The Prevalence of Occupational Knee Injury Among Active Duty Royal Malaysian Army in Kuala Lumpur Camp

Majar (Dr) Nur Hidayah Shamsudin[1,2], Salmiah Md. Said[1]

[1] Medical Faculty and Health Sciences, University of Putra Malaysia
[2] Malaysian Armed Forces

ABSTRACT

Background: The members of the military are exposed to extreme occupational demands, requiring excellent physical and mental fitness. With frequent physical training, the military members are exposed to the risk of knee injury. Injuries among military personnel causing disability will negatively impact the capabilities of the armed forces. **Methods**: This is a cross-sectional study conducted among Royal Malaysian Army in a camp in Kuala Lumpur for 12 months using a self-reported questionnaire. 1244 respondents' data were analysed in this report to determine the prevalence of occupational knee injury and the associated factors. **Results**: The prevalence of knee injury among respondents is 27.8% (95% CI: 25.4, 30.4), and the prevalence of occupational knee injury among the respondents is 16.6% (95% CI: 14.6, 18.8). Sports injury while on duty is the highest reported with 11%, followed by road traffic accidents (5.5%). Military drill (3.7%), sport's activities while not on duty (3.5%), fall on duty (2.1%), fall out of duty (1%) and other causes of knee injury (1.4%). Age group, race, household income, troop element, service years, BMI, comorbidity were found to be significantly associated with the cause of knee injury, while rank, gender and education were not. Activities like jogging, cycling, football / futsal, gym or heavy weight lifting activities and other sports activities were also found to be significantly associated with the cause of injury. The factors contributing to occupational knee injuries were age 30 years old and above, BMI more than 25 kg/m2, and those who play football or futsal. Other types of sports and comorbidity were the factors that contribute to both occupational and non-occupational knee injury, while jogging and slow run were the protective factors for both. **Conclusion**: Further assessment on the occurrence of occupational knee injuries during sports activities is needed to identify the problem and an intervention to reduce the occurrence is needed. A detailed research on each occupation in the Armed Forces and its impact towards occupational injury is also needed.

Keywords: Malaysian Armed Forces, Knee Injury, Malaysian Royal Army

INTRODUCTION

The military members are exposed to extreme occupational demands, requiring excellent physical and mental fitness. With frequent physical training, the military members are exposed to the risk of knee injury [1,2]. Although there are reports on the prevalence of knee injuries, the cause of knee injuries among Malaysian Active Duty Army (ADA) is not well described in general and differentiated between occupational or non-occupational causes[3]. Injuries among military personnel causing disability will have a negative impact on the armed forces' capabilities if the causes are not prevented[4].

Knee injuries can lead to permanent disability. It may lead to the risk of knee osteoarthritis (KOA), and the risk of KOA among the Malaysian Army increases by 16 fold if it is not prevented early[5]. The risk is higher after any chronic ligament injuries, intra-articular fractures or with meniscus tear[6]. Every personnel with occupational injuries leading to permanent disability is subjected to a medical board and will be compensated. Thus, it is important to recognise the risk that could be caused due to military training or due to other injuries that may jeopardise the force's capabilities.

METHODS AND MATERIALS

This is a cross-sectional study, conducted among the Royal Malaysian Army in a camp in Kuala Lumpur. The study protocol was approved by the Ethics Committee of the s Malaysian Armed Forces Health Services. This study was conducted for 12 months from September 2019 till August 2020. The objective of this study is to determine the prevalence of occupational knee injuries among the respondents and to determine its associated factors. All active-duty army personnel between 18 to 60 years old were included in this study. Any active-duty army personnel with a history background of coagulopathies, inflammatory joint disease and any local or systemic infections were excluded from the study. All participants were selected using stratified systematic random sampling from the name lists. The sample size was calculated using hypothesis testing 2 proportion formula (Stokes, 2014). This study was conducted using a self-reported questionnaire, reviewed by experts.

Analysis

The data set obtained from the questionnaires was analysed using IBM SPSS version 27.0. Missing values and irrelevant answers were excluded from the analysis. All hypothesis testing was two-sided, and the level of significance was set at $\alpha = 0.05$. Descriptive statistics were used to describe the distribution of respondents by sociodemographic characteristic, occupational characteristic, history of a knee injury, occupational knee injury and body mass index. Measurement for central tendency was used for continuous data (age, Body Mass Index (BMI)).

For inferential statistics, the Chi-Square test was used to determine the association between the independent variable and dependent variable. In order to identify the factor of an

occupational knee injury, multinomial logistic regression was used with selection criteria of significance in the chi-square test.

RESULTS

1274 respondents were selected for this study. All of them consented and only 1260 returned the questionnaire. Sixteen (16) respondents were excluded from the final data analyses because of incomplete data giving the respondent rate 98.9%. See Figure 1.

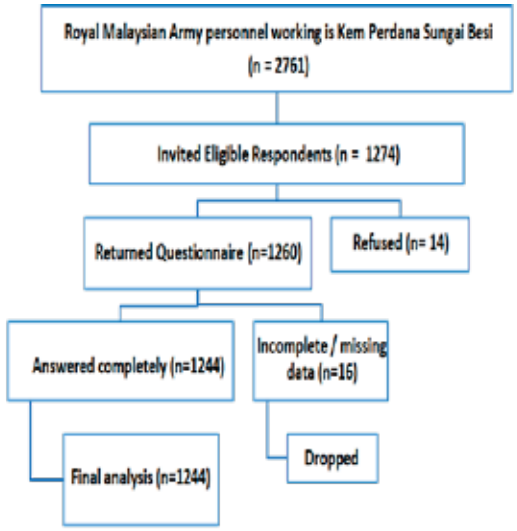

Figure 1: Response Flow Chart

The prevalence of knee injury among respondents is 27.8% (95% CI: 25.4, 30.4), and the prevalence of occupational knee injury among the respondents is 16.6% (95% CI: 14.6, 18.8). The breakdown of the cause of knee injury in Table 1 and Table 2 shows that sport injury that occurs while on duty is the highest being reported with 11%, followed by knee injury sustained due to road traffic accident (5.5%). Knee injuries sustained during military drills or training were reported at 3.7%, followed by sport's activities that occur while not on duty (3.5%). While falling on duty, falling out of duty and other causes of knee injury were reported at 2.1%, 1% and 1.4% respectively.

Sociodemographic Characteristics

Table 3 shows the distribution of the respondents by socio-demographic characteristics. The results indicated that the median (IQR) age of the respondents was 30.0 (10) with a range of age from 18 to 55 years old. The majority of the respondents were in the age group of 30 and above (51.0%). Most of them

Table 1: Types of knee injury among respondents

Types of knee Injury		
Never Injured, n (%)	**Occupational, n (%)**	**Non-Occupational, n (%)**
889 (71.5)	212 (59.7)	143 (40.3)

Table 2: Frequency of the cause of knee injury among respondents (n=335)

The cause of knee injury	n (%)
Sports injury while on duty	140 (11.3)
Sports injury while off duty	44 (3.5)
Fall while on duty	26 (2.1)
Fall out while off duty	12 (1.0)
Injured during military drill and training	46 (3.7)
Road Traffic Accident	69 (5.5)
Other cause of injury	18 (1.4)

respondents (94.8%). The majority were Malays (77.5%). Most of the respondents completed education until Sijil Pelajaran Malaysia (88.3%) and only 11.7% had diplomas up till master and Doctor of Philosophy (PhD). 61.3% of the respondents have income RM3000 and below and 38.7% have income more than RM 3000. Age group (X^2= 53.213, p <0.001), race (X^2= 6.976, p = 0.03) and household income (X^2= 26.707, p <0.001) were found to be significantly associated with the cause of knee injuries (occupational or non-occupational). While gender and education level were found not significantly associated with the cause of knee injury. The prevalence of occupational knee injury was highest among those at age 30 and above (24.6%), Malay (18.5%) and those with household income above RM3000 (23.7%).

Occupational characteristics

Table 4 shows the occupational characteristics of the respondents. The majority of the respondents were "other ranks" (95%) that are "Corporal and below" or "enlisted" with 72.7%, and "Sergeant and above" or "senior enlisted" with 22.3%. As for the "officers" (62%), 4.7% were "Major and below" and only 0.2% were "Lieutenant Colonel and above" or "senior officer". In terms of troop's element, the majority of the respondents were from the "combat support" element (41.2%) followed by "combat" (32.2%) and "Service support" (26.5%). Most of the respondents have been in the service for 10 years or lesser (55.4%), followed by 11 to 20 years (42.7%), and only 1.9% had been in the service for more than 21 years. The majority of the respondents had a BMI of less than 25 (66.2%), with the median (IQR) of BMI of 23.7 (4.2). In this study, 13.9% were reported to have comorbidities and the majority of the respondents were free from any diseases. Troop element (X^2= 1.260, p = 0.02), service years (X^2= 39.195, p <0.001), BMI (X^2= 26.420, p <0.001) and comorbidity (X^2= 40.271, p <0.001) were found to be significantly associated with the cause of knee injury, while rank was found not significantly associated with the cause of knee injury. The prevalence of occupational knee injury was found highest among those in the service support (21.8%), who has been in the service for more than 21 years (25%), BMI of 25 and above (24.7%) and those with comorbidity (30.6%).

Table 3: Distribution of respondents by socio-demographic characteristic and the association. (n=1244)

Socio-demographic variables	n (%)	Knee Injury			X^2	*p*-value
		Never injured n (%)	Occupational n (%)	Non-occupational n (%)		
Age group (year)						
Less than 30	610 (49.0)	472 (77.4)	56 (9.2)	82 (13.4)	53.213	<0.001*
30 and above	634 (51.0)	417 (65.8)	156 (24.6)	61 (9.6)		
Gender						
Male	1179 (94.8)	842 (71.4)	200 (17.0)	137 (11.6)	0.394	0.821
Female	65 (5.2)	47 (72.3)	12 (18.5)	6 (9.2)		
Race						
Malay	964 (77.5)	684 (71.0)	177 (18.4)	103 (10.7)	6.976	0.031*
Non-Malay	280 (22.5)	205 (73.2)	35 (12.5)	40 (14.3)		
Education Level						
STPM and below	1099 (88.3)	786 (71.5)	185 (16.8)	128 (11.6)	0.433	0.805
Diploma and above	145 (11.7)	103 (71.0)	27 (18.6)	15 (10.3)		
Household Income						
RM 3000 and below	763 (61.3)	565 (74.0)	98 (12.8)	100 (13.1)	26.707	<0.001*
Above RM 3000	481 (38.7)	324 (67.4)	114 (23.7)	43 (8.9)		

Note: (*) -Significant, $p < 0.05$

Table 4: Distribution of respondents by occupational characteristic, comorbidity, and the association (n=1244)

Variables	n (%)	Knee Injury			X^2	p-value
		Never Injured n (%)	Occupational n (%)	Non-occupational n (%)		
Rank (n=1244)					1.260	0.532
Other ranks	1182 (95.0)	845 (71.5)	199 (16.8)	138 (11.7)		
Officer	62 (5)	44 (71.0)	13 (21.0)	5 (8.1)		
Troop element (n=1244)					11.406	0.022*
Combat element	401 (32.2)	280 (69.8)	64 (16.0)	57 (14.2)		
Combat support	513 (41.2)	383 (74.7)	76 (14.8)	54 (10.5)		
Service Support	330 (26.5)	226 (68.5)	72 (21.8)	32 (9.7)		
Service Years (n=1244)					39.195	<0.001*
Less than 10 years	689 (55.4)	522 (75.8)	77 (11.2)	90 (13.1)		
11 to 20 years	531 (42.7)	350 (65.9)	129 (24.3)	52 (9.8)		
More than 21 years	24 (1.9)	17 (70.8)	6 (25.0)	1 (4.2)		
BMI					26.420	<0.001*
Less than 25	823 (66.2)	61 (74.8)	108 (13.1)	99 (12.0)		
25 and above	421 (33.8)	273 (64.8)	104 (24.7)	44 (10.5)		
Comorbidity					40.271	<0.001*
No	1071 (86.1)	800 (74.7)	159 (14.8)	112 (10.5)		
Yes	173 (13.9)	89 (51.4)	53 (30.6)	31 (17.9)		

Note: (*) -Significant, $p < 0.05$

Sports Activity

Table 5 shows the sports activity among respondents. The results indicated that the majority (75.8%) of respondents used to jog or slow run, followed by playing football or futsal (37.8%), other sports activities (18.8%), and badminton or tennis (13.5%). Jogging (X^2= 40.633, p <0.001), cycling (X^2= 7.473, p = 0.02), football / futsal (X^2= 9.960, p = 0.007), gym or heavy weight lifting activities (X^2= 6.720, p = 0.03) and other sports activities (X^2= 20.492, p <0.001) were significantly associated with the cause of knee injury. The prevalence of occupational knee injury was found higher among those who do not jog (28.1%), cycling (26.7%), who plays football or futsal (21%), who does heavy weight lifting or gym (40%) and those who do other sports activities (26.2%).

The factors that contribute to occupational and non-occupational knee injuries were identified in this study as per Table 6. Respondents with the age 30 years old and above are 2.6 times more likely to get occupational knee injuries as compared to those who are less than 30 years old (OR 2.6, 95% CI: 1.44, 4.69, p = 0.001). Those with a BMI of 25 kg/m2 and above are 1.5 times more likely to get occupational knee injuries as compared to those who have a BMI of less than 25 kg/m2 (OR 1.48, 95% CI: 1.04, 2.11, p = 0.03). Respondents who jog or slow run are 0.4 times less likely to get occupational knee injuries as compared to those who don't jog (OR 0.38, 95% CI: 0.27, 0.547, p = 0.009). Those who play football or futsal are twice likely to have occupational knee injuries as compared to those who don't play football or futsal (OR 1.82, 95% CI: 1.29, 2.54, p = 0.001). Those who play other sports are also found to be twice likely to have occupational knee injuries as compared to those

Table 5: Distribution of respondents by sport's activity and the association. (n=1244)

Variables	n (%)	Knee Injury			X^2	p-value
		Never Injured n (%)	Occupational n (%)	Non-occupational n (%)		
Jogging					40.633	<0.001*
No	299 (24.0)	173 (57.9)	84 (28.1)	42 (14.0)		
Yes	945 (76.0)	716 (75.8)	128 (13.5)	101 (10.7)		
Marathon					2.723	0.256
No	1158 (93.1)	821 (70.9)	202 (17.4)	135 (11.7)		
Yes	86 (6.9)	68 (79.1)	10 (11.6)	8 (9.3)		
Cycling					7.473	0.024*
No	1143 (91.9)	824 (72.1)	185 (16.2)	134 (11.7)		
Yes	101 (8.1)	65 (64.4)	27 (26.7)	9 (8.9)		
Aerobic / Zumba					1.051	0.591
No	1220 (98.1)	874 (71.6)	207 (17.0)	139 (11.4)		
Yes	24 (1.9)	15 (62.5)	5 (20.8)	4 (16.7)		
Swimming					0.570	0.752
No	1150 (92.4)	825 (71.7)	194 (16.9)	131 (11.4)		
Yes	94 (7.6)	64 (68.1)	18 (19.1)	12 (12.8)		
Badminton					1.341	0.511
No	1075 (86.4)	768 (71.4)	187 (17.4)	120 (11.2)		
Yes	169 (13.6)	121 (71.6)	25 (14.8)	23 (13.6)		
Football/ Futsal					9.960	0.007*
No	773 (62.1)	562 (72.7)	113 (14.6)	98 (12.7)		
Yes	471 (37.9)	327 (69.4)	99 (21.0)	45 (9.6)		
Martial Arts					5.225	0.073
No	1187 (95.4)	853 (71.9)	196 (16.5)	138 (11.6)		
Yes	57 (4.6)	36 (63.2)	16 (28.1)	5 (8.8)		
Golf					1.451	0.484
No	1233 (99.1)	880 (71.4)	210 (17.0)	143 (11.6)		
Yes	11 (0.9)	9 (81.8)	2 (18.2)	0 (0.0)		
Gym/ Heavy Weight Lifting					6.720	0.035*
No	1229 (98.8)	880 (71.6)	206 (16.8)	143 (11.6)		
Yes	15 (1.2)	9 (60.0)	6 (40.0)	0 (0.0)		
Other sports activities					20.492	<0.001*
No	1011 (81.3)	749 (74.1)	151 (14.9)	111 (11.0)		
Yes	233 (18.7)	140 (60.1)	61 (26.2)	32 (13.7)		

Note: (*) -Significant, $p < 0.05$

who don't play other sports (OR 1.92, 95% CI: 1.32, 2.78, p = 0.001). Respondents with comorbidity were to be 3 times likely to have occupational knee injuries as compared to those without any comorbidities (OR 2.76, 95% CI: 1.32, 2.79, p = 0.001).

The factors contributing to non-occupational knee injuries in this study were jogging or slow running, playing other types of sports and having comorbidity. Those who jog or slow run are 0.5 times less likely to have non-occupational knee injuries as compared to those who don't jog or slow run (OR 0.58, 95% CI: 0.38, 0.87, p = 0.009). Those who play other sports are twice likely to have non-occupational knee injuries as compared to those who don't play other sports (OR: 1.92, 95% CI: 1, 2.41, p = 0.06). Respondents with comorbidity were to be 3 times likely to have non-occupational knee injuries as compared to those without any comorbidities (OR 2.73, 95% CI: 1.69, 4.41, p< 0.001).

DISCUSSION

The prevalence of knee injury among military in this study is reported to be higher as compared to other studies. A study among the military in Iran reported that the prevalence of knee injuries was 13.4%[7], while in Australia it was 16%[1]. A study on non-battle injuries reported that 33% of the Danish military members being deployed to the war zone in Afghanistan complaints of knee pain and the risk of having knee injury increased by 1.5 times with the time spent in vehicle patrols weekly (OR 1.49, CI 1.1, 1.56, p= 0.002)[8]. Those with knee injury require a long medical leave. A study among the Brazilian army reported that 9.8% who injured their knees required 7 to 15 days of medical leave and 8.9% required more than 15 days of medical leave (9).

Age 30 and above has become the factor causing occupational knee injury but not in non-occupational knee injury. A study in Dhaka, reported that the majority of military members with knee injury were from the age group of 25 to 34 years old (41.8%) followed by age 15 to 24 years old (30.1%)[4]. A study on knee injury among the US Army reported that age is significantly related to soft tissue knee injury that is consistent with this

Table 6: Multinomial Analysis of occupational and non-occupational knee injuries. Never Injured as reference

Variables	Occupational			Non-occupational		
	OR	95% CI	p- value	OR	95% CI	p-value
Age						
< 30 yo	1			1		
≥ 30 yo	2.60	1.44, 4.69	0.001*	1.08	0.54, 2.19	0.820
BMI						
< 25 kg/m^2	1			1		
≥ 25 kg/m^2	1.48	1.04, 2.11	0.03*	1.02	0.67, 1.57	0.914
Jogging/ slow run						
No	1			1	1	
Yes	0.38	0.27, 0.547	<0.001*	0.58	0.38, 0.87	0.009*
Football/ Futsal						
No	1			1		
Yes	1.82	1.29, 2.54	0.001*	0.762	0.51, 1.13	0.180
Other sports						
No	1			1		
Yes	1.92	1.32, 2.78	0.001*	1.54	1, 2.41	0.06*
Comorbidity						
No	1			1		
Yes	2.76	1.32, 2.79	0.001*	2.73	1.69, 4.41	<0.001*

Note: (*) -Significant, $p < 0.05$. Goodness-of-fit= p = 0.02, Cox and Snell = 0.131, Negelkerke = 0.165.

study[2]. The study found that those from age 20 to 30 is 1.3 likely to develop soft tissue knee injury as compared to those age 20 and below (OR 1.3, 95% CI: 1.25, 1.36) and those from age 30 and above is 1.5 times likely to develop soft tissue knee injury as compared to those age 20 and below (OR 1.57, 95% CI 1.50, 1.65)[2].

Another factor to occupational knee injuries is BMI 25 kg/m2 and above. This finding is consistent with the studies conducted among the U.S and Israel Army[10,11]. Overweight contributes to mechanical loads to the knee joints making the joints become more vulnerable to injuries during sporting activities[12]. This is due to the changes that happen in biomechanical patterns during mobilization of the joints[13]. A study among U.S army on the association of BMI and lower extremity injury reported that those with BMI 25 to 29 kg/m2 had 11% increased risk of getting musculoskeletal injuries as compared to those with normal BMI, and those with BMI more than 30 kg/m2[10].

Few studies reported sports activities as the main cause of knee injuries among the military that is consistent with this study[3,7]. Schram et al, (2018). however reported in the study that combat training (43%) and physical training (29.5%) were the leading cause of knee injury among the military members[1]. Among sports activities, jogging or slow run, playing football and other sports were found to be the factors in this study. Other sports that are reported by respondents were mainly netball, volleyball, basketball, and hockey. Jogging or slow running was found to be a protective factor in this study. Although knee injuries such as iliotibial band syndrome, patellofemoral pain and patellar tendinopathy were known to be common among runners, however, with proper short warming up and exercises could increase muscular flexibility, hence, reducing musculotendinous injury[14,15]. A pilot study on the effect of running and circulating markers showed that running reduces knee inflammation and increases the movement of cartilage oligomeric matric protein, hence reducing knee injuries[16]. This could explain why jogging and slow running reduce the risk of both occupational and non-occupational knee injuries. Reduce running distance, avoid running on hard surfaces, increase the awareness on correct running practice, and correcting those with pes planus and cavus would help in preventing knee injuries[17].

A study among the military in Dhaka reported that 20.3% of the respondents had knee injury due to football, by volleyball (6.5%) and running (4.6%)[4]. The finding was also consistent with another study among defence departments in Iran which reported 35% of knee injuries were caused by sports activities. Among them, 33.5% happen during football and futsal activities, followed by morning exercise (30.7%) and martial arts (13.6%)[7].

In this study, football or futsal is the factor contributing to occupational knee injury, while other sports activities are the factor contributing to both occupational and non-occupational knee injury. Since the prevalence of occupational knee injury due to football and futsal is 21% and other sports activities is 26.2% it is important to start the intervention in reducing the occurrence of knee injuries during sports activities while at work. This study also found that comorbidity is one of the factors contributing to occupational and non-occupational knee injuries among the respondents. Most of the studies associate comorbidity with the occurrence of knee osteoarthritis rather than the occurrence of knee injuries[18,19]. Although having BMI > 25 kg/m2 and having comorbidity had higher risk of getting occupational knee injuries, this does not mean that those with these conditions should avoid doing military or sports activities, but instead to do physical activities with caution.

CONCLUSION

The prevalence of knee injury among respondents is 27.8% and the prevalence of occupational knee injury is 16.6%. Sports injury that occurs while on duty is the highest being reported, followed by road traffic accidents and military training. Age group, race, household income, troop element, service years, BMI, comorbidity were found to be significantly associated with the cause of knee injury, while rank, gender and education were not. Activities like jogging, cycling, football / futsal, gym or heavy weight lifting activities and other sports activities were also found to be significantly associated with the cause of injury. The factors contributing to occupational knee injuries were age 30 years old and above, BMI more than 25 kg/m2, and those who play football or futsal. Other types of sports and comorbidity were the factors that contribute to both occupational and non-occupational knee injury, while jogging and slow run were the protective factors for both.

Recommendation

In sports activities, football or futsal and other types of sports were the highest contributor to the occupational knee injury. Thus, further assessment of the cause of sports injury while working is needed for specific intervention. The intervention can be from improving the individual level by having proper stretching, avoiding overuse of muscles, awareness on the impact of injuring others while in games, a trained coach with proper training sessions, and proper rehabilitation. As for the environment, to ensure good field and court conditions through good maintenance. The Armed Forces should design a special conditioning program related to the types of activities and exercise that suits the age, BMI, and background condition to improve flexibility, endurance, power, and strength of personnel to prevent knee injury. Further research on the impact of occupation in the Armed Forces and occupational injury need to be initiated in order to identify factors that could contribute to non-combat disability hence, reducing the force capability.

REFERENCES

1. Schram B, Orr R, Pope R. A profile of knee injuries suffered by Australian army reserve soldiers. Int J Environ Res Public Health. 2019;16(1).
2. Hill OT, Kay AB, Wahi MM, McKinnon CJ, Bulathsinhala L, Haley TF. Rates of knee injury in the U.S. active duty Army, 2000-2005. Mil Med. 2012;177(7):840–4.
3. Md Shihabudin TMT, Ahmad S, Kasmin M, Mohamad Nor M, Daud MF, Hamdan MA. The activity leading to ACL injury and the ability to resume duty following reconstructive surgery in Malaysian military patients. Med J Malaysia. 2013;68(2):115–8.
4. Rahman MM, Rahman MF, Amin ZA, Faiza ZH, Islam Z, Islam MZ. Pattern of Knee Injury Cases Attending Combined Military Hospital, Dhaka. J Armed Forces Med Coll Bangladesh. 2020;15(1):98–101.
5. Nur Hidayah S, Salmiah MS. Prevalence Of Knee Osteoarthritis And Its Associated Factors Among Active Duty Royal Malaysian Army In A Kuala Lumpur Camp. 2020;
6. Snoeker B, Turkiewicz A, Magnusson K, Frobell R, Yu D, Peat G, et al. Risk of knee osteoarthritis after different types of knee injuries in young adults: A population-based cohort study. Br J Sports Med. 2020;54(12):725–30.
7. Rezasoltani Z, Dehghan F, Azizan A, Dadarkhah A, Yadegarian F. The Frequency of Knee-Joint Injuries Caused by Sports Activities Among the Armed Forces Personnel. J Arch Mil Med. 2016;4(4).
8. Lundin CR, Houe T, Sevelsted A, Nissen L. Prolonged mounted patrolling is a risk factor for developing knee pain in Danish military personnel deployed to the Helmand Province. J R Army Med Corps [Internet]. 2016 Oct 1;162(5):348 LP – 351. Available from: http://militaryhealth.bmj.com/content/162/5/348.abstract
9. de Andrade Gomes MZ, Pinfildi CE. Prevalence of musculoskeletal injuries and a proposal for neuromuscular training to prevent lower limb injuries in Brazilian Army soldiers: An observational study. Mil Med Res. 2018; 5(1) :3–9.
10. Hruby A, Bulathsinhala L, McKinnon CJ, Hill OT, Montain SJ, Young AJ, et al. BMI and Lower Extremity Injury in U.S. Army Soldiers, 2001-2011. Am J Prev Med. 2016 Jun;50(6):e163–71.
11. Hollander NA, Finestone AS, Yofe V, Bader T, Magnezi R. The Association between Increased Body Mass Index and Overuse Injuries in Israel Defense Forces Conscripts. Obes Facts. 2020;13(2):152–65.
12. Logerstedt DS, Ebert JR, MacLeod TD, Heiderscheit BC, Gabbett TJ, Eckenrode BJ. Effects of and Response to Mechanical Loading on the Knee [Internet]. Sports Medicine. Springer International Publishing; 2021. Available from: https://doi.org/10.1007/s40279-021-01579-7
13. Harding G, Hubley-Kozey C, Dunbar M, Stanish W, Astephen Wilson J. Body mass index affects knee joint mechanics during gait differently with and without moderate knee osteoarthritis. Osteoarthritis Cartilage. 2012 Aug 16;20:1234–42.
14. Cushman DM, Ross B, Denq W, Lippman J, Cummings K. Chapter 18 - Knee Injuries in Runners. In: Harrast MABT-CC of the R, editor. Elsevier; 2020. p. 197–214. Available from: https://www.sciencedirect.com/science/article/pii/B9780323679497000185
15. Chaabene H, Behm DG, Negra Y, Granacher U. Acute Effects of Static Stretching on Muscle Strength and Power: An Attempt to Clarify Previous Caveats. Front Physiol. 2019;10 (November).
16. Hyldahl RD, Evans A, Kwon S, Ridge ST, Robinson E, Hopkins JT, et al. Running decreases knee intra-articular cytokine and cartilage oligomeric matrix concentrations: a pilot study. Eur J Appl Physiol [Internet]. 2016;116(11):2305–14. Available from: https://doi.org/10.1007/s00421-016-3474-z

17. Mousavi SH, Hijmans JM, Minoonejad H, Rajabi R, Zwerver J. Factors associated with lower limb injuries in recreational runners: A cross-sectional survey including mental aspects and sleep quality. J Sport Sci Med. 2021;20(2):204–15.
18. Yoshimura N, Muraki S, Oka H, Tanaka S, Kawaguchi H, Nakamura K, et al. Accumulation of metabolic risk factors such as overweight, hypertension, dyslipidaemia, and impaired glucose tolerance raises the risk of occurrence and progression of knee osteoarthritis: A 3-year follow-up of the ROAD study. Osteoarthr Cartil. 2012
19. Eymard F, Parsons C, Edwards MH, Petit-Dop F, Reginster JY, Bruyère O, et al. Diabetes is a risk factor for knee osteoarthritis progression. Osteoarthr Cartil. 2015

Mejar (Dr) Nur Hidayah Shamsudin, Medical Faculty and Health Sciences, University of Putra Malaysia, Serdang, Malaysia, Tel: +60132077488
Email: drnurhidayahshamsudin@gmail.com