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## AWARENESS AND SELF-PERCEPTION OF HALITOSIS AMONG UNDERGRADUATE STUDENTS AT UNIVERSITI BRUNEI DARUSSALAM.

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### ABSTRACT

**Introduction:** Halitosis, or bad breath, is a prevalent health concern with social and psychological implications. This study investigated the knowledge of halitosis among undergraduate students at Universiti Brunei Darussalam (UBD), focusing on health-science (HS) and non-health-science (non-HS) students. The research aimed to contribute to the understanding of halitosis within the context of undergraduate student populations and the impact of health science-based programmes. **Methods:** The study was conducted among 4108 undergraduate UBD students using a self-administered, closed-ended online questionnaire. **Results:** 279 students from five UBD undergraduate faculties participated in the study giving a response rate of 6.79%. HS students exhibited significantly higher awareness of factors contributing to halitosis, including smoking, tooth cavities, incorrect teeth cleaning, gastrointestinal tract disease, tonsillitis and certain medications. Furthermore, HS students reported receiving more educational material on halitosis (24.1% vs. 2.3%). Both HS and non-HS students primarily relied on dentists (62.0% vs. 56.1%) for halitosis consultations. In terms of self-perception, no significant difference was found between the two groups. The vast majority of students agreed that halitosis could negatively impact a person's life (92.8%). 49.1% of the respondents have been told that they have bad breath and felt embarrassed. **Conclusion:** The greater level of halitosis-related knowledge in HS students indicates the positive impact of HS programs and the potential need for educational initiatives among non-HS students. Halitosis presents a potentially significant issue in the sample, reflecting the relevance of its physical and psychological impact. Broader research with larger and more diverse samples is necessary to improve generalisability.

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**Keywords:** Awareness, Brunei, Halitosis, Self-perception, Undergraduate students.

## INTRODUCTION

Halitosis, characterised by an unpleasant odour originating from the mouth, is a widespread problem affecting over 50% of the population.<sup>1</sup> Clinical research has shown a

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strong association between oral health status and halitosis, with tongue coating identified as a significant factor.<sup>2</sup> In most cases (90%), halitosis arises directly from the oral cavity itself.<sup>3</sup> Individuals with tongue coatings and/or gingival diseases are particularly susceptible to halitosis due to the retention of bacteria responsible for foul-smelling volatile sulphur compounds.<sup>4-10</sup> Less commonly (10-15%), hal-

itosis may result from other factors such as tonsillitis, dietary habits, smoking, or dry mouth, which may indicate an underlying systemic disease.<sup>11-15</sup>

Self-perception of halitosis is significant as it often prompts individuals to improve oral hygiene and mitigate the negative consequences associated with the condition. Halitosis can have psychological and social implications, leading to phobias, depression, changes in behaviour, and impacting self-esteem and social participation.<sup>16,17</sup> Proper oral hygiene practices, focusing on preventing tongue coating and gingival disease, can help address the primary causes of halitosis.<sup>18</sup> Thus, recognising and prioritising the primary prevention of halitosis is crucial to minimising its impact on individuals.

Despite extensive research on the causes, diagnosis, and treatment of halitosis, there is a significant gap in understanding the awareness and self-perception of halitosis among undergraduate students.<sup>19</sup> This study aims to address this gap by focusing specifically on undergraduate students at Universiti Brunei Darussalam (UBD). The authors hypothesise that there may be a difference in the perception of halitosis between undergraduate HS and non-HS students. This is supported by the more specialised education in healthcare-related disciplines that HS students receive, providing them with a deeper understanding of halitosis compared to non-HS students. Their educational background may lead them to prioritise oral hygiene practices and perceive halitosis differently compared to non-HS students who may not have the same level of exposure to oral health topics.

The study sought to assess the level of knowledge and self-perception of halitosis among undergraduate students at UBD, with a specific focus on comparing HS and non-HS students. It aimed to explore disparities be-

tween the two groups regarding awareness, understanding of contributing factors, exposure to educational resources, treatment choices, and preferred healthcare providers. By examining the influence of students' academic background on their perception and knowledge of halitosis, the research aimed to identify factors that contribute to knowledge gaps and misconceptions, ultimately informing the need for educational initiatives.

## METHODOLOGY

In light of the COVID-19 restrictions in place at the time, a cross-sectional study was conducted electronically to minimise the risks associated with potential transmission of the virus. A total of 4108 undergraduate UBD student participants were invited via email, by their respective faculty administrators, to complete a self-administered survey.

The questionnaire used in this study was derived from a previous investigation conducted by Alim et al., with permission and appropriate adaptations made.<sup>20</sup> The closed-ended and structured questionnaire was pre-tested among a total of ten undergraduate students, representing the five faculties. More advanced questions on halitosis knowledge were removed during this pre-testing phase. Additionally, the participant information sheet defined halitosis as 'bad breath' to ensure clarity for all participants.

The survey was sent to undergraduate student participants via email on the 1st November 2020 with a response period of 14 days provided. The email invitations and survey distribution were coordinated through the respective faculty administrators. A reminder to participate in the survey was emailed to all students midway through the response period. Participants who opened the email link were presented with a Participant Information Sheet (PIS) and a consent form to read before proceeding to the survey. The survey did

not collect any participant-identifying information to ensure confidentiality.

Data entry and analysis was done using RStudio Desktop version 1.3. Descriptive statistics were used to report the students' sociodemographic characteristics. Chi-square test for independence was computed to determine the relationship between the knowledge level of halitosis and sociodemographic factors. The test is two-sided and a p-value less than 0.05 was considered statistically significant.

## RESULTS

Of the 279 student participants, 108 subjects (38.7%) were HS students and 171 subjects (64%) were non-HS students. The majority of the participants (73.0%) were female. 53.2% of the participants were below 20 years old. The vast majority (93.9%) were Bruneian, and most were in their 1st and 2nd years of study (33.5% and 38.8% respectively). The participant demographics are shown in [Table I](#).

[Table II](#) displays the frequency and percentage of respondents who identified various factors as causes of halitosis, their exposure to educational materials on halitosis, the effectiveness of different treatments, and their preferred healthcare professionals to consult for halitosis.

Regarding the factors associated with halitosis awareness, it was found that a significant proportion of both non-HS students and HS students believed that halitosis is caused by eating certain types of food (66.7% and 78.7%, respectively) and smoking (71.9% and 84.3%, respectively). A higher percentage of HS students also recognised the presence of cavities in the teeth (86.1% vs. 69.0%), cleaning teeth the incorrect way (79.6% vs. 69.0%), gastrointestinal tract disease (68.5% vs. 42.7%), tonsillitis (40.7%

vs. 26.9%), and some types of medication (49.1% vs. 31.0%) as factors contributing to halitosis.

Moreover, the analysis revealed that educational material about halitosis was more frequently received by HS students (24.1%) compared to non-HS students (2.3%). The majority of respondents in both groups reported not receiving any educational material on halitosis (89.6%).

In terms of treatment options, the use of mouthwash was identified as a possible remedy by a higher percentage of HS students (86.1%) compared to non-HS students (72.5%). Similarly, a greater proportion of HS students (54.6%) indicated that chewing gum could help treat halitosis, compared to non-HS students (35.7%). Brushing teeth was considered a potential treatment by the majority of respondents in both groups (80.1% non-HS students, 90.7% HS students).

When answering about whom they would consult for halitosis, the most common response among both non-HS students and HS students was the dentist (56.1% and 62.0%, respectively), followed by self-treatment (26.3% and 25.9%, respectively). A smaller percentage of respondents mentioned general practitioners as their preferred healthcare professional for halitosis concerns.

[Table III](#) presents the frequency and percentage of respondents' evaluations of received educational material, reasons for not receiving information, perceptions about the treatability of halitosis, ability to provide advice and solutions, perception of the impact of halitosis on a person's life, and experiences of being told they have bad breath and indicate that HS students reported receiving more educational material on halitosis compared to non-HS students, which could contribute to their increased awareness. These

**Table I: Demographic Characteristics of UBD Undergraduate Students Participating in the Study (n=279).**

	Non-HS students (n=171)		HS students (n=108)		Total (n=279)		p-value
	n	%	n	%	n	%	
<b>Gender</b>							
Male	45	26.3	30	27.8	75	26.9	0.810
Female	125	73.1	78	72.2	203	72.8	
Non-response	1	0.6	-	-	1	0.4	
<b>Age (years)</b>							
≤ 20	86	50.3	62	57.4	148	53.0	0.452
> 20	77	45.0	46	42.6	123	44.1	
Non-response	8	4.7	-	-	8	2.9	
<b>Nationality</b>							
Bruneian	162	94.7	99	91.7	261	93.5	0.336
Other	8	4.7	8	7.4	16	5.7	
Non-response	1	0.6	1	0.9	2	0.7	
<b>Degree programme</b>							
Bachelor of Business	46	26.9	-	-	46	16.5	3.661
Bachelor of Science	60	35.1	-	-	60	21.5	
Bachelor of Health Science	0	0.0	108	100.0	108	38.7	
Bachelor of Arts	43	25.1	-	-	43	15.4	
Bachelor of Engineer	22	12.9	-	-	22	7.9	
<b>Major (if Bachelor of Health Science is selected):</b>							
BHS Medicine	-	-	22	20.4	22	7.9	
BHS Dentistry	-	-	24	22.2	24	8.6	
BHS Biomedical Sciences	-	-	23	21.3	23	8.3	
BHS Pharmacy	-	-	12	11.1	12	4.3	
BHS Nursing & Midwifery	-	-	27	25.0	27	9.7	
<b>Year</b>							
1	51	29.8	42	38.9	93	33.3	<b>0.013*</b>
2	68	39.8	40	37.0	108	38.7	
3	19	11.1	19	17.6	38	13.6	
4	32	18.7	7	6.5	39	14.0	
Non-response	1	0.6	-	-	1	0.4	

\* indicates significance,  $p < 0.05$

feeling embarrassed.

Regarding the self-perception of halitosis, there was no significant difference in the responses of both HS and non-HS students. A statistically significant difference was observed between HS and non-HS students in their ability to provide advice and solutions about halitosis. Specifically, 35.2% of HS students answered positively compared to only 17.5% of non-HS students. Regarding the ease of treatment of halitosis, 48.1% HS students and 37.4% non-HS indicated 'it was easy to treat'. A smaller percentage considered it difficult to treat (14.6% non-HS stu-

dents, 14.8% HS students), while a few respondents believed it can't be cured.

Of the participants who reported having received educational material about halitosis (24.1% of HS students and 2.3% of non-HS students), the majority of respondents rated the material as either "good enough" (75.0% non-HS students, 65.4% HS students) or "average" (25.0% non-HS students, 26.9% HS students).

When answering about reasons for not receiving any educational material on halitosis, the most common response among



Table II: Perceived Causes, Educational Exposure, Treatments, and Healthcare Preferences.

	Non-HS students (n=171)		HS students (n=108)		Total (n=279)		p-value
	n	%	n	%	n	%	
<b>Halitosis is caused by (Reponse = "Yes")</b>							
1 Eating some types of food	114	66.7	85	78.7	199	71.6	<b>0.048*</b>
2 Smoking	123	71.9	91	84.3	214	77.0	<b>0.034*</b>
3 Presence of cavities in the teeth	118	69.0	93	86.1	211	75.9	<b>0.004*</b>
4 Cleaning teeth the incorrect way	118	69.0	86	79.6	204	73.4	0.166
5 Bleeding gums	57	33.3	49	45.4	106	38.1	0.101
6 Dry mouth	87	50.9	67	62.0	154	55.4	0.207
7 Cleaning tongue the incorrect way	110	64.3	77	71.3	187	67.3	0.431
8 Gastrointestinal tract disease	73	42.7	74	68.5	147	52.9	<b>&lt;0.001*</b>
9 Tonsillitis	46	26.9	44	40.7	90	32.4	<b>0.045*</b>
10 Accumulation of mucus at the back of throat	72	42.1	48	44.4	120	43.2	0.908
11 Stress	36	21.1	30	27.8	66	23.7	0.447
12 Some types of medication	53	31.0	53	49.1	106	38.1	<b>0.010*</b>
13 Rhinitis	48	28.1	32	29.6	80	28.8	0.884
14 Lung disease	21	12.3	23	21.3	44	15.8	0.109
15 Liver disease	19	11.1	29	26.9	48	17.3	<b>0.003*</b>
<b>Have you ever received any educational material about halitosis?</b>							
Yes	4	2.3	26	24.1	30	10.8	1.0
No	167	97.7	82	75.9	249	89.6	
<b>Can I do the following to treat halitosis? (Response = "Yes"):</b>							
a. Use mouthwash	124	72.5	93	86.1	217	78.1	<b>0.017*</b>
b. Chew gum	61	35.7	59	54.6	120	43.2	<b>0.009*</b>
c. Brush teeth	137	80.1	98	90.7	235	84.5	<b>0.049*</b>
d. Floss at least once a day	107	62.6	82	75.9	189	68.0	0.060
e. Keep yourself hydrated	123	71.9	87	80.6	210	75.5	0.263
<b>Who would you go to when you have halitosis?</b>							
Dentist	96	56.1	67	62.0	163	58.6	0.904
General practitioner	11	6.4	6	5.6	17	6.1	
No one, halitosis can be self-treated	45	26.3	28	25.9	73	26.3	
Other	3	1.8	3	2.8	6	2.2	

\* indicates significance,  $p < 0.05$

both non-HS students (70.8%) and HS students (58.3%) was that they had never researched about it. Other reasons mentioned included not being taught by parents and not being notified by healthcare providers.

When answering if they had ever been told they have bad breath and felt embarrassed, a higher proportion of non-HS students (54.0%) reported experiencing this compared to HS students (47.2%). The vast majority of students (92.8%) indicated that halitosis can negatively affect a person's life.

## DISCUSSION

HS students exhibited a higher level of awareness compared to their non-HS counterparts, particularly regarding the association of halitosis with smoking, tooth cavities, incorrect teeth cleaning, gastrointestinal tract disease, tonsillitis, and certain medications. This suggests that enrolment in HS programmes, which likely included specific education on halitosis-related factors, may play a significant role in shaping students' understanding of halitosis-related factors. Furthermore, our findings indicate that HS students reported receiving more educational material

results suggest that targeted educational initiatives could be effective in improving halitosis awareness among non-HS students.

The students' knowledge regarding the causes of halitosis reveals interesting patterns. While 67.3% of the participants correctly identified improper cleaning of the tongue as a contributing factor to oral malodour, it ranked only fifth in their choices. This observation holds for both Health Science (HS) and non-HS students, with no significant statistical difference between the two groups ( $p = 0.431$ ). Moreover, students displayed a strong association between smoking and halitosis with 77% of students identifying it as a cause. This may be due to anti-smoking messages within the HS curriculum aimed at discouraging tobacco use.<sup>21</sup> These findings align

with Alim *et al.*'s study, which reported that smoking ranked highest among perceived causes of halitosis among Saudi students, with a prevalence of 87.6%.<sup>20</sup> However, 60.2% of Saudi participants correctly identified bleeding gums as a cause, while the corresponding percentage among Bruneian students was only 38.1%. This discrepancy may be attributed to the disparity in educational exposure, with 47% of Saudi participants reporting receiving education on halitosis compared to a mere 10.8% among Bruneian students, indicating a potential correlation between education and knowledge on the topic of halitosis.

When it comes to seeking consultation for halitosis, although there was no significant difference between HS and non-HS

**Table III: Assessment of Educational Material, Treatability Perceptions, and Impact on Individuals.**

	Non-HS students (n=171)		HS students (n=108)		Total (n=279)		p-value
	n	%	n	%	n	%	
<b>If you have received any educational material about halitosis, how would you evaluate it?</b>							
Excellent	0	0.0	2	1.9	2	0.7	0.835
Good enough	3	75.0	17	65.4	20	70.2	
Average	1	25.0	7	26.9	8	26.0	
Poor	0	0.0	0	0.0	0	0.0	
<b>If you have never received any educational material about halitosis, why do you think you have never received any information?</b>							
I have never researched about it	121	70.8	63	58.3	184	66.2	0.651
My parents did not teach me anything about it	9	5.3	3	2.8	12	4.3	
I am not notified by my health care provider	25	14.6	9	8.3	34	12.2	
Other	10	5.8	7	6.5	17	6.1	
<b>About halitosis, do you think...</b>							
It is easy to treat	64	37.4	52	48.1	116	41.7	0.350
It is difficult to treat	25	14.6	16	14.8	41	14.7	
Can't be cured	5	2.9	1	0.9	6	2.2	
I don't know	0	0.0	0	0.0	0	0.0	
<b>Do you think you are able to give advice &amp; solutions about halitosis?</b>							
Yes	30	17.5	38	35.2	68	24.5	0.001*
No	132	77.2	68	63.0	200	71.9	
<b>Do you think that halitosis can negatively affect a person's life?</b>							
Yes	153	89.5	105	97.2	258	92.8	0.051
No	9	5.3	1	0.9	10	3.6	
<b>Have you ever been told that you have bad breath and felt embarrassed?</b>							
Yes	87	54.0	50	47.2	137	49.1	0.272
No	74	46.0	56	52.8	130	46.6	

\* indicates significance,  $p < 0.05$

students, a majority (58.6%) expressed their preference for seeking advice from a dentist, while only 6.1% of students indicated their intention to seek consultation with a general practitioner. This is an encouraging finding, as unless patients present significant personal or family history of systemic diseases, redirecting them away from dentists may result in delayed diagnosis and treatment of halitosis.<sup>22</sup>

In addition to the findings discussed earlier, it is noteworthy that nearly half of the participants (49.1%) in this study reported being informed about their bad breath and experiencing feelings of embarrassment. This suggests that awareness of halitosis is relatively high among the student population. Interestingly, the incidence rate did not show a significant difference between HS and non-HS students ( $p = 0.272$ ), indicating that the issue of halitosis affects students across different educational settings. Comparing these results to a previous study conducted by Alim *et al.*, where only 36.7% of student participants reported being informed about having halitosis, suggests that there may be differences in the level of awareness or communication about halitosis between the populations studied.<sup>20</sup> This variation could be attributed to cultural, educational, or healthcare system differences. Further investigation and comparative studies would be valuable in understanding the factors contributing to the discrepancy in reported awareness levels.

There are several limitations to this study. Due to a low response rate (6.8%), the sample size of 279 fell short of the minimum number of 384 required needed to achieve a precision (power) of 5% with an expected proportion of 50% at a 95% confidence level. Therefore, there is higher than acceptable probability of Type II (beta) error limiting generalisability of the findings. Another limitation is that some items in the questionnaire relied on the respondents' re-

call accuracy, which may have affected the reliability of the results. Additionally, the study may be subject to response bias, as those who chose to participate may have had a greater interest or knowledge about halitosis than those who did not participate. One aspect to consider is the presence of non-responders to certain questions, which could introduce limitations in our study. This potentially affects the statistical power and precision of the results and the non-response bias could impact the representativeness and generalisability of our findings. Objective measures, such as clinical assessments of halitosis or observations of oral hygiene practices, would provide more accurate and reliable data. Alternatively, including focus group discussion could help to explore and enhance the data collected. Additionally, the study focused on undergraduate students at a single institution (UBD), which may limit the generalisability of the findings to other populations or settings. Cultural and contextual factors specific to the university and Brunei Darussalam could have influenced the results.

## CONCLUSION

The greater level of halitosis-related knowledge in HS students, indicates the positive influence of HS programmes and suggests a potential need for increased educational initiatives for non-HS students. Notably, nearly half of all students (49.1%) reported being informed about their bad breath and experiencing feelings of embarrassment, indicating a potentially significant issue in the sample. Encouragingly, both student groups identified dentists as their preferred healthcare professionals for halitosis concerns. The study highlights the need for broader research involving larger and more diverse samples to enhance generalisability to other student populations.

## ETHICAL CONSIDERATIONS

The study received ethics approval from the PAPRSB IHS Research Ethics Committee (IHSREC):ERN:UBD/PAPRSBIHSREC/2020/51

## CONSENTS

Informed consent were obtained from all individual participants included in the study and for submission for publication.

## DECLARATION OF CONFLICT OF INTEREST

The authors have no conflict of interest to declare.

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