The presence of previous injuries
4. The psychological, constitutional aspects and those linked to the age.

Among the external factor are gathered:

1. Sports (branch and specialty, amount of time during practice and kind of rival)
2. Facilities (turf, courts, fields/light/security measures)
3. Equipment (material/safety equipments/dressing)
4. Environmental (temperature/humidity/ wind)
5. Trainer-coach (rules put into practice).

In a personal opinion, the environmental conception is perceived strongly naturalistic. It can be explained this way, since the original author of this paper excluded the facilities and the social connection of the sport staff out of the environmental factor for the prevention and treatment of these injuries.

In 2003, Navarro [2] separated the factors of sport injuries into two big groups; the intrinsic factors and the extrinsic factors: the first have to do with personal characteristics; biological, psychological, morphological, and related to physical condition, challenges, attitude, behavior to the training and competition. Otherwise, the extrinsic factors are based on all the independent items out of the athlete's nature, just like the process of training, the environment and the requirements of sports.

In 2004, the classification of these factors was more simple and different according to the work of Zafra, *et al* [3]. They resumed the factors into 4 groups: psychological factors, sport factors, factors related to sport demand and factors due to other's behavior. Here, the environmental factor was not even mentioned, instead there was a slight announcement of environmental stimuli which could probably alter the psychological factor. It meant that here the environmental side was only an influencing agent that could harm the athlete's psychology. From this viewpoint, some questions emerge: If an athlete suffers an injury due to the irregularities of the field or a sudden change of climate in a competition does it only affect his/her psychology?

In 2006, the factors changed the term for causes, if we take as reference the work of Díaz, FJ [4]. He groups or classifies the factors as:

1. Muscular fatigue
2. Alteration in muscular equilibrium
3. Change of work system and the fields of training
4. Other factors.

Differing from the precedent analysis, this author did not go into a deep diagnosis of the athlete regarding his previous injuries, the role of psychology and behavior.

The environmental factor was included in the fourth item referred to other factors, obviously naturalistic, with no integration to the social and resourceful support of sports. This was also the item corresponding to technology, health, athlete's rest, infections through the travels of competition, hypothetically it is the factor to group everything that could affect the athlete and it was not included in the former 3 items.

In 2007 the tendency was to retake the same classification of internal and external factors but this time the inner structure of these factors was even different. The internal factors based on Ciro, *et al*. [5] might be described as:

1. Age
2. Gender
3. Body constitution
4. Health condition
5. Physical conditioning
6. Hormonal factors
7. Nourishing factors
8. Toxic factors
9. Metabolic diseases
10. Pharmacological
11. Sport technique
12. Body alignment
13. Coordination
14. Mental state.

**The external ones are distinguished as follows:**

1. Training regime
2. Equipment for sport practice and protection
3. Characteristics of the training and competition fields

4. Human factors
5. Environmental factors.

As a marked difference this approach specified more closely the internal factors than the precedent one in the year 2000. However, the environmental factor only referred to the incidence of snow and rain onto the surface of the field which provoked sport injuries. So, it could be very clarifying this question here: Is the surface of the field the only environmental factor which could lead sport injuries?

In 2009 no trend emerged to enrich or propose any new standard of classification, It was only used already established patterns to carry out a diagnosis on sport injuries. That is the case of Zafra., *et al.* [6] who intended to verify the role of psychological factors in sport injuries determined in tennis athletes, based on the classification presented by Zafra., *et al* [3]. In any case these authors took into consideration as determining factors of his Tennis athletes: muscular fatigue, physical condition, coordination, concentration, life style. However, the environmental factor was not an item to evaluate, not even to confirm that the conditions of the facility and the temperature changes are depreciable in this study.

In 2011, the injury taxonomy for sports tended to be more anatomic, that's to say more linked to the inherent biology of man. Following works such as Peeri., *et al.* [7] the types were:

1. Articulation injuries
2. Muscular injuries
3. Bony injuries
4. Skin injuries.

Particularly this study was centered on different questionnaires in which each Karate athlete should give information about his injuries. It is obvious that the rank of choice was more approximate to the result than to the agents that interplay in the sport process, that's why the items were elaborated to be understandable and manageable enough for athletes and not for specialists. Maybe it is the reason why the environmental factor is not included in the list. Besides, factor was not the suitable term in this study for the patterns already followed in this matter. In the paper it was attributed to the effect rate factors involved in injury occurrences such as: not having primary physical preparation, not having the body build related to karate, Inappropriate warm up, not being skillful enough in performing the techniques and others.

In 2012 and 2013, the papers of sport injuries followed a similar conception to that one written in 2011, giving a particular stress to physical condition in order to facilitate competitions and get the best results in top athletes. Reinstolen., *et al.* [8]; Avalo [9]. The environmental topic was only reduced to the physical context where the athlete carries out his sport activity, there was not remarkable opinion of the diversity of ways in which the environment could serve or affect to the athlete.

In 2014, the priority was to apply surveys to characterize the sports injuries in most of sports and to establish some general conclusions as a description of the problem that generated the production of injuries in the growing population of amateur sport practitioners. Following this line, comparative case-control based on scientific data, Garcia-González., *et al.* [10] was a vivid example of this trend when they diagnosed 1616 subjects that suffered an injury doing any kind of recreational sport in Spain. The reason for it was to know the results of amateur sports injuries on the general population in Spain, avoiding any bias based on the different sports habits of every region. It was clear that the environmental factor was not an item to consider in this survey.

In 2015, there prevailed a reaffirmation of the already mentioned internal and external factors which led to sport injuries. Specifically in this case, Andreu [11] was aimed at determining the relation between the amount of total injuries (frequency and impact) with the social demographical indicators such as (age and gender) and the sport indicators (experience, training schedule and sport specialty). The most indicators close to environmental factors were those ones related to practicing sports indoor and outdoor, production of injuries

on grass and roads. However, figures on percentages shown there, only gave vague conclusions about the interconnection between the athlete and the physical and social context where he/she practiced sports.

In 2016, studies have been directed to diagnose the definition of sport injury in certain sample of population, in this case Weiler [12] proposed an identification of risk factors for injury by placing sports injuries in greater intrinsic and extrinsic context. The results revealed that injury definitions varied from any conditions involving a medical consultation with a healthcare professional, without consideration of outcomes, to conditions resulting in 1 or more days' absence from training or competition. This study went a little far from the logic of sport injuries which have prevailed so far, but in any of the readings, the environmental factor kept on being more unfamiliar than the whole papers above.

In 2017, the concept was to find a framework to differ sport injury from risk factors and the interactions between the athlete (i.e. intrinsic factors) and environmental stimuli (i.e. extrinsic factors) [13]. In brief, this initiative brought to light an operational structure for managing injury risk. It is organized into 6 stages:

1. Injury trends
2. Injury factors
3. Sport demands
4. Athlete monitoring
5. Athlete management
6. Athlete profile.

What most calls our attention is the way these authors present stage 2 Injury risk factors and how they conceive the environmental factors into these stage. But all that we could encounter is that certain variables can modify the impact of individual risk factors, for example: acute spikes in training load increase injury risk, or simply adopt premises like the one below: "Similarly, previous injury increases risk of incurring a future injury, however confounding variables such as neural inhibition, selective muscle atrophy, alterations in fascicle length, strength deficits, and increased susceptibility to fatigue need to be considered. Such maladaptations may exist in some athletes following rehabilitation periods which may alter their injury susceptibility following return to play. Thus, practitioners should avoid reliance on a single risk factor when managing injury risk" Roe., *et al.* [13], p. 3.

As in many others papers, here the environment worked as an extrinsic stimuli that could be identified as an object, happening or context out of the athlete's nature which might affect his activity, performance or health condition. It was a very simple and superficial background that would take a debate to understand it more dimensional and influencing.

In 2018 the papers dedicated to sport injuries were more focused on a diagnosing what part of the body has been more affected by sport injuries. Here prevailed one very remarkable in Racquet-Sport Injuries in the United States, 1997-2016 Nhan., *et al.* [14] in this work the most important target was not to determine the cause, or the doer of the sport injuries but to reach figures about the injured athletes, to know what part of the body was mostly wounded or affected, which were the places with more sport injured and other statistics. Starting from this condition it was very difficult to know if the environmental factors had more or less incidence in the athlete.

In 2019, the paper consulted about sport injury was directed to diagnose the situation of sport injuries into the statistics of a school; in extracurricular activities in the community or during activities performed under teacher supervision [15]. To determine the factors classification was not a field to establish in that research. Sprains and contusions were among the type of injury most frequently perceived, specifically in ankles and knees. An amount of 27.3% of the injuries informed made students aware in Physical Education sessions for more than three days. It was very possible that the environmental factors could influence in these results (above all in the community extracurricular activities) but obviously it was not the target of the authors either.

In 2020, the consulted research was the thesis conducted by Tercero García [16], based their paper on the referents established so far regarding sport injuries (intrinsic and extrinsic taxonomy). The good news was that these authors took into account the environmental factor in the diagnosis they realized as objective 3.

The values to consider were the following:

1. Lights
2. Noise
3. Temperature
4. Volleyball Court structure
5. Ground floor.

The bad news was that still they continued assuming the environment from a reduced naturalistic vision.

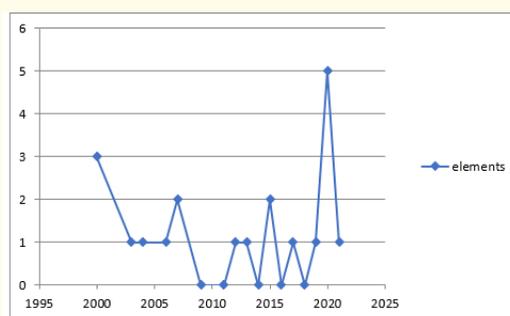
In 2021, Rios Garit [17] presented a study on sport injuries from a psychological dimension, trying to connect the mood, self esteem, self confidence, self control and other psychological processes with the athlete’s performance in baseball pitchers. In this research the environmental condition was only guaranteed to make possible the application of the survey. However, the environment was a possible factor in the athlete’s performance and the repercussion of this item for his psychological stability and mental health has been underestimated.

### Final considerations of the review

The author of this research could summarize after analyzing the characteristics of the consulted paper that in most of the works about sport injury factors, the taxonomy intrinsic/extrinsic or internal/external has been prevailing.

In the papers consulted there are diverse ways to treat this matter; some refers to factors and its taxonomy, some other to which parts of the bodies have been injured, and some other only manage figures and statistics around the topic.

According to graph 1, it can be seen clearly than in the consulted papers there is a poor reference to the environmental factor and the elements added are not enough to reach an integrated conception of the environmental factor, mostly attributed to the naturalistic dimension.



Graph 1: Presence of environmental elements per year.

The environmental factor as it can be seen in recent scientific documents may not be only attributed to naturalistic nature. The social-ethical environment, as the cohesion in the collective sports or the integration between athlete-trainer, maybe an item to take into account as a psychological influence. This is environment as well, and might cause a sport injury. The constructed environmental factors are also determining, it is more tending to cause sport injuries, the hard surfaces with irregularities than the soft plain surfaces.

### Conclusion

In this paper it has been developed a review of some consulted research about sport injury factors. This study reveals that there is not a homogenous consensus about the treatment of sport injuries regarding factors, causes, prevention and rehabilitation.

Most of the papers exclude the environmental factors underestimating the incidence of environment in the athlete's performance during training and competitions.

Most of the approaches of the environment factor adopted are coming from a naturalistic dimension, underestimating the social ethical and constructed environment dimensions.

The tendency to include this environmental factor in the papers is decreasing (except the thesis carried out in 2020). It is a point to take into account by experts because in this way sport authorities can design a most scientific strategy to keep athletes away from sport injuries.

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