

Musculoskeletal Injuries In Female Soldiers: Analysis Of Cause And Type Of Injury

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ABSTRACT

Objectives: To record and analyse those injuries and conditions requiring referral to a military sports injury and rehabilitation centre over a three year period, with special reference to gender, type and site of injury, and the cause of the injury.

Methods: A prospective study in which data on the gender, diagnosis, and cause of injury, of all patients referred to the Colchester Garrison Sports Injury and Rehabilitation Centre was recorded. All subjects were trained, serving soldiers in the British Army referred via their General Practitioner.

Results: Low back pain (OR 2.71, $p < 0.0001$) and injuries to the hip, thigh and lower leg (OR 2.33, $p < 0.0001$) were more frequent in female soldiers. Military training (OR 4.62, $p < 0.0001$), work (OR 2.53, $p < 0.0001$), recreation (OR 2.39, $p < 0.0001$), and pre-existing conditions (OR 4.2, $p < 0.0001$) were the causes most commonly cited by female rather than male soldiers. There was no statistical gender difference for sport related or road traffic accident injuries.

Conclusions: Female soldiers are more likely to sustain an injury than their male counterparts. Specific injuries account for the majority of this difference. Military training, work, and recreation are more likely to be the cause of injury in the female soldier. Conditions existing prior to military service were also more common. There was no gender difference in the injuries caused by sport or road traffic accidents. These results may act as a basis for targeted intervention in order to reduce inequality without reducing overall training standards.

Introduction

The number of females in the British Army has increased over the past ten years as a result of social pressure, equal opportunities legislation and Government policy. Female recruits were originally trained separately and to a lower level of physical fitness, but integration of training in 1994 brought male and female recruits together for the first time. Training standards for females remained lower than their male counterparts

as an acknowledgement of differences in size and strength. This policy was known as "gender fair" training. However, this policy was reversed as a result of women being unable to perform the physical tasks required of them in their eventual role. The new policy of standardised "gender free" training, was adopted in 1998.

Much has been published on the overall differences in the injury rate of male and female recruits undergoing basic military training, and of those with injuries considered to be incompatible with continued military service. The aim of this paper is to explore the cross gender variation in overall injury profile, and the cause of those injuries, in trained soldiers undertaking ongoing military and fitness training, as well as routine sporting and social activities, since the introduction of gender free training.

Subjects and Methods

Colchester Garrison Sports Injury and Rehabilitation Centre is a primary care based facility, treating British Army personnel serving with an Air Assault Brigade and other co-located units. The average population during the period of the study was 3555, comprising 3377 males and 178 females. The soldiers had all completed basic training and ranged in age from 17 to 55 years old (17 – 24 yrs 41%, 25 – 35 yrs 43%, over 35 yrs 16%). All patients who first attended between 1st November 1998 and 31st October 2001 were included in the study. All patients were referred by a general practitioner according to practice guidelines. The diagnosis and cause were recorded and corresponded to the categories used by the Colchester Garrison Sports Injury and Rehabilitation Centre and the Defence Medical Services as described by Strowbridge and Burgess (1).

A number of patients were referred on more than one occasion. Only first referrals for a given condition have been included in the data on type of injury or condition. Those referred for a second time with a given condition, but different cause, have been included in the data on cause. Subsequent referrals for the same condition, with the same cause, have been excluded.

Statistical analysis of the results was performed using the Chi-square test. Odds ratio and 95% confidence intervals were calculated using EpiInfo v 6.04.

Table 1 Gender differences in type of injury. Rates expressed as Cases/1000/month.

Injury or Condition	Female Rate n = 178	Male Rate n = 3377	OR	95% CI	p
Low back pain	11.08	5.47	2.71	1.95 - 3.73	< 0.0001
Sprains of the ankle and foot	6.87	4.11	1.89	1.29 - 2.71	0.0003
Disorders of the knee	4.84	3.12	1.67	1.08 - 2.51	0.0117
Injuries to the hip, thigh and lower leg	6.40	3.16	2.33	1.58 - 3.39	< 0.0001
Injuries to the shoulder and upper limb	2.18	2.33	0.93	0.49 - 1.64	> 0.05
Neck and cervical spine pain	4.06	2.16	2.03	1.26 - 3.17	0.001
Ligament and tendon lesions of lower limb	1.72	1.27	1.38	0.66 - 2.60	> 0.05
Disorders of patella	1.40	0.94	1.52	0.67 - 3.07	> 0.05
Tibial syndrome	1.09	0.83	1.33	0.51 - 2.90	> 0.05
Sprains and strains of collateral knee ligaments	0.62	0.88	0.7	0.19 - 1.89	> 0.05
Achilles tendinitis	0.94	0.83	1.13	0.40 - 2.60	> 0.05
Thoracic disorders	0.47	0.40	1.16	0.23 - 3.67	> 0.05
Fractures	0.94	0.36	2.64	0.91 - 6.34	> 0.05
Other musculo-skeletal diseases	0.62	0.35	1.78	0.46 - 4.49	> 0.05
Other ligament and tendon lesions	0.62	0.25	2.48	0.63 - 7.13	> 0.05
Stress fracture	0.62	0.15	4.29	1.04 - 13.20	0.021
<i>All rates expressed as Cases/1000/month</i>					

Results

A total of 2662 individuals were referred to the Sports Injury and Rehabilitation Centre during the period of the study, having sustained 3921 initial and subsequent injuries. First referrals for a given injury or condition totalled 3521 (males 3236, females 285). A total of 3893 causes were cited by individuals (males 3571, females 322).

Table 1 shows the incidence of each category of injury expressed as cases/1000/month for each gender. The commonest single diagnosis for both male and female soldiers was low back pain, however the incidence of this condition was much higher in the female population (Female Male Odds Ratio 2.71, p < 0.0001). Traumatic injuries to the hip, thigh and lower leg, whilst less frequent, were also significantly more common in female soldiers (F:M OR 2.33, p < 0.0001). Neck and cervical spine pain (F:M OR 2.03), sprains of the ankle and foot (F:M OR 1.89), and disorders of the knee (F:M OR 1.67) showed a similar gender difference. The overall rate of injury for female soldiers was 44.5/1000/month (or 53.4% per annum) and 26.6/1000/month (or 31.9% per annum) for male soldiers.

Table 2 shows the incidence of cause of injury, again expressed as cases/1000/month. Military training (including supervised PT)

is the activity that results in the most injuries for both sexes but is significantly more likely to result in injury in females (F:M OR 4.62, p <0.0001). A similar pattern is noted for injuries occurring in the workplace, during recreational activity, and prior to military service. There is no gender difference in injuries resulting from sporting activity or road traffic accidents.

Discussion

The number of female personnel discharged from the British Army, as a result of injury, has been rising steadily since 1992 (2) but has increased significantly since the introduction of the “gender free” policy in 1998 (3). There are well established anatomical, biomechanical and physiological reasons why female soldiers are at greater risk of injury. Wider hips, smaller stature, lighter bones, lower muscle mass, increased mobility of joints and hormonal status may all predispose to overuse disorders, particularly of the lower limbs (2,3,4,5,6). Decreased cardiovascular fitness and increased BMI have also been shown to have a key role in increased female rate of injury (7,8). Stress fractures and other overuse syndromes have accounted for 70.2% of medical discharges amongst British female recruits (2). Female soldiers undergoing basic and advanced training in the US Army

Table 2 Gender differences in cause of injury. Rates expressed as Cases/1000/month.

Injury or Condition	Female Rate n = 178	Male Rate n = 3377	OR	95% CI	p
Military training or PT	20.29	10.27	4.62	3.27 - 6.62	<0.0001
Work	9.52	4.75	2.53	1.80 - 3.52	<0.0001
Sport	8.43	8.68	0.96	0.60 - 1.34	0.75
Recreation or other	7.65	3.81	2.39	1.66 - 3.40	<0.0001
Pre-existing	2.81	0.72	4.2	2.32 - 7.24	<0.0001
RTA	1.56	1.15	1.38	0.63 - 2.67	0.36
<i>All rates expressed as Cases/1000/month</i>					

displayed double the rate of injury with a preponderance of overuse and lower limb injuries (8,9).

The stated aim of military fitness training is to afford protection from injury, reduce disease resulting from inactivity, and reduce psychological stress (10). The Air Assault Brigade maintains an ethos of hard military fitness training, much of which is directed towards the combat fitness test. Female soldiers do not undertake front line infantry duties but are employed in support roles and participate fully in the training which involves a 12.8km loaded march, to be completed within two hours, carrying a load of between 15kg and 25kg depending on role. In addition, further tasks such as a fireman's carry of 100m, a single lift of a 35kg ammunition box to a height of 1.45m (irrespective of size) and carrying two 20kg Jerry cans for a distance of 150m may be required.

This study examines the injury profile and gender bias in soldiers serving with the Air Assault Brigade and other co-located units. The Female Male injury ratio corresponds with the US studies, however low back pain and traumatic injuries are more common than overuse syndromes in both sexes. Female soldiers are significantly more likely to suffer from neck and back pain, traumatic injuries to the hip, thigh and lower leg, and ankle sprains than their male counterparts.

Musculo-skeletal conditions and injuries may arise from many different activities. A previous study of this population (1) has shown that military training and sport are the commonest causes of injury overall. This study demonstrates that female soldiers attribute their condition to military training twice as often as their male colleagues. Work and recreation related injuries were also more common.

It is of particular note that injuries caused by sport showed no gender bias. A study of a civilian out-patient sports clinic (11) indicated that traumatic injuries were less common in women who were more likely to suffer from lower limb overuse syndromes. Other researchers, however, have indicated that there is no gender difference in injury rate between male and female athletes competing in team and field sports at the intercollegiate level (12). Sporting activity does not come under the "gender free" policy and female soldiers are allowed to participate and compete at their individual level of fitness and capability; also they may not participate in sporting activities as often as male colleagues. Female soldiers are more likely to consider their injury to be the result of a condition pre-dating military service.

Further study might be considered to assess if there is a true difference in entry standard between male and female recruits.

Clinical observation of female soldiers with back pain resulting from military training suggests that the injury is commonly caused by unexpected twisting of the spine, usually when fatigued and load bearing. However, this clinical impression needs to be validated by further study.

Caution, however, should be used when interpreting cross gender injury rates: higher injury rates in female soldiers may also be explained by differences in symptom reporting. A study of US recruits (13) showed that females were nearly twice as likely to report injuries than male colleagues (44% compared with 25.6%). When both reported and non reported injuries were measured, no statistical difference between the sexes could be found.

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