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LESÃO MUSCULOESQUELÉTICA RELACIONADA À
CORRIDA: DEFINIÇÕES, DESCRIÇÕES E FORMAÇÃO DE
CONSENSO

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Dissertação apresentada ao Programa de
Mestrado e Doutorado em Fisioterapia da
Universidade Cidade de São Paulo como
requisito exigido para a obtenção do título
de Mestre sob orientação do Prof. Dr.
Alexandre Dias Lopes.

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Resumo

Os objetivos desta dissertação de mestrado foram: 1) Revisar na literatura quais são as definições de lesão musculoesquelética relacionada à corrida; 2) Propor um consenso sobre definição de lesão musculoesquelética relacionada à prática da corrida através de um estudo do tipo Delphi modificado em 3 etapas. Para os objetivos propostos foram realizados dois estudos, uma revisão sistemática para o primeiro objetivo e um estudo de consenso do tipo Delphi para o segundo objetivo. Para a revisão sistemática, as buscas foram realizadas em 6 bases de dados (Embase, Pubmed, Cinahl, SportsDiscus, Lilacs e Scielo) até julho de 2013. Foram incluídos estudos de corrida que apresentaram uma definição para lesão musculoesquelética relacionada à corrida. Para o estudo Delphi, foram convidados 112 potenciais participantes. Na primeira etapa os participantes receberam o formulário *online* para classificar termos/palavras das definições de lesão encontradas na revisão. Os termos com uma concordância mínima de 75% entre os participantes seguiram para as próximas etapas. Na terceira etapa foi apresentado o consenso gerado pelas duas etapas anteriores. Em relação aos resultados da revisão sistemática, 48 artigos foram incluídos, nos quais foram extraídas as definições de lesões e classificadas em três domínios e subcategorias: 1) presença de queixa física (sintoma, sistema do corpo e região); 2) interrupção de treinos ou competições (esporte primário, extensão da lesão, extensão da limitação, interrupção e período em que a lesão ocorreu); 3) procura por assistência médica (assistência médica/ medicamentos). A principal subcategoria reportada foi “sintoma”, seguida por “extensão da lesão” e “extensão da limitação”. As subcategorias com menos termos reportados foram “procura por assistência médica” e “período em que a lesão ocorreu”. Em relação ao estudo Delphi, 36 participantes aceitaram participar do consenso. Após as três rodadas, o consenso gerado foi: “Dor musculoesquelética relacionada à corrida (treino ou competição) nos membros inferiores que provoca uma restrição ou interrupção na corrida (distância, velocidade, duração ou treinamento) por pelo menos sete dias ou três treinos consecutivos ou que requer do corredor uma consulta com um médico ou outro profissional da saúde”. Sendo que para estudos retrospectivos o questionamento sobre a lesão deve estar relacionado aos últimos seis meses. Podemos concluir que as definições de lesão se baseiam em informar a presença de queixa física e a necessidade de um período de interrupção de treinos/competições. O consenso gerado nesta dissertação deve auxiliar na comparação e elaboração dos estudos sobre corrida.

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

Abstract

The objectives of this dissertation were: 1) to review the literature about the definitions of running-related musculoskeletal injury. 2) to propose a consensus definition of running-related musculoskeletal injury throughout a modified Delphi approach in 3 steps. For these objectives we performed two studies: a systematic review for the first aim and a Delphi study for the second. For the systematic review, the searches were performed in 6 databases (EMBASE, PubMed, CINAHL, SportsDiscus, Lilacs and SciELO) until July 2013. We included studies that showed a definition of running-related musculoskeletal injury. For the Delphi study, 112 potential participants were invited. In the first stage the participants received the online form to classify words/terms of the definitions found in the systematic review. The terms with a minimum of 75% of agreement among participants followed for the next steps. In the third stage, the consensus was presented. Regarding the results of the systematic review, 48 articles were included in which the definitions were extracted and classified into three domains and subcategories: 1) presence of physical complaints (symptoms, body system and region), 2) interruption of training or competition (primary sport involved, extent of injury, extent of limitation, interruption and period which the injury occurred), 3) seeking for medical care (seek medical help/medication). The main subcategory reported was "symptom", followed by "extent of injury" and "extent of limitation". The subcategories with fewer reported terms were "seek medical attention" and "period which the injury occurred". Regarding to the Delphi study, 36 participants agreed to participate in the consensus. After three rounds, the consensus reached was: "Running related musculoskeletal pain (training or competition) in the lower limbs that cause a restriction or interruption in running (distance, speed, duration, or training) for at least seven days or three consecutive training sessions or that requires the runner a consultation with a doctor or other health professional". For retrospective studies, the question about injury must be related to the last six months. We can conclude that the definitions of injury are based on informing the presence of physical complaint and the need for a interruption of training/competitions. The consensus generated should aid in the comparison and elaboration of studies on running injuries.

Keywords: runners, sport, consensus, athletic injuries.

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- CAPÍTULO 1 –
CONTEXTUALIZAÇÃO

1.1 CONTEXTUALIZAÇÃO

A corrida é um dos tipos de atividade física mais popular em todo o mundo^{1,2}. Além de oferecer melhoria da qualidade de vida³ e outros diversos benefícios à saúde, a corrida pode ser considerada uma modalidade de baixo custo e assim, o número de praticantes vem aumentando gradativamente nas últimas décadas⁴⁻⁷. Uma das consequências do aumento da popularidade da prática da corrida é o aumento das lesões musculoesqueléticas entre os participantes, que apresenta incidência de lesão com taxas que podem variar entre 19 e 92% ou 6,8 e 59 lesões por cada 1000 horas de exposição à corrida^{4, 8-17}, dependendo da definição de lesão utilizada e da população de corredores estudada^{2, 4, 18-20}.

Existe um universo relativamente grande de estudos relacionados à lesão na corrida nas principais bases de dados desta área e uma das dificuldades que muitos pesquisadores apontam, durante a condução de seus estudos, é o que considerar como definição de lesão musculoesquelética^{4, 12, 18}. Algumas dezenas de estudos descrevem suas definições de lesão musculoesquelética relacionada à corrida (LMRC), mas dentre estas, é possível observar diversas estruturas e diferentes critérios para considerar de fato uma lesão relacionada à corrida. A necessidade de uma definição padronizada de LMRC já foi sugerida em outros estudos^{4, 8}, porém, até o momento, não existe um consenso sobre qual seria a melhor definição, permitindo assim, que os pesquisadores utilizem diferentes definições^{1, 11, 18}.

A falta de uma definição do que é considerada uma lesão musculoesquelética acaba por levar os autores a elaborarem suas próprias definições, que geralmente estão baseadas em três características: 1) presença de queixa física; 2) necessidade de ocorrer um tempo de afastamento dos treinos e/ou competições; e 3) quando há procura por assistência médica^{21, 22}. Os autores normalmente optam por utilizar apenas umas das três características ou então uma combinação das três²¹. A falta de padronização de conceitos na pesquisa clínica é considerada como uma das principais barreiras para a comparação de estudos²³ e ainda, a realização de estudos clínicos sobre lesões na corrida torna-se difícil devido às diferentes definições de lesão existentes²⁴. No caso da área de lesões no esporte, um dos primeiros requisitos necessários para que seja possível a comparação entre estudos, é a utilização de uma definição padronizada, evitando assim que os achados revelem apenas parte do problema total²⁰.

Considerar uma definição de lesão esportiva de forma que esta necessite de atenção médica, por exemplo, pode resultar em encontrar apenas lesões graves e predominantemente agudas, uma vez que as lesões menos graves ou por sobrecarga, podem não ser registradas²⁰. Exemplos da influência da definição sobre os resultados das pesquisas podem ser observados em alguns estudos^{4, 18-20}. Um deles, publicado por Bovens e cols. (1989)¹⁴, encontrou uma das maiores taxas de incidência de lesão (84,9%) observada até o momento na literatura, muito provavelmente devido à utilização de uma definição abrangente: “qualquer queixa física desenvolvida em relação à corrida que cause restrição na distância, velocidade, duração ou frequência de treinos”. Em contrapartida, Blair e cols.²⁵ considerou lesão relacionada à corrida como “alguma queixa que impossibilite o atleta de correr por pelo menos sete dias”, o que pode ser considerado uma definição rigorosa, apresentando uma taxa de incidência de lesão de 24% nos corredores avaliados.

Associada ainda aos diferentes tipos de definição de lesão é preciso ressaltar a importância de definir a população de corredores com a qual será realizado o estudo²⁴. Para estudar corredores recreacionais, por exemplo, deve-se saber que estes não costumam treinar ou participar de corridas de alta quilometragem, diferentemente de uma população de ultramaratonistas, composta por indivíduos que percorrem distâncias muito maiores, o que provavelmente levaria a queixas e afecções diferentes das observadas nos corredores recreacionais. Para uma definição de LMRC devem ser levados em conta alguns fatores como o momento em que ocorreu a lesão (treino ou durante uma prova); consequências da lesão; se a lesão vai alterar o desempenho, treinos e/ou competições; período que corredor permanecerá afastado; e, a severidade da lesão.

A dificuldade da implementação de consensos de definição de lesão, especificamente, vem sendo apontada em diversas modalidades esportivas^{26, 27}, uma vez que, entende-se a importância destas padronizações para auxiliar, por exemplo, na identificação de fatores de risco, das taxas de incidência de lesão e na criação de programas de prevenção^{22, 27-29}. A busca de um consenso já foi utilizada em outras áreas como é o caso de um estudo para definição de “especialista em medicina esportiva”³⁰, assim como o que buscou um consenso para identificar as “prioridades de pesquisa em ortopedia e traumatologia”³¹, e ainda, outro em que os autores objetivavam propor uma terminologia padrão para definir “dor lombar recorrente”²³. A técnica do estudo tipo Delphi foi, portanto, criada para transformar a opinião de um

determinado tema em consenso de grupo^{23, 32-34}. Ou seja, trata-se de uma técnica de facilitação que procura obter consenso sobre a opinião de “especialistas” num determinado assunto^{32, 35-38}. Esta abordagem tem sido comumente adotada na área da saúde³⁵ e pode ser feita na sua forma clássica ou em formas variadas em que se modificam algumas de suas características³⁶ e etapas³². É possível encontrar várias formas modificadas de Delphi, uma vez que não existem orientações universais para tal tipo de estudo^{32, 35}.

A técnica Delphi se dá através de uma série de questionários estruturados, comumente chamados de “etapas”, que são anônimos entre os participantes especialistas^{32, 36-38}. Portanto o estudo do tipo Delphi é um processo com diversos estágios, interativo e criado para combinar a opinião destes participantes em questão^{32, 36}. O primeiro questionário enviado aos participantes deve coletar também dados qualitativos, que mais adiante serão devolvidos aos participantes de forma quantitativa em um segundo questionário^{32, 33}. O primeiro questionário qualitativo será importante para formar a primeira etapa quantitativa do estudo³². Desta forma, este processo vai evoluindo até o consenso ser obtido, ou seja, as respostas obtidas pelos participantes são resumidas de uma etapa para outra e as informações voltam aos participantes em forma de resposta controlada^{32, 36-38}. Este processo é repetido até que o consenso seja alcançado, sendo que, este tipo de Delphi é conhecido como Delphi clássico³⁶. Entretanto, quatro etapas tem sido sugeridas como ideais para que se alcance um consenso^{36, 39} no Delphi clássico³² e, ainda outros estudos recentes sugerem que duas ou três etapas parecem ser preferíveis^{32, 33}.

Saber o momento de parar as etapas é crucial, por isso é de grande importância que se saiba o nível de consenso a ser empregado e este dependerá dos participantes da amostra, do objetivo da pesquisa e dos recursos utilizados³². A pesquisa Delphi tem mostrado que não existe um critério claro para estabelecer o momento em que o consenso foi alcançado^{32, 36}. Alguns estudos sugerem que o consenso deve ser equivalente a 60% de concordância entre os participantes^{23, 36}, porém outros citam uma concordância que varia entre 50% e 80% para se alcançar o consenso³². Quando os autores de um estudo do tipo Delphi optam por guiar o estudo de forma que as etapas acabem rapidamente (uma ou duas etapas), corre-se o risco de obter respostas que não serão tão significativas³². Em contrapartida, optar por estender demais as etapas e elaborar inúmeras etapas, pode causar um cansaço dos participantes, correndo o risco de se alcançar o consenso simplesmente, devido à esta fadiga da

amostra³⁶ ou então, o abandono do estudo^{32,33}. É também importante citar que através de um estudo do tipo Delphi, a existência de um consenso não significa necessariamente que foi encontrada a resposta, a opinião ou o julgamento mais correto, mas foi possível identificar fatores que um grupo de participantes especialistas no assunto considera relevante em relação ao tópico discutido^{32,36}.

A necessidade de um consenso para definições já vem sendo descrita há algum tempo, assim como a falta desta padronização vem implicando seriamente na redução da capacidade de comunicação eficiente dos resultados de pesquisas e de tratamentos de atletas²⁰. Apesar do número de estudos desenvolvidos sobre o assunto lesão na corrida ter aumentado bastante nas últimas décadas, somente será possível comparar os resultados dos estudos se forem adotados conceitos comuns e minimamente padronizados²⁰.

Até o momento, não foi proposto na literatura revisar as definições de lesão musculoesquelética relacionada à corrida, e tampouco propor um consenso para tal definição. Desta forma, esta dissertação teve como objetivos: 1) Revisar na literatura quais são as definições de lesão musculoesquelética relacionada à corrida; 2) Propor um consenso sobre definição de lesão musculoesquelética relacionada à prática da corrida através de um estudo do tipo Delphi modificado em 3 etapas.

1.2 APRESENTAÇÃO DOS ESTUDOS ENVOLVIDOS NA DISSERTAÇÃO

Esta dissertação está dividida em quatro capítulos. O Capítulo 1 se trata da contextualização do assunto abordado nesta dissertação. O Capítulo 2 se trata de uma revisão sistemática da literatura sobre o que os autores utilizam como definição de lesão musculoesquelética relacionada à corrida. Esta revisão sistemática foi submetida e está em processo de revisão na *British Journal of Sports Medicine* (as normas para os autores está disponível na seção Material Suplementar).

O Capítulo 3 se trata de um estudo do tipo Delphi que teve como objetivo propor um consenso sobre definição de lesão musculoesquelética relacionada à prática da corrida através da técnica Delphi modificada em três etapas. Este estudo está em fase de preparação para ser submetido à *British Journal of Sports Medicine*.

O Capítulo 4 se trata das considerações finais desta dissertação, ou seja, conclusões que foram identificadas através da revisão sistemática e do estudo do tipo Delphi.

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- CAPÍTULO 2 -

**DEFINIÇÕES UTILIZADAS PARA DESCREVER LESÃO
MUSCULOESQUELÉTICA RELACIONADA À
CORRIDA: UMA REVISÃO SISTEMÁTICA**

**DEFINITIONS USED TO REFER A RUNNING-RELATED
MUSCULOSKELETAL INJURY: A SYSTEMATIC REVIEW**

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2.1 ABSTRACT

Background: Running is a popular physical activity around the world and its rates of injury can vary depending on the definition of injury used.

Objective: To systematically review about the definitions of running-related musculoskeletal injury reported in the literature and to analyse the impact of the diversity of definition on the prevalence and severities of the injuries reported in the literature.

Methods: The searches were conducted on EMBASE (1980 to July 2013), PUBMED (1946 to July 2013), CINAHL (1988 to July 2013) SPORTDiscus (1977 to July 2013), LILACS (1985 to July 2013) and SCIELO (1998 to July 2013) databases, without a limit on language. We included only articles that gave a definition of musculoskeletal injury related to running. The structure of the definitions was divided according to their characteristics based on three main domains. The definitions were classified according to three main domains: 1) presence of physical complaint, 2) interrupting training and/or competition and, 3) seeking medical assistance.

Results: A total of 8,304 articles were found, in which 48 articles were included. After the selection of articles, the definitions were grouped and organised in subcategories according to the three main categories: 1) presence of physical complaint (subcategories: symptom, body system, region); 2) interrupting training and/or competition (subcategories: primary sports involved, extent of injury, extent of limitation, interruption, period of the time of injury); and 3) seeking medical assistance (subcategory: medical assistance/medication). The subcategory with the greatest number of terms used by the articles was symptom, which the most common terms were injury, pain and complaint. The categories extent of injury and extent of limitation had a great number of terms allocated, where the most commons were

reduction and restriction for the first category, and training, running and distance for the second. The categories with fewer terms reported by studies were medical assistance and period of the time of injury.

Conclusion: The different definitions of running-related musculoskeletal injury found in this review are based on informing the presence of physical complaint or the need for a minimum period of interruption to training or competition.

2.2 INTRODUCTION

Running is one of the most popular physical activity that people participated in the world,[1] and the practice of this sport offers numerous health benefits, such as reduced risk of cardiovascular disease, diabetes, and systemic high blood pressure, as well as improved quality of life.[2, 3] Due to its various health benefits and low cost in nature, the number of participants has gradually increased over the last few decades.[4, 5] Aside from the health effect on running, the injuries associated with running should not be taken lightly. Indeed, the incidence of injuries in runners had been reported between 19 and 92%, depending on the definition of injury and the runner population being studied.[4, 6-9] In addition, one study showed that the prevalence of musculoskeletal pain in runners just before a race was approximately 25%.[10]

A relatively large number of studies on running injuries can be found in the databases most relevant to the area. In this body of literature, a few dozen studies provide definitions of running-related musculoskeletal injury (RRMI) based on different criteria. Examples of the influence of injury definition on the studies results can be observed in some studies.[4, 7-9] Bovens et al[11] found one of the highest incidence rate of injury (84.9%), most likely due to the use of a comprehensive and loose definition “any physical complaint developed in relation with running activities and causing restriction in running distance, speed, duration or frequency”. In contrast with this definition, Blair et al[12] considered “a injury that cause the runners to stop running for at least seven days” and found 24% of injury incidence. This second definition could be considered stricter by the period of seven days out of training. This lack of standardization for the definition of RRMI hinders comparisons between the different rates of prevalence and incidence reported in the literature.[9]

In the epidemiological studies of sports injuries, a consensus of the definition of injury is crucial such that the prevalence and incidence of the sports injury can be accurately reflected. Sports such as cricket, tennis, rugby, and soccer each have their consensus and studies has pointed out the importance of this standardization to identify risk factors and incidence of injuries, as well as the implementation of effective prevention programs.[4, 7, 13-17] While many investigators have suggested the need for a standard definition of RRMI,[4, 18, 19] no consensus has been reached so far. Thus, investigators[1, 7, 20] frequently define running injuries according to all of the three main characteristic: 1) presence of physical complaint; 2) need to interrupting routine training and/or competition; and 3) seeking medical assistance,[15, 21, 22] or just one or two of these domains.[21]

In addition to the different definitions of injury, the characteristics of the runners influence the prevalence and severity of the injuries. Recreational runners, for example, usually do not train or participate in long-distance races, whereas ultramarathon runners cover long distances and are likely to have complaints and problems that might not occurred in recreational runners. Moreover, the RRMI should contain information on the incidence of the injury (whether the injury is sustained during training or actual running); the consequence of the injury (i.e. whether the injury affects the performance, training or competitions); and the effects of injury (i.e. the duration in each the running/training is interrupted). These all indicated the severity of the injury. Thus, the lack of standardized definitions in RRMI hinders the formation of evidence-based practice and the implementation of effective preventive strategies.[4, 23] Given the importance of these, the aim of this study is to systematically review about the definitions of running-related musculoskeletal injury reported in the literature and to

analyse the impact of the diversity of definition on the prevalence and severities of the injuries reported in the literature.

2.3 METHODS

2.3.1 Eligibility criteria and review process

The searches were conducted on the databases EMBASE (1980 to July 2013), PUBMED (1946 to July 2013), CINAHL (1988 to July 2013), SPORTDiscus™ (1977 to July 2013), Latin American and Caribbean Centre on Health Sciences Information (LILACS) [1985 to July 2013] and Scientific Electronic Library Online (SCIELO) [1998 to July 2013], without a limit on date of publication and language, using subjects headings, synonymous, relevant terms and variant spellings for each database (see Appendix 1, full strategy for EMBASE). We included only articles that gave a definition of musculoskeletal injury applied to the runner population. To be included in the present study, each article was analysed in two phases. The first involved the analysis of the title and abstract, and the second, the analysis of the full text. In the first phase, articles were excluded if the title and abstract did not mention the runner population or running itself. After this first phase, the full text was analysed, and articles were excluded if they did not provide the definition of running-related musculoskeletal injury. In each of these phases, two independent reviewers (TPY and BTS) conducted the assessments. If they did not reach a consensus, a third reviewer (ADL) helped to decide whether or not the article should be included. This systematic review follows PRISMA recommendations (Supplement 2) .

2.3.2 Data Analysis

The following data were extracted from these articles that had been selected for this review: first author's name, year of publication, study design, type of runner assessed, sample size, and the definition for RRMI. Two independent reviewers performed the data extraction, and if necessary a third reviewer helped to reach a consensus. The quality of the methodological data of the articles related to the definitions of RRMI was assessed by four criteria based on previous studies,[4, 24] and adapted by the authors: (1) clear description of the inclusion criteria for the study participants; (2) definition of the type of runner being studied; (3) same method of RRMI collection for all runners; and, (4) data collected directly from the participants or a health professional. These criteria are described in detail in Table I. The assessment of the methodological data of the articles related to the definitions of RRMI was calculated by adding the score for the 4 items. One point was given for 'yes' answers and zero was given for 'no' answers, with a maximum total of four points.

2.3.3 Analysis of the Structure of Definitions for RRMI

To analyse the structure of the definitions for RRMI in each article, the definitions were divided according to their similarities and characteristics as suggested by previous studies,[15, 21, 22] in which these authors states that definitions related to sports injuries tend to be based on three main domains: 1) presence of physical complaint; 2) interrupting training and/or competition; and 3) seeking medical assistance.[15, 21, 22]

2.4 RESULTS

After the search strategy, 8,304 studies were found, and 1,647 appeared in at least two databases. Based on the above-mentioned inclusion and exclusion criteria, 48 articles were selected for the study. Figure 1 shows the flow diagram for the complete process of article inclusion. Table II shows the simplified the data extraction (full data extraction available in the Supplemental 1).

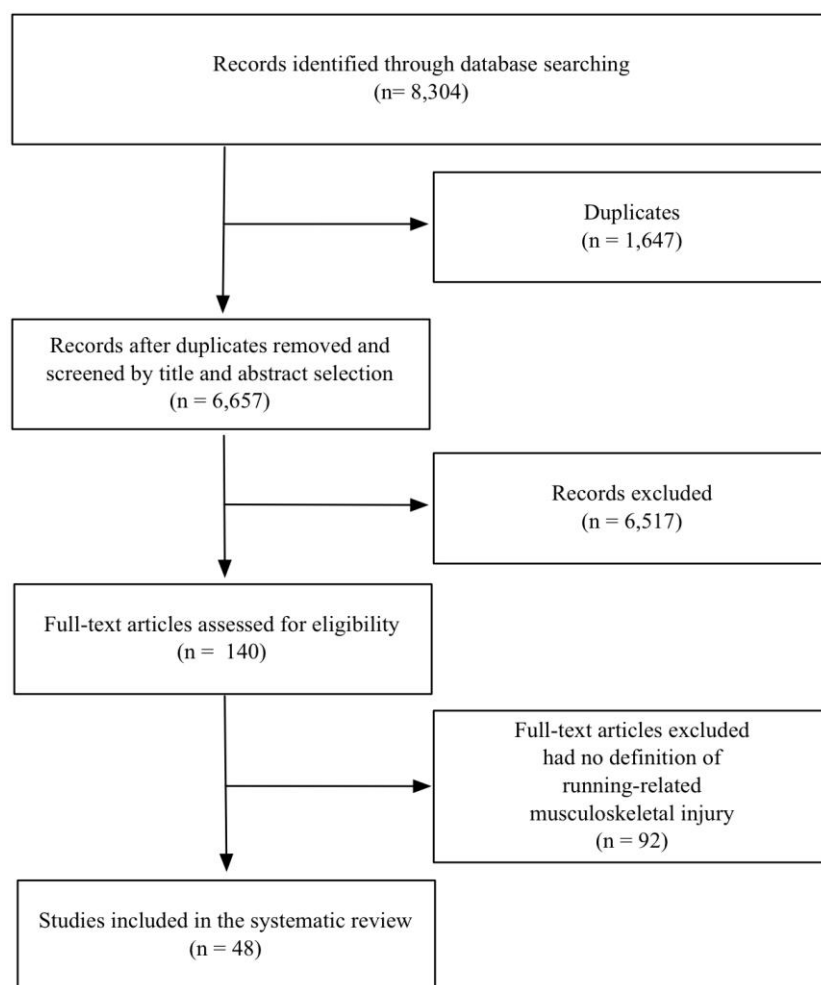


Figure 1. Flow diagram of selection and inclusion process in the systematic review

Among the 48 articles selected, there were 22 prospective cohort studies, 16 cross-sectional studies, 5 randomized controlled trials, 2 non-randomized controlled trials, 2 retrospective studies, and 1 case-control study. In addition to that, the methodological data of the articles related to the definitions of RRMI showed that 22 studies obtained a full score on the four criteria. Twenty-two studies scored three out of the four criteria, and three studies met two of the criteria. Only one study met only one of the criteria used to assess the methodological data. Therefore, most of the articles met at least three of the four criteria. The assessment of all articles is described in Table III.

After the allocation of these 48 studies into the three domains suggested by previous studies,[15, 21, 22] we found that the definitions of the RRMI among these studies can be clustered into similar subcategories. We created subcategories according to the previous categories to group and organise the terms included in all definitions found. Thus, in the domain of “presence of physical complaint”, three subcategories were created: “symptom”, related to the keyword in the beginning of the definitions that was used to describe the injury itself; “body system”, which refers to the system of the body that occurred the injury; and “anatomical region”, related to the area of the body that the authors described to consider their definition of RRMI. For the domain of “interrupting training and/or competition”, five subcategories were created: “primary sports involved” related to the moment that the injury occurred or what activity this injury was associated; “extent of injury”, i.e. the results of the RRMI to the runner; “extent of limitation” referring to which factor should be affected to the injury occur and associated with the extent of injury; “interruption”, related to the time off considered by the authors for an RRMI; and “description of the period of injury”, which refers to the time considered by the authors to determine the occurrence of an injury. For the third main domain, “seeking medical assistance”, only one subcategory was

created: seeking “medical assistance/medication”. A full description of the characteristics of the definitions of RRMI can be seen in Table II.

Regarding the main findings in the studies included in this review, most of them described the “symptom” as an injury (19 studies), followed by pain (10 studies) and complaint (6 studies). In the category identified as “body system”, 22 studies reported the term musculoskeletal, and most studies did not provide details of the “body system” (23 studies). Sixteen of all definitions cited lower extremity (LL) as the “region” that had to be involved in an RRMI, but thirty studies did not cite the “region”.

In the category named the “primary sports involved”, half of the studies (22 studies) did not establish the time of the RRMI, but some established that the injury had to be running-related (13 studies). The category “extent of injury”, ten studies defined as something that cause a reduction, other ten studies used the term restriction, and seven studies did not provide details for this category. In addition to this last category (extent of injury), we created another named “extent of limitation”, that is, the aspect affected by the respective consequence of “extent of injury” mentioned above. Sixteen studies defined it as training, fourteen as running, and nine as training mileage or distance. Regarding the category identified as “interruption”, we found twelve descriptions. Ten studies stated that, for an injury to be considered an RRMI, there should be an “interruption” in which any factor related to running generated a consequence that interrupted the runner’s normal routine for at least one week. Three of these ten studies described the possibility of at least one week or three consecutive training sessions. The last category was “description of the period of injury” and we found two descriptions. One related to the last six months and another related to a five years recall period.

Furthermore, some studies established as a criterion for RRMI that runners had to necessarily “seek medical help” (8 studies). Table IV shows the most cited terms in the articles included in this review for all categories and subcategories of the definitions. Twelve studies added to their definitions of RRMI a “classification regarding severity of injuries”, which is shown in Table V.

2.5 DISCUSSION

We selected 48 articles that met the inclusion criteria and extracted the definitions, which were divided into the following categories: Symptom, Body System, Region, Primary Sports Involved, Extent of Injury, Extent of Limitation, Interruption, Restriction of the Time of Injury, and Medical Assistance/Medication. Most of the articles described more than half of the categories adopted in the present study, which shows that the definitions of RRMI offer a detailed description of the characteristics of a running-related injury, but without standardization. Most of the selected articles were prospective cohort or cross-sectional studies and for methodological quality, most of the studies satisfied this review’s assessment criteria.

All of the studies defined RRMI based on a keyword that described the injury itself, which has been classified as the “symptom” in this review. Among the various synonyms used for “symptom”, there were a wide variety of meanings. The symptoms described as ailment, complaint, disease, and disorder are more closely associated with a “disease itself or condition of being ill, which causes changes to body function”.[25] The studies that use these terms tend to consider not only RRMI, but also taking diseases into account. Other terms such as pain, problem, injury, and incapacity are associated with something that “is not in line with the good functioning of the body or part thereof”,[25] which may better represent a musculoskeletal lesion, such as in the

consensus definitions of injury in rugby and soccer. The consensus for rugby and soccer considers injury any physical complaint reported by a player resulting from a match or from training regardless of the need for medical attention or interruption to training.[15, 16]

For the category “body system”, we found terms such as musculoskeletal, physical, metabolic, and neurological disorder. The differences between these words can be significant for the definition of RRMI. The choice of using the musculoskeletal system[15] in a definition seems to be the most adequate when dealing with any definition related to running because it comprises any injury associated with the locomotor apparatus.

Regarding the “anatomical region” involved, the areas mentioned were: lower extremity, lumbar region, and some part of the body, Defining the anatomical region of a running injury, specifically lower extremity that is the most common location of running injuries,[24] studies can avoid registering injuries unrelated to running (i.e. upper limb injuries). More than half of the studies in this review did not describe the injury location in their definitions, which could lead to a higher rate of injuries of all types (upper limb and head) counted.[4, 6, 20, 26]

In the category “primary sports involved” in which the injury occurred, there were significant differences between the studies. While some studies considered this “primary sports involved” and associated it with any exercise, others associated it directly with running. However, half of the studies reported that a “primary sports involved” should necessarily be associated with the specific running modality. It is believed that this information can influence injury rates, as well as limit the comparison of the results. Thus, the description of a definition of RRMI must take into account the relationship with running, as seen in the consensus definition of injury for rugby,[16]

soccer,[15] tennis,[14] and cricket,[13] which included the need for the injury to be a consequence of the practice of the sport in question.

While analysing the category “extent of injury”, we found different meanings for the terms cited in the definitions, which may restrict or expand the consequence of an RRMI. Words such as restriction, limitation, and reduction describe facts that cause restriction and/or decrease.[25] In contrast, the terms prevent, interrupt, and stop characterize time off so that the participant will stop[25] and restricting the “extent of injury” as shown in the findings by Blair et al in 1987[12] and Pazin et al in 2008.[5] They found 24% and 37.7% prevalence of injury, respectively. The terms impair, interfere, affect, and alter describe something that can cause a change[25] and characterize the “extent of injury” of an RRMI in a less restrictive manner as they try to describe any change in the runners routine. For example, Hutson et al in 1984,[27] recorded all medical reports and injuries during a running race, used the term “impair” in their definition of injury, and these authors found a rate almost double (60%) the prevalence of injuries in runners compared to the study by Pazin et al in 2008[5] aimed to identify the physical, demographic and training characteristics and their association with the prevalence of injuries.

The category “extent of limitation” refers to the factor that is altered by the “extent of injury” of an RRMI, and its definition can pinpoint what was changed with the injury. Definitions that do not include the aspect of running that was affected (i.e. factor) hinder what is understood regarding the consequence because of the lack of information. In contrast, the inclusion of “extent of limitation” such as distance, duration or frequency of training and performance help to better represent the running, training routine, and runner performance, contributing to determine the factors that suffered consequences.

When the definition includes “interruption”, it is important to describe the time frame that was used. Definitions that consider a long interruption of two weeks, for example, can restrict the number of injured runners, while definitions that include a short interruption can include a larger number of injured runners. A definition that includes a relatively long interruption tends to find a lower injury rate, as seen in Buist et al in 2008,[28] who defined injury as any musculoskeletal complaint in the lower extremities or back region that restricts running for at least a week. The authors found an incidence rate of only 20% and that is because of the high prevalence of injuries due to overload, which cause significant pain and reduce function but do not interrupt running,[21]

Only a few of the studies in this review included a specific period to “description of the period of injury” in their definitions. Considering that these studies are based on retrospective information, it is necessary to consider that the authors gathered information dependant on the runner’s memory (retrospective information). A study reported that memory bias can reach 30% each year,[29] therefore it is suggested that the set period for retrospective questioning be short to avoid memory bias.[18, 30] The authors of this study suggest that this short period is a maximum of 6 months, so that the results are not at risk in relation to risk of bias.

According to some studies, runners are considered to have RRMI if they have to “seek medical assistance”, and in one study runners are considered to have RRMI if they have ingested medication. Although the requirements of seeking medical assistance or taking medication are seldom used in studies, it is worth noting that when they are used as criteria for classifying a runner as injured,[31] the injury rate may be different than that of studies that only consider interruption to training or presence of pain.[32] An example of this can be seen in the definition by Walter et al, 1989,[31] in which the

authors classified as injured only subjects who decreased mileage, took medication or visited a health professional, identifying a prevalence of 48% of injuries. Unlike the definition used by Jakobsen et al, in 1994,[32] who found an incidence of 75.6% of injuries after defining RRMI as any injury to the musculoskeletal system sustained during running and preventing the runner from taking part in training or competition. However, it is believed that this factor can be used to complement the definition of injury, as seen in the consensus definition of injury in other modalities.[13-16]

Only a few studies added to their definitions of RRMI a classification regarding to the degree/severity of injuries, despite its importance. It is believed that this classification is important to distinguish different levels of severity. Two studies used as a definition of RRMI only descriptions for classifications of severity.[33, 34] The classification of severity should be a complementary factor in the definition, allowing not only the identification of the injury itself, but also comparisons between studies with results that have similar levels of involvement.

We could not find a clear association between the objectives of the studies and definitions of injury chosen by the authors, perhaps due to the different study designs and type of runner in the studies. The hypothesis that the definition of injury may vary according to the purpose or the population of the study should be verified in future studies. The association between injury definitions and injury rates could be observed in some studies, especially when the structures of these definitions were very different among them. However, these large differences were not observed in most studies since most definitions use similar terms in their structures, such as the presence of physical complaint (e.g. injury, musculoskeletal and lower extremities) and the need to interrupt running (e.g. training reduction).

The present study has some limitations. Some articles may not have been found because they were not indexed in the databases included in the study. We suggest that a consensus for the definition of injury should be performed, so that future studies could provide more consistent and reliable findings of injuries, and rates that are possible to make comparisons,[13, 14] providing relevant information for the runner population, and making it possible to characterize the more frequent injuries, risk factors, and other elements to be considered in an RRMI prevention program.

2.6 CONCLUSION

The different definitions of RRMI found in this systematic review are based in two main domains, informing the presence of physical complaint, such as injury, musculoskeletal and lower extremities; and, the need for a period of interruption to training or competition, such as reduction of training routine. The different criteria used by the authors to describe their definitions of LMRC show how the concept of injury could be changed. Therefore, different rates of injuries are found according to the definition used in the study, hindering the comparison between studies.

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COMPETING INTERESTS

None.

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What this study adds:

- This study shows many definitions used to refer a running-related musculoskeletal injury.
- There are more than 30 different definitions to refer to a running-related musculoskeletal injury that can influence the results of the studies.
- Our findings confirm the need for a standard definition of running injury.
- Most of the definitions are based on informing the presence of physical complaint and the need for a period of interruption to training or competition.

How might it impact on clinical practice in the near future:

- The different definitions of running-related musculoskeletal injury hamper the comparison between studies and populations.
- Our findings confirm the need for a standard definition of running injury.

Table I. Description of the criteria used to assess the quality of the methodological data of the articles related to the definitions of RRMI.

Criteria	Description of assessment criteria and examples	Answer	
1. Definition of eligibility criteria for participating runners	Studies must have included in the Methods section the inclusion and exclusion criteria used for the study participants. Studies that clearly defined the eligibility criteria were given a YES answer, and studies that did not provide a clear definition received a NO answer.	YES: high quality	NO: low quality
2. Definition of type of runner being studied	Studies that reported the type of runners or described the general characteristics of training, allowing the identification of the type of runner being assessed, received a YES answer in this criterion. Studies that were conducted in running competitions (which can determine the type of runner) and described the distance of the race also received a YES answer for this criterion. The studies that did not describe the type of runner were given a NO answer.	YES: high quality	NO: high quality
3. Same method of data collection	If the same method of data collection was used for all runners who took part in the study, the item received a YES answer. If data collection was not standardized, the item received a NO answer.	YES: low quality	NO: low quality
4. Data collected directly from the subjects or collected from a health professional.	Studies in which the interview or questionnaire was applied directly to the runner or in which the medical assessment was conducted during the study received a YES answer. Studies in which the interview or questionnaire was applied to someone other than the runner (trainer, physical therapist, etc.) or studies in which the medical assessment was conducted prior to the study period and reported in a medical chart, interview or questionnaire (retrospective data collection) received a NO answer.	YES: high quality	NO: low quality

Table II. Simplified data extraction from the articles and definitions of RRMI.

			Subitems of the definitions of RRMI found in the studies								
			Presence of physical complaint			Need to interrupt training/competition				Seeking medical assistance	
Author/Year of Publication	Type of study	Participants	Symptom (45/48)	Body system (25/48)	Region (18/48)	Primary sports involved (26/48)	Extent of injury (41/48)	Extent of limitation (41/48)	Interruption (15/48)	Description of the period of injury (4/48)	Medical assistance/Medication (8/48)
1	Blair <i>et al</i> 1987[12]	Retrospective	438 Runners from a fitness club	Injury			Stop	Running	Seven days		
2	Bovens <i>et al</i> 1989[11]	Non-Randomized Controlled Trial – NRCT	115 Novice runners	Complaint	Physical		Running-related	Restriction	Distance, speed, duration or frequency		
3	Bredeweg <i>et al</i> 2013[35]	Prospective Cohort	210 Novice runners	Complaint	Musculoskeletal	Lower extremities or back		Restriction	Running	One week	
4	Bredeweg <i>et al</i> 2010[36]	Randomized Controlled Trial – RCT (Study Protocol)	432 Novice runners	Ailment	Musculoskeletal	Lower extremities or back	Running-related	Restriction	Running	One week / Three consecutive training sessions	
5	Buist <i>et al</i> 2007[37]	RCT (Study Protocol)	532 Novice runners	Ailment	Musculoskeletal	Lower extremities or back	Running-related	Restriction	Running	One week / Three consecutive training sessions	
6	Buist <i>et al</i> 2008[28]	RCT	532 Novice runners	Complaint	Musculoskeletal	Lower extremities or back	Running-related	Restriction	Running	One week	
7	Buist <i>et al</i> 2009[38]	Prospective Cohort	532 Novice runners	Pain	Musculoskeletal	Lower extremities or back	Running-related	Restriction	Running	One week / Three scheduled consecutive training	
8	Buist <i>et al</i> 2010[39]	Prospective Cohort	629 Novice and recreational runners	Pain	Musculoskeletal	Lower limb or back	Running-related	Restriction	Running	One day	
9	Caldwell <i>et al</i> 1981[40]	Cross-Sectional	84 Marathon runners	Problem	Physical			Affected	Performance		

10	Chorley <i>et al</i> 2002[41]	Cross-Sectional	1548 Marathon runners	Disorder / Illness	Musculoskeletal - metabolic or neurologic		During running training	Alter	Training			
11	Fields <i>et al</i> 1990[42]	Prospective Cohort	40 Runners from a racing club	Problem	Musculoskeletal		During running	Interrupted	Training	One or more days		
12	Hespanhol <i>et al</i> 2012[43]	Cross-Sectional	200 Recreational runners	Pain	Musculoskeletal		Running-related	Prevent	Training	One training session		
13	Hino <i>et al</i> 2009[44]	Cross-Sectional	295 Street runners	Pain / Aggravation				Limit / Remove	Training / Competitions		Last six months	
14	Hoffman <i>et al</i> 2011[45]	Cross-Sectional	500 Ultramarathon runners	Injury				Interfere	Training		Previous year	
15	Hootman <i>et al</i> 2002[46]	Prospective Cohort	3 090 Adults aged 20 to 85 engaged in running, walking or jogging (RWJ)	Injury		Lower extremity	After starting an RWJ program				Five-years recall period	Consultation with a physician
16	Hutson <i>et al</i> 1984[27]	Cross-Sectional	25 Ultramarathon runners	Injury				Impair	Performance			
17	Jacobs <i>et al</i> 1986[47]	Cross-Sectional	451 Participants in a 10 km race	Pain		Lower extremities or lower back		Restriction / Prevented	Distance, speed / running			
18	Jakobsen <i>et al</i> 1994[32]	NRCT	41 Recreational runners	Injury	Musculoskeletal		During running	Prevented	Training / Competitions			
19	Knobloch <i>et al</i> 2008[48]	Prospective Cohort	291 Elite runners	Complaint	Physical		Competition / Training					
20	Koplan <i>et al</i> 1982[49]	Cross-Sectional	1423 Recreational runners	Ailment	Musculoskeletal			Reduce	Weekly mileage		Take medicine or Visit a health professional	
21	Koplan <i>et al</i> 1995[50]	Prospective Cohort	535 Participants in a 10 km race	Ailment	Musculoskeletal			Reduce / Cease / Interfered	Exercise / Work or school activities			
22	Lloyd <i>et al</i> 1986[51]	Retrospective	207 University runners in 10 km races	Ailment	Musculoskeletal			Interrupt	Running program		Seek medical help	
23	Lun <i>et al</i> 2004[52]	Prospective Cohort	87 Recreational runners	Symptom	Musculoskeletal	Lower limb		Reduction / Stoppage	Training			
24	Lysholm <i>et al</i> 1987[53]	Prospective Cohort	60 Sprinters, medium-distance runners and marathon runners	Injury				Hampered	Training / Competitions	One week		
25	Macera <i>et al</i>	Prospective	583	Injury /	Musculoskeletal	Lower	Running-related	Reduction	Weekly distance		Visit a health	

	1989[20]	Cohort	Recreational runners 4 358	Problem		extremities						professional or use of medication
26	Marti <i>et al</i> 1988[54]	Cross-Sectional	Participants of a 16km race 2 886	Injury				Reduction / Interruption	Training	Two weeks		
27	Mc Kean <i>et al</i> 2006[55]	Cross-Sectional	Participants of the Oregon running relay/August 2002	Event				Affected	Training / Competitions		Previous one year	
28	Nielsen <i>et al</i> 2013a[56]	Prospective Cohort	927 Novice runners	Complaint	Musculoskeletal	Lower extremity or back	Caused by running	Restricted	Running	One week		
29	Nielsen <i>et al</i> 2013b[57]	Prospective Cohort	930 Novice runners	Complaint	Musculoskeletal	Lower extremity or back	Caused by running	Restricted	Running (volume, duration, pace, or frequency)	One week		
30	*Parker <i>et al</i> 2011[33]	Cross-Sectional	378 Marathon runners 115									
31	Pazin <i>et al</i> 2008[5]	Cross-Sectional	Street, marathon, and ultramarathon runners 18	Injury	Musculoskeletal			Interruption	Training	Two days		
32	*Pileggi <i>et al</i> 2010[34]	Prospective Cohort	Amateur runners 157									
33	Pollock <i>et al</i> 1977[58]	RCT	Inmates	Incident			Training	Prevented	Jogging	One week		
34	Rauh <i>et al</i> 2000[59]	Prospective Cohort	3233 Cross-Country High School Runners 421	Problem			Athletic participation	Removed / Missed	Practice / Competitive event			
35	Rauh <i>et al</i> 2006[60]	Prospective Cohort	Cross-Country Runners	Problem / Injury	Musculoskeletal	Lower extremity or back		Removed / Missing	Practice / Training			
36	Roberts <i>et al</i> 2000[61]	Cross-Sectional	81 277 Marathon runners	Disability				Interferes	Function			Medical assistance is requested or rendered
37	Satterthwaite <i>et al</i> 1999[17]	Prospective Cohort	1 054 Marathon runners	Injury / Illness				Affected	Pre-marathon training			
38	Tang <i>et al</i> 2008[62]	Cross-Sectional	1 144 Marathon runners	Injury / Illness			A long course route / Finish line					Medical aid station
39	Taunton <i>et al</i> 2003[6]	Prospective Cohort	844 Recreational runners	Pain			After exercise					
40	Taunton <i>et al</i> 2002[26]	Retrospective case-control	2002 Patients of the Allan McGavin Sports Medicine Centre	Pain / Symptoms / Injury			Running-related	Stop / Reduce	Running mileage			Seek medical assistance
41	van Mechelen	RCT	327	Injury			Running-related					

42	<i>et al</i> 1993[63] van Middelkoop <i>et al</i> 2007[1]	Prospective Cohort	Recreational runners 165 Marathon runners	Injury	Musculoskeletal	Lower extremities	Running-related	Reduction	Distance, speed, duration or frequency	
43	<i>et al</i> 2008[64] van Middelkoop <i>et al</i> 2008[64]	Prospective Cohort	726 Marathon runners	Injury	Musculoskeletal	Lower extremities	Running-related	Reduction	Distance, speed, duration or frequency	
44	<i>et al</i> 2008[65] van Middelkoop <i>et al</i> 2008[65]	Prospective Cohort	726 Marathon runners	Injury	Musculoskeletal	Lower extremities	Running-related	Reduction	Distance, speed, duration or frequency	
45	Valliant <i>et al</i> 1981[66]	Cross-Sectional	41 Male participants of 5, 8 and 10-mile races	Damage / Pain	Physiological / Bodily			Interfered	Training / Competition	
46	Walter <i>et al</i> 1989[31]	Prospective Cohort	1 288 Short and long- distance runners					Reduce	Mileage	Take medicine or see a health professional
47	Wen <i>et al</i> 1997[67]	Cross-Sectional	304 Runners of a marathon-training program	Injury / Pain		Anatomic part		Stop / Slow / Modify	Training / Pace	
48	Wen <i>et al</i> 1998[68]	Prospective Cohort	355 Novice runners	Injury / Pain		Anatomic part		Stop / Slow / Modify	Training / Pace	

* These articles described only the severity of the injury.

Table III. Assessment of the quality of the methodological data of the articles included in the review.

Author/Year of Publication	Criteria of the quality assessment				Score
	1	2	3	4	
Blair <i>et al</i> , 1987	+	+	+	+	4/4
Bovens <i>et al</i> , 1989	+	+	-	+	3/4
Bredeweg <i>et al</i> , 2013	+	+	+	+	4/4
Bredeweg <i>et al</i> , 2010	+	+	+	+	4/4
Buist <i>et al</i> , 2007	+	+	+	+	4/4
Buist <i>et al</i> , 2008	+	+	+	+	4/4
Buist <i>et al</i> , 2009	+	+	+	+	4/4
Buist <i>et al</i> , 2010	+	+	-	+	3/4
Caldwell <i>et al</i> , 1981	-	+	+	+	3/4
Chorley <i>et al</i> , 2002	-	+	+	+	3/4
Fields <i>et al</i> , 1990	+	-	+	+	3/4
Hespanhol <i>et al</i> , 2012	+	+	+	+	4/4
Hino <i>et al</i> , 2008	-	+	+	+	3/4
Hoffman <i>et al</i> , 2011	+	+	-	+	3/4
Hootman <i>et al</i> , 2002	+	-	+	+	3/4
Hutson <i>et al</i> , 1984	+	+	+	+	4/4
Jacobs <i>et al</i> , 1986	+	+	+	+	4/4
Jakobsen <i>et al</i> , 1994	-	+	+	+	3/4
Knobloch <i>et al</i> , 2008	-	+	+	+	3/4
Koplan <i>et al</i> , 1982	-	+	+	+	3/4
Koplan <i>et al</i> , 1995	-	+	-	+	2/4
Lloyd <i>et al</i> , 1986	-	+	+	+	3/4
Lun <i>et al</i> , 2004	+	+	+	+	4/4
Lysholm <i>et al</i> , 1987	+	+	+	+	4/4
Macera <i>et al</i> , 1989	+	+	+	+	4/4
Marti <i>et al</i> , 1988	-	+	+	+	3/4
Mc Kean <i>et al</i> , 2006	+	+	-	+	3/4
Nielsen <i>et al</i> , 2013a	+	+	+	+	4/4
Nielsen <i>et al</i> , 2013b	+	+	+	+	4/4
Parker <i>et al</i> , 2011	+	+	-	+	3/4

Pazin <i>et al</i> , 2008	+	+	+	+	4/4
Pileggi <i>et al</i> , 2010	+	+	+	+	4/4
Pollock <i>et al</i> , 1977	+	+	+	-	3/4
Rauh <i>et al</i> , 2000	+	+	+	+	4/4
Rauh <i>et al</i> , 2005	+	+	+	-	3/4
Roberts <i>et al</i> , 2000	-	+	+	-	2/4
Satterthwaite <i>et al</i> , 1999	+	+	-	+	3/4
Tang <i>et al</i> , 2008	+	+	+	+	4/4
Taunton <i>et al</i> , 2003	-	+	+	+	3/4
Taunton <i>et al</i> , 2002	-	-	+	-	1/4
van Mechelen <i>et al</i> , 1993	+	+	+	+	4/4
van Middelkoop <i>et al</i> , 2007	+	+	-	+	3/4
van Middelkoop <i>et al</i> , 2008	+	+	-	+	3/4
van Middelkoop <i>et al</i> , 2008	+	+	-	+	3/4
Valliant <i>et al</i> , 1981	+	+	+	+	4/4
Walter <i>et al</i> , 1989	+	+	+	+	4/4
Wen <i>et al</i> , 1997	+	+	+	+	4/4
Wen <i>et al</i> , 1998	-	+	-	+	2/4

Table IV. Main terms cited by the articles for each one of the categories and subcategories.

CATEGORIES	SUBCATEGORIES	TERMS	No. STUDIES
Presence of physical complaint	Symptom	Injury	19
		Pain	10
		Complaint	6
	Body System	Musculoskeletal	22
		<i>without description</i>	23
	Region	Lower extremity	16
<i>without description</i>		30	
Need to interrupt training/competition	Primary sports involved	<i>without description</i>	22
		Running-Related	13
	Extent of injury	Reduction	10
		Restriction	10
		<i>without description</i>	7
	Extent of limitation	Training	16
		Running	14
		Distance	9
	Interruption	At least one week	10
	Description of the period of injury	Last six months	1
Five-years recall period		1	
Seeking medical assistance	Medical assistance/ medication	Seek medical help	8

Author/Year of publication	Type of Study	Participants	Classification of severity of RRMIs (8/45)
Bredeweg <i>et al</i> 2010	RCT (Study Protocol)	432 Novice runners	Pain without limitation = no RRI; Pain that caused a restriction of running = scored as an RRI; Pain which made running impossible RRI = scored as an RRI.
Buist <i>et al</i> 2007	RCT (Study Protocol)	532 Novice runners	Pain without limitation = no RRI; Pain that caused a restriction of running = scored as an RRI; Pain which made running impossible RRI = scored as an RRI.
Chorley <i>et al</i> 2002	Cross-Sectional	1548 Marathon runners	A five-point scale that was based on the degree of activity modification required: 1. Mild - slowed pace, same weekly routine; 2. Slowed pace and decreased weekly mileage; 3. Moderate - stopped running for less than one week; 4. Stopped running for 1-4 weeks; 5. Severe - stopped running for more than one month.
Knobloch <i>et al</i> 2008	Prospective Cohort	291 Elite runners	An injury that results in a runner receiving medical attention was referred to as a "medical attention" injury, and an injury that resulted in a runner being unable to take a part in running training or competition as a "time loss" injury.
Marti <i>et al</i> 1988	Cross-Sectional	4 358 Participants in a 16 km race	Grade I: Injuries involved maintenance of full training activity in spite of symptoms; Grade II: A reduction of training activity, and Grade III: Full training interruption/interruption of running of at least two weeks' duration".
Parker <i>et al</i> 2011	Cross-Sectional	378 Marathon runners	1. No change in running pace or routine; 2. Slowed pace while running, same weekly routine; 3. Slowed pace while running and decreased weekly mileage; 4. Stopped running for less than 1 week; 5. Stopped running for 1 to 4 weeks; 6. Stopped running for more than 1 month.
Pileggi <i>et al</i> 2010	Prospective Cohort	18 Runners	The injuries were classified according to interference to training at level 1 (no interruption); level 2 (reduced training volume); level 3 (interruption for at least two weeks) and according to symptoms: acute (symptoms persisting for up to two weeks); subacute (symptoms lasting two to six weeks); and chronic (symptoms for more than six weeks).
van Mechelen <i>et al</i> 1993	RCT	327 Recreational runners	1. The subject had to stop running; 2. The subject could not run; 3. The subject could not go to work; 4) the subject needed medical attention; or, 5. The subject suffered from pain or stiffness during 10 subsequent days while 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
32. limits/ embase

Supplement 1. Data extraction from the articles and definitions of Running-Related Musculoskeletal Injury (RRMI).

Author/Year of publication	Type of Study	Participants	Definition of RRMI	Classification of Severity of RRMI and Complements
Blair <i>et al</i> 1987	Retrospective	438 Runners from a fitness club	Injury that caused them to stop running	
Bovens <i>et al</i> 1989	Non-Randomized Controlled Trial – NRCT	115 Novice runners	Any physical complaint developed in relation with running activities and causing restriction in running distance, speed, duration or frequency was considered to be an injury	
Bredeweg <i>et al</i> 2010	Randomized Controlled Trial – RCT (Study Protocol)	432 Novice runners	Definition of a RRI in this trial was running related musculoskeletal ailment of the lower extremities or back, causing a restriction of running for at least one week, i.e. three consecutive training sessions	Severity of pain was subdivided in pain without limitation (no RRI), pain that caused a restriction of running (scored as an RRI) and pain which made running impossible RRI (scored as an RRI)
Bredeweg <i>et al</i> 2013	Prospective Cohort	210 Novice runners	Any self-reported musculoskeletal complaint of the lower extremity or back causing a restriction of running for at least one week	
Buist <i>et al</i> 2007	RCT (Study Protocol)	532 Novice runners	Definition of a RRI in this trial was running related musculoskeletal ailment of the lower extremities or back, causing a restriction of running for at least one week, i.e. three consecutive training sessions	Severity of pain was subdivided in pain without limitation (no RRI), pain that caused a restriction of running (scored as an RRI) and pain which made running impossible RRI (scored as an RRI)
Buist <i>et al</i> 2008	RCT	532 Novice runners	An RRI was defined as any musculoskeletal complaint of the lower extremity or back causing a restriction of running for at least	

			one week	
Buist <i>et al</i> 2009	Prospective Cohort	532 Novice runners	The definition of an RRI in this prospective cohort study is as follows: running related musculoskeletal pain of the lower extremity or back causing a restriction of running for at least one week, that is, three scheduled consecutive training	
Buist <i>et al</i> 2010	Prospective Cohort	629 Novice and recreational runners	A running-related injury was defined as any musculoskeletal pain of the lower limb or back causing a restriction in running (mileage, pace or duration) for at least one day	
Caldwell <i>et al</i> 2002	Cross-Sectional	84 Marathon runners	An injury was defined as any physical problem that the runner felt negatively affected his/her performance	
Chorley <i>et al</i> 2002	Cross-Sectional	1548 Marathon runners	An injury was defined as a musculoskeletal, metabolic, or neurologic disorder/illness that occurred during running training that caused the participant to alter his/her training regimen	Injury severity is graded on a five-point scale that was based on the degree of activity modification required: (1) Mild - slowed pace, same weekly routine; (2) slowed pace and decreased weekly mileage; (3) Moderate - stopped running for less than one week; (4) stopped running for 1-4 weeks; (5) Severe - stopped running for more than one month
Fields <i>et al</i> 1990	Prospective Cohort	40 Runners from a racing club	Any musculoskeletal problem occurring during running that interrupted training for 1 or more days	
Hespanhol <i>et al</i>	Cross-Sectional	200 Recreational runners	Any running-related musculoskeletal pain	

2012				that have being severe enough to prevent the runner to perform at least one training session
Hino <i>et al</i> 2008	Cross-Sectional	295 Street runners		Any pain or aggravation that limited or removed the participation of the athlete of training or competitions in the last 6 months
Hoffman <i>et al</i> 2011	Cross-Sectional	500 Ultramarathon runners		Injury in the previous year that was severe enough to interfere with training
Hootman <i>et al</i> 2002	Prospective Cohort	3 090 Adults aged 20 to 85 engaged in running, walking or jogging (RWJ)		The first reported lower extremity injury requiring consultation with a physician that occurred after the start of an Running/ Walking/ Jogging program and during the 5-year recall period
Hutson <i>et al</i> 1984	Cross-Sectional	25 Ultramarathon runners		Injuries sufficiently severe to impair their performance
Jacobs <i>et al</i> 1986	Cross-Sectional	451 Participants in a 10 km race		Any lower extremities or lower back pain caused a restriction in running distance or speed, or prevented any running at all
Jakobsen <i>et al</i> 1994	NRCT	41 Recreational runners		Any injury of the musculoskeletal system that was sustained during running and prevented training or competition
Knobloch <i>et al</i> 2008	Prospective Cohort	291 Elite runners		Any physical complaint sustained by a runner that result from a running competition or training, irrespective of the need for medical attention or time lost from running activities
				An injury that results in a runner receiving medical attention was referred to as a “medical attention” injury, and an injury that resulted in a runner being unable to take a part in running training or competition as a “time loss” injury. An overuse injury was defined as any injury with a

			gradual onset, which influenced performance during competition or training
Koplan <i>et al</i> 1982	Cross-Sectional	1423 Recreational runners	Musculoskeletal ailment attributed to running that caused the runner to reduce the weekly mileage, take medicine, or visit a health professional
Koplan <i>et al</i> 1995	Prospective Cohort	535 Participants in a 10 km race	Musculoskeletal ailment that caused respondents to reduce or cease exercise or interfered with their work or school activities
Lloyd <i>et al</i> 1986	Retrospective	207 University runners in 10 km races	Any musculoskeletal ailment attributed to running that caused the runner to interrupt her running program and/or to seek medical help
Lun <i>et al</i> 2004	Prospective Cohort	87 Recreational runners	Any musculoskeletal symptom of the lower limb that required a reduction or stoppage of normal training.
Lysholm <i>et al</i> 1987	Prospective Cohort	60 Sprinters, medium-distance runners and marathon runners	Any injuries that markedly hampered training or competition for at least 1 week were noted
Macera <i>et al</i> 1989	Prospective Cohort	583 Recreational runners	Self-reported muscle, joint or bone problem/injury of the lower extremities (foot, ankle, Achilles tendon, calf, shin, knee, thigh, or hip) that the participant attributed to running and cause a reduction in weekly distance, a visit to a health professional, or the use of medication

Marti <i>et al</i> 1988	Cross-Sectional	4 358 Participants of a 16km race	Injuries that had occurred during the previous 12 months according to their effect on running	Grade I injuries involved maintenance of full training activity in spite of symptoms; Grade II, a reduction of training activity, and Grade III, full training interruption, defined as "involuntary complete interruption of running of at least two weeks' duration"
Mc Kean <i>et al</i> 2006	Cross-Sectional	2 886 Participants of the Oregon running relay/August 2002	An event that affected the athlete's ability to train or race over the previous 1-year period	
Nielsen <i>et al</i> 2013a	Prospective Cohort	927 Novice runners	Musculoskeletal complaint of lower extremity or back caused by running, which restricted the amount of running for at least one week	
Nielsen <i>et al</i> 2013b	Prospective Cohort	930 Novice runners	Musculoskeletal complaint of lower extremity or back caused by running, which restricted the amount of running (volume, duration, pace, or frequency) for at least one week	
Parker <i>et al</i> 2011	Cross-Sectional	378 Marathon runners		<ol style="list-style-type: none"> 1. No change in running pace or routine 2. Slowed pace while running, same weekly routine 3. Slowed pace while running and decreased weekly mileage 4. Stopped running for less than 1 week 5. Stopped running for 1 to 4 weeks 6. Stopped running for more than 1

				month
Pazin <i>et al</i> 2008	Cross-Sectional	115 Street, marathon, and ultramarathon runners	Musculoskeletal injury that caused an interruption of training for at least 2 days	
Pileggi <i>et al</i> 2010	Prospective Cohort	18 Amateur runners		Level I (no interruption); Level II (reduction of training volume); Level III (interruption for at least 2 weeks) and according to symptoms: Acute (symptoms persisting for up to two weeks); Subacute (symptoms lasting two to six weeks); and Chronic (symptoms for more than six weeks)
Pollock <i>et al</i> 1977	RCT	157 Inmates	A training related incident that prevented a subject from jogging for at least one week	
Rauh <i>et al</i> 2000	Prospective Cohort	3233 Cross-country high school runners	A medical problem resulting from athletic participation that required an athlete to be removed from a practice or competitive event or to miss a subsequent practice or competitive event	
Rauh <i>et al</i> 2005	Prospective Cohort	421 Cross-country runners	Any reported muscle, joint, or bone problem/injury of the back or lower extremity (i.e., hip, thigh, knee, shin, calf, ankle, foot) resulting from running in a practice or meet and requiring the runner to be removed from a practice or meet or to miss a subsequent one	
Roberts <i>et al</i> 1999	Cross-Sectional	81 277 Marathon runners	Medical injury/illness was defined as any disability that interferes with function where medical assistance is either requested or	

				rendered
Satterthwaite <i>et al</i> 1999	Prospective Cohort	1 054 Marathon runners	Injuries or illnesses that might have affected their pre-marathon training	
Tang <i>et al</i> 2008	Cross-Sectional	1 144 Marathon runners	Subjects presenting to a medical aid station along the course route or at the finish line were defined as “injured or ill”	
Taunton <i>et al</i> 2003	Prospective Cohort	844 Recreational runners	Experienced at least a grade 1 injury (pain only after exercise)	
Taunton <i>et al</i> 2002	Retrospective case-control	2002 Patients of the Allan McGavin Sports Medicine Centre	(1) had pain or symptoms during or immediately after a run; (2) had pain or symptoms within the approximate time span of beginning a running programme; (3) the injury was felt to be related to running; (4) the injury was significant enough to force them to stop running or significantly reduce their running mileage and seek medical assistance	
van Mechelen <i>et al</i> 1993	RCT	327 Recreational runners	Any injury that occurred as a result of running	1) the subject had to stop running, 2) the subject could not run on the next occasion, 3) the subject could not go to work, 4) the subject needed medical attention, or 5) the subject suffered from pain or stiffness during 10 subsequent days while running
van Middelkoop <i>et al</i> 2007	Prospective Cohort	165 Marathon runners	A running injury was defined as a self-reported “injury to muscles, joints, tendons and/or bones of the lower extremities (hip, groin, thigh, knee, lower leg, ankle, foot, toe) that the participant attributed to	

			running.’’ The problem had to be severe enough to cause a reduction in distance, speed, duration, or frequency of running	
van Middelkoop <i>et al</i> 2008	Prospective Cohort	726 Marathon runners	An injury to muscles, joints, tendons, and/or bones of the lower extremities (hip, groin, thigh, knee, lower leg, ankle, foot, toe) that the participant attributed to running. The problem had to be severe enough to cause a reduction in distance, speed, duration, or frequency of running.	
van Middelkoop <i>et al</i> 2008b	Prospective Cohort	726 Marathon runners	An injury to muscles, joints, tendons, and/or bones of the lower extremities (hip, groin, thigh, knee, lower leg, ankle, foot, toe) that the participant attributed to running. The problem had to be severe enough to cause a reduction in distance, speed, duration, or frequency of running.	
Valliant <i>et al</i> 1981	Cross-Sectional	41 Male participants of 5, 8 and 10-mile races	Physiological damage or bodily pain which interfered with one’s ability to run during training or competition	
Walter <i>et al</i> 1989	Prospective Cohort	1 288 Short and long-distance runners	Reduce the number of miles run, take medicine, or see a health professional	Distinguished “new” from “recurrent injuries”
Wen <i>et al</i> 1997	Cross-Sectional	304 Runners of a marathon-training program	Injury or pain to an anatomical part and having to had to stop training, slow pace, stop intervals, or otherwise having had to modify training	A “gradual” or “immediate” onset of the injury
Wen <i>et al</i> 1998	Prospective Cohort	355 Novice runners	Injury or pain to an anatomical part and having to had to stop training, slow pace,	A “gradual” or “immediate” onset of the injury

stop intervals, or otherwise having had to
modify training

SUPPLEMENT 2 - 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 19
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 20
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	✓ Page 22
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 25
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 25
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 25
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 25
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 24/ 25
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	n/a

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
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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 26
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.	✓ Table II
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 27 and Table III
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.	✓ Table II
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 29
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 34
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	✓ Page 34
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 –

**ELABORAÇÃO DE UM CONSENSO SOBRE A DEFINIÇÃO DE
LESÃO MUSCULOESQUELÉTICA RELACIONADA À
PRÁTICA DA CORRIDA: UM ESTUDO TIPO DELPHI**

ELABORAÇÃO DE UM CONSENSO SOBRE A DEFINIÇÃO DE LESÃO MUSCULOESQUELÉTICA RELACIONADA À PRÁTICA DA CORRIDA: UM ESTUDO TIPO DELPHI

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São Paulo Running Injury Group - SPRunIG

3.1 RESUMO

Introdução: A prática de corrida vem crescendo nos últimos anos, levando a um aumento do número de lesões, as quais estão intimamente relacionadas à definição de lesão musculoesquelética utilizada. A necessidade de uma definição padronizada de lesão já foi sugerida em outros estudos, porém até o momento não existe um consenso sobre qual seria a melhor definição para a corrida, permitindo assim, que cada pesquisador crie sua própria definição. **Objetivo:** Propor um consenso de definição de lesão musculoesquelética relacionada à corrida através de um estudo do tipo Delphi modificado em três etapas. **Métodos:** Foram identificados 112 potenciais participantes, que foram convidados por e-mail para participar deste consenso em três etapas através de um formulário *online*. Na primeira etapa os participantes receberam o termo de consentimento e, caso optassem participar do estudo, eram direcionados para um formulário *online* para classificar termos/palavras identificados em outras definições da literatura. Os termos com uma concordância mínima de 75% entre os participantes seguiram para a próxima etapa. Na segunda etapa, os participantes classificavam as novas termos/palavras

adicionadas na primeira etapa. Na terceira etapa foi apresentado o consenso gerado na etapa anterior para que os participantes julgassem. **Resultados:** Um total de 53 participantes responderam ao convite para a participação no estudo, sendo que destes, 36 aceitaram participar do consenso. As taxas de respostas foram 94,73% na primeira rodada, 83,33% na segunda e, 86,66% na terceira rodada. Os participantes foram de nove países diferentes. Após as três rodadas deste estudo, o consenso gerado pelos participantes foi: “Dor musculoesquelética relacionada à corrida (treino ou competição) nos membros inferiores que provoca uma restrição ou interrupção na corrida (distância, velocidade, duração ou treinamento) por pelo menos sete dias ou três treinos consecutivos ou que requer do corredor uma consulta com um médico ou outro profissional da saúde”. Sendo que para estudos retrospectivos o questionamento sobre a lesão deve estar relacionado aos últimos seis meses. **Conclusão:** A utilização da definição baseada neste consenso tem a possibilidade de auxiliar na comparação dos resultados obtidos em diferentes estudos da área de lesão na corrida.

3.2 INTRODUÇÃO

A corrida é um dos tipos de atividade física mais popular em todo o mundo[1, 2] e o número de praticantes vem aumentando gradativamente nas últimas décadas, principalmente por ser uma modalidade de baixo custo e por promover diversos benefícios à saúde.[3-6] Uma das consequências do aumento da popularidade da prática da corrida é o aumento das lesões musculoesqueléticas entre os participantes, que apresenta incidência de lesão com taxas que podem variar entre 19 e 92%, dependendo da definição de lesão utilizada e da população de corredores estudada.[2, 3, 7-14]

A falta de uma padronização de conceitos na pesquisa talvez seja a dificuldade mais significativa para a comparação de resultados entre os estudos.[15] O número de estudos relacionados às lesões na corrida vem crescendo gradativamente nos últimos anos e uma das dificuldades que muitos pesquisadores da área da corrida apontam durante a condução de seus estudos é o que considerar como definição de lesão musculoesquelética.[3, 13, 16] A necessidade de uma definição padronizada de lesão musculoesquelética relacionada à corrida (LMRC) já foi sugerida em outros estudos,[3, 14] porém até o momento não existe um consenso sobre qual seria a melhor definição, permitindo assim que os pesquisadores utilizem definições diferentes entre si.[1, 8, 13]

A influência de uma definição de lesão sobre os resultados das pesquisas podem ser observados em alguns estudos na literatura.[3, 13, 17] Por exemplo, ao utilizar uma definição que considera como lesão “qualquer dor musculoesquelética relacionada à corrida, nos membros inferiores ou na lombar, que cause restrição na corrida por pelo menos um dia”,[18] significa utilizar uma definição detalhada, que leva em conta a descrição de diversos fatores como o sintoma à ser reportado, a região e as consequências que devem ocorrer para que se considere

lesão. Em contrapartida, utilizar uma definição que é descrita como “evento que afete a habilidade do atleta de competir ou treinar”,[19] significa utilizar uma definição sem detalhes para descrever os fatores considerados em uma lesão, ou seja, ela passa a ser considerada ampla de forma que não é necessário obter tantos requisitos, para que se considere uma lesão.

A falta de definições padronizadas na área de lesões do esporte já vem sendo discutida há cerca de 20 anos, uma vez que compromete a comparação dos resultados de estudos propostos nesta área.[20] A busca de um consenso já foi proposta em outras áreas da medicina esportiva.[21] Modalidades como o cricket, tênis, rugby e futebol têm seus consensos formados e apontam a importância destas padronizações para auxiliar na identificação de fatores de risco e incidência de lesões, além de contribuir para a criação de programas de prevenção.[22-25] A técnica do estudo tipo Delphi foi criada para transformar a opinião de um determinado tema em consenso de grupo,[15, 26, 27] ou seja, trata-se de uma técnica que procura obter um consenso sobre a opinião de “especialistas” no determinado assunto. Sendo assim, este estudo tem como objetivo propor um consenso sobre definição de lesão musculoesquelética relacionada à prática da corrida através de um estudo do tipo Delphi modificado em três etapas.

3.3 MÉTODOS

3.3.1 Desenho do estudo e participantes

Para o planejamento do estudo e, com o intuito de testar os métodos escolhidos para a realização do mesmo, foi realizado um estudo piloto com cinco pesquisadores da área de lesões na corrida.

A partir de uma revisão sistemática (Capítulo 2) sobre definições de lesão musculoesquelética relacionada à corrida e, após uma busca manual com o objetivo de encontrar

pesquisadores da área de lesões na corrida que não tinham até o momento artigos publicados com definição de LMRC foi possível identificar 112 potenciais pesquisadores para esse estudo. A comunicação com os participantes foi realizada através de e-mails, que foram encontrados em uma busca *online* e a partir do contato com outros pesquisadores. Foram enviados três e-mails convites para o estudo, com intervalos de 15 dias entre eles. Os participantes que não retornaram nenhum destes três convites não foram mais contatados. Este estudo tem como delineamento um estudo do tipo Delphi modificado.

3.3.2 Coleta dos dados – etapas do consenso

Primeira Etapa

Essa etapa foi iniciada com um e-mail convite em que os participantes foram convidados à participar do estudo e tiveram a possibilidade de clicar em um *link* que os direcionou à um formulário *online* na língua inglesa. Neste formulário *online* haviam detalhes do estudo e um termo de consentimento. Se o participante escolhesse participar do estudo, ele continuaria nas próximas páginas do formulário *online*, onde ele era direcionado à classificar os termos/palavras para descrever LMRC.

O formulário *online* foi estruturado em três categorias principais para descrever LMRC sendo elas: (1) Presença de Queixa Física; (2) Necessidade de Interromper Treinos e Competições; e, (3) Procurar por Assistência Médica. Cada uma destas categorias incluiu algumas subdivisões, de forma que “Presença de Queixa Física” incluiu três subdivisões (sintoma, acometimento, região); “Necessidade de Interromper Treinos e Competições” incluiu cinco subdivisões (esporte primário, extensão da lesão, extensão da limitação, interrupção e descrição do período em que a lesão ocorreu); e “Procurar por Assistência Médica” incluiu uma subdivisão (assistência médica/medicamentos). Estas divisões de termos/palavras surgiram a

partir do que foi encontrado na revisão sistemática de definições de LMRC. Os participantes foram então, direcionados à classificar estes termos/palavras para descrever cada uma destas subdivisões.

Cada termo foi classificado através de uma escala de 0 a 3 pontos, sendo zero (0) um termo não adequado para descrever uma lesão musculoesquelética relacionada à corrida, e o três (3) um termo extremamente adequado para descrever lesão musculoesquelética relacionada à corrida, assim como foi proposto em estudo com delineamento semelhante[15]. Foi considerado um nível de consenso de 75% para incluir os termos/palavras no consenso da definição[26]. Portanto, os termos que não alcançaram um escore médio (soma dos escores de cada item) de no mínimo 75% dos pontos da escala proposta foram excluídos. Os participantes poderiam acrescentar comentários para todos e quaisquer termos que julgassem necessário, com a possibilidade de acrescentar novos termos. Qualquer opinião ou item sugerido foi automaticamente incluído na próxima etapa para avaliação por parte dos participantes.

A resposta deste formulário com a opinião dos pesquisadores deveria ser enviada de volta aos autores deste estudo em até 15 dias. Caso isso não ocorresse, seria enviado um lembrete via e-mail no 16º dia e esperava-se a resposta em até mais 15 dias. Passando um mês do primeiro envio e se o pesquisador não tivesse enviado sua resposta, ele foi comunicado e informado sobre um novo prazo de mais 15 dias. Caso não houvesse resposta no prazo estipulado o participante seria excluído do estudo. Para garantir a viabilidade do estudo foi proposto que cada etapa tivesse a duração máxima dois meses.

Segunda Etapa

Essa etapa teve início com as respostas da primeira etapa, em que as classificações e os comentários individuais de cada pesquisador foram registrados e analisados. Esta análise foi

quantitativa em relação às classificações dos termos a partir da escala de 0 a 3 e, foi realizado também uma análise qualitativa, de forma a reconhecer os termos semelhantes entre os comentários dos participantes, criando categorias e agrupamentos dos termos semelhantes. Estas análises foram realizadas com a finalidade de elaborar o segundo formulário *online*, o qual foi enviado nesta segunda etapa.

Os pesquisadores foram então, direcionados à avaliar cada termo incluído neste formulário e classificá-los de acordo com a escala (0 a 3 pontos). Foi considerado um nível de consenso de 75% para incluir os termos/palavras no consenso da definição.[26] Portanto, os termos que não alcançaram um escore médio (soma dos escores de cada item) de no mínimo 75% dos pontos da escala proposta foram excluídos. Os pesquisadores também poderiam, neste etapa do estudo, sugerir novas opiniões e novos termos que julgassem importantes para a formação do consenso da definição de lesão musculoesquelética na corrida. O formulário permitiria que o pesquisador fizesse comentários gerais e/ou específicos sobre cada termo. Nesta segunda etapa foi adotada a mesma forma de resposta dos participantes descrita na primeira etapa, assim como os mesmo critérios de exclusão do participante do estudo.

Terceira Etapa

Coletadas as informações das respostas da segunda etapa, foi realizada uma nova análise das opiniões que já estivessem com as respectivas críticas e comentários de cada participante, além de seus escores de acordo com a escala proposta. Foi considerado um nível de consenso de 75% para incluir tais opiniões no consenso da definição.[26] Portanto, os termos que não alcançaram um escore médio (soma dos escores de cada item) de no mínimo 75% dos pontos da escala proposta foram excluídos. Na análise desta etapa pode-se perceber preferência visível em todos os termos, ou seja, apenas uma opinião representou o consenso para todos os participantes e

não houve nenhuma nova sugestão, sendo assim, o consenso foi formado e proposto na etapa seguinte.

Uma vez alcançado o consenso para a definição, os pesquisadores foram, nesta etapa, questionados quanto à aprovação do mesmo. Foi então enviado aos participantes um terceiro formulário *online* com o consenso que incluiu os termos/palavras que alcançaram um escore mínimo para a formação do consenso (75%). Os pesquisadores também poderiam, neste momento do estudo, fazer comentários em relação ao consenso, mas não foram aceitos novos termos propostos.

Nesta etapa foi adotada a mesma forma de resposta dos participantes descrita na primeira etapa, assim como os mesmo critérios de exclusão do participante do estudo. Todas as etapas do estudo estão resumidas na Figura 2.

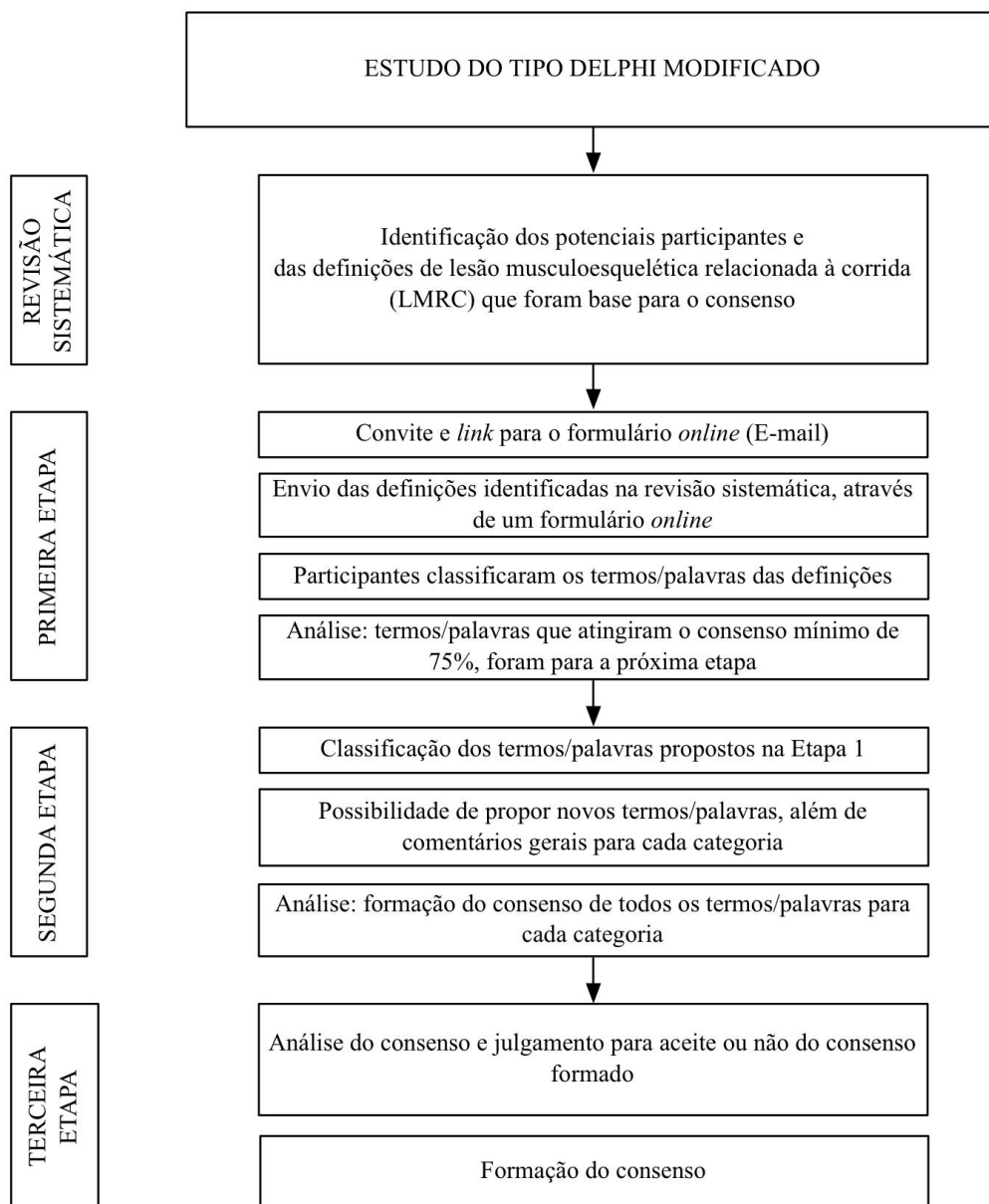


Figura 2. Fluxograma explicativo das quatro etapas do estudo Delphi modificado.

3.3.3 Forma de análise dos dados

A análise dos dados foi feita com os dados qualitativos e quantitativos. Os dados da primeira etapa foram analisados qualitativamente através de técnicas de análise de conteúdo. A descrição de como foi feita a análise dos dados para cada etapa está descrita junto com o procedimento da respectiva etapa. A análise do perfil dos participantes foi feita através de uma pesquisa na base de dados ISI Web of Knowledge, em que foram identificadas algumas informações relevantes de publicação, como número de artigos publicados, citações, índice H, número de artigos publicados em corrida e citações dos artigos sobre corrida, para cada um dos participantes deste estudo. Estas informações foram reportadas através da média e desvio padrão da amostra.

3.4 RESULTADOS

Um total de 112 participantes elegíveis foi contatado para participar deste estudo do tipo Delphi. Destes, 53 especialistas em lesão na corrida responderam ao convite (47,32%) e 38 aceitaram participar (33,92%). As taxas de resposta foram relativamente altas, alcançando 94,7% na primeira rodada (36/38), pois dois participantes responderam o questionário de forma incompleta, 83,3% na segunda rodada (30/36) e 86,6% na terceira rodada (26/30). Sendo assim, a taxa de participantes que desistiram do estudo foi de 31% considerando os participantes que aceitaram participar e os que responderam aos questionários até a formação do consenso. Os participantes do estudo eram de nove países diferentes (Austrália, Brasil, Canadá, China, Dinamarca, Estados Unidos da América, Holanda, Japão e Nova Zelândia). A Tabela 1 apresenta o perfil dos participantes deste estudo através de uma busca na base de dados ISI Web of Knowledge. A média de artigos publicados pelos participantes foi de 72,9 (DP 145,6), com índice

H de 12,7 (DP 14,0) e 1390 (DP 2756,7) citações no ISI Web of Knowledge. O apêndice 1 mostra a lista de membros que completaram o estudo (quatro rodadas).

Optamos por subdividir as definições citadas pelos participantes em categorias, para facilitar o entendimento de termos diferentes utilizados para descrever uma mesma categoria. Sendo assim, utilizamos as categorias: (1) Presença de Queixa Física com as subdivisões “sintoma”, referente à palavra-chave do início das definições que fosse utilizada para descrever a lesão propriamente dita; “acometimento”, que se refere ao acometimento necessário para que os autores considerassem LMRC; e “região”, referente à região em que os autores descreveram para considerar uma LMRC; (2) Necessidade de Interromper Treinos e Competições com as subdivisões “esporte primário”, referente à qual momento o indivíduo sofreu a lesão ou com que atividade esta lesão foi relacionada; “extensão da lesão”, ou seja, o que esta LMRC causou para o indivíduo lesionado; “extensão da limitação” que se refere à consequência da extensão da lesão; “interrupção”, que justamente se refere ao tempo que os autores consideraram de afastamento para considerar uma LMRC; e “descrição do período em que a lesão ocorreu”, que se refere ao tempo considerado pelos autores para julgar a ocorrência de uma lesão; e (3) Procura por Assistência Médica com a subdivisão “assistência médica/medicação”.

Primeira Etapa

Nesta etapa os participantes decidiram se as subdivisões propostas deveriam fazer parte da definição de LMRC e quais termos deveriam compor esta definição. Todas as subdivisões atingiram um ótimo mínimo de consenso entre os participantes. A subdivisão “sintoma” obteve 97% de concordância, seguida pelas subdivisões “região” e “esporte primário” com 94%, “extensão da lesão” e “extensão da limitação” com 92%, “interrupção” e “assistência médica”

com 89%, “descrição do período em que a lesão ocorreu” com 80% e, por fim, a subdivisão “acometimento” com 78% de concordância.

Em relação aos termos escolhidos pelos participantes, os termos com um nível de concordância acima de 75% foram: 1) “dor” para o sintoma; 2) “musculoesquelético” para acometimento; 3) “membros inferiores” para a região; 4) “relacionado à corrida”, “durante o treinamento de corrida” e “durante a corrida” para esporte primário; 5) “perder”, “parar” e “restringir” para a extensão da lesão; 6) “corrida”, “distância”, “velocidade”, “duração” e “treinamento” para extensão da limitação; 7) “sete dias” e “três treinos consecutivos” para a interrupção; 8) “últimos seis meses” para a descrição do período em que a lesão ocorreu; e 9) “consulta com um médico” e “visita a um profissional da saúde” para a assistência médica. A Tabela 2 mostra os termos que atingiram o consenso mínimo de 75% entre os participantes e os novos termos sugeridos na etapa 1.

Segunda Etapa

Na segunda etapa foram coletadas as classificações dos termos/palavras propostos na primeira etapa: rigidez (para a subdivisão sintoma), membros superiores, parte superior das costas e tronco (para a subdivisão região), intensidade (para subdivisão extensão da limitação), uma competição (para a subdivisão interrupção), último ano (para a subdivisão descrição do momento em que a lesão ocorreu) e exigir cirurgia (para a subdivisão assistência médica/medicação). Entretanto, nenhum destes termos propostos na primeira etapa alcançaram o consenso mínimo (mais de 75% das respostas) e, além disso, nenhum novo termo/palavra foi proposto no segundo questionário *online*. A Tabela 3 mostra os termos que atingiram o consenso entre os participantes para esta etapa.

Terceira Etapa

Nesta etapa foi possível alcançar e propor o consenso para definição de lesão musculoesquelética relacionada à corrida estruturada com os termos/palavras classificadas pelos participantes deste estudo. O consenso foi aprovado pela maioria dos participantes (80,76%) nesta rodada e, inclui as categorias sintoma, acometimento, região, esporte primário, extensão da lesão, extensão da limitação, interrupção, descrição do momento em que a lesão ocorreu e assistência médica/medicação, de forma que, lesão musculoesquelética relacionada à corrida, para este grupo de pesquisadores, foi considerada originalmente como:

“Running-related (training or competition) musculoskeletal pain in the lower limbs that causes a restriction or stoppage on running (distance, speed, duration or training) for at least seven days or three schedule consecutive training sessions or that requires the runner a consultation with a physician or other health professional” *

* To retrospective studies, the question about injury must to be related to the last 6 (six) months.

Para expressar este consenso na língua portuguesa, foi realizada a tradução da seguinte forma: “Dor musculoesquelética relacionada à corrida (treino ou competição) nos membros inferiores que provoca uma restrição ou interrupção na corrida (distância, velocidade, duração ou treinamento) por pelo menos sete dias ou três treinos consecutivos ou que requer do corredor uma consulta com um médico ou outro profissional da saúde”. Sendo que para estudos retrospectivos o questionamento sobre a lesão deve estar relacionado aos últimos seis meses.

3.5 DISCUSSÃO

Este estudo do tipo Delphi modificado foi composto por 38 (colocar % - mas depende do que vamos considerar como total da amostra) participantes que aceitaram participar deste consenso. Foi possível verificar que boa parte dos participantes deste estudo possui grande experiência na área de lesões na corrida. De forma geral, a estrutura da definição que atingiu o consenso é semelhante à algumas estruturas utilizadas por outros consensos de definição de lesão em outras modalidades esportivas, que, apesar de estarem relacionadas à esportes de alto rendimento, consideraram em suas descrições aspectos como a presença de queixa física, a necessidade de interromper treinos e competições e a procura por assistência médica.[22-25]

Para descrever o sintoma de uma lesão relacionada à corrida, o termo “dor” foi o escolhido pelos participantes deste consenso e parece ser o termo mais apropriado para esta descrição, uma vez que um sintoma comum à uma lesão é a presença de dor. Ao fazer uma comparação com os estudos sobre lesão na corrida, é possível encontrar dez estudos[7, 28-36] que definiram lesão utilizando este termo. Para a categoria “acometimento”, o termo “musculoesquelético” foi o escolhido pelos participantes desde a primeira rodada com alto índice de concordância entre os participantes (92%), o que mostra que este termo deve constar na definição de lesão já que estamos definindo uma lesão musculoesquelética. Em uma busca na literatura foram encontradas outras 22 definições[1, 6, 8, 10, 28-30, 37-51] de lesão na corrida que utilizam este termo para descrever o tipo de acometimento.

Em relação à região lesionada, os participantes escolheram os membros inferiores para compor a definição de lesão na corrida deste consenso. Esta região escolhida parece ser a que melhor descreve as lesões na corrida, já que as principais lesões nesta modalidade estão localizadas nos membros inferiores.[52] Ao analisar as definições existentes na literatura, esta

região está presente em 16 estudos que definiram lesão.[1, 8, 10, 28, 29, 32, 37-39, 46-51, 53] Alguns estudos não descrevem a região acometida em suas definições, fazendo com que estes estudos encontrem lesões que não estão relacionadas à corrida. Para a categoria “esporte primário”, foi proposto que a definição contenha o termo “relacionado à corrida”, visto que a definição proposta é para lesões na corrida, o acometimento deve estar relacionado à prática da corrida. Este termo também foi encontrado em 13 estudos de corrida que utilizaram uma definição de lesão.[1, 8, 10, 28-30, 33, 38, 39, 50, 51, 54, 55]

As categorias “extensão da lesão” e “extensão da limitação” são dependentes uma da outra. Por exemplo, ao considerar o termo “restringir” como extensão da lesão, este deve ser acompanhado por uma extensão de limitação, como treinos, frequência ou duração. Neste consenso foi proposto uma restrição ou interrupção na corrida, podendo envolver as variáveis distância, velocidade, duração ou treinamento. Dez estudos[10, 28, 29, 32, 37-39, 47, 48, 54] reportaram o termo “restrição” e sete estudos[6, 41, 44-46, 56, 57] reportaram “interrupção/parar” para a extensão da lesão, e ainda 14 estudos[1, 10, 28, 29, 32, 37-39, 47, 48, 50, 51, 54, 56] utilizaram “corrida” na extensão da limitação, podendo ou não acrescentar as variáveis distância, duração, velocidade, ritmo e treinamento.

Para descrever a interrupção necessária em uma definição de lesão, foi estabelecido para o consenso um tempo de sete dias ou três treinos consecutivos para considerar uma lesão. Foram encontrados 9 estudos[10, 28, 29, 37-39, 56, 58, 59] que utilizaram um tempo de sete dias em suas definições de lesão, sendo que em três deles foi utilizado a necessidade de se interromper três treinos consecutivos.[10, 28, 38] A categoria “assistência médica/medicação” foi selecionada neste consenso como uma alternativa à interrupção de sete dias ou três treinos consecutivos, uma vez que dependendo da população estudada os corredores podem ou não procurar atendimento médico para suas lesões. Neste consenso foi aprovado a necessidade de uma consulta com um

médico ou outro profissional da saúde para a definição de lesão. Na literatura foram encontrados seis estudos[8, 33, 43, 45, 53, 60] em que a procura por assistência médica fazia parte da definição de LMRC.

Por fim, para os estudos retrospectivos definirem lesão foi criada a categoria “descrição do momento em que a lesão ocorreu” para que seja determinado o período do questionamento de uma lesão do passado. Neste consenso, foi proposto pelos participantes um período de seis meses para que seja coletada a informação retrospectiva sobre uma lesão. Uma minoria dos participantes ainda comentou ao final do consenso que os estudos retrospectivos deveriam considerar um período de um ano em suas definições. Contudo, uma informação retrospectiva maior que 6 meses pode deixar os participantes sujeitos a um viés de memória, já que muitas vezes os corredores são questionados não apenas em relação à presença de lesão, mas também sobre as características desta lesão, como intensidade, localização precisa e diagnóstico, gerando maior dependência da memória do indivíduo.[61, 62]

Outra preocupação de alguns participantes ao final do consenso foi em relação à procura por assistência médica considerada neste consenso, em que ao considerarmos a necessidade de consulta ao médico ou algum outro profissional da saúde, poderíamos estar superestimando o número de lesões pois, dependendo do contexto de um país ou cultura local, os corredores podem procurar auxílio médico por motivos considerados irrelevantes, ou seja, é comum a procura por um médico por motivos menores, como dores passageiras que costumam melhorar em poucos dias. Este parece um ponto a ser considerado, porém em outros países esta tendência pode ser a inversa, as pessoas podem procurar auxílio médico apenas para casos mais graves, subestimando as taxas de lesão. Neste consenso, foi estabelecida a necessidade de consulta médica ou outro profissional da saúde como uma alternativa ao tempo de interrupção da corrida ou treinos, não sendo uma condição necessária para considerar uma lesão.

Através do estudo do tipo Delphi, a existência de um consenso não significa necessariamente que foi encontrada a resposta, a opinião ou o julgamento mais correto, mas que foi possível identificar fatores que um grupo de especialistas no assunto consideram relevantes para uma definição de lesão. Embora esta definição tenha sido formada através de um consenso entre pesquisadores selecionados através de uma revisão sistemática para identificar os pesquisadores da área da corrida, é preciso ressaltar que este consenso pode não representar a opinião de todos os pesquisadores da área. A definição de lesão deste estudo foi aprovada por mais de 75% dos participantes, o que pode ser considerado uma ótima concordância para estudos do tipo Delphi.[26] Acreditamos que este estudo representa um avanço para a área de lesões na corrida com este consenso, porém, sabe-se que esta definição ainda não foi testada na população e que não há nenhum estudo de validação deste consenso na população de corredores. Portanto, devemos ter cautela sobre o quanto este consenso pode ser eficiente para estudos de lesão na corrida. Pesquisas futuras testando a validade do consenso desta definição de LMRC podem ser importantes para o início da utilização deste consenso.

3.6 CONCLUSÃO

Após este estudo do tipo Delphi foi possível encontrar a seguinte definição de lesão musculoesquelética relacionada à corrida: “Dor musculoesquelética relacionada à corrida (treino ou competição) nos membros inferiores que provoca uma restrição ou interrupção na corrida (distância, velocidade, duração ou treinamento) por pelo menos sete dias ou três treinos consecutivos ou que requer do corredor uma consulta com um médico ou outro profissional da saúde, e para estudos retrospectivos a lesão deve estar relacionada aos últimos seis meses”. A

utilização da definição baseada neste consenso possibilita a comparação dos resultados obtidos em diferentes estudos da área de lesão na corrida.

Tabela 1. Perfil dos participantes do estudo

Dados de publicação dos participantes	Média (desvio padrão)
Total de artigos publicados	72,9 (145,6)
Total de citações	1390,2 (2756,7)
Artigos relacionados à corrida	8,2 (9,3)
Citações relacionadas à corrida	178,9 (213,7)
Índice H	12,7 (14,0)

Tabela 2. Resultados da Etapa 1 para o consenso de definição de LMRC proposto

Termos utilizados para descrever as definições de LMRC	Nível de Consenso (%)
Sintoma	
Dor	79,05%
Acometimento	
Musculoesquelético	92,86%
Região	
Membros inferiores	76,47%
Esporte primário	
Relacionado à corrida	86,27%
Durante o treinamento de corrida	76,47%
Durante a corrida	79,41%
Extensão da lesão	
Perder	75,76%
Parar	77,78%
Restringir	75,76%
Extensão da limitação	
Corrida	83,84%
Distância	82,83%
Duração	75,76%
Velocidade	79,80%
Treinamento	75,76%
Interrupção	
Sete dias/uma semana	79,17%
Três treinos consecutivos	76,04%
Descrição do momento em que a lesão ocorreu	
Últimos seis meses	82,76%
Assistência médica/medicação	
Consulta com um médico	79,17%
Visita a um profissional da saúde	83,33%

Tabela 3. Resultados da Etapa 2 para os termos que já haviam atingido o consenso na etapa 1 e os novos consensos propostos com seu respectivo nível de consenso

Termos utilizados para descrever as definições de LMRC	Nível de Consenso (%)
Sintoma	
Dor	79,05%
Rigidez*	41,38%
Acometimento	
Musculoesquelético	92,86%
Região	
Membros inferiores	76,47%
Membros superiores*	32,18%
Parte superior das costas*	39,08%
Tronco*	49,43%
Esporte primário	
Relacionado à corrida	86,27%
Durante o treinamento de corrida	76,47%
Durante a corrida	79,41%
Extensão da lesão	
Perder	75,76%
Parar	77,78%
Restringir	75,76%
Extensão da limitação	
Corrida	83,84%
Distância	82,83%
Duração	75,76%
Velocidade	79,80%
Treinamento	75,76%
Intensidade*	70,11%
Interrupção	
Sete dias/uma semana	79,17%
Três treinos consecutivos	76,04%
Uma competição*	36,78%

Descrição do momento em que a lesão ocorreu

Últimos seis meses 82,76%

Último ano* 48,28%

Assistência médica/medicação

Consulta com um médico 79,17%

Visita a um profissional da saúde 83,33%

Exigir cirurgia* 42,53%

* Termos propostos na primeira etapa

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- CAPÍTULO 4 –
CONSIDERAÇÕES FINAIS

4.1 CONSIDERAÇÕES FINAIS

Esta dissertação de mestrado teve como objetivos revisar na literatura quais são as definições de lesão musculoesquelética relacionada à corrida existentes, analisar o impacto destas definições nos resultados dos estudos e propor um consenso sobre definição de lesão musculoesquelética relacionada à prática da corrida através de um estudo do tipo Delphi modificado.

O Capítulo 2 apresenta uma revisão sistemática em que foram investigadas diversas definições encontradas na literatura. Os resultados desta revisão mostraram que existe um grande número de definições diferentes para a lesão musculoesquelética relacionada à corrida (LMRC). Este grande número de definições aparece com estruturas semelhantes de forma geral, ou seja, descrevem as mesmas categorias, porém, o que diferencia estas definições são, na grande maioria, a vasta diversidade de termos utilizados para descrever cada uma das categorias, sendo que, em alguns casos, estes termos aparecem com diferentes significados. Pôde-se perceber também a influência das diferentes definições nas taxas de lesão na corrida em alguns estudos.

A revisão sistemática evidenciou a necessidade da formação de um consenso para definição de LMRC para facilitar a comparação dos resultados de diferentes estudos sobre lesão na corrida. A adoção de uma definição padronizada para LMRC pode contribuir para estudos futuros de incidência de lesões na corrida, uma vez que estes poderão comparar seus resultados.

O Capítulo 3 mostra o resultado de um estudo do tipo Delphi feito com o objetivo de se formar um consenso entre pesquisadores especialistas na área de lesões na corrida. O consenso formado neste estudo foi semelhante à algumas definições de LMRC encontradas na revisão sistemática do Capítulo 2. Além disso, este consenso pode ser utilizado na literatura em futuros estudos de forma a facilitar a padronização na avaliação de LMRC e auxiliar na comparação dos resultados dos estudos na área de lesões na corrida.

Por fim, a partir desta dissertação foi possível entender que os estudos relacionados à lesões na corrida são muitas vezes de difícil comparação, uma vez que geralmente os autores optam por utilizarem e/ou criarem suas próprias definições. Também foi possível observar uma grande variação entre as taxas de lesão, muito provavelmente resultado das diferentes definições utilizadas. Através das diversas estruturas encontradas para descrever definição de LMRC pode-

se entender a necessidade de se propor um consenso. Com a proposta de um consenso, assim como a avaliação e a aprovação por parte de pesquisadores especialistas na área de lesões na corrida foi possível supor que a utilização deste consenso contribuirá na comparação entre os resultados dos futuros estudos da área.

- MATERIAL SUPPLEMENTAR –

Instructions for authors and manuscript preparation – British Journal of Sports

Medicine (BJSM)

Instructions for Authors

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Fillers
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 I-test - Sports medicine radiology/imaging
 Pictorial essay
 Supplements
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Make sure that each question focuses only on one problem

The answers you offer should be homogeneous: for example 5 diagnostic procedures, 5 therapeutic interventions

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Example references:

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13 Koziol-McLain J, Brand D, Morgan D, et al. Measuring injury risk factors: question reliability in a statewide sample. *Inj Prev* 2000;**6**:148–50.

Chapter in book

14 Nagin D. General deterrence: a review of the empirical evidence. In: Blumstein A, Cohen J, Nagin D, eds. *Deterrence and Incapacitation: Estimating the Effects of Criminal Sanctions on Crime Rates*. Washington, DC: National Academy of Sciences 1978:95–139.

Book

15 Howland J. *Preventing Automobile Injury: New Findings From Evaluative Research*. Dover, MA: Auburn House Publishing Company 1988:163–96.

Abstract/supplement

16 Roxburgh J, Cooke RA, Deverall P, et al. Haemodynamic function of the carbomedics bileaflet prosthesis [abstract]. *Br Heart J* 1995;**73**(Suppl 2):P37.

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Electronic journal articles

Morse SS. Factors in the emergency of infectious diseases. *Emerg Infect Dis* 1995 Jan-Mar;**1**(1). www.cdc.gov/nciod/EID/vol1no1/morse.htm (accessed 5 Jun 1998).

Electronic letters

Bloggs J. Title of letter. *Journal name Online* [eLetter] Date of publication. url

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