



Factors Influencing The Incidence Of Stress Fractures Based On The Characteristics of Command Education Students At The Special Forces Command Education And Training Center In Batujajar, West Java, Indonesia: A Retrospective Approach With Secondary Data

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Abstract

Stress fractures caused by repetitive mechanical loading represent a significant threat to physical performance and operational readiness among military personnel. This study aimed to identify factors associated with stress fracture occurrence among command education students at the Special Forces Education and Training Center in Batujajar, West Java, Indonesia. A retrospective descriptive study was conducted using secondary data from forty-three documented stress fracture cases collected over a six-year period. The variables analyzed included age, body mass index (BMI), and anatomical location of the fracture. Data were analyzed using univariate and bivariate descriptive analysis to characterize the distribution of stress fractures based on the studied variables. The results showed that the majority of cases occurred in individuals aged 20–25 years (90.7%), with the left tibia being the most frequently affected anatomical site (34.9%). All subjects had BMI values within the normal range, indicating no significant association between abnormal BMI and stress fracture occurrence. These findings suggest that age and fracture location are key characteristics of stress fractures among command education students. The study provides evidence to support the development of targeted prevention and early intervention strategies aimed at reducing stress fracture incidence, improving training completion rates, and enhancing the operational readiness of special forces personnel.

Keyword: Stress Fracture, Command Education Students, Age Characteristics, Body Mass Index, Anatomical Location, Special Forces

Introduction

Repetitive stress fractures are a significant health concern among military personnel undergoing intensive training with high physical demands. These fractures occur when repeated overloading causes microscopic bone damage that exceeds the tissue's natural ability to regenerate, resulting in an imbalance between new bone formation and old bone absorption (Milgrom et al., 2020). The Special Forces Command Education and Training Center in Batujajar, West Java, established on January 1, 1963, is responsible for training Kopassus soldiers and has reported forty-four cases of stress fractures among commando students in the past six years. This issue is critical because regulations require students who miss more than three days of activities to be excluded from the program, while recovery from stress fractures is often prolonged. Although several studies have examined risk factors for stress fractures in military populations abroad, there is limited research on the specific characteristics of Indonesian command education students that contribute to these injuries.

Several studies have identified factors contributing to stress fractures in military populations worldwide. Milgrom et al. (2020) found that mechanical stress can increase bone

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absorption and decrease new bone formation, leading to structural weakness and fractures. Environmental factors such as fatigue, psychological stress, and inadequate nutrition also play a role. Schepull & Aspenberg (2019) reported that Swedish soldiers with lower body mass had a higher risk of stress fractures, while those with higher body mass and proper foot protection had a lower risk. In Indonesia, Feliciano et al. (2023) found a 2.28% incidence of stress fractures at the Jakarta Kodam Jaya Combat Training Center, and Mawaddah et al. (2025) reported a 0.8% incidence among soldiers in basic parachuting training at the Penerbad Education and Training Center.

This study aims to identify student characteristics, particularly age and body mass, that increase the risk of stress fractures, and to analyze the most common anatomical locations of these injuries among command education students at the Kopassus Batujajar Education Center. The hypothesis is that specific characteristics, especially age and body mass, are associated with a higher incidence of stress fractures and that certain fracture locations are more prevalent in this group. Using a retrospective review of medical records from the past six years, this research seeks to enhance understanding of risk factors for stress fractures. The findings will inform trainers, medical staff, and management, supporting the development of effective prevention and intervention programs (Waterman et al., 2021) to improve program outcomes and reduce preventable student injuries.

Methods

This study employs a descriptive study using secondary medical record data at the Special Forces Education and Training Center, Special Forces Command, West Java. Data were collected from August 2023 to January 2024 using verified doctor's certificates documenting the chronology and diagnosis of stress fractures, in accordance with relevant decrees. The study population consists of all command education students at the Batujajar Education and Training Center. Targeted sampling was used to select students who met the inclusion criteria. Inclusion criteria were students with a history of stress fractures and complete doctor's certificate documentation. Exclusion criteria were students without a history of stress fractures or without available doctor's certificates in the health documentation system (Nurdin & Hartati, 2019).

The study examined the incidence of stress fractures as the dependent variable. Independent variables included student age, categorized as young adult (18-25 years) and adult (26-35 years), and body mass index (BMI), calculated as weight in kilograms divided by height in meters squared and classified according to Asia Pacific standards. The study also recorded the locations of fractures in the long bones. Data were analyzed using a univariate approach with statistical software to describe the characteristics and distribution factors of stress fractures. Ethical considerations included respect for autonomy, beneficence, and justice (Mappaware, 2016). Formal approval for the research was obtained from the Special Forces Education and Training Center in accordance with established procedures.

Results

Age Characteristics and Location of Stress Fractures in Command Education Students

A study of forty-three commando education students with stress fractures found that most cases occurred in the 20-25 year age group, accounting for thirty-nine cases (90.7%). Only four cases (9.3%) were recorded in the 26-30 year group, as shown in Table 1. These results indicate that young adults are more susceptible to stress fractures during commando training. This pattern aligns with Kepel & Lengkong (2020), who identified similar age ranges as being at higher risk for fractures in populations engaged in intensive physical activity.

Table 1. Frequency Distribution of Respondent's Ages

Age Group	Frequency	Percentage
20-25 years	39	90,7%

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26-30 years	4	9,3%
Quantity	43	100%

Analysis of fracture locations shows a dominant concentration in the shin segment. The left shin is most frequently fractured, with fifteen cases (34.9%), followed by the right shin with thirteen cases (30.2%), as shown in Table 2. This pattern suggests the shin bears the greatest mechanical load during intensive command training. These findings align with Parahita & Kurniyanta (2013), who also found the shin to be the highest risk zone for stress fractures in populations exposed to repetitive physical activity and high loads, due to its role as the main support for body weight.

Table 2. Frequency Distribution of Crack Locations

Crack Location	Frequency	Percentage
Left shin	15	34,9%
Right shin	13	30,2%
Right Foot	4	9,3%
Left calf bone	2	4,7%
Right and Left Shain	2	4,7%
Others	7	16,3%
Quantity	43	100%

Characteristics of Body Mass Size and Age Relationship with Crack Location

Analysis of body mass measurements showed that all respondents with stress fractures were within the normal weight range of 18.5-25 kilograms per square meter (100%), as presented in Table 3. No cases occurred among individuals classified as underweight, overweight, or obese. These results suggest that, among commando education students, stress fractures are primarily associated with intensive training loads and repetitive mechanical stress rather than variations in body mass outside the normal range. While Esau et al. (2020) found a link between body weight and the crack healing process, and Loa et al. (2022) identified a significant relationship between weight and fracture risk, the homogeneous, normal-weight profile of this student population means body mass does not significantly influence the incidence of stress fractures.

Table 3. Distribution of Respondents' Body Mass Size

Categories Body Mass Measurements	Frequency	Percentage
Normal (18.5-25)	43	100%
Quantity	43	100%

Cross-tabulation analysis showed that among students aged 20-25 years, fractures most commonly occurred in the left shin (14 cases, 35.9%), followed by the right shin (13 cases, 33.3%). In the 26-30 year age group, only one case (25%) involved the left shin, with other cases distributed more evenly across locations. This suggests that younger students are more likely to experience shin fractures, while older students have a more varied but less frequent distribution. These findings align with Rozi et al. (2021), who identified a relationship between age and fracture location, and Galo' et al. (2019), who found a significant association between age and stress fractures. Rozi et al. (2021) also confirmed the link between fracture location and the occurrence of stress fractures, highlighting the complex interaction between age and anatomical site. Overall, the predominance of left shin fractures in the 20-25 year age group is a key characteristic among command education students at the Batujajar Education and Training Center. Therefore, targeted preventive measures, including intensive monitoring and the development of effective prevention strategies, are recommended to support students' physical health and performance (Kahanov et al., 2015; Orr et al., 2014).

Conclusion

This study provides a descriptive overview of stress fractures among command education students at the Batujajar Education and Training Center. Three key findings were identified. First, the majority of stress fracture cases occurred among students aged 20–25 years, accounting for 90.7% of all cases. Second, the tibial region particularly the left tibia was the most frequently affected anatomical site, representing 34.9% of documented fractures. Third, all affected students were classified within the normal body mass index range, suggesting that body mass was not a distinguishing characteristic among individuals who experienced stress fractures in this population. These findings indicate that stress fractures among command education students are predominantly observed in younger trainees and show a consistent anatomical distribution. Preventive strategies focusing on training load management, exercise intensity, recovery duration, and adequate rest may be considered to reduce musculoskeletal injuries during intensive military education programs.

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