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FATORES DE RISCO PARA LESÕES MUSCULOESQUELÉTICAS EM PRATICANTES DE CORRIDA

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RESUMO

Os objetivos desta dissertação de mestrado foram: (1) revisar na literatura quais são os fatores de risco para as lesões musculoesqueléticas relacionadas à corrida; (2) entender as opiniões e crenças de praticantes de corrida sobre quais são os fatores de risco para as lesões na corrida. Foram realizados dois estudos, uma revisão sistemática da literatura para o objetivo primário e um estudo qualitativo para o objetivo secundário. A revisão sistemática foi realizada através da busca em 6 bases de dados (Embase, Pubmed, SportsDiscus, Cinahl, Lilacs e Scielo) sem limite de data de publicação ou idioma, até dezembro de 2012. Foram incluídos apenas estudos de coorte prospectivos que investigaram fatores de risco para lesões na corrida. Para o estudo qualitativo, foi realizada uma entrevista semiestruturada a partir da questão "O que você acha que pode causar lesões nos corredores?". Após as entrevistas, foi realizada uma estatística descritiva das características dos participantes e, em seguida, realizada a análise das entrevistas em três etapas: 1) organização dos dados em unidades temáticas; 2) leitura e a reorganização dos dados de acordo com sua frequência; e 3) interpretação e sistematização dos dados. Em relação aos resultados dos estudos, após as análises de título, resumo e texto completo, um total de 14 artigos foram incluídos na revisão sistemática. O principal fator de risco para lesões na corrida encontrado foi a presença de lesão prévia, presente em 60% dos estudos que investigaram este fator. Em relação ao estudo qualitativo, foram entrevistados um total de 96 corredores, sendo 65 homens e 30 mulheres. Os principais fatores extrínsecos citados pelos participantes foram relacionados ao treinamento e ao tênis de corrida, como não realizar alongamento, excesso de treinamento e não utilizar um tênis adequado. Os principais fatores intrínsecos citados foram não respeitar os limites do corpos e alterações na pisada. Podemos concluir que O principal fator de risco para lesões na corrida encontrado na revisão sistemática foi presença de lesão previa, porém mais estudos de coorte prospectivos bem delineados são necessários para investigar os fatores de risco para lesões na corrida.. Além disso, os corredores entrevistados demonstraram grande preocupação em relação aos fatores relacionados ao treinamento e ao tênis de corrida. Intervenções educativas são necessárias para um melhor entendimento dos corredores em relação às lesões na corrida.

Palavras-chave: corrida, esportes, traumatismos em atletas, fisioterapia.

ABSTRACT

The objectives of this dissertation were: (1) review the literature what are risk factors for running-related musculoskeletal injuries, (2) understand the opinions and beliefs of runners on what are the risk factors for running injuries. Two studies were conducted, a systematic review for the primary aim, and a qualitative study for the secondary objective. A systematic review was performed by searching in 6 databases (Embase, Pubmed, SportsDiscus, Cinahl, Lilacs and Scielo) without limit of publication date or language up to December 2012. We included only prospective cohort studies that investigated risk factors for running injuries. For the qualitative study, we performed semi-structured interviews based on the question "What do you think that cause injuries in runners?" After the interviews, a descriptive analysis was performed and the interviews were analyzed in three stages: 1) organizing the data into thematic units, 2) reading and reorganization of data according to their frequency, and 3) data interpretation and systematization. Regarding the results, after the analysis of titles, abstracts and full texts, a total of 14 articles were included in the systematic review. The main risk factor for running injuries found was the presence of previous injury, present in 60% of studies that have investigated this factor. Regarding the qualitative study, we interviewed a total of 96 runners, 65 men and 30 women. The main extrinsic factors cited by participants were related to training and running shoes, do not perform stretching, over-training and not using proper shoes. The main intrinsic factors cited were do not respect the body limits and changes in foot strike. We can conclude that the main risk factor for running injuries found in the systematic review was previous injuries, but well designed prospective cohort studies are needed to investigate the risk factors for running injuries. In addition, the runners interviewed showed great concerns of factors related to training and running shoes. Educational interventions are necessary for a better understanding of the runners in relation to running injuries.

Keywords: running, sports, athletic injuries, and physiotherapy.

SUMÁRIO

- CAPÍTULO 1 -

CONTEXTUALIZAÇÃO

1.1 APRESENTAÇÃO DOS ESTUDOS ENVOLVIDOS NA DISSERTAÇÃO

O capítulo 2 desta dissertação de mestrado apresenta uma revisão sistemática com o objetivo de identificar os fatores de risco para lesões musculoesqueléticas relacionadas à corrida. Foram realizadas buscas em seis bases de dados para identificar estudos prospectivos que investigaram os fatores de risco para as lesões na corrida. Esta revisão sistemática foi concluída e submetida para a revista Sports Medicine (normas para submissão na seção "material suplementar").

Em seguida, o capítulo 3 apresenta um estudo do tipo qualitativo com o objetivo de identificar as crenças e opiniões de corredores sobre os fatores associados as lesões na corrida. A amostra deste estudo foi composta por 96 corredores entrevistados em parques e provas de corrida na cidade de São Paulo. Este estudo está em fase de preparação para submissão ao Journal of Science and Medicine in Sports (normas para submissão na seção "material complementar").

O quarto e último capítulo desta dissertação apresenta as considerações finais desta dissertação de mestrado, discutindo os principais achados dos estudos, assim como suas implicações e recomendações para futuras pesquisas.

1.2 CONTEXTUALIZAÇÃO

mundo[1]. Devido ao seu fácil acesso, baixo custo e, aparentemente, fácil execução, o número de praticantes de corrida cresce significativamente[2-5]. No Brasil, estima-se que aproximadamente 5% da população pratica corrida, o que equivale a cerca de 10 milhões de corredores[6]. Dentre os benefícios da prática da corrida, podemos citar a melhora da capacidade física, o controle do peso corporal e a diminuição do risco de doenças cardiovasculares e outros problemas crônicos de saúde[7-9]. No entanto, o número de lesões em praticantes de corrida é alto[1]. Diversos estudos tem reportado a prevalência e a incidência de lesões em corredores com taxas variando entre 19 e 92%, ou 6,8 a 59 lesões por cada 1000 horas de exposição à corrida[7, 10-19], dependendo da população de corredores estudada e a definição de lesão relacionada à corrida utilizada pelos estudos[7, 20-22]. Em dois estudos recentes[23, 24], observou-se que, mesmo antes da participação de uma prova de corrida, cerca de 25% dos corredores apresentam alguma dor de origem musculoesquelética.

As lesões que atingem os corredores são vistas como resultado de uma sobrecarga proveniente de microtraumas acumulativos durante um determinado período de tempo[25]. Uma revisão sistemática recente[15] investigou as principais lesões da corrida e encontrou como a principal lesão a síndrome do estresse medial tibial, seguida pela tendinopatia do calcâneo e a fasceíte plantar. Os fatores de risco para lesões na corrida, de um modo geral, estão associados às características pessoais do indivíduo, fatores anatômicos e biomecânicos e ao treinamento[4, 26, 27]. Na literatura, os fatores de risco para lesões na corrida variam de acordo como delineamento dos estudos, a população de corredores estudada e a definição de lesão musculoesquelética utilizada pelos autores[7, 21].

Grande parte dos estudos realizados para investigar os fatores de risco para lesões em corredores utilizam estudos retrospectivos ou transversais. Os estudos retrospectivos e transversais não são os delineamentos de pesquisa mais indicados para se determinar associações entre eventos ou prognóstico, como a determinação de fatores de risco ou proteção para lesões, sendo que o delineamento de pesquisa mais indicados para esta finalidade são os estudos prospectivos, especialmente estudos de coorte prospectivos[28-30]. Além disso, a maioria dos estudos na corrida são realizados com populações específicas de corredores, como os corredores recreacionais[11, 18, 31-34],

maratonistas[1, 2, 12, 13, 35-41],corredores iniciantes envolvidos num programa de treinamento (corredores novatos)[16,42-44]ou ultramaratonistas e corredores de elite[45-47]. Portanto, dependendo da população de corredores estudada, as taxas de lesões e os fatores de risco encontrados podem variar[7].

Outro fator influente para a determinação de fatores de risco é a definição de lesão na corrida utilizada pelos autores[21], pois de acordo com a definição empregada pelo estudo podemos encontrar diferentes taxas de lesão, assim como diferentes fatores de risco. Por exemplo, no estudo de Bovens et al.[16] os autores consideraram lesão musculoesquelética relacionada à corrida "qualquer queixa física desenvolvida em relação à corrida que cause restrição na distância, velocidade, duração ou frequência de treinos". Por ser uma definição abrangente os autores encontraram uma taxa de lesão de 85% na população estudada. Por outro lado, Blair et al.[48] em seu estudo considerou lesão musculoesquelética relacionada à corrida "alguma queixa que impossibilite o atleta de correr por pelo menos sete dias", sendo uma definição mais severa em relação ao tempo de afastamento, os autores encontraram uma taxa de lesão de 24% nos corredores avaliados. As diferentes taxas de lesão encontradas nos estudos podem resultar em diferente fatores de risco.

Desde os anos 90, diversos modelos teóricos tem sido propostos para um melhor entendimento da etiologia e prevenção de lesões[22, 49]. Os modelos teóricos mais aceitos e utilizados na prática clinica e pesquisa científica são os modelos postulados por van Mechelen et al. em 1992[22] e o modelo de Meeuwisse et al. de 1994[49]. No modelo teórico de van Mechelen et al.[50] foi desenvolvido um modelo para prevenção de lesões a partir de quatro estágios: (1) estabelecer a dimensão do problema; (2) estabelecer a etiologia e os mecanismos de lesão; (3) introduzir medidas preventivas; (4) testar a efetividade das medidas preventivas repetindo o estágio 1. O modelo de Meeuwisse et al.[49] descreve a influência de diversos fatores ao longo do caminho de uma lesão. No entanto, nenhum destes modelos tradicionais de prevenção ou etiologia de lesões tem levado em conta os aspectos comportamentais dos atletas ou praticantes de esporte.

Finch et al. em 2006[51], desenvolveu o modelo mais recente para a prevenção de lesões. Baseado nos dois modelos citados anteriormente foi desenvolvido um novo modelo teórico chamado TRIPP (Traduzindo a Pesquisa em Prática da Prevenção de Lesão, ou o significado original *Translating Research into Injury Prevention Practice*). O modelo TRIPP tem como objetivo uma abordagem do contexto da

implementação de um programa de prevenção de lesão, ressaltando a importância do entendimento dos aspectos comportamentais dos atletas e praticantes de esporte. O modelo TRIPP é composto por seis estágios: (1) levantamento das lesões; (2) estabelecer a etiologia e os mecanismos de lesão; (3) desenvolvimento de intervenções preventivas; (4) avaliação cientifica destas intervenções em ambientes controlados; (5) entender o contexto das intervenções e possíveis modificações nas intervenções dentro deste contexto; e (6) avaliação da efetividade das medidas preventivas dentro do contexto da implementação.

A criação de novos modelos teóricos como o TRIPP foi um grande passo em direção ao sucesso para a prevenção de lesões[52]. Através do direcionamento para a importância dos aspectos comportamentais para a prevenção, é possível entender quais são as barreiras impostas para se alcançar a prevenção, e o porque atletas e praticantes de esporte podem não adotar as estratégias preventivas propostas[52].

Um estudo recente[53] mostrou a opinião de profissionais e atletas de diferentes modalidades esportivas sobre o que eles consideram como uma definição de lesão por sobrecarga e, o que eles consideram como fatores de risco para lesões por sobrecarga. Os autores deste estudo encontraram que os participantes acrescentaram aspectos psicológicos e sociais nas definições de lesões existentes na literatura, criadas por um ponto de vista médico, que até então não abordavam estes aspectos. Em relação aos fatores de risco para lesões no esporte, também foi encontrado uma abordagem diferente por parte dos participantes do estudo, em que foram encontrados diversos fatores relacionados ao comportamento dos atletas como causadores de lesão, fatores pouco investigados na literatura como causadores de lesão ou para a prevenção de lesão. Uma revisão sistemática recente[54] mostrou que, de 100 estudos publicados sobre prevenção de lesões no esporte, apenas 11 utilizaram modelos comportamentais ou sociais em seus programas de prevenção. Estes resultados mostram a falta de estudos que abordam os aspectos comportamentais como fator influente na relação com as lesões nos esporte.

Alguns estudos mostram que a maioria dos corredores possuem uma visão extremamente positiva da corrida[55-57]. Relatos dos próprios corredores em relação à pratica da corrida estão associados com maior disposição, menor estresse, mais energia e maior confiança pessoal[56, 57]. Entretanto, quando perguntado aos corredores sobre não poder correr por algum motivo, grande parte deles apresentaram sentimentos de culpa, tensão, menor energia e até sintomas de depressão e

dependência[55-57]. Um estudo demonstrou que a maioria dos corredores possui a percepção de que são viciados em corrida, associando a corrida a um "vício bom", devido à sensação de bem estar e os benefícios desta atividade[55]. Porém, é preciso ter consciência dos riscos desta modalidade que, em excesso, pode se tornar prejudicial, ocasionando lesões que podem fazer com que estes indivíduos tenham que parar o esporte ou até apresentar incapacidades para atividades cotidianas.

O comportamento de praticantes de esporte, assim como suas opiniões e crenças, tem sido sugerido como um fator chave para a prevenção de lesões[52, 54, 58]. A opinião de praticantes de corrida em relação aos fatores de risco para as lesões musculoesqueléticas ainda não foi estudada na literatura. Contudo, uma abordagem das opiniões dos corredores pode ser útil para a elaboração de um programa de prevenção de lesões completo, ou mesmo para auxiliar no tratamento destas lesões[53].

Até o presente momento, os fatores de risco para as lesões musculoesqueléticas relacionadas à corrida ainda são incertos na literatura e existe uma carência de estudos que abordem as crenças e opiniões de corredores. Portanto, os objetivos desta dissertação são:

- Revisar na literatura quais são os fatores de risco para as lesões musculoesqueléticas relacionadas à corrida;
- Entender as opiniões e crenças de praticantes de corrida sobre quais são os fatores de risco para as lesões na corrida.

Pretendemos, com estes estudos, contribuir para a identificação dos fatores de risco para as lesões na corrida para que estratégias preventivas possam ser criadas para as lesões da corrida. Além disso, esperamos identificar crenças e opiniões dos praticantes de corrida para o melhor entendimento dos aspectos comportamentais desses corredores e, futuramente, contribuir para a abordagem e orientação dos programas de prevenção.

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- CAPÍTULO 2 -

QUAIS SÃO OS FATORES DE RISCO PARA LESÕES RELACIONADAS À CORRIDA? UMA REVISÃO SISTEMÁTICA

WHAT ARE THE MAIN RISK FACTORS FOR RUNNING-RELATED INJURIES? A SYSTEMATIC REVIEW

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Figure Caption:

Figure 1. Flow diagram of selection and inclusion process in the systematic review.

ABSTRACT

Background: Despite several studies that have been conducted on running injuries, the risk factors for running-related injuries are still not clear in the literature.

Objective: The aim of this study was to systematically review prospective cohort studies that investigated the risk factors for running injuries in general.

Data Sources: We conducted electronic searches without restriction on language on EMBASE (1980 to Dec 2012), PUBMED (1946 to Dec 2012), CINAHL (1988 to Dec 2012) SPORTDiscus (1977 to Dec 2012), Latin American and Caribbean Centre on Health Sciences Information (LILACS) [1985 to Dec 2012] and Scientific Electronic Library Online (SCIELO) [1998 to Dec 2012] databases, using subject headings, synonyms, relevant terms and variant spellings for each database.

Study Selection: Only prospective cohort studies aimed to investigate the risk factors for running-related musculoskeletal injuries were included in this review. Two independent reviewers screened each article and, if they did not reach a consensus, a third reviewer decided whether or not the article should be included.

Study Appraisal and Synthesis Methods: Year of publication, type of runners, sample size, definition of running-related musculoskeletal injury, baseline characteristics, reported risk factors and the statistical measurement of risk or protection association were extracted from the articles. A scale adapted by the authors evaluated the risk of bias of the articles.

Results: A total of 11 articles were considered eligible in this systematic review. A total of 4,671 pooled participants were analysed and 62 different predictive factors were investigated. The main risk factor reported was 'previous injury' (last 12 months), reported in 5 of the 8 studies that investigated previous injuries as a risk factor. Only one article met the criteria for random selection of the sample and only six articles included a follow up of 6 months or more. Gender was not associated with running injuries in most of the studies, since many of them described risk factors separately, with no individual association with gender.

Limitation: It is possible that eligible articles for this review were published in journals that were not indexed in any of the searched databases. We found a great heterogeneity of statistical methods between studies, which prevented us from performing a meta-analysis.

Conclusions: The main risk factor identified in this review was 'previous injury' in the last 12 months, although many risk factors had been investigated in the literature.

Relatively few prospective studies were identified in this review, reducing the overall ability to detect risk factors. This highlights the need for more, well-designed prospective studies in order to fully appreciate the risk factors associated with running.

1. INTRODUCTION

Running is one of the most popular physical activities around the world, and due to the health benefits, low cost and ease of implementation, the number of runners has grown significantly over the past decade [1-3]. However, injuries in runners are common [4, 5]. Depending on the population of runners studied and the definition of running-related musculoskeletal injuries (RRMI) used [4, 6, 7], incidence rates range between 18.2% and 92.4%, and prevalence rates range between 6.8 to 59 injuries per 1,000 hours of running [4, 8-11]. Running injuries have multifactorial aetiology and are commonly related to overuse (repetitive microtrauma that overloads musculoskeletal structures). In addition, they can be classified as gradual onset injuries caused by repeated microtrauma without a single and identifiable event [12, 11]. Generally, the factors associated with running injuries are attributed to personal characteristics of the runners, anatomical or biomechanical factors and training errors such as training volume, weekly distance and running experience [9, 2, 13, 5].

Some studies have reviewed the literature on the associated factors for running injuries [4, 6, 5, 7, 14]. However, some of these reviews are not systematic or included studies with retrospective or cross-sectional designs, which are not the proper designs to investigate risk factors[15]. Additionally, runners experience over 20 different injuries and the most common injuries vary among studies[16]. Therefore, when assessing risk factors of all running injuries, including studies of specific injuries may introduce bias by placing too much emphasis on that injury or a specific risk factor, and overlook other important risk factors. This bias may also be the result of excluding participants in the cohort who develop a different, unrelated running injury. We note that only a systematic review of prospective cohort studies focused on all injuries caused by running is capable of overcoming these limitations [17, 15, 18]. Despite several studies that have been conducted on running injuries, the risk factors for running-related injuries are still not clear in the literature. Therefore, this study aims to systematically review only prospective cohort studies that investigated the risk factors for the overall injuries that affect runners.

2. METHODS

2.1 Information Sources

We conducted electronic searches on EMBASE (1981 to Dec 2012), PUBMED (1946 to Dec 2012), CINAHL (1988 to Dec 2012) SPORTDiscus™ (1977 to Dec 2012), Latin American and Caribbean Centre on Health Sciences Information (LILACS) [1985 to Dec 2012] and Scientific Electronic Library Online (SCIELO) [1998 to Dec 2012] databases, without restriction for languages and date of publication. We used subject headings, synonyms, relevant terms, and variant spellings for the searches on each database. The full electronic search for EMBASE database is presented on Electronic Supplementary Material Appendix S1.

2.2 Study Selection

We only included prospective cohort studies that investigated risk factors for running-related injuries, since prospective cohort studies are the preferred design to provide direct and accurate estimates of incidence and risk[15]. We excluded articles that (1) studied risk factors for a specific injury (e.g., medial tibial stress syndrome); (2) aimed to analyse risk factors and/or injuries of other sports that include running (e.g., triathlons); (3) analysed only injured runners or did not describe if all runners were injury-free at baseline; (4) reported on experimental and controlled studies on the effectiveness of an intervention or prevention program. We chose to exclude articles that focused on specific injuries because some injuries could be under or over-represented in this review and our results would be biased toward risk factors for that specific injury regardless of the true injury distribution in the population of injured runners. The screening of eligible studies was performed in two steps. First, screening the title and abstract, where we excluded articles if they did not mention runners or running. Second, the full text of the selected articles were analysed according to our inclusion and exclusion criteria. Each step was performed by two independent reviewers (BTS and TPY), and if they did not reach a consensus, a third reviewer (ADL) helped decide whether the article should be included.

2.3 Data Collection

The following data were extracted from these articles selected for the review: first author's name, year of publication, type of runners (e.g., marathon runners or recreational runners), sample size, definition of running-related musculoskeletal

injuries, baseline characteristics, reported risk or protection factors, and the statistical measurement of risk or protection factors associated to RRMI. The results were expressed with the statistical measure used by the author (HR: hazard ratio; OR: odds ratio; RR: relative risk; RIR: relative injury rate; and CI: confidence intervals). Predictive factors to running-related injuries were classified as risk or protection. A risk factor was considered when HR, OR, RR or RIR were greater than 1.0; and a protective factor was considered when HR, OR, RR or RIR were lower than 1.0. Two independent reviewers extracted the data (BTS and LCHJ) and disagreements were resolved by discussion between the two review authors; if no agreement could be reached, arbitration was performed by a third reviewer (ADL).

2.4 Risk of Bias Assessment

The instrument used for assessing risk of bias of the included articles was adapted from the Newcastle Ottawa Scale (NOS) for cohort studies[19]. The NOS is a quality assessment tool for cohort and case-controls studies, in which a star rating system is used to indicate the quality of a study, with a maximum of nine stars[20]. The instrument was modified for the purpose of this review and the population of runners, with three criteria added to the original scale. The criteria adopted to assess risk of bias were: (1) description of runners or type of runners; (2) definition of running-related musculoskeletal injuries; (3) representativeness of the exposed cohort; (4) selection of the non exposed cohort; (5) ascertainment of exposure; (6) demonstration that outcome of interest was not present at start of study; (7) comparability of cohorts on the basis of the design or analysis; (8) assessment of outcome; (9) was follow-up long enough for outcomes to occur; (10) adequacy of follow up of cohorts; (11) statistical measurement of the association of risk factors (e.g., hazard ratio, odds ratio, relative risk). The articles could be awarded a maximum of one star for each item, except for the item 7 that could be awarded two stars. Thus, a total of 12 stars could be given to the articles. The description of each criterion is presented in Table 1.

Table 1 – Description of the 11 criteria designed to assess risk of bias in the studies.

Criterion	**Description of criteria**
1. Description of runners or type of runners	There are several types of runners (recreational, elite, ultra marathoners, marathoners, etc.). Without the description regarding to the type runners it is impossible to conclude which population refers to the incidence rates. Studies that reported the description of runners or informed the type of runners receive a star for this criterion. Studies conducted in running races (which may determine the type of runners, e.g. marathon race) and describe the race characteristics receive a star for this criterion as well. Studies that did not describe the characteristics or the type of runners, and studies conducted in running races that did not describe the characteristics of the race did not receive a star for this criterion.
2. Definition of running-related musculoskeletal injury	Studies that aimed to investigate running injuries should present a definition of a running-related musculoskeletal injury informing what was considered as an injury in the study. Studies that present a definition of running-related musculoskeletal injury received a star for this criterion.
3. Representativeness of the exposed cohort	a) truly representative of the average runners in the community (*); b) somewhat representative of the average runners in the community (*); c) selected group of users ; d) no description of the derivation of the cohort. For alternatives "a" or "b", the article received a star for this criterion.
4. Selection of the non exposed cohort	a) drawn from the same community as the exposed cohort (*); b) drawn from a different source; c) no description of the derivation of the non exposed cohort. For alternative "a", the article received a star for this criterion.
5. Ascertainment of exposure	a) secure record (*); b) structured interview (*); c) written self report; d) no description. For alternatives "a" or "b", the article received a star for this criterion.
6. Demonstration that outcome of interest was not present at start of study	a) yes (*); b) no. Studies that described that all runners included were injury-free at baseline received a star for this criterion.
7. Comparability of cohorts on the basis of the design or analysis	a) study controls for the most important factor (stated on the background of the study) (*). b) study controls for any additional factor (*). For this criterion, studies could be awarded with two stars if the study receive "a" and "b".
8. Assessment of outcome	a) independent blind assessment (*); b) record linkage (*); c) self report; d) no description. For alternatives "a" or "b", the article received a star for this criterion.
9. Was follow-up long enough for outcomes to occur	a) yes (*); b) no. Studies that carried out a follow-up period of at least 12 weeks received 'yes' and a star for this criterion.
10. Adequacy of follow up of cohorts	a) complete follow up of all subjects accounted for (*); b) subjects lost to follow up unlikely to introduce bias (up to 20% loss) or description provided of those lost (*); c) follow up rate < 80% and no description of those lost; d) no statement. A loss to follow-up greater than 20% may increase the risk of bias in prospective studies [21]. For alternatives "a" or "b", the article received a star for this criterion.
11. Statistic measurement for risk association	Prospective studies should inform a statistical measure to determine risk association (e.g. Hazard ratio, Odds ratio, Relative Risk) and the Confidence Interval. Studies that gave a statistical measure of risk receive a star for this criterion.

The articles could be awarded a maximum of one star for each item, except for the item 7 that could be awarded two stars. A total of 12 stars could be given for the articles.

3. RESULTS

A total of 7,536 studies were found. Among them, 1,494 were duplicates that appeared in at least two databases. Screening the titles, abstracts and full text, if appropriate, we found 11 prospective cohort studies that met the inclusion criteria. Figure 1 shows a flow diagram of the complete process of article inclusion.

From the 11 articles included in this review, a total of 4,671 participants were pooled and 61 different risk factors were investigated. The main intrinsic risk factor reported by the studies was 'previous injury' in the last 12 months (Table 2), reported as a risk factor in five [22-27] of 8 studies that investigated this factor. Higher quadriceps angle of the knee (Q-angle) was associated with running injuries in two [24, 28] of the three studies that analysed this factor. Two [27, 23] of the five studies that investigated weekly distance as risk factor identified that training for more than 64 km a week was a risk factor lower extremity injuries. Five studies investigated the relationship between weekly running frequency and running injuries, and two studies [29, 27] reported a significant association with running injuries. One study [27] reported that running three to seven times a week was a risk factor for running injuries in men and running seven times a week was a risk factor for women. Another study [29] reported that running once a week was a risk factor for women. Regarding to gender, this factor was not associated with running injuries in most of the studies, since many of them described risk factors separately, with no individual association with gender.

Due to the importance of the 'previous injury' factor found in this study, we presented all data of the articles that investigated previous injuries in a separate table (Table 3). Eight studies investigated previous injury as a risk factor and five of these found a positive association (62%), three articles found the association in men and other three articles found the association for both sexes. Due to the different statistical measures used by the studies, we contacted the authors for the raw data of the articles. However, most authors did not provide the raw data, which prevent us to perform a meta-analysis or a more comprehensive inter-study comparison. We extracted data from multivariable analysis, since univariate or raw data were not available in most of the articles included. The full list with the 61 factors investigated by the articles is presented in Electronic Supplementary Material Table S1. The characteristics of the 11 articles included in this review are described in Table 4.

Regarding to the assessment of risk of bias, the criteria in which most articles awarded a star were definition of running-related musculoskeletal injury (12/12), selection of the non exposed cohort (12/12), demonstration that outcome of interest was not present at start of study (12/12) and, follow-up long enough for outcomes to occur (11/12). On the other hand, the criteria with fewer stars awarded by the articles were ascertainment of exposure (4/12) and assessment of outcome (3/12). Table 5 shows the risk of bias analysis for each study included in this review.

Table 2 – Risk factors related to running-related injury observed at least two articles.

Risk factor	Articles that identified risk factor (n)	Articles that investigated risk factor (n)
Previous injuries	5	8
Q-angle	2	3
Weekly distance	2	5
Weekly frequency	2	5

[a] The 'risk factors' were ordered according to the number of articles that identified risk factor and the rate between risk factor and number of articles.

Table 3. Articles that found previous injuries as a risk factor for running-related injuries.

Study (year)	**Previous injury period** *(months)*	**Risk factor for men**		**Risk factor for women**		**Risk factor for both sex**	
		Statistic	95% CI	Statistic	95% CI	Statistic	95% CI
Pileggi et al, 2010 [30]	*n/r*	p>0.05	*n/r*	p>0.05	*n/r*		
Buist et al, 2009 [22]	3 to 12	HR: 2.7	1.3 to 5.3[a]	*n/r*	*n/r*		
	> 12	HR: 2.1	1.0 to 4.3[a]	*n/r*	*n/r*		
Lun et al, 2004 [31]	12	*n/r*	*n/r*	*n/r*	*n/r*		
Fields et al, 1990 [32]	*n/r*	p>0.05	*n/r*	p>0.05	*n/r*		
Macera et al, 1989 [23]	12	OR: 2.7	2.6 to 2.7[a]	OR: 1.9	0.7 to 4.9		
Walter et al, 1989 [27]	12	RR: 1.69	1.3 to 2.2[a]	RR: 2.3	1.3 to 4.1[a]		
Rauh et al, 2006 [24][c]	*n/r*					RR: 1.8	1.0 to 3.1[a]
Wen et al, 1998 [26]	12					RIR: 2.0	1.2 to 3.2[a]

CI: Confidence Interval. **HR**: hazard ratio; **OR**: odds ratio; **RR**: relative risk; **RIR**: relative injury rate; **n/r**: not reported. [a] Statistically significant. [b] Included only men in the sample. [§]Did not separate women and men for the analysis. [c] This article found the risk factor only for more than four (4) previous injuries.

Table 4. Description of studies included, statistic measures and 95% confidence interval of multivariate analysis[a].

Study (year)	Follow-up period	Population	Country of origin	Risk factors for men	Risk factors for women	Risk factors for both sex
Bredeweg et al, 2012 [33]	9 weeks	210 novice runners	Netherland	n/a	n/a	n/a
Pileggi et al, 2010 [30]	12 months	18 amateur runners	Brazil	n/a	n/a	Lower left knee extension (p<0.05) Lower left plantar flexion (p<0.05) Lower resting cardiac frequency (p<0.05) Less lower extremities flexibility (p<0.05)
Buist el al, 2009 [22]	13 weeks	532 novice runners	Netherland	Higher BMI (HR: 1.14/CI: 1.05 to 1.25) Previous injury 3 to 12 months (HR: 2.7/ CI: 1.32 to 5.30) Previous injury >12 months (HR: 2.14/ CI: 1.05 to 4.35) Previous sports activities without axial load (HR: 2.05/ CI 1.03-4.11)	Navicular drop (HR: 0.87/CI: 0.77 to 0.98)	n/a
Rauh et al, 2007 [28]	One season	393 cross-country runners	USA	Q-angle 15 to <20 (RR: 1.5/ CI: 1.1 to 2.3) Q-angle right-left difference ≥ 4	Q-angle ≥ 20 (RR: 1.6/ CI: 1.1 to 2.5) Q-angle right-left difference	Q-angle ≥ 20 (RR: 1.7/ CI: 1.2 to 2.4) Q-angle right-left difference ≥

				(RR: 1.8/ CI: 1.1 to 2.9)	≥4 (RR: 1.8/ CI: 1.3 to 2.7)	4 (RR: 1.8/ CI: 1.4 to 2.5)
Rauh et al, 2006 [24]	11 weeks	421 cross country runners	USA	n/a	n/a	Q-angle ≥15 and <20 (RR: 1.4/ CI: 1.1 to 1.9) Q-angle >20 (RR: 2.0/ CI: 1.4 to 2.8) Q-angle ≥20 (RR: 1.8/ CI: 1.3 to 2.4) Previous running injuries ≥4 (RR: 1.8/ CI: 1.0 to 3.1) Pace adjusted – Q-angle ≥20 (HR: 2.43/ CI: 1.63 to 3.63) Pace adjusted - Summer injury (HR: 1.62/ CI: 1.02 to 2.56) Surface adjusted – Q-angle ≥20 (HR: 2.42/ CI: 1.62 to 3.63) Surface adjusted - Summer injury (HR: 1.60/ CI: 1.01 to 2.55) Terrain adjusted – Q-angle ≥20 (HR: 2.45/ CI: 1.64-3.65) Terrain adjusted - Summer injury (HR: 1.64/ CI: 1.04 to 2.61)
Lun et al, 2004 [31]	6 months	87 recreational runners	Canada	n/a	n/a	n/a
Taunton et al,	13 weeks	844 recreational	Canada	BMI >26 kg/m^2	Age greater than 50 years	n/a

2003 [29]		runners		(RR: 0.40 /CI: 0.21 to 0.78) Running shoe age 4-6 months (RR: 0.35 /CI: 0.15 to 0.83)	(RR: 1.91 /CI: 1.10 to 3.32) Age less than 31 years (RR: 0.57 /CI: 0.34 to 0.96) Frequency 1 day/week (RR: 3.64 /CI: 1.08 to 12.29) Running shoe age 4-6 months (RR: 1.73/ CI: 1.00 to 2.98) Running shoe age 1-3 months (RR: 0.61 /CI: 0.37 to 0.98)	
Wen et al, 1998 [26]	32 months	255 runners of a marathon training program	USA	n/a	n/a	Exposure hours: low leg-length difference (RIR: 1.96/ CI: 1.07 to 3.58) Exposure hours: hours/week increased (RIR: 0.57/ CI: 0.45 to 0.73) Exposure hours: high arch index (RIR: 0/ CI: 0 to 0.36) Exposure miles: hours/week increased (RIR: 0.57/ CI: 0.42 to 0.78) Exposure miles: low age (RIR: 0.38/ CI: 0.15 to 0.97) Exposure weeks: high experience (RIR: 1.88/ CI: 1.15 to 3.05) Exposure weeks: previous

						injuries (RIR: 2.01/ CI: 1.26 to 3.21)
Fields et al, 1990 [32]	1 year	40 runners of a running club	USA	n/a	n/a	Type A behaviour high scores (p<0.05)
Macera et al, 1989 [23]	12 months	583 recreational runners	USA	LEX injury 12 months (OR: 2.7/ CI: 2.6 to 2.7) Running experience 0-2 years (OR: 2.2/ CI: 1.5 to 3.3) Weekly distance >64km (OR: 2.9/ CI: 1.1 to 7.5)	Concrete surface (OR: 5.6/ CI: 1.1 to 29.3)	n/a
Walter et al, 1989 [27]	12 months	1288 runners enrolled in two community race events	Canada	Type of runner "competitive" (RR: 1.73/ CI: 1.21 to 2.49) Previous injury past 12 months (RR: 1.69/ CI: 1.27 to 2.25) Height "average" 1.70-1.79 cm (RR: 2.04/ CI: 1.15 to 3.46) Height "tallest" ≥1.80cm (RR: 2.30/ CI: 1.29 to 3.90) 3 days running per week (RR: 2.93/ CI: 1.27 to 6.20) 4 days running per week (RR: 2.49/ CI: 1.08 to 5.26) 5 days running per week (RR: 3.13/ CI: 1.38 to 6.46) 6 days running per week (RR: 3.66/ CI: 1.62 to 7.50) 7 days running per week	Injures in previous year (RR: 2.35/ CI: 1.33 to 4.07) 7 days running per week (RR: 5.50/ CI: 1.44 to 17.39) Running year round (RR: 2.00/ CI: 1.01 to 3.75) Weekly distance ≥64 km (RR: 3.42/ CI: 1.42-7.85)	n/a

(RR: 5.92/ CI: 2.49 to 12.75)

Running year round

(RR: 1.64/ CI: 1.12 to 2.35)

Longest run each week >8 km

(RR: 2.49/ CI: 1.64 to 3.71)

Weekly distance ≥64 km

(RR: 2.22/ CI: 1.30 to 3.68)

Use of stretching "sometimes"

(RR: 1.56/ CI: 1.10 to 2.21)

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n/a: no association; **HR**: hazard ratio; **OR**: odds ratio; **RR**: relative risk; **RIR**: relative injury rate; **CI**: confidence interval; **BMI**: body mass index; **LEX**: lower extremity. [a] We extracted only data from multivariate analysis for the articles, because some articles did not report the univariate analysis or used a different statistical analysis.

Table 5. Risk of bias assessment of the studies.

Author, year	**Risk of bias assessment of the studies**										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Bredeweg et al, 2012 [33]	*	*	*	*	*	*	**			*	*
Pileggi et al, 2010 [30]	*	*		*	§	*		*	*	*	
Buist et al, 2009 [22]	*	*	*	*		*	**		*	*	*
Rauh et al, 2007 [28]	*	*	*	*	*	*	*	*	*	*	*
Rauh et al, 2006 [24]	*	*	*	*	§	*	**	*	*		*
Lun et al, 2004 [31]	*	*	*	*	*	*			*	*	
Taunton et al, 2003 [29]	*	*	*	*		*	**		*		*
Wen et al, 1998 [26]	*	*		*	*	*	**		*		*
Fields et al, 1990 [32]		*		*		*			*	*	
Macera et al, 1989 [23]	*	*	*	*		*	**		*	*	*
Walter et al, 1989 [27]	*	*	*	*		*	**		*	*	*

Method of assessing risk of bias: (1) description of runners or type of runners; (2) definition of running-related musculoskeletal injuries; (3) representativeness of the exposed cohort; (4) selection of the non exposed cohort; (5) ascertainment of exposure; (6) demonstration that outcome of interest was not present at start of study; (7) comparability of cohorts on the basis of the design or analysis; (8) assessment of outcome; (9) was follow-up long enough for outcomes to occur; (10) adequacy of follow up of cohorts; (11) statistical measurement of the association of risk factors.

*star awarded for each criterion.

§some of the exposures were classified as "secure record" and others as "self-reported".

4. DISCUSSION

Eleven articles met the inclusion criteria and were included in this systematic review. A total of 4,671 pooled participants were analysed and 61 different risk factors were investigated. However, whilst many risk factors have been investigated, just ten of these were investigated in at least five articles. The main risk factor found was previous injuries, usually in the past 12 months, reported in 62% of the articles that investigated this factor. Weekly distance, weekly frequency and higher Q-angle were associated as risk factor by two studies. This is the first systematic review with only prospective cohort studies that studied risk factors for running-related injuries. Other reviews focused on the factors associated with running injuries have also found an association with previous injury and weekly distance.

The association between previous injury and the development of a new injuries or a similar injury of greater magnitude has been reported as a risk factor for sports in general[34]. In addition, some authors suggested that the association between 'previous injuries' and 'new injuries' was due to an incomplete recovery from the earlier injury [29, 26]. Most studies (6/8) defined the period for previous injuries to be in the last 12 months. Running injuries are commonly related to overuse, which is an overload of the musculoskeletal system [11]. An overuse injury can be defined as one caused by repeated microtrauma without a single, identifiable event responsible for the injury [12]. Therefore, increased training loads can exacerbate the symptoms of a previous overuse injury, which can be mistaken as a new injury. Importantly, runners can adopt different biomechanical patterns when injured, probably in an attempt to execute a strategy of motor protection of the injured structure during running. This change of pattern can lead to overloading of musculoskeletal structures that were intact before the injury, causing a new injury.

Only one biomechanical (alignment) risk factor was found in more than one study. Higher 'Q-angle factor' was significantly associated with running-related injury. Theoretically, a greater Q angle is related to the increase of the lateral pull on the patella against the lateral femoral condyle, which contributes to patellar subluxation and other patellofemoral disorders [28]. A recent systematic review [35] of the factors associated with patellofemoral pain syndrome demonstrated that a large Q angle could be associated with the development of patellofemoral syndrome, despite the great difference found among several methods of measuring the Q angle that made it difficult to compare studies. Furthermore, there is no consensus on what can be considered a normal Q-angle [35, 36]. This high heterogeneity of studies demonstrates the importance of standardizing the methods of measuring and interpreting the Q angle [35, 36].

This review found in two studies [27, 23] that ‘weekly distance’ was a risk factor for running injuries; runners who train a distance of more than 64 km per week might be more likely to sustain a running injury. Runners who usually train longer distances each week can overload their musculoskeletal structures beyond their body’s regeneration abilities, resulting in a musculoskeletal injury. Two studies [29, 27] also reported an association of ‘weekly frequency’ and running injuries. One study [27] reported that a frequency of three to seven times per week for men and seven times a week for women was associated with risk of injury. In another study [29] a frequency of once a week was found as a risk factor for only women. The association between training characteristics and running injuries seems to be complex. A systematic review of training errors and running injuries could not identify which training variable are related to running injuries, since methodological limitations hinders comparison between studies. [14]

The magnitude of risk found for all risk factors were between 1.4 and 5.9. For the main risk factor, previous injury, the magnitude of risk varied from 1.7 to 2.7 among the studies, which represents the same scale of risk for most studies that investigated previous injuries. In the assessment of risk of bias, most of the articles awarded at least nine stars (75%) of a total of 12, representing a relatively low risk of bias. Only one article awarded four stars, representing less than a half of the total stars; however, no study achieved the maximum number of stars (12). The criteria met least by the articles were ascertainment of exposure (4/12) and assessment of outcomes (3/12), representing a large source of bias in the studies included. The criteria in which most articles awarded a star were definition of running-related musculoskeletal injury (12/12), which is directly related to the rates of injury, and consequently to the predictive factors reported [7, 37]; selection of the non exposed cohort (12/12), demonstration that outcome of interest was not present at start of study (12/12), which is related to our inclusion criteria and, follow-up long enough for outcomes to occur (11/12), in this case we chose to use 12 weeks because we understand that is a minimum period for an overuse injury occur.

Even though the electronic search was conducted in the main databases related to the sports injuries field, it is possible that eligible articles have been published in journals not indexed in any of the searched databases. We found a great heterogeneity of statistical methods between studies, which prevented us from performing a meta-analysis. These inconsistencies among studies complicate inter-study comparisons and prevent us from confirming the relationship between all 63 risk factors and running injuries. Relatively few

prospective studies were identified in this review, reducing the overall ability to detect risk factors.

5. CONCLUSION

The main risk factor identified in this review was ‘previous injury’ in the last 12 months, although many risk factors had been investigated in the literature. Relatively few prospective studies were identified in this review, reducing the overall ability to detect risk factors. This highlights the need for more, well-designed prospective studies in order to fully appreciate the risk factors associated with running.

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Appendix 1. Search strategy for EMBASE database.

1. running/exp
2. marathon runner/exp
3. jogging/exp
4. treadmill exercise/exp
5. runner/syn
6. runners
7. jogger
8. joggers
9. run
10. marathon running/syn
11. marathon
12. exercise/syn
13. treadmill/syn
14. treadmill running/syn
15. OR/ 1-14
16. sport injury/exp
17. sports injuries
18. athlete injury/syn
19. athlete trauma/syn
20. athletic injuries/syn
21. athletic injury/syn
22. athletic trauma/syn
23. sport accident/syn
24. sport trauma/syn
25. sports injury/syn
26. sports trauma/syn
27. OR/ 16-26
28. AND/ 15,27
29. limits/ article
30. limits/ article in press
31. limits/ humans

Web Content Supplemental File – All factors investigated by the articles and its association with running-related injury.

	Risk Factor	Protective Factor	Articles
Intrinsic factors			
Previous injuries	6	0	10
Q-angle	2	0	3
Age	1	2	10
BMI	1	1	8
Type A behaviour	1	0	2
Non-musculoskeletal comorbidities	1	0	2
Leg-length difference	1	0	2
Q-angle right-left difference	1	0	1
Competitive runner	1	0	1
Lower extremity flexibility	1	0	1
Height	1	0	1
Unwell before the race	1	0	1
Ankle plantar flexion	1	0	1
Educational level	0	1	4
Navicular drop	0	1	1
Arch index (high)	0	1	1
Smoking	0	0	5
Alcohol consumption	0	0	4
Nutritional supplements	0	0	3
Gender	0	0	3
Ankle dorsiflexion	0	0	3
Hip internal/external rotation	0	0	2
Food intake	0	0	2
Arch type	0	0	2
Knee alignment	0	0	2
Body composition	0	0	1
Previous surgery	0	0	1
Laboratory tests	0	0	1
Ankle pronation	0	0	1
Spine flexibility	0	0	1
Forefoot valgus/varus	0	0	1
Subtalar valgus/varus	0	0	1
Arch height	0	0	1
Tubercle-sulcus angle	0	0	1
Loading rate	0	0	1
Contact time	0	0	1
Impact peak	0	0	1
Active peak	0	0	1
Time to impact peak	0	0	1
Time to active peak	0	0	1
Step frequency	0	0	1
Anabolic steroids use	0	0	1
Medical check-up	0	0	1

Stride length	0	0	1
Extrinsic factors			
Weekly distance	2	0	7
Weekly frequency	2	0	6
Running experience	1	1	9
Duration of running shoes	1*	1*	3
Stretching habits	1	0	6
Races last 12 months	1	0	4
Previous sports activities	1	0	3
Surface	1	0	3
Running all year round	1	0	2
Terrain	0	0	6
Number of pairs of running shoes used	0	0	5
Use of orthotics	0	0	4
Pace	0	0	2
Fitness level	0	0	2
Other physical activities	0	0	2
Use of medicine	0	0	1
Warm-up	0	0	1
Running shoes criteria	0	0	1
Preseason running	0	0	1

The factors were ordered according to the number of articles that found risk association with running-related injury.

* The same article found association with risk and protection.

PRISMA CHECK LIST			
Section/topic	**#**	**Checklist item**	**Reported on page #**
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	✓ Page 21
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	✓ Page 22
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	✓ Page 23
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	✓ Page 23
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	✓ Page 24
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	✓ Page 24
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	✓ Page 43
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	✓ Page 24
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	✓ Page 24
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	✓ Page 24
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	✓ Page 25/26
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	✓ Page 32
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	n/a

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	-
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	n/a
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	✓ Page 28
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	✓ Page 32
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	✓ Page 36
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	✓ Page 32
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	n/a
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	-
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	n/a
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	✓ Page 37
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	✓ Page 38
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	✓ Page 38
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	-

- CAPÍTULO 3 -

O QUE OS CORREDORES PENSAM SOBRE LESÃO? ESTUDO DESCRITIVO DAS CRENÇAS E OPINIÕES DE PRATICANTES DE CORRIDA

O QUE OS CORREDORES PENSAM SOBRE LESÃO? ESTUDO DESCRITIVO DE CRENÇAS E OPINIÕES DE PRATICANTE DE CORRIDA

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3.1 RESUMO

Introdução: Estudos recentes tem colocado como prioridade para a prevenção de lesões entender os aspectos comportamentais dos praticantes de esporte, assim como suas opiniões e crenças. **Objetivo:** Descrever as crenças e opiniões de praticantes de corrida sobre quais são os fatores associados às lesões musculoesqueléticas relacionadas à corrida. **Métodos:** Foi realizado um estudo qualitativo, por meio de entrevistas semiestruturadas aplicadas aos praticantes de corrida. Foram coletados os dados pessoais dos entrevistados, rotina de treinamento, experiência, participação de provas e o histórico de lesões. Em seguida, a entrevista foi iniciada a partir da questão "O que você acha que pode causar lesões nos corredores?". Foi realizada uma estatística descritiva das características dos participantes do estudo e, em seguida, realizada a análise das entrevistas em três etapas: 1) organização dos dados em unidades temáticas; 2) leitura e a reorganização dos dados de acordo com sua frequência; e 3) interpretação e sistematização dos dados. **Resultados:** Foram entrevistados um total de 96 corredores, sendo 65 homens e 30 mulheres. Os principais fatores extrínsecos citados pelos participantes foram relacionados ao treinamento e ao tênis de corrida, como não realizar alongamento, excesso de treinamento e não utilizar um tênis adequado. Os principais fatores intrínsecos citados foram não respeitar os limites do corpos e alterações na pisada. **Conclusão:** Os corredores demonstraram grande preocupação em relação aos fatores relacionados ao treinamento e ao tênis de corrida. Intervenções educativas são necessárias para um melhor entendimento dos corredores em relação às lesões na corrida.

3.2 INTRODUÇÃO

A corrida é uma das modalidades de atividade física mais populares em todo o mundo. Indivíduos que procuram a corrida como atividade física, geralmente buscam a melhora do condicionamento físico e mental, incluindo o controle do peso, diminuição do estresse e maior envolvimento social[1-3]. Além disso, após o início da prática, corredores relatam mudanças no estilo de vida através da melhora dos hábitos alimentares, condições de sono, diminuição da ingestão de álcool e tabaco e ainda, que a prática da corrida faz com que se sintam mais felizes, relaxados e com mais energia[3-5]. Entretanto, perder treinos ou parar de correr faz com que alguns corredores fiquem desconfortáveis, reportando sentimento de culpa, maior irritabilidade, menos energia e podendo ainda demonstrar sinais de depressão e dependência[3].

É preciso estar ciente de que, apesar dos benefícios observados, o número de lesões na corrida é preocupante, uma vez que suas taxas de prevalência e incidência variam entre 19 e 92%[2, 6-12], dependendo da população de corredores estudada e definição para lesão relacionada à corrida utilizada[2, 13]. As lesões que atingem os corredores, de um modo geral, são consideradas lesões por sobrecarga[14], ou seja, provenientes de microtraumas acumulativos durante um determinado período de tempo[14, 15]. Os fatores associados às lesões na corrida são, geralmente, atribuídos às características pessoais do indivíduo, aos fatores anatômicos e biomecânicos e aos erros de treinamento, como a distância semanal e a experiência de corrida[1, 16, 17]. Porém, estes fatores de risco ainda se mostram incertos na literatura, dificultando a criação de estratégias de prevenção para a corrida.

Para a criação de uma estratégia eficaz de prevenção de lesões, Finch et al.[18] criou um modelo teórico generalizado, levando em consideração a importância do entendimento dos aspectos comportamentais dos praticantes de esporte, incluindo suas crenças e opiniões dentro do contexto da implementação de uma estratégia preventiva. Este novo modelo de prevenção de lesões complementa os modelos prévios criados nos anos 90[19, 20], baseados no entendimento da etiologia das lesões e sua relação com os fatores internos e externos para o desenvolvimento de uma lesão. A importância de se investigar as opiniões e crenças de praticantes de esporte tem sido apontada na literatura por alguns estudos recentes[21-23], porém, ainda existem poucos estudos que investigaram os fatores comportamentais e as lesões no esporte. Uma revisão sistemática recente[23], mostrou que de 100 estudos publicados sobre prevenção de lesões, apenas 11 utilizaram aspectos comportamentais ou sociais em seus

programas de prevenção. Um estudo recente[24] demonstrou que as crenças e opiniões pré-existentes de atletas e técnicos devem ser incorporadas nos programas de prevenção de lesões, podendo aumentar a efetividade destes programas.

Entender a opinião dos corredores sobre as lesões pode ser um importante fator para a elaboração de um programa de prevenção de lesões específico para praticantes de corrida. Este é o primeiro estudo a trazer a opinião de corredores sobre as lesões na corrida. Acreditamos que as opiniões e as crenças dos corredores em relação aos fatores de risco para lesões na corrida sejam diferentes dos fatores de risco encontrados na literatura, já que os praticantes de corrida, assim como praticantes de esporte de um modo geral, estão expostos a diferentes influências, como as crenças e os aspectos culturais. Além disso, muitos corredores possuem a percepção de que são viciados em corrida, associando a corrida como um "vício bom", porém se estes corredores não estiverem cientes dos riscos desta modalidade, este "vício" pode se tornar prejudicial[3, 25]. Sendo assim, o objetivo deste estudo foi o de descrever as crenças e opiniões de praticantes de corrida sobre quais são os fatores associados às lesões relacionadas à corrida.

3.3 MÉTODOS

Foi realizado um estudo transversal quantitativo, por meio de entrevistas semiestruturadas aplicadas a praticantes de corrida. Foram entrevistados praticantes de corrida recrutados de forma aleatória em parques comuns para a prática de corrida na cidade de São Paulo. Os critérios de inclusão para a participação no estudo foram: 1) ser praticante de corrida há pelo menos seis meses; 2) correr uma distância mínima de 10 quilômetros semanais; 3) ter idade igual ou superior a 18 anos. Estes critérios foram designados para que os participantes do estudo tenham mínima experiência como corredor para que as entrevistas possam refletir as opiniões dos praticantes de corrida. O tamanho da amostra deste estudo foi determinado a partir do momento em que o surgimento de novos dados se tornou cada vez mais raro, levando a saturação do tema, ou seja, conforme as entrevistas forem analisadas e não houverem mais temas ou categorias novas será determinado o tamanho da amostra. Este estudo obteve aprovação do Comitê de Ética em Pesquisa da Universidade Cidade de São Paulo (Protocolo: 0084.0.186.000-11) e todos os participantes leram e assinaram o termo de consentimento livre e esclarecido.

O termo "crença" representa um conceito complexo de opiniões e ideias que podem influenciar o comportamento. Neste estudo, o termo "crença" foi adaptado de estudos prévios

e definido como “ideias que surgem na mente das pessoas como hábitos, costumes, tradições, maneiras folclóricas e populares de pensar baseadas em experiências ou opiniões de outros que influenciam ações e atitudes”[26, 27].

Todas as entrevistas foram conduzidas pelo mesmo entrevistador durante toda coleta de dados, o qual foi orientado a conduzir as entrevistas de maneira a permitir ao entrevistado se expressar livremente e com o máximo de informações possíveis sobre o tópico, procurando adotar uma posição neutra e evitar que a entrevista fuja do tema proposto. Além disso, o entrevistador teve a liberdade de estender a duração da entrevista pelo tempo que achar necessário, em que o critério utilizado para o término da entrevista foi o momento em que o entrevistador compreender ou que o entrevistado tomar consciência de que o assunto está saturado. Um gravador de voz Olympus® Digital VN-8100PC foi utilizado para o registro das informações fornecidas pelos participantes. As gravações das entrevistas foram transcritas para um documento de texto manualmente e encaminhado para outro pesquisador, que fez a leitura sincronizada ao áudio para confirmar a transcrição dos dados.

Antes do início das entrevistas foram coletados, através de um formulário, os dados pessoais e de treinamento dos entrevistados, tais como idade, gênero, número de treinos por semana, quilometragem semanal, tempo de prática de corrida, supervisão de um profissional nos treinamentos e o histórico de lesões relacionadas à corrida, o que poderá ser um fator que influencie na opinião do participante sobre o tema desta pesquisa. Após a coleta destes dados, foi conduzida a entrevista semiestruturada que foi iniciada a partir da seguinte pergunta: “O que você acha que pode causar lesões nos corredores?”.

Para a análise dos dados, inicialmente foi realizada uma estatística descritiva das características dos participantes do estudo obtidas pelo formulário inicial. Em seguida, foi realizada a análise das transcrições das entrevistas, realizadas em três etapas: 1) organização dos dados transcritos em unidades temáticas, ou seja, palavras ou frases que descrevem um dos tópicos apresentados na resposta do participante (por exemplo: na frase “eu acho que treinar em excesso pode causar lesões”, a unidade temática seria o termo “treinar em excesso”); 2) exploração dos dados, que envolveu a leitura cautelosa e a reorganização dos dados em categorias que foram definidas de acordo com a frequência das unidades temáticas definidas previamente; e 3) interpretação dos dados de forma que permita sua sistematização, que envolveu a junção de sinônimos ou unidades temáticas de mesmo significado (por exemplo: o termo “treinar em excesso” foi adicionado ao termo “excesso de treinamento”). Após as análises das entrevistas, as categorias criadas foram classificados entre fatores intrínsecos e extrínsecos para a condensação dos dados. Os fatores intrínsecos foram àqueles

relacionados as características individuais dos corredores, como gênero, idade, características antropométricas e fatores relacionados ao comportamento. Os fatores extrínseco foram àqueles relacionados ao ambiente, clima, equipamentos e treinamento[28].

3.4 RESULTADOS

Foram entrevistados um total de 96 corredores, sendo 65 homens e 30 mulheres, com idade média de 40 anos. As entrevistas semiestruturadas tiveram duração média de 8 minutos, sendo que a entrevista mais curta teve duração de 3 minutos e a mais longa 18 minutos. As características de todos os participantes do estudo estão descritas na Tabela 1. A partir da análise dos dados, foram criadas 8 categorias divididas entre os fatores intrínsecos e extrínsecos, sendo que para os fatores intrínsecos foram criadas as categorias: características pessoais, biomecânica/técnica, comportamento e outros. Para os fatores extrínsecos foram criadas as categorias: tênis, nutrição, treinamento e outros.

Em relação aos fatores intrínsecos, a categoria nomeada como "comportamento" foi a que obteve maior número de citações pelos participantes, em que o termo "não respeitar os limites do corpo" foi o mais mencionado. A segunda categoria de fatores intrínsecos com maior número de termos citados pelos participantes foi biomecânica/técnica, com o fator "alterações na pisada" mais citado pelos entrevistados. Por fim, a categoria sobre "características pessoais" teve com principal termo o "excesso de peso". Todos os fatores intrínsecos citados nas entrevistas estão em descritos na Tabela 2, divididos por categorias e por ordem de citação.

Os fatores extrínsecos foram os fatores mais citados pelos corredores como causadores de lesões. A categoria "treinamento" foi claramente a categoria com maior número de fatores citados, em que os termos mais reportados pelos participantes foram "não fazer alongamento", "excesso de treinamento", "não fazer aquecimento", "falta de fortalecimento" e "falta de acompanhamento profissional". A segunda categoria extrínseca com maior número de citações foi a categoria "tênis", com o fator "tênis inadequado para a pisada" sendo o mais relatado pelos corredores. Finalmente, a categoria "nutrição", teve o termo "alimentação desequilibrada/ inadequada" como o mais referido nas entrevistas. Todos os fatores intrínsecos citados nas entrevistas estão em descritos na Tabela 3, divididos por categorias e por ordem de citação.

Tabela 1. Características dos participantes do estudo (n=96)

Idade	40,1 (12,6)
Gênero	
Masculino	67,7 (65)
Feminino	32,3 (30)
Participação em assessoria	
Sim	33,3 (32)
Não	66,7 (63)
Participação em provas	
Sim	56,2 (54)
Não	42,8 (41)
Frequência de treinos por semana	3,7 (1,4)
Distância semanal (km/sem)	34,9 (24,8)
Tempo de prática (anos)	5,5 (5,5)
Lesão no momento da entrevista	
Sim	10,4 (10)
Não	89,6 (86)
Lesão prévia	
Sim	44,8 (43)
Não	55,2 (53)

Os dados contínuos estão expressos em média (desvio padrão) e os dados categóricos estão expressos em percentagens (número de participantes).

Tabela 2. Fatores extrínsecos citados pelos participantes durante as entrevistas.

Tênis	Nutrição	Treinamento	Outros
Tênis inadequado para a pisada (22)	Alimentação desequilibrada/ inadequada (20)	Não fazer alongamento (31)	Obstáculos (buracos, pedras, condições da pista/asfalto no geral) (6)
Tênis inadequado para corrida (8)	Não utilizar suplementos (1)	Excesso de treinamento (28)	Participar de provas em excesso (3)
Tênis sem amortecimento (4)		Não fazer aquecimento (20)	Quedas (3)
Tênis muito baixo (1)		Não fazer musculação/ Falta de fortalecimento (19)	Correr ouvindo música (1)
Tênis antigo (1)		Falta de acompanhamento profissional ou assessoria (17)	
Desgaste do tênis (1)		Falta de condicionamento físico (11)	
Calçado de má qualidade (1)		Falta de regularidade nos treinos (9)	
		Treinar em alta velocidade/ritmo (7)	
		Treinamento competitivo (4)	
		Treinar todos os dias sem interrupção (4)	
		Correr em terrenos inclinados (subidas ou descidas) (4)	
		Não seguir a planilha/orientações (4)	
		Não alongar corretamente (4)	
		Fadiga muscular (3)	
		Mudança súbita na intensidade de treinamento (3)	
		Falta de descanso (3)	
		Distância semanal alta (2)	
		Má orientação (2)	
		Treinar com grupos de corrida avançados (2)	
		Não parar quando estiver exausto (2)	

Os fatores estão em ordem de frequência de citação pelos participantes.

Tabela 3. Fatores intrínsecos citados pelos participantes durante as entrevistas.

Características pessoais	**Biomecânica/Técnica**	**Comportamento**	**Outro**
Excesso de peso (8)	Alterações na pisada (14)	Não respeitar os limites do corpo (18)	Azar (1)
Predisposição genética (5)	Má postura durante a corrida (7)	Falta de atenção durante a corrida (3)	
Falta de experiência (4)	Erro na técnica (4)	Afobação de querer treinar mais (2)	
Histórico de lesões (2)	Vícios da técnica de corrida (2)	Medo de se lesionar (2)	
Alteração anatômica (2)	Impacto da corrida no corpo (1)	Ignorar a dor (1)	
Idade avançada (2)	Não testar a pisada antes de começar a correr (1)	Euforia para participar de provas (1)	
Estresse (1)			
		Correr de forma competitiva (1)	
		Superproteção contra lesões (1)	

Os fatores estão em ordem de frequência de citação pelos participantes.

3.5 DISCUSSÃO

O presente estudo identificou a opinião de 96 corredores sobre os fatores relacionados ao surgimento de lesões na corrida. Os principais fatores extrínsecos citados pelos corredores foram: não realizar alongamento (antes ou depois dos treinos), excesso de treinamento e não utilizar o tênis adequado. Em relação aos fatores intrínsecos, os mais apontados foram: não respeitar os limites do corpo e alterações na pisada. A amostra deste estudo foi composta de corredores recreacionais na faixa de 40 anos de idade, predominantemente homens com cerca de cinco anos de experiência na corrida que correm em média 35 quilômetros semanais. Além disso, aproximadamente metade destes corredores costuma participar de provas e já sofreu lesões prévias.

Os corredores entrevistados citaram a não realização de alongamento como o principal fator associado ao surgimento de lesões. No relato a seguir, pode-se perceber o poder desta crença que foi construída para os corredores sobre a prática do alongamento:*"...Eu acredito que o alongamento é o principal causador de lesões...quando eu faço um treino e não me alongo bem antes eu sinto que estou correndo diferente e já fico preocupado...(S11)".* Evidentemente, os corredores acreditam que o alongamento realizado antes ou depois das atividades pode impedir que se lesionem, embora não existam evidências científicas que justifiquem tal afirmação. Uma revisão sistemática de estudos controlados aleatorizados (ECA's)[29] sobre intervenções para prevenção de lesões na corrida encontrou que a prática do alongamento, seja antes ou depois dos treinos ou fora do período de treino, não possui um efeito protetor contra lesões da corrida, resultados que corroboram com diversos outros estudos de coorte prospectivos que investigaram fatores de risco para lesões na corrida[8, 9, 30-33]. E ainda, alguns estudos apontam que o alongamento pode ter maior associação ao risco de lesões do que proteção[34]. Mesmo diante do grande número de evidências de que o alongamento não prevenirá lesões na corrida, porque os corredores continuam se alongando? Existem relatos de que a crença equivocada de que o alongamento prévio diminuiria a dor muscular após o exercício pode ter sido o início desta convicção que se tornou cada vez mais forte ao longo dos anos[35]. Outro motivo seria realizar incorretamente o alongamento como forma de aquecimento para as atividades. O termo aquecimento é definido como um período de exercícios preparatórios para as atividades subsequentes[36], e quando combinado com o alongamento não possui os mesmos efeitos[34]. Medidas educativas são necessárias para que os corredores compreendam os efeitos da prática do alongamento, assim como as diferenças entre o alongamento e o aquecimento.

Os corredores deste estudo também demonstraram grande preocupação em relação ao tênis de corrida, como no seguinte relato: *"...Eu acho que se você não tem um tênis bom para a corrida e adequado para a sua pisada você vai se machucar, vai estar correndo errado e com a pisada errada...(S21)"*. Muitos corredores acreditam que um tênis inadequado para a corrida ou ao tipo de pisada pode causar lesões, assim como a falta de amortecimento, o desgaste, a altura e o tempo de uso deste calçado. Entretanto, os poucos estudos que investigaram a influência do tipo tênis nas lesões da corrida mostram resultados em contrapartida com o que os corredores acreditam. Em três estudos de grande escala[37-39], não foram encontradas diferenças no risco de lesões entre indivíduos que receberam um tênis especial de corrida (controle do movimento, estabilidade ou neutro) baseado no seu tipo de pisada comparado com indivíduos que utilizaram o tênis independente do tipo de pisada. Além disso, Ryan et al.[40] encontrou que, corredoras identificadas como tipo de pé pronado que utilizaram tênis para controle do movimento, tiveram maior risco de lesões comparado àqueles que utilizaram um tênis neutro.

De acordo com o relato de um dos entrevistados sobre a importância de se adquirir um tênis especial de corrida: *"...Eu acho que o tênis interfere. Você precisa ter um tênis adequado pra você, pra sua pisada. É simples, você vai lá (em uma loja esportiva) faz o teste, vê a sua pisada e qual tênis acha mais confortável pra correr e ele (tênis) vai te ajudar a ter menos lesões...(S58)",* podemos entender que a indústria de calçados esportivos, de certa forma, contribui para que os corredores acreditem que um tênis especial para o tipo de pé de cada individuo é algo fundamental, mesmo sem a devida evidência científica disponível até o momento. Richards et al.[41] em uma revisão sistemática concluiu que a prescrição do tênis de corrida baseado no tipo de pé do individuo não é baseada em evidência. Sugerimos que no momento da escolha de um tênis de corrida, os corredores considerem outros aspectos que podem ser relevantes para a prática da corrida, como a sensação de conforto e o peso desses calçados.

O excesso de treinamento foi apontado como um dos principais fatores relacionados ao risco de lesões pelo corredores. O relato de um corredor com mais de cinco anos de experiência mostra sua preocupação com o excesso de treinos: "*...A corrida empolga no inicio, quando você corre, você não quer parar, acreditando que tem esta condição física, mas sobrecarrega o seu corpo que pode não estar acostumado...(S49)".* Alguns estudos tem associado esta empolgação gerada pela corrida com um certo estado de dependência ou vício, em que os corredores geralmente associam isso a um "vício bom", até pelos inúmeros benefícios à saúde desta atividade[3, 25]. Entretanto, quando realizada em excesso, a corrida,

assim como qualquer outro esporte, pode acarretar prejuízos como as lesões. Este raciocínio parece óbvio, mas corredores que costumam exagerar nos treinos, parecem associar este excesso à algo mais positivo do que negativo, sem adotar certos cuidados com este excesso de treinamento. Uma medida possivelmente eficaz para o excesso de treinamento é a periodização, como incorporar pausas ou outras medidas passivas entre sessões de treinamento intenso, como no relato de um corredor que já sofreu lesões previas: *"...Tem gente que acha que o descanso atrapalha, mas o descanso é parte do treinamento... (S37)"*. Esta conscientização em relação ao repouso, cuidados com a distância semanal e intensidade, deve ser incorporada em um possível programa de prevenção de lesões na corrida.

Apesar das inúmeras provas que muito corredores fazem anualmente, uma parte dos praticantes de corrida considera a corrida como uma atividade de lazer, como no relato deste corredor: *"...Para mim, vir ao parque correr é uma terapia, me alivia os problemas. Eu acho que devemos encarar a corrida como uma atividade de lazer, assim você não terá problemas com isso (lesões)...(S65)"*. Um estudo encontrou que corredores que se consideram competitivos podem estar mais susceptíveis a lesões quando comparado àqueles que se consideraram recreacionais[9], porém existem poucos estudos que investigaram a associação entre o comportamento dos corredores e a incidência de lesões, assim como o desenvolvimento de instrumentos ou formas de mensuração do comportamento na população de corredores.

Muitos corredores afirmaram que uma possível causa de lesões seria ultrapassar os limites do corpo, fator este que estaria relacionado ao excesso de treinamento citado anteriormente e a percepção individual dos corredores em relação ao esforço da atividade. Um corredor atribui esta percepção a algo único para cada um, como no relato: *"...Não pode ultrapassar os limites do corpo, porque todo mundo tem seu limite, você tem que obedecer e respeitar, todo mundo sabe o próprio limite (S13)..."*. Saber o próprio limite, como sugerido por alguns corredores, parece uma característica subjetiva e de difícil mensuração que está associada à percepção de cada indivíduo sobre o próprio corpo. Entretanto, esta conscientização sobre não ultrapassar o próprio limite, respeitar a dor e o corpo deve ser incorporada em programas educativos para a prevenção de lesões em corredores.

A amostra deste estudo foi composta de corredores entrevistados em diferentes parques e provas de corrida de diferentes distâncias, porém ainda assim, esta amostra pode não representar a opinião de corredores que não costumam treinar em parques ou participar de provas, como aqueles que treinam em academias por exemplo, sendo uma limitação deste estudo. Outra limitação seria em relação ao tamanho da amostra, já que não foi possível

realizar um cálculo amostral pela característica do delineamento do estudo proposto. A opinião de corredores sobre os fatores relacionados ao surgimento de lesões pode complementar as perguntas científicas dos pesquisadores da área e contribuir para a criação de estratégias de prevenção para lesões na corrida. Intervenções educativas são necessárias para um melhor entendimento dos corredores em relação às lesões na corrida, para que os corredores possam entender melhor os fatores de risco para lesões na corrida descritos na literatura e esclarecer os conceitos equivocados dos corredores.

3.6 CONCLUSÃO

Os corredores demonstraram grande preocupação em relação aos fatores relacionados ao treinamento e ao tênis de corrida como fatores relacionados às lesões na corrida, em especial ao excesso de treinamento, a não realização de alongamento e ao uso de um tênis inadequado ao tipo de pisada. Como fatores intrínsecos, muitos corredores apontaram como causa de lesões fatores como não respeitar os limites do corpo e alterações na pisada.

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- CAPÍTULO 4 –

CONSIDERAÇÕES FINAIS

4.1 CONCLUSÕES E PERSPECTIVAS FUTURAS

Os objetivos desta dissertação de mestrado foram o de revisar os fatores de risco associados às lesões na corrida reportados na literatura através de uma revisão sistemática de estudos de coorte prospectivos e investigar as crenças e opiniões dos corredores sobre as causas das lesões na corrida por meio de um estudo qualitativo.

Na revisão sistemática do capítulo 2 foi possível identificar como principal fator de risco para lesões na corrida à presença de lesões prévias nos corredores. Além disso, algumas variáveis relacionadas ao treinamento, em especial a distância semanal, foi associado às lesões na corrida por diversos estudos. Muitos fatores ainda permanecem incertos na literatura, como as características pessoais dos indivíduos (ex. idade, índice de massa corporal e experiência de corrida), os fatores biomecânicos (ex. tipo de pé e ângulo Q) e os fatores relacionados ao comportamento dos corredores. Os fatores de risco associadas ao treinamento podem ser considerados fatores modificáveis, pois é possível alterá-los e ajustá-los de acordo com o objetivo do programa de prevenção. Sendo assim, estas variáveis devem ser melhores investigadas e testadas no desenvolvimento de programas de prevenção de lesões na corrida. O principal fator encontrado na revisão sistemática (lesões prévias) é um fator não modificável, ou seja, não é possível alterar durante um programa de corrida, porém pode-se adotar um monitoramento para o corredor com histórico de lesões dentro de um programa de corrida, por exemplo maior controle das variáveis de treinamento e avaliações sobre o estado da lesão do passado.

A revisão sistemática mostrou que a maioria dos fatores de risco reportados pelos estudos ainda são inconclusivos, apresentando diversos resultados conflitantes, ou seja, diferentes resultados para um mesmo fator de risco, ou resultados limitados pela falta de estudos investigando determinado fator de risco. Estes resultados demonstram ainda a carência de estudos de coorte prospectivos nesta área.

O Capítulo 3 desta dissertação apresentou um estudo qualitativo sobre as crenças e opiniões dos corredores em relação aos fatores relacionados às lesões na corrida. De acordo com nosso conhecimento sobre a área de lesões na corrida, este estudo foi o primeiro a investigar as crenças e opiniões de corredores. Foi possível identificar que os corredores acreditam que a não realização de alongamento, o excesso de treinamento e o uso de um tênis inadequado podem ser as principais causas de lesões na corrida. Além disso, os corredores citaram com frequência fatores como alimentação desequilibrada, não respeitar os limites do

corpo e ainda outras variáveis de treinamento, como não realizar aquecimento, falta de fortalecimento e falta de acompanhamento profissional. De um modo geral, as opiniões dos corredores variaram bastante sobre as causas de lesões, refletindo a incerteza encontrada nos estudos prospectivos da revisão sistemática do capítulo 2, embora os fatores mais citados pelos corredores não correspondem aos fatores reportados na literatura. Por fim, este estudo do capítulo 3 pode contribuir com futuros estudos desta natureza na população de corredores e para a elaboração de medidas preventivas e educativas para que os corredores possam entender mais sobre as lesões na corrida, principalmente suas causas e fatores de risco.

A partir dos resultados obtidos nesta dissertação, pretendemos contribuir para o desenvolvimento e a implementação de programas de prevenção de lesões na corrida, fazendo com que os corredores aproveitem os benefícios da corrida com menor risco de lesão. Sugerimos ainda que mais estudos de coorte prospectivo bem delineados, com grandes populações e por um período de tempo adequado sejam realizados para esclarecer os fatores de risco para lesões na corrida e para um melhor entendimento da influência de alguns fatores pouco estudados até então, como fatores psicossociais e biomecânicos. Além disso, mais estudos controlados aleatorizados são necessários para se verificar a eficácia de propostas de intervenções com o objetivo de prevenir lesões na corrida. Acreditamos que com estas medidas será possível entender melhor os fatores de risco em praticantes de corrida e diminuir efetivamente as taxas de lesão, promovendo uma prática mais segura para essa modalidade.

- MATERIAL SUPLEMENTAR –

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Indexing

Sports Medicine is indexed in MEDLINE, EMBASE/Excerpta Medica, Current Contents/Clinical Medicine, SciSearch, Science Citation Index, Journal Citation Reports/Science Edition, Focus On: Sports Science & Medicine, CINAHL, PASCAL, SPORT, SportDiscus, SPONET, Focus On: Sports Science & Medicine, PsycINFO and Journals@OVID.

Journal Aim and Scope

Sports Medicine focuses on definitive and comprehensive commissioned review articles that interpret and evaluate the current literature to provide the rationale for and application of research findings in areas such as:

- Sports medicine and sports science (including performance research)
- The medical syndromes associated with sport and exercise
- The practical role that clinical medicine plays in sport, through injury prevention and treatment
- The medical use of exercise for rehabilitation and health and the application of physiological and biomechanical principles to specific sports. Please see Appendix A for the types of paper this journal considers for publication.

Authorship and Contributorship Criteria

Each author should have participated sufficiently in the work to take public responsibility for appropriate portions of the content. Authors should meet all the following criteria: (i) conceived and planned the work that led to the manuscript or played an important role in the acquisition, analysis and interpretation of the data or both; (ii) wrote the paper and/or made substantive suggestions for revision and; (iii) approved the final submitted version. The corresponding author takes responsibility for the work as a whole, from inception to the published manuscript, and will be responsible for sign-off of the final proofs prior to publication.

The Author Declaration Form is attached and is also available on the journal website. The journal will not consider a manuscript for publication unless it has received a signed copy

of this form from all authors. Any change in authors and/or contributors after initial submission must be approved by all authors. This applies to additions, deletions, change in order of the authors, or contributions being attributed differently. Any alterations must be explained to the editor. We advise that the order in which authors names are listed on a manuscript should reflect the magnitude of each author's contribution to the work. Please note that in citations of articles on the US National Library of Medicine's bibliographic database Medline the primary and only institution quoted for a manuscript is that of the first listed author.

The journal encourages all authors to specify their individual contributions to a manuscript in the Acknowledgements section; this is particularly pertinent in the case of original research. The corresponding author must provide a statement indicating the names and contributions of all persons who have contributed to the work reported in the manuscript but who do not fulfill authorship criteria. This information will be published in an Acknowledgments section of the paper. Authors should obtain written permission from individuals to be named in the Acknowledgments section.

Conflict of Interest Statement for Authors

The potential for conflict of interest arises when authors have personal or financial relationships that could influence their actions. All authors should indicate potential conflicts of interest, including specific financial interests relevant to the subject of their manuscript, in section F of the Author Declaration Form. To prevent ambiguity, authors must state explicitly whether potential conflicts *do* or *do not* exist. Details of relevant conflicts of interest (or the lack of) must be declared in the Acknowledgments section of the manuscript for all authors.

Role of the Funding Source

All sources of funding used to support the preparation of a paper should be declared in the Acknowledgements section of the manuscript.

MANUSCRIPT SUBMISSION

Submissions to *Sports Medicine* are considered on the understanding that the manuscript has been submitted exclusively to *Sports Medicine*, the data presented have not been published elsewhere and that no additional submission will be made elsewhere unless the paper is rejected. Please inform editorial staff in your covering letter if your paper has

previously been submitted to another journal and rejected; if this is the case you are required to provide the editorial/referee comments along with an explanation of how these comments have been addressed at the time of submission to *Sports Medicine*.

Manuscripts must be prepared and submitted in the manner described in "Uniform Requirements for Manuscripts Submitted to Biomedical Journals" (see http://www.icmje.org/). To submit a manuscript to the journal you will need to go to the AdisOnline site (http://adisonline.com) and follow the links and instructions to our online submission system (Adis Editorial Manager; www.editorialmanager.com/adis). Step-by-step instructions are available on the website. If you are unable to submit through the Editorial Manager site, e-mail us at journals@adis.co.nz or sportsmed@adis.co.nz, and include the journal name and "Article Submission" in the subject line.

Manuscript Format and Style

Sports Medicine publishes several categories of review article, each with its own specific focus/format, and letters to the editor. Authors should specify in their covering letter the category they prefer for their submission. In general, manuscripts should be prepared and paginated in the following manner: A. **Title page**: include title, authors (please also provide forename[s]) and institutions for each author where the work was done (indicating the city), and a condensed running title of not more than 50 characters including spaces. B. **Acknowledgments:** See Appendix A, point 4. C. **Name and address for correspondence:** Mailing address plus telephone and fax number. An e-mail address should also be supplied, but will not be published without your permission. D. **Table of contents** E. **Figure captions** F. **Abstract**: The abstract should succinctly highlight, in an informative manner, the specific important points addressed in the main body of the text; it should not just describe the general areas covered in the manuscript. The aim is for the abstract to stand alone as a synopsis of the article to accommodate those readers who do not have access to the full article. The journal style is to not cite references in the abstract so as to provide a discrete synopsis of the article. The length can be up to 400-500 words. G. **Text pages:** Text pages must have numbered pages. All review articles must include an introductory section that provides background on the topic and the aim should be clearly stated. If applicable, review articles should include details of the literature search parameters used to locate the material included in the review. The author should specify the databases searched, other sources of articles/data used, search terms and date limits, as well as inclusion/exclusion criteria if

relevant. Review articles should finish with a conclusion section putting the area into perspective and pointing the way for future research.

H. **Footnotes** I. **Reference list** (in Vancouver style) J. **Tables** (begin each table on a new page) K. **Figures** (place each figure in a separate file) L. **Supplemental digital content** (place each item in a separate file)

Please put sections A-J into a single file.

Abbreviations and Symbols

Use SI symbols and recognised abbreviations for units of measurement. The first time an abbreviation appears in the abstract and the text it should be preceded by the full name for which it stands, followed by the abbreviation in parentheses. Generally, abbreviations should be avoided as much as possible, and used only when the full term would make the text unduly cumbersome.

Drug Names

Generic names (International Nonproprietary Names [INN]) must be used. In review papers, brand names or trade names can be used in selected instances, e.g. when use of the generic name would be impractical or ambiguous. In original research a therapeutic intervention should be named by both its generic name and trade name (along with the manufacturer and location) in the methods section in order to precisely identify the product investigated.

Tables and Figures

Tables and figures help to convey information to the reader. Please make every effort to include such items in your article. Tables can be used, for example, to summarise important points, to compare agents or treatment regimens, or to list information that would otherwise impede the flow of the text. Figures may be schematic diagrams, graphical representations of data, photographs or treatment algorithms. Large numbers of tables and figures and lengthy tables can be problematic in print – these can, however, be published online-only as supplemental digital content.

Tables

Tables should be comprehensible without reference to the text, and data given in tables should in general not be duplicated in the text or figures. Any necessary descriptions

should appear in the table heading, and abbreviations and footnotes should be placed immediately below the table. Each table should be cited in the text. Please prepare tables in ‘table format', rather than using ‘tab' or ‘indent' commands. Do not format tables using word spaces. Number tables with Roman numerals (I, II, etc.) and provide a heading for each. Please put each table on a separate page. This is an example of the standard style for tables.

Table I. Table heading

Heading	Headinga	Straddle heading	Reference
subhead		subhead	
Subheading			
Parameter			
Parameter			
Subheading			
Parameter			
Parameter			
Parameter			

a Footnote. **Abbreviation** = XXXX; **abbreviation** = XXXX.

Figures

Captions should make the figure understandable independent of the text, and each figure should be cited in the text. Symbols, abbreviations and spelling should be consistent with the text. Lettering and symbols on figures should be clear and legible, preferably in Helvetica or Arial typeface.

Computer-Generated Figures

Figures should be prepared, where possible, using a computer drawing program. The saved file should be in PC format (not Macintosh), with a preview image included. Each figure (including components of a multi-part figure) should be saved as a separate file. Preferred typefaces for lettering and axis labels are Helvetica or Arial: any other fonts should be embedded in the file. The finish type size is 7pt for text and labels.

Line Drawings and Charts

Excel, Adobe Illustrator or CorelDraw files are preferred. If tints are used, we recommend using the range 20% to 80% and keeping a minimum 20% step between tints.

Photographs and Colour Artwork

Clinical photographs should be of high quality and taken against a plain background. If the patient is identifiable in a photograph, written permission must be obtained. Photographs should be supplied as high-resolution files at a minimum 300 dpi resolution (.TIF or .EPS files). Halftone figures should be saved or exported as .TIF files. Halftone figures without line artwork should be supplied at a minimum 300 dpi resolution; those incorporating line artwork or text (including screen grabs) should be supplied at a minimum 1200 dpi resolution. Each colour halftone should be saved or exported in 32-bit CMYK. These should be supplied as a single 4-color image (not as separated CMYK subfiles), and the CMYK colour profile is preferred over RGB or other palettes. If the file is compressed, please indicate the type of compression method used.

Supplemental Digital Content

Authors may submit additional material that enhances their paper to be considered for online-only posting as supplemental digital content (SDC). SDC may include standard media such as text documents, graphs, tables, figures, graphics, illustrations, audio, animations and video. SDC material is not edited by Adis staff and will be presented digitally as submitted.

REFERENCE STYLE

References are required to support all significant statements. They are also used to indicate the origin of material (quotations, tables, figures), and as a source for research and further reading. References need to be given in a form where the reader can quickly and easily identify the correct reference and locate the material in a library or on a database. Please cite primary sources of information, as opposed to books or reviews, where possible. Our referencing system is based on the ‘Uniform Requirements for Manuscripts Submitted to Biomedical Journals' (the ‘Vancouver' style), with some minor modifications.

Citations in Text

Number references consecutively in the order in which they are first mentioned in the text. Identify references in text, tables and captions by superscript arabic numerals in square brackets. For example,

Stress can be fatal.[4,5] Smith and Maple[12] found that stress can be fatal. Green et al.,[14] among others,[15-19] have disagreed with this assertion. Note: These examples are

chosen to illustrate particular points that may arise occasionally. In general, it is not necessary to mention the authors' names in the text in the Vancouver system (including in tables). The only reason to do so is if you specifically wish to draw the reader's attention to the authors – for example, in relation to a controversial issue where there are groups of authors whose views are well known to be polarised.

References cited only in tables or in captions to figures should be numbered as if they appear in the text at the first mention of the particular table or figure. Include among the references papers accepted but not yet published;; give the journal and add ‘In press' in the reference list (see example 72). Try to avoid using abstracts as references. ‘Unpublished observations' (i.e. your own unpublished work) and ‘personal communications' (i.e. the unpublished work of others) may not be used as references, although they may be inserted (in parentheses) in the text. If you cite a ‘personal communication' you should provide written evidence that the person(s) quoted has given permission for the use of the material. Information from manuscripts submitted but not yet accepted should be cited in the text as ‘unpublished observations' (in parentheses).

Reference List

List references in numerical order. Titles of journals should be abbreviated according to the style used on MEDLINE. Please consult the *Journals Database* on the PubMed website: http://www.ncbi.nlm.nih.gov/journals?itool=sidebar . State or province abbreviations should accompany city names (for conference locations or place of publication). The country may also be included where the location could be unclear to readers. Only the first three authors' names are given, then ‘et al.’ for additional authors. Spellings in references should appear as in the original publication; accents in the original should be followed. If the month of publication is available that should also be included. Authors should verify their reference citations against the original documents.

APPENDIX A Article types published in *Sports Medicine*

All review articles should be readable and authoritative, of international scope, and appropriately referenced.

Review Article (word count up to 6000)

A review article should:

- Provide an authoritative, comprehensive and critical review of the literature.
- Provide a balanced, rather than personal, view of the literature.
- Emphasise and highlight the practical implications and educational message(s).
- Be fully referenced, with all agents of relevance to the topic discussed in order to provide full coverage of the area.

Current Opinion (word count 1500 to 3000)

- A current opinion article should:
- Place an area in perspective given that it is of current international interest and a consensus has not yet been reached; therefore, the arguments presented may be controversial, but at the same time must be balanced and rational.
- Emphasise and highlight the practical implications and educational message(s).
- Clearly identify personal opinion where this is included. **Leading Article (word count up to 3000)** A leading article should:
- Provide a short, balanced overview of the current state of development of an emerging area.
- Emphasise and highlight the practical implications and educational message(s).

Injury Clinic (word count up to 3000) An injury clinic should:

- Provide an overview from the latest studies of a particular sports injury or injuries.
- Provide clinically useful information.
- Provide guidelines for treatment and rehabilitation. **Letter to the Editor (word count up to 1000)** A brief correspondence item commenting on an article published recently in the journal; a response to the comments would normally be sought from the authors of the original article and published in the same issue, where possible.

GUIDE FOR AUTHORS OF THE *JOURNAL OF SCIENCE AND MEDICINE IN SPORT*

ISI Impact Factor (2012): 2,899

PREPARATION OF MANUSCRIPTS

- Microsoft Word is the preferred software program. Use Arial or Times New Roman font, size eleven (11) point.

- Manuscript is double-spaced throughout (including title page, abstract, text, references, tables, and legends).

- Margins are 1 inch or 2.5 cm all around - Include **page and line numbers** for the convenience of the peer reviewers.

- Number the pages consecutively, beginning with the title page as page 1 and ending with the Figure legend page.

- All headings (including the Title) should be in sentence-case only, not in capital letters.

- Sub-headings are generally not accepted. Incorporate into the text if required.

- Footnotes are not acceptable.

- Keep the use of tables, figures and graphs to a minimum. - See notes on Tables, Figures, Formulae and Scientific Terminology at the end.

WORD COUNT LIMITS

Original Research papers

- 3000 word count limit (excluding title, abstract, tables/figures, figure legends, Acknowledgements, and References)

- Maximum number (combined) of tables and figures is 3 - Long tables should only be included as supplementary material and will be made available on-line only

- Maximum number of references is 30 - A **structured abstract** of less than 250 words (not included in 3000 word count) should be included with the following headings: Objectives, Design, Method, Results, and Conclusions

Review articles

- 4000 word count limit (excluding title, abstract, tables/figures, figure legends, Acknowledgements, and References)

- Maximum number (combined) of tables and figures is 3

- Long tables should only be included as supplemental files and will be available online only - Maximum number of references is 60

- A **structured abstract** of less than 250 words (not included in 4000 word count) should be included sticking as closely as possible to the following headings: Objectives, Design, Method, Results, and Conclusions

STRUCTURE OF THE MANUSCRIPT (in order):

1. Cover Letter

- Every submission, regardless of category must include a letter stating: - the category of article: Original Research or Review article - the *sub-discipline*: sports medicine, sports injury (including injury epidemiology and injury prevention), physiotherapy, podiatry, physical activity and health, sports science, biomechanics, exercise physiology, motor control and learning, sport and exercise psychology, sports nutrition, public health (as relevant to sport and exercise), rehabilitation and injury management, and others having an interdisciplinary perspective with specific applications to sport and exercise and its interaction with health.

- Sources of outside support for research (including funding, equipment and drugs) must be named.

- Financial support for the project must be acknowledged, or "no external financial support" declared.

- The role of the funding organisation, if any, in the collection of data, their analysis and interpretation, and in the right to approve or disapprove publication of the finished manuscript must be described in the Methods section of the text.

- When the proposed publication concerns any commercial product, either directly or indirectly, the author must include a statement (1) indicating that he or she has no financial or other interest in the product or distributor of the product or (2) explaining the nature of any relation between himself or herself and the manufacturer or distributor of the product.

- Other kinds of associations, such as consultancies, stock ownership, or other equity interests or patent-licensing arrangements, also must be disclosed. Note: If, in the Editor's judgment, the information disclosed represents a potential conflict of interest, it may be made available to reviewers and may be published at the Editor's discretion; authors will be informed of the decision before publication.

The *Ethical Guidelines* that have been followed must be stated clearly. Provide the Ethics Committee name and approval number obtained for Human investigation. - *Authors*

must declare that manuscripts submitted to the Journal have not been published elsewhere or are not being considered for publication elsewhere and that the research reported will not be submitted for publication elsewhere until a final decision has been made as to its acceptability by the Journal.

Permission from the publisher (copyright holder) must be submitted to the Editorial Office for the reproduction of any previously published table(s), illustration(s) or photograph(s) in both print and electronic media or from any unmasked participants appearing in photographs.

2. Title Page (first page) should contain:

a. *Title*. Short and informative b. *Authors*. List all authors by first name, all initials and family name c. *Institution and affiliations*. List the name and full address of all institutions where the study described was carried out. List departmental affiliations of each author affiliated with that institution after each institutional address. Connect authors to departments using alphabetical superscripts. d. *Corresponding author*. Provide the name and e-mail address of the author to whom communications, proofs and requests for reprints should be sent. e. *Word count* (excluding abstract and references), the Abstract word count, the number of Tables, the number of Figures.

3. Manuscript (excluding all author details) should contain: (in order)

a. *Abstract* - must be structured using the following sub-headings: Objectives, Design, Methods, Results, and Conclusions. Avoid abbreviations and acronyms.

b. *Keywords* - provide up to 6 keywords, with at least 4 selected via the Index Medicus Medical Subject Headings (MeSH) browser list: http://www.nlm.nih.gov/mesh/authors.html. These keywords should not reproduce words used in the paper title.

c. Main body of the text.

For Original Research papers, text should be organised as follows:

i. *Introduction* - describing the (purpose of the study with a brief review of background

ii. *Methods* - described in detail. Include details of the Ethics Committee approval obtained for Human investigation, and the ethical guidelines followed by the investigators. This section is not called Materials and Methods, and should not include subheadings. Do not use the term "subjects" - use terms such as "participants", "patients" or "athletes", etc.

iii. *Results* - concisely reported in tables and figures, with brief text descriptions. Do not include subheadings. Use small, non-italicized letter p for p-values with a leading zero, e.g.

0.05; Measurements and weights should be given in standard metric units. Do not replicate material that is in the tables or figures in the text.

iv. *Discussion* - concise interpretation of results. Cite references, illustrations and tables in numeric order by order of mention in the text. Do not include subheadings.

v. *Conclusion*

vi. *Practical Implications* - 3 to 5 dot (bulleted) points summarising the practical findings derived from the study to the real-world setting of sport and exercise - that can be understood by a lay audience. Avoid overly scientific terms and abbreviations. Dot points should not include recommendations for further research.

vii. *Acknowledgments* - this section is compulsory. Grants, financial support and technical or other assistance are acknowledged at the end of the text before the references. All financial support for the project must be acknowledged. If there has been no financial assistance with the project, this must be clearly stated.

viii. *References* - authors are responsible for the accuracy of references.

ix. *Tables* - may be submitted at the end of the text file, on separate pages, one to each page.

x. *Figure Legends* - must be submitted as part of the text file and not as illustrations.

4. Figures - must be submitted as one or more separate files that may contain one or more images.

5. Supplementary material (if any) - tables or figures to be viewed online only

REFERENCES

- References should be **numbered consecutively** in un-bracketed superscripts where they occur in the text, tables, etc, and listed numerically (e.g. "1", "2") at the end of the paper under the heading "References".
- For Original Research papers, **no more than three references** should be used to support a specific point in the text.
- All authors should be listed where there are three or fewer. Where there are more than three, the reference should be to the first three authors followed by the expression "et al".
- Book and journal *titles* should be in *italics*.
- Conference and other abstracts should not be used as references. Material referred to by the phrase "personal communication" or "submitted for publication" are not considered full references and should only be placed in parentheses at the appropriate place in the text (e.g.,

(Hessel 1997 personal communication). References to articles submitted but not yet accepted are not encouraged but, if necessary, should only be referred to in the text as "unpublished data".

- Footnotes are unacceptable.

- **Book references:** Last name and initials of author, chapter title, chapter number, italicised title of book, edition (if applicable), editor, translator (if applicable), place of publication, publisher, year of publication.

Example: Wilk KE, Reinold MM, Andrews JR. Interval sport programs for the shoulder, Chapter 58, in *The Athlete's Shoulder*, 2nd ed., Philadelphia, Churchill Livingstone, 2009

- **Journal references:** Last name and initials of principal author followed by last name(s) and initials of co-author(s), title of article (with first word only starting in capitals), abbreviated and italicised title of journal, year, volume (with issue number in parenthesis if applicable), inclusive pages.

For guidance on abbreviations of journal titles, see Index Medicus at www.nlm.nih.gov/tsd/serials/lji.html.

Example: Hanna CM, Fulcher ML, Elley CR et al. Normative values of hip strength in adult male association football players assessed by handheld dynamometry. *J Sci Med Sport* 2010; 13(3):299-303.

- **Internet references** should be as follows: Health Care Financing Administration. 1996 statistics at a glance. Available at: http://www.hcfa.gov/stats/stathili.htm. Accessed 2 December 1996.

- **Articles in Press** are cited using a DOI: http://www.doi.org. The correct format for citing a DOI is as follows: doi:10.1016/j.jsams.2009.10.104.

TABLES

- Tables should be part of the text file, placed on separate sheets (one to each page) after the References section. Do not use vertical lines.

- Each table should be numbered (Arabic) and have a title above. Legends and explanatory notes should be placed below the table.

- Abbreviations used in the table follow the legend in alphabetic order.

- Lower case letter superscripts beginning with "a" and following in alphabetic order are used for notations of within-group and between-group statistical probabilities.

- Tables should be self-explanatory, and the data should not be duplicated in the text or illustrations.

FIGURE LEGENDS

- Figure legends should be numbered (Arabic) and double-spaced in order of appearance, beginning on a separate page.

- Identify (in alphabetic order) all abbreviations appearing in the illustrations at the end of each legend.

- All abbreviations used on a figure and in its legend should be defined in the legend.

- Cite the source of previously published (print or electronic) material in the legend.

- Figure legends must be submitted as part of the text file and not as illustrations.

FIGURES AND ILLUSTRATIONS

- Images or figures are submitted online as one or more separate files that may contain one or more images.

- Within each file, use the figure number (e.g., Figure 1A) as the image filename.

- The system accepts image files formatted in TIF and EPS. PowerPoint (.ppt) files are accepted, but you must use a separate PowerPoint image file for each PowerPoint figure.

- Symbols, letters, numbers and contrasting fills must be distinct, easily distinguished and clearly legible when the illustration is reduced in size.

- Black, white and widely crosshatched bars are preferable; do not use stippling, gray fill or thin lines.

- Written permission from unmasked patients appearing in photographs must be obtained by the authors and must be surface mailed or faxed to the editorial office once the manuscript is submitted online.

FORMULAE, Equations and Statistical Notations

- Structural formulae, flow-diagrams and complex mathematical expressions are expensive to print and should be kept to a minimum.

- Present simple formulae in the line of normal text, where possible. Use a slash (/) for simple fractions rather than a built up fraction. Do not use italics for variables.

- In statistical analyses, 95% confidence intervals should be used, where appropriate. Experimental design should be concisely described and results summarised by reporting means, standard deviations (SD) or standard errors (SE) and the number of observations. Statistical tests and associated confidence intervals for differences or p-values should also be

reported when comparisons are made. Only use normal text for statistical terms: do not use bold, italics or underlined text.

SCIENTIFIC TERMINOLOGY

- To enable consistency, authors should generally follow the technical guidelines of Medicine and Science in Sports and Exercise, unless otherwise stipulated in these Instructions. - Following are some examples of the Journal style in the most basic cases and some general SI unit guidelines.

- Mass: 10 g, 2 kg - Temperature: 20 o C - Distance: 10 cm, 4 m, 20 km - Time: 10 s, 20 min, 2 hr, 5 wk, 1 y - Power: 10 W - Energy: 400 J, 10 kJ.

- The centigrade scale (C) and the metric units (SI) must be used, except in the case of heart rate (beats per min: bpm), blood pressure (mmHg) and gas pressure (mmHg). - When opening a sentence, numbers should be expressed in words, e.g.: Forty-seven patients were contacted by phone.

- The 24-hour clock should be used.