

FACTORS INFLUENCING THE OCCURRENCE OF PAIN AND INJURY IN RUNNERS

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A – study design, B – data collection, C – statistical analysis, D – interpretation of data, E – manuscript preparation, F – literature review, G – sourcing of funding

ABSTRACT

Background: With the growth of running popularity, the number of running-related injuries has risen. Long-term training and inadequate training loads are only a few factors causing overload injuries amongst runners.

Aim of the study: To determine factors influencing the onset of pain and injury in runners.

Material and methods: The study involved 150 runners aged 17-64 years (mean age: 30±10 years) and was conducted via a questionnaire containing questions concerning, for example, training frequency, location of pain, type of trauma, treatment and rehabilitation.

Results: 38% (n = 57) of runners often felt pain during training. 41% of them (n = 23) reported pain after running short distances and it was most frequently located in the knee joints (26%, n = 15). 48% (n = 72) experienced a running injury. The largest percentage of these (36%, n = 26) were related to knee injuries. As factors causing injuries, the interviewees mentioned one-sided training plan (24%, n = 17), overtraining (24%, n = 17), and insufficient warm-up (16%, n = 12). The analysis of the results has shown a statistically relevant positive correlation ($r = 0.177$, $p < 0.05$) between weekly frequency of training and the number of injuries sustained in the last year. The higher the weekly frequency, the more often injuries occur amongst runners.

Conclusions: The study shows that the occurrence of pain and injury depends on many factors. A frequent cause of any disturbances within the musculoskeletal system is overloaded soft tissue caused by overtraining. Lower limbs, particularly knee joints, are mostly at risk.

KEYWORDS: running, injuries, pain, overloading syndrome, knee injuries

BACKGROUND

Running is a natural human activity which nowadays is perceived as an element of a modern, healthy lifestyle. It is a simple and an easily accessible sport, which does not require expensive or specialist equipment, resulting in its great popularity amongst all ages. Nowadays, it is one of the most widely spread amateur sports disciplines. The awareness of a healthy lifestyle has risen considerably which has led to increased interest in running. It has beneficial influence on many conditions, including cardiovascular diseases. Unfortunately, as well as the positive effects of running, there is a high number of injuries concerning the locomotor system.

There are great discrepancies between scientific reports on how often injuries occur among runners, ranging from 1.4 to 94.4% [1-3]. Such discrepancies may be due to different definitions of injury, the choice of the group under examination or different research methods. Long-term training and inadequate training

loads are only a few of the factors contributing to overload injuries amongst runners.

Usually the most acute sign of overload of the locomotor system is pain, which can take different forms. If overload is sustained over in time, this often results in overload syndromes, which typically appear about two-years after commencing a sport [4]. They occur in about 25-50% of sportspeople treated in sports surgery clinics and if they are ignored, can lead to more serious injuries [5].

Research concerning the of frequency of lower limb injuries amongst long distance runners has revealed that most injuries affected the knee joints (7.2% – 50%), lower legs (9% – 32.2%), feet (5.7% – 39.3%) and upper legs (3.4% – 38.1%). Research has also shown that for 2000 injuries connected with running, the most frequent were: medial tibial stress syndrome (4.9%), Achilles Tendinitis (4.8%), tibial fractures (3.3%) and straining and tears of the triceps surae (1.3%) [6].

AIM OF THE STUDY

The aim of this research is to show the causes and locations of the most common injuries in runners. The research also aims to describe the treatments undertaken by injured runners.

MATERIAL AND METHODS

The questionnaire used in the survey did not require any assessment from the Bioethical Commission. It was created by the author of this article and consisted of 43 questions, which were divided into four areas. The research was conducted from September to the end of November 2017 during the following competitions: “Leśne Run” in Zabrze, “IX Bytom Half-Marathon” and “IV The Golden Cone Run” in Bystra.

150 people were asked to fill out a questionnaire. The group consisted of 78 women aged from 17 to 48 (mean = 27.025 ± 7.034), and 72 men aged from 21 to 64 (mean = 33.861 ± 11.485). The average age of the group was 30 (mean = 30 ± 10).

The women weighed between 47 to 85 kilograms (mean = 60.512 ± 7.792), and their heights ranged from 155 to 176 centimeters (mean = 167.641 ± 5.357). The men’s weights ranged from 60-105 kilograms (mean = 78.083 ± 10.769), and their height were between 164-196 centimeters (mean = 179.388 ± 6.909).

On the basis of body weight and height, the BMI of the questioned women was calculated. This ranged from 18 to 25 (mean = 20.1 ± 2). The men’s BMI ranged between 18 to 29 (mean = 22.1 ± 2.34).

Sixty-four percent (n = 96) of the people trained from 2 to 5 years. 26% (n = 39) of the whole group consists of those who trained from 1 to 2 years (Tab. 1).

Table 1. Period of training percentage.

Training period [years]	1-2	2-5	4-10	>10
Number of people [%]	26, n = 39	64, n = 96	4, n = 6	6, n = 9

Forty-four percent (n = 66) were the people training from 2 to 3 times a week, 34 % (n = 51) trained 4 to 5 times a week, and 7% (n = 11) trained over five times a week. (Tab. 2).

Table 2. Weekly training frequency percentages.

Weekly training frequency	1x	2-3x	3-4x	>5
Number of people [%]	15, n = 23	44, n = 66	34, n = 51	7, n = 11

Among the interviewees, 49% (n = 73) ran at least 6-10 kilometers during a training session, 43% (n = 64) ran 1-5 kilometers at a time, 7% (n = 11) ran 11-15 kilometers and 1% (n = 2) over 20 kilometers.

The maximum distance during one training session was 6-10 km for 27% (n = 41) of the respondents, 16-20 kilometers for 20% (n = 30), 11-15 kilometers for 19% (n = 28) and 20-30 kilometers for 19% (n = 29) of all groups. 11% (n = 16) covered distances above 30 kilometers during a training session. For 4% (n = 6) of the survey participants the longest distance at one time was 1–5 kilometers.

The respondents took part in different running competitions, such as: a street running (50%, n = 75), half marathon (38%, n = 57) quarter-marathon (36%, n = 54), marathon (20%, n = 30), mountain runs (19%, n = 29), obstacle running (6%, n = 9) and other runs (5%, n = 8).

RESULTS

During the previous year, 10% (n = 8) of the women and 13 % (n = 9) of the men never felt any pain. Pain appeared in 42% (n = 33) of the women and 33 % (n = 24) of the men (fig. 1).

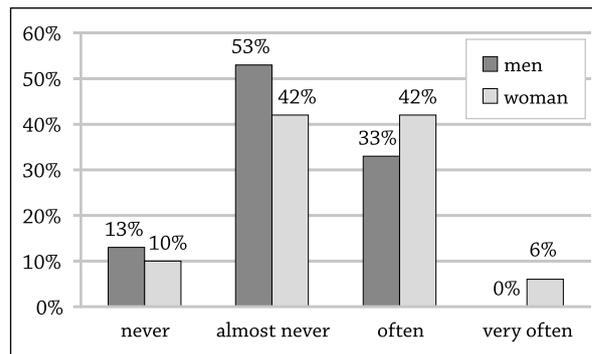


Figure 1. Pain during training in the last year differentiated by gender - percentage distribution.

The highest percentage of women who felt pain was after running 6 to 10 km, the fewest women felt pain after running 16–20 kilometers (7%, n = 5) and over 20 kilometers (7%, n = 5). 47% of the men felt pain after running the distance from 1 to 5 kilometers (fig. 2).

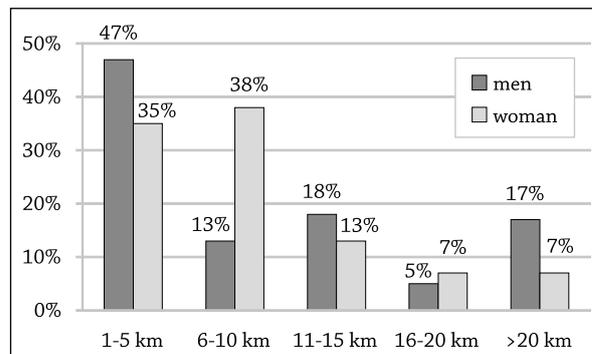


Figure 2. Distance after which pain occurs - differentiated by gender in percentage terms.

Pain in knee joints appeared in 57% (n = 86) of the respondents. Pain also appeared in the foot area (27%, n = 23), shin (24%, n = 21), calf (14%, n = 12), hip joints (12%, n = 10), lumbar spine (14%, n = 12), thoracic spine (5%, n = 4) and other (2%, n = 2).

Thirty-four percent (n = 30) of respondents held the opinion that the occurrence of pain was closely related to a previous injury. As factors causing pain, respondents identified either: one event of overtraining (34%, n = 30), insufficient warm-up, training too often (25%, n = 22), adverse weather conditions (7%, n = 6) or being in a bad frame of mind (5%, n = 4) (fig. 3).

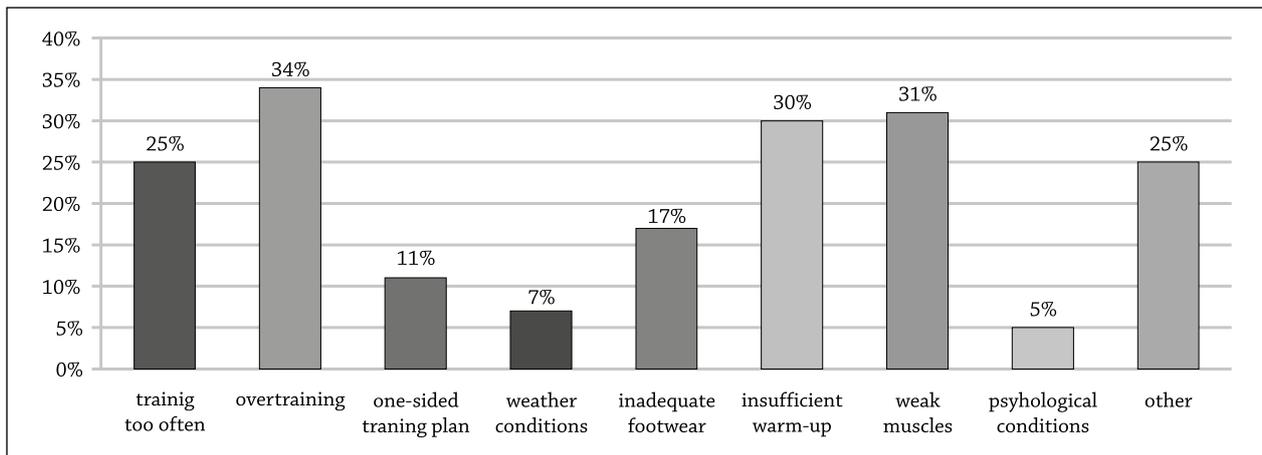


Figure 3. Causes of pain according to respondents – percentage distribution.

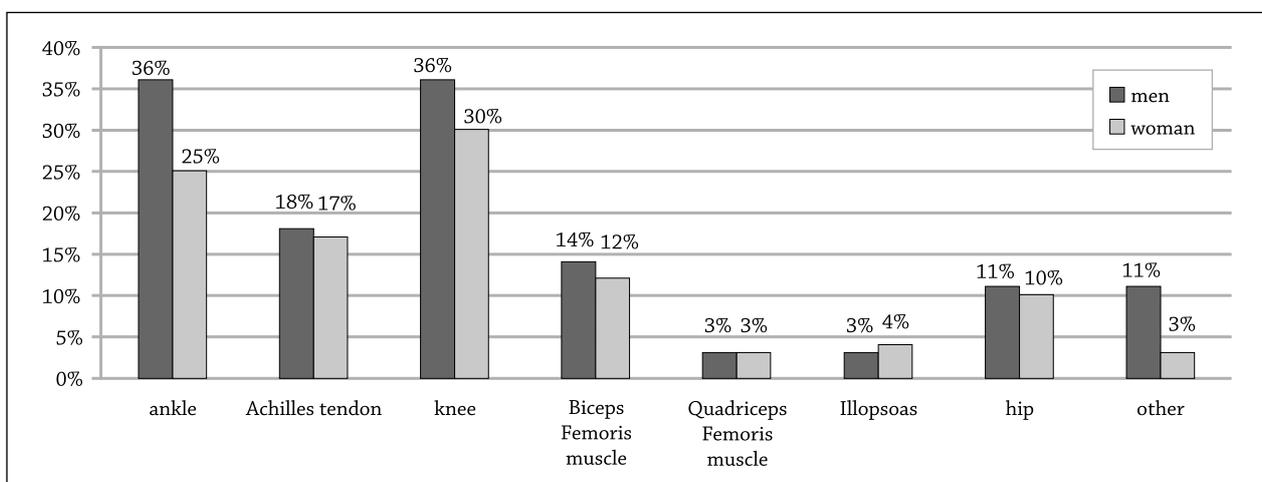


Figure 4. Location of injuries among respondents – differentiated by gender in percentage terms.

The most frequent strategy for dealing with pain was a break in training until the ailment stopped (48%, $n = 41$) and using analgesic creams (42%, $n = 36$).

During the last year, 48% of the runners sustained an injury ($n = 90$), out of which 37% ($n = 36$) were women, and 60% ($n = 54$) were men. In the group studied, the most common injuries were those affecting knee joints (36%, $n = 32$) and the ankle (32%, $n = 29$). Injuries were also located in area of the Achilles tendon (19%, $n = 17$), Biceps Femoris muscle (12%, $n = 11$), Hip joints (8%, $n = 7$), Quadriceps Femoris muscle (7%, $n = 6$), Iliopsoas (3%, $n = 3$) and other areas (20%, $n = 18$).

In the female group, the percentage of knee joint injuries was 36% ($n = 13$), ankle injuries 36% ($n = 13$), and hip joint injuries 11% ($n = 4$). Amongst the men, damage to knee joints accounted for 35% ($n = 19$) of injuries, and ankle injuries were 32% ($n = 17$) (fig. 4).

The respondents experienced either: a pulled tendon (45%, $n = 41$), sprain (33%, $n = 30$), muscle tear (29%, $n = 26$), pulled muscle (9%, $n = 8$), tendinitis (7%, $n = 6$) or another injury (15%, $n = 14$).

Ninety-eight percent ($n = 88$) of the interviewees did not require an operation. 32% ($n = 29$) started rehabilitation after suffering from the injury. 80% ($n = 72$) of the respondents expressed the opinion that the injury

could have been avoided. They mentioned the following causes of the injury: training too often (42%, $n = 38$), following one event of overtraining (42%, $n = 38$), insufficient warm-up (27%, $n = 24$), as well as other factors such as: third party interference, lack of concentration, uneven terrain.

The analysis of these results has shown that there is a statistically significant positive correlation ($r = 0.177$, $p < 0.05$) between weekly frequency of training and the number of injuries sustained in the last year. The higher the weekly frequency, the more often injures occur amongst runners.

There was a statistically significant correlation between the minimal distance covered at a time and the number of injuries ($r = 0.253$; $p < 0.05$). The longer the minimal distance at one training session, the more frequently injuries occurred. In the group studied there is a statistically significant correlation ($r = 0.233$; $p < 0.05$) between the maximum distance covered during training and the number of injuries in a year.

There is a statistically relevant association between the average weekly distance and the number of injuries in the runners ($r = 0.244$; $p < 0.05$). The longer the average weekly distance, the more injuries appeared in the examined group of runners.

DISCUSSION

Undoubtedly, running has many benefits, such as lowering the risk of cardiovascular diseases. However, negative effects of this sport should not be underestimated. Pain is usually the first sign of injury, and if one notices this symptom, it can prevent the development of serious medical consequences.

In medical literature we find information that experiencing pain is closely connected with the period of training and the distances that one runs [7,8]. The frequency of injuries among runners ranges from 18.2% to 92.4% [9,10]. It can be stated that each 1000 hours of training leads to between 6.8 to 59 injuries [11–13]. In the group of high-ranking sportspeople, the frequency of injuries varies, depending on the distance. It is 7.2% amongst sprinters, 12.8% amongst middle-distance runners and 15.6% in long-distance runners [22].

If we take training load into consideration, the most frequent injuries experienced by runners are located in the pelvis and lower limbs. In subject literature, knee injuries are most frequent among beginners (30.6%), recreational runners (22.5%) and marathon runners (26.6%) [14,15]. Injuries of the hip joint and those of the hamstrings occur the most often amongst sprinters, and are the rarest amongst cross country runners, who often experience injuries affecting lower leg muscles (30.3%) and the ankles (16.2%) [16].

Risk factors include those that are modifiable such as: the period of training, the frequency of training, a runner's preparation for training, posture, strength, physical fitness or footwear; and those that are not modifiable, such as: build, limb length or weather conditions. What may also be essential in injury prevention is the psychological aspect. In the examined group, statistically significant correlations between the number of injuries, period of training and the frequency have been found. Most factors can be modified by more conscious training, which is suited to one's capabilities and needs. In order to prevent injuries and overload, every runner should pay careful attention to their posture during training [17,18]. In order to prevent musculoskeletal overload and injuries, one should even consider details such as running on both sides of the street. Running on just one side causes pelvic tilt, curvature of the lumbar spine and asymmetrical load on the hips, knees and ankles. Distance and duration of running also should not be increased

to more than 5 to 10%. During the initial phases of training this is not significant, but for distances further than 15 kilometers, this helps avoid overtraining injuries [19].

Ewa Brzozowska's study conducted on 113 professional sprinters, revealed that runners react to injuries in different ways. The most common reactions are to stop training in order to recover, undergo pharmacological treatment or physiotherapy. In the group studied, 32% of injured runners used a physiotherapist's assistance. Amongst them, over half did not continue training, allowing their bodies to recover. An appropriate length of recuperation is crucial to completely recover from an injury. If the time of recuperation is shorter than necessary, there is a high likelihood of suffering the injury again in the same location [20].

Running is rewarding, character forming and, with time, becomes an essential element to an individual's life. Bearing in mind the high rate of injuries amongst runners, taking preventive measures should be considered. These could be achieved by educating the public on the physiology and mechanics of running, paying attention to early signs and using physiotherapy. Suiting the training schedule to one's capabilities and extending one's knowledge on preventing injuries could save many runners from ailments.

There are several limitations of this study which may have contributed to the data collected. The sample surveyed is small ($n = 150$) and could not be contributed to some statistically significant correlations. Furthermore, the questionnaire was filled during the competition and factors such as fatigue and stress may have an impact on the reliability of the answers. This study involved a cross section of community runners in one Silesian Voivodeship area and is not necessarily generalizable to other geographical regions.

CONCLUSION

This study shows that both the occurrence of pain and injury depends on many factors. A frequent cause of any disturbances within the musculoskeletal system is overloaded soft tissues caused by overtraining. Injuries are most often caused by either training too frequently, a specific event of overtraining or insufficient warm-ups. Lower limbs, particularly knee joints, are most at risk.

REFERENCES

- Lopes AD, Costa LO, Saragiotto BT, Yamato TP, Adami F, et al. Musculoskeletal pain is prevalent among recreational runners who are about to compete: an observational study of 1049 runners. *J Physiother* 2011; 57(3): 179–182.
- Chandy TA, Grana WA. Secondary school athletic injury in boys and girls: a three-year comparison. *Phys Sports Med* 1985; 13: 106–111.
- Reinking MF, Austin TM, Hayes AM. A survey of exercise – related leg pain in community runners. *Int J Sports Phys Ther* 2013; 8(3): 269.
- Wilder RP, Magrum E. Exertional compartment syndrome. *Clin Sports Med* 2010; 29(3): 429–435.
- Kluitenberg B, Middelkoop M, Diercks R, Van der Worp H. What are the differences in injury proportions between different populations of runners? A systematic review and meta-analysis. *Sports Med* 2015; 45: 1143–1161.
- Taunton JE, Ryan MB, Clement DB, McKenzie DC, Lloyd-Smith DR, et al. A retrospective case-control analysis of 2002 running

- injuries. *Br J Sports Med* 2002; 36: 95–101.
7. International Association for the Study of Pain. Subcommittee on taxonomy of pain terms: a list with definitions and notes on usage. *Classification of chronic pain* 1979; 6: 249–252.
 8. Barber FA, Oothby MH, Troop RL. Z-plasty lengthening for iliotibial band friction syndrome. *J Knee Surg* 2007; 20(4): 281–284.
 9. Van Middelkoop M, Kolkman J, Van Ochten J, Bierma-Zeinstra SM, Koes B. Prevalence and incidence of lower extremity injuries in male marathon runners. *Scand J Med Sci Sports* 2008; 18(2): 140–144.
 10. Bovens AM, Janssen GM, Vermeer HG, Hoebregts JH, Janssen MP, et al. Occurrence of running injuries in adults following a supervised training program. *Int J Sports Med* 1989; 10(3 Suppl.): 186–190.
 11. Buist I, Bredeweg SW, Bessem B, van Mechelen W, Lemmink KA, et al. Incidence and risk factors of running-related injuries during preparation for a 4-mile recreational running event. *Br J Sports Med* 2010; 44(8): 598–604.
 12. Rauh MJ, Koepsell TD, Rivara FP, Margherita AJ, Rice SG. Epidemiology of musculoskeletal injuries among high school cross-country runners. *Am J Epidemiol* 2002; 163(2): 151–192.
 13. Sieverdes JC, Sui X, Lee DC, Hooker SP, Blair SN. Independent and joint associations of physical activity and fitness on stroke in men. *Phys Sportsmed* 2011; 39(2): 119–126.
 14. Askling C, Tengvar M, Saartok T, Thorstensson A. Sports related hamstring strains – two cases with different etiologies and injury sites. *Scand J Med Sci Sports* 2000; 10: 304–307.
 15. Cona G, Cavazzana A, Paoli A, Marcolin G, Grainer A, et al. It's a matter of mind! Cognitive functioning predicts the athletic performance in ultra marathon runners. *PLoS ONE* 2015; 10(7): e0132943. doi:10.1371/journal.pone.0132943.
 16. Clanton TO, Coupe KJ. Hamstring strains in athletes: diagnosis and treatment. *J Am Orthop Surg* 1998; 6: 237–248.
 17. Allen DJ, Heisler H, Mooney J, Kline R. Original research the effect of step rate manipulation on foot strike pattern of long distance runners. *Int J Sports Phys Ther* 2016; 11(1): 54–63.
 18. Luedke LE, Heiderscheit BC, Williams B, Rauh MJ. Association of isometric strength of hip and knee muscles with injury risk in high school cross country runners. *Int J Sports Phys Ther* 2015; 10(6): 868–876.
 19. Hadała M. Ekscentryczna niewydolność mięśnia pośladkowego średniego, jako częsta przyczyna urazów stawu kolanowego w sporcie na podstawie Kinetic Control. *Prakt Fizjoter Rehabil* 2012; 34: 58–63. (in Polish).
 20. Brzozowska E. Charakterystyka rodzaju i częstotliwości występowania urazów u zawodników trenujących biegi krótkie. *Rozprawy Naukowe Akademii Wychowania Fizycznego we Wrocławiu* 2013; 43: 66–72. (in Polish).

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