Assessment of Oral Health Status and Associated Lifestyle Factors among Malaysian Fishermen in Teluk Bahang, Penang: An Analytical Cross-sectional Study

Abstract

**Background:** Given background sparsity of country-specific literature evidence, and the pervasive unhealthy lifestyle habits such as tobacco, alcohol use, and high sugar consumption among fishermen, the aim of this study was to assess the oral health status and associated lifestyle factors among Malaysian fishermen in Teluk Bahang, Penang. **Subjects and Methods:** In an analytical cross-sectional design, we used simple random sampling technique to select 242 multiracial Malaysian male fishermen aged between 18 and 75 years from five fishing villages located at Gurney Drive, Tanjong Tokong, Tanjong Bungah, Batu Ferringhi, and Teluk Bahang to participate in this study. During four consecutive weekends in January 2017, we conducted face-to-face interviews with participants using a pre-validated, interviewer-administered WHO oral health questionnaire. We categorized participants as having “good” or “poor” oral health based on a mean cutoff score of 14. Multivariate regression models were fitted to assess the oral health status and associated lifestyle factors among the study population, using SPSS version 22. **Results:** We achieved a response rate of 97.6%. Overall, the prevalence of poor oral health in this study was 47.5%. “Income” (RM/month), “type of fishing,” “additional occupation,” “age” (years), “frequency of pies, buns consumed,” and “frequency of sweets, soft drinks consumed” were significant predictors of oral health status among the fishermen. **Conclusion:** Poor oral health is relatively highly prevalent among the fishermen in our study. The oral health status of fishermen in Teluk Bahang was consistent with the national average and significantly associated with their sociodemographic and lifestyle factors. Targeted interventions are required to arrest and reverse this trend.

**Keywords:** Assessment, fishermen, lifestyle factors, Malaysia, oral health, prevalence

Introduction

Oral health is essential to general health and quality of life. It is a state of being free from mouth and facial pain, oral and throat pain, oral infection, sores, periodontal (gum) disease, tooth decay, tooth loss, and other diseases and disorders that limit an individual's capacity in biting, chewing, smiling, speaking, and psychosocial well-being. The global prevalence of dental cavities among schoolchildren and adult population is estimated to be around 60%–90% and 90%, respectively. Similarly, the prevalence of severe periodontal disease is estimated to be around 15%–20% among middle-aged adults. Literature evidence suggests that oral disease, and by extension oral health status, is estimated to be around 15%–20% among middle-aged adults. Literature evidence suggests that oral disease, and by extension poor oral health, disproportionately affects the poor and disadvantaged children and adult population groups.

Globally, one in three persons aged 65–75 years have no natural teeth, a situation reported to be as high as 41% among Malaysian adults. Conflicting literature evidence suggests a disproportionate prevalence of poor oral health among certain occupations such as fishermen, farmers, and those in low-income jobs. The studies conducted in India reported the prevalence of oral disease or poor oral health among fishermen to be as high as 52.8%. Factors related to the epidemiology of oral health among fishermen have been widely reported by international studies. Due to the long uncertain hours that fishermen keep earning a living, behavioral habits tend to affect their lifestyles. Ironically, despite being a major contributor to the economy and nutrition of the country, Malaysian fishermen are generally an understudied, economically disadvantaged rural-dwelling population, a factor which is believed to play an additive role with other lifestyle factors in predisposing them to poor oral health.
Some of the lifestyle factors that are practiced by these fishermen are tobacco-related which cause long-lasting effects in their oral cavities and affect their general health. While tobacco use might not be the primary cause, it does lead to oral and later general health problems.\cite{3,8-10} The use of tobacco is linked to 50% of all the gum diseases known as periodontal diseases.\cite{11} Smoking causes tooth loss\cite{12,13} and is usually practiced together with alcohol consumption, a combination of which is estimated to increase the risk of oral cancer by 15 times. Poor diet, such as high sweets and sugar consumption, has also been well documented as a risk factor of poor oral health.

Other socioeconomic factors (age, residential area, income level, level of education, knowledge of oral health, and practice of good oral hygiene) also play a part in determining the oral health status of individuals.\cite{12-15} Including access to oral health care and treatment options sought when ill.\cite{15} Due to poor knowledge and motivation, visits to a dental practitioner are never done until and unless there is a problem.\cite{16-18}

Oral health problems have a strong association with overall general health of individuals. For example, periodontal disease has been shown to have a strong association with poorly controlled diabetes mellitus,\cite{19} pneumonia, coronary heart disease, cerebrovascular disease,\cite{20} and erectile dysfunction.\cite{11} These associations are believed to be confounded by smoking. Given these associations and the risk of convergence and multiplicity conferred on noncommunicable diseases and oral health by the above-mentioned lifestyle factors, it has become pertinent to pay extra attention to understand the deeper mechanisms underlying these relationships, for the ultimate purpose of targeting prevention approaches to specific high-risk groups. There is an increasing need to integrate oral healthcare with general healthcare systems, especially in developing countries where inequalities and access gap remain wide on account of several socioeconomic factors. According to the World Dental Federation, this has made a strong point for cross-cutting and multi-sectoral integration of oral health into the sustainable development goals.\cite{21}

In Malaysia, despite the high reported prevalence of oral health diseases among the general population,\cite{22} little or no studies targeting specific population groups and in particular fishermen (generally considered low-income group, residing in rural to semi-urban areas) have been conducted. The objective of this study was to assess the oral health status and associated lifestyle factors among Malaysian fishermen in Teluk Bahang, Penang.

**Subjects and Methods**

**Study location and context**

The current study was conducted in five fishing villages that were under the Teluk Bahang Fishermen’s Association. These fishing villages included Gurney Drive, Tanjong Tokong, Tanjong Bungah, Batu Ferringhi, and Teluk Bahang [Figure 1]. These villages are situated on the Northwestern tip of the island of Penang. The communities that live in these fishing villages are multicultural, consisting of Malays, Chinese, and Indians.\cite{23} This multiracial mix was ideal for the study since it reflected the racial mix of the overall population of the whole country. Teluk Bahang is the largest and historically, the oldest fishing village on the island. It is about 25 km from the city center of George Town and the furthest in distance. It is situated in a semi-rural area. Gurney Drive, Tanjong Tokong, Tanjong Bungah, and Batu Ferringhi are tourist spots as well. Due to their low and unstable income (<RM 1000 minimum monthly wage), fishermen in these villages currently benefit from Malaysian Government’s fuel subsidy of up to 50 L daily or 20,000 L monthly (depending on boat size) for their boat operations.

**Study design and sampling strategy**

This was an analytical cross-sectional study in which simple random sampling technique was applied to select 242 consenting adult participants who met the inclusion criteria of the study. This technique was implemented using the random number list/sequence generated from OpenEpi software. Here, the sample of fishermen for the study was selected from an adjusted sampling frame containing the names and unique identifiers of the 321 fishermen who fulfilled the study criteria. We included adult male participants aged 18–75 years who were registered under the Teluk Bahang Fishermen’s Association. Participants were excluded if they had significant cognitive impairment or mental disabilities,
were unable to communicate in English, Malay, or Tamil, and/or were foreigners (non-Malaysians). We had determined through a sample size calculation from Stata 13 software (StataCorp. 2013. Stata Statistical Software: Release 13.0. College Station, TX: StataCorp LP) using two-sample proportion formula; a sample size of 206 respondents was required to provide 80% power in determining a 16% higher prevalence of dental caries among fishermen (compared to 70.5%\(^{[22]}\) among general adult population of Malaysia) assuming a two-tailed test and type-1 error rate of 5%. We adjusted for a 20% nonresponse and arrived at a final sample size of 248.

**Ethical considerations**

This study was conducted in strict observance of the Declarations of Helsinki. Ethical approval for conducting this study was sought and obtained from the Penang Medical College Independent Research Ethics Committee, before the commencement of the study. Signed written informed consent was also obtained from each participant before filling out the questionnaire. The study was explained in detail to each participant before beginning the interviews, as well as that their anonymity will be preserved to ensure that there is no breach of confidentially.

**Data collection and analysis**

A slightly modified, prevalidated, interviewer-administered World Health Organization (WHO) oral health questionnaire\(^{[24]}\) was the study instrument used in this study. Face-to-face interview sessions were conducted with consenting individual participants to ensure transparency and consistency, to reduce interviewer and misclassification bias, and also to retain the internal validity of the study estimates. Data collection was done in January 2017 on four consecutive weekends (January 6 to January 29, 2017). The study instrument consisted of two parts. Section A (sociodemographic profile) contained eight items, measuring the age, ethnicity, religion, marital status, level of education, level of income, type of occupation, and residential location of the study participants. Section B (oral health questionnaire) consisted of 14 items (social questions), measured on a variety of scales – yes/no and Likert-like scales. This section of the questionnaire consisted of two sub-sections. The first sub-section was oral health status measured as a composite weighted score of number of natural teeth present, presence of pain or discomfort, presence of dentures, types of dentures if present, frequency of brushing, and last dental visit. The second sub-section explored the lifestyle and other risk factors. Under the risk factors, the use of tobacco and alcohol was asked. For the lifestyle factors, the amount of sugar consumed in different ways such as eating sweet pies, buns, jam, and honey as well as in soft drinks was asked. Finally, participants were asked whether or not (and how regularly) they had tea and coffee with sugar.

Data were entered into Microsoft Excel database and subsequently imported into SPSS version 22 software [IBM SPSS Statistics for Windows, version 22 (IBM Corp., Armonk, N.Y., USA)] software for analysis. All numerical variables were tested for normality using graphical and statistical tests. The oral health scores – the main outcome variable of this study – were observed to be normally distributed (\(P\) value for Kolmogorov–Smirnov test was >0.05). The prevalence of oral health status was examined using descriptive analysis. Based on scored responses to five major items known to be highly predictive of overall periodontal health\(^{[25‑27]}\) on the oral health questionnaire [Table 1], respondents were categorized into “poor” and “good” oral health status using the mean cutoff score from our data of <14 (poor oral health) and ≥14 (good oral health).\(^{[24]}\) For ease of analysis, and guided by the univariate distribution of responses to items on lifestyle factors (use of tobacco, alcohol, and diet), we recategorized responses of “seldom/never” as “rarely,” while those that answered “several times/month,” “once/week,” “several times/week,” “daily,” and “several times/day” were recategorized as “regularly.”

To determine the association between the independent categorical variables and oral health status, Chi-Square test was performed. When the expected cell frequency was <20%, Fisher’s exact test was used instead. The variables that were significant in the Chi-square test and Fisher’s exact test were examined further in a simple/bivariate logistic regression analysis. Here, the odds ratio (OR) with the 95% confidence level was read to determine the strength of association of the determinants with oral health status. We further fitted multivariate logistic regression models to examine these associations further. Variable selection into the multivariate logistic regression model considered a \(P < 0.25\) (Hosmer–Lemeshow) at bivariate level, as well as principle of biological plausibility. Crude and adjusted ORs (aORs) with associated 95% confidence interval (CI) and \(P\) values were reported for variables in the final multivariate model. Statistical significance was considered at a \(P = 0.05\).

| Item                           | Maximum score |
|-------------------------------|---------------|
| Number of natural teeth       | 3             |
| Experience with tooth pain    | 2             |
| Presence of removable dentures| 2             |
| Frequency of tooth cleaning   | 7             |
| Regularity of dental visits   | 6             |
| Total                         | 20            |

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Singh, et al.: Oral health status of Malaysian fishermen
Results

Sociodemographic characteristics of fishermen in Teluk Bahang

Two hundred and forty-two out of 248 participants approached completed the questionnaires, giving an overall response rate of 97.6%. Majority of the respondents in the sample were Malays (69.8%, 169/242), who practiced the religion of Islam (70.2%, 170/242), were married (92.1%, 223/242), and had primary education (65.3%, 158/242), with a monthly income of ≥RM 900 (61.2%, 148/242). The mean monthly income was RM 938 ± 412.5 and the mean age in years was 55.87 ± 10.7. More than half of the fishermen were ≥50 years old (72.3%, 175/242) and did not have any other additional occupation. About equal proportion were coastal (45.9%, 111/242) as well as both coastal and deep-sea fishermen (44.2%, 107/242), where 65.7% (159/242) had spent 31–60 years as fishermen. The mean duration of work in years was 37.39 ± 12.4. The mean time spent at sea (days) was 5.53 ± 1.3, and more than half of coastal (67.4%, 163/242) and deep-sea (53.3%, 129/242) fishermen spent ≥6 days at sea. The mean time spent at sea (hours) was 6.40 ± 2.2 [Table 2].

Distribution of teeth and gum characteristics among fishermen in Teluk Bahang

Table 3 summarizes the distribution of teeth and gum characteristics among fishermen in Teluk Bahang. Almost half of the respondents had 10–19 natural teeth present in the mouth (44.2%, 107/242). Majority (88%, 213/242) of the respondents had no dentures and experienced tooth pain/discomfort in the mouth in the past 12 months. Of those who wore dentures (n = 29), almost an equal number had either a full upper (20.7%, 6/29) or a full lower denture (17.2%, 5/29). Twelve respondents had no teeth left in their mouth, and among the 230 with teeth present in the mouth, only about one-third rated their teeth condition as good (32.6%, 75/230). A similar proportion of respondents rated their gum condition as good (30.2%, 73/242). More than half of the respondents brushed their teeth 2 or more times/day and last visited a dentist ≥5 years ago (55.8%, 135/242). The mean oral health score was 14.11 ± 1.96. The respondents with good oral status (52.5%, 127/242) were slightly more than those with poor oral health (47.5%, 115/242) [Table 3].

Distribution of oral health problems, psycho-behavioral effects, and health-seeking behavior (dental clinic visits) among fishermen in Teluk Bahang

Table 4 summarizes the oral health problems with associated psycho-behavioral effects and patterns of dental clinic visits among fishermen in Teluk Bahang. Out of the 242 respondents, only 164 (67.8%) had been to a dental clinic. More than half of the respondents who had gone to the dental clinic visited on account of dental problems faced (68.3%, 112/164) while less than a quarter had gone for actual dental treatment (20.1%, 33/164) and only a handful attended routine check-up (7.3%, 12/164). More than half of the respondents had no problems of biting (69.4%, 169/242) and chewing (63.6%, 154/242) food, while 28.5% (69/242) and 33.2% (78/242) quite often had problems of biting and chewing during the past 12 months, respectively. More than 92% of the respondents

| Variables                                | Frequency (%) |
|------------------------------------------|---------------|
| Race                                     |               |
| Malay                                    | 169 (69.8)    |
| Chinese                                  | 53 (21.9)     |
| Indian                                   | 20 (8.3)      |
| Religion                                 |               |
| Islam                                    | 170 (70.2)    |
| Buddhist                                 | 49 (20.2)     |
| Hindu                                    | 6 (2.5)       |
| Christian                                | 5 (2.1)       |
| Others                                   | 12 (5.0)      |
| Marital status                           |               |
| Married                                  | 223 (92.1)    |
| Single                                   | 13 (5.4)      |
| Divorced                                 | 6 (2.5)       |
| Highest education                        |               |
| None                                     | 28 (11.6)     |
| Primary                                  | 158 (65.3)    |
| Secondary                                | 56 (23.1)     |
| Income (RM/month)                        |               |
| <900                                     | 94 (38.8)     |
| ≥900                                     | 148 (61.2)    |
| Duration of work (years)                 |               |
| 1-30                                     | 80 (33.1)     |
| 31-60                                    | 159 (65.7)    |
| >60                                      | 3 (1.2)       |
| Type of fishing                          |               |
| Coastal                                  | 111 (45.9)    |
| Deep-sea                                 | 24 (9.9)      |
| Both                                     | 107 (44.2)    |
| Additional occupation                    |               |
| Yes                                      | 23 (9.5)      |
| No                                       | 219 (90.5)    |
| Age (years)                              |               |
| <50-year-old                             | 67 (27.7)     |
| ≥50-year-old                             | 175 (72.3)    |
| Time spent at sea                        |               |
| Times/week (days)                        |               |
| <6                                       | 113 (46.7)    |
| ≥6                                       | 129 (53.3)    |
| Hours/day (h)                            |               |
| <6                                       | 79 (32.6)     |
| ≥6                                       | 163 (67.4)    |

*Mean±SD. RM=Ringgit Malaysia, SD=Standard deviation

Table 2: Sociodemographic characteristics of participants (n=242)
did not experience problem with sleep, social interactions, inability to work or perform activities of daily living on account of oral health problems [Table 4]. Therefore, there

| Table 3: Distribution of teeth and gum characteristics among fishermen in Teluk Bahang (n=242) |
|----------------------------------|----------------------------------|
| Variables                        | Frequency (%)                    |
| Number of natural teeth present  |                                 |
| 1-9                              | 69 (28.5)                        |
| 10-19                            | 107 (44.2)                       |
| 20 or more                       | 66 (27.3)                        |
| Tooth pain or discomfort         |                                 |
| No                               | 2 (0.8)                          |
| Yes                              | 213 (88)                         |
| Don’t know                       | 27 (11.2)                        |
| Denture present                  |                                 |
| Yes                              | 29 (12)                          |
| No                               | 213 (88)                         |
| Type of denture worn (n=29)      |                                 |
| Partial                          | 18 (62.1)                        |
| Full upper                       | 6 (20.7)                         |
| Full lower                       | 5 (17.2)                         |
| State of teeth (n=230)           |                                 |
| Excellent                        | 1 (4)                            |
| Very good                        | 5 (2.2)                          |
| Good                             | 75 (32.6)                        |
| Average                          | 53 (23)                          |
| Satisfactory                     | 41 (17.8)                        |
| Not satisfactory                 | 47 (20.4)                        |
| Do not know                      | 8 (3.5)                          |
| State of gums                    |                                 |
| Excellent                        | 1 (4)                            |
| Very good                        | 5 (2.1)                          |
| Good                             | 73 (30.2)                        |
| Average                          | 58 (24)                          |
| Satisfactory                     | 49 (20.2)                        |
| Not satisfactory                 | 47 (19.4)                        |
| Do not know                      | 9 (3.7)                          |
| Frequency of teeth cleaning      |                                 |
| Never                            | 5 (2.1)                          |
| 1/week                           | 2 (0.8)                          |
| 2-6/week                         | 12 (5)                           |
| 1/day                            | 91 (37.6)                        |
| 2 or more/day                    | 132 (54.5)                       |
| Last dental visit                |                                 |
| <6 months                        | 9 (3.7)                          |
| 6-12 months                      | 9 (3.7)                          |
| >1 year=<2 years                 | 3 (1.2)                          |
| >2 years=<5 years                | 8 (3.3)                          |
| >5 years                         | 135 (55.8)                       |
| Never                            | 78 (33.2)                        |
| Oral health score (mean±SD)      | 14.11±1.96                       |
| Oral health status               |                                 |
| Poor                             | 115 (47.5)                       |
| Good                             | 127 (52.5)                       |
| SD=Standard deviation            |                                 |

| Table 4: Distribution of oral health problems, psycho-behavioral effects, and health-seeking behavior (dental clinic visits) among fishermen in Teluk Bahang (n=242) |
|----------------------------------|----------------------------------|
| Variable                         | Frequency (%)                    |
| Reasons for last dental visit (n=164) |                                 |
| Advice                           | 3 (1.8)                          |
| Dental problems                  | 112 (68.3)                       |
| Treatment                        | 33 (20.1)                        |
| Routine visit                    | 12 (7.3)                         |
| Do not know                      | 4 (2.4)                          |
| Problems biting                  |                                 |
| Frequently                       | 1 (4)                            |
| Quite often                      | 69 (28.5)                        |
| Sometimes                        | 4 (1.7)                          |
| No                               | 168 (69.4)                       |
| Problems chewing                 |                                 |
| Frequently                       | 1 (4)                            |
| Quite often                      | 78 (33.2)                        |
| Sometimes                        | 9 (3.7)                          |
| No                               | 154 (63.6)                       |
| Dry mouth                        |                                 |
| Quite often                      | 40 (16.5)                        |
| Sometimes                        | 4 (1.7)                          |
| No                               | 198 (81.8)                       |
| Embarrassed by teeth             |                                 |
| Quite often                      | 14 (5.8)                         |
| Sometimes                        | 1 (0.4)                          |
| No                               | 227 (93.8)                       |
| Tense due to teeth               |                                 |
| Quite often                      | 17 (0.7)                         |
| Sometimes                        | 1 (0.4)                          |
| No                               | 224 (93.8)                       |
| Avoid smiling due to teeth       |                                 |
| Quite often                      | 13 (5.4)                         |
| Sometimes                        | 5 (2.1)                          |
| No                               | 224 (92.6)                       |
| Unable to sleep due to teeth     |                                 |
| Quite often                      | 4 (1.7)                          |
| Sometimes                        | 2 (0.8)                          |
| No                               | 236 (97.5)                       |
| Off days from work due to teeth  |                                 |
| Quite often                      | 3 (1.2)                          |
| Sometimes                        | 2 (0.8)                          |
| No                               | 237 (97.9)                       |
| Unable to perform normal duties  |                                 |
| Quite often                      | 3 (1.2)                          |
| Sometimes                        | 1 (0.4)                          |
| No                               | 238 (98.3)                       |
| Intolerant to people who are close|                                 |
| Quite often                      | 1 (0.4)                          |
| Sometimes                        | 1 (0.4)                          |
| No                               | 240 (99.2)                       |
| Unable to perform social activities|                                 |
| Quite often                      | 1 (0.4)                          |
| Sometimes                        | 1 (0.4)                          |
| No                               | 240 (99.2)                       |
were little or no psycho-behavioral effects due to oral health status among the fishermen in this study.

Frequency of usage of tobacco, alcohol, and other food/drinks that impact oral health among fishermen in Teluk Bahang

In Tables 5a and 5b, the risk factors that impacted oral health of fishermen were assessed. There were 16 variables related to sweets, sugar, tobacco, and alcohol consumption. More than half of the respondents ate fresh fruits several times/week (54.5%, 132/242). Majority of the respondents seldom/never chew sugar gum (90.5%, 219/242), seldom/never eat jam/honey (76.4%, 185/242), seldom/never eat sweets/candy (58.7%, 142/242), and seldom/never eat sweet pies, buns (57.9%, 140/242) while almost half of the respondents seldom/never ate sweet biscuits, cakes (48.1%, 117/242). Although about half of the respondents seldom/never drank sweet soft drinks such as coke (53.7%, 130/242), one-third did several times/month (30.2%, 73/242). Up to 65.7% (159/242) of respondents drank tea with sugar at least once a day. Similarly, majority of the respondents...

### Table 5a: Frequency of usage of tobacco, alcohol, and other foods/drinks that impact oral health among fishermen in Teluk Bahang (n=242)

| Variables                          | Frequency (%) |
|------------------------------------|---------------|
| **Frequency of eating fresh fruits** |               |
| Seldom/never                       | 19 (7.9)      |
| Several times/month                | 18 (7.4)      |
| 1/week                            | 42 (17.4)     |
| Several times/week                 | 132 (54.5)    |
| Daily                              | 26 (10.7)     |
| Several times/day                  | 5 (2.1)       |
| **Frequency of eating biscuits cakes** |            |
| Seldom/never                       | 117 (48.1)    |
| Several times/month                | 56 (23.1)     |
| 1/week                            | 18 (7.4)      |
| Several times/week                 | 35 (14.5)     |
| Daily                              | 15 (6.2)      |
| Several times/day                  | 1 (0.4)       |
| **Frequency of eating sweet pies, buns** |           |
| Seldom/never                       | 140 (57.9)    |
| Several times/month                | 37 (15.3)     |
| 1/week                            | 5 (2.1)       |
| Several times/week                 | 41 (16.9)     |
| Daily                              | 19 (7.9)      |
| **Frequency of eating jam, honey** |               |
| Seldom/never                       | 185 (76.4)    |
| Several times/month                | 46 (19)       |
| 1/week                            | 6 (2.5)       |
| Several times/week                 | 3 (1.2)       |
| Daily                              | 2 (0.8)       |
| **Frequency of chewing sugar gum** |               |
| Seldom/never                       | 219 (90.5)    |
| Several times/month                | 19 (34.7)     |
| 1/week                            | 2 (1.7)       |
| Several times/week                 | 1 (4.1)       |
| Daily                              | 1 (0.8)       |
| **Frequency of eating sweets, candy** |           |
| Seldom/never                       | 142 (58.7)    |
| Several times/month                | 84 (34.7)     |
| 1/week                            | 4 (1.7)       |
| Several times/week                 | 10 (4.1)      |
| Daily                              | 2 (0.8)       |

### Table 5b: Frequency of usage of tobacco, alcohol, and other foods/drinks that impact oral health among fishermen in Teluk Bahang (n=242)

| Variables                                      | Frequency (%) |
|-----------------------------------------------|---------------|
| **Frequency of drinking sweet, soft drinks,** |               |
| **e.g., coke**                                |               |
| Seldom/never                                  | 130 (53.7)    |
| Several times/month                           | 73 (30.2)     |
| 1/week                                        | 7 (2.9)       |
| Several times/week                            | 12 (5)        |
| Daily                                         | 6 (2.5)       |
| Several times/day                             | 14 (5.8)      |
| **Frequency of drinking tea with sugar**      |               |
| Seldom/never                                  | 39 (16.1)     |
| Several time/month                            | 27 (11.2)     |
| 1/week                                        | 1 (0.4)       |
| Several times/week                            | 16 (6.6)      |
| Daily                                         | 52 (21.5)     |
| Several times/day                             | 107 (44.2)    |
| **Frequency of drinking coffee with sugar**   |               |
| Seldom/never                                  | 30 (12.4)     |
| Several times/month                           | 8 (3.3)       |
| 1/week                                        | 1 (0.4)       |
| Several times/week                            | 6 (2.5)       |
| Daily                                         | 29 (12.0)     |
| Several times/day                             | 168 (69.4)    |
| **Use of cigarettes**                         |               |
| Seldom/never                                  | 31 (12.8)     |
| Several times/month                           | 9 (3.7)       |
| Daily                                         | 1 (0.4)       |
| Several times/day                             | 201 (83.1)    |
| **Use of cigars**                             |               |
| Seldom/never                                  | 240 (99.2)    |
| Several times/day                             | 2 (0.8)       |
| **Use of pipe**                               |               |
| Seldom/never                                  | 240 (99.2)    |
| Several times/day                             | 2 (0.8)       |
| **Use of chewing tobacco**                    |               |
| Seldom/never                                  | 240 (99.2)    |
| Several/day                                   | 2 (0.8)       |
| **Use of snuff**                              |               |
| Seldom/never                                  | 239 (98.8)    |
| Several times/month                           | 1 (0.4)       |
| Several times/day                             | 2 (0.8)       |

Indian Journal of Dental Research | Volume 29 | Issue 3 | May-June 2018
Singh, et al.: Oral health status of Malaysian fishermen

Table 6: Association of sociodemographic profiles with oral health status among fishermen in Teluk Bahang

| Variable                  | Poor oral health (n=115), n (%) | Good oral health (n=127), n (%) | \(\chi^2\) | OR     | 95% CI       | P     |
|---------------------------|---------------------------------|---------------------------------|----------|--------|--------------|-------|
| Race                      |                                 |                                 |          |        |              |       |
| Malay                     | 74 (64.3)                       | 95 (74.8)                       | 0.207    | 1.57   | 0.618-3.984  | 0.343 |
| Chinese                   | 30 (26.1)                       | 23 (18.1)                       | 0.90     | 0.333-2.638 | 0.937     |
| Indian                    | 11 (9.6)                        | 9 (7.1)                         | Reference|        |              |       |
| Religion                  |                                 |                                 |          |        |              |       |
| Islam                     | 74 (64.3)                       | 96 (75.6)                       | 0.285†   | 1.82   | 0.554-5.952  | 0.343 |
| Buddhist                  | 29 (25.2)                       | 19 (15.0)                       | 0.92     | 0.254-3.316 | 0.895     |
| Hindu                     | 3 (2.6)                         | 4 (3.1)                         | 1.87     | 0.283-12.310 | 0.517     |
| Christian                 | 2 (1.7)                         | 3 (2.4)                         | 2.10     | 0.251-17.594 | 0.494     |
| Others                    | 7 (6.1)                         | 5 (3.9)                         | Reference|        |              |       |
| Marital status            |                                 |                                 |          |        |              |       |
| Married                   | 108 (93.9)                      | 115 (90.6)                      | 0.460†   | 1.07   | 0.210-5.390  | 0.939 |
| Single                    | 4 (3.5)                         | 9 (7.1)                         | 2.25     | 0.308-16.411 | 0.424     |
| Divorced                  | 3 (2.6)                         | 3 (2.4)                         | Reference|        |              |       |
| Highest Education         |                                 |                                 |          |        |              |       |
| None                      | 17 (14.8)                       | 11 (8.7)                        | 0.004*   | 0.26   | 0.100-0.672  | 0.006*|
| Primary                   | 82 (71.3)                       | 76 (59.8)                       | 0.37     | 0.192-0.716 | 0.003*     |
| Secondary                 | 16 (13.9)                       | 40 (31.5)                       | Reference|        |              |       |
| Income (RM/month)         |                                 |                                 |          |        |              |       |
| <900                      | 52 (45.2)                       | 42 (33.1)                       | 0.053    | 0.60   | 0.356-1.008  | 0.054 |
| ≥900                      | 63 (54.8)                       | 85 (66.9)                       | Reference|        |              |       |
| Duration of work (years)  |                                 |                                 |          |        |              |       |
| 1-30                      | 28 (24.3)                       | 52 (40.9)                       | 0.006*†  | Reference|              |       |
| 31-60                     | 84 (73.0)                       | 75 (59.1)                       | 0.48     | 0.278-0.837 | 0.010*     |
| >60                       | 3 (2.6)                         | 0 (0)                           | 0.64     | 0.327-0.902 | 0.001*     |
| Type of fishing           |                                 |                                 |          |        |              |       |
| Coastal                   | 47 (40.9)                       | 64 (50.4)                       | 0.092    | 1.29   | 0.755-2.197  | 0.354 |
| Deep sea                  | 16 (13.9)                       | 8 (6.3)                         | 0.47     | 0.187-1.198 | 0.114     |
| Both                      | 52 (45.2)                       | 55 (43.3)                       | Reference|        |              |       |
| Additional occupation     |                                 |                                 |          |        |              |       |
| Yes                       | 4 (3.5)                         | 19 (15.0)                       | 0.002*†  | 1.86   | 1.173-2.940  | 0.008*|
| No                        | 111 (96.5)                      | 108 (85.0)                      | Reference|        |              |       |
| Age                       |                                 |                                 |          |        |              |       |
| <50-year-old              | 16 (13.9)                       | 51 (40.2)                       | 0.001*   | 4.15   | 2.198-7.845  | 0.001*|
| ≥50-year-old              | 99 (86.1)                       | 76 (59.8)                       | Reference|        |              |       |
| Time spent at sea         |                                 |                                 |          |        |              |       |
| Hours/day (h)             |                                 |                                 |          |        |              |       |
| <6                        | 43 (37.4)                       | 36 (28.3)                       | 0.134    | 0.66   | 0.386-1.137  | 0.135 |
| ≥6                        | 72 (62.6)                       | 91 (71.7)                       | Reference|        |              |       |
| Times/week (days)         |                                 |                                 |          |        |              |       |
| <6                        | 48 (41.7)                       | 65 (51.2)                       | 0.141    | 1.46   | 0.880-2.433  | 0.142 |
| ≥6                        | 67 (58.3)                       | 62 (48.8)                       | Reference|        |              |       |

OR=Odds ratio, CI=Confidence interval, RM=Ringgit Malaysia, †=P value obtained from Fishers Exact Test, *Significant at P<0.05

drank coffee with sugar several times/day (69.4%, 168/242) [Table 5a].

Majority of the respondents smoked cigarettes several times/day (83.1%, 201/242). Virtually, all of the respondents never smoked cigars (99.2%, 240/242), never smoked a pipe (99.2%, 240/242), never chewed tobacco (99.2%, 240/242), never used snuff (98.8%, 239/242), and never used others such as sniffing glue (99.2%, 240/242). Majority also did not consume alcoholic drinks (92.6%, 224/242) [Table 5b].

Association of sociodemographic profiles with oral health status among fishermen in Teluk Bahang

Table 6 summarizes the results of the association of sociodemographic profiles with oral health status among the fishermen in Teluk Bahang. First, Chi-square test was conducted to determine the association of sociodemographic

384
profiles with the oral health status among the fishermen. Where >20% of the expected cell frequencies were <5, \( P \) value of Fisher’s exact test was interpreted.

Among the 11 variables in the sociodemographic profiles, there were four that were found to be statistically significant and associated with oral health. These four variables are “highest education” \( (P = 0.004) \), “duration of work (years)” \( (P = 0.006) \), “additional occupation” \( (P = 0.002) \), and “age” \( (P = 0.001) \). The main additional occupation on Penang Island for the fishermen was in hotels and tourism-related sectors such as tour guides and tour van drivers.

The results were similar in the bivariate logistic regression analysis conducted using the “enter” method. We observed that lower education levels \( (P = 0.006, \text{none vs. secondary}) \) and longer duration of work \( (P = 0.001, \geq60 \text{ years vs. } 1–30 \text{ years}) \) were significant risk factors of poor oral health. On the other hand, younger respondents \( (<50 \text{ years}) \) \( (OR = 4.15, 95\% \text{ CI} = 2.198–7.845, P = 0.001) \) and those with additional occupation \( (OR = 1.86, 95\% \text{ CI} = 1.173–2.940, P = 0.008) \) had significantly higher odds of having good oral health status [Table 6].

**Association of dietary factors, smoking, and alcohol use with oral health status among fishermen in Teluk Bahang**

Table 7 summarizes the results of the association of dietary factors with oral health status of the fishermen in Teluk Bahang. Chi-square test was used to determine the association of the dietary factors with the oral health status of the fishermen. However, when >20% of the expected cell frequencies were <5, \( P \) value of Fisher’s exact test was interpreted. Of the nine dietary factors evaluated, three were found to be statistically significant and associated with oral health. These included “frequency of pies, buns consumed” \( (P = 0.014) \), “frequency of jam, honey consumed” \( (P = 0.036) \), and “frequency of sweet, soft drinks consumed” \( (P = 0.017) \). We found no statistically significant associations between oral health status and use of cigarettes and other tobacco products as well as alcohol consumption \( (P > 0.05) \) [Table 7].

These findings were confirmed by the bivariate logistic regression analyses conducted using the “enter” method. In reference to “frequency of sweet, soft drinks consumed,” those respondents that rarely consumed sweet, soft drinks had more than twice higher odds \( (OR = 2.21, 95\% \text{ CI} = 1.322–3.705, P = 0.003) \) of having good oral health compared to those who regularly consumed sweet, soft drinks. Respondents who rarely consumed pies, buns were 47.9% \( (OR = 0.52, 95\% \text{ CI} = 0.310–0.877, P = 0.014) \) less likely to have good oral health status than those who consumed pies, buns on a regularly basis. No other significant associations were observed [Table 7].

**Multivariate logistic regression (backward Wald) of sociodemographic and lifestyle factors on oral health status of fishermen in Teluk Bahang**

A multivariate logistic regression analysis was conducted to examine the predictors of oral health status among fishermen in Teluk Bahang. All the variables that showed a bivariate association with oral health status at \( P \leq 0.25 \) (Hosmer–Lemeshow) were selected to be included in the multivariate model. Models were fitted and compared using the enter, forward, and backward Wald methods. The backward Wald method produced the most statistically significant model and explained the largest variance in the oral health status. The final multivariate logistic regression model was statistically significant \( (\chi^2 = 53.81, df = 8, P < 0.001) \). The model explained 26.6% of the variance in oral health status among fishermen and predicted 69.8% of oral health status categories correctly.

As shown in Table 8, overall, the model produced six factors that were statistically significantly associated with oral health status. These were “age,” “income (RM/month),” “type of fishing,” “additional occupation,” “frequency of pies and buns consumed,” and “frequency of sweet, soft drinks consumed.” With reference to “income (RM/month),” the respondents who earned ≤RM 900 were 53% \( (aOR = 0.47, 95\% \text{ CI} = 0.255–0.849, P = 0.013) \) less likely to have good oral health status than those respondents who earned ≥RM 900. Deep-sea fishermen were 68% \( (aOR = 0.32, 95\% \text{ CI} = 0.110–0.929, P = 0.036) \) less likely to have good oral health status compared to those fishermen who were both coastal and deep-sea fishermen [Table 8].

Fishermen who were ≤50 years of age had about four times higher odds \( (aOR = 4.15, 95\% \text{ CI} = 2.077–8.290, P = 0.0001) \) of having good oral health status than those who were ≥50 years of age. Similarly, fishermen who had an additional occupation had more than three times higher odds \( (aOR = 3.48, 95\% \text{ CI} = 1.010–11.988, P = 0.048) \) of having good oral health status compared with those fishermen who did not have an additional occupation [Table 8].

Regarding dietary factors, fishermen who rarely consumed sweet, soft drinks had about twice higher odds \( (aOR = 1.80, 95\% \text{ CI} = 1.122–2.560, P = 0.019) \) of achieving good oral health status than those fishermen who regularly did. Finally, fishermen who rarely consumed pies and buns were 59% less likely \( (aOR = 0.41, 95\% \text{ CI} = 0.219–0.784, P = 0.007) \) to have good oral health status than those that regularly consumed pies and buns [Table 8].

**Discussion**

This is the first study on oral health status conducted among fishermen in Malaysia, who are predominantly economically disadvantaged males living in rural to semi-urban locations around the country. Given the multicultural nature of our
Table 7: Association of dietary factors, smoking, and alcohol use with oral health status among fishermen in Teluk Bahang

| Variable                                | Poor Oral Health | Good Oral Health | $\chi^2$ | OR   | 95% CI           | P   |
|-----------------------------------------|------------------|------------------|---------|------|------------------|-----|
| Frequency of fresh fruit consumed       |                  |                  |         |      |                  |     |
| Rarely                                  | 11 (9.6)         | 8 (6.3)          | 0.346   | 0.64 | 0.246-1.640      | 0.349|
| Regularly                               | 104 (90.4)       | 119 (93.7)       | Reference |      |                  |     |
| Frequency of cake, biscuits consumed    |                  |                  |         |      |                  |     |
| Rarely                                  | 57 (49.6)        | 60 (47.2)        | 0.718   | 0.91 | 0.550-1.510      | 0.718|
| Regularly                               | 58 (50.4)        | 67 (52.8)        | Reference |      |                  |     |
| Frequency of pies, buns consumed        |                  |                  |         |      |                  |     |
| Rarely                                  | 76 (66.1)        | 64 (50.0)        | 0.014*  | 0.52 | 0.310-0.877      | 0.014*|
| Regularly                               | 39 (33.9)        | 63 (49.6)        | Reference |      |                  |     |
| Frequency of jam, honey consumed        |                  |                  |         |      |                  |     |
| Rarely                                  | 81 (70.4)        | 104 (81.9)       | 0.036*  | 0.0001 | -               | 0.997|
| Regularly                               | 34 (29.6)        | 23 (18.1)        | Reference |      |                  |     |
| Frequency of chewing consumed           |                  |                  |         |      |                  |     |
| Rarely                                  | 102 (88.7)       | 117 (92.1)       | 0.364   | 1.01 | 0.429-2.395      | 0.975|
| Regularly                               | 13 (11.3)        | 10 (7.9)         | Reference |      |                  |     |
| Frequency of sweets, candy consumed     |                  |                  |         |      |                  |     |
| Rarely                                  | 67 (58.3)        | 75 (59.1)        | 0.900   | 1.03 | 0.619-1.725      | 0.900|
| Regularly                               | 48 (41.7)        | 52 (40.9)        | Reference |      |                  |     |
| Frequency of sweet, soft drinks consumed|                  |                  |         |      |                  |     |
| Rarely                                  | 71 (61.7)        | 59 (46.5)        | 0.017*  | 2.21 | 1.322-3.705      | 0.003*|
| Regularly                               | 44 (38.3)        | 68 (53.5)        | Reference |      |                  |     |
| Frequency of tea with sugar consumed    |                  |                  |         |      |                  |     |
| Rarely                                  | 19 (16.5)        | 20 (15.7)        | 0.870   | 0.58 | 0.288-1.156      | 0.121|
| Regularly                               | 96 (83.5)        | 107 (84.3)       | Reference |      |                  |     |
| Frequency of coffee with sugar consumed |                  |                  |         |      |                  |     |
| Rarely                                  | 12 (10.4)        | 18 (14.2)        | 0.378   | 0.77 | 0.356-1.650      | 0.497|
| Regularly                               | 103 (89.6)       | 109 (85.8)       | Reference |      |                  |     |
| Use of cigarettes                       |                  |                  |         |      |                  |     |
| Rarely                                  | 15 (13)          | 16 (12.6)        | 0.918   | 0.96 | 0.452-2.043      | 0.918|
| Regularly                               | 100 (87)         | 111 (87.4)       | Reference |      |                  |     |
| Use of snuff                            |                  |                  |         |      |                  |     |
| Rarely                                  | 113 (98.3)       | 126 (99.2)       | 0.606†  | 2.23 | 0.200-24.925     | 0.515|
| Regularly                               | 2 (1.7)          | 1 (0.8)          | Reference |      |                  |     |
| Use of alcoholic drinks                 |                  |                  |         |      |                  |     |
| Rarely                                  | 107 (93)         | 117 (92.1)       | 0.786   | 0.88 | 0.333-2.298      | 0.786|
| Regularly                               | 8 (7)            | 10 (7.9)         | Reference |      |                  |     |

OR=Odds ratio, CI=Confidence interval, †=P value obtained from Fishers Exact Test, *Significant at P<0.05

**Summary of main findings**

The prevalence of poor oral health in this study was 47.5%. We found that “income” (RM/month), “type of fishing,” “additional occupation,” “age” (years), “frequency of pies, buns consumed,” and “frequency of sweets, soft drinks consumed” were significant predictors of oral health status among the fishermen in Teluk Bahang.

**Prevalence of poor oral health among fishermen**

The prevalence of poor oral health in our study population was relatively high (47.5%). Although slightly higher, the prevalence of poor oral health reported in the current study is almost similar to 41.5% reported by the 2000 National Oral Health Survey of Adults in Malaysia (NOHSA).[2] Of important note is the fact that whereas half of the participants in the national survey were males, in contrast, all the respondents in the current study were male. This finding could point to the possibility that poor oral health was more prevalent among males in Malaysia. This is probably due to the fact that males are more likely to be involved in lifestyle factors that adversely affect oral health such as tobacco use.
Notably, focused studies on oral health among fishermen have been very few and far between, especially in Southeast Asia and Asia at large. Most of the literature evidence comes from India where oral health of fishermen has been extensively studied over the past two decades. Like our study, one Indian study reported the prevalence of poor oral health among fishermen to be as high as 41.8%.[28] This similarity is probably because, in both studies, the study instrument used was the WHO standardized, prevalidated questionnaire. Our findings are also consistent with the prevalence reported in many recent studies conducted across several rural fishing villages in India.[3,4,29,30] WHO encourages the use of the oral health questionnaire as it is standardized, making the results internationally comparable. It is also used as a tool to evaluate and plan oral health programs, to form an integrated model for surveillance, and for data collection to support policy formulation and implementation. Further, in most of these prevalence studies, there appears to be a consensus that the main contributory factors to poor oral health of fishermen were sociodemographic, socioeconomic, and other lifestyle-related factors similar to those that were seen in this study.[7,18,31]

Association of sociodemographic and socioeconomic factors with oral health status

The distribution of the races, marital status, and education level of respondents in this study matched the distribution in the NOHSA survey and one recent study among Malaysian fishermen in Penang.[32] We found in our bivariate regression analysis that lower levels of education were predictive of poor oral health. This is consistent with reports from other similar studies.[16,22,33] From these studies, it was also observed that those with lower level of education were more likely to also have a higher level of poverty. Generally, people with higher income are more likely to be able to afford healthcare (especially where they have to make insurance contributions or pay out of pocket), and this also creates more awareness of oral health and access to it. In a household where the employment and income of the main provider are not stable, this creates inequality of access to healthcare and oral health services for the family members. Given that higher education is a direct correlate of higher income and consequent affordability of healthcare services, it is important that targeted interventions take this potential tripartite relationship into account when designing such interventions, to achieve better impact.

The mean monthly income in this study was RM 938.51 ± 412.5. The respondents who earned ≤RM 900 were about twice less likely to have good oral health status than those respondents who earned ≥RM 900. Income is a tool to measure socioeconomic status and an individual’s position and influence in society. The 2017 basic minimum monthly wage set by the Malaysian

| Table 8: Multivariate logistic regression (Backward Wald) of sociodemographic and lifestyle factors on oral health status of fishermen in Teluk Bahang |
|---------------------------------|----------------|----------------|-----------------|---|
| Variables                        | Crude OR | Adjusted OR | 95% CI          | P |
| Income (RM/month)                |           |              |                  |   |
| <900                             | 0.60      | 0.47         | 0.255-0.849      | 0.013* |
| ≥900                             | Reference |              |                  |   |
| Type of fishing                  |           |              |                  |   |
| Coastal                          | 1.29      | 1.05         | 0.552-1.990      | 0.885 |
| Deep-sea                         | 0.47      | 0.32         | 0.110-0.929      | 0.036* |
| Both                             | Reference |              |                  |   |
| Additional occupation            |           |              |                  |   |
| Yes                              | 1.86      | 3.48         | 1.010-11.988     | 0.048* |
| No                               | Reference |              |                  |   |
| Age                              |           |              |                  |   |
| <50-year-old                     | 4.15      | 4.15         | 2.077-8.290      | 0.0001* |
| ≥50-year-old and above           | Reference |              |                  |   |
| Time spent at sea (times/week)   |           |              |                  |   |
| <6                               | 1.46      | 1.66         | 0.920-2.981      | 0.092 |
| ≥6                               | Reference |              |                  |   |
| Frequency of pies, buns consumed |           |              |                  |   |
| Rarely                           | 0.52      | 0.41         | 0.219-0.784      | 0.007* |
| Regularly                        | Reference |              |                  |   |
| Frequency of sweets, soft drinks consumed | | | | |
| Rarely                           | 2.21      | 1.80         | 1.122-2.560      | 0.019* |
| Regularly                        | Reference |              |                  |   |

*Significant at P<0.05. OR=Odds ratio, CI=Confidence interval, RM=Ringgit Malaysia
Government is RM 1000/month. The fishing profession is classified under low-income profession, where the monthly wages are generally below the government’s minimum wage prescription and Malaysian fishermen are believed to be multidimensionally poor. Similar results of association between low income and poor oral health status were reported from systematic reviews and other studies conducted in Brazil. Income inequalities are directly related to mortality and morbidity from all health conditions including oral health. Low income and poverty can cause polarization of diseases where the oral health problems become even worse and cause dis-investment of public funds and condition known as stress-induced oral health behavior. All these ultimately lead to tooth loss which would then require prosthesis that costs more money or for the individual to remain without teeth affecting their quality of life.

The respondents in the study who were deep-sea fishermen were significantly less likely to have good oral health status. This was again supported by the study done by Sobotta et al. Our study findings suggest that due to the long monotonous hours spent at sea (majority spent > 6 h/day on 6 or more days per week), social isolation and lack of exercise often caused boredom and stress that led to adverse habits such as smoking, excessive drinking of coffee, and consumption of free sugar in foods. This was in addition to an ambivalent attitude toward oral health, low motivation, and inadequate information caused by spending so much time at sea. These factors contribute in a synergistic manner to why poor oral health is highly prevalent among our study population.

Fishermen who had an additional occupation had more than three times higher odds of having good oral health status compared with those fishermen who did not have an additional occupation. This could be due to earning more income to be able to afford to take better care of the mouth using mouthwashes, replacing toothbrushes more often, and use of electric toothbrushes. In addition, it may not be unrelated to their need to be more aware of and take better steps to maintain their oral health, especially among those working in the hospitality industry.

Those fishermen who were ≤50 years of age had about four times higher odds of having good oral health status than those who were ≥50 years of age. Besides the local studies by Jaafar et al. and Solaymani and Kari, others that reported similar findings include those conducted by Patil et al., Maida et al., and Slade in South India, United States, and other parts of the world. One of the factors that could probably explain this finding is the fact that the younger fishermen had more disposable income either by being unmarried, holding an additional occupation, or generally having fewer monetary or financial responsibilities. In addition, xerostomia — otherwise known as dry mouth — generally affects older patients. About 30% of those affected are in their seventh decade of life and 40% in those older than 80 years of age. Although this condition is often associated with underlying noncommunicable diseases such as diabetes, cardiac diseases, Alzheimer’s disease, and Parkinson’s disease, it is usually due to the effects of medications. Worse still, the prevalence of the above-mentioned diseases increases with age, and elderly people are generally more afflicted thereby necessitating them to take more prescription drugs. The effects of dry mouth are cracked lips, fissured tongue, dental caries, and mucositis.

**Association of lifestyle factors with oral health status**

The three major risk factors that affect general health and oral health are tobacco use, alcohol use, and sugar consumption. We found in the current study that those fishermen who rarely consumed sweet, soft drinks had about twice higher odds of achieving good oral health status than those fishermen who regularly consumed sweet, soft drinks. This finding is consistent with evidence from the previous similar studies which revealed that sugar consumption causes oral health diseases such as dental caries and periodontal diseases. Sugar is a necessary part of the daily energy intake. However, when its consumption exceeds WHO recommended 10% daily intake, it can then have a detrimental effect on the health of people, resulting in incidence of noncommunicable diseases such as diabetes and obesity. This in turn can affect the mouth and cause periodontal diseases. In periodontal diseases, there is swelling of the gums that causes inflammation and bleeding. If this condition is not checked, it can cause the loss of bone and the loosening of teeth and ultimately loss of natural teeth, all of which lead to poor oral health and diminished oral health quality of life. Sugar also can have a direct effect in the mouth. It causes dental caries and periodontal diseases. When there is excess sugar in the mouth, this causes the bacteria to increase the breakdown of sugar to be digested. The by-product of this breakdown is acid that causes the resorption of the enamel which is the outermost hardened layer of the tooth which causes caries.

Alcohol consumption is associated with higher incidence of noncommunicable diseases such as cirrhosis of the liver and cancers. It is also established as a major risk factor for oral cancers. In combination with tobacco, there is a 15-fold increase in the incidence of developing oral cancer. This study failed to find any relationship between alcohol consumption and poor oral health. This is probably because of very low prevalence of alcohol use among the study population as majority of the respondents were Malays (69.8%) and of the Muslim faith (70.3%) and did not consume alcohol. Even though tobacco use is a major established risk factor (as reported by the previous studies) for poor oral health, and given that a very high proportion of our respondents smoked several times daily (83.1%), it was not significantly associated with poor oral health in this study. This could be due to the fact that more than half of the fishermen in this study (54.5%) reported brushing
their teeth 2 or more times/day. Strangely, we found that those fishermen who rarely consumed pies and buns were more than twice less likely to have good oral health status than those that regularly consumed pies and buns. It is unclear why this is so, and we recommend further studies to explore this isolated finding further.

Strengths of the study
To the best of our knowledge, ours is the first Malaysian study that evaluated the prevalence and risk factors of poor oral health among fishermen, who despite being a low-income group are deemed to be a very important contributor to the economy of the nation. We applied a probability random sampling procedure which minimizes selection bias and improves the external validity of our estimates. In addition, the use of a WHO standardized oral health questionnaire ensured that not only are our results valid but also are comparable with other international studies that utilized a similar recommended approach.

Limitations of the study
There are important limitations in this study. One major limitation of this study was its inability to determine temporal relationships between lifestyle factors and oral health status, and this is important in exploring the role that noncommunicable diseases such as hypertension, diabetes, and depression (and their treatment) – which are generally highly prevalent among fishermen and general adult population of Malaysia – might have played in the overall incidence and prevalence of poor oral health observed in this study. In addition, the cross-sectional nature of our study made it difficult to explore the deeper meanings behind respondents’ attitude toward their oral health. This study used a questionnaire that was structured and standardized. Respondents had to think and recall the answers to the questions which could have led to recall bias. Like other self- or interviewer-administered surveys, the potential for social desirability bias must be acknowledged especially as it relates to sensitive sociocultural issues in a community setting. Another limitation was that we included only men in the study, apparently because there was only one female member of the fishermen’s association, and this precluded our understanding of how prevalent poor oral health would have been among fisherwomen or factors that may differentially affect their oral health status. Although beyond the scope of our study, inclusion of oral health examination in our study could offer the potential of improving the study estimates by providing clinical correlate of poor oral health status and highlighted the need for focused oral health intervention.

Conclusion
Although the prevalence of poor oral health among fishermen in Teluk Bahang seemed relatively high, our findings were within the parameters of Malaysian national average. Sociodemographic factors such as age, income, additional occupation, and type of fishing affected oral health status of the fishermen. High frequency of consuming sweet, soft drinks was a risk factor of poor oral health in the lifestyle of the fishermen in this study. Tobacco and alcohol consumption were not risk factors for poor oral health among the fishermen in our study. These findings suggest the need for intersectoral collaboration to address poverty, poor diet, and oral health awareness as well as access to treatment among the fishermen in Teluk Bahang, Penang, Malaysia.

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Conflicts of interest
There are no conflicts of interest.

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