

ORIGINAL ARTICLE

The Association between Smoking and Periodontal Health Status among Army Personnel in North-East Malaysia

Ruzawani Ruslan¹, Munirah Mohd Adnan², Normastura Abd Rahman²

¹ Dental Service Malaysian Armed Forces, Ministry of Defence, 50450, Kuala Lumpur

² School of Dental Sciences, Universiti Sains Malaysia, Health Campus, 16150 Kubang Kerian, Kelantan.

ABSTRACT

Introduction: Smoking is a common risk factor for periodontal disease and other chronic diseases. This study was conducted to determine the prevalence of smoking among army personnel and its association with periodontal health status. **Methods:** A cross-sectional study was carried out among randomly selected 233 army personnel in 8th Brigade Infantry, Kelantan. A face validated self-administered Bahasa Malaysia questionnaire was used for data collection. Periodontal examination was done using Community Periodontal Index (CPI) and coded as '0' for healthy; '1' for bleeding observation; '2' for detection of calculus; '3' for probing of 4-5mm pocketing and '4' for probing of 6mm or more pocketing. **Results:** All respondents (n=233) were male, the majority (92.7%) Malays, not married (60.5%) with the mean (SD) age of 25.8 (5.06) years. The prevalence of smoking among army personnel was 76.0% (95% CI: 70.4, 81.5). Almost all (97.4%) have some degree of periodontal disease. The non-smoker, ex-smoker and smoker groups were highest for having calculus with a percentage of 40.5%, 57.1%, and 57.1%, respectively. No significant association was found between smoking status (ever-smoker and non-smoker) and periodontal pocketing (CPI 0-2 and CPI 3-4) (p=0.960). However, the ever-smokers (93.2%) significantly higher percentage for the need of invasive treatment (CPI >2) compared to the non-smokers (76.2%) (p=0.002). **Conclusion:** The prevalence of smoking among army personnel in North-East Malaysia was high, with most of them have some degree of periodontal disease. Smoking cessation intervention should be strategized in the military community to reduce the burden of care for chronic diseases.

Keywords: Periodontal disease, Cigarette smoking, Military personnel, Periodontal index

Corresponding Author:

Munirah binti Mohd Adnan, DrDPH

Email: muniraha@usm.my

Tel: +609-7675888

INTRODUCTION

Various studies have reported that military service is a contributing factor for smoking (1-3). It has been shown that military operational activities increase the tendency of smoking in some troops (4) and regular smokers of armed forces increased their frequency of smoking by 19% during deployment (5). According to the Malaysian Armed Forces Oral Health Survey in 2011, the overall prevalence of smoker was 63.9% (6). Zain (2015) did a study in the year 2006 among 319 army personnel in four camps in Kelantan revealed that the prevalence of smokers was 69.3% (95% CI: 63.9, 74.3) (7). Jasmin and Jaafar (2011) did a study among 181 army personnel from the 8th Brigade in Kelantan found that 70.8% (95% CI: 63.7, 76.9) of the respondents were smoker (8). Another study by Ramli (2012) among 307 army infantry personnel in Kelantan and Pahang which involved in a military operation, revealed that 76.8% of them were

smokers (3).

Quality of life aspects can be compromised due to periodontal diseases and other negative impacts related to function, pain and aesthetic (9) including military readiness. Studies among military personnel during deployment revealed the presence of emergency cases of oral origin include gingival and periodontal problems (10-12). According to a study by Moss (2002), among Spanish military personnel deployed in Bosnia-Herzegovina, 6.73% of them treated as emergency dental cases (10). Dunn (2004) on the other hand, revealed data on emergency cases during deployment of the US Army in Oman, presents figures range from 2.8% to 9.6% of emergency cases (11). According to Richardson (2005), 426 emergency dental cases were causing moderate or serious operational impact among United Kingdom armed forces serving in Iraq, 2003 (12). These emergency cases during military deployment reduce the health employment degree of army personnel to unfit, thus compromising military readiness of troops through deployment difficulties for the operational task, either for manpower deficit or logistic utilisation covering medical casualties.

It is important to preserve good periodontal health status among the military population in maintaining military readiness (13). A study was done by Esa *et al.* (1996), among 188 personnel of the Royal Signal Regiment of Fourth Division Malaysian Army found that 95.7% of army personnel had some form of periodontal disease with 86% of them had calculus according to CPITN index (14). A survey by Dental Service Malaysian Armed Forces in 2011 among 1215 personnel from three services of Malaysian Armed Forces (Army, Navy and Air Force) found that prevalence of periodontal disease was 96.7% with majority (83.6%) of the respondents exhibiting calculus involving an average of about 2.7 sextants (6). However, there is a very limited study done on periodontal health status among the military population in Malaysia. Therefore, this study was conducted to determine the prevalence of smoking among army personnel and its association with periodontal health status among army personnel in North-East Malaysia. This study would contribute as baseline data for smoking cessation intervention programs as a common risk factor approach towards chronic diseases that affect military readiness.

MATERIALS AND METHODS

A cross-sectional study was conducted for two weeks in April 2018, at the Armed Forces Dental Clinic (AFDC) in two bases of 8th Brigade Infantry in Kelantan. Military camps involved in this study were Desa Pahlawan Military Camp and Pengkalan Chepa Military Camp. Medically fit infantry army personnel (15), as well as personnel with the minimum of ten occluding teeth/units in each jaw (functional dentition) for standardised periodontal examination charting (16), were included in the study. Army personnel with fixed orthodontic appliances (17) were excluded due to the need for a special oral health care regime to achieve optimum oral health care. Medically fit infantry army personnel is defined according to health readiness grading system of Malaysian Armed Forces (2016) named as PULHEEMS System of Medical Classification. PULHEEMS is an acronym for 'Physical capacity, Upper limb, Locomotion, Hearing, Eye equity (Right), Eye equity (Left), Mental capacity and Stability'. It is a set of the minimum standard of health, which will be updated every two years in the army personnel's health record aged below than 35 years and once yearly for personnel aged 35 years old and above (15). Medically fit infantry army personnel are graded as FE (Forward Everywhere) denoted as capable for employment and deployment at full combatant duties (15).

The sample size was calculated using PS software (18) based on the prevalence of periodontitis among non-smokers (28%) and smoker/ex-smokers (45%) (19) at the power of 80%, determined that a total of 336 respondents were needed in this study. Lists of names of infantry personnel were obtained from Brigade Headquarters

upon permission for data collection granted by Brigade General. Simple random sampling was done using IBM SPSS Version 24 on the list of army personnel who fulfilled the inclusion and exclusion criteria. Invitation for participation was done through their Commanding Officer, and to the army personnel themselves. Study procedures were explained and discussed thoroughly before informed consents were taken.

Socio-demographic data and smoking status were collected using a validated, self-administered Bahasa Malaysia questionnaire adapted from Yahya (2017) (20). The questionnaire consists of age, military rank, ethnicity, marital status, level of education, monthly household income in Ringgit Malaysia (RM), smoking status, forms of tobacco used (chew/embedded at buccal pouch/others) and types of cigarette used (cigarette/e-cigarette/vape/pipe/hand-rolled cigarette, etc.). In this study, smoker was defined as an adult who has smoked 100 cigarettes in his lifetime and currently smokes cigarettes (21). Meanwhile, ex-smoker was described as an adult who was a smoker and has been abstinent for at least six months (22). Ever-smoker was referred to either ex-smokers or/and current-smokers (23). Time to complete the questionnaire observed to be around 10 minutes for each session.

Periodontal examination was done by one of the researchers who is a dentist that serves in the Ministry of Defence Malaysia. Calibration exercise was done against a periodontal specialist prior to the data collection, with the kappa score of 0.67. Intra-examiner reliability calculated with a kappa score of 0.7. Periodontal examination was done using the Community Periodontal Index (CPI) index based on a guideline by the World Health Organisation (WHO)(1997) (24) after completion of the questionnaire. The examination was done at respective Armed Forces Dental Centre for each camp, using the standard dental chair and under good lighting. Instruments involved during periodontal examination include periodontal health record form, mouth mirror and WHO CPI probe with ball tip of 0.5mm wide, black band at 3.5 to 5.5mm and rings at 8.5 and 11.5mm from the ball tip.

The mouth was divided into sextants defined by tooth numbers 18-14, 13-23, 24-28, 38-34, 33-43 and 44-48. A sextant was examined if there were two or more teeth present which were not indicated for extraction. The teeth to be examined were the index teeth 17 or 16, 11, 26 or 27, 36 or 37, 31 and 46 or 47. The two molars in each posterior sextant were paired for recording, and if one is missing, no replacement was done. In the case there was no index tooth present in a sextant qualifying for examination, all the remaining teeth in that sextant were examined, and the highest score will be recorded as the score for the sextant. In this case, distal surfaces of third molars were not scored (24).

Index teeth were probed at the sensing force not more than 20gram for pocket depth, subgingival calculus, and bleeding response. The highest score for each sextant was recorded in the periodontal health record form. Codes for CPI were in ordinal measure of periodontal health status severity with '0' for healthy; '1' for bleeding observation; '2' for calculus detected; '3' for probing of 4-5mm pocketing and '4' for probing of 6mm or more pocketing. Codes of 'X' and '9' to assist in charting, which indicates excluded sextant and not recorded sextant, respectively. Code other than 0 was classified as periodontal disease (24).

Those who diagnosed with dental problems were referred to the existing computer-software system by AFDC, for further management. Data were analysed using IBM SPSS Version 24. All continuous numerical variables were described using mean and standard deviation (SD) for normally distributed data, otherwise as a median and interquartile range (IQR). Whereas for categorical data, frequency and percentage were used. Pearson Chi-Square or Fisher's exact test was performed to determine the significant association between groups of the categorical variables. P-value was set significant at p less than 0.05. Variables with significant p-value were further analysed intergroup between each category.

Ethical approval for this study was obtained from the Human Research and Ethics Committee, Universiti Sains Malaysia (Reference number: USM/JEP/EM/17120729). This study was also approved by the Malaysian Armed Forces (Letter of Approval Reference no: MATM/BPK-GIGI/1120/18 (1)) and permission was also granted by the 8th Brigade Commanding General.

RESULTS

A total of 233 out of 336 respondents participated in this cross-sectional study (response rate of 69.3%). The socio-demographic background of the respondents has presented in Table I. All the respondents were male with the mean (SD) age of 25.8 (5.06) years. Only three Captain (1.3%) participated in the study, while others were from other ranks (98.7%). Majority of the respondents were Malay (n=216, 92.7%) while other races (7.3%) included Iban (n=5, 2.1%), Bidayuh (n=3, 1.3%), Bajau (n=3, 1.3%), Tidung (n=2, 0.9%), Dusun (n=2, 0.9%), Melanau (n=1, 0.4%), and Indian (n=1, 0.4%). The highest level of education for most of the respondents was secondary schools (90.6%), and their median monthly income was RM1700.00 (IQR 400.00).

Table II showed the prevalence of smoking status among army personnel. Prevalence of smokers, ex-smokers and non-smokers army personnel were 76.0% (95% CI:70.4, 81.5), 6.0% (95% CI: 2.9, 9.1) and 18.0% (95% CI: 13.1, 23.0) respectively. None of the army personnel used other forms of tobacco either chew or embedded at the buccal pouch in the oral cavity. However, there were

Table I: Socio-demographic characteristics of respondents (n=233)

Characteristics	n (%)
Age	25.8 (5.06) ^a
Military Rank	
Private	142 (60.9)
Lance Corporal	30 (12.9)
Corporal	36 (15.5)
Sergeant	16 (6.9)
Staff Sergeant	5 (2.1)
Warrant Officer 1	1 (0.4)
Captain	3 (1.3)
Ethnicity	
Malay	216 (92.7)
Non-Malay	17 (7.3)
Marital status	
Single	141 (60.5)
Married	90 (38.6)
Divorced/Widowed	2 (0.9)
Level of education	
Secondary school	211 (90.6)
Certificate	14 (6.0)
STPM/ Matriculation	4 (1.7)
Diploma	1 (0.4)
Degree and above	3 (1.3)
Income per month (RM)	1700 (400) ^b

^a Mean (SD)

^b Median (IQR) because data not normally distributed, Kolmogorov Smirnov p<0.05.

Table II. Prevalence of smoking status and types of cigarettes among army personnel

Variables	n (%)	95% CI
Smoking Status (n=233)		
Smoker	177 (76.0)	(70.4,81.5)
Ex-smoker	14 (6.0)	(2.9,9.1)
Non-smoker	42 (18.0)	(13.1,23.0)
Type of cigarette (n=177) ^a		
Cigarette only	149 (84.2)	(78.8,89.6)
Cigarette and e-cigarette	9 (5.1)	(1.8, 8.4)
Cigarette and vape	17 (9.6)	(5.2, 14.0)
Cigarette and pipe	1 (0.6)	(-0.6, 1.7)
Cigarette and hand-rolled cigarette	1 (0.6)	(-0.6, 1.7)

^a among smokers

some of the respondent smoke cigarettes with other types of cigarettes such as e-cigarettes (n=9, 5.1%), vape (n=17, 9.6%), pipe (n=1, 0.6%) and hand-rolled cigarette (n=1, 0.6%). In general, 97.4% of army personnel in this study presented with some form of periodontal diseases, with 36.0% of them with periodontal pocketing. Having calculus was the highest percentage for the non-smokers (n=17, 40.5%), ex-smokers (n=8, 57.1%) and smokers (n=101, 57.1%) (Table III).

Table IV showed there was no significant association between smoking (ever-smoker and non-smoker) and periodontal health status of army personnel (p=0.960). However, as shown in Table V, it was found that smoking was significantly associated with the type of periodontal treatment needed (p=0.002). Ever-smokers significantly need more invasive treatment for the periodontal

Table III: Distribution of periodontal health status among army personnel (n=233)

Smoking status	n	Periodontal health status				
		Healthy gingiva n (%)	Bleeding on probing n (%)	Calculus n (%)	Pocket 4-5mm n (%)	Pocket more than 6mm n (%)
Non-smoker	42	1 (2.4)	9 (21.4)	17 (40.5)	9 (21.4)	6 (14.3)
Ex-smoker	14	0 (0.0)	1 (7.1)	8 (57.1)	5 (35.7)	0 (0.0)
Smoker	177	5 (2.8)	7 (4.0)	101 (57.1)	48 (27.1)	16 (9.0)
Total	233	6 (2.6)	17 (7.3)	126 (54.1)	62 (26.6)	22 (9.4)

Table IV: The association between smoking and the presence of periodontal pocketing among army personnel (n=233)

Smoking status	n	Periodontal health status		x ² statistic (df)	p-value
		Without pocketing (CPI 0-2)	With pocketing (CPI 3-4)		
		n (%)	n (%)		
Non-smoker	42	27 (64.3)	15 (35.7)	0.003 (1)	0.960
Ever smoker*	191	122 (63.9)	69 (36.1)		

*Ever smoker = Current smokers and Ex-smokers
All data fulfil assumptions for Pearson Chi-square test.

Table V. The association between smoking status and type of periodontal treatment needed (n=233)

Smoking status	n	Type of treatment needed		p-value ^b
		Non-invasive treatment ^c (CPI < 2)	Invasive treatment ^d (CPI ≥ 2)	
		n (%)	n (%)	
Non-smoker	42	10 (23.8)	32 (76.2)	0.002
Ever smoker ^a	191	13 (6.8)	178 (93.2)	

^a Ever smoker = Current smokers and ex-smokers
^b Fisher Exact test - assumptions for Chi-square test was not met
^c Non-invasive treatment includes self-oral hygiene care through oral health instruction and education
^d Invasive treatment is referring to scaling and polishing, root planning and surgical procedure

condition (93.2%) compared to non-smokers (76.2%).

DISCUSSION

This study involved infantry army personnel in North-East Malaysia served in infantry regiments of Malaysian Army. This study population is the frontliners that safeguard our national borders and the backbone to our national defence in the land. They also served in peacekeeping contingent under the flag of United Nation Mission such as in Lebanon and Western Sahara (15). Honouring their sacrifices facing of all threats in the various non-conductive environment, it is a national social responsibility to ensure their health and wellbeing.

Socio-demographic background

The response rate in this study was 69.6%. More extended data collection period may improve the response rate as army personnel was rotated for their task (3). The majority of the participants were Malay, Private military rank, the highest level of education was

secondary school with the mean age of 25.8 (SD 5.06) years old. A literature review by Barraclough and Morrow (2017) reported that Malays have the highest smoking prevalence among Malaysia’s major ethnic groups (25). Military rank for ‘other rank’ group begins with Private, which is recruited to the service as early as 18 years old, after completion of secondary school formal education. The median income was RM 1700 (IQR RM 400), which was below the median monthly income for the group of bottoms 40% of Malaysian (B40) which is RM 3000 in 2016 (26).

Prevalence of smoking among army personnel

The prevalence of smoking among army personnel in this study was 76.0% (95% CI: 70.4, 81.5). It was consistent with the previous finding by Ramli (2012) (3) but higher compared to earlier studies by Dental Service Malaysian Armed Forces (2011) (6), Jasmin and Jaafar (2011) (8) and Zain (2015) (7). Globally, the prevalence of smoking found in the study was the highest when compared to Indonesia, 47.8% (27), Finland, 39.4% (28), Uganda, 34.8% (1), Kingdom of Saudi Arabia, 35% (29) and the United States of America, 24% (30).

The prevalence of smoking among the general Malaysian population was 43% (31). The higher prevalence of smoking among army personnel can be expected because military service is one of the risk factors for tobacco use (1). In military settings, smoking was used to combat anxiety, boredom routine, sleep deprivation, peer influence, and weather challenge during operation (2, 3). Factors such as younger age, lower education, living with friends who smoked and military deployment history can be predictors for the high prevalence of smoking among army personnel (1, 32). The same situation was reported among Uganda population, which the general population prevalence for smoking was 5.8% compared to the military population, 34.8% (1).

Despite the decision by Muzakarah Fatwa Committee National Council of Islamic Affairs, Malaysia forbids the action of smoking from a religious perspective, as a ‘haram’ act, the impact among the study population, was not that impressive. Compared to the Kingdom of Saudi Arabia, where smoking was prohibited for the same reason, the prevalence of smoking was lower (35%) among their soldiers (29). This study demonstrated in line findings with a study by Garusi *et al.* (2012) (33),

religious belief can't influence smoking habit compared to other factors such as the societal norms. It seems to have a stronger impact on starting or quitting the habit.

Periodontal health status among army personnel

In general, 97.4 % of army personnel in this study presents with some form of periodontal disease, which was consistent with the previous study among military personnel (6, 14). Periodontal disease is a bacterial induce disease and has a direct association with poor oral hygiene status (9). Effectiveness of oral hygiene care is still low among the military population, thus induce the occurrence of periodontal diseases. Occupational factors of military organizations, the nature of the operation and environmental conditions do affect oral hygiene practice and compromised oral health condition of army personnel (3, 6).

Bleeding on probing was prominent among non-smoker and consistent with other studies by Machuca *et al.* (2000) compare to smokers and ex-smokers (34). These conditions did superimpose the true effects of smoking on periodontal tissue. Cigarette smoke can suppress the vascular reaction of the alveolar margin in response to bacterial plaque. It increased vasoconstriction, decreased blood flow, thickened fibrotic consistency, thus results in minimal erythematous reaction (35). With the increment of age, loss of attachment and deeper pocketing depth would be presented among smokers (36).

Dental calculus presented as the most prominent periodontal health status among all groups in this study with a percentage of 51.6%, which is lower than the previous study among the military population in 1996, 86% (14) and in 2011, 83.6% (6). Since 2012, Royal Medical and Dental Corps (RMDC) made policy for all military personnel to have compulsory once yearly dental visits as part of their health readiness assessment (15). During the visit, oral health status was diagnosed, and any treatment required being managed and treated by a dental officer or dental hygienist (37). Improvement of the percentage of periodontal health status that presents with calculus among army personnel to almost one-third of the last 20 years study may be the presentation of successful implementation of this policy by the RMDC to improve the oral health status of the military population. However, the prevalence of calculus in this study was higher than a recent study among Malaysian adults aged more than 18 years in the general population, 42.2% (38). Despite curative treatment given in the armed forces, efforts for preventive measures need to be further strengthened, empowered and sustained (39-41).

On the other hand, this study found almost 40% of the army personnel presented with periodontal pocketing. It is a worrying figure because periodontal disease can affect the quality of life (9) and military readiness (10-12). Army personnel with periodontitis require referral

to periodontal specialists for further management of the problem. The higher proportion of disease prevalence to the number of periodontal specialists is way too high among the military population (37). Currently, there are only three periodontal specialists posted at AFDC in Malaysia. Most of the cases will be referred to the nearest Ministry of Health facilities. Optimal treatment may not be delivered due to a few factors such as non-committed patient, busy regiment schedule, need of permission from camp and logistic factors to move army personnel from duty area to specialist centre (12, 37).

Association between smoking and periodontal health status among army personnel

Periodontal disease is a chronic inflammatory condition, shares similar characteristics with other chronic diseases which were aged related condition. The risk of periodontal disease is dynamic and changes in response to complex interactions of genetic, environmental and other modifying factors over the lifespan. Many modifiable risk factors, such as smoking and excess caloric intake, psychologic stress contribute to increases in systemic markers of inflammation upon prolong exposure overtime and its cumulative effects (9, 36). Periodontal disease has negative impacts related to aesthetic, function and pain, thus compromised quality of life (9). Since the 1990s, periodontal disease has been established to have a direct causal relationship with cigarette smoking (36). Smokers have three-time higher chances of getting periodontitis compared to non-smokers (36).

In this study, a comparison between smoking and periodontal health status was analysed. No significant difference between smoking status (ever-smoker and non-smoker) with periodontal health status was found in this study population. This study recruited fit army personnel, with the mean age of 25.8 years, which was considered as a young adult. Therefore, smoking effects on periodontal health status are still not prominent and confounding with other factors, including utilisation of health facilities and undergoing treatment (42).

Further analysis was done to compare the need for invasive treatment among army personnel in this study. Results found that significantly the ever-smokers army personnel require more invasive treatment compared to non-smokers. Invasive treatment includes scaling and polishing, root planning, surgical treatment as well as chemical therapy as an adjunct to the mechanical treatment is required for treatment of calculus and periodontal pocketing. Invasive treatment incurs more cost for clinical materials, instruments and health personnel speciality compared to non-invasive treatment (43). Army personnel received free treatment (subsidized by the government) for invasive periodontal procedures during service as well as after retirement. Treatment was given periodically upon diagnosis at yearly dental check-ups (15). The rehabilitative period will be longer,

which cause increase burden to the service (12). On the other hand, non-invasive treatment may involve oral health education and instruction to improve oral hygiene care of the patients (44). The non-invasive treatment is preferable for its cost-effectiveness as well as versatility to incorporate current preventive approach in fighting the periodontal diseases among this population.

Prevention and control of periodontal diseases

Traditionally, prevention and control of periodontal disease at a patient-level directed towards educating patients with good oral habits and teaching proper oral hygiene based on their current health status. This approach is difficult to sustain and fails to achieve improvements in oral health due to the lack of enforcement in integrating other socioeconomic determinants of health and aim to attain normative need of the practitioner. According to Baehni (2012), the current strategy for prevention and control of periodontal disease need to focus on patient-centred approach, appreciating all modifiable systemic factors related to lifestyle, as well as at the immediate local causal factors. This concept often referred to as patient empowerment, implies that patients play an active role in the management of their conditions and share responsibility for the outcomes. Patient's demands, values, perceived and expectations become the central point. In contrast, oral health professional becomes a counsellor who supports patients in making decisions on their own self-care measures as well as helping them gain necessary therapeutic skills to achieve the desired goal of health (39).

Tackling the high prevalence of periodontal disease (97.4%) in this study is a challenging task. It is suggested to optimise resources to a more realistic preventive strategy. According to Thompson *et al.* (2012), strategies for prevention and control of periodontal disease in a population should be based on three strategies. First is population strategy which targeting on promoting effective self-oral hygiene practices as well as tobacco control. Next is the secondary preventive strategy aimed for detection and treat people with destructive periodontal diseases, and last but not least high-risk strategy targeting preventive and therapeutic care to individuals at special risk such as diabetics patient (40). Common risk factor approach and health promotion approach are key aspects of these strategies (40) and can be translated into both clinical and community setting. It is hoped with these strategies, the maintenance of a functional, aesthetically and socially acceptable, natural dentition during military service as well as for the lifetime can be achieved.

Other than that, learning from Japan experience, reorienting health services to public health measures through strong and healthy public policy and health promotion in the community also recorded prominent achievement. In 2000, a National Health Promotion Campaign for the 21st century, "Healthy Japan 21",

was launched to prevent lifestyle-related diseases (non-communicable diseases (NCDs) such as cancers, cardiovascular diseases, diabetes, and chronic obstructive pulmonary disease). "Healthy Japan 21" set up national goals for the year 2010 in nine specific fields for improving lifestyles, reducing risk factors, and decreasing diseases. Oral health is one of the NCD conditions identified, and specific goals were set up to prevent tooth loss. Other than that, The "Health Promotion Act" was enacted in 2003, and it supported the development of health promotion activities throughout the nation. In 2005, Japan achieved the proportion of 40-year-old persons with no missing teeth as 54.1%, which is an excellent indicator for good periodontal health among adults (44).

Smoking cessation as a common risk factor approach in a dental setting

Dentists are ideally placed for smoking cessation because they have frequent access to patients and can easily identify the localised effects of smoking intra-orally (45-47). World Health Organisation-South East Asia Region (WHO-SEAR) published a manual for Doctors and Dentist in 2010 entitle Helping People Quit Tobacco. The manual enforces dentist to screen for tobacco use through history taking and physical examination including extra and intra-oral examination. Identification of smoking status as part of routine examination opens the door for intervention for smoking cessation. During the brief intervention, the manual stated five steps, including advice to quit, educate about addiction, provide brief counselling, offer medication and follow-up contacts. The manual also incorporated the use of a patient workbook which contains two parts, including information regarding tobacco smoke and steps to quitting (45).

A program "Kesihatan Oral Tanpa Asap Rokok (KOTAK)" was launched by Ministry of Health Malaysia in 2016 as a strategy to screen, prevent and counsel school children on smoking cessation. KOTAK incorporated into School Dental Program, run by dental nurses and dentist for screening, prevention and brief intervention during school dental program treatment and dental health education session (46). In a recent study by Yahya *et al.* (2018), through a randomized control trial of smoking cessation interventions conducted by dentists among general Malaysian population, concluded that dentists are well-positioned to influence smokers to quit regardless of the type of intervention they were using (47).

In the Malaysian Armed Forces, dentists are encouraged to use the 5A's approach based on the Malaysian Clinical Practice Guideline Treatment for Tobacco Use Disorder 2016. However, most dentists refer their dental patients who want to quit smoking to the existing Quit Smoking Clinic located in Klinik Kesihatan provided by Ministry of Health (37). It is timely for Dental Service

Malaysian Armed Forces to embark on smoking cessation intervention as a common risk factor approach towards chronic diseases, including periodontal diseases, thus reducing the burden of care.

Smoking cessation and tobacco control in a community setting

In Malaysia, tobacco control is regulated under the Food Act of 1983 (48). The Control of Tobacco Product Regulations 2004 was issued under the Food Act of 1983 and regulate, among other things, smoke-free environments; tobacco advertising, promotion and sponsorship; and tobacco packaging and labelling (48). National Strategic Plan for Tobacco Control 2015-2020 was developed to ensure the smoking issue ends with a smoking prevalence target of less than 5% and is known as the end of the game (The End Game) by 2045 (46). It is also in line with the country's commitment to achieving Global Non-communicable Disease targets by 2025. It denotes the active involvement of inter-ministries, health institutes, universities, non-governmental organisations and the Malaysian Council for Tobacco Control in achieving the target: A Smoke-Free Generation (46). The plan outlined the strategies according to MPOWER, a package of selected demand reduction measures contained in the by World Health Organisation Framework Convention on Tobacco Control (WHO FCTC). It includes monitor tobacco use and prevention policies, protects people from tobacco smoke, offers help to quit tobacco use, warn about the dangers of tobacco, enforce bans on tobacco advertising, promotion and sponsorship and raise taxes on tobacco (49).

Malaysian Armed Forces facilities are regulated as the smoke-free environment under The Control of Tobacco Product Regulations 2004 (48). In 2006, Royal Medical and Dental Corps (RMDC) and Universiti Sains Malaysia collaborated to conduct a quasi-experimental study on the effectiveness of the integrated approach to reduce the prevalence of smoking among Malaysian army in four camps in Kelantan (7). The intervention program included weekly quit smoking clinic with Nicotine Replacement Therapy, individual and group counselling, health talk, forum and religion component which result in 39 (49.4%) smokers completely quitted smoking after nine months of intervention (7). Other than that, RMDC has limited smoking cessation practice regarding the smoking habit of the army personnel, specifically in North-East Malaysia region.

Smith *et al.* (2016) suggested that a systematic programme could be implemented. It includes strict policy on smoking availability at training, smoking free camp, control of tobacco supply, promoting a healthy lifestyle and proper smoking cessation help centre (50). The uniqueness of military culture allows for innovative means of tobacco regulation and prevention.

Limitations of the study

The response rate of this study was low because some of the army personnel were involved with military operational tasks during data collection day. Longer duration of data collection is required to overcome this limitation.

CONCLUSION

The prevalence of smoking among army personnel in North-East Malaysia was high, with most of them have some degree of periodontal disease. There was no significant association between smoking status and periodontal health status among army personnel in this study. However, smokers and ex-smokers army personnel in North-East Malaysia significantly require more invasive periodontal treatment compared to non-smokers.

This study involves a unique population with a specific occupational condition that affecting their health condition directly throughout life. Smoking is a risk factor for periodontal disease and other chronic diseases that can affect military readiness. Military readiness is deemed necessary among army personnel to ensure their full capability in securing national sovereignty from all kinds of threats. Therefore, reorienting health services to preventive efforts such as smoking cessation intervention as a common risk factor approach should be strategized in the military community to ensure that both health and oral health problems can be prevented.

A dentist is well-positioned as an agent for smoking cessation due to compulsory yearly dental check-ups requirement in the Malaysian Armed Forces. Effectiveness of smoking cessation programed by dentists in the general population was proven thus may be utilised in the military dental clinical setting. Therefore, more studies are needed on the effectiveness of dental smoking cessation intervention among the military population.

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REFERENCES

1. Basaza R, Otieno E, Musinguzi A, Mugenyi P, Haddock CK. Factors influencing cigarette smoking among soldiers and costs of soldier smoking in the work place at Kakiri Barracks, Uganda. Tobacco control. 2017;26(3):330-3.

2. Hussain N, Akande M, Adebayo E. Prevalence of cigarette smoking and knowledge implications among Nigerian soldiers of its health. *East African Journal of Public Health*. 2010;7(1):81-3.
3. Ramli HO. The Effects of xylitol chewing gum on oral environment among Malaysian infantry personnel involved in military operations. Kelantan, Malaysia: Universiti Sains Malaysia; 2012.
4. Khan MA, Akram S, Usman HB, Ahmed A. Effect of military deployment in operational area on the trend of smoking among troops. *Pakistan Armed Forces Medical Journal*. 2015;65(4):520-3.
5. Anderson MK, Grier T, Canham-Chervak M, Bushman TT, Jones BH. Physical training, smoking, and injury during deployment: a comparison of men and women in the US Army. *Army Med Dep J*. 2015:32-8.
6. Dental Service Malaysian Armed Forces. Malaysian Armed Forces Oral Health Survey. Kuala Lumpur. Dental Service Malaysian Armed Forces. 2011.
7. Zain RM. A study on smoking prevalence and the effectiveness of integrated intervention to reduce smoking prevalence among army personnel in Kelantan. Kelantan, Malaysia: Universiti Sains Malaysia; 2015.
8. Jasmin B, Jaafar N. Dental caries and oral health behaviour in the Malaysian Territorial Army Personnel. *Arch Orofacial Sci*. 2011;6(2):19-25.
9. Ferreira M, Dias-Pereira A, Branco-de-Almeida L, Martins C, Paiva S. Impact of periodontal disease on quality of life: a systematic review. *Journal of Periodontal Research*. 2017;52(4):651-65.
10. Moss DL. Dental emergencies during SFOR 8 in Bosnia. *Military Medicine*. 2002;167(11):904-6.
11. Dunn WJ. Dental emergency rates at an expeditionary medical support facility supporting operation enduring freedom. *Military medicine*. 2004;169(5):349-53.
12. Richardson PS. Dental morbidity in United Kingdom armed forces, Iraq 2003. *Military Medicine*. 2005;170(6):536-41.
13. Sandoval RM, Puy CL. Periodontal status and treatment needs among Spanish military personnel. *Med Oral Patol Oral Cir Bucal*. 2008;13(7):464-9.
14. Esa R; Jasmin B; Razak I. Periodontal status and treatment needs among Malaysian Armed Forces Personnel. *Dental Journal Malaysia*. 1996;17(1):6-10(AUNILo Institutional Repository).
15. Malaysian Armed Forces. Malaysian Armed Forces Medical Administration and Technical Instruction Malaysia Armed Forces. Kuala Lumpur. Health Service Malaysian Armed Forces. 2016; Edition IV, Volume 1.
16. Siddall AG, Bilzon JL, Thompson D, Greeves J, Izard R, Stokes K. Smoking status and physical fitness during initial military training. *Occupational Medicine*. 2017;67(3):205-10.
17. Rody Jr W, Elmaraghy S, McNeight A, Chamberlain C, Antal D, Dolce C, *et al*. Effects of different orthodontic retention protocols on the periodontal health of mandibular incisors. *Orthodontics & Craniofacial Research*. 2016;19(4):198-208.
18. Dupont WD, Plummer WD. PS power and sample size program available for free on the Internet. *Controlled Clinical Trials*. 1997;18(3):274.
19. Arora S, Ramachandra SS, Gundavarapu KC. Association between smoking, body mass index, and periodontal disease: a case-control study. *Indian Journal of Oral Health and Research*. 2016;2(1):23.
20. Yahya NA, Saub R, Mariani M, Yusoff N. Dental patient knowledge about the effects of smoking and attitudes about the role of dentists in smoking cessation. *Southeast Asian Journal of Tropical Medicine and Public Health*. 2017;48(2):473-84.
21. US Centre for Disease Control and Prevention. Behavioral Risk Factor System 2017 [Available from: https://www.cdc.gov/nchs/nhis/tobacco/tobacco_glossary.htm] [Accessed 14th November 2017].
22. Starr G, Rogers T, Schooley M, Porter S, Wiesen E, Jamison N. Key outcome indicators for evaluating comprehensive tobacco control programs. *Key outcome indicators for evaluating comprehensive tobacco control programs: Centre of Diseased Control, United States*; 2005.
23. Osanai S, Ogasa T, Sumitomo K, Hasebe N. Respiratory function in healthy ever-smokers is impaired by smoking habits in a dose-dependent manner. *Respiratory Investigation*. 2018;56(1):21-7.
24. World Health Organisation. *Oral Health Surveys: Basic Methods (Fourth Edition)*: World Health Organization. 1997.
25. Barraclough S, Morrow M. Tobacco and the Malays: ethnicity, health and the political economy of tobacco in Malaysia. *Ethnicity & Health*. 2017;22(2):130-44.
26. Department of Statistic Malaysia. Report of Household Income and Basic Amenities Survey 2016. 2016 https://www.dosm.gov.my/v1/index.php?r=column/cthemByCat&cat=120&bul_id=RUZ5REwveU1ra1hGL21JWVlPRmU2Zz09&menu_id=amVoWU54UTl0a21NWmdhMjFMMWcyZz09. [Accessed 9th September 2019].
27. Oktavia F. Besar risiko kejadian hipertensi berdasarkan faktor demografi, biologi dan perilaku pada tentara nasional Indonesia (TNI). Di Rumkital Dr. Ramelan Surabaya Tahun 2015: Universitas Airlangga 2016.
28. Tanner T, Päckilä J, Karjalainen K, Kämpfi A, Järvelin MR, Patinen P, *et al*. Smoking, alcohol use, socioeconomic background and oral health among young Finnish adults. *Community Dentistry and Oral Epidemiology*. 2015;43(5):406-14.
29. Al-Khashan HI, Al Sabaan FS, Al Nasser HS, Al Buraidi AA, Al Awad AD, Horaib GB, *et al*. The

- prevalence of smoking and its associated factors among military personnel in Kingdom of Saudi Arabia: A national study. *Journal of Family & Community Medicine*. 2014;21(3):147.
30. Barlas FM, Higgins WB, Pflieger JC, Diecker K. 2011 Health related behaviors survey of active duty military personnel. ICF International INC Fairfax VA; 2013.
 31. World Health Organisation. Prevalence of tobacco smoking by country. Global Health Observatory (GHO) data. 2016
 32. Boyko EJ, Trone DW, Peterson AV, Jacobson IG, Littman AJ, Maynard C, *et al*. Longitudinal investigation of smoking initiation and relapse among younger and older US military personnel. *American Journal of Public Health*. 2015;105(6):1220-9.
 33. Garrusi B, Nakhaee N. Religion and smoking: a review of recent literature. *The International Journal of Psychiatry in Medicine*. 2012;43(3):279-92.
 34. Machuca G, Rosales I, Lacalle JR, Machuca C, Bullyn P. Effect of cigarette smoking on periodontal status of healthy young adults. *Journal of Periodontology*. 2000;71(1):73-8.
 35. Shah AF, Batra M, Baba IA, Saima S, Yousuf A. Periodontal disease and smoking: An overview. *Clinical Cancer Investigation Journal*. 2016;5(2):99.
 36. Chahal GS, Chhina K, Chhabra V, Chahal A. Smoking and its effect on periodontium– Revisited. *Indian Journal of Dental Sciences*. 2017;9(1):44.
 37. Pusat Pergigian Angkatan Tentera Kem Desa Pahlawan. Laporan Tahunan Pusat Pergigian. Kuala Lumpur. Kementerian Pertahanan. 2017
 38. Ministry of Health Malaysia. Periodontal Treatment and Status: National Oral Health Survey Adults 2010. Kuala Lumpur. Ministry of Health Malaysia. 2010
 39. Thomson WM, Sheiham A, Spencer AJ. Sociobehavioral aspects of periodontal disease. *Periodontology 2000*. 2012 Oct;60(1):54-63.
 40. Baehni PC. Translating science into action– prevention of periodontal disease at patient level. *Periodontology 2000*. 2012 Oct;60(1):162-72.
 41. Zaitsu T, Saito T, Kawaguchi Y. The oral healthcare system in Japan. In *Healthcare 2018 Sep (Vol. 6, No. 3, p. 79)*. Multidisciplinary Digital Publishing Institute.
 42. Holtfreter B, Albandar JM, Dietrich T, Dye BA, Eaton KA, Eke PI, *et al*. Standards for reporting chronic periodontitis prevalence and severity in epidemiologic studies: Proposed standards from the Joint EU/USA Periodontal Epidemiology Working Group. *Journal of clinical periodontology*. 2015;42(5):407-12
 43. Thevissen E, De Bruyn H, Colman R, Koole S. Attitude of dental hygienists, general practitioners and periodontists towards preventive oral care: an exploratory study. *International Dental Journal*. 2017;67(4):221-8.
 44. Bedi R, Sutcliffe P, Donnan PT, McConnachie J. Oral cleanliness of dentally anxious schoolchildren and their need for periodontal treatment. *ASDC Journal of Dentistry for Children*. 1993;60(1):17-21.
 45. World Health Organisation. Helping people quit tobacco: a manual for doctors and dentists. World Health Organisation. 2010
 46. Ministry of Health Malaysia. Pelan strategik kebangsaan bagi kawalan tembakau 2015-2020. Kuala Lumpur. Ministry of Health Malaysia. 2015
 47. Yahya NA, Saub R, Mariani MN. A Randomized control trial of smoking cessation interventions conducted by dentists. *Sains Malaysiana*. 2018;47(1), 131-140
 48. Malaysian Government. The Control of Tobacco Product Regulations, Food Act of 1983. Kuala Lumpur. 2004
 49. World Health Organisation. WHO Framework Convention On Tobacco Control (WHO-FCTC). World Health Organisation. 2003
 50. Smith EA, Poston WS, Haddock CK, Malone RE. Installation tobacco control programs in the US military. *Military Medicine*, 2016; 181(6), 596-601.