Neck Strength, Flexibility, Posture, and Proprioception Differences between Healthy Male and Female Soldiers in the US 101st Airborne Division (Air Assault)

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Context: Neck pain is a common complaint of military personnel, especially in female populations. Researchers have identified several musculoskeletal and neuromuscular characteristics that may predispose individuals to neck pain such as decreased muscular strength. In many cases female Soldiers are assigned to the same military occupational specialties (MOS) as male Soldiers and are required to perform identical duties under similar physical demands. This combination may ultimately place females at greater risk of musculoskeletal injuries including neck pain. **Objective:** To determine if neck strength, flexibility, posture, and proprioception differences existed between healthy male and female Soldiers. **Design:** Cross-sectional study. **Setting:** Research laboratory. **Participants:** A total of 12 female (Age=29.8±4.7 years, height=164.5±9.2 cm, weight=68.7±3.6 kg) and 12 male Soldiers (Age=29.2±3.9 years, height=175.2±5.6 cm., weight=82.1±9.8 kg) were recruited. Subjects were matched based on age (±3 years) and MOS. All subjects were free of musculoskeletal injuries preventing active duty. **Interventions:** All subjects underwent the following assessments: cervical strength, shoulder strength, cervical flexibility, forward head and shoulder posture, pectoralis minor length, and cervical proprioception. Strength was measured using hand-held dynamometry with the exception of shoulder abduction, which was tested using an isokinetic dynamometer. Flexibility was measured using a cervical range of motion instrument, and posture was measured using a carpenters' double-square device. Proprioception was determined using a 3D motion capture system. All tests were performed bilaterally when possible. Paired *t*-tests were used to compare genders with significance set at $p < 0.05$ *a priori*. **Main Outcome Measures:** The dependent variables were peak force (normalized to body mass) for neck flexion, extension, lateral flexion, rotation, and shoulder abduction, cervical range of motion (ROM) for flexion, extension, lateral flexion, and rotation, forward head (FH), right/left shoulder posture (RSP, LSP), pectoralis minor length, and cervical active joint position sense. **Results:** Female Soldiers demonstrated significantly less strength across all measurements (p<0.05). Female Soldiers also demonstrated significant increases in cervical rotation ROM (F: 80.5±6.2°, M: 74.3±4.8°, p=0.013) and significant decreases in FH (F:20.5±1.5 cm, M:22.2±1.4 cm, p=0.015), RSP (F:14.4±2.7 cm, M:17.1±2.7cm, p=0.009), LSP (F:13.7±2.3 cm, M:15.6±2.3 cm, p=0.026). **Conclusions:** The current results indicate gender-related differences in various musculoskeletal characteristics. Female Soldiers

displayed better flexibility and posture and similar proprioception compared to male Soldiers, but they had significantly less strength which may predispose them to injury. Females typically have a smaller body size than males, which would indicate a need for increased muscular strength relative to body mass in order to safely and properly perform the occupational tasks required of them. Decreased muscular strength also influences joint stability, which may contribute to increased injury risk. Further research should focus on identifying modifiable risk factors for neck pain and developing interventions influencing those characteristics.

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