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Prevalence of dental caries, oral hygiene status and treatment needs among seafarers and trainee sailors in the state of Goa, India: a descriptive cross-sectional study

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ABSTRACT

Background: *The fixed regimen and strict dietary habits of seafarers and trainee sailors, make them susceptible to several oral diseases. The aim of the study was to assess prevalence of dental caries, oral hygiene status and treatment needs among seafarers and trainee sailors in the state of Goa.*

Materials and methods: *This descriptive, cross-sectional study was carried out from January 2023 to March 2023. After a pilot study, convenience sampling technique was employed to recruit 261 participants. The investigators were standardized and calibrated to record World Health Organization Oral Health Assessment Form (1997) and Oral Hygiene Index-Simplified (OHI-S) which were instrumented in the study. Intra-examiner and inter-examiner reliability scores were recorded using kappa statistics (0.81, 0.83) and (0.83, 0.85), respectively. The data was analysed using descriptive analysis, chi-square test, Mann-Whitney U test and multivariate linear regression analysis at statistical significance ($p \leq 0.05$).*

Results: *The mean ages of seafarers ($n = 133$) and trainee sailors ($n = 128$) were 36.41 ± 6.40, and 25.36 ± 7.39, respectively. The prevalence of dental caries among seafarers and trainee sailors was determined to be 59% and 78%, respectively ($p = 0.01$). The mean OHI-S score of seafarers (1.31 ± 0.68) and trainee sailors (1.53 ± 0.82) was statistically significant ($p = 0.015$).*

Conclusions: *Seafarers and trainee sailors demonstrated high caries prevalence and poor oral hygiene status due to their distinctive lifestyle, representing a vulnerable community in terms of oral health.*

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Key words: dental caries, maritime dentistry, occupational health, oral health, oral hygiene, seafarers, trainee sailors

INTRODUCTION

India is often regarded as a dependable and significant supplier of marine labour. Ship board jobs for Indian seafarers increased by 42.3% in the last 4 years (2013–2017) [1, 2]. As a labour-intensive country, India has historically offered quality sailors for both domestic and international shipping. The number of sailors operating aboard ships around the world climbed from 108,446 in 2013 to

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154,349 in 2017 [2]. India today contributes 9.35% of global seafarers and ranks third among significant seafarer supplying nations to the global maritime industry [2, 3]. An individual who steers waterborne vessels or serves as a crewmember in their operation and maintenance in all types of weather is known as a sailor, seaman, mariner, or seafarer [1]. Seafaring was the world's first globally integrated industry [3].

Poor oral health among sailors has been linked to pain and suffering for individuals as well as logistical issues for shipping corporations during trips. Excessive snacking is one of the most common problem found among sailors due to their unusual working hours and lifestyle [3]. Seafarers are known to overlook dental hygiene on long journeys, due to work stress, irregular duty hours and solitude; in addition, fruits and vegetables are scarce in their diet, and meals are consumed at irregular intervals [4]. A trainee seaman or sailor is an inexperienced sailor who comes onboard and participates in shipboard chores (typically in a limited capacity) [5]. Cadets are the ship's lowest-ranking sailors [4, 5]. Due to their fixed regimen and strict dietary habits, they may lack adequate nutrients, hence they are susceptible to several oral diseases. Oral disorders are extremely common, affecting more than one-third of the world's population, or 3.5 billion people [6]. Oral health is a multifaceted notion that represents an individual's oral as well as general health state at any given moment. Numerous variables impact it, including current pathology, dental disorders, tooth loss, prosthesis use, and age, as well as extra cultural, psychological, social, educational, nutritional, and socioeconomic concerns [7]. Dental caries left untreated; the condition can progress to more serious consequences. Severe untreated caries has also been linked to general health and well-being. The interaction of many aetiological and predisposing variables with varied capacities determines oral health status [8].

The current epoch of dental caries care has quietly progressed from "extension for prevention" to "prevention of extension" paradigm. Dental caries is a worldwide health problem, yet progress towards a remedy is still visible. The combined effects of excessive consumption of alcohol, tobacco, refined carbohydrates (sweets/dairy products), and a lack of oral hygiene awareness are manifested in the majority of seafarers' poor oral hygiene status [3, 9]. Due to poor oral hygiene and inadequate dietary habits, seafarers and trainee sailors are at a risk of developing numerous oral problems [10]. It is critical that sailors get thorough knowledge on oral hygiene regimens and the benefits of maintaining a healthy mouth [3, 11]. However, little research has been done to identify the conditions that may lead to an assessment of seafarer dental health and comprehensive oral health services. The scarcity in the literature prompted to take up the present study with aim to assess prevalence of dental caries, oral hygiene status and treatment needs among seafarers and trainee sailors in the state of Goa.

MATERIALS AND METHODS

STUDY SETTING

This descriptive, cross-sectional study was conducted among seafarers and trainee sailors in the National Union of Seafarers of India (NUSI) Maritime Academy, situated in South Goa district in India from January 2023 to March 2023. The NUSI established the NUSI/ITF Trust for Indian seafarers and their families in collaboration with the International Transport Workers Federation (ITF). This study had been carried out in compliance with the STROBE guidelines for reporting.

PERMISSION, ETHICAL CONSIDERATIONS AND INFORMED CONSENT

Ethical clearance was obtained from the Institutional Research and Ethics Committee (EC/NEW/2021/2435/1549). This study followed the ethical standards of human experimentation and the Helsinki Declaration of 1975, amended in 2000. An official permission was obtained from the Secretary-General, International Maritime Organization (IMO). The method of data collection, confidentiality of personal information and aim of the study was described to the study participants and a written informed consent was acquired.

TRAINING AND CALIBRATION OF INVESTIGATORS

Prior to the commencement of the study, the investigators were standardized and calibrated to enable consistent examination by a panel of experts to ensure similar interpretations of the codes and criteria to be recorded for World Health Organization Oral Health Assessment Form (1997) [12], and Oral Hygiene Index Simplified (OHI-S) [13], which was supervised by subject experts. Intra-examiner (0.81, 0.83) and inter-examiner reliability (0.83, 0.85) were recorded by using kappa statistics, indicating a high degree of agreement.

SELECTION CRITERIA

The participants comprised those who were present on the day of the study and willing to provide informed consent. Whereas, participants who had shown disinterest in oral examination and those who were absent on the day of examination were excluded from the study.

SAMPLE SIZE ESTIMATION AND SAMPLING TECHNIQUE

A pilot study was conducted among 30 participants to determine the feasibility of the study. The sample size was estimated to be 241 with type I (α) error = 0.05 and Power (1-β) = 0.95 using G*Power statistical software (Ver. 3.1.9.4.), considering 10% attrition, total sample size was

Table 1. Distribution of study population by designation and educational qualification

Qualification	Designation	
	Seafarers (n = 133)	Trainee sailors (n = 128)
Higher secondary	4 (3%)	32 (25%)
Diploma	53 (39.85%)	89 (69.53%)
Graduation	36 (27.07%)	3 (2.34%)
Specialization	40 (30.07%)	4 (3.12%)

All values are expressed as frequency with percentages (in parentheses)

estimated to be 261. The participants were selected by convenience sampling technique.

DATA COLLECTION

A survey proforma consisted of three sections: (1) Demographic data including name, age and education; (2) Oral hygiene practices; (3) Clinical parameters assessed were the dentition status, OHI-S [14] and treatment needs. On predetermined dates the examiners visited the NUSI Maritime Academy situated in South-Goa where 133 seafarers and 128 trainee sailors were examined. The examiners performed a type III examination in natural light, taking approximately 15 minutes for each participant.

STATISTICAL ANALYSIS

The data was imported into Microsoft Excel 2019 and analysed with IBM SPSS® Statistics Version 21 (IBM, USA). Descriptive statistics were generated, which included percentages, means and standard deviations. The Shapiro-Wilk test was used to evaluate the normality of the data distribution. Chi-square test was performed to check for the association between the study variables among the participants. Mann-Whitney U test was performed to check for any significant differences in the study parameters. The association with the demographic details was analysed by multivariate linear regression analysis. For all the tests, confidence level and level of significance were set at 95% and 5%, respectively.

RESULTS

A total of 261 participants [133 seafarers (51%) and 128 trainee sailors (49%)] were examined. The mean ages of seafarers and trainee sailors were 36.41 ± 6.40, and 25.36 ± 7.39, respectively. Majority of the participants had qualified diploma education. The distribution of study participants is presented in Table 1.

The prevalence of dental caries among seafarers and trainee sailors was found to be 59% and 78%, respectively (Fig. 1) and their mean Decayed, Missing and Filled Teeth (DMFT) index score was 6.22 ± 2.55 and 7.35 ± 3.92,

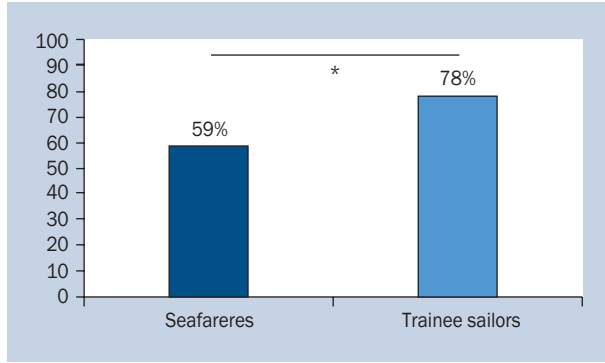

Figure 1. Comparison of caries prevalence (%) in seafarers and trainee sailors. Statistical test used: Mann-Whitney U test; *statistically significant, p = 0.01

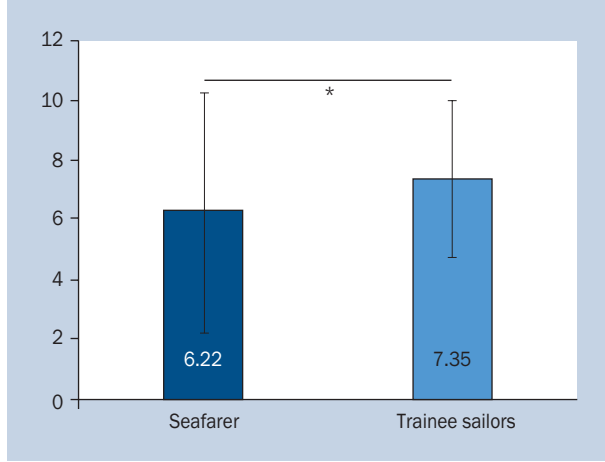

Figure 2. Comparison of Decayed, Missing and Filled Teeth (DMFT) scores (mean ± standard deviation) in seafarers and trainee sailors. Statistical test used: Mann-Whitney U test; *statistically significant, p = 0.047

respectively (Fig. 2). Mann-Whitney U test depicted that there were statistically significant differences in caries prevalence (p = 0.01) and DMFT index score (p = 0.047) among the participants. Most participants — 96.99% of seafarers and 96.09% of trainee sailors — were using a toothbrush and toothpaste as their oral hygiene aid. There was no statistically significant

Table 2. Oral hygiene aids and status of the seafarers and trainee sailors

Parameters	Seafarers	Trainee sailors	P
Oral hygiene aid			0.156
Toothbrush and toothpaste	129 (96.99%)	123 (96.09%)	
Finger and toothpaste	4 (3%)	2 (1.56%)	
Finger, charcoal and toothpowder/salt	0	3 (2.34%)	
OHI-S score			0.050*
Good	107 (80.45%)	86 (67.19%)	
Fair	10 (7.52%)	15 (11.72%)	
Poor	16 (12.03%)	27 (21.09%)	

All values are expressed as frequency with percentages (in parentheses). The statistical test used: Chi-square test; level of significance: *p ≤ 0.05 is considered statistically significant; OHI-S — Oral Hygiene Index-Simplified

Table 3. Treatment needs of the population

Treatment needs	Seafarer	Trainee sailors	P
One surface filling	56 (42.1%)	24 (18.75%)	
Two or more surface filling	27 (20.30%)	39 (30.47%)	
Pulp care	17 (12.78%)	21 (16.41%)	≤ 0.001*
Extraction	30 (22.56%)	42 (32.81%)	
Crown	3 (2.25%)	2 (1.56%)	
Total	133	128	

All values are expressed as frequency with percentages (in parentheses). The statistical test used: Chi-square test; level of significance: *p ≤ 0.001 is considered statistically significant association

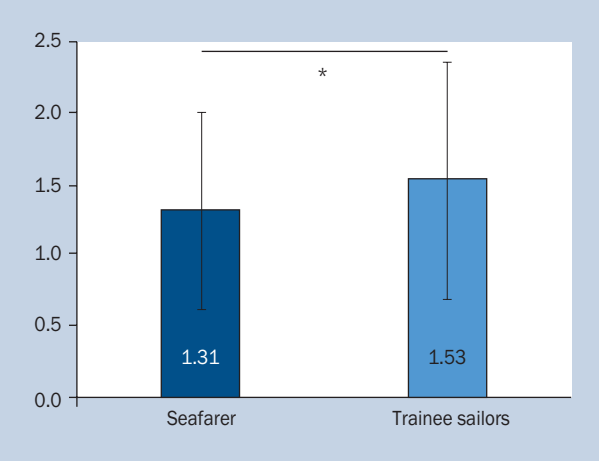

Figure 3. Comparison of Oral Hygiene Index-Simplified (OHI-S) scores (mean ± standard deviation) in seafarers and trainee sailors. Statistical test used: Mann-Whitney U test; *statistically significant, p = 0.015

difference between the participants with regards to oral hygiene aid (p = 0.156). Among seafarers, 80% had good oral hygiene; in contrast to 21% trainee sailors with poor oral hygiene which was statistically significant (p = 0.050) (Table 2).

Figure 3 depicts mean OHI-S score of seafarers (1.31 ± 0.68) and trainee sailors (1.53 ± 0.82) which was statistically significant (p = 0.015). In trainee sailors, extraction (32.81%) was the highest treatment need whereas in seafarers it was one surface filling (42.1%) (Table 3).

The categorisation of the variables obtained a significant relation between caries prevalence and OHI-S score with the designation (p < 0.001) using multivariate linear regression analysis. Whereas there was no significant relationship with education (p > 0.05) and oral hygiene practices (p > 0.05). The dependence of caries prevalence and OHI-S score were found to be 33% and 14%, respectively on designation, education and oral hygiene practices (Table 4).

DISCUSSION

This descriptive, cross-sectional study was conducted among 261 seafarers and trainee sailors in the NUSI Maritime Academy, situated in South Goa district in India. Each disease has a distinct natural history that may not be the same in all patients. A complicated interplay between a person, an agent, and the environment leads to disease. One such hazardous occupation is sailing, which involves pernicious habit, stress, and an unbalanced diet. The oral

Table 4. Association between caries prevalence and Oral Hygiene Index-Simplified (OHI-S) with designation, education qualification and oral hygiene aids

	Unstandardized coefficients		Standardized coefficients	t	95.0% confidence interval for B		P	Adjusted R2
	B	SE	Beta		Lower bound	Upper bound		
Dependent variable: caries prevalence								0.33
(Constant)	0.509	1.071		0.476	–1.599	2.618	0.635	
Designation	1.089	0.351	0.227	3.105	0.398	1.779	0.002*	
Education	0.113	0.192	0.043	0.587	–0.265	0.49	0.557	
OHP	0.254	0.57	0.027	0.447	–0.867	1.376	0.655	
Dependent variable: OHI-S score								0.14
(Constant)	0.889	0.341		2.609	0.218	1.561	0.01	
Designation	0.282	0.112	0.186	2.527	0.062	0.502	0.012*	
Education	0.058	0.061	0.07	0.948	–0.062	0.178	0.344	
OHP	–0.02	0.181	–0.007	–0.108	–0.377	0.338	0.914	

The statistical analysis used: multivariate linear regression; level of significance: *p ≤ 0.05 is considered statistically significant; CI — confidence interval; SE — standard error; OHP – oral hygiene practices

and overall health of sailors may be impacted by their lower socioeconomic level, poor oral hygiene, and lack of literacy. World Health Organization Oral Health Assessment Form (1997) was utilised in the current study to assess the oral health status of seafarers and trainee sailors. We integrated the findings of the present study with those of other working populations due to the dearth of literature on sailors.

In the present study the prevalence of dental caries among seafarers and trainee sailors was found to be 59% and 78%, respectively which was in congruence to a similar study conducted to assess the oral hygiene status among fishermen in Kerala whereby the caries prevalence of dental caries was (47%) high among the fishermen due to higher sweet intake (70.9%), poor brushing habits (11.3%) and lower frequency of dental visits (28.5%) [4]. Singh et al. [14] also reported the prevalence of poor oral health among Malaysian Fishermen in Teluk Bahang, Penang to be relatively higher (47.5%). They may have a higher prevalence of dental caries since their 24-hour operations necessitate working in shifts. This affects dietary habits leading to frequent eating and caffeine use as stimulants, especially at night. The use of excessive amounts of snacks is another factor contributing to the common mouth diseases seen in sailors which contain fermentable sugars and carbohydrates, which are major risk factors for dental caries and related dental disorders. Long work hours promote unhealthy habits, inactivity, and social isolation, while placing a low focus on dental health [15].

The majority of seafarers (96.99%) and trainee sailors (96.09%) were using a toothbrush and toothpaste as their oral hygiene aid, which contrasted with a study conducted among Seafarers in Mundra port, Kutch where majority of them (59.2%) chewed sea weeds to maintain their oral hygiene as compared to only 18.9% participants who used toothpaste plus toothbrush to clean their teeth [1]. The mean OHI-S score of seafarers was 1.31 ± 0.68 and trainee sailors was 1.53 ± 0.82, which was similar to mean OHI-S score among fishermen in South Goa (2.11 ± 1.25). Among seafarers, 80% had good oral hygiene; in contrast to 21% trainee sailors with poor oral hygiene. The trainee sailors are subjected to dietary constraints, rigid schedules, and a lack of sufficient nutrients. In such cases, oral hygiene when on board for extended periods of time may be completely neglected, and self-reported tooth-brushing habits may become less frequent than those on land. The fact that the training sailors had poorer oral hygiene is another evidence of the group's continued lack of oral hygiene education and motivation. Due to low family income or relocation from one location to another, this may also be related to the trainee sailors' lower educational levels when compared to seafarers [16, 17].

The mean DMFT index score among seafarers and trainee sailors was 6.22 ± 2.55 and 7.35 ± 3.92, respectively. A study conducted by Saravanan et al. [4] comparing the oral health status and treatment needs among fishermen and non-fishermen in Tamil Nadu also concluded that the mean DMFT was 3.61 among fishermen group whereas in non-fishermen group it was 2.88. This lack of dental hygiene among ship dwellers may be related to their low educational level, physically demanding jobs, stress, psy-

chological problems, and poverty. Despite the enormous numbers of crew members, dentists are typically not on board. Dental assistants and a small number of dentists have occasionally been used. Usually, these departments lack the necessary resources to offer either general or urgent dental care. The obstacles faced by ship operators include the lack of available space aboard, the expensive cost of high-quality dental supplies and equipment, and the difficulty in finding qualified dentists. It can be difficult to keep a seaman on board healthy. The percentage of dental-related consultations for civilian seafarers who lack dental services on board can reach 66.9%. A study reported that the frequency of consultations for oral health problems in foreign ports on commercial cargo ships might be as high as 67% and just 19 nations provide full oral health facilities for seafarers [15].

Teledentistry may be a means of offering seafarers a respectable degree of oral help given their oral health, their isolation on board, and their restricted access to health and dental care. Teledentistry may become a new tool for treating people with poor oral/dental conditions on board seagoing vessels. It has the potential to enhance access to oral health care while lowering treatment costs. It might be linked to electronic health records and employ digital imaging to provide teleconsultations with dental professionals [16].

LIMITATIONS OF THE STUDY

The limitation of the study is its inability to determine temporal relationships between lifestyle factors and oral health status. Furthermore, because our study was cross-sectional in design, it was challenging to delve deeper into respondents' attitudes towards their dental health. An analytical study could be carried out to identify the risk factors that contribute to the development of oral disease among them.

FURTHER RECOMMENDATIONS

The baseline data from this study will serve as the foundation for the implementation of interventions to promote oral health. Given the lack of fundamental dental care guidelines, a concise strategy should be created to raise this population's dental awareness and oral health including national programmes for preventing oral diseases; effective systems for screening oral health; dental care provided as a part of their primary health care; and delivery systems for those services. It is evident from the discussion above that greater oral hygiene education and supervision are necessary for sailors in order to help them better take care of their dental health. Because of the stress that comes with living at sea in difficult conditions, it is crucial that seafarers are fully informed about proper dental and oral hygiene practises.

CONCLUSIONS

Seafarers and trainee sailors demonstrated high caries prevalence and poor oral hygiene status due to their distinctive lifestyle, representing a vulnerable community in terms of oral health. Therefore, further research is needed on dental hygiene habits of sailors to broaden our present understanding of the challenges this community faces in maintaining its oral health, which has direct repercussions on their systemic health.

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Conflict of interest: None declared

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