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Study of the Nature of Injuries Sustained while Undergoing Pre Commission Training and Recommend Measures to Decrease the Incidence of Injuries in Cadets at Pre Commission Training Academy / Cadet Training Wings

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Abstract: ***A study was undertaken to document the nature of injuries sustained by cadets during basic military training. The injuries were documented retrospectively over a five years period and prospectively over a period of six months. As the data of injuries sustained during training by military cadets is sparse, this study focused on the incidence of injury , injury sites/locations, mode of injury and the outcome of injury on training. The main reason for the overuse injuries is the cumulative training load experienced by the novice trainee, accumulating over days, weeks or months. Majority of the injuries (86%) were mild in nature. Knee , leg, ankle and back were commonly injured in Male cadets, whereas pelvic injuries accompanied by leg, knee and ankle were common in lady cadets. Knee injuries, stress fractures and other fractures were the common cause for relegation and withdrawal from training. In order to reduce injuries during basic military training, attention must be directed towards modifying the type of training and prevention of bone stress injuries.***

Keywords: Training, injury, cadets, stress fracture, location of injury, Relegation

1. Introduction

It is a well known fact that the Armed Forces are the most important pillar of strength in any country. They are the last ray of hope in any adverse condition. Therefore it is but obvious that the leaders of the Armed Forces must possess extraordinary attributes which enable them in serving the motherland in the best manner whenever and whatsoever the demand of the occasion be. These attributes include not only physical fitness and all round knowledge but also steely resolve to accomplish the mission despite of all odds such as extreme environment, discomfort & pain.

The molding of a common civil person into an officer possessing the above mentioned attributes is a very challenging task. This is done by imparting training to cadets at respective Pre-commissioning Training Academies or Cadet Training Wings. The training undoubtedly is rigorous which is sustained over a defined period varying from weeks to years. The nature and type of training is unique and therefore most of the cadets are unaccustomed initially. The necessity to undergo such a rigorous training over a short period leads to large number of injuries.

The study of injuries sustained by cadets during training is sparse therefore most of the details related to the epidemiology of injuries is available in studies involving recruits or trained soldiers. The max number of Indian studies done on military training is on stress fracture in recruits (1, 2) and cadets (3, 4). There is scarcity of Indian study related to overall training related injuries. In view of the non availability of published data related to injuries in military training among Indian cadets, data from studies involving US, Australia, South Africa & New Zealand recruits/army have been referred here.

Majority (39.6-80%) of these injuries are in lower extremities (5, 6). Knee (16-32.1%), lower leg (7.3-15.1%), ankle (11.6-35%) and foot (11.9-20.8%) are the common sites of injury (5, 7, 8). Injury to the Spine (15.2%) is also common (5). Upper extremity injuries account for approx (19.4%) only (5). Although the injuries accounted for 56% of total sick report but caused nearly ten times the no of limited duty days as compared to illness (9). Between 80-90% of all limited duty days accrued by US Army trainees and infantry soldiers was the result of training related injuries (10). Injuries not only cause absence from training, if severe enough it may lead to repeating the entire term (relegation) or discharge from training (withdrawal). Apart from the cost involved in treating the injuries, relegation and withdrawal of cadets due to injury cause heavy financial burden on the Govt exchequer. It also leads to attrition of precious manpower which otherwise would have increased the strength of the Armed Forces.

2. Review of Literature

2.1 Causes of Injuries

Overuse is the most common cause of military training injuries reported in literature (5, 6, 10, 11). As opposed to acute injuries which occur suddenly because of a specific event (such as twisting of ankle during a football match) the overuse injuries develop without the trainee noticing any specific cause. The overuse injuries gradually increase in severity with the continuation of training exposure. The trainee seeks medical care only when the injury starts affecting his day to day routine. Thus the cause of overuse

injury is the cumulative training load which the trainee is experiencing (the training load of running, drill, sports/games all combined) over past days/ weeks/ months. The predisposing factors for overuse injuries have been classified into extrinsic and intrinsic factors. The list of the extrinsic and extrinsic factors is given below:-

Extrinsic factors	*Intrinsic factors*
Training errors • Excessive volume • Excessive intensity • Rapid increase • Sudden change in type • Excessive fatigue • Inadequate recovery • Faulty technique	Mal-alignment • Flat feet • High arch • Knock knee • Bow leg Leg length discrepancy Muscle imbalance
Surfaces (Hard, Soft, Cambered/Sloped)	Muscle weakness Lack of flexibility/ hyper mobility Sex /Gender Body composition
Shoes (Inappropriate, Worn out) Environmental conditions (hot, cold, humid) Inadequate nutrition	Other factors • Genetic • Endocrine Metabolic

2.2 Prevention of Injuries

As has been brought out earlier, training injuries account for most of the loss of training hours as well as cause heavy burden on medical setup and ultimately cost heavily on the Govt exchequer. Measures to prevent or reduce these injuries will reduce the training cost exponentially. Therefore all across the world, militaries are always in pursuit of methods to prevent or reduce the occurrence of injuries. Since any injury prevention program can work only when the risk factors causing those injuries are identified. Therefore a deeper understanding of the mechanism by which the various risk factors mentioned above contribute to injuries will help in devising successful injury prevention measures.

(a) Extrinsic factors

Extrinsic factors are those factors which are external to individual's body (training program, training surface, shoes, environment, nutrition etc). The most common extrinsic risk factor for lower extremities injuries in military is the training error related to running (12).

(i) **Training error**: The scenario when a beginner suddenly starts running excessively is the commonest training error in most of the military training establishments. Increased running mileage when coupled with inadequate recovery between training sessions is the main risk factor for overuse injuries of lower extremities.

(ii) **Measures to prevent injury**: The literature overwhelmingly supports reduction in running distances among trainees as a strategy to reduce injury rates while still attaining minimal physical fitness std (13-16) . Also allowing for adequate recovery between training sessions will lead to further reduction in training related injuries (17).

(iii) **Training surface**: Running on hard surface such as concrete or asphalt causes higher quantity of mechanical shock to the joints, muscles and tendons thereby leading to more number of injuries. Running on too soft a surface may allow excessive movements of joints, fatiguing muscles and cause overuse injuries. Running on cambered/sloped surface can cause abnormal stress on one side of the body (18).

(iv) **Measures to prevent injury**

Running on wood chips or "Kaccha track" on the other hand offers an excellent surface for injury prevention (18).

(v) **Shoes**

Shock absorption can be enhanced by well fitting shoes. A running shoe should be a stable shoe with optimal shock absorption in the sole/ insole and well fitting heel cup that is stiff around the heel foot pad. Shock absorption qualities of a shoe reduce as it wears out. After approx 400 Km of running there is reduction in shock absorption quality of the shoe by 30–50% (18). Apart from running in PT shoes, drill and endurance marches are conducted in Ammo boots (Drill boots) and Combat boots (DMS). Biomechanical research study has demonstrated significantly greater shock absorbing capabilities of PT shoes as compared to Drill boots and DMS boots (19).

(vi) **Measures to prevent injury**

Issue new PT shoes every three months irrespective of the look as by this time the shock absorbing capacity reduces by 30-50%. Drill and endurance marches to be done initially in PT shoes and then graduated to DMS boots and Drill shoe. This will give enough time for the body (muscle, tendon & bone) to adapt to the unique stress given by the demand of military training.

(vii) **Inadequate nutrition**

The quality and quantity of nutrition at training establishments is of the highest standard. Adequate nutrition helps in repair and regeneration of exercised muscles thus making them stronger. The one hour duration immediately after finishing the training session is the golden hour for recovery as during this period the body's uptake of nutrients is very quick. Thus breakfast becomes one of the most important recovery meals since it is consumed within one hour of finishing the morning strenuous sessions of PT or drill. However because of availability of limited time for breakfast which also includes activities such as bathing, dress change and reporting for next parade; many trainees either miss their breakfast or do it half way during the initial months of training. This leads to inadequate recovery which further leads to injuries.

(viii) **Measures to prevent injury**

Allotment of adequate time for breakfast

Consumption of nutrients to restore energy balance within one hour following high intensity activity (High carbohydrate/protein replacement within 15-30 minutes of finishing high intensity exercise leads to more rapid glycogen restoration in muscle and liver besides preservation of muscle mass (e.g. Banana shake, chocolate milk, smoothie etc.) (17).

(b) Intrinsic factors

Intrinsic factors are those factors which are related to individuals body (eg. malalignment such as knock knee &

flat feet, muscle imbalance, muscle weakness, age, sex, body composition etc).

(i) **Malalignment**
Trainees with any of the conditions such as flat feet, high arch, knock knee and bow leg are at increased risk of overuse injuries (18). However the prevalence of these conditions in cadets is approx nil because of the rigorous medical screening examination conducted before enrolment.

(ii) **Measures to prevent injury**
Screening for presence of malalignment during start of training, prescription of corrective orthotics and exercises.

(iii) **Muscle imbalance and muscle strength**
The various groups of muscles of the body work together to perform any task. It is important that both the sides of the body are balanced in terms of strength (normal acceptable difference between two sides is 10%). Variation more than this leads to more stress on the stronger side thus leading to injuries (20). Muscle bulk and strength is required to stabilize the body segment and absorb the ground reaction forces to the bones/ joints. Weaker muscles lead to more number of overuse injuries.

(iv) **Measures to prevent injury**
- Screening for muscle imbalance & strength during start of training & prescription of corrective ex.
- Focusing on muscle strength & conditioning rather than running during initial three months of training.

(v) **Lack of flexibility and hyper-mobility**
Presence of either of these makes a trainee prone to injuries.

(vi) **Measures to prevent injury**
Screening for lack of flexibility and hyper-mobility during start of training and prescription of corrective ex (regular stretching for those with less flexibility and strengthening ex with restriction on stretching for those with hyper-mobility (18).

(vii) **Sex/ Gender**
The musculoskeletal system is dimensioned differently in women, who have 25% less muscle mass per Kg body weight, 40% weaker upper body strength when expressed relative to lean body mass, lower bone density, wider pelvis and more mobile joints compared with men (17,18). While running women exhibit greater hip adduction, hip internal rotation and knee abduction than men. Women soldiers also have lower initial fitness level as compared to men. These factors may make women more susceptible to specific injuries such as stress fracture pelvis, medical tibial stress syndrome and Patello femoral pain syndrome. It has also been known that menstrual disorder is a risk factor for certain overuse injuries such as stress fracture (18). Studies of Australian, British and American troops have reported higher rates of injury among female soldiers as compared to their male counterparts (21-24).

(viii) **Measures to prevent injury**
Training program should focus on strength and conditioning before increasing the running mileage in the first three months. Lady Cadets (LCs) with menstrual disorder to be put through a lower intensity training program.

(ix) **Body composition**
There is a clear relationship between body composition and performance on run tests with one and two mile run. Timing increases dramatically with increased % body fat. For males the highest % body fat group had more injuries; however, in females the reverse was true, with leanest having more injuries (25).

(x) **Measures to prevent injury**
Body composition testing should be done during the screening medical and thereafter once in every three month. Trainees should be encouraged to maintain a healthy body composition.

2.3 Aim

To recommend measures to decrease the incidence of injuries sustained by Cadets while undergoing Pre commission training at Pre commission training academy (PCTA) and Cadet training wings (CTW).

2.4 Objectives

In order to achieve the above aim, the objectives of the study are as follows:-
- To study the epidemiology of injuries sustained by cadets while undergoing pre commission training at PCTAs/CTWs.
- To find out the most probable cause of the injuries sustained by cadets while undergoing pre commission training at PCTAs/CTWs.
- Based on the analysis of epidemiology of injuries & its association with major risk factors, recommend measure to prevent or reduce the incidence of injuries sustained by cadets while undergoing Pre commission training at PCTAs/CTWs.

3. Materials and Methods

The structure of the materials and methods is being discussed under the following headings:

(a) **Place of study**
Pre commission training academy (PCTA) and Cadet training wings (CTW).

(b) **Study design**
Retrospective study of last five years (2014 - 2019) and Prospective study of six months (Jun –Dec 19). Questionnaires for Retrospective study as well as Prospective study were forwarded to all PCTAs/CTW for compilation of data and returning the same to the same to the principle worker.

(c) **Study population**
All cadets who underwent Pre commission training at above PCTAs/CTWs anytime during the five years period wef Apr 2014 to Mar 2019 and during the period of prospective study of six months.

3.1 Methodology

The injury data (date of injury, cadet no, name, diagnosis and type of treatment taken) was obtained from the sick reporting record maintained in the medical facility of the PCTAs/CTWs. Demographic data (Age, Height and weight) was obtained from the record of initial medical screening done routinely on the day of joining the academy. BMI was calculated for each cadet using height and weight data. Injuries were categorized into **mild** (not resulting in relegation**), moderate** (resulting in relegation) and **severe** (resulting in Low medical category or withdrawal). Apart from this any fracture case was categorized into severe grade. Each injury was classified into one of the body part as per loc of injury. Relegation and withdrawal data was obtained from various respective records maintained in the academy. Presence of stress fracture in the cadet reporting sick for any injury was found from medical record. Only sick report data of musculoskeletal injuries was included in the study. Illnesses were excluded from the study.

3.2 Statistical analysis

Summary statistics including mean, standard deviation were calculated for age, height, weight, BMI, sick report for injuries per year. The average no of injuries occurring per year were also calculated as per body part or loc wise. Each body part or loc as a share of total injuries was calculated in percentage. The same is presented in pie/bar chart. Separate pie/bar chart is presented for Gentleman cadets (GC) and Lady cadets (LC) to bring out the difference in pattern of injuries because of gender. Total no of withdrawals and relegation were calculated and the respective injury responsible for it was mentioned as per the data available.

4. Findings of the Study

Academy 'A'
Retrospective study (Apr 2014 to Mar 2019)
A total of (n= 2946) Cadets comprising (n=2584) GCs and (n=362) LCs underwent training during the period of study (Apr 2014 to Mar 2019). Their anthropometric and injury data are presented in tabular form below.

(a) Anthropometric parameters
GCs & LCs have different anatomical & physiological characteristics thus they form two distinct groups. All the injury data was therefore analyzed separately for GCs & LCs. This would help in providing recommendations specific to the need of each group. The anthropometric data expressed as mean ± SD of all GCs (n =2584) and LCs (n = 362) is given below:-

Descriptive parameter	GCs (n=2584)	LCs (n=362)
Age (years)	23.8 ± 3.4	23.5 ± 1.6
Height (cm)	172.9 ± 35.4	161.9 ± 5.8
Body mass(Kg)	68.8 ± 10.8	56.4 ± 6.6
Body mass index (BMI)	22.1 ± 1.4	21.5 ± 1.0

(b) Epidemiology of Injuries
Total no of sick reports related to injury during the five years study period was 13,579. The injuries were classified into mild, moderate & severe. The same is presented below:-

Severity	Total no of cases	%
Mild	11,611	85.5
Moderate (Resulting in relegation)	721	5.30
Severe (Resulting in withdrawal)	1,247	9.20
Total	13,579	

(c) Average no of injuries
Average no of injuries per year distributed every four weeks is presented in table below:-

1-4	5-8	9-12	13-16	17-20	21-24	25-28	29-32	33-36	37-40	41-44	45-48
160	297	277	286	259	124	167	277	228	289	310	149

The same data is presented in bar diagram below for easier understanding. As per the data presented in the table above and the bar diagram below most of the injuries are occurring in the 5 to 20th week in the Junior term & 29 to 44 weeks in the Senior term.

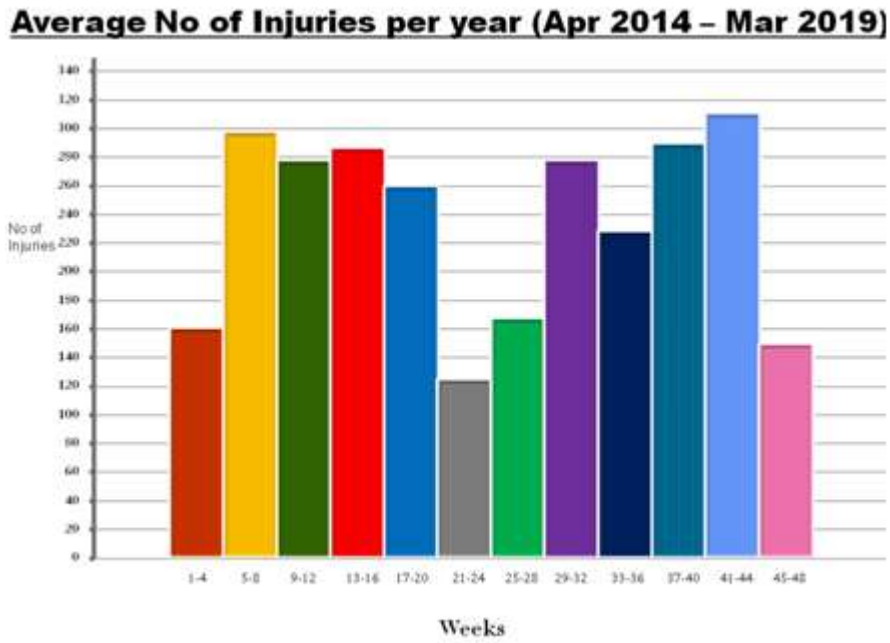

Figure 1

(d) Description of occurrence of injuries as per body part

(i) GCs only

When the injury data as per body part for GCs is analyzed, the lower limb injuries alone account for approx 72.8 % of total injuries. The back injuries account for 11.97% followed by upper limb injuries 11.95%. The same is presented in the Pie chart below.

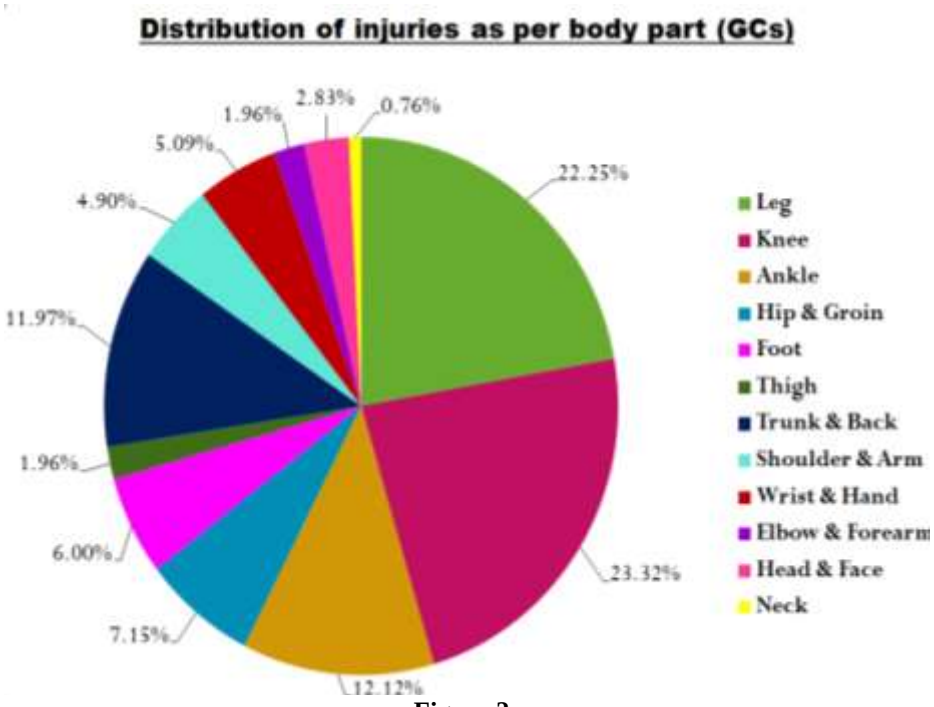

Figure 2

(ii) LCs only

When the injury data as per body part for LCs is analyzed, the result is very different. Although lower limb injuries still account for the majority (79.66%) of injuries, hip & groin injuries account for the highest percentage of injuries as compared to leg & knee injuries in GCs. The back injuries account for 9.29% followed by upper limb injuries 8.08%. The same is presented in the Pie chart below:-

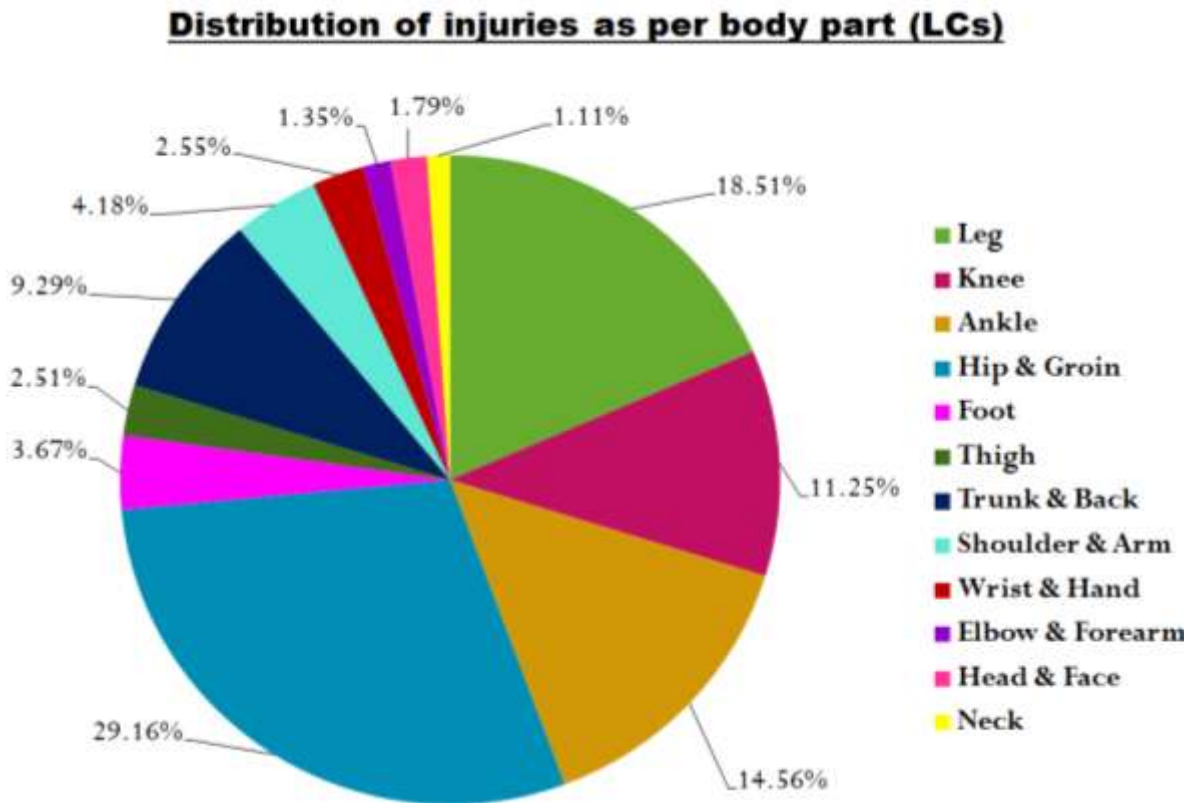

Figure 3

(iii) Relegation

The no of cadets relegated on medical grounds per year is presented below:-

Year	No of cases	GC/LC
Apr 14 – Mar 2015	14	12/02
Apr 15 – Mar 2016	22	20/02
Apr 16 – Mar 2017	19	18/01
Apr 17 – Mar 2018	19	19/00
Apr 18 – Mar 2019	23	20/03

On an average 19 cases of relegation on medical ground occur every training year. On analysis of the injuries leading to relegation, knee injuries, stress fracture and other fractures account for 78.34% of all relegation cases. Common injuries leading to relegation expressed in percentage is also depicted in the pie chart given below:-

(iv) Withdrawal

The no of cadets withdrawn on medical ground per year is presented below:-

Year	No of cases	GC/LC
Apr 14 – Mar 2015	02	01/01
Apr 15 – Mar 2016	03	03/00
Apr 16 – Mar 2017	03	03/00
Apr 17 – Mar 2018	02	02/00
Apr 18 – Mar 2019	02	02/00

On an average 2-3 cases of withdrawal on medical ground occur every training year. On analysis of the injuries leading to withdrawal, knee injuries, other fractures, shoulder and head injuries account for 83.2% of all withdrawal cases. Common injuries leading to withdrawal expressed in percentage is also depicted in the pie chart given below.

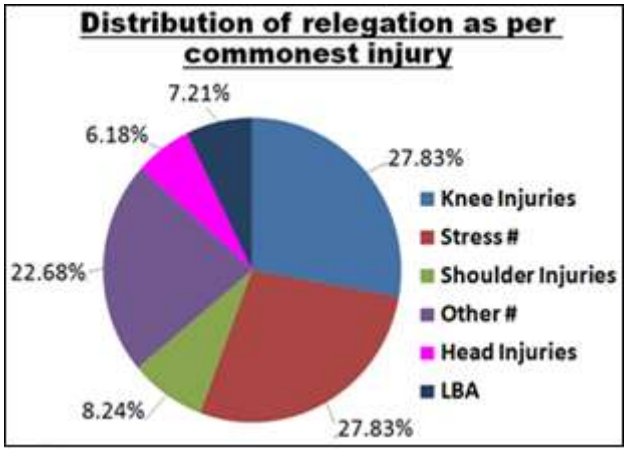

Figure 4

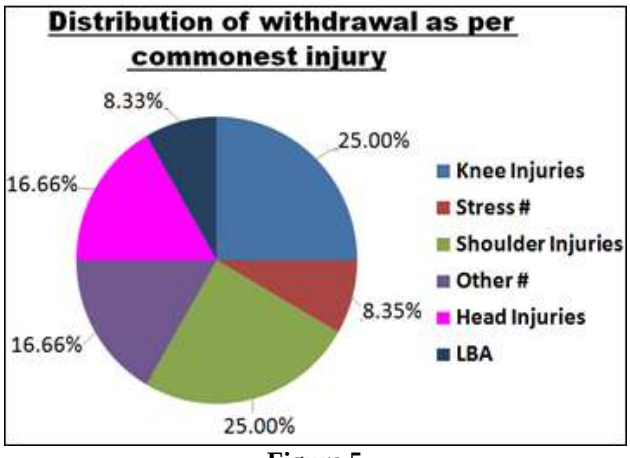

Figure 5

Academy 'B'

Retrospective study (Apr 2014 to Mar 2019) & Prospective study (Jun to Dec 19)

A total of (n= 51) Cadets comprising (n=51) GCs sustained injuries during the period of Retrospective study study (Apr 2014 to Mar 2019) and a total of (n=17) cadets comprising of (n=17) GCs sustained injuries during the six months Prospective study. Their anthropometric and injury data are as under:

(a) Anthropometric parameters

GCs & LCs have different anatomical & physiological characteristics thus they form two distinct groups. All the injury data was therefore analyzed separately for GCs & LCs. This would help in providing recommendations specific to the need of each group. The anthropometric data of **Retrospective study** expressed as mean ± SD of all GCs (n =51) and LCs (n = 0) is given below:-

Descriptive Parameter	GCs (n=51)	LCs
Age (Years)	25± 8	Nil
Heights (cm)	175±9	Nil
Body Weight	65±10	Nil
BMI	20±4	Nil

The anthropometric data of **Prospective study** is expressed as mean ± SD of all GCs (n =17) and LCs (n = 0) is given below:-

Descriptive Parameter	GCs (n=17)	LCs
Age (Years)	25+8	Nil
Heights (cm)	175+15	Nil
Body Weight	63+12	Nil
BMI	20+4	Nil

(b) Epidemiology of Injuries

Total no of injuries during the period of five years **Retrospective** study period was 51. The injuries were classified into mild, moderate & severe. The same is presented below:-

Severity	Total no of cases	Percentage
Mild	10	19.60%
Moderate	41	80.40%
Severe	Nil	-
Total	51	

Total no of injuries during the period **of prospective study** was 17 and the same is presented as under:

Severity	Total no of cases	Percentage
Mild	08	47.0%
Moderate	08	47.0%
Severe	01	6%
Total	17	

The same data is presented in bar diagram for easier understanding. As per the data presented in the table above and the bar diagram below most of the injuries (80.4%) injuries resulted in relegation. Similarly during the **prospective study** 47.0% of the injuries sustained were mild in nature and 47.0% injuries resulted in relegation.

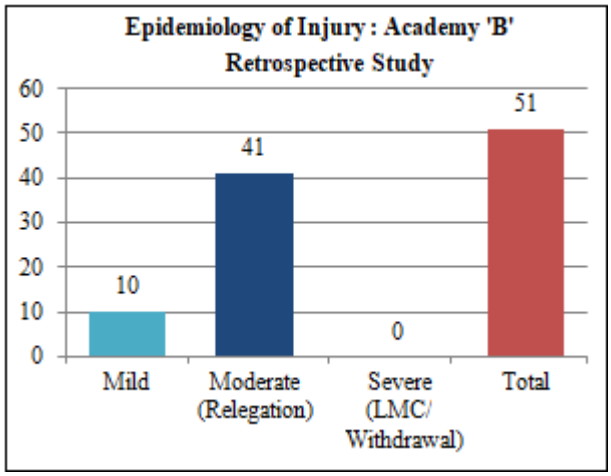

Figure 6

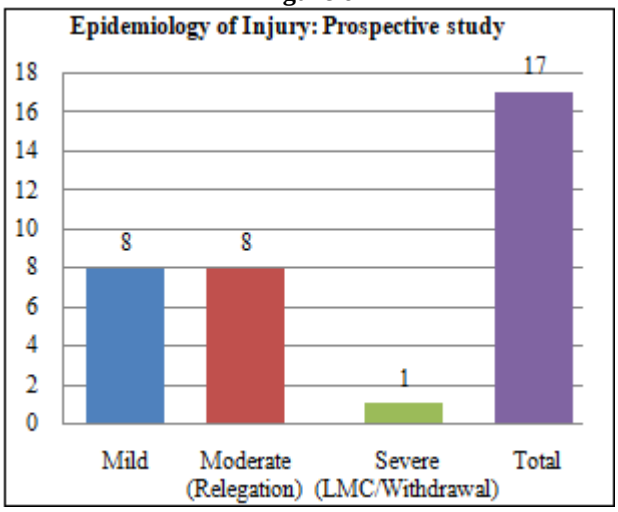

Figure 7

(c) Description of occurrence of injuries as per body part.

(i) GCs only

When the injury data as per body part for GCs is analyzed, the lower limb injuries alone account for majority of the injuries. The same is presented in tabular form and bar chart below:

Distribution as Per Body Parts: Male (GCs)		
Ser No	**Loc/Site of Injury on body**	**Total Nos**
1.	Tibia	09
2.	Knee	08
3.	Unspecified	08
4.	Femur	06
5.	Shoulder	04
6.	Eye	02
7.	Fibula	02
8.	Radius	02
9.	Ulna	01
10	Malleolus	01
11.	Vertebra	01
12.	Urinary System	01
13.	Ankle	01
14.	Finger	01
15.	Head	01
16.	Hip	01
17.	Scaphoid	01
18.	Mandible	01
	Total	**51**
(ii) Distribution As Per Body Parts: Female (LCs)		
Nil		

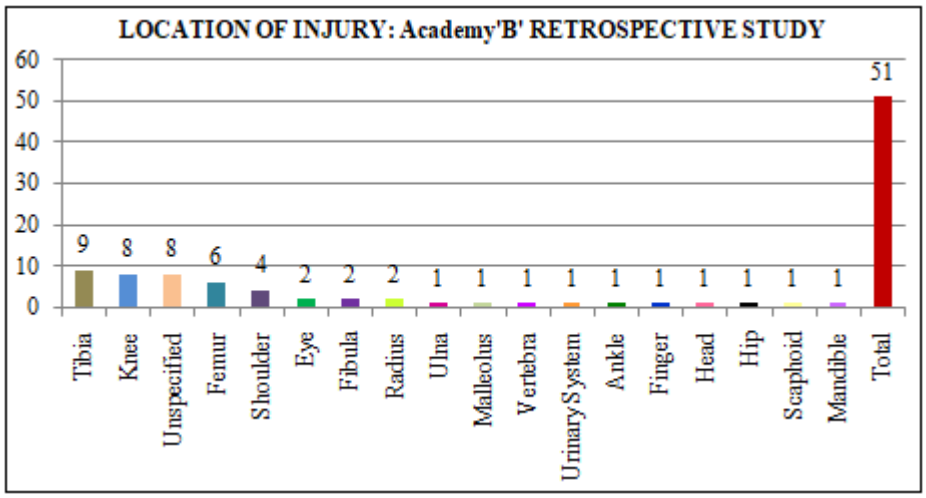

Figure 8

When the injury data of **prospective study** as per body part for GCs is analyzed, the lower limb injuries are again predominant and account for majority of the injuries. The same is presented in tabular form and bar chart below:

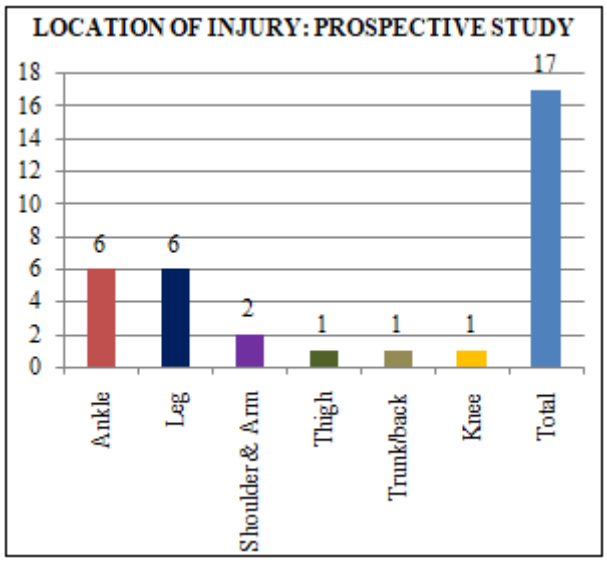

Figure 9

(iii) <u>Relegation</u>. The total no of cadets relegated on medical ground during the **retrospective study** is presented below.

Ser No	Year	No of Cases	GCs	LCs
1.	Details not available	41	41	-

The total no of cadets relegated on medical ground during the period of **prospective study** is presented below:

Ser No	Month	No of Cases	GCs	LCs
1.	Details not available	08	08	-

(iv) <u>Withdrawal.</u> The total no of cadets withdrawn on medical ground during the period of **retrospective study** is presented below.

Ser No	Year	No of Cases	GCs	LCs
1.	-	Nil	-	-

The total no of cadets withdrawn on medical ground during the period of **prospective study** is presented below:

Ser No	Month	No of Cases	GCs	LCs
1.	Details not available	01	01	-

<u>Description of injuries as per type of injury</u>

GCs only When the injury data as per type of injury is analyzed, the stress fractures alone account for majority of the injuries. The same is presented in bar chart below:

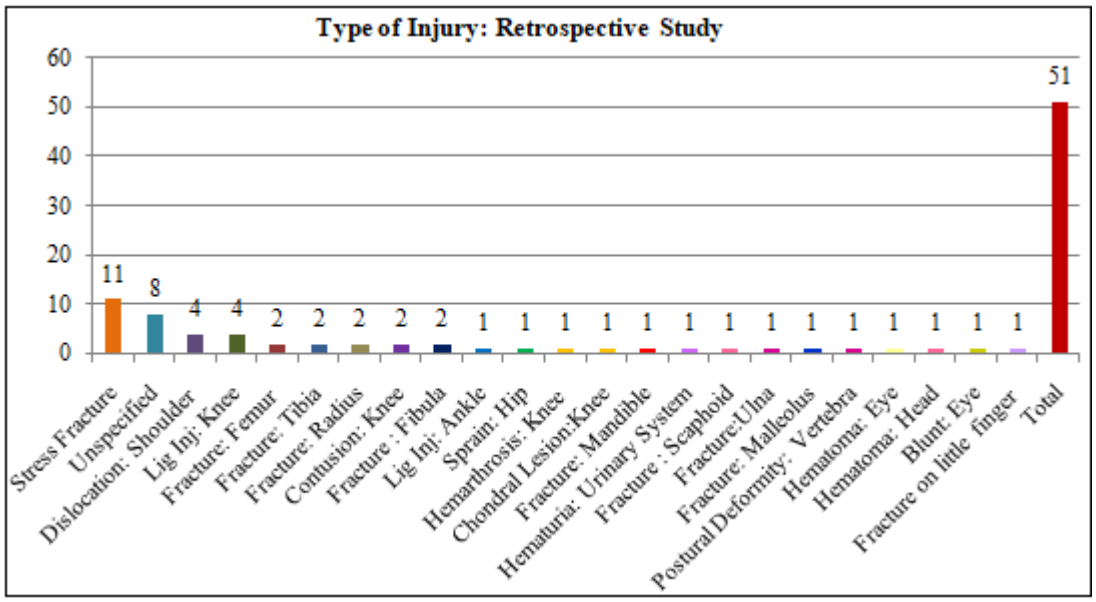

Figure 10

When the injury data obtained from **Prospective study** as per type of injury is analyzed, **Stress fracture tibia and ankle injury account for majority of the injuries**. The same is presented in bar chart below:

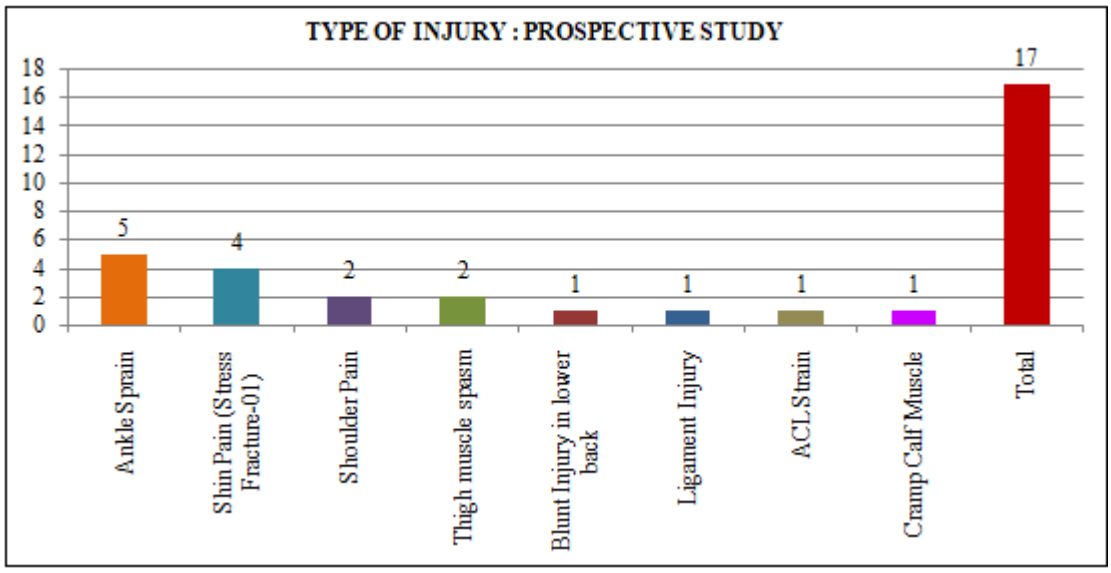

Figure 11

5. Observation & Discussion

Injury data of five years Retrospective study (Apr 14 to Mar 19) and of six month prospective study was retrieved from the medical record. The main findings of the present study are as follows:-

(a) **Overuse injuries accounted for majority of the injuries**. The finding of this study is in agreement with other studies done on military training (5, 6, 10, 11). The main reason for the overuse injuries is the cumulative training load experienced by the novice trainee, accumulating over days, weeks or months. Inadequate recovery between training sessions, between weeks and sometimes in between months because of the extremely packed training scheduled, contributes as much as the cumulative training load to the cause of overuse injuries. Employment of fundamental principles of training (progressive increase in training load and provision of adequate rest/recovery period in between training sessions, weeks etc. also known as principles of periodization) will definitely help reduce the occurrence of overuse injuries (17).

(b) **Majority of the injuries (86%) were mild in nature.** The findings of this study are in agreement with the military training related literature. Most of the injuries fall in the category of muscle strain, ligament sprain, tendinopathies, stress reaction etc. These injuries resolve quickly when medical attention is sought at an early stage. However if neglected in the initial stage, they have the potential to cause extreme morbidity in form of loss of training days, relegation & withdrawals. Early reporting coupled with gradual return to training following treatment & rehab is the key to avoid loss of training hours.

(c) **The lower limb accounted for majority of the injuries in both GCs & LCs.** The findings of this study are in agreement with other studies done on military training (5, 6). The main reason for involvement of lower limb is the extreme dominance of running & drill in the daily routine of the trainees. Measures to reduce the running mileage have shown to be extremely effective in reducing injury rates while still attaining minimal physical fitness (13-16). With respect to drill, use of better shock absorbing shoes, conducting drill on "Kaccha" ground & avoiding hard stamping might lead to reduction of lower limb injuries (18, 19).

(d) **Knee, Leg, ankle & back were the most common body part injured in GCs.** The findings of this study are in agreement with other studies done on military training (5, 7, 8). The reasons for this findings are same as discussed in Para 14 (c) ibid.

(e) **Pelvic injuries accompanied by leg, knee, ankle & back were the most common body part injured in LCs.** There is dearth of data related to training related injuries in female trainees. Most of the available data is in relation to stress fracture. Although the injuries discussed here are different from stress fracture, the risk factors for both are the same as both are overuse injuries. Therefore the comparisons were made with stress fracture data available in literature. The finding of pelvic injuries accounting for the maximum no of injuries in female cadets is in agreement with higher percentage (28.5 to 51%) of pelvic fractures seen in Indian female cadets (3,4). The main reasons illustrated in literature for the dominance of pelvic injuries are shorter height, wider pelvis, more mobile joints, lower initial fitness and higher prevalence of relative energy deficiency syndrome (RED-S) comprising of disordered eating, low bone density & menstrual disorder (17,18). Since the cause of pelvic injuries and stress fracture are the same, measures to reduce the fracture will also reduce the no of pelvic injuries. Certain training modifications have been found to nearly abolish the incidence of pelvic fractures (pelvic stress fractures rate fell from 11.2% to 0.6%) in female recruits (26). Interventions included a reduction in route march speed from 7.5 Km/hr to 5 Km/hr, placing shorter women at the head of the column to reduce stride length. Individual step length was promoted instead of marching in step, March & run formations were more widely spaced and interval running replaced traditional middle-distance runs.

(f) **Knee injuries, stress fractures & other fractures were the commonest reason for relegation.** Those knee injuries which are severe and stress fractures contribute to the majority of relegation cases. Other fractures which occur because of accidental fall are also an important cause of relegation. Since relegations not only cause loss of time to the trainee it also leads to additional burden on the government exchequer by increased training expenditure. The measures to reduce relegations due to knee injuries and stress fractures are already mentioned in above paragraphs. However it is really difficult to prevent accidental falls leading to other fractures.

(g) **Knee, shoulder injuries, other fractures were the commonest reason for withdrawal**. Knee injuries such as anterior cruciate ligament tear grade three require surgery followed by a minimum of 6 to 9 months of supervised and dedicated rehab. Similar is the case of other fractures. However lack of adequate time for supervised dedicated rehab along with grueling nature of military training leads to multiple relegation on medical ground and finally withdrawal. Head injury cases never become 100 % fit. Considering the mandate of military leaders, these cases are not considered fit for military training and therefore lead to withdrawal. Allotment of facility for supervised and dedicated rehab for Knee lig injuries & other fractures may reduce the no of withdrawals. This will lead to augmentation of the force strength and prevent wastage of government money.

(h) **The injuries mostly occurred over Initial months of each term.** This finding shows that the training during the initial period (first month) is gradual, as also because of the term break (six month) in between two terms. The no of injuries during the rest of the period is high because of the grueling training schedule over a very short span of time.

6. Conclusion

The analysis related to the injuries sustained by cadets during the Retrospective study of five year and prospective study of six months once again confirmed that majority of injuries occurring during military training are in lower limb. Running and drill on hard surface coupled with inadequate recovery are the most important risk factors for these injuries. While the mandate given to train naive civil persons into a robust leader within a short time frame, comes with inherent risk. It is clear that through a scientific approach, it is possible to reduce injury, improve retention and thus create healthy military leaders.

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