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THE TYPE OF INJURIES SUSTAINED IN THE TEXAS A&M CORPS OF CADETS DURING AN ACADEMIC SEMESTER

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ABSTRACT

INTRODUCTION: Injuries during military training is a major problem, affecting readiness. Researchers have attempted to determine the various types of injuries that occur during initial basic training and for specialized training for all branches of the military. However, there are relatively few investigations specifically conducted with Reserved Officer Training Corps (ROTC). The purpose of this investigation was to determine specific types of injuries sustained in the Corps of Cadets (CoC) at Texas A&M University over the course of a fall semester. **METHODS:** 2,450 cadets were included in this study. Injured cadets that could not participate in their physical training were asked to complete an injury profile questionnaire. These questionnaires were collected and used to determine injury rates. **RESULTS:** Over the course of the semester, 152 cadets (6.2%) sustained injuries. Injury rates and body part distributions were calculated. However, some cadets fit into more than one category. Cadets suffered injuries to specific muscle groups (32.3%), joints (43.3%), bones (9.5%), skin (1.5%), and tendons/ligaments (40.3%). Two cadets experienced a heat-related illness during training while the remaining (8.5%) missed training due to a non-injury-related illness. **DISCUSSION:** This study found knee and ankle joint injuries to be the most prevalent. These specific injuries are consistent with similar enlisted and officer training investigative outcomes.

Keywords: Military, Injury, Injury Prevention, Reserve Officer Training Program (ROTC), Corps of Cadets (CoC)

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INTRODUCTION

Musculoskeletal injuries are a prevalent issue among active military populations. There have been studies examining this particular topic in order to better determine the cause of such injuries so that policies may be more affectively enacted within the Department of Defense (DoD) to reduce the potential risk of future injuries [1, 2]. According to the May 2018 Medical Surveillance Monthly Report, injury and poisoning accounted for 24.9% of all medical encounters. There were 156,062 individuals affected by knee injuries, 133,947 for arm and shoulder, 144,970 for foot and ankle, 100,156 for leg, 75,566 for hand and wrist, 52,445 for head and neck, and 31,535 for back and abdomen [3]. According to the Defense Medical Surveillance System (DMSS), the DoD's top five injuries, which resulted in hospitalization, were fractures of the ankle, fractures of the tibia and fibula, fractures of face bones, sprains and strains of the knee and leg, and fractures of the radius and ulna [4].

Most commonly, these injuries are due to overuse, particularly pain, inflammation, and stress fractures, predominantly of the lower extremity, the torso, as well as the upper extremity [4-14]. Furthermore, the cost of injuries can amount to hundreds of millions of dollars annually, which can detract from operating costs as well as deplete additional resources. In some of the worst-case scenarios, injuries have led to hospitalizations, life-long disabilities, and even death [4, 15]. However, many injuries either go unreported or do not result in hospitalization; however, these injuries still have the capacity to decrease combat readiness.

Both intrinsic and extrinsic factors contribute to this increased risk. Intrinsic

factors include age, gender, race, physical fitness, anatomical traits, behavioral traits, and past injury while extrinsic factors include terrain, equipment, weather conditions, and physical training [15]. Therefore, it is crucial that preventative measures are taken to reduce the risk of injury, so operating military units can perform as effectively as possible. Once the injury has occurred, not only are these troops excluded from training, both conditioning and military occupation skills (MOS) specific training, but they are also more prone to subsequent injuries [4, 16].

The purpose of this study was to analyze the types of injuries sustained over the course of a fall semester in the Corps of Cadets' (CoC) at Texas A&M University. This study also sought to differentiate between the types of injuries sustained by freshmen versus those sustained by upper classmen.

METHODS

Design

When a cadet could not participate in their physical training (PT) session, they reported to the research team to fill out an injury profile questionnaire (QS) designed specifically for the Corps of Cadets (CoC) [17]. The research team at Texas A&M University created the QS. The QS contains questions about the injured person's sleep patterns, stress, physical fitness, training schedule, prior injury status, academic load, type of injury sustained, and mechanism of injury.

Participants

After the researchers in this investigation received approval from the Texas A&M University IRB committee, the Corps of Cadets read and signed a human consent form to participate in this study. The Texas A&M

(CoC) is comprised of 42 units and approximately 2,450 cadets. To enable statistical descriptive group comparisons, cadets were categorized as either freshmen (FM) or upper classmen (UC).

Procedures

Injured cadets filled out the entire QS on their first missed PT session. When the cadet was able to fully participate in PT, they would return and complete the QS to determine how long they were absent from training, as well as how many training sessions they missed.

Statistical Analyses

Data were analyzed to assess percentage rates and distributions of CoC injury categories. Data were analyzed using the statistical software SPSS version 22.0 (IBM SPSS Statistics, Chicago, IL).

RESULTS

Throughout the study, the cadets' reported injuries for specific muscle groups (32.3%), joints (43.3%), bones (9.5%), skin (1.5%), and tendons/ligaments (40.3%). Only two cadets experienced heat illness, and 8.5% of the cadets missed training due to an illness. Of the 65 cadets that experienced muscular injuries (32.3%), there were injuries reported for the calf (15), hamstrings (11), lower back (11), quadriceps (8), upper arm (5), gluteal region (4), upper back (3), abdominal muscles (2), neck (2), pectoralis major (1), and lower arm (1), with two unspecified injuries. Of the 87 cadets (43.3%) who injured their joints, injuries were reported for the ankle (41), knee (49), hip (7), lumbar spine (6), thoracic spine (2), glenohumeral (9), wrist (1), and cervical spine (2), with no injuries reported for the elbow. The following figures depict the injury type and occurrence (Figure 1), the prevalence of musculoskeletal injuries (Figure 2), and the prevalence of joint injuries (Figure 3).

Figure 1. Injury Type and Occurrence in CoC Fall 2014

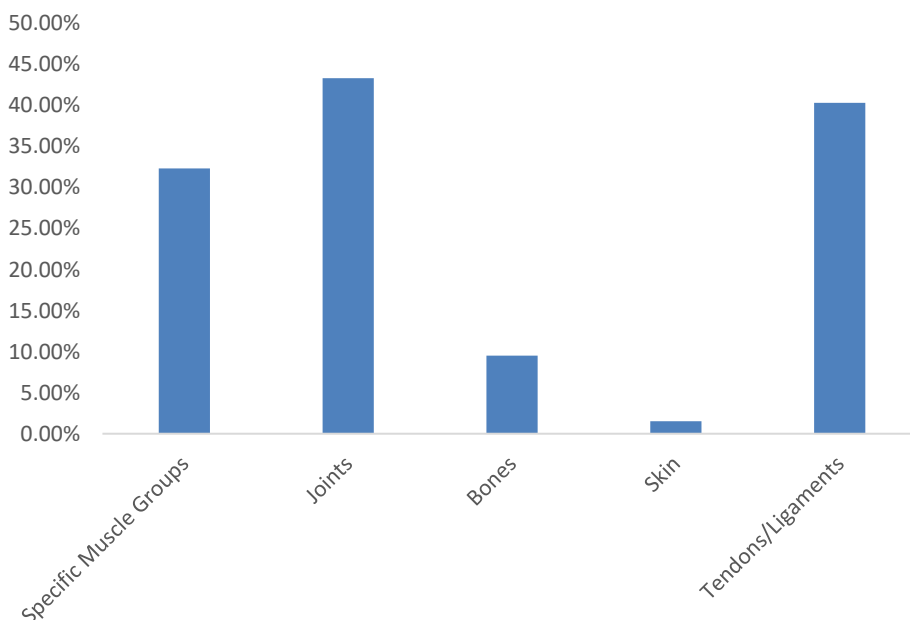
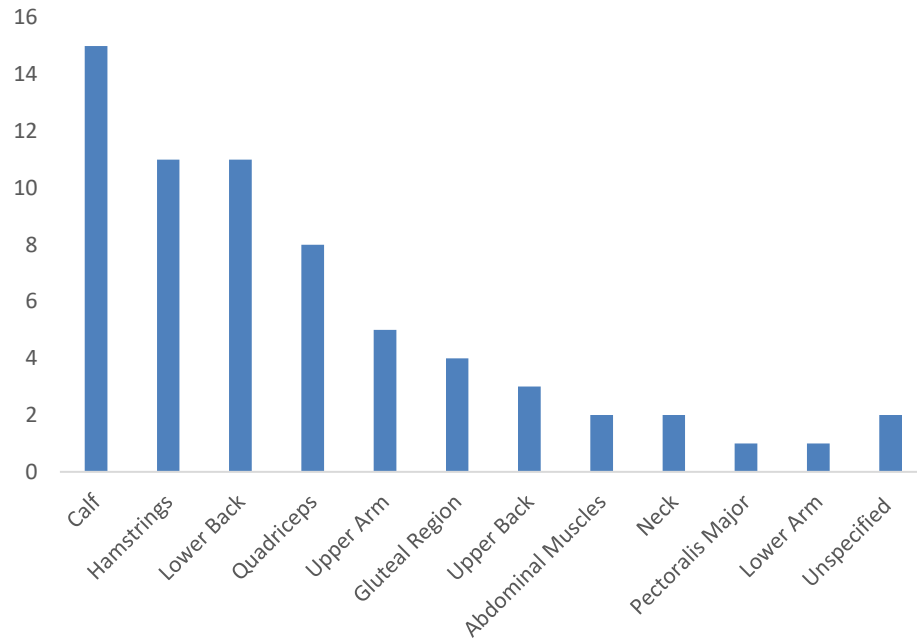
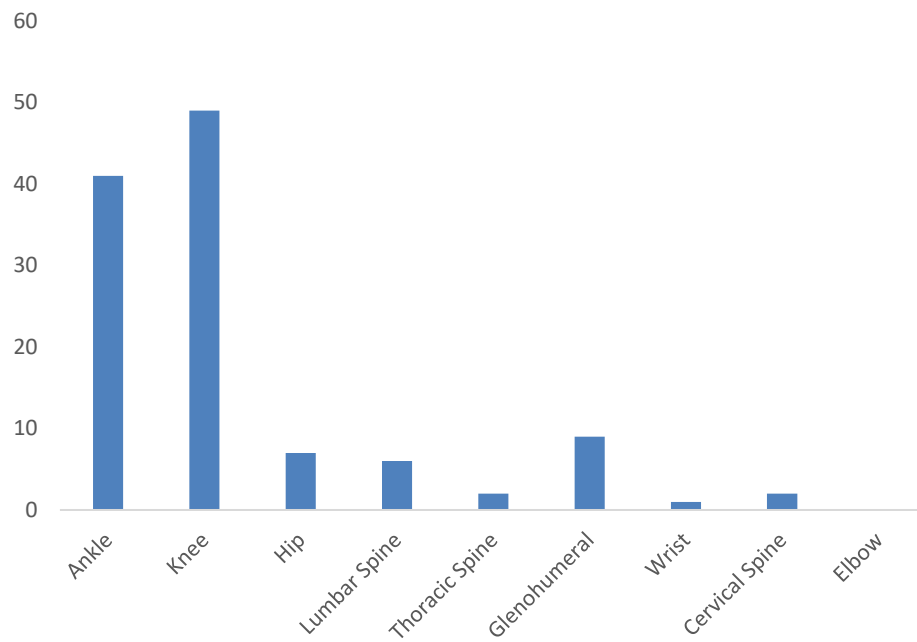


Figure 2. Prevalence of Musculoskeletal Injury in CoC Fall 2014**Figure 3.** Prevalence of Joint Injury in CoC Fall 2014

DISCUSSION

Over the 2014 fall semester, 152 cadets sustained an injury, at a 6.2% injury rate. The results were consistent with previous data that demonstrated the increased risk of lower extremity injury, compared to other parts of the body [13]. Furthermore, there were unreported cases of injuries that occurred during the present study. In these particular instances, a cadet might have been injured but did not report these on their QS. The cadets only reported to the research team if they missed training events due to injuries. Cadets who trained while injured went unreported. Though they did not miss training days, through decreased performance, training with an injury impairs combat effectiveness and has the ability to decrease combat readiness by making the injury worse with a longer recovery time.

Our investigation demonstrated that knee injuries were the most affected joint with the ankle being the second most common injury. Calf injury was the most common musculoskeletal injury that occurred. Hamstrings and lower back were the second most reported musculoskeletal injuries; however, vertebral column injuries were less prevalent within our sample than lower extremity injuries. This is most likely due to the fact that in basic training troops will conduct loaded movements with a greater frequency than in the CoC. Rosendal et al. [13] found that 92 subjects of their 330-subject sample (27.9%) sustained an injury during basic training; 35% of injuries were acute while 65% of the injuries sustained were from over-usage. In particular, these researchers found that the overuse injuries were more highly correlated with lower self-reported levels of fitness. In other words, the less fit the individual perceived him or herself, the more

likely he or she would sustain and overuse injury. Other studies [18] have found that vertebral column injuries are just as prevalent, if not more so, than lower extremity injuries. Hauret et al. [18] found in their study that vertebral column injuries accounted for 40% of all injuries while lower extremity injuries accounted for 39%, and upper extremity injuries only accounted for 14%. Overuse injuries were responsible for 82% of all injuries with joint derangement accounting for 9% and dislocation for 0.4%. The knee and lower leg were most effected since they composed 22% of the overuse injuries while the ankle and foot composed 13% of overuse injuries. In our particular study, we did account for previous levels of fitness prior to joining the CoC in our QS, especially the type of training that had occurred the summer right before the commencement of the Fall 2014 semester. We observed that the freshmen who were of lower fitness status and not used to the exercises, were the cadets getting injured more frequently. Thus, adding in an anatomical adaptation training period prior to the fall semester could potentially reduce injuries that occur for this population.

Armstrong et al. [14] was one of the first studies to compare 18-year-old military men and women with stress fractures to uninjured controls matched by multiple factors. They found that the most common injury site, in terms of stress fractures, was the tibia. Women were found to have a higher relative rate of incidence of stress fractures compared to their male counterparts. Unlike the freshmen in our study, most of whom had not done any training the summer prior to the semester, 85% of their sample class earned a varsity letter in at least one high school sport and 50% of the females within the class were recruited to play a division I sport. This particular study was a useful means of comparison since it was able

to offer data on a similar military age group. Nevertheless, another limitation of our study was the lack of specific comparison and analysis between males and females. Perhaps there were not enough injuries sustained by our female cadets to draw a significant comparison, but notwithstanding, this is an increasing area of interest. Particularly because in several studies women were found to be at greater risk for training injuries than their male counterparts [7] [13, 15].

In fact, one of the primary predictors of dropout rate within the female Marine Corps recruits was found to be related to a self-reported history of lower extremity injury as well as a poor initial fitness level [19]. Bell et al., [8] corroborated this in their findings during an 8-week study in which female Army trainees sustained twice as many injuries as men, however, this was predominantly due to their entering basic training with lower initial fitness levels. Upon further multivariate analysis, this particular study also found, that gender was not a significant predictor of injuries when compared to factors such as body composition, demographics, and initial fitness level [7]. Similar findings were also reported for females within the Israeli Army. In this sample, women were shown to have a higher incidence of stress fractures (12%) compared to males who experienced none. However, Finestone et al. [8], found that prior physical fitness scores at the beginning of training were not predictive of potential stress fractures in consequent training. Therefore, more research needs to be conducted to ascertain if there is a cause-and-effect relationship between previous training and future injury reduction.

Other investigations on stress fractures have also corroborated that women are more prone to stress fractures. To increase both

combat readiness and combat effectiveness, preventing injuries for females is of utmost importance. Cosman et al. [19], found that 19.1% of female cadets experienced at least one stress fracture during their first 3 months at the United States Military Academy (USMA) while only 5.7% of men experienced stress fractures. The authors suggested two explanations for women's increased susceptibility to stress fractures, smaller bone diameters, and a shorter time duration had passed since their most recent menstrual period. Similarly, Beck et al. [6], found that women were more prone to stress fractures due to having narrower bones and thinner cortices. Jones et al. [20], suggested, from previous findings, some decreased risk of stress fractures with the regular consumption of oral contraceptives, however, there is yet to be a large enough study conducted to determine its significance. These findings, in relation to women, are not only important for the commencement and development of programming, but further investigation of the role that nutritional intake, body composition, and various supplements has on injury susceptibility [15].

Recent promising studies have highlighted the predictive benefits of Functional Movement Screenings (FMS) on future injury occurrence [21, 22]. The study of ROTC cadets by Cosio-Lima et al. [21] found that both a traditional training program and a periodized training program improved FMS scores. Lisman et al. [22], contrarily found that only a slower 3-mile run time was associated with increased injury risk and not FMS score. Although this relatively new research has yet to be conclusive in its finding, FMS might provide helpful, additional screening measures in our QS. Therefore, if these measures are taken prior to the initiation of PT, findings can be used to identify weakness and asymmetries

that if corrected may reduce injuries.

Other researchers assert that prevention of overtraining should be the first priority through the implementation of more multiaxial, neuromuscular, proprioceptive, and agility training along with strength training [2, 9, 23]. Bullock et al. [2], listed other potential intervention strategies such as wearing mouth guards, wearing semirigid ankle braces, consuming appropriate nutrients within an hour of high-intensity activity, and wearing synthetic blend socks for blister prevention [2]. Kaufman et al. [23], also argues that mouth guards and semi-rigid ankle braces for higher-impact activities might offer some greater safety measures. Hoffman et al. [9], found that poor lower body strength during a 1RM leg-press, correlated with a higher risk for stress fractures, particularly amongst new recruits who were not physically active prior to military training. Based on these findings, if new recruits are given and follow a periodized training program prior to entry into the CoC, in addition to preventative exercises routines, this approach could help decrease the risk of injury even further.

CONCLUSION

Both the knee and ankle joints, along with calf and hamstring muscles, appear to be the most prone to injuries for the CoC, especially the FM class, which is in agreement with prior research. Furthermore, as found within our earlier research, this is primarily the result of the abrupt increase in running volume, running in poorly lit areas on uneven ground, running while in formation, and running in boots [18]. Therefore, if more preliminary measures can be taken to better prepare and acclimate the cadets before their first semester of physical training, then there is an increased likelihood that a larger number of these

injuries may be prevented. This will not only increase overall productivity within the Corps itself, but it will also most importantly improve military readiness amongst its participants.

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