Injury Prevention: Just the Facts

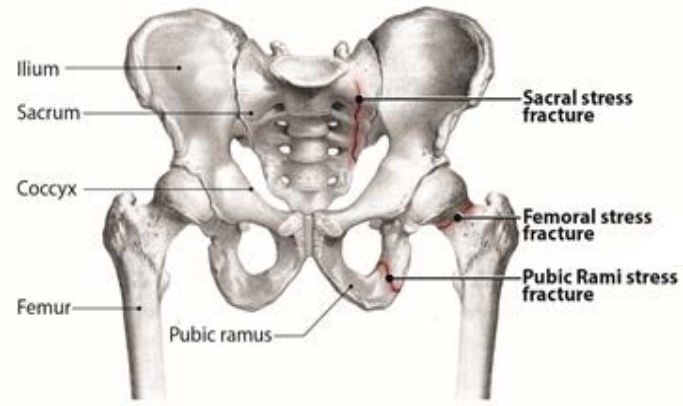
Preventing Injuries in Female Soldiers

FACT SHEET 12-021-0319

What are common female Soldier injuries?

Injuries among female Army trainees and Soldiers are primarily to musculoskeletal (MSK) tissues in the lower extremities (feet, ankles, knees, leg, and hip).[1-3] While these include *acute injuries* (e.g., ankle sprains and anterior cruciate ligament (ACL) tears), most are *overuse injuries*. Examples include patellofemoral syndrome and patellar tendonitis (knee pain or runner's knee), Achilles tendonitis, plantar fasciitis, and stress fractures.[1,2]

These same injuries are also the most common among men. However, evidence has repeatedly shown that Army women are more likely to be injured than men.[1-5] They are also more likely to be discharged for MSK injuries.[1] In particular, military women have over twice the risk of stress fractures than men.[1, 5-8] Stress fractures commonly occur in the metatarsals of the foot and tibia and fibula of the leg. More common to women are those that cause groin and hip pain (see femoral stress fracture and pubic rami in Figure below).[1,8] Stress fractures occur gradually, so may not be immediately diagnosed. They can be very costly to treat and limit activity for weeks to months



Why are injuries in female Soldiers a concern?

The Army monitors Soldiers' injuries to identify ways to improve MSK resilience and medical readiness as Army missions and tasks evolve. Women make up approximately 15% of the Army (2001-2018 DOD data).[1] In 2016 combat arms occupations were opened to women potentially exposing them to new injury risks.[9,10,13,14] Studies have reported injury rates 1.1 to 10 times higher among military women compared to men, 1.5 to 2.5 times being most common.[1,2,5] Some studies indicate that women and men have more similar injury rates if fitness levels are taken into account.[6,9-11] While the exact rate of injuries experienced by women can depend on the types of injuries evaluated, the occupations, age or rank, the impacts to readiness require continued awareness and prevention prioritization. As with men, injuries are the largest reasons for medical encounters and costs, and leading reason for medical non-deployment status.

What causes injuries in female Soldiers?

During activities like running, jumping and foot-marching long distances, the repeated physical force on the lower body causes microscopic tears to body tissues. The body repairs these tears and rebuilds even stronger tissues. This is called adaptation. However, if tears accumulate before a person's body can repair, the resulting damage is an overuse injury.[2] Though these repetitive on-foot activities are a necessary part of military training, several factors increase the likelihood that a person will experience an injury. Some factors are more frequently found among women.

What factors increase injury risk in women?

Higher injury rates among women are partially explained by physiological differences between men and women, such as skeletal structure (e.g., pelvic width) and higher fat mass (less body muscle).[1,8,13,15] However, injury risk is also increased by modifiable behaviors or conditions found in both sex. For example, both men and women who have poor aerobic fitness (slow running speed) experience higher injury rates.[3,9-11] Since female Soldiers have historically been less aerobically fit than male Soldiers, this has contributed to their higher injury risk. The more risk factors a person has the higher the injury risk. Key factors that will increase a woman's risk include:

- Prior injury (e.g., a stress fracture or ankle sprain) [1,5,16]
- *Under* or *over* weight, per Army height-weight standards [1,3,17,18]
- Poor aerobic fitness (e.g., 2 mile run >19 minutes) [3,5, 9,19]
- Smoking [3,5]
- Female athlete triad [1,8]

What is the Female Athlete Triad?

Female athlete triad is a condition associated with physically active women that involves three interrelated components that increase risk of stress fractures [1,15]

- *Low energy availability* – caused by not consuming enough calories and/or poor nutrition (e.g., inadequate protein, iron, calcium, vitamin D, etc.)
- *Decreased bone mineral density (BMD)* – determined by tests that show if bone content of calcium and other essential minerals is not within normal range and therefore is structurally weakened. Very low body fat is a strong predictor of low BMD.
- *Menstrual dysfunction (amenorrhea)* – the absence of menstruation results in estrogen deficiency and dysfunction of hormones needed for bone health. Stress fracture risk is 2 to 4 times greater than women with normal menstrual cycles.

Army Public Health Center - Injury Prevention Division
usarmy.apg.medcom-aphc.mbx.injuryprevention@mail.mil; ***410-436-4655/DSN 584-4655***
8252 Blackhawk Road, APG, MD 21010-5403
Approved for Public Release, Distribution Unlimited

What strategies can help reduce injuries in female Soldiers?

Maintain good weight through proper nutrition.

- ♥ Being overweight (above Army height-weight standards) can lead to various health problems like diabetes and hypertension. Evidence also shows greater difficulties accomplishing physical tasks and higher rates of injury.[1,10, 11, 13,17,18]
- ♥ Being "too thin" (e.g., *below* minimum Army height-weight standards) has also been shown to increase injury risk. Don't confuse being skinny with being physically fit.[18,19]
- ♥ Inadequate *nutritious* calories can weaken the body's ability to rebuild tissues as they are stressed through physical training. For most women, absorption of nutrients is most effective through eating varied foods instead of supplements. Your health provider can advise if you would benefit from supplements such as calcium, magnesium, vitamin D, or iron.[1,16]
- ♥ The Army does not endorse any specific diets or fads such as cleanses. Recommended is a balance of fruits, vegetables, proteins, healthy fats, unprocessed carbohydrates, and adequate fluid intake. *See APHC website for more information.*

Discuss menstrual problems with a healthcare provider.

Absence or change in your period can be a serious indicator of increased risk of stress fracture and other health conditions. See your health care provider to determine a solution. [1, 8, 15]

Don't smoke.

Evidence shows smoking can increase injury risk, possibly from reducing the body's ability to properly absorb nutrients and repair tissues.[3] Alcohol or drugs may also contribute to higher injury risk.[1,8]

Change a 'sedentary' lifestyle – but increase activity gradually.

- ♥ *Start before joining*. Basic combat training (BCT) trainees who haven't conducted regular aerobic training *prior* to starting BCT have a higher risk of injury.[1,3, 5,20, 21]
- ♥ *Start easy after stopping.* After any injury or pregnancy, activity levels should build slowly. The time for recovery and reduced activity may vary; follow your provider's remedial profile plan or post-pregnancy fitness guidelines.[1,20-22]

Aim to achieve and maintain excellent fitness, but focus on the whole.

- ♥ *Increase and change training gradually*. To safely build strength and aerobic fitness, increase the amount and intensity (e.g., distance, amount of time, speed, and weight) incrementally. A general rule is to start light if it's a new activity and to increase by 10% a week. Army doctrine provides examples of how to increase loaded march distances and weights.[1, 15, 19,20]
- ♥ *De-emphasize running and commit to cross-training*.[1, 10, 11, 16] Current Army doctrine [20, 21] emphasizes balancing aerobic training with muscle endurance and strength, agility and balance activities. Reduce distance runs with interval training.
- ♥ *Avoid activities that stress legs on consecutive (back-to-back) days*. Both running and road marching distances of 2 miles (3 kilometers) or more are examples of such activities.[1, 16]

Wear shoes that are comfortable and in good condition.

Studies of running shoes (stability, shock absorbing, motion control) don't clearly show differences, but always ensure shoes are the correct size (thumbnail toe to end), comfortable, and not too old (e.g., replace if soles show visible signs of wearing).[1,3]

Stop activity if pain develops and seek medical evaluation.

Some muscle soreness can be expected, but "No pain no gain" is not the mantra if your pain is in your foot, knee, shin, or hip. See your provider if you have pain in these areas. A few days/week off is better than months from more serious injury.[1, 20, 21]

INFORMATION SOURCES

1. Borden Institute Monograph Series. 2011. *Musculoskeletal Injuries in Military Women*. Available at http://www.cs.amedd.army.mil.
2. Hauschild et al. 2018. Etiology of Injuries in US Army Initial Training. *AMEDD Journal*. July–Dec 2018; 22–29.
3. Jones et al. 2018. Musculoskeletal Injury Prevention in the US Army: Evolution of the Science and the Public Health Approach. *JSAMS*. 21(11) 1139–1146.
4. APHC. 2017. Health of the Force.
5. CDC. 2000. Recommendations Regarding Selected Conditions Affecting Women's Health. *MMWR*. Vol. 49/No. RR-2. March 31.
6 Wentz et al. 2011. Females Have Greater Incidence of Stress Fractures than Males: A Systemic Review. *Mil Med*. 176,4:420–430.
7. Jones et al. 2002. Prevention of Lower Extremity Stress Fractures in Athletes and Soldiers: A Systematic Review. *EpiRev* 2002;24:228–247.
8. Institute of Medicine.1998. *Reducing Stress Fracture in Physically Active Military Women*.
9. Rappole et al. 2017. Factors Associated with Lower Extremity Training-related Injuries among Enlisted Women in U.S. Army Operational Units. *JMVH*. 26; No. 1, 16–26.
10. Anderson et al. 2017. The Role of Gender and Physical Performance on Injuries: An Army Study. *AJPM*. 52(5) e131–38.
11. Grier et al. 2015. The Effects of Cross-Training on Fitness and Injury in Women. *AMEDD Journal*. April–June 2015. 23–31.
12. Defense Manpower Data Center (DMDC) Statistics and Reports https://www.dmdc.osd.mil/appj/dwp/stats_reports.jsp
13. Nindl et al. 2017. Functional Physical Training Improves Women's Military Occupational Performance. *JSAMS*. 20:S91–S97.
14. PHC. 2017. PHR No. S.0047783-17. Injury Surveillance and Longitudinal Studies for Gender Integration in the Army. Available in DTIC.
15. American College of Sports Medicine - Position Stand. The Female Athlete Triad. 2007. *MSSE*.1868–1882.
16. Bullock et al. 2010. Prevention of Physical Training-Related Injuries: Recommendations for the Military and Other Active Populations Based on Expedited Systematic Reviews. *AJPM*. 38:S156–S181.
17. Jones et al. 2017. Impact of Physical Fitness and Body Composition on Injury Risk among Active Young Adults: A Study of Army Trainees. *JSAMS*. 20:S17–22.
18. U.S. Army. 2012. Army Regulation 600-9. *Army Weight Control Program.*
19. Internal APHC data.
20. U.S. Army. 2012. Field Manual 7–22. *Army Physical Readiness Training.*
21. U.S. Army. 2011. Technical Bulletin-Medical 592. *Prevention and Control of Musculoskeletal Injuries Associated with Physical Training.*