

# RUNNING-RELATED INJURIES IN LONG-DISTANCE RUNNERS AND A STUDY ON LJUBLJANA MARATHON PARTICIPANTS

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## THE RUNNING EPIDEMIC

Running has become an important health-promoting activity and long-distance runners now represent a significant leisure group<sup>1</sup>. Practising running even in relatively low doses (5 to 10 minutes per day) has recently shown to reduce the risk of death from all causes<sup>2</sup> which makes it one of the healthiest activities. The number of recreational runners in developed countries is often between 12.5 and 25% of the population<sup>3</sup>. Estimated numbers available state there are more than 40 million runners in the USA<sup>3</sup> and more than 50 million in Europe<sup>4</sup>. Running requires little to no equipment and can be performed almost everywhere.

## RUNNING-RELATED INJURIES

It is not surprising that the increase in the amount of long-distance runners has been followed by an increase in incidence of running-related injuries (RRI) ranging from 18 to 92% prevalence and 7 to 59 injuries per 1000 hours of training<sup>5</sup>. At any given time, 25% of long-distance runners are injured and about a half experience an injury that stops their activity for any period of time during a year<sup>6</sup>. Novice runners seem to be the most vulnerable group, with a much higher risk of injury seen among recreational runners<sup>3</sup>.

After looking at the literature a non-uniform definition of an 'injury' seems to be the biggest problem in finding the aetiology of RRI. However, a common definition of

RRI has been suggested: a musculoskeletal ailment that is attributed to running and that causes a restriction of running speed, distance, duration or frequency for at least 1 week<sup>7</sup>. The effects of running injuries include short-term and long-term pain and discomfort. Short-term pain and discomfort is due to the immediate effects of the injury. Long-term effects may include a reduction of physical activity, osteoarthritis following acute injury and increased healthcare costs<sup>8</sup>. Recent studies have shown that the knee is the most common location for RRI, followed by the lower leg, foot and thigh, and, less frequently, the ankle and hip<sup>9</sup>. The most common clinical diagnoses are iliotibial band syndrome, patellofemoral

pain syndrome, stress fractures, medial tibial stress syndrome, Achilles tendon and calf injuries, meniscus injuries and muscle injuries to the hamstrings and quadriceps<sup>6,10</sup>. Among long-distance runners, men report more hamstring and calf problems, whereas women report more hip complaints<sup>11</sup>.

#### RISK FACTORS FOR RUNNING-RELATED INJURIES

Identifying risk factors for RRIs is a crucial task in RRI prevention. The aetiology of RRI is usually related to overuse via repeated musculoskeletal microtrauma and can be attributed to several risk factors described in the literature. Each one of them varies according to the personal characteristics of the runner (anatomical and biomechanical factors), training errors (such as training volume, weekly distance), and running experience<sup>5</sup>. The differences between studies originate from a non-uniform definition of RRI and from the cohort examined<sup>12</sup>. Individual factors identified by the relevant literature suggest that the majority of RRI is of multifactorial origin. The most common reported risk factor in prospective studies is previous injury in the past 12 months, followed by higher quadriceps angle of the knee (Q angle) and weekly running distance (over 40 miles/64 km)<sup>5</sup>. Increased BMI, male gender, lack of running experience, participation in races of greater distance, increased training days per week, increase in training distance per week, shoe age and running throughout the whole year have also been reported as risk factors for RRI, albeit with limited evidence<sup>9,13</sup>. Training distance per week has been shown as the only protective factor for running-related knee injury<sup>9</sup>.

#### RUNNING-RELATED INJURIES IN LJUBLJANA MARATHON PARTICIPANTS

Slovenia, like many other countries, has seen an increase in the popularity of marathons and long-distance running. In the last decade, Slovenia has registered more than 40,000 competitive runners, which represents 2% of the population<sup>14</sup>. The



18th Ljubljana Marathon, in 2013, recorded almost 20,000 participants. More than 1400 participants attended the 42 km run, 6500 participated in half-marathon, and the rest ran over the 10 km distance. The aim of our study was to determine the self-reported incidence and prevalence of RRI among participants and to identify risk factors for their occurrence. This retrospective cohort study data is presented in full elsewhere<sup>15</sup>. For this study, a customised questionnaire on general data, running history, running distance per week, previous participation at official events, type of training for the event, regions of RRI, other sports participation, bare foot running and life/

season prevalence/incidence of RRI was distributed over registration emails. Questions were specifically designed to target RRI risk factors reported elsewhere in the literature<sup>5,9,16</sup>. RRI was defined as a cause of absence from running for 2 weeks or more with running being the only cause.

Out of 14,176 distributed questionnaires, 697 (5%) were eligible for analysis (19% full marathon runners, 60% half-marathon, 21% 10 km track). Our study group was gender-balanced and included 340 (49%) females and 357 (51%) males with an average age of 42 years and average body mass index (BMI) of 23 kg/m<sup>2</sup>. The participants reported lifetime running injury (absence more than



2 weeks) incidence as following: 322 (46%) none, 328 (47%) rarely, 31 (4%) occasionally, and 16 (2%) often. Knee was the most commonly injured body region, followed by the ankle and Achilles tendon, foot and calf. In the season preceding the 18th Ljubljana Marathon event 452 (65%) participants had not experienced any running injuries, 131 (19%) reported minor problems (max. 2 weeks absence), but 66 (10%) participants suffered from moderate (absence 3 to 4 weeks) and 48 (7%) major (more than 4 weeks absence) running-related injuries.

Male gender, running experience of 1 to 3 years and a history of previous injuries were exposed as risk factors for lifetime RRI. We also showed that higher age was a risk factor for lifetime lower leg RRI and running distance of 21 to 50 km per week was a risk factor for lifetime foot RRI. Barefoot running was also considered a statistically significant risk factor for lower leg lifetime RRI. On the contrary, factors such as BMI, running experience of 4 years or more and other sports participation were not related to lifetime running injuries. In the season preceding that particular marathon event BMI was the only RRI risk factor.

To summarise, our self-reported retrospective study on Ljubljana Marathon

participants revealed a 53% lifetime prevalence of RRI, predominantly of the knee, ankle, and Achilles tendon. One in three recreational runners experienced at least one running injury in the season preceding the event. Male gender, less running experience, previous injury and higher BMI were shown to increase the risk of RRI in general. Higher age and barefoot running increased the risk of lower leg RRI specifically, while high weekly running distance (20 to 50 km) increased the risk of foot RRI.

#### POSSIBLE PREVENTIVE MEASURES

Knowledge of the risk factors for overuse problems in specific injury locations aids the development and implementation of prevention programmes. According to a review article by Klügl et al<sup>17</sup>, injury prevention programmes should be focused on three main categories:

- Training
- Equipment
- Rules and regulations

There has been a substantial increase in the interest in and number of injury prevention programmes in the last 2 decades. However, much of this has been in professional sports settings, with limited

access for recreational athletes<sup>17,18</sup>. It seems that these limitations also influenced our study group as we were unable to demonstrate that supervised training in a club or dedicated training group influences risk for RRI<sup>15</sup>. Supervised training provides a motivational effect on running, but improvements to training protocols in terms of RRI prevention are required. In order to be effective, preventive programmes require good compliance and runner/coach willingness to change daily behaviour<sup>17</sup>. Cross training and the FIFA 11+ represent good examples of preventive programmes that have been shown to reduce risk for sports injuries<sup>19-21</sup>. Our study identified four main target groups for RRI prevention:

- Males
- Novice runners
- Overweight runners
- Previously-injured runners

All of them can be tackled with regular and controlled training programmes. Lessons learned from anterior cruciate injuries and hamstring muscle tears have clearly shown that both can be reduced with dedicated preventive exercise<sup>21,22</sup>. Both of these injuries are quite easy to detect after an abrupt injury as sportsmen are unable to continue with sports without medical help.

**Male gender, running experience of 1 to 3 years and a history of previous injuries were exposed as risk factors for lifetime RRI. We also showed that higher age was a risk factor for lifetime lower leg RRI and running distance of 21 to 50 km per week was a risk factor for lifetime foot RRI.**



On the other hand, running-related overuse injuries are often less traumatic, with a wide spectrum of pathologies, compounded by the fact that many runners do not seek medical attention for minor injuries. Given that novice runners with higher BMI have increased risk of sustaining an RRI<sup>3-9</sup>, preventive measures should focus on a slow transition into running and involvement of other means to lose weight, rather than solely running. Although a population with previous RRI seems an easily accessible target for secondary prevention, studies on functional diagnostics were not able to delineate clear criteria for RRI<sup>23-25</sup>. Unfortunately, this means that, currently, secondary prevention in such cases relies on personal expert opinion.

#### SUMMARY

Marathon and long-distance running is an easily accessible form of exercise with significant health benefits that has experienced a notable increase in popularity over the last decade. This has resulted in a surge in the number of running-related injuries – affecting more than 50% of runners, with the knee being the most common injury site and weekly mileage

the most significant injury risk factor. These findings were confirmed by our self-reported study on Ljubljana Marathon participants. Identifying risk factors for overuse problems and affected body regions allows specific preventive training programmes to be implemented in order to reduce the number of injuries among long distance runners.

References available at  
[www.aspetar.com/journal](http://www.aspetar.com/journal)

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