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# Injuries in runners

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## ABSTRACT

Sixty runners belonging to two clubs were followed for 1 year with regard to training and injury. There were 55 injuries in 39 athletes. The injury rate per 1,000 hours of training was 2.5 in long-distance/marathon runners and 5.6 to 5.8 in sprinters and middle-distance runners. There were significant differences in the injury rate in different periods of the 12 month study, the highest rates occurring in spring and summer. In marathon runners there was a significant correlation between the injury rate during any 1 month and the distance covered during the preceding month ($r = 0.59$). In a retrospective analysis of the cause of injury, a training error alone or in combination with other factors was the most common injury-provoking factor (72%). The injury pattern varied among the three groups of runners: hamstring strain and tendinitis were most common in sprinters, backache and hip problems were most common in middle-distance runners, and foot problems were most common in marathon runners.

Injuries in runners are almost exclusively exertion injuries. Apart from ankle sprains, trauma is rare. In this respect runners' injuries differ from soccer and other injuries, and knowledge about injury predisposing factors in soccer[2] cannot therefore be applied to running. On the basis of experience in treatment of runners' injuries, James et al.[6] assert that training errors are the most common cause of injury. To analyze injury predisposing factors, a prospective study of a defined population of runners is necessary. In an extensive prospective study, Orava[9] discussed causes and treatment of exertion injuries in athletes. Two-thirds of Orava's injuries, assembled prospectively, were seen in track and field athletes or joggers treated together with other athletes at a Finnish sports medicine center which served an unknown population of competitive and recreational athletes.

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In the present study, only injuries in a defined group of runners, comprising all categories from sprinters to marathon runners, were included. All aspects of training and all injuries were carefully noted. This made it possible to calculate the incidence of injury in relation to training exposure, to study injury-provoking factors in training and competition, and to compare differences in injury pattern between different groups of runners.

## MATERIALS AND METHODS

The series comprised 60 runners, 44 men and 16 women belonging to two local track and field athletic clubs. A few were competing at international level, and the others were top or average district athletes. Sprinters, middle-distance runners, and long-distance/marathon runners were included (Table 1). Previous experience of training (7 hours per week or more) varied between 1 and 32 years. Only a few women were competitive long-distance or marathon runners, so in this category only men were included in the study.

All runners recorded in detail their training and competition, month for month, over a period of 1 year, and their reports were analyzed by one of us (JW). Any injuries that markedly hampered training or competition for at least 1 week were noted. All athletes with such injury were examined at least once by JL, who made a diagnosis and scrutinized the training reports for possible injury predisposing factors.

Statistical analysis was done using the student's *t*-test, the chi square test, and the linear regression test.

TABLE 1
Sex, mean age, and experience of training (7 hours per week or more) of runners included in the study

| | Sprinters | Middle-distance runners | Long-distance/ marathon runners |
|---|---|---|---|
| No. | 19 (12 males, 7 females) | 13 (9 males, 4 females) | 28 (all male) |
| $\bar{x}$ age | 20.6 ± 3.8 | 18.6 ± 2.4 | 34.5 ± 7.4 |
| $\tilde{x}$ median experience (years) | 4 | 3 | 5 |

## RESULTS

The mean number of workouts per month varied between 16 and 21 (Table 2), the normal, active, work-out time being 1 hour. In middle-distance and long-distance/marathon runners, endurance training predominated (75% and 99%, respectively). Sprinters' training was more differentiated, and included sprints and endurance training, and strength, technique, and flexibility exercises.

Fifty-five injuries occurred in 39 of the 60 runners (65%). The number of injuries per 1,000 hours of training varied between 2.5 and 5.8 (Table 3). Each runner had an average of 1.6 to 1.9 days of involuntary rest due to injury per month (Table 2). There were significant ($P < 0.001$ to 0.05) variations in the incidence of injury over different periods of the 12 month study (Fig. 1). Injuries were most common during spring and summer. In long-distance/marathon runners, the only difference in training intensity over the year concerned distance. A significant relation (r = 0.59, Fig. 2) was found in long-distance/marathon runners between the distance covered during a given month and the number of injury days the following month. No significant relation emerged between distance run and injury days during the same month.

The diagnoses are listed in Table 4. The injury pattern varied among the three groups of runners. Hamstring strains and tendinitis were significantly more common in sprinters (9/21) than in middle-distance and long-distance runners (1/34) ($P < 0.001$).

Injuries of the foot were significantly more common in long-distance/marathon runners (6/18) than in sprinters and middle-distance runners (1/37) ($P < 0.002$). Back and hip injuries were more common among middle-distance and long-distance/marathon runners (7/34) than in sprinters (0/21) ($P < 0.05$).

Among sprinters, 2 of 12 injuries occurred during competitions; all others were training related. There was no significant difference in injury rate between men and women. However, the women tended to sustain more injuries; only

TABLE 2
Number of work-out days and number of days of planned or involuntary rest (illness, injury; mean values) per 30 day period

| | Sprinters | Middle-distance runners | Long-distance/ marathon runners |
|---|---|---|---|
| Workout | 16.0 | 18.1 | 20.7 |
| Rest | 10.1 | 6.5 | 6.8 |
| Sick leave | 2.3 | 3.8 | 0.6 |
| Injury | 1.6 | 1.6 | 1.9 |

TABLE 3
Injuries over a 12 month period in 60 runners[a]

| | Sprinters | Middle-distance runners | Long-distance/ marathon runners |
|---|---|---|---|
| No. injuries ($N$) | 21 | 16 | 18 |
| $N$/1,000 hours | 5.8 | 5.6 | 2.5 |
| No. injured athletes | 13 (68%) | 10 (77%) | 16 (57%) |

[a] About two-thirds of the runners sustained at least one injury.

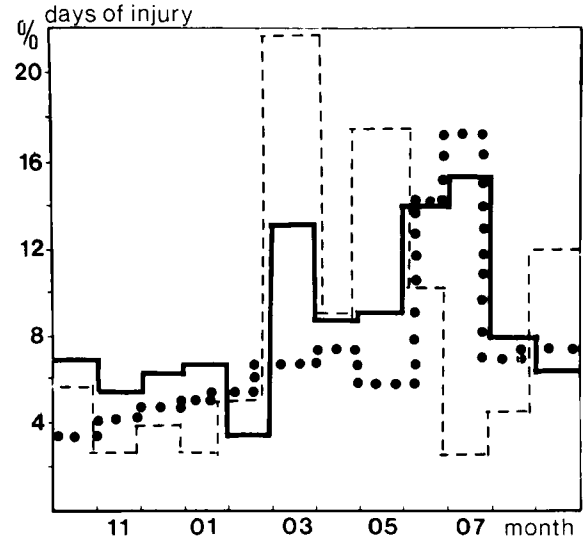


**Figure 1.** Days of injury (%) over the period October 1981 to September 1982 in sprinters (—), middle-distance runners (----), and long-distance or marathon runners (. . . .).

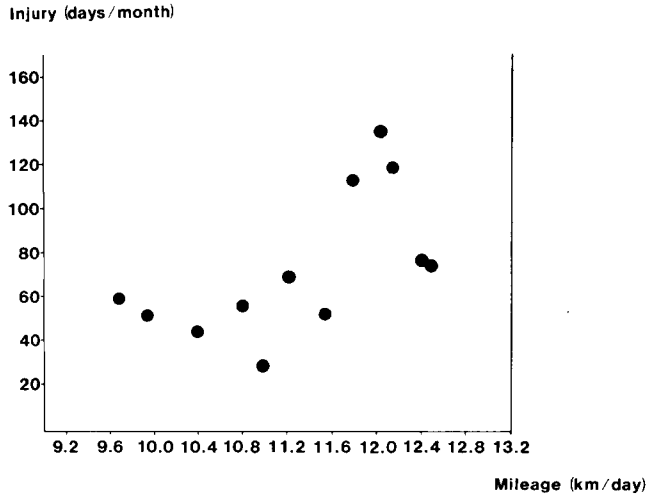


**Figure 2.** Total number of injury days (rest or restricted activity) in 28 long-distance or marathon runners in relation to distance (kilometers per available training day, injury days excluded) during the preceding month.

1 of 11 sustained no injury, and 6 of 11 had two or more, as compared to 8 of 21 and 5 of 21 among the men (not significant).

In 38 of 65 injuries (69%), one or more possible injury-causing factors were identified: a training fault (excessive distance, sudden change of training routines) was the cause in 72% of the injuries, and in 39% the cause was multifactorial (Fig. 3).

## DISCUSSION

Any injury can be said to be caused by intrinsic and extrinsic factors, either alone or in combination. In exertion injuries,

TABLE 4
Diagnosis of 55 injuries in 39 runners

| Site | No. |
|---|---|
| Hip/back | |
| Low back pain | 3 |
| Hip trochanteritis | 2 |
| Hip adductor tendinitis | 2 |
| Hamstrings | |
| Strains | 6 |
| Tendinitis | 4 |
| Knee | |
| Patellofemoral pain | 3 |
| Jumper's knee | 3 |
| Iliotibial tract syndrome | 1 |
| Leg/ankle | |
| Medial tibial stress syndrome | 8 |
| Achilles tendinitis | 5 |
| Tibialis posterior tendinitis | 2 |
| Gastrocnemius strain | 2 |
| Gastrocnemius tendinitis | 1 |
| Foot | |
| Plantar fasciitis | 4 |
| Toe tendinitis | 2 |
| Metatarsalgia | 1 |
| Miscellaneous injuries | |
| Ankle sprains | 6 |

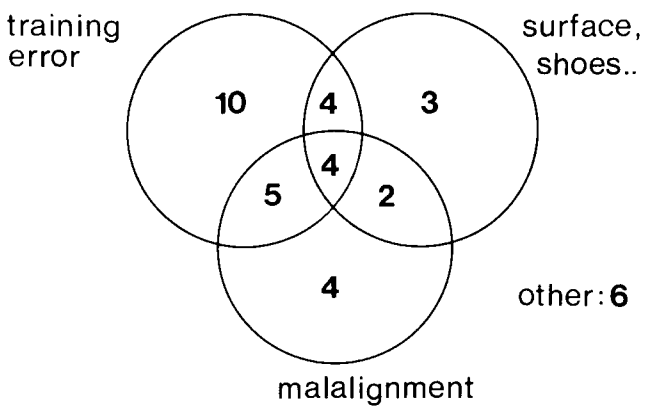


**Figure 3.** Retrospective analysis of the cause of 38 injuries. In the remaining 17 injuries no cause was found. By malalignment is meant foot insufficiency ($N$ = 8), lower extremity muscle stiffness ($N$ = 5), genu varum ($N$ = 1), and high Q-angle ($N$ = 1).

an interplay between the two is probable. Piederman[11] differentiated exertion injuries between primary exertion injuries with no identifiable intrinsic factor, and secondary exertion injuries, in which a congenital or acquired deformity was present. Similar ideas about the cause of exertion injuries have been proposed,[6,9,12] but little substantial evidence for this plausible hypothesis has been offered. The present study of injuries in runners mainly concerns extrinsic factors, and also provides data on the incidence of injury in a defined population of runners. Intrinsic factors are no less important, and have been studied by us and others.[5,7,8,15]

Over the 12 month period, two-thirds of the runners sustained at least one injury. The incidence per 1,000 hours of activity varied between 2.5 and 5.8, which is less than figures reported for soccer.[1,4,14] The lowest injury rate was seen among long-distance/marathon runners, even though they had as many days of involuntary rest (due to injury) as sprinters and middle-distance runners. The probable explanation is that the duration of symptoms preventing the usual training was longer in long-distance runners.

The frequency of injuries varied over the year, the highest incidence not surprisingly occurring during spring and summer, when training and competition are most intense. A similar variation in injury rate was reported by Orava and Puranen,[10] and in soccer players by Ekstrand and Gillquist.[3] In long-distance/marathon runners, increased training intensity was equivalent to increased distance. In this group, a significant relation emerged between the injury rate during a given month and the distance covered during the preceding month. This is logical, because a delay between an increased distance, the onset of symptoms, and the runners' acceptance of the injury as hampering training was commonly seen.

In the present study, the injury patterns varied among different groups of runners. Sprinters sustained significantly more injuries to the hamstrings than did runners in other categories, possibly because this muscle group is of particular importance for fast running.[13] The long-distance runners had significantly more foot problems, while long-distance and middle-distance runners showed significantly more low back pain and hip problems. The patterns of injury have previously been reported for certain categories of athletes,[9] including distance runners,[6] but reports on injuries in sprinters have been sparse. The injury patterns of Orava[9] and James et al.[6] are similar to ours in long-distance and middle-distance runners, the only difference being that they reported a rather higher frequency of knee injuries.

The differences in injury incidence, localization of injuries, and in particular, the proven relation between distance and injury rate in long-distance runners all indicate the importance of extrinsic and activity-related factors in causing injury. It is therefore not surprising that retrospective analysis of the causes of injury shows that training errors (excessive distance, sudden change in training routine, etc.) are the most common factors. It should be noted that intrinsic factors (malalignment, etc.) were also involved in 40% of our cases. Further investigation is needed of some important intrinsic factors.

## ACKNOWLEDGMENTS

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