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Article

Prevalence of Use, Impact on Oral Health, and Knowledge Regarding Tobacco Smoking: Findings from a Cross-Sectional Survey in Military Marines

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Abstract

Background: Despite its negative impact on systemic and oral health, tobacco smoking in the military remains a long-standing problem. It contributes to the high prevalence of tobacco smoking worldwide, while it serves as a stress-reliever in military life. **Purpose:** This survey aimed to identify the tobacco use, impact on oral health, and knowledge among Marines military personnel. **Materials and methods:** An online survey verified for validity and reliability, was employed to collect socio-demographic information of Marine smokers by age, education level, and length of military service, as well as their smoking behaviors, impact on oral health, and knowledge. Data were presented descriptively, and the associated factors were analyzed using multivariate analysis. **Results:** A total of 475 naval marine unit personnel completed the study, with 44.8% reported being current smokers, 25.7% former smokers, and 29.5% never smokers. Seventy-one percent of the participants had a good knowledge of smoking. The most commonly reported impacts on oral health are bad breath, tooth staining, and taste impairment. Smoking habits were not significantly different according to age ($p = 0.095 > 0.05$), nor by education level ($p = 0.610 > 0.05$), but were significantly different by length of service ($p = 0.00 < 0.05$) and level of knowledge ($p = 0.00 < 0.05$). The results of multivariate analysis utilizing multinomial logistic regression based on p-value ($p = 0.005 < 0.05$) and 95% CI (0.282-0.8) demonstrated that the 1-5 years length of service is the most significant factor influencing smoking habits. According to OR (odds ratio) values, smoking habits increase the risk by 1.8 times among those with 11-15 years of military service. **Conclusion:** Despite a good level of knowledge of smoking-related health risks, the present study indicates a high prevalence of tobacco smoking. The most common impacts on oral health among smokers include stained teeth, bad breath, and taste impairment. It was also found that the length of military service and knowledge significantly influence smoking behavior.

Keywords: smoking; perception; knowledge; Marines; military; survey

1. Introduction

Tobacco smoking remains a significant global health issue, with smoking prevalence varying widely across countries. Global Adult Tobacco Survey reported that from 28 countries, the median prevalence of tobacco smoking was 22.5% among persons aged ≥ 15 years [1]. Although the negative health effects of smoking have long been well-known, knowledge of the health risks of smoking is still underestimated, particularly among current smokers. While general awareness that smoking is harmful is high, a significant gap exists in understanding specific and relative risks. The oral habit of tobacco smoking is a leading behavioral risk factor for numerous health outcomes, both systemic and oral health, such as coronary heart disease, stroke, and multiple types of cancer, including lung cancer. While in the oral cavity, smokers experience an 80% increased risk of periodontitis and a 36.6% higher caries prevalence and increased oral cancer risk [2].

The use of tobacco is often closely associated with military service, as it is considered a stress reliever; thus, it contributes to smoking prevalence globally. Military members experienced more stressful conditions than the general population; hence, the higher prevalence of smokers in the military can be expected. In the US military, tobacco use was 15.0% higher than in civilians, with an overall rate of 28.26% in 2022, while in a Russian military study, it was found that 48.7% of military personnel were active smokers, with the highest rates at 56.6% [3,4]. The prevalence of smoking among national military service recruits in the UAE is 41.6%.⁵ Smoking rates in Uganda are substantially higher in the military (34.8%) compared to the general public (5.3%) [6]. In Germany, military smoking rates were slightly above the general population, while in Israel, their prevalence increased by 39.4% during military service [7].

Previous studies indicate a high prevalence of tobacco use in military populations, particularly in the Naval services at 24.1% [8], including in the U.S., with 24.5% reported as current smokers, whereas in the Taiwan Navy was 32.8% [9]. In the Chinese Navy, smoking rates were higher than in civilian and other military populations, found to be 56.14% [10]

There are significant gaps between the knowledge of smoking among military personnel and the high prevalence rates. The vast majority of military personnel underestimate their personal health risks related to tobacco smoking[11]. Implementation of harm reduction, including strategies that increase knowledge about the health risks posed by tobacco use, might help to reduce tobacco use and tobacco-related disease, including heart disease, stroke, and lung cancer, and oral conditions, particularly in active military personnel [11].

The present study aimed to investigate tobacco smoking, perception, and knowledge regarding smoking in Marines as part of military personnel working in a highly stressful environment.

2. Materials and Methods

2.1. Participants and Procedures

This survey was conducted using an online questionnaire. The validity test was performed with Pearson Product-Moment and the reliability test with Kuder-Richardson (KR20) on 40 Marines. A convenience sampling was taken among the Navy-Marine personnel who were willing to complete the questionnaire. The study protocol was approved by the Ethics Committee of the Faculty of Medicine, Universitas Padjadjaran, Bandung, Indonesia (No. 1065/UN6.KEP/EC/2023) with a research permit from Naval Dental Hospital RE Martadinata, Jakarta, Indonesia (B/627/VII/2023).

Subjects had to meet the inclusion criteria, i.e., male or female, minimum age of 18 years, active marine unit members, capable of filling out the questionnaire voluntarily, and without coercion from any person. Exclusion criteria were military personnel who did not agree to take part in the research procedures. Before filling out the questionnaire, informed consent was obtained from all participants, stating their agreement to participate in the study. Access to the survey was closed after reaching the predetermined number of target respondents. The questionnaire was developed according to a previous study¹⁰ and was structured by behavior, impact on oral healths, and knowledge related to

smoking habits. Before commencement of the study, the questionnaire had been tested for validity and reliability, piloted on 30 respondents, and designed to be completed in about 5 to 10 minutes.

2.2. General Characteristics

Smoking status in the present report was categorized into several groups:

Current smokers were defined as individuals who reported smoking up to the time of the survey, former smokers were considered those who smoked in the past but did not smoke currently, and never smokers were individuals who had never used a tobacco product. Subject's characteristic data was collected, including age, gender, educational levels, and duration of military service.

2.3. Current Smoking Behavior and Cessation Attempts

This section was only applied to current smokers, including 7 questions regarding smoking behaviors, i.e., the period of smoking, type of cigarette, purpose, duration, frequency, and number of cigarettes consumed per day. Current smoker cessation attempts were explored through 5 questions, including whether or not they had ever tried to stop smoking, whether or not they had received counseling for smoking cessation, whether or not they were confident of being able to cease smoking within 6 months, whether or not there were any perceived negative effects, and their health expectations about their cessation attempts.

2.4. Former Smoker Behavior

This section was only collected from former smokers, containing three questions (1) how long it had been since they ceased smoking, (2) how long they had been active smokers, and (3) the type of cigarettes consumed.

2.5. Impact on Oral health Regarding Smoking

Impact on oral health due to smoking includes 7 questions: bad breath, tooth staining, impaired taste, delayed wound healing, and gingival impacts (soreness, bleeding, and swelling).

2.6. Knowledge Regarding Smoking and Combustion-Free Nicotine Delivery System (C-F NDS)

Participants' knowledge about smoking was explored with 14 questions, including the impact of smoking on the condition of the oral cavity and on systemic diseases that may result from smoking. Respondents' knowledge about C-F NDS consisted of 3 questions, including whether or not they had received information about C-F NDS, whether they recognized these products, and their variety.

2.7. Statistical Analysis

Data were analyzed using descriptive statistics, reported in frequency distributions. The comparative test further examined differences in factors related to smoking habits. Variables were then analyzed using multivariate multinomial logistic regression; factors with significant p-values were then analyzed to see any associations with smoking habits. Independent variables were smoking habits: Current smokers (those who have smoked ≥ 100 cigarettes in their lifetime and still smoke up to the present); Former smokers (those who have smoked ≥ 100 cigarettes in their lifetime but no longer smoke); and Non-smokers (those who have never smoked ≥ 100 cigarettes in their lifetime. The dependent variables were age, education level, military service, and knowledge regarding smoking). The SPSS software version 23.0 was employed, and the level of significance was set at $p < 0.05$.

3. Results

3.1. Socio-Demographic Data

The total number of participants who completed the survey was 475. The socio-demographic data are presented in Table 1.

Table 1. Socio-demographic (n=475).

Characteristics	F (%)
Age (years)	
<20	20 (4.2)
20-29	225 (47.4)
30-39	121 (25.5)
40-49	99 (20.8)
50-59	10 (2.1)
Sex	
Male	475 (100)
Female	0 (0)
Military service (years)	
1-5	178 (37.5)
6-10	87 (18.3)
11-15	33 (6.9)
>15	177 (37.3)
Education level	
Senior high school or equivalent	448 (94.5)
College	25 (5.2)
Postgraduate and above	2 (0.4)

3.2. Smoking Behavior

The smoking behavior of participants in the present study is listed in Table 2, which includes the prevalence of 44.8%, 25.7%, and 29.5%, current smokers, former smokers, and never smokers, respectively. The majority of current smokers and former smokers use conventional/combustible cigarettes (80%), and only a small proportion use vapes/e-cigarettes. Most current smokers have been smoking for over 10 years, smoke 5-10 times a day, and spend 1-2 hours with 5-10 cigarettes. Smokers mainly smoke with no purpose to achieve, others to relieve stress, and to improve focus and concentration during work.

Table 2. Smoker behavior.

Behavior	Current Smokers n= 213 (44.8) F (%)	Former Smokers n= 122 (25.7) F (%)	Never Smokers n= 140 (29.5) F (%)
Type of cigarette			
Conventional Cigarette	188 (88.3)	99 (81.8)	NA
Electric Cigarette	3 (1.4)	3 (2.5)	
Conventional & E-cigarette	22 (10.3)	19 (25.7)	
NA	-	1 (0.8)	
Duration of smoking (year)			
<1	15 (7.1)	43 (36.0)	NA
1-2	18 (8.6)	21 (18)	
3-5	41 (19.5)	22 (18.0)	
5-10	61 (29.0)	12 (10.0)	
>10	75 (35.7)	22 (18.0)	

NA	3 (1.4)	2 (1.6)	
Smoking frequency/day			
<5	62 (29.5)		
5-10	79 (37.6)	NA	NA
>10	69 (32.9)		
NA	3 (1.4)		
Total smoking time/day (hours)			
<1	55 (26.1)	30 (25.0)	
1-2	69 (32.7)	30 (25.0)	
3-5	60 (28.4)	28 (23.3)	NA
>5	27 (12.8)	15 (12.5)	
NA	2 (0.9)	2 (1.9)	
Number of cigarettes smoked / day			
<5	52 (24.9)		
5-10	82 (39.2)		
>10	75 (35.9)	NA	NA
NA	4 (1.9)		
Purpose to smoke			
Promote concentration on work	46 (22.1)		
Relieve stress	60 (28.8)		
Enjoy the smell (of e-cig liquid)- without harming your health	2 (1.0)	NA	NA
Have no reason	105 (49.3)		
Total N (%)	213 (44.8)		

Abbreviations: NA, not available

3.3. Cessation Attempts and History of Current Smokers

Almost all current smokers in this survey (Table 3) have attempted to quit smoking, most of them have received advice to quit smoking, and believe they could quit smoking within 6 months. More than half of smokers reported having experienced negative effects on their health related to smoking, and agree with the statement about their health expectancy from smoking cessation.

Table 3. Cessation attempts and history of current smokers.

Cessation Attempts and History		F (%)
Have attempted to quit		
Yes		191 (91.0)
No		19 (9.0)
NA		3 (1.4)
Has received advice to quit smoking		
Yes		124 (59.0)
No		86 (41.0)
NA		3 (1.4)
Believe they will be able to quit in six months if they decide to quit smoking		
Yes		159 (76.1)
No		50 (23.9)
NA		4 (1.9)
Have experienced negative health impacts due to smoking		
Yes		125 (59.5)
No		85 (40.5)
NA		3 (1.4)
Health expectancy related to smoking cessation		

Yes	194 (93.3)
No	14 (6.7)
NA	6 (5.6)

3.4. Impact on Oral Health Regarding Smoking

Stained teeth and bad breath are the most common impacts on oral health regarding smoking among active and former smokers, as listed in Table 4. Half of them experience impaired taste, and about a third have delayed wound healing, including gingival soreness, gingival bleeding, and gingival swelling.

Table 4. Impact on oral health associated with smoking among current and former.

Impact on oral health	Yes N (%)	No N (%)	NA N (%)
Bad breath	272 (83.4)	54 (16.6)	9(3.4)
Staining of teeth	285 (87.7)	40 (12.3)	10(3.0)
Taste impairment	169 (52.0)	156 (48.0)	10(3.0)
Delay wound healing	124 (38.2)	201 (60.8)	10(3.0)
Gingival soreness	126 (38.7)	200 (61.3)	9(2.7)
Gingival bleeding	114 (35.1)	211 (64.9)	10(3.0)
Gingival swelling	112 (34.5)	213 (65.5)	10(3.0)

3.5. Knowledge Regarding Smoking

Participants’ knowledge about smoking was assessed by questionnaires (Table 5) with a dichotomous response (Yes or No). Correct answers were assigned 1 point, whilst incorrect answers were 0 points. All questions were accumulated for a total of points, with a total of 0-5 points representing poor knowledge, 6-11 representing fair knowledge, and 12-16 representing good knowledge. All questions were cumulated into a total of 0-5, 6-11, and 12-16 points, representing poor, fair, and good knowledge, respectively. Table 4 reveals that most of the respondents in this study have a good knowledge of smoking.

Table 5. Knowledge regarding smoking.

Knowledge regarding smoking	N (%)	
Good (12-16)	339 (71.4)	
Fair (6-11)	100 (21.1)	
Poor (0-5)	36 (7.6)	
Statement on smoking	Yes— N (%)	No— N (%)
I have received information about smoking and its risks	462 (97.3)	13 (2.7)
Smoking may cause changes in the oral cavity (hard tissue or soft tissue)	395 (83.2)	80 (16.8)
The number of cigarettes affects the onset of changes in the oral cavity	374 (78.7)	101 (21.3)
Smoking is not cool		
Nicotine in cigarettes is the chemical that most contributes to oral cancer	408 (85.9)	67 (14.1)
	400 (84.2)	75 (15.8)
Cigarette smoking may lead to apoplexy		
Cigarette smoking may lead to lung cancer	254 (53.9)	221 (46.5)
Cigarette smoking may lead to stained teeth	410 (86.3)	65 (13.7)
Cigarette smoking may lead to premature aging	438 (92.2)	37 (7.8)
Cigarette smoking may lead to coronary heart disease	329 (69.3)	146 (30.7)
Cigarette smoking may lead to mouth cancer	390 (82.1)	85 (17.9)
Cigarette smoking may lead to impotence in male smokers	386 (81.3)	89 (18.7)

Passive smoking may lead to lung cancer in non-smokers	370 (77.9)	105 (22.1)
	398 (83.8)	77 (16.2)
Statement about C-F NDS		
Heard about C-F NDS	297 (62.5)	178 (37.5)
Recognize about C-F NDS	261 (54.9)	214 (45.1)
Variants of C-F NDS that are known:		
Vape	125 (26.3)	
Heated tobacco product	45 (9.5)	
Nicotine patch	31 (6.5)	
Nicotine gum	35 (7.4)	
Snus	5 (1.1)	
Do not familiar	234 (49.3)	
Total N (%)	213 (44.8)	

3.6. Knowledge Regarding Non-Combustible Tobacco Products

Table 5 showed that 6 out of 10 participants had heard of C-F NDS, yet many participants were unfamiliar with alternative tobacco products. The most widely recognized product by far was vape, whilst the other variants lacked recognition.

3.7. Comparison of Smoking Habits According to Socio-Demographic Data and Knowledge

The results of a comparative test in Table 6 found that smoking habits were not significantly different according to age ($p0.095>0.05$), nor according to education level ($p0.610>0.05$). However, smoking habits were significantly different when compared to the length of service ($p0.00<0.05$) and the level of knowledge ($p0.00<0.05$).

Table 6. Comparison of Smoking Habits According to Socio-demographic Data and Knowledge.

Characteristics	Current Smokers n= 213 (44.8) F (%)	Former Smokers n= 122 (25.7) F (%)	Never Smokers n= 140 (29.5) F (%)	P-Value
Age				
<20	6 (2.8)	7 (5.7)	7 (5.0)	0.095
20-29	86 (40.4)	61 (50.0)	78 (55.7)	
30-39	65 (30.5)	28 (23.0)	28 (20.0)	
40-49	50 (23.5)	23 (18.9)	26 (18.6)	
50-59	6 (2.8)	3 (2.5)	1 (0.7)	
Education Level				
Senior high school or equivalent	201 (94.4)	115 (94.3)	132 (94.3)	0.610
College	10 (4.7)	7 (5.7)	8 (5.7)	
Postgraduate and above	2 (0.9)	0 (0)	0 (0)	
Military service (years)				
1-5	58 (27.2)	57 (46.7)	63 (45.0)	0.00**
6-10	42 (19.7)	16 (13.1)	29 (20.7)	
11-15	22 (10.3)	5 (4.1)	6 (4.3)	
>15	91 (42.7)	44 (36.1)	42 (30.0)	
Knowledge				
Good	129 (60.6)	95 (77.9)	115 (82.1)	0.00**
Fair	58 (27.2)	21 (17.2)	21 (15.0)	
Poor	26 (12.2)	6 (4.9)	4 (2.9)	

Factors included in the multivariate analysis were significant factors based on the results of the comparison test in Table 7. Using multinomial logistic regression, based on p-value ($p = 0.005 < 0.05$) and 95% CI (0.282-0.8), it was shown that the most significant length of service in the military affecting smoking habits is in the range of 1-5 years ($p < 0.05$). Concerning OR (odds ratio) values, most smoking habits increase the risk by 1.8 times among those with 11-15 years of military service. The most significant knowledge level in influencing smoking habits is a good level of knowledge ($p < 0.05$).

Table 7. Multivariate Analysis on Current Smokers.

Factor	Beta Coefficient	SE	P-Value	OR	95%	CI OR
					Lower	Upper
Military service (years)						
1-5	-0.745	0.266	0.005	0.475	0.282	0.8
6-10	-0.307	0.313	0.327	0.736	0.399	1.358
11-15	0.624	0.506	0.218	1.866	0.692	5.035
>15	-	-	-	-	-	-
Knowledge						
Good	-1.65	0.557	0.003	0.192	0.064	0.572
Fair	-0.774	0.6	0.197	0.461	0.142	1.494
Poor	-	-	-	-	-	-
Intercept	2.065	2.065	0.559	0.00	-	-

4. Discussion

The findings of the present study showed the high prevalence of current smokers in Marines (44.8%), and it was higher than the civilian smoking rate of 33.8% in adults and 12.7% in adolescents, based on the Indonesian National Report on Basic Health Research [12]. It is in line with previous studies’ findings that military service indicates a high prevalence of tobacco use in military populations, particularly in the Naval services, which contributes to the high prevalence of smoking and tends to increase in several units [3,8,9,13]. This highlights the added risk within the military.

The age of current smokers in the present study is dominated by the young age (20-29 years of age). This may be influenced by the high number of survey participants at that age, but when compared to other age groups, all proportions of smokers are notably higher than non-smokers in each age group. In Germany, smoking prevalence is higher among younger military personnel compared to older [14]. In South Korea, the highest smoking prevalence was initially observed in the 22-24 age group [15]. The prevalence of smoking among young Greek male military recruits was high, with most starting between ages 10-20 [16]. Dolich et al. (2021) revealed critical contributing factors, including negative social environment influences (parents and friends smoking), psycho-emotional stress, and living independently from parents [17]. Yeji Lee et al., 2019 further demonstrated that factors like stress levels, secondhand smoke exposure, and social interactions strongly correlate with smoking behaviors in young adults [18].

The education level of smokers in this study was predominantly lower education. Research across multiple countries reveals complex relationships between education levels and smoking behaviors. The U.S. military has more smokers at educational levels lower than a bachelor’s degree [19]. A study of 21 European nations found that lower education was associated with higher daily smoking rates [20]. However, education level in this study was not statistically associated with their habit of smoking. Previous research in military populations consistently demonstrates significant relationships between age, education, and smoking behaviors. Younger military personnel exhibit higher smoking rates compared to older service members, a pattern observed across multiple studies [14,21]. Educational attainment shows a strong inverse relationship with smoking, where lower education levels are associated with increased smoking prevalence [14,21].

According to the comparative test and the multivariate analysis of this current study, length of service was significantly associated with and affecting the smoking habit, the number of participants

with 1-5 of year length of military service was the highest but after comparison, smoker participants who had served in the military for more than 15 years had a higher proportion of the entire current smokers group, and the risk of smoking habits increased by 1.8 times among those who had served in the military for 11-15 years. Regarding the knowledge level, a good level influences the smoking habits.

This suggests that in the present survey, length of military service appears to significantly increase smoking behavior among personnel; the longer the military service of a smoker, the more the smoking habit increases. Research consistently showed that military service was associated with increased smoking rates and longer smoking durations across the life course [22]. This is in accordance with military service in older Vietnamese, which significantly increased the risk of smoking initiation [23]. The association between smoking and service duration appears most pronounced in personnel with prior smoking history, who show substantially elevated relapse risk, those experiencing combat exposure or prolonged deployments (>9 months), enlisted personnel at lower pay grades, personnel in transition periods approaching service separation, and Navy personnel compared to Air Force [7,8,19].

Since vape/e-cigarettes are listed as tobacco products, we also evaluated the use of vape among Marines as smoking behavior. Most smokers in this study generally used conventional/combustible cigarettes; only a small proportion were e-cigarette users and dual users. This may be because e-cigarettes are still not widely used, only available in certain places, and the pricing may still be considered uneconomical compared to conventional cigarettes. Although recent studies have highlighted the increasing prevalence of e-cigarette use among U.S. military personnel, particularly among younger service members, while cigarette use in the military declined from 24% in 2011 to 13.8% in 2015, e-cigarette use increased to 12.4% during the same period [24], and in the Health Related Behavior Survey was found to be 16.2% [25]. This trend is especially pronounced among those aged 17-24, with 22.8% reporting e-cigarette use [24]. Notably, e-cigarette use among new Air Force recruits increased dramatically, reaching 15.3% in 2018 [26]. Factors associated with higher e-cigarette use include young age, lower military ranks, other tobacco use, and low perception of harm [27].

Despite the impact of smoking on health being clear, and almost all smokers (>90%) in this study had attempted to quit smoking and were confident that they could quit smoking within 6 months if they decided to, they continued to smoke. As a matter of fact, smoking cessation remains a significant challenge. Only about half of U.S. adult smokers attempt to quit annually, and only 7.5% achieve sustained cessation [28,29]. Similar trends are observed in Malaysia, where 49% of smokers attempted quitting in the past year, but only 31.4% successfully quit [30]. This could be due to numerous barriers to smoking cessation, including addiction, stress, and ingrained habits [31]. The military environment often exacerbates these challenges, with factors such as work-related stressors and the desire to fit in with one's unit contributing to increased smoking intensity and nicotine dependence [32]. Most of the current smokers in this study had no reason why they initiated smoking a cigarette, this might be affected by an environment dominated by smokers who typically consider smoking to be acceptable, so they do not have a reason for why they engage in the habit of smoking; whilst more than a quarter of smokers admitted to relieve stress and promote concentration at work.

Impact on oral health related to smoking reported in the present study was tooth staining and bad breath. Smoking is a significant contributor to tooth staining, which is attributed to toxins from tobacco smoke accumulating in the porous structure of tooth enamel [33]. Studies have shown that even light smokers (1-4 cigarettes per day) experience stain formation on their teeth [34]. Furthermore, smoking is a major risk factor for bad breath, a condition characterized by unpleasant breath odor [35]. Cigarette smoke disrupts the oral bacterial community, leading to increased production of volatile sulfur compounds in periodontal pockets [36]. Delayed wound healing and perception of the gingiva are less reported; this could be due to good oral hygiene or possibly due to the masking effect of smoking on the gingiva. Previous research states that smoking masks the actual condition, tobacco smoking significantly impacts vascular health and function through multiple

mechanisms, leading to reduced bleeding, assuming that the gums are healthy, while in fact the underlying tissue structure is prone to disease [37].

The level of knowledge regarding smoking in this study is generally good, they have received information about smoking and its risks, affected the oral cavity, and knew that nicotine contained in cigarettes was the most contributing factor to the oral cavity ranging from tooth staining to oral cancer, even though current research has identified that tar from burning conventional cigarettes is responsible for smoking-related diseases [38]. Although 71% had “good” knowledge, many continued to smoke. This suggests a knowledge-behavior gap. A study among students at Riyadh Elm University sheds further attention on the significant prevalence of smoking and the knowledge gap regarding its major risks. These findings emphasize the necessity for focused and integrated tobacco control interventions that concentrate on correcting specific misconceptions, boosting self-reliance to quit, and extending the provision of accessible smoking cessation assistance to encourage healthier lifestyle habits [39].

Smoking behavior among military personnel is influenced by various factors across individual, interpersonal, and organizational levels, including education level, service duration, family smoking history, and smoking knowledge [10]. Socioecological factors such as stress, work-related stressors, and smoking to fit in with one’s unit are associated with increased smoking intensity and nicotine dependence [32]. Military-specific factors, including service era, and duration of service, also impact smoking behaviors [21]. Research on psychological aspects of smoking and quitting in military populations reveals complex relationships between mental health and tobacco use. In UK military personnel, smoking initiation is associated with psychological distress, and deployment experiences [40]. Among active duty U.S. military personnel, smoking intensity and nicotine dependence are linked to using smoking to fit in with one’s unit, stress-related smoking, and work-related stressors [32]. In the Chinese Navy, smoking prevalence exceeds civilian and other military rates, with stress relief and social needs as primary motivators [10]. The main reasons for smoking in the military were social needs and stress alleviation [9]. Other factors associated with increased smoking among military personnel include life stressors [41]. Factors contributing to high military smoking rates include stress alleviation, social needs, and targeted marketing by tobacco companies [10]. Despite some overall reduction in military tobacco use, recent years have seen an increase, highlighting the need for improved cessation counseling and interventions [3]. In the present study, the level of knowledge was shown to be associated with smoking habits.

This survey includes questions about vaping/e-cigarettes as they have the potential to reduce the adverse effects of combustible cigarettes for smokers who find it difficult or are reluctant to quit smoking. For more than half of the participants, combustion-free nicotine delivery systems (C-F NDS) were not unfamiliar; they had recognized them. Research indicates that C-F NDS availability and marketing vary by neighborhood demographics, with inexpensive combustible products more prevalent in low-income, minority areas, while potentially less harmful non-combustible options are more accessible in higher-income [42]. Young adults’ initiation and continued use of C-F NDS are influenced by factors like peer pressure, flavors, and stress management, while cessation motivations include family responsibilities and health concerns [43]. A systematic review suggests that C-F NDS, such as electronic cigarettes, smokeless tobacco, and nicotine replacement therapy, can moderately reduce daily cigarette consumption and potentially assist in smoking cessation attempts, with fewer adverse events compared to traditional cigarettes [44].

Quitting smoking is the best approach to reducing health risks. A health-promoting program may help improve smoking-related conditions [35]. After a military health-promoting program, there are some beneficial effects in to a decline in the prevalence of cigarette smoking for military personnel in Taiwan. More active intervention and health-promoting programs in the prevention and cessation of smoking are needed for the military. The military also has to develop specific approaches and programs to prevent cigarette smoking [13]. These findings highlight the need for targeted smoking prevention and cessation programs for military personnel.

5. Conclusions

This study demonstrated a high prevalence of tobacco use among military personnel, particularly in the Marine Corps, wherein there was a gap in the high level of knowledge concerning tobacco smoking. The most frequently recorded impact on oral healths among smokers include stained teeth, bad breath, and taste impairment. It was also found that the length of military service and knowledge significantly positively related to smoking behavior.

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References

1. Ahluwalia IB, Smith T, Arrazola RA, et al. Current Tobacco Smoking, Quit Attempts, and Knowledge About Smoking Risks Among Persons Aged ≥15 Years — Global Adult Tobacco Survey, 28 Countries, 2008–2016. *MMWR Morbidity and Mortality Weekly Report*. 2018;67(38). doi:10.15585/mmwr.mm6738a7
2. Almesmari S, Ameri F Al, Shanqaiti H Al, Mansoori L Al, Humariya Heena. Prevalence of smoking among national military service recruits in UAE. *Front Public Health*. 2024;1(1):1-10. doi:https://doi.org/10.3389/fpubh.2024.1335545
3. Patrick S, Boyle C, LaMorte D, Dore M. Tobacco use Prevalence in the Military Health System: A Retrospective Study. *Military Medicine*. 2024;00(01):1-6. doi:10.1093/milmed/usae208
4. Simonchick. The Prevalence of Smoking and The Level of Nicotine Addiction Among Military Personnel. *Military Medicine*. Published online 2024.
5. Almesmari S, Ameri F Al, Shanqaiti H Al, Mansoori L Al, Humariya Heena. Prevalence of smoking among national military service recruits in UAE. *Frontiers in Public Health*. 2024;1(1):1-10. doi:https://doi.org/10.3389/fpubh.2024.1335545
6. Cochran D. Section 9: Implant Therapy I. *Annals of Periodontology*. 1996;1(1).
7. Zarka S, Levine H, Rozhavski V, et al. Smoking behavior change during compulsory military service in Israel, 1987-2011. *Nicotine and Tobacco Research*. 2017;19(11). doi:10.1093/ntr/ntw285
8. Ulanday KT, Jeffery DD, Nebeling L, Srinivasan S. Perceived deterrence of cigarette use and smoking status among active duty military personnel. *Military Medicine*. 2017;182(5). doi:10.7205/MILMED-D-16-00201

9. Yang W, Zou Q, Tan E, et al. Future health and economic impact of comprehensive tobacco control in DoD: A microsimulation approach. *Military Medicine*. 2018;183(1-2). doi:10.1093/milmed/usx015
10. Chen F, Hu P, Chang W, Chen C, Ding T, Liu X. A cross-sectional survey on cigarette smoking in the Chinese navy. *Military Medicine*. 2019;184(5-6). doi:10.1093/milmed/usy363
11. Hicks TA, Thompson AC, Wilson SM, Travis EA, Beckham JC, Calhoun PS. Knowledge gaps around smoking and nicotine among u.S. military veterans who smoke and implications for practice. *Military Behavioral Health*. 2019;7(1). doi:10.1080/21635781.2018.1530625
12. Ministry of Health Republic of Indonesia. National Report on Basic Health Research (Riskesdas) 2018. Badan Penelitian dan Pengembangan Kesehatan. Preprint posted online 2018.
13. Chu NF, Lin FH, Wu YC. Prevalence and trends of cigarette smoking among military personnel in taiwan: Results of 10-year anti-smoking health promotion programs in military. *Military Medicine*. 2017;182(7). doi:10.7205/MILMED-D-16-00361
14. Sammito S, Claus A, Rose DM. Smoking prevalence in the area of responsibility of the German Ministry of Defense—Results of the employee survey in the context of occupational health management. *Military Medical Research*. 2020;7(1). doi:10.1186/s40779-020-00236-w
15. Jung S, Kang H, Cho S il. Age-period-cohort analysis of smoking prevalence trends among career military personnel in South Korea. *Tobacco Induced Diseases*. 2024;22(185):1-8.
16. Grapatsas K, Leivaditis V, Dimopoulos E, et al. Characteristics of smoking among young Greek males at the time of their recruitment in the army. *Annals of Research Hospitals*. 2017;1. doi:10.21037/arh.2017.04.10
17. Dolich VN, Komleva NE, Zaikina IV, Mazilov SI, Rajkin SS, Yakovleva TA. Analysis of the prevalence of smoking among young people taking into account socio-economic and psycho-emotional factors. *Sanitarnyj vrac (Sanitary Doctor)*. 2021;(12). doi:10.33920/med-08-2112-05
18. Lee Y, Lee KS. Factors related to smoking status among young adults: An analysis of younger and older young adults in Korea. *Journal of Preventive Medicine and Public Health*. 2019;52(2). doi:10.3961/jpmph.18.201
19. Nieh C, Powell TM, Gackstetter GD, Hooper TI. Smoking Among U.S. Service Members Following Transition From Military to Veteran Status. *Health Promotion Practice*. 2020;21(1_suppl). doi:10.1177/1524839919881478
20. Huijts T, Gkiouleka A, Reibling N, Thomson KH, Eikemo TA, Bambra C. Educational inequalities in risky health behaviours in 21 European countries: Findings from the European social survey (2014) special module on the social determinants of health. *European Journal of Public Health*. 2017;27. doi:10.1093/eurpub/ckw220
21. Golden SE, Thakurta S, Slatore CG, Woo H, Sullivan DR. Military Factors Associated with Smoking in Veterans. *Military Medicine*. 2018;183(11-12). doi:10.1093/milmed/usy115
22. London AS, Herd P, Miech RA, Wilmoth JM. The influence of men's military service on smoking across the life course. *Journal of Drug Issues*. 2017;47(4). doi:10.1177/0022042616678617
23. Korinek K, Loebach P, Trinh HN. Military service and smoking in a cohort of northern Vietnamese older adults. *International Journal of Public Health*. 2017;62(1). doi:10.1007/s00038-016-0841-9
24. Keltner CH, Kao TC, Ahmed A, Mancuso JD. E-cigarette and dual product use as an emerging health threat to the US military. *Tobacco Prevention and Cessation*. 2021;7. doi:10.18332/TPC/135516
25. Mancuso JD, Anwar E. Ahmed, PhD M, Kristen R. Rossi M. Tobacco and Nicotine Use Among Active Component U.S. Military Service Members: A Comparison of 2018 Estimates from the Health Related Behaviors Survey and the Periodic Health Assessment. *MSMR*. 2024;31(3):1-12.
26. Little MA, Fahey MC, Wang XQ, Talcott GW, McMurry T, Klesges RC. Trends in Tobacco Use among Young Adults Presenting for Military Service in the United States Air Force between 2013 and 2018. *Substance Use and Misuse*. 2020;56(3). doi:10.1080/10826084.2020.1868517
27. Lin J, Zhu K, Hoang PK, et al. Electronic Cigarette Use and Related Factors among Active Duty Service Members in the U.S. Military. In: *Military Medicine*. Vol 185. 2020. doi:10.1093/milmed/usz267
28. Dai X, Gil GF, Reitsma MB, et al. Health effects associated with smoking: a Burden of Proof study. *Nature Medicine*. 2022;28(10). doi:10.1038/s41591-022-01978-x

29. Leventhal AM, Dai H, Higgins ST. Smoking Cessation Prevalence and Inequalities in the United States: 2014-2019. *Journal of the National Cancer Institute*. 2022;114(3). doi:10.1093/jnci/djab208
30. Lim KH, Heng PP, Nik Mohamed MH, et al. Prevalence and Factors Associated With Attempts to Quit and Smoking Cessation in Malaysia. *Asia-Pacific Journal of Public Health*. 2019;31(7_suppl). doi:10.1177/1010539519874944
31. Hashim MA bin, Ismail IH bin, Md Sabri BA binti. "We're tough, but so is quitting." Barriers to Smoking Cessation: The Royal Malaysian Navy Perspective. In: *Military Medicine*. Vol 188. 2023. doi:10.1093/milmed/usad268
32. Brown JM, Anderson Goodell EM, Williams J, Bray RM. Socioecological Risk and Protective Factors for Smoking among Active Duty U.S. Military Personnel. *Military Medicine*. 2018;183(7-8). doi:10.1093/milmed/usx021
33. Gasmi Benahmed A, Gasmi A, Menzel A, et al. A review on natural teeth whitening. *Journal of Oral Biosciences*. 2022;64(1). doi:10.1016/j.job.2021.12.002
34. Dondokambey SD V., Pangemanan DHC, Khoman JA. Pengaruh Kebiasaan Merokok terhadap Pembentukan Stain pada Gigi. *e-GiGi*. 2021;9(2). doi:10.35790/eg.v9i2.34878
35. Zanetti F, Semren TZ, Battey JND, et al. A Literature Review and Framework Proposal for Halitosis Assessment in Cigarette Smokers and Alternative Nicotine-Delivery Products Users. *Frontiers in Oral Health*. 2021;2. doi:10.3389/froh.2021.777442
36. Kauss AR, Antunes M, Zanetti F, et al. Influence of tobacco smoking on the development of halitosis. *Toxicology Reports*. 2022;9. doi:10.1016/j.toxrep.2022.02.012
37. Buduneli N, Scott DA. Tobacco-induced suppression of the vascular response to dental plaque. *Molecular Oral Microbiology*. 2018;33(4). doi:10.1111/omi.12228
38. Lee PN. Tar level of cigarettes smoked and risk of smoking-related diseases. *Inhalation Toxicology*. 2018;30(1). doi:10.1080/08958378.2018.1443174
39. Nadiyah Hendi Alshammri, Ghiada Hakem Almejlal, Rawan Saud Alanzi MAAI, Malak Adnan Alenzi, Wesayef Adnan Alenzi, Ahoud Atiyah Alkhaldi, Munira Mohammed Alsubaie, Shahad Hussein Alanazi CL. Smoking Prevalence, Knowledge, and Attitude among College Students of Riyadh Elm University: A Cross- Sectional Study. *International Journal of Advanced Multidisciplinary Research Studies*. 2025;5(4):821-831.
40. Thandi G, Fear NT. Factors associated with smoking behaviour change in UK military personnel. *Occupational Medicine*. 2017;67(9). doi:10.1093/occmed/kqx149
41. Nieh C, Mancuso JD, Powell TM, Welsh MM, Gackstetter GD, Hooper TI. Cigarette smoking patterns among U.S. military service members before and after separation from the military. *PLoS ONE*. 2021;16(10 October). doi:10.1371/journal.pone.0257539
42. Giovenco DP, Spillane TE, Merizier JM. Neighborhood differences in alternative tobacco product availability and advertising in New York City: Implications for health disparities. *Nicotine and Tobacco Research*. 2019;21(7). doi:10.1093/ntr/nty244
43. Vu M, Getachew B, Payne JB, Kirchner TR, Berg CJ. Initiation, continuation of use and cessation of alternative tobacco products among young adults: A qualitative study. *Tobacco Prevention and Cessation*. 2018;4(February). doi:10.18332/tpc/84869
44. Zakiyah N, Purwadi F V., Insani WN, et al. Effectiveness and safety profile of alternative tobacco and nicotine products for smoking reduction and cessation: A systematic review. *Journal of Multidisciplinary Healthcare*. 2021;14. doi:10.2147/JMDH.S319727.

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