

Risk Factors of Lower Limb Injuries in Long Distance Runners

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Abstract:

Background: Long distance running is one of the most popular and also one of the most painful sports. As a result of participation in sport is the high incidence of injuries. Most injuries of the long distance runners occur on the lower limb, especially the knee joint. Up to 75% of injuries occur due to overuse by the constant repetition of the same motor pattern.

Materials and Methods: This paper is a literature review report concerning the factors leading to lower limb injuries in long distance running. A thorough analysis of relevant literature sources such as articles, studies and books was carried out and is presented.

Results: Causative factors associated with injuries to long-distance runners include previous history of injury, lack of experience running and over-week workout. The relationship between injury and risk factors such as warming up, frequency of training, stability of the locomotor pattern running, height of the body, muscle imbalance, limited range of motion, stretching exercises, shoes and quite orthotics devices remains unclear and under investigation. Factors not associated with significant injuries appeared to be age, gender, body mass index, running outdoors or on hard surfaces, participation in other sports, season and time of day.

Conclusion: The prevention of sport injuries should focus on changing health behaviors. The health education for injuries should be mainly focused on the importance of full rehabilitation, early recognition of symptoms of overuse and training guidance.

Key Word: long-distance runners; incidence of injuries; injuries risk factors.

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I. Introduction

Long distance running is one of the most popular recreational activities. Along with the beneficial effects on health, the negative effects of sports injuries must also be acknowledged. Depending on the specifics of the group of runners (athletes or leisure runners, men or women) these percentages vary. Research in long-distance runners has reported that the incidence of lower limb injuries ranges from 19.4% to 79.3%^{2,7,9,10,14,18,32}.

The most common injuries of the lower limb occur in the knee, the frequency of which ranges from 7.2% to 50.0%. The incidence rates in the tibia range from 9.0% to 32.2% (tibia, Achilles tendon, gastrocnemius, heel), in the soles from 5.7% to 39.3% (including toes) and in the thigh (iliac tendon, quadriceps) from 3.4% to 38.1%, respectively. Less common injury points of the lower limb are the ankle and hip / lumbar region (and groin), ranging from 3.9% to 16.6% and 3.3% to 11.5%, respectively^{2,3,10,14,16,17,18,31,39}.

There are a number of factors besides the structure of training which can affect the running efficiency and the neuromuscular adaptation. Passive interventions such as shoes and the use of orthotics, as well as a history of musculoskeletal injuries, can be assumed as important factors of the neuromuscular control and running performance. In addition, changes in muscle activity have been reported for the same reasons. The type of the shoe which helps the motor control may increase the running endurance and this results in reducing injuries that are caused from overuse, in athletes with decreased foot stability during long distance running¹. Muscular imbalance between the lower extremities has also been mentioned as a risk factor⁵.

Running involves moving on the ground at a rapid pace^{1,8,12,25}. Energy accumulates and returns to the musculoskeletal system^{13,20} through a complex transfer system that includes muscles, tendons, ligaments, and soft tissue of the lower extremities. This complex system behaves more like a linear motion transfer when the entire lower limb moves on the sagittal axis^{10,30}. Deviations from the normal motor pattern result in the appearance of injuries that may be due to a number of factors.

The aim of the present study was to review recent data concerning lower limb injuries in long distance runners. More specifically the main purpose of this study was to identify the risk factors of lower limb injuries in long distance runners as have been mentioned in English language scientific bibliography.

II. Risk factors

Risk factors for lower extremity injuries in runners may be divided into four categories: systemic factors, running / training factors, health factors, and lifestyle factors.

Systemic factors

Opinions vary as to whether age is a significant risk factor. Research suggests that older age constitutes an important risk factor for injury^{15,17,19,39}. However, other studies in older runners present the age as a protective factor^{19,35}. There is also evidence that older runners are more likely to get injured in the anterior femurs and more difficult in the gastrocnemius, while female runners are more prone to hip injuries¹⁹. Studies in which participants, regardless of age, underwent the same level of education show a significantly increased tendency for injury with age^{22, 33}. In contrast, in the general population, older age has been reported to be potentially protective against injury, based on the experience of a runner to "hear his body language" and know how to avoid injury³⁶. One study concluded that increasing age was associated with a significant reduction in running injuries, but argued that it was due to a lack of previous medical history²⁸.

Research suggests that a small difference in leg length is associated with lower limb injuries and that greater knee stiffness is a risk factor for tibial injury¹⁷. In addition, there is evidence that higher heel wryness protects against knee and foot injuries, while lower heel wryness is an indicator of knee injury protection¹⁷.

Krivickas et al.²³ associated the plantar clubfooted with the onset of plantar fasciitis and fatigue fractures. Kvist et al.²⁴ reported that a clubfooted sole is associated with the induction of tendonitis of the Achilles tendon, while Wen et al.³⁸ associated the relative abnormal height of the foot arch with iliac tendonitis and tibial injuries. On the other hand, Ogon et al.³⁴ argued that a higher load on the lumbar spine occurs in people with a low arch.

In a study by McPoil et al.³¹ male runners whose height was 1.70 meters or more are reported to have a significantly higher risk of injury. However, there is limited evidence for the association between height and the incidence of lower extremity injuries. Contrariwise, higher body weight seems to act protectively against injuries¹⁷, while there is evidence that a body mass index greater than 26 kg/m² protects male runners from lower limb injuries³⁹.

Factors related to training

There are conflicting views on whether there is a positive relationship between training volume and overall lower limb injuries^{17,19}. Studies report that male runners are statistically significantly more at risk when running more than two days a week, and similar data were found for women³⁹. These researchers also report that training at more than 64 km per week is a significant risk factor for lower limb injuries in male runners, while in women this relationship has not been confirmed^{2,31}. Other researchers argue that increasing the running distance training per week is an important factor in preventing knee and ankle injuries^{17,19}.

In the studies of Van Mechelen³⁷ and Brill and Macera⁷, running distance is considered one of the most powerful injury-causing factors. In fact, these researchers confirm that it is difficult to accurately determine the risk of injury to a population, despite the recording of numerous risk factors, unless training time is taken into account. It is recommended that future research on the risk of injury to runners include exercise time in their method.

According to some research, warm-up does not play an important role in the occurrence of lower limb injuries. However, there is some evidence linking lower limb injuries to women runners who run on hard surfaces². However, there was no significant amount of occurrence in men. James et al.²¹, however, did not find any association between training on hard surfaces with an increased risk of injury^{4,28}. The apparent lack of effect of the training surface may be due to the difficulty of quantifying the time and intensity of the run performed on each of the running surfaces.

There is evidence linking tibial injuries to the use of a larger number of running shoes¹⁷, while there is limited evidence that a shoe aged four to six months is a protective factor for lower extremity injuries in male runners, but a risk factor in women³⁹.

Finally, no significant correlation was found between running rate and lower extremity injury^{17,18}.

Health related factors

History of previous injuries has been reported to be a significant risk factor for injury in many studies^{2,9,17,31}. There is evidence of a positive relationship between the history of previous injuries and the appearance of new injuries to the lower extremities.

According to Marti et al.²⁸ and Macera et al.²⁷, a previous injury is an important harbinger of injury reappearance. Macera et al.²⁶ stated that it is not clear whether the high reappearance rate is due to incomplete treatment of the initial injury, a tendency to re-injury, or an uncorrected kinetic problem.

Lifestyle factors

There is evidence that alcohol consumption is a risk factor for anterior femoral injuries. Involvement in cycling and other aerobic activities are also risk factors for injuries to the anterior femur and pelvic tendon, respectively¹⁹. This prospective comparative study was carried out on patients of Department of general Medicine at Dr. Ram Manohar Lohia Combined Hospital, Vibhuti Khand, Gomti Nagar, Lucknow, Uttar Pradesh from November 2014 to November 2015. A total of 300 adults (men and women) aged ≥ 18 years participated in this study.

III. Discussion

Based on bibliography findings, risk factors for lower limb injuries in athletes fall into four categories: systemic factors, running / training-related factors, health factors, and lifestyle factors. In terms of systemic factors, age appears to be a risk factor^{15,17,19,39}. According to research conducted in athletes, age is a risk factor while in the general population it seems to act protectively for the occurrence of injuries³⁶. A similar correlation is observed between the sexes of runners.

The existence of asymmetry¹⁷, the height of athletes³¹, and their body weight¹⁷, based on research's data seem to be factors that cause injuries. Conflicting are the views on training frequency^{17,19} and the weekly running distance during training^{17,39}, while the warm up^{2,31} the surface type^{4,28} and running rate^{17,18} do not appear to be positively correlated with injury occurrence.

Regarding health risk factors and while they have not been clearly defined²⁷, there is an agreement among research views as to the correlation of the athlete's previous history of injuries with a new injury. While research confirms this correlation, also fails to adequately determine the causes of the increased tendency for recurrence of lower limb injuries, given some unidentified possible causes.

Research shows that athletes' daily lifestyle can be a potential cause of lower extremity injuries due to alcohol consumption and aerobic activity¹⁹.

IV. Conclusion

Concluding, the contribution of mechanisms that may affect neuromuscular control and running efficiency, such as the type and age of the athletic shoe, the hardness and the type of surface need further investigation. It is not clear that inadequate recovery from an old injury may be a risk factor for reappearance of a new injury²⁶, while the effect of changes in the neuromuscular control, as a result of running injuries, needs to be thoroughly considered⁶.

The preponderance of research, classifies the stability of locomotor running pattern, muscle imbalance, reduced range of motion, stretching exercises, knee stiffness, abnormal height of the foot arch and the use of orthotics devices as factors that may affect the lower limb injuries to some extent.

Most researchers agree that the main factors leading in lower limb injuries, includes previous history of injuries, lack of experience in running and overtraining per week.

Based on the findings of this study we may support that for injury prevention it would be wise to change the way previous injuries are managed and take into account the overall health of the athlete. As the factors of lower limb injuries are not sufficiently established, the main way to prevent them is to completely recover from any previous injuries and recognize early the symptoms of overuse

More scientific data is needed to determine the causes of lower limb injuries. Those information might benefit a large number of athletes by giving them the opportunity to design ways to prevent and avoid unwanted injuries. In addition, further research is needed to determine whether the training methods, training frequency, and running duration may affect the incidence of injuries.

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