Injuries in Australian Army Recruits. Part II: Location and Cause of Injuries Seen in Recruits

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Three hundred fifty male recruits were randomly allocated to either the standard recruit training program (N=180) or substituted a weighted-march activity for all formal run periods (N=170) in the physical training program. All injuries were seen at a single medical facility, and the cause, location, and severity of injury were recorded in the medical documents. Lower-limb injuries constituted 79.8% of all Run injuries and 61.1% of all Walk injuries. Foot (18.9%), knee (16.7%), ankle (13.3%), and shoulder (8.9%) were the most common sites of injury in the Walk group. In the Run group, the most common sites were knee (32.1%), ankle (18.3%), foot (11.9%), and shin (7.3%). There were two stress fractures (tibial) in the Run group and none in the Walk group, giving the Run group an incidence of 1.1%. There were 10 medical discharges in the Walk group and 16 in the Run group. Ten (62.5%) of the Run and 2 (20%) of the Walk discharges were due to lower-limb causes. Of these, only 1 (10%) of the Walk and 4 (25%) of the Run injuries were not considered to be pre-existing conditions. Marching (30.0%), physical training (25.5%), and the obstacle course (11.1%) were the most frequent causes of injury in the Walk group. In the Run group, the leading causes were running (36.6%), physical training (19.2%), and the obstacle course (14.6%). Running was the major cause of knee injury in the Run group (17/35), whereas physical training was the major cause of knee injury in the Walk group (5/15). Running was also the major cause of other lower-limb injuries in the Run group (19/38), whereas marching was the major cause in the Walk group (19/50). Lower-limb injuries were more frequent in the Run group, with running cited as the major cause of these injuries.

Introduction

Most injuries in civilian runners occur in the lower limb. van Mechelen noted that that 70 to 80% of all running injuries were at or below the knee, with the knee itself involved in 25 to 40% of cases. The lower limb has been reported as the most common site of injury in a number of studies in military trainees. Lynch-Blosse found that lower-limb injuries accounted for 58.2% of medical discharges in British Army recruits, with knee injuries being the single most common cause (35%). Only 40% of the lower-limb discharges were thought to be a consequence of training. Eighty-nine percent of all training-related medical discharge was due to lower-limb or back injury.

Lower-limb injuries were responsible for 40% of all injuries reported by Australian Army soldiers between 1987 and 1991. Physical training and sports accounted for 40% of all reported injuries during that period. This study sought to determine any differences in the reported sites or causes of injury in a group of recruits whose physical training had a reduction in running distance.

Materials and Methods

Study Design

This study was a randomized, controlled trial comparing a group of recruits who underwent a standard Australian Army physical training program based on running with a group who substituted weight-load walking in all programmed running periods. There were no other formal differences in the training program.

The groups were followed prospectively for the duration of a 12-week recruit course. Data on the nature, incidence, cause, and associated morbidity of injury were collected, and various physiological parameters were also measured.

The recruits were given an information sheet detailing the aims of the study, and this was reinforced with a verbal briefing. All gave written consent for participation.

Sample Selection

Recruits were randomly allocated into platoons of approximately 45 by Department of Defence recruiting personnel in Wagga Wagga during March and April 1989. The names were grouped alphabetically after clearance through the processing procedure. The recruits were drawn from all over Australia and ranged in age from 17 to 31 years, with an average age of 19.1 years. They were all male.

Two paired platoon groups were enrolled during a given week, and a platoon was randomly assigned to be either a Walk or a Run group. Four pairs of platoons were enrolled over 4 consecutive weeks. There were 170 subjects in the Walk group and 180 in the Run group.

Training Program

The standard physical training program has already been detailed. The physical training program was designed to prepare recruits to complete the Army basic fitness assessment. This consisted of a 5-km run in less than 25 minutes, a chin-up activity, and a sit-up activity. It also sought to prepare them for the physical demands of field training. The Walk group was required to pass this test, and run a 5-km trial in week 3 and the test run in week 6. The Run group participated in these and additional periods of running.

The Weight-Load Walking Program

The Walk group substituted a walk activity wherever a run activity was programmed in the physical training program. The weight-load walking schedule has already been detailed.
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Table I shows all recorded injuries listed by location. There were significantly more lower-limb and knee injuries in the Run group than in the Walk group. There were significantly more shoulder injuries in the Walk group than in the Run group (χ² = 5.28, p = 0.022). There were no other statistically significant differences in the frequency of other injuries.

Table II shows the distribution of injuries by region. Lower-limb injuries accounted for 62.3% of all Walk injuries and 79.8% of all Run injuries. A higher percentage of upper-limb injuries was seen in the Walk group, and this was most likely due to the carriage of the weighted backpack.

Cause of Recorded Injury

Table III shows the recorded causes of injury for the two groups. Running was the single most common cause of injury in the Run group, whereas marching was the leading cause in the Walk group.

Running (25%), physical training (PT, 19%), and the obstacle course (14%) were the most common causes in the Run group, whereas marching (30%), PT (25%), and causes not specified (13%) were most frequent in the Walk group.

The number of injuries caused by running and PT was 61 (55.8%) in the Run group and 28 (31%) in the Walk group. When all the related physical training activities (running, marching, obstacle course) are combined, they were responsible for 72.1% of all injuries in the Walk group and 76.8% in the Run group. Therefore, the physical training component of recruit training generated the overwhelming majority of injuries.

Excluding blisters, there were 19 march-related injuries in the Walk group and 39 running-related injuries in the Run group. There was a highly significant increase in the number of running-related injuries seen in the Run group, whereas the number of march injuries was significantly greater in the Walk group. All other causes were not statistically different. Of particular note was the high number of injuries specifically attributed to the 5-km run in the Run group.

Running/PT was responsible for 22 (62.8%) knee injuries and whereas marching (30%), PT (25%), and causes not specified (13%) were most frequent in the Walk group.
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TABLE IV
THE CAUSES OF KNEE, OTHER LOWER-LIMB, AND BACK INJURY IN THE RUN AND WALK GROUPS

<table>
<thead>
<tr>
<th>Cause</th>
<th>Run</th>
<th>Walk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical training</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>Running</td>
<td>13</td>
<td>12</td>
</tr>
<tr>
<td>5-km run</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>Marching</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Obstacle course</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Field training</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>35</td>
<td>58</td>
</tr>
</tbody>
</table>

30 (51.7%) lower-limb injuries in the Run group. In the Walk group, running/PT was the cause of 6 (42.9%) knee injuries and 14 (28%) lower-limb injuries. Running/PT was the single major cause of knee injury in both the Walk and Run groups, and this was despite formal distance running being forbidden in the Walk group. Running activities would appear to place the knee at significantly greater risk of injury than marching.

Causes of Medical Discharge

Table V shows that pre-existing injury was a major factor in medical discharges for both groups. There were four new training-related injuries leading to discharge in the Run group and 1 in the Walk group.

Tables VI and VII show the specific causes of medical discharge in both groups. The new injuries in the Run group were caused by running, the obstacle course, and a fall during field training. The single new injury in the Walk group was caused by a fall from a wall during an obstacle course crossing.

Pre-existing injuries were major contributing factors to medical discharge in both groups. PT and running were the major causes of exacerbation in the Run group, whereas PT and backpack marching were the major precipitants in the Walk group.

Ten of the 16 discharges (62.5%) in the Run group were for lower-limb causes, whereas 2 of the 10 walkers (20%) were discharged for lower-limb injury. PT/running was responsible for 8/16 (50%) of the Run discharges and 3/10 of the Walk discharges.

Back and shoulder injuries were the major causes of discharge in the Walkers. Three of the Walk discharges were specifically attributed to backpack marching, whereas both shoulder injuries were attributed to PT.

Discussion

The location and cause of injury was markedly different in the two groups. Lower-limb injuries constituted 80% of all Run injuries and 62% of all Walk injuries (excluding blisters). Running was the major cause of knee and lower-limb injury in the Run group, whereas marching and physical training were the leading causes of lower-limb injury in the Walk group.

These results are consistent with the findings of epidemiological studies in runners. The knee accounted for 25 to 40% of all civilian injuries, followed by the shin (6-31%), ankle (9-20%), feet (2-22%), and lower leg (2-30%).

The incidence of knee (33.3%) and ankle (18.0%) injuries in the Run group was similar to the incidence reported in the civilian running community, whereas the Walk group had significantly fewer knee injuries.

There were more foot and shoulder injuries in the Walk group, with the increase in foot problems partly explained by a small
excess of blister injuries. The significant increase in shoulder injuries was probably due to the carriage of the weighted pack.

Surprisingly, there was no increase in back injury seen in the Walk group despite the carrying of heavy packs. However, four medical discharges for back injury (all pre-existing) were seen in the Walk group.

Thus, the injury profile of the Run group closely resembled that of civilian runners. This suggests that the mechanisms of injury were similar and related to the running activity.

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Running and PT were the two major causes of injury in the Run group. These two activities accounted for 55.8% of all injuries in the Run group and 31% of all injuries in the Walk group. Marching accounted for 30% of Walk injuries and 6.3% of Run injuries.

Of note was the low level of injury reported during field training activities: only 5% of total reported injuries in both groups. This is somewhat ironic because field training is the most occupationally relevant part of recruit training, yet the least injurious. The obstacle course caused between 10 and 14% of all injuries and was responsible for two of the five medical discharges not due to pre-existing causes.

When the specific causal relationships were examined in the Run group, running and PT were responsible for 62.8% of all knee injuries, with the obstacle course responsible for another 24%. In the Walk group, running and PT were responsible for 43% of all knee injuries and the obstacle course was responsible for 14%.

In the Run group, running was the single most common cause of knee injury, accounting for nearly half, whereas PT was the major cause in the Walk group. The obstacle course was also a major cause of knee injury in the Run group, and to a lesser extent in the Walk group.

The majority of recruits were medically discharged as a consequence of injury, with only 10% of discharges in the Walk group and 25% of discharges in the Run group due to illness. In all cases, these were pre-existing conditions (asthma, migraines). There was only one new training injury that resulted in medical discharge in the Walk group, and four in the Run group; all were injuries to the lower limb.

Back pain was the major cause of medical discharge (40%) in the Walk group, but these were all pre-existing conditions. It could be argued that the carriage of a weighted pack acted as a functional test of back capacity. The aggravation of pre-existing back injuries may have been a blessing in disguise by identifying potential medical liabilities early in the military training.

There were no stress fractures reported in the Walk group and two in the Run group. The incidence of stress fracture was 1.1%, which is consistent with U.S. Army studies indicating an incidence of 1 to 2% in recruits, but much lower than the incidence in Israeli recruits, in whom rates of 30% have been reported. Both stress fractures were in the tibia, which is the classic site of stress fracture in civilian runners.

Jordaan and Schwellnus noted that knee injury and stress fractures were the two most common injuries in South African recruits and resulted in the greatest number of lost days training. They argued that prevention of these would have the greatest impact on recruit training morbidity.

Jefferson noted that there were 897 British Army recruits medically discharged in 1988. With 5,563 discharges and an intake of approximately 20,000, the British Army had a total recruit wastage of 27%. Medical discharges accounted for 16.7% of all discharges and 4.5% of the total intake. Fifty-four percent (486) of all recruit medical discharges were due to lower-limb or back causes.

Jefferson calculated the total cost of these medical discharges to be GBP£14,318,000 and noted that a 1% decrease in wastage would yield a saving of GBP£143,000.

In the Australian Army, the cost of acquiring and enlisting a recruit has been estimated at approximately A$20,000 (personal communication). The 26 medical discharges in this study therefore represent a loss of A$520,000. This does not include medical treatment, rehabilitation, or pension costs post-discharge.

High rates of medical wastage are a concern for most western armies. With volunteer forces and shrinking defense budgets, the challenge is to train recruits with maximum efficiency and minimum loss. The results of this study indicate that running and physical training are the major causes of lower-limb injuries, which in turn are the major cause of both injury and discharge in the Australian and British armies.

Within the military training environment, the aim is to convert a very heterogeneous group into a homogeneous one. A high standard is set, but the high reported rates of injury suggest that the physical training component may be inappropriate, particularly in the light of more modern methods (e.g., interval training).

A review of physical training programs for military recruits is indicated. Such a review is currently in progress in the Australian army. Reductions in running distance and the development of physical training progression during the early weeks of training are likely to avoid overtraining and prevent large numbers of lower-limb injuries.

References