Equal opportunities, equal risks? Overuse injuries in female military recruits

Beverly P. Bergman and Simon A. St J. Miller

Abstract

Background The rate of female personnel medically discharged from service in the British Army has been rising steadily since 1992 from around 3 per 1000 per year to over 35 per 1000 in 1996, although there has been only a minor increase in medical discharges for males over the same period. This paper examines the increasing rate of medical discharge in young female members of the British Army from an aetiological perspective and reviews the literature to identify risk factors that may be relevant.

Methods Data from published military medical statistical reports were reviewed and the clinical records of a 10 per cent sample of females medically discharged for relevant conditions were examined.

Results The majority of the excess medical discharges had occurred in females under the age of 22 and were due to musculoskeletal disorders and injuries caused by military training. Data from the clinical records showed that 75.5 per cent (37/49) of those medically discharged for these conditions were recruits. Stress fractures and other overuse syndromes accounted for 70.2 per cent of medical discharges among the recruits in the sample.

Conclusion Females undertaking strenuous exercise alongside males are at increased risk of injury. Risk factors include smoking, short stature, restricted dietary intake and menstrual disturbance. Equal opportunities legislation has been interpreted to require identical training for males and females, but some segregation of training may be acceptable provided the outcome of training is no less favourable to either gender, and this may reduce the excess risk of injury to females.

Keywords: female, military, injuries, overuse

Introduction

The rate of female personnel medically retired (‘medically discharged’) from service in the British Army has been rising steadily since 1992 from a baseline of around 3 per 1000 per year to over 35 per 1000 in 1996. Published tables show that the increase has been especially marked for those under the age of 25. By comparison, there has been only a minor increase in medical discharges for males over the same period.

Each year about 34 000 young people make initial enquiries about a military career at an Army Careers Information Office. About 6000 do not pursue their initial enquiry but the remainder go forward to begin the selection process. While at the Army Careers Information Office, they complete a preliminary medical screening questionnaire, as some pre-existing medical conditions are incompatible with military service. It is particularly important that individuals who have no chance of acceptance are screened out early to avoid premature relinquishment of civilian employment and subsequent disappointment.

Around 3500 applicants are rejected on medical grounds as a result of this preliminary filter, and approximately 24 000 go forward to attend a Recruit Selection Centre for more in-depth tests. Here they undergo a battery of tests including general intelligence and aptitude, fitness and a comprehensive medical examination. The medical examination has two purposes: to identify those whose health would make them unsuitable for military service, and to document each individual’s baseline health status on entry to the Army. Military personnel have to be robust enough to undergo strenuous training in all weathers and under adverse conditions without prejudice to their health. They are also likely to be operating in conditions where medical facilities are less sophisticated than in the United Kingdom, and such conditions would be unsuitable for an individual who has a pre-existing medical problem that may dictate ready access to medical care. For these reasons, the medical criteria are strict, and a total of about 25 per cent of all applicants or 7500 of the initial 28 000 formal applicants fall at this hurdle.

About 16 000 young people each year go forward to begin training, and currently about 12 per cent of these are female, although females make up only around 7 per cent of the trained strength of the Army, reflecting lower recruiting figures in the past. Basic training takes place at one of the Army’s five Army Training Regiments and is identical for all soldier entrants, male and female, regardless of their eventual occupation. Around 12 per cent of individuals who enter basic training fail to complete it. Of those who leave before completion, the majority exercise their right to change their mind (known as Discharge As Of
Right) having opted not to follow a military career. A small number are discharged for disciplinary reasons. However, about 1000 young people are discharged from basic training each year on medical grounds. Around 300 of these are found to be suffering from pre-existing conditions that are incompatible with military service but were not declared on entry, for example asthma, concealed on the screening questionnaire and at the entry medical examination, which becomes clinically manifest during early training. Amongst the remainder, injuries predominate, and many of these are overuse injuries such as stress fractures, shin splints and anterior knee pain.

Data on medical retirements from the Armed Forces are routinely collected by the Defence Analytical Services Agency (DASA) and are highly reliable as the medical database is cross-referenced to the Army’s master personnel database. Microfilmed copies of the clinical summaries on all medically discharged personnel are held centrally by DASA and the diagnoses are ICD coded. All injuries are additionally coded to show aetiology using the NATO Forces External Cause of Injury supplement to ICD. Anonymized data on medical discharges are published annually and can be examined for trends.

Several years ago, it was noted that the rate of medical discharge for female personnel was rising, and that this increase was not mirrored for male personnel. Preliminary analysis of the published DASA statistics confirmed that the increase in medical discharges was predominantly in females (Fig. 1), that most were under the age of 22 (Fig. 2), and that the majority of discharges were for musculoskeletal disorders and injuries as a result of military training (Fig. 3).

This paper examines the increasing rate of medical discharge in young female members of the British Army to seek common aetiological and demographic factors, and reviews the literature to identify risk factors that may be relevant to this population group.

**Method**

Individuals were included in the study if the recorded reason for medical discharge was musculoskeletal disorder, which was defined as a diagnosis in the ICD-9 range 710–739, or injury as shown by the presence of a NATO injury code in addition to the ICD code. ICD-9 codes were used to retain compatibility with earlier records. Demographic and clinical data were extracted from a 10 per cent sample of the microfilm medical discharge

![Figure 1](image1.png) British Army medical discharges 1986–1996, all causes. ◆, males; □, females.

![Figure 2](image2.png) Age at onset of symptoms (from 10 per cent sample). Females medically discharged for injury or musculoskeletal disorder 1989–1996. Bars, number of discharges; ◆, cumulative percentage of total.
summarizes for females who had been discharged for these conditions between 1989 and 1996. Data analysis was performed using Epi Info and Microsoft Excel™. Ethical approval for access to clinical records was obtained from the Army Medical Services Research Executive (now the Defence Medical Services Clinical Research Committee).

**Results**

Examination of the records of a 10 per cent sample of females discharged for these conditions showed that 75.5 per cent (37/49) were of recruit status. Of the 37 recruits in the sample, 26 (70.2 per cent) were medically discharged for stress fracture or other overuse syndromes. Seventeen (45.9 per cent) of the female recruits had overuse conditions affecting the knee, lower leg or foot. Four had sustained pelvic stress fractures. The majority of the remainder had injuries resulting from trips and falls. Among trained (non-recruit) females, falls were the commonest single cause of injury leading to medical discharge, accounting for 33.3 per cent of cases (4/12), whereas overuse injuries accounted for only three discharges in this group. The main results are summarized in Table 1 and show that recruit status is strongly associated with medical discharge for overuse conditions [OR 7.09 (95 per cent confidence interval 1.36–41.46), \( \chi^2 = 7.69, p = 0.005 \)].

![Figure 3](image-url)  
**Figure 3** Female medical discharges 1986–1996 by diagnostic group. White bars, training injuries; black bars, all other injuries; grey bars, all musculoskeletal disorders; striped bars, other diseases.

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**Table 1** Medical discharges for injury and overuse conditions in females – analysis of 10 per cent sample (numbers, with percentages in parentheses)

<table>
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<th>Condition</th>
<th>Recruits (n = 37)</th>
<th>Trained personnel (n = 12)</th>
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<td>Overuse conditions</td>
<td>26 (70.2)</td>
<td>3 (25)</td>
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<tr>
<td>Other injury or musculoskeletal disorder</td>
<td>11 (29.8)</td>
<td>9 (75)</td>
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Discussion

Before 1992, most women in the Army were employed either in the Women’s Royal Army Corps (WRAC) as clerks, signallers, drivers or cooks, or as nurses in the Queen Alexandra’s Royal Army Nursing Corps (QARANC). Both of these women’s services had their own training centres, where women were trained mainly by women, and the skills in which they were trained reflected their future role. In 1992 the British Army began to embrace the concepts of equal opportunities, and the WRAC was disbanded and careers in the QARANC became open to males. Women were to be employed in the same regiments and corps as male soldiers to do the same jobs, with few exceptions, and as a result, it was no longer justifiable or acceptable to train women separately. Indeed, as women were now to be liable for armed guard duty and other military tasks that had formerly fallen only to male soldiers, it had become essential for them to be trained in the necessary skills.

The majority of female recruits enthusiastically embraced the opportunity to train alongside their male colleagues and to demonstrate their strength and physical ability. Unfortunately, it was not long before the routine medical statistics began to demonstrate a possible penalty to health. The published statistics demonstrated that medical discharge figures for females had started to worsen around 1992, at the same time that females had started to train alongside males.

A literature review was conducted to examine whether the armies of other nations had experienced similar problems, whether females were more susceptible to overuse injury than males, and whether gender-specific risk factors had been identified. It was found that the increased susceptibility to overuse injury experienced by females when training alongside males was well documented by other British researchers, by the US Army and by the Australian Army, and a number of risk factors had been identified. Females have only 30–50 per cent of the upper body strength and 70 per cent of the lower body strength of a male of comparable size, and because of hormonal differences, strength training produces less increase in muscle bulk in women than in men. Women tend to have a lower circulating blood volume and lower haemoglobin than men, and consequently on average have 15–30 per cent lower maximum oxygen uptake. In practice, therefore, for a given level of physical exertion, women have to exert more effort than men of comparable size.

There are important anatomical differences, notably the wider female pelvis and the increased angle at which the femur meets the tibia, which give rise to biomechanical differences in the stresses occurring in the male and female skeleton during strenuous exercise. This may be important in the aetiology of the excess stress fractures occurring during physically intensive recruit training that were observed in this study. In addition, women of all ages tend to have a lower bone density than men, which is exacerbated if they have done little physical exercise or in the presence of low circulating oestrogen levels. Absent or infrequent menstruation may arise from natural causes, or may be secondary to an eating disorder in association with extreme weight loss. Paradoxically, intensive exercise, and particularly distance running, can also cause hormonal disturbance and amenorrhoea, and a syndrome of disordered eating, amenorrhoea and osteoporosis in female athletes has been described, known as the ‘athletic triad’. A US Army study showed that the known risk factors for osteoporosis including amenorrhoea, smoking, positive family history and white or Asian ethnic origin were also strongly associated with the development of stress fracture during military training. Further research is indicated to investigate the association between these risk factors and overuse injuries occurring in female British military recruits.

Other nutritional factors are important in determining susceptibility to overuse injury, and both iron and zinc appear to be important. Diets based on meat avoidance are more likely to be deficient in these factors, and it has been suggested that more women than men take a diet of this type. A recent US paper cautions against describing all such women as ‘vegetarian’, as haphazard meat avoidance is probably more common and, because it does not carry the careful commitment of the true vegetarian, may in fact present much more risk of dietary deficiency and hence overuse injury to the athlete. Further work is needed to determine the prevalence of vegetarianism and meat avoidance in the British Army and its relationship with injury patterns, to determine the potential benefits of nutritional advice or dietary supplementation.

A number of established risk factors are particularly relevant to female military recruits. Footwear is important in determining susceptibility to lower limb injury, and the US Army has shown that a badly fitting boot increases the risk of injury so that if women wear a boot designed for the male foot, the width is likely to be excessive, giving rise to lateral instability, which may aggravate or even cause foot or ankle problems. Like the US Army, the British Army issues the same style of boot and training shoe to males and females, and these may be too wide for the majority of female feet, presenting an additional risk factor.

All runners, both male and female, are at risk of stress fracture if they suddenly increase their running distance, for example during the transition from a relatively sedentary civilian life to active military training, and the 11 week period of basic training allows little time to build up distance gradually. Girls may be more at risk as they are less likely to have played energetic sports at school than boys. Short stature has been shown to be a risk factor, and a number of reports of stress fracture of the inferior pubic ramus in females implicated overstriding as the shorter females struggled to keep pace with the taller males. Placing the females at the front of the squad so that they set the pace greatly reduced the incidence of stress fractures in the females in one study conducted in British Army recruits, although there was some concern that the males might be at risk as they were taking a shorter pace than their natural stride.
Conclusion

This study demonstrated that female personnel undergoing recruit training in the British Army have a increased incidence of medical discharge compared with males undertaking the same training and that this is most likely to be due to stress fracture or other overuse syndromes predominantly affecting the lower limb. This increased incidence first became apparent after the introduction of mixed-gender training following the disbandment of the women’s corps in 1992.

The increased susceptibility of females to injury when undergoing intensive training alongside males is widely described in the literature. Risk factors include menstrual disturbance (particularly amenorrhoea), smoking, short stature and eating disorders or restricted dietary intake. Further research is needed to determine the role of these risk factors in the British female recruit population and to assess the potential for specific intervention. The majority of females undertaking training alongside men are both anatomically and physiologically disadvantaged, and this leads to an increased risk of injury. None the less, other studies have shown that females are capable of achieving the same standard of strength and fitness as men, as long as they undergo appropriate training.

This presents a challenge in terms of equal opportunities legislation. It is unlawful to discriminate against anyone in employment on the grounds of gender, and this has been the basis of the British Army’s ‘gender-free’ physical assessment programme, which ensures that individuals are selected for jobs for which they have the necessary physical ability, regardless of gender. However, there is now evidence that training men and women together is associated with more injuries among the women. None the less, other studies have shown that females are capable of achieving the same standard of strength and fitness as men, as long as they undergo appropriate training.

The outcome of such segregated training must not result in women being trained to a lower standard, but should reflect the fact that the training needs of men and women have to be planned and implemented differently so as to bring both genders to the required standard with a minimum of injury. However, it is important to ensure that any segregated training undertaken by male personnel is not perceived as more likely to cause injury than that undertaken by females. The majority of the Army Training Regiments have recently introduced some segregation of training, and early reports suggest that the injury figures are beginning to demonstrate an improvement.

References


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