



OVERUSE INJURIES IN LONG DISTANCE RUNNING - A LITERATURE REVIEW ON RISK FACTORS

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ABSTRACT **INTRODUCTION:** In the past three decades, the incidence of running-related overuse injuries has significantly increased because of the increasing number of recreational athletes and higher training intensity in competitive athletes. Long distance running has gained popularity in recent years, but between 19.4 and 79.3% of runners sustain a running related injury every year. Various risk factors contribute to the occurrence of this issue and shoe modifications are thought to be an efficient tool in managing running-related over use injuries. The aim of this study was to collect and review information about the risks factors of overuse injuries long distance running.

METHODOLOGY: A systematic search of the electronic database of PUBMED, Bireme and PEDro which were selected that addressed clinical trials, control cases, prospective and cross-sectional studies.

RESULTS: The search yielded 246 references. A predefined inclusion criteria (case studies, clinical trials, prospective studies, cross sectional studies that addressed adult runners either amateur or professional) was used and 51 articles remained. 18 citations were excluded and 20 articles were after reading the abstract and full text. Therefore 13 studies that met the criteria for analysis were included.

CONCLUSION: The overuse injuries are very much prevalent in long distance runners and the ethology is multifactorial. The distance, terrain, weekly sessions and history of previous injuries are the risk factors that influence the occurrence of these injuries.

KEYWORDS : Long Distance Running, Overuse Injuries, Risk Factors.

INTRODUCTION

Running is one of the most popular sports and the number of people who practice running has increased significantly in last three decades^{1, 2}. It has gained popularity in recent years and statistics show significant growth in recent years^{3,4}.

Being an aerobic exercise, running is often used to assist in weight reduction. Also it is suggested that running may ease stress, lower blood pressure and lowers total cholesterol while increasing high density lipoproteins⁵.

Despite the health benefits associated with running, concerned have been raised about the high incidence of musculoskeletal injuries, primarily of the lower limbs⁶. It is estimated that between 19.4 and 79.3% of runners sustain a running-related injury in any given time⁷. Overuse injuries have a multifactorial ethology with many risk factors - both intrinsic and extrinsic - associated with injury incidence, such as anthropometric variations, weekly mileage, history of previous running injuries, number of years in running, training characteristics (speed, frequency, surface and timing), training surface and footwear⁸. These injuries range from inflammation to structural degeneration. Preventive strategies include modifying the training schedule, stretching or changing the footwear^{9,10}.

In order to efficiently integrate valid information regarding the runners' overuse injuries and the risk factors pertaining to this issue, the available information had to be systematically reviewed. The aim of this study was to perform a systematic search of available evidence that dealt with risk factors of overuse injuries in long distance running.

METHODS

The study was developed at the department of Physical Medicine & Rehabilitation, Rajagiri Hospital, Aluva, Kerala.

INCLUSION CRITERIA

Case studies, clinical trials, prospective and cross-sectional studies that addressed adult runners 18-50 years old, amateur or professional were only considered for the study. The studies which evaluated biomechanics and risk factors and published in peer reviewed journals within 10 years on subjects with a history of overuse injury to lower extremity were only considered. Studies that addressed disorders which are not overuse injuries, review articles and case reports were excluded. The study designs should be a longitudinal cohort study with a minimal follow-up of 30 days. The study objective was to investigate

the association between risk factors and the occurrence of lower limb injuries. The study population which consisted novice runners, recreational or competitive long distance runners. Studies with population of elite, professional or ultra-runners, patients, children, young adolescents (age <18 years) were excluded. Also excluded are the studies with participants predominantly exposed to other styles of sporting activity than running (e.g. military training, triathlon, etc.). if the population consisted of a mixed subjects, the results for the runners had to be presented separately in order for the study to be included.

RESEARCH STRATEGY

A systematic search of electronic database was carried out in PubMed, PEDro and Bireme. The search aimed to extract studies published as overuse injuries in the lower limb of long distance runners. A best-evidence rating system was used to determine the strength of evidence.

REVIEW PROCESS

The researchers conducted the review process independently. The selection of articles for inclusion involved multiple stages. Titles and abstracts of articles were studied which involved the first stage to determine the compliance of the study to the objective and to check whether the study followed the predetermined eligibility criteria. The references were selected after reading the titles and abstracts independently, and creating a single list of all articles to be included into, excluded from the study. The complete article was read whenever more clarity required.

DATA ANALYSIS

From the included studies, the following information was extracted: year of publication, study design with follow-up period, injury definition, sample characteristics (age, gender, body mass index, height or weight), proportion of subjects analysed in the included studies (number of subjects analysed, divided by the number of included subjects multiplied with 100) and the incidence of running injuries, injury specific or overall and, if given gender specific.

The main dependent outcome variable was running related overuse injury. Identified risk factors were summarised per injury, overall and injury specific. All risk factors were grouped into three main categories: 1) personal 2) running / training related, and 3) health and lifestyle related factors.

p-values, crude odds ratios, hazard ratios and relative risks with 95%

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confidence intervals were retrieved from the included articles in order to evaluate the association between risk factors and overuse injuries.

In articles where risk factors were presented separately for men and women, the potential sex differences in risk were determined by dividing risk factor for women by the risk factor for men, which produced a sex ratio. If the ratio higher than 1.25 (women had a higher risk) or lower than 0.75 (women had a lower risk) was considered as a relevant sex difference.

RESULTS

The search resulted in 330 references. 61 articles remain using the inclusion criteria, out of which 23 citations were excluded after reading the citation and 18 citations were excluded after reading the abstract and full text. Only 20 studies which met the criteria were only chosen for data extraction, and analysis.

Out of 20 included longitudinal cohort studies, 17 were prospective and 3 were retrospective studies. Article publication year ranged from 2007 to 2017. Sample size ranged from 18 to 754 and mean age of subjects ranged from 23 to 51 years. 16 studies had mixed population, 2 studies included only men, 1 study included only women and there were no report of gender of subjects in one study. All articles were clinical studies where follow-up time ranged from 7 weeks to 13 months.

Table 1. Articles detected with each keyword located in each of the databases

Keywords	PUBMED	BIREME	PEDro
Overuse	43,221	3011	39,887
Injuries	7,86,021	1543	8,92,114
Long distance running	54,332	6107	74,332
Running AND injuries	5022	543	6332
Running AND overuse	653	432	891
Injuries AND lower limb	13,227	77	18,774
Overuse AND injuries AND running	366	44	521
Articles with potential for inclusion in the study	270	14	46

Table 2. Details of the articles describing the risk factors found during the search

Risk factors (Independent variables)	No. of studies investigated the particular risk factor	Outcome	
Personal factors	Age	14	Only one study found age as a significant risk factor for developing overuse injuries.
	Gender	8	Two studies found men to have a significantly higher risk of overuse injuries. Thus limited evidence that men are at higher risk.
	BMI	6	Five studies proved increase in BMI has a significant effect on overuse injury risk.
	Height	12	Ten studies found that lower the height in men to be a significant risk factor for overuse injuries.
	Weight	14	Higher the weight both in men and women have significant association with the overuse injuries.
	Flat foot	16	Fourteen studies proved that long distance runners with flat feet are at high risk of developing overuse injuries.

Running and training related factors	Overtraining	5	All the five studies proved that overtraining by the runners to improve their performance had a great chance of overuse injuries
	Weekly mileage	8	Four studies showed that runners with a weekly mileage of more than 32 km are high chances of overuse injuries.
	Lack of training	4	Three studies found that runners attempting the long distance running events without adequate training are at high risk of overuse injuries.
	Running terrain	9	Two studies found that running in long distances in soft terrains such as beach sand can develop overuse injuries due to the changes in running biomechanics.
	Footwear	16	Thirteen studies concluded that barefoot long distance runners are at high risk of overuse injuries. Eight studies proved that running with worn out shoes will increase the risk of overuse injuries.
Health & Life style related factors	History of previous injury	12	Nine studies stated that long distance runners with a history of previous injuries within 12 months were at great risk of developing overuse injuries. A previous disorder of the Achilles tendon was a significant risk factor for Achilles tendinopathy.

Though all the article included various overuse injuries in lower limb, plantar fasciitis was the most discussed overuse injury appearing in sixteen articles.

DISCUSSION

Overuse injuries generally happen when a structure is repeatedly exposed to loading forces. These injuries primarily of the lower limb, are commonly treated sports related injuries in medical and physiotherapy clinics. Overuse injuries which are attributed to various risk factors, are manageable conservatively with various treatment modalities¹¹. This review systematically examines the evidence of risk factors of overuse injuries in long distance runners.

Overuse injuries in long distance runners have a multifactorial origin that can be subdivided into personal, running / training, and health or lifestyle factors. These factors can reinforce each other and hence its significance to the risk of symptoms and injuries varies among runners¹².

In this systematic review, it was found with strong evidence that height, weight, BMI and flat foot have strong association with the overuse injuries in long distance runners^{3,5}. Furthermore, there was only limited evidence for other personal factors such as age and gender of the runners^{6,10}.

Strong correlation between the overuse injuries and running and training factors such as overtraining, weekly mileage, lack of training, running terrain and the footwear was found in this review. Runners with high training frequency or running distance appeared to be more vulnerable to overuse injuries^{15,16,17,18}. From one study it was also found that running only once a week could lead to overuse injuries especially

in women, the reason probably being running stresses the musculoskeletal system which does not have time to adapt to this particular exercise because of the low frequency of running¹⁰. Hence the running or training related factors being the important modifiable risk factor overuse injuries could be prevented by selecting optimum and personalised training

Previous injury was consistently associated with development of overuse injuries in one distance runners^{19,20,21,22,23}. There exists an ambiguity whether a high rate of re-injury is due to incomplete healing of the initial injury or an uncorrected biomechanics problem. Previous lower extremity injuries which were managed well and have healed completely should not increase the risk of an overuse injury²⁹. But the injuries that give rise to structural or biomechanical malfunction permanently increase the risk of overuse injuries^{25,27,28}. Hence previous lower extremity injury must be considered as an important risk factor for overuse injuries in long distance runners. Further research may be needed in this aspect.

CONCLUSION

The etiology of overuse injuries in long distance runners is multifactorial. This systematic review shows that personal factors such as height, weight, BMI, foot abnormalities such as flat foot; running and training related factors such as overtraining, weekly mileage, running terrain, lack of training, inappropriate or imperfect footwear; and the history of the previous injuries to lower extremity are found to be important the risk factors that influence the occurrence of overuse injuries in long distance runners.

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