Muskuloskeletal Injuries in Mountain Running Races: a 5 Seasons Study

ABSTRACT

Introduction: Mountain running races have grown in popularity in the recent years. Nonetheless, there are few studies on injuries and injury rates. Moreover, these studies have focused on long-distance events such as ultramarathons (>42 km). Therefore, the aim of the present study was to examine the severity, type, and body location of musculoskeletal injuries during 20–42 km mountain running races. In addition, the injury rates in this type of races were examined.

Methods: Data on injuries were collected during 36 mountain running races over 5 consecutive seasons from 2015 to 2019. The participants reported all musculoskeletal injuries on a standardized injury report form. The results were presented as the number of injuries per 1000 h exposure and per 1000 participants.

Results: Twenty eight injuries were reported. Most injuries occurred in the ankle (32%) followed by the knee (14%) and foot/toe (11%). The number of injuries represented an overall injury rate of 1.6 injuries per 1000 h running and 5.9 injuries per 1000 runners. The case fatality rate was 0.

Conclusions: The incidence of musculoskeletal injuries during 20–42 km mountain running races is low. In addition, the majority of injuries experienced by runners are minor in nature and located in lower extremities, mainly the ankles.

Keywords: sports injury, injury rate, epidemiology, trail running.

Introduction

Mountain running races have grown in popularity in the recent years.[1] Because of this, several studies on the physiology, biomechanics, and psychology associated with mountain running have been published in the past few years.[2,3] However, there are paucity of studies on injuries and injury rates. Moreover, these studies have focused on long-distance events such as ultramarathon,[4–7] and multiple day ultramarathon races.[8–10]

The International Skyrunning Federation[11] classifies mountain running races according to their distance (up to 99 km) and elevation gain (up to or exceeding 2000 m). Although most research has focused on studying the most challenging events (i.e., mountain ultramarathons), mountain runners often compete in 20–42 km races[12] where they have to overcome a minimum vertical climb of 1300 m. To our knowledge, no studies have evaluated musculoskeletal (MSK) injuries among mountain runners in races between 20–42 km. It is plausible that the different orographic characteristics and physiological demands of longer races[12] could differently affect the injuries incidence and their severity differently than those of shorter races.

Therefore, the first purpose of the present study was to examine the severity, type, and body location of MSK injuries during 20–42 km mountain running races. In addition, the injury rates of this type of races were examined. The study was approved by the Castilla y León (Spain) Mountain Sports, Climbing and Hiking Federation review board, with the requirement for informed consent waived.

Methods

This was a retrospective study based on a self-reported participant form. The study was performed during 5 consecutive seasons, from 2015 to 2019. During this period all official mountain running races approved by the Castilla y León (Spain) Mountain Sports, Climbing and Hiking Federation were included (n=36) whith a total of 6167 runners. All races were performed in central northern Spain. Participants were over 18 y and most were amateur mountain runners. Those runners who sustained an injury during the race and required medical attention had to submit a standardized form to the sport federation to get assistance from a physician. Information was deidentified using an individual code, and runners remained anonymous throughout the study. All MSK injuries were taken into account and classified by their effect on the runners' ability to continue the race. An injury was classified as major when the runner could not continue running or as minor when the runner was able to continue running.[6,8] Finally, the number of participants and their performance (i.e., individual time) in each race were obtained from the official information supplied by the organization of each race. This allowed us to analyze all participants' total exposure.

Statistics

A descriptive analysis was used to describe the information collected, such as the subjects' age, injured participants, severity of MSK injuries, body location of the injuries, and races' characteristics. Data were presented as means ± standard deviation (*SD*). In addition, the races' characteristics were accompanied by 95% confidence intervals (95% CI). In order to compare the risk of injury in mountain running, an injury risk per 1000 h exposure was calculated.[8,13] Furthermore, an injury rate per 1000 participants was computed.[5,8] All statistical analysis were conducted using the statistical package SPSS for Windows (V.26.0, Chicago, Illinois, USA).

Results

The races' mean distance was 28±6 km (95% CI, 26–30) and their mean accumulative positive/negative elevation change was 3497±717 m (95% CI, 3254–3740). The maximum elevation was 1810±371 m (95% CI, 1684–1935) (Table 1). The races' environmental conditions varied according to their location and the month in which they were performed. The minimum and maximum environmental temperature was 7±5 (95% CI, 5–9) and 23±7 °C (95% CI, 20–25), respectively.

(TABLE 1)

In total, 4831 mountain runners took part in the study. Subjects' ages ranged from 18 to 72 y (40±7 y) (Table 2).

(TABLE 2)

The characteristics of the injured runners and the severity of their MSK injuries are showed in Table 3. The total number of injured participants was 28. Most injuries involved lower limbs (78%) and most of them occurred in ankle (32%) followed by knee (14%) and foot/toe (11%). Upper limb injuries accounted for 18%, while those of the trunk reached 7%.

(TABLE 3)

The competition accumulative time of all mountain runners was 19684 h. The MSK injuries represented an overall injury rate of 1.6 injuries per 1000 h running and 5.9 injuries per 1000 runners. The case fatality rate was 0.

Discussion

To our knowledge, this is the first study to focus on the incidence of MSK injuries in 20–42 km mountain running races. This type of races has a high number of participants and events during the season due to its short distance. They are usually used as initiation or training races for amateur and ultramarathons runners, respectively. Despite this, previous studies have focused on ultramarathons events.[5,6,8,9] These studies have reported MSK injury rates per exposure time (4.2–12.0 injuries per 1000 h of running)[6,8] and per participant (26.1–716.2 injuries per 1000 runners)[5,6,8,9] higher than those found in the present study (1.6 and 5.9 injuries per 1000 h of running and per 1000 runners, respectively). The highest MSK injury rates both per exposure (12.0 injuries per 1000 h of running) and per runner (716.2 injuries per 1000 runners) have been reported in multiday ultramarathon races.[8] Conversely, the running-related injures per 1000 h obtained in our study were slightly lower than those found in long-distance track and field athletes (2.5 injures per 1000 h of running).[14] Collectively, results from these studies highlight the influence that mountain runners' exposure has on their injury rates. An increase in the length of the mountain running races leads an increase in the terrain hardness and a greater variation in the environmental temperature,[12] which might negatively affect the injury incidence in the

longer mountain running races.[8] In addition, the differences between studies might have been accentuated by the participants' different performance levels. It has been previously reported that novice versus recreational runners have a greater running-related injury incidence per 1000 h of running (17.8 *vs* 7.7).[15]

In addition to the low injury incidence analyzed in this study, 75% of the injured mountain runners experienced minor MSK injuries (*i.e.*, they could finish their races), which mostly involved the lower extremity. This agrees with earlier studies, where most participants with MSK injuries were able to finish their races.[5,8,9]

When comparing injury risk among outdoor sports, the injury rate per exposure is a useful parameter. The methods of our study are in line with those used in other studies on outdoor sports. The injury rate observed was 1.6 per 1000 h of exposure, which is similar to the reported injury rate of 1.5 injuries per 1000 h in mountainbike.[16] It appears that mountain activity (injury rate of 0.005 to 0.013 injuries per 1000 h)[17], or nordic walking (0.9 injuries per 1000 h)[18], are less dangerous. These comparisons, however, are limited due to different study design and injury definition. Compared to injury risk per 1000 h in other outdoor sports, injury rates in mountain running are lower than climbing and bouldering (2.71 injuries per 1000 h)[19], competition climbing (3.1 injuries per 1000 h)[20] and canyoning (4.2 injuries per 1000 h).[21]

There are limitations related to this study such as only MSK injuries were collected while medical illness or skin disorders were not considered. This fact might lead to missing some minor injuries, and as a consequently the total number of MSK injuries could be underestimated. Another limitation is that it was a retrospective study based on a self-reported participant form.

Conclusion

Despite the terrain hardness of the 20–42 km mountain running races, the findings of this study show that the MSK injury incidence is low. The overall incidence was 1.6 injuries per 1000 h exposure or 5.9 injuries per 1000 participants. The most frequent injury locations were the ankle, knee and foot/toe. These results provide useful information as a basis for developing specific injury prevention training programs. In addition, they may help to provide adequate medical coverage in this type of mountain running race.

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Disclosures: None.

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***Conflict/Declaration of Interest Statement**

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Declaration of interests

☒ The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

☐The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

None.

Highlights

1. Mountain running races have grown in popularity in the recent years.
2. The study was carried out with data from 36 careers during 5 seasons.
3. In total, 4831 mountain runners took part in the study.
4. We show that the number of injuries represented an overall injury rate of 1.6 injuries per 1000 h running and 5.9 injuries per 1000 runners.

Table 1. Characteristics of mountain running races

Race *(season)*	Distance (km)	Positive/negative elevation (m)	Maximum elevation (m)
Alto Sil *(2019)*	32	3800	1620
Arganza Trail-Cañón del Rio Lobos *(2015, 2016, 2017, 2018, 2019)*	32	3700	1270
Biosfera Trail *(2017, 2019)*	26	4030	1584
Carrera por Montaña de Sanabria *(2017)*	20	2056	1633
Carrera por Montaña Miranda de Ebro *(2018, 2019)*	27	2716	959
Carrera por Montaña Pico Zapatero *(2016, 2017, 2018, 2019)*	22	3300	2158
Desafio Urbión *(2018)*	36	4880	2192
Integral del Valdecebollas *(2015, 2016)*	42	4446	2131
K-22 Peñalara *(2015, 2016, 2017, 2018, 2019)*	23	3056	1837
Subida al San Millán *(2015, 2016, 2017, 2018, 2019)*	29	4000	2131
Trail Cueto del Oso *(2019)*	26	4010	1899
Transvaldeónica *(2015)*	28	4200	2160
Tres Valles *(2016)*	36	4240	1668
Villalfeide *(2015, 2016, 2018)*	25	3356	2007

Table 2. Characteristics of mountain runners

		%
Age (y)	18-29	11
	30-39	41
	40-49	40
	50-59	8
Sex	Male	91
	Female	9

Table 3. Characteristics of injured runners

		%
Age (y)	18-29	14
	30-39	39
	40-49	39
	50-59	7
Sex	Male	79
	Female	21
Injury severity	Major	25
	Minor	75