The association between BMI and Shoulder Injury in combat soldiers

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Introduction

- Shoulder dislocations are a common cause of musculoskeletal morbidity, leading to loss of active duty days and combat-role dropout.
- Previous studies on BMI and shoulder dislocation were in predominantly male cohorts, with inconsistent findings and lacking specificity in describing the nature and strength of association. The recent inclusion of females in combat roles enables investigating the association in females.

Methods

- 263,052 recruits assigned to combat roles, between 2010-2024
- Exclusion criteria: < 30 days of consecutive service, over the age of 25, medical fitness grading preventing combat assignment, record of previous shoulder injury.
- Outcomes :
  - **Primary** - **shoulder dislocation** according to ICD9 & military medical fitness code
  - **Secondary** - **other shoulder injury** incidence diagnosis according to ICD9 (e.g., subluxation, pain in limb)
- BMI was categorized as <18.5, 18.5–22, 22–25, 25–30, and ≥30 kg/m^2.
- Cox multivariable proportional hazard models included age category, BMI category, and combat training intensity (High/Low) as covariates selected a-priori.

Results

- A total of 250,060 soldiers included in the cohort, with median follow-up time of 32 months (IQR 27.3, 36.2 months).
- Dislocations were diagnosed in 3,902 (1.8%) males and 203 (0.6%) females.
- In males, dislocation risk was lower in the underweight BMI group 221 (1.3%) and increased in the overweight 696 (2.1%) and obese 179 (2%) (Figure 1).

Figure 1 Forest plot of Shoulder dislocation Hazard Ratio by BMI group

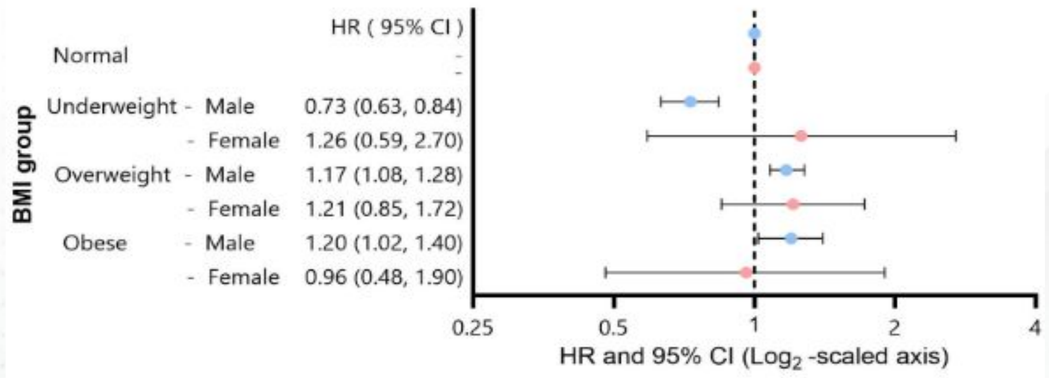
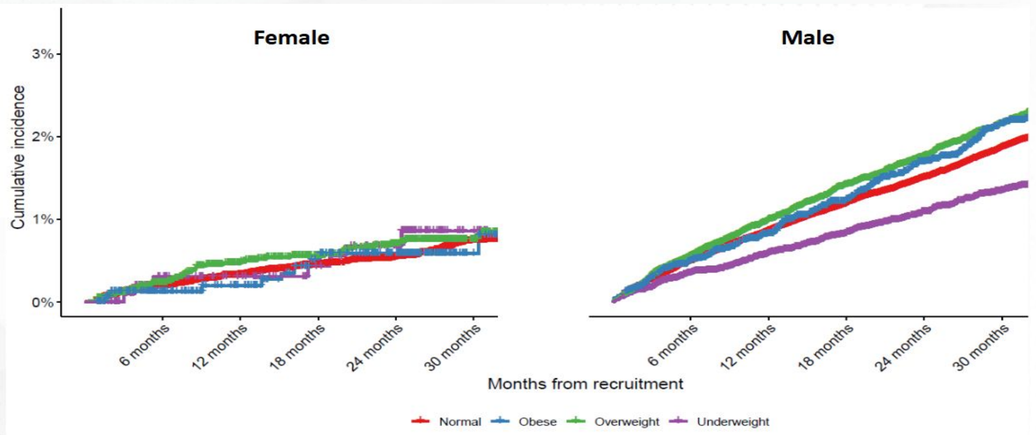


Figure 2 Cumulative incidence of shoulder injury or dislocation over 32 months, stratified by sex and categorized by BMI groups.



- In females, no significant association was found between BMI and shoulder dislocations, with an overall low incidence of dislocation across BMI groups.
- Males in the underweight BMI group had a lower incidence of shoulder injury (13.2% compared to 16.7% of the reference group) throughout their time in combat service.
- The increased risk for shoulder dislocation associated with higher BMI was consistent when stratified by intensity and covariate-adjusted analyses.
- In the multivariable model, low training intensity was associated with lower dislocation risk (HR 0.78, 0.72-0.84). There was no significant interaction between training intensity and the BMI groups (P=0.408).

Discussion and conclusions

- We observed a significant association between BMI and shoulder dislocations in the male cohort of combat soldiers.
- Incidence of shoulder dislocation was infrequent in the female cohort, regardless of BMI.
- This supports BMI as a sex-specific contributing factor to shoulder dislocation among male in combat training, rather than a sole selection criterion.

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