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**Health literacy and health-related habits among conscripts in the Norwegian Armed Forces
– a cross-sectional survey**

Short Title: Health literacy among conscripts

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INTRODUCTION

In Norway, approximately 1/6 (80% male, 20% female) of the age cohort 18-20 years of age (YOA) are called to serve as conscripts in the Norwegian Armed Forces (NAF) (1,2). The first eight weeks in the NAF are characterised by comprehensive training and education, including exercise, stress management, and general and specific health education, to equip conscripts with an understanding of how their habits affect their health. Oral health, diet, and tobacco use are not integrated parts of this general health education.

Oral health among Norwegian youth has been a focal point for public health efforts in Norway. Children and adolescents are entitled to free dental services until they turn 18. This includes regular dental check-ups, preventive treatments, and necessary dental care (3). While the oral health of Norwegian youth is generally good, ongoing efforts are needed to address social inequalities and improve health habits (4). According to studies performed by the Norwegian Directorate of Health, sugar consumption has slightly declined among children and adolescents in recent years. However, the levels are still higher than recommended (5).

Caffeinated energy drinks (with and without sugar) are increasingly popular among adolescents and young adults in Norway, and the sales of such products have increased 400% in the last ten years. The Norwegian Institute of Public Health (NIPH) reported a weekly energy drink consumption of 43% in the age cohort 15-18, with 6% using these beverages daily or several times per day (6). There is an obvious social gradient in the increased consumption of energy drinks in this cohort, particularly in families with a lower socio-economic status. Some of the possible health risks of energy drinks include increased blood pressure and heart rate, insomnia and anxiety, as well as dental erosion from the high sugar content and/or the high acidity of caffeinated energy drinks (7). When it comes to the use of tobacco products, approximately 10% of the Norwegian population smokes daily (2022), and the recruitment to smoke cigarettes among young people is generally low. In contrast, the use of snus and e-cigarettes have increased in the last ten years, and currently 20% of the Norwegian adult population use snus, and 1-4% use e-cigarettes (8).

In order to implement good health-related habits, health literacy is needed. Health literacy entails the knowledge, motivation, and competencies to access, understand, and apply health information in order to make judgments and make decisions in everyday life concerning healthcare, disease prevention and health promotion to maintain or improve quality of life during the life course (9). Health literacy is essential for young adults, and particularly for conscripts in NAF, as they need to be able to comprehend and follow health instructions, communicate effectively with health professionals, and access and use health resources to fulfil their purpose as soldiers. (10). Studies have shown inadequate health literacy to be connected to a lower ability to understand and apply advice from health authorities (11). According to the report "The Population's Health Skills Part 1", 66% of the Norwegian population has satisfactory health skills, while students score somewhat lower than the rest of the population (12).

There is currently no information regarding health literacy among the NAF personnel, and scarce information regarding oral health habits, dietary habits, and use of tobacco by conscripts. For the NAF to be able to offer preventive measures and support to their personnel, research is needed in this field.

Purpose

The purpose of this study was to assess the health literacy of Norwegian conscripts and investigate their oral health habits, dietary sugar consumption habits, and tobacco use, during field exercises, at military camp and at home.

METHOD AND MATERIAL

The study population

A total of 9991 conscripts who completed first-time military service in 2022, and who had participated in field exercises when the survey was sent out, received an online questionnaire. A total of 3153 were registered after opening the request, and 2498 replied. Among those who replied 2225 consented to their data being used in the research, while 273 did not consent. Of the 2225 in the study population, 1858 have answered all questions in the questionnaire (Fig 1).

The questionnaire

The questionnaire was developed as a collaboration between The Arctic University of Norway , The University of Oslo , and the Norwegian Armed Forces' Health Register (NAFHR). The form consisted of 38 questions related to oral hygiene habits, tobacco use and sugary diet in field exercises, in camp and at home. Health literacy was self-reported using the HLS-Q12 questionnaire. (Full questionnaire in Norwegian in supplementary).

The survey was distributed at the start of November 2022 through the Norwegian Armed Forces' Personnel and Conscription Senter, within their framework of the Data Protection Impact Assessment. The participants received information about the survey along with the questionnaire. A reminder was sent out to the participants after three weeks. The results were exported to the NAFHR. The NAFHR includes information on all conscripts and employees in the NAF, which provides the data basis for statistical research on health and safety (13).

Ethics

This survey is part of an internal quality study of the NAFHR. It is approved by the NAF joint medical services and NAFHR, and the results will be used to improve routines during the initial training of conscripts.

Data included in the study

Information on the age of participants was reported as age 31th Desember2022.

Information about the work environment during service

The conscripts were divided into 5 groups depending on the type of service they were deployed to during the first-time service, the army, the air force, the navy, the home guard, or the special forces. Stratified analyses were performed to determine differences in self-reported health literacy and habits between the groups. Information regarding the work schedule was collected with the question: Is most of your working time in the evening or at night? The groups were used to stratify in the analysis to determine differences in self-reported health literacy and habits between the groups. The participant was asked to report the number of days of field exercise they had participated in. Registrations of 45 days of field exercise were set as maximum.

Self-reported health-related habits

The soldiers reported the frequency of health-related habits like tooth brushing and dental flossing, tobacco usage (cigarettes, snus and/or e-cigarettes), and use of sugary/non-sugary food and/or beverages. The personnel were asked to describe the self-perceived oral health and quality of their diet on a 5-point Likert scale 1. very low, 2. low, 3. average, 4. high, 5. very high. These were merged into three categories: low=1, average=2, high=3.

Assessment of health literacy

In this study we assessed health literacy using the validated tool European Health Literacy Survey Questionnaire-Q12 (HLS-Q12) the short version of the HLS-EU-Q47 (14). The HLS-Q12 gives a score from 12-48. The literature states that individuals with an HLS-Q12 score of 33 or above can typically access, appraise, understand and apply health information and advice relevant to enhancing physical and mental health, and this was applied as the cut-off (15). The "don't know" response category in the survey was re-coded to missing data, and participants with scores below 12 were excluded from the analyses. Scores from 12 to 32 represent inadequate health literacy (coded as 1), while scores from 33-48 represent adequate health literacy (coded as 2). In the sample, there were n=1858 who answered all 12 questions in the HLS-Q12. Missing group n=416 consists of 367 who did not answer the HLS-Q12 plus 49 participants (2.6%) with a score below 12. The final sample consists of 1809 participants with valid HLS-Q12 scores.

Statistics

The data was explored using descriptive statistics as crosstab, and chi-square with standardised Residuals and Pearson correlations. A Chi-square test was performed between the adequate/inadequate HLS-Q12 scores and self-reported health habits (dental hygiene, tobacco use, consumption of sugar/acidic drinks). Pearson correlation analysis was performed to explore association between the self-reported health habits dental hygiene, diet and tobacco use in field exercise, camp and home settings. No expected cell frequencies were less than five. Running Little's Missing Completely at Random test showed that that data was not missing at random, and consequently missing data were excluded from the analysis. IBM SPSS statistics 27 (16) was used for the analysis.

RESULTS

The study population consists of n=2225 conscripts who consented to their data being used in research, and with a fairly equal distribution of gender among the responders (female 1015, 45,6%, male 1210, 54,4%), and an age range from 19-27 years (mean 20.2). The number of field exercise days ranged from 1-45 (mean 5.1). 315 soldiers (14.2%) reported that most of their working time was in the evening or at night (Table 1). The army conscripts constitute over half of the participants in the study population (57%), while one-third served in the navy (33%), 6% served in the air force, 3% served in the home guard, and 1% served in the special forces (Table 1).

When dividing the scores of HLS-Q12 into two categories, 43% of the study population scored inadequate health literacy, and 57% scored adequate health literacy (19 % did not answer) (Table 2). Self-assessed oral health showed poor, average, and good oral health in 4%, 28% and 68%, respectively, of the total study population (17% did not answer). Self-assessing the quality

of the diet (17% did not answer), soldiers categorised it as low in 7%, while average and high quality were 35% and 58%, respectively. In response to the questions on frequency of dental visits; 99 (4%) answered that they visit the dentist more than once per year, 1528 (69%) visit regularly, 224 (14%) visit irregularly, and 289 (13%) were missing (data not presented).

When stratifying the categories of self-assessed oral health and diet quality by inadequate/adequate health literacy, we found that there was a significant difference (Pearson chi squares <0.05) in the low, average, and high categories of self-rated health habits between those having inadequate and adequate HLS-Q12 scores (Table 2). Conscripts with an inadequate health literacy score reported poorer oral health, and lower diet quality than conscripts with an adequate HLS-Q12-score. The stratified HLS-Q12 scores showed a significant difference (Pearson chi squares <0.05) between inadequate/adequate health literacy in the groups that reported use of tobacco during field exercise, in camp and at home, with higher usage in the group with adequate health literacy. The reported use of tobacco was highest during the field exercise (Table 2).

Table 3 shows how the conscripts reported their habits of oral hygiene, consumption of sugar/acidic drinks, and smoke/snus in the setting of field exercise, camp, and home. Correlation analysis showed a positive association within categories in all the reported health habits between field exercise, camp, and home environment, indicating a context in health habits regardless of the setting. There was a positive correlation between the consumption of energy drinks and sugary drinks in field exercise ($r=.10$, $p<0.05$), camp ($r=.16$, $p<0.05$), and at home ($r=.19$, $p<0.05$). Dental flossing was correlated with tooth brushing in the field exercise ($r=.11$, $p<0.05$), camp ($r=.10$, $p<0.05$) and at home ($r=.10$, $p<0.05$). While there was a negative correlation between reporting smoking and use of snus in all three setting: field ($r=-.35$, $p<0.05$), camp ($r=-.44$, $p<0.05$), and home ($r=-.34$, $p<0.05$), indicating the use of either snus or smoke, not both. We found the same negative correlations between reported use of e-cigarettes and snus.

DISCUSSION

This study aimed to assess the health literacy of Norwegian conscripts and investigate their health-related habits in field exercises, at military camp and at home.

Surprisingly many conscripts had inadequate level of health literacy, and a relatively high proportion had unfavorable health habits including consumption of unhealthy food and beverages and tobacco usage. In Norway, children and adolescents are on a regular recall system in the Public Dental Services from 3 to 18 YOA. Much effort has been provided by dental hygienists and dentists in preventive oral health care and chair-side oral health education. Our findings may suggest the need for a more systematic approach to increase health literacy, in general, and specifically to oral health and nutrition, and should be a national concern throughout the life course. The Norwegian government recently published a national strategy to improve the health literacy in the population (17). This strategy is primarily aimed at healthcare personnel, decision-makers, and leaders in the healthcare and social care services, as well as patient and user organizations. It suggests a combination of individual-level and system-level approaches and highlights the importance of tailoring both the message and the communication method to the needs of the target group. For instance, younger persons might be reached through social media and peers. The data from this survey also suggest the need for targeted information from the NAF to the conscripts. Healthy nutrition is essential for oral health and general health among the soldiers, as well as being a preventive measure for disease

and injuries, also in cold weather environments, and should be important to the military command at every level.

The unhealthy habits among the conscripts regarding high sugar consumption, inadequate oral health and use of tobacco products are significantly associated with health literacy scores. The conscripts generally reported to have a self-perceived lower quality of health habits during field exercises with significantly less brushing and flossing, higher use of tobacco products and higher consumption of sugary drinks and snacks compared to reported habits in camp and at home. In general, exercises are more physically and mentally demanding for the soldiers, with elements of surprise, and of waiting for the unknown. Access to fast consumables is essential. This requires, however, conscripts to be informed and provided with healthy, easily consumables. This should be a national and military concern, taking care of conscripts for the duration of their service, stopping the onset of unwanted behaviours, and avoiding future problems. Poor nutrition can lead to obesity, diabetes, cardiovascular diseases, and other chronic conditions that impair the physical and mental readiness of the soldiers. Young adults are generally a group with low burdens of disease, and the latest statistics from the NAFHR reported no dental treatment needs in 78.6% of the soldiers (18). However, if these unhealthy habits continue in the years to come, it is likely to assume that the treatment needs will expand. Moreover, excessive sugar consumption can cause inflammation, mood swings, and energy crashes that affect the morale and discipline of the troops, in addition to dental caries (8,9). Hence, it is essential to promote healthy dietary habits in a manner adapted to the soldiers' ability to understand and reduce the availability and intake of sugary foods and drinks among the military personnel. The time served in the military might, in fact, be regarded as a context in which specific health interventions might help pave the way for a healthy lifestyle in the future.

In this study, as many as 25% of the conscripts report daily tobacco use at home, which increased both in camp and during field practice. Snus was the most frequently used with 23.5% reporting to using snus at home, and 27% reported using snus at field exercises. Use of cigarettes in field exercises increased from 2.7% at camp to 10.8% in the field. These data are somewhat higher than in the general population within the same age cohort, especially among the women. Tobacco use was even higher in the group with high health literacy scores. This is surprising and may indicate there are factors (cultural, environmental and more) other than health literacy influencing tobacco usage in this population. It may also indicate the need of several different approaches to reduce the tobacco usage, and not only plan for a single approach of information and improvement of health literacy. Studies conducted among Jordanian and Iranian university students found that health literacy was negatively associated with smoking (19,20). A US study analysis based on results from a nationally representative survey from 2016 found no significant association between health literacy and cigarette smoking (21). Also, the large European health literacy survey did not demonstrate a relevant and consistent effect of health literacy on smoking behaviour, and suggests that smoking might be regarded more as an addiction than a habit (22).

Within the NAFJMS there is a growing concern regarding the increased use of snus. While all tobacco products have a negative effect on the cardio-vascular system, the respiratory system (smoke), on cancer risk and on physical performance, snus has a specific negative effect in cold-weather environment, with increased risk of hypothermia and frost-bites (23,24). This have the potential to greatly affect the combat ability of the soldier, and to be a challenge in military health care and evacuation in cold weather operations. Additionally, all tobacco products have various negative effects on both general and oral health. In our study we found that the group

with highest health literacy scores report a higher frequency of tobacco use, and snus is the tobacco product that are most frequently reported used. It is disturbing findings that Norwegian conscripts with a high health literacy score are ignoring the national recommendations to not use tobacco products. This finding can also be connected to the attitudes and environment in the NAF where the use of snus is widespread among the officers and use of snus and cigarettes during field exercises are “common”.

The Armed Forces have an opportunity to take responsibility to optimize the health skills of their soldiers and to encourage them to make informed decisions about their own health. Improved adaptation to the national recommendations regarding nutrition, tobacco use, and oral health are areas having the potential to greatly improve the overall health habits of conscripts.

Studies on health literacy among active duty military personnel conclude that military personnel have adequate health literacy skills although variations were noted on the basis of health training and race/ethnicity (25). Both history of and current military service predict higher health literacy rates (26) and a study among Spanish military personnel showed a higher level of health literacy than among the general population (27). Our findings among the conscripts of a lower level of health literacy than the general population might reflect on the age, experience and maturity the conscripts compared to military personnel. The number of days spent in field exercises and night shifts varies depending on the service groups suggesting a wide variation in the type of training or roles within these branches. The nature of their duties may reflect different opportunities for health practices to be completed.

A weakness of this survey is the relatively low response rate of 21.6%. A strength is that of the 2,498 who opened the survey, 89% agree and respond to the survey. This suggests that if you are encouraged to open the survey, you are motivated to complete it. Future studies may succeed to get a higher response rate if efforts are made to inform the soldiers about the ongoing survey.

In conclusion, the results from our study suggest that the conscripts in the Norwegian armed forces have a lower health literacy than the general population, and this is reflected in reported higher frequency of unhealthy habits in service settings than at home. Health literacy can be influenced by the social environment within military units. Encouraging a culture of support and camaraderie where healthy habits are valued fosters an environment where individuals are likelier to adopt and maintain healthy habits. As such, the military service might be regarded as a potential health promotional context.

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Table 1. Descriptive table showing type of service, self-reported number of days in field exercise, age, nightshift duty, and health literacy score.

	All	Army	Navy	Air force	Special Forces	Home guard
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
	2225	1257 (57)	741 (33)	138 (6)	32 (1)	57 (3)
Age*						
mean	20.2	20.3	20.2	20.1	20.1	20.1
range	19-27	19-26	19-27	19-24	19-22	19-23
field exercise days						
mean	5.1	5.3	4.6	4.5	6.8	5.3
range	1-42	1-31	1-42	1-7	2-15	2-11
nightshifts (% of total)	315 (14.2)	102	174	24	7	14
HLS-Q12 (% of total)	1809** (81)					
inadequate (% of HLS)	773 (43)	417 (41)	266 (44)	56 (49)	11 (42)	23 (50)
adequate (% of HLS)	1036 (57)	605 (59)	334 (56)	59 (51)	15 (58)	23 (50)

* Age 31th December 2022

**missing category HLS-Q12 n=416 (19% of total responses)

Table 2. The table shows the responses of health literacy HLS-Q12 n=1809, self-reported dental health quality (n=1857) and diet quality (n=1852) and reported use of tobacco. The responses are further stratified according to inadequate/adequate HLS-Q12 scores.

	Total N	HLS-Q12 Inadequate	HLS-Q12 adequate	Missing responses
	N	N (%)	N (%)	N
HLS-Q12	1809	773(43)	1036 (57)	
dental health quality	1854	770	1035	49
Low	69	27 (4)*	40 (4)*	2
Average	529	265 (34)*	247 (24)*	17
High	1256	478 (62)*	748 (72)*	30
diet quality	1852	770	1033	49
Low	129	73 (10)*	52 (5)*	4
Average	653	336 (47)*	296 (29)*	21
High	1070	361 (43)*	685 (66)*	24
use of tobacco				
Field exercise	597	227 (38)*	370 (62)*	0
Camp	564	220 (39)*	344 (61)*	0
Home	519	119(38)*	320 (62)*	80

N=1809 answered every HLS question, while the self-rated dental and diet quality questions were answered by more responders.

*Significant difference between HLS-Q12 inadequate and adequate score groups (Pearson chi squares <0.05).

Table 3. Self-reported health habits of oral hygiene, tobacco use, consumption of sugary drinks and snacks, and energy drinks in the setting of field exercise, camp, and home.

	Field exercise	Camp	Home
	N (%)	N (%)	N (%)
Brushing			
adequate	1205 (54)	1822 (82)	1581 (71)
in-adequate	956 (43)	180 (8)	356 (16)
missing	64 (3)	223 (10)	288 (13)
Flossing			
adequate	90 (4)	553 (25)	683 (31)
in-adequate	2071 (93)	1449 (65)	1254 (56)
missing	64 (3)	223 (10)	288 (13)
Tobacco			
Any use	695 (31)	629 (28)	557 (25)
missing	184 (8)	261 (12)	310 (14)
cigarettes	241 (11)	58 (3)	59 (3)
snus	606 (27)	585 (26)	522 (23)
e-cigarettes	17 (1)	16 (1)	15 (1)
Sugary drinks			
never	799 (36)	396 (17)	639 (29)
1-2 day	986 (44)	814 (36)	669 (30)
3 or more day	265 (12)	800 (36)	617 (28)
missing	175 (8)	242 (11)	300 (13)
Energy drinks			
never	1337 (60)	1691 (76)	1594 (72)
1-2 day	517 (23)	250 (11)	277 (12)
3 or more day	196 (9)	42 (2)	54 (2)
missing	175 (8)	242 (11)	300 (14)
Sugary snacks			
never	299 (13)	623 (28)	720 (32)
1-2 day	1351 (61)	1169 (52)	1030 (46)
3 or more a day	436 (20)	173 (8)	166 (8)
missing	139 (6)	260 (12)	309 (14)