Original Article

Relationships of Acculturative Stress, Perceived Stress, and Social Support with Oral Health-related Quality of Life among International Students in Malaysia: A Structural Equation Modelling

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ABSTRACT

Aim: This study aimed to investigate the relationships between acculturative stress, perceived stress, social support, and subjective oral health outcomes among international graduate students in Malaysian public universities. **Materials and Methods:** A total of 312 international graduate students completed a web-based questionnaire, including measures of acculturative stress (ASSIS-36), perceived stress scale (PSS-4), social support (MSPSS-12), oral health perceptions (global rating item), and oral health-related quality of life (OHRQoL, OIDP-8). The hypotheses of the conceptual model were tested using structural equation modeling-partial least squares (SEM-PLS) with the support of SmartPLS. **Results:** Twenty-seven percent (27.1%) of the variance in OHRQoL was explained by acculturative stress, perceived stress, social support, and oral health perceptions. The path coefficient between oral health perception and OHRQoL was the strongest ($\beta = -0.385$, $P < 0.001$). Acculturative stress directly influenced OHRQoL ($\beta = 0.20$, $P = 0.009$) and indirectly through perceived stress ($\beta = 0.05$, $P = 0.019$). Social support mediated the relationship between perceived stress and OHRQoL ($\beta = 0.046$, $P = 0.02$). The overall predictive power of the model was 23%. **Conclusion:** Results indicated that acculturative stress, perceived stress, and social support are among the predictors of OHRQoL. Oral health perceptions and acculturative stress were the most significant predictors that contributed the largest amount to the model. The findings emphasize the potential role of psychosocial factors in relation to oral health. The empirical evidence of this study could facilitate the planning of targeted strategies that address stress reduction and social support. Such strategies might be a new promising way to enhance OHRQoL as these elements can be modified and response to interventions.

KEYWORDS: *Oral health, Quality of life, Perceptions, Acculturative stress, Perceived stress, Social support, International students, Malaysia, Structural Equation Modelling*

INTRODUCTION

The oral health concept follows the change from the biomedical perspective to the psychosocial perspective, which considers other essential roles of the oral cavity in interaction and communication. Oral health-related quality of life (OHRQoL) pertains to the oral health impact on individual well-being and overall quality of life. OHRQoL is a multidimensional construct that influenced by different factors other than clinical factors.[1,2]

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Many studies on the potential determinants of OHRQoL mainly addressed the clinical, socioeconomic, and demographic characteristics, which may explain only part of the variation of the OHRQoL.[3-6] However, a growing interest directed toward the roles of psychosocial factors as determinants of OHRQoL.[7-11]

To continue a postgraduate study overseas is a stressful life event in which international students may encounter additional stressors besides the rigors of education that may arise from differences in the environment and culture of the new host country. Such experienced stressors can lead to a kind of stress known as acculturative stress, which is related to a reduction in physical, psychological, and social health.[12]

It has been suggested that the cultural changes encountered by individuals in a new country may have either beneficial or deleterious impact on their oral health and oral health-related behaviors. However, the available oral health-related literature focused mainly on acculturation rather than acculturative stress, in addition to the usage of unidimensional proxies to measure acculturation, that is, host language proficiency, age at migration, and length of residency. According to the existing evidence, acculturation was found to have positive associations with different oral health outcomes.[13,14] Nevertheless, the oral health impact of acculturation in international students has been underreported, whereas it has been widely discussed in immigrants and ethnic minority groups.

Social support is the other crucial concern for international students due to separation from familiar social networks. The literature provides strong evidence for the social support role in stress reduction, specifically the acculturative stress.[15,16] Also, in relation to oral health outcomes, many studies reported positive associations with social support.[17]

There is a research scarcity in the field of acculturative stress and oral health in general and OHRQoL in specific. Hence, there is a gap in the literature concerning the effect of acculturative stress on oral health outcomes. Moreover, a neglected part of the acculturated groups, international students, is yet to be studied. Identifying the relationships between these psychosocial factors and OHRQoL is vital, especially in a multicultural Asian country like Malaysia, with unique characteristics compared to western and eastern cultures. Such determinants may provide opportunities and directions for new oral health promotion strategies.

In this context, the researchers hypothesized that international students might experience additional stress, that is, acculturative stress, which may affect subjective oral health outcomes. Moreover, the effect of such stress might be buffered by the influence of social support. Thus, this study aimed to examine the relationships between acculturative stress, perceived stress, and social support with their effects on the subjective oral health outcomes (oral health perceptions and OHRQoL) among international graduate students in Malaysian public universities.

RESEARCH METHODS

STUDY CONCEPTUAL FRAMEWORK

The conceptualized model was adapted mainly from the revised Wilson and Cleary model by Ferrans et al.,[18] which is a multidimensional model that captures the psychosocial and biomedical concepts of health. In this model, five levels of health outcomes are described in a linear sequence of causal links along a causal pathway. The five health outcomes on a continuum from left to right are (a) biological/physiological factors, (b) symptoms status, (c) function status, (d) general health perceptions, and (e) overall quality of life. The effect of individual and environmental characteristics is acknowledged in this model. The possibility of bidirectional and reciprocal relationships is acknowledged as well but not explicitly presented.

The revised Wilson and Cleary model was selected to guide this research because it is clear, adequate, and consistent. Also, it is useful in all individuals regardless of their age, culture, or disease and health conditions.[19]

The selected measures to operationalize the revised Wilson and Cleary's model are shown in [Figure 1]. The first three health outcomes, namely, biological, symptoms, and functional status, were not included in this study. Oral health perception and OHRQoL
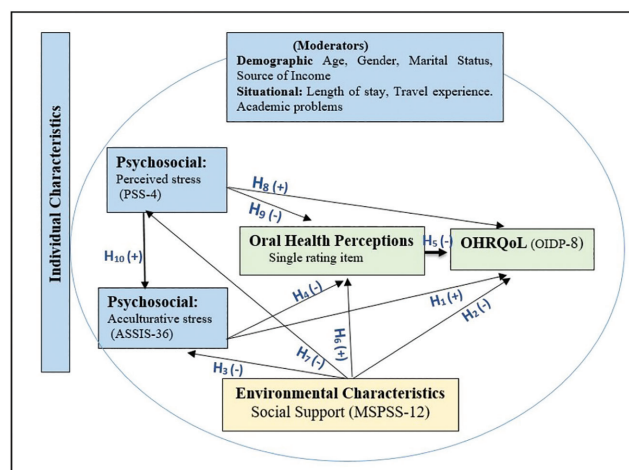

Figure 1: Conceptual framework of study variables. Adapted from revised Wilson and Cleary model, Ferrans et al.[18]

were assessed. Social support was modeled as an environmental characteristic. The individual characteristics included in this paper were acculturative stress and perceived stress. The other individual characteristics, namely, age, gender, marital status, source of income, length of stay and previous travel experience, and academic problems, were all modeled as moderators and discussed elsewhere.

RESEARCH DESIGN

The employed design was a descriptive, quantitative, cross-sectional study.

PARTICIPANTS

The study population is international graduate students attending public universities in Malaysia. The participants' inclusion criteria were non-Malaysian, resident temporarily in Malaysia for study purposes, the minimum duration of stay in Malaysia was 6 months, pursuing postgraduate education in Malaysian public university. A universal sampling method was employed, and those who met the inclusion criteria were invited to participate in this study.

MEASURES

1. *Sociodemographic and situational characteristics*: The questions developed based on the literature by the main researcher and were modeled as moderators. Sociodemographic characteristics included were age, gender, marital status, and source of income, whereas situational characteristics included were the presence of academic concerns/problems, length of stay in Malaysia, and previous travel experience.

2. *Acculturative stress*: Acculturative Stress Scale for International Students (ASSIS-36) by Sandhu and Asrabadi[20] was used. It consists of 36 items with seven main subscales, namely, homesickness, discrimination, fear, perceived hate, guilt, stress due to change/culture shock, and miscellaneous. The participants responded to the questions using a 5-point Likert scale "1 = Strongly disagree, 2 = Disagree, 3 = Not sure, 4 = Agree, 5 = Strongly agree." The overall score was the sum of the scores of the 36 questions, which ranged from 36 to 180, with higher scores reflecting higher acculturative stress perceived by the students.

3. *Perceived stress*: Perceived Stress Scale (PSS-4) by Cohen *et al.*[21] was used. It consists of four items with a five-point Likert "0 = Never, 1 = Almost Never, 2 = Sometimes, 3 = Fairly Often, 4 = Very Often." Scores are obtained by summing across all four items. The overall score ranges from 0 to 16;

the higher the scores, the greater are the levels of perceived stress.

4. *Social support*: Multidimensional Scale of Perceived Social Support (MSPSS-12) by Zimet *et al.*[22] was used. It consists of 12 items with three domains (friends, family, and significant others). The items rated on a seven-point Likert scale "1 = Very Strongly Disagree, 2 = Strongly Disagree, 3 = Mildly Disagree, 4 = Neutral. 5 = Mildly Agree, 6 = Strongly Agree, 7 = Very Strongly Agree." The overall score ranges from 12 to 84), the higher scores indicating higher perceived social support.

5. OHRQoL: Oral Impact on Daily Performance (OIDP-8) by Adulyanon and Sheiham[23] was used. This is an eight items index with three domains, namely physical, social, and psychological. To measure severity, six options of varying severity "0 = None, 1 = Very Little, 2= Little, 3 = Moderate, 4 = Severe, 5=Very Severe." The frequency was measured by six choices with different frequency affected "0 = never affected, 1 = less than once a month, 2 = once or twice a month, 3 = once or twice a week, 4 = three or four times a week, 5 = nearly every day." The score for each item was calculated by multiplying the severity with frequency and ranged from 0 to 25. The sum of the eight items represents the overall score that ranged from 0 to 200.

6. *Oral health perception*: It was measured by a global rating question, where participants rated their oral health status on five points Likert scale "1 = Poor, 2 = Fair, 3 = Good, 4 = Very Good, 5 = Excellent".

PRETESTING OF THE QUESTIONNAIRE

Pretesting was conducted to evaluate the face validity in terms of the wording, clarity, appropriateness of the items, identifying/reporting any ambiguous items, difficulties with language, technical jargon, instructions used, and to estimate the required duration to complete the questionnaire. Twenty international postgraduate students were approached by the investigator at the Visa Unit, University of Malaya. The nature and purpose of this invitation were explained. The paper-pencil questionnaire was administered to the participants. Necessary amendments were made according to the feedback.

RELIABILITY OF THE QUESTIONNAIRE

In terms of test–retest reliability, 30 participants were recruited and asked to fill the questionnaire twice, 14 days apart. The overall questionnaire (ICC) ranged between 0.55 and 0.96. The internal consistency of the questionnaire was also evaluated by the reliability coefficients (Cronbach

α). Cronbach α of included scales: ASISS (0.95), PSS-4 (0.71), MSPSS (0.86), and OIDP (0.85).

DATA COLLECTION

The protocol was reviewed and approved by the Medical Ethics Committee, Faculty of Dentistry, University of Malaya (DFCO1815/0089P). Permission letters were sent to the postgraduate institute/center of six public universities. After follow-ups in the form of emails, phone contacts, and repeated reminders over 6 weeks, five public universities responded by either providing the lists or distributing the questionnaire' URL link via their email system. Participants were excluded when not fulfilling the inclusion criteria (as listed above) by screening their responses to specific personal information questions (length of stay in Malaysia, original country, and degree type). The survey link was made available to the participants for 6 months (February–July 2019), and follow-up reminders were sent as needed.

DATA ANALYSIS

The hypotheses of the conceptual model were examined using structural equation modeling (SEM-PLS) supported by SmartPLS 3.2.8.[24] The explanatory power of the model assessed by means of R^2 of the dependent outcomes. The Blindfolding procedure was used to test out-of-sample predictive power (Q^2). Bootstrapping technique (with 5000 subsamples) was used to calculate the t value for the statistical significance of the paths. All statistical tests were assessed at 0.05 level of significance. The researchers applied the cut-off values as outlined in Table 1.

RESULTS

PARTICIPANTS CHARACTERISTICS

A total of 325 completed web-based questionnaires, of which 13 were excluded because their length of stay was less than 6 months. As a result, 312 questionnaires included in the analysis, of which female's responses constituted 111 (35.6%), and male's responses constituted 201 (64.4%). The mean age of students was 33.6 (standard deviation [SD] = 7.1). Table 2 presents the sample characteristics.

THE STUDY VARIABLES AND THEIR CORRELATIONS

Descriptive statistics of the variables with the α coefficient are presented in Table 3. The α coefficient of the measures ranged between 0.61 and 0.94.

A preliminary assessment of the correlation matrix between the main study variables was made using Spearman's correlation [Table 4]. The bivariate correlation results showed that 9 of 10 correlations were statistically significant, with (r) values ranged between –0.5 and 0.12.

MODEL TESTING

Measurement model (outer model) results

a. *The formative measurement models*: Bootstrapping procedure results showed that the weights of all items were found to be significant ($t > 1.96$, $P < 0.05$), signifying that sufficient item (indicator) validity had been achieved. The items' weights ranged between 0.2 and 0.9. All variance inflation factor (VIF) values were found to be less than 3, which means that there was no multicolinearity and indicating sufficient construct validity of the formative indicators [Supplement 1].

b. *The reflective measurement model*: Results revealed that the average variance extracted (AVE) range in this study was above the recommended threshold (0.52–0.66). The heterotrait-monotrait ratio of correlations (HTMT) values were acceptable and ranged between 0.42 and 0.66. All the indicator loadings were above 0.70, except for item 7 in MSPSS (I can count on my friends when things go wrong). The item loading was (0.67), which is still considered as acceptable as AVE value above 0.50. All reflective constructs revealed reliability values well above the recommended level of 0.70 and ranged between 0.81 and 0.88 [Supplement 2].

Structural model (inner model) results

Figure 2 summarizes the structural model results, including path coefficients (β) and explained variance (R^2). The R^2 value of OHRQoL was 0.271 (substantial), indicating that 27.1% of the variance in OHRQoL is predicted by acculturative stress, perceived stress, oral health perceptions, and social support. Although 14.8% of the variance (moderate) in acculturative stress is predicted by perceived stress and social support, only 5.9% of the variance (weak) in oral health perception is explained by acculturative stress, perceived stress, and social support. Results of individual testing of direct and indirect paths are presented in Tables 5 and 6, respectively.

DISCUSSION

This study confirmed the hypothesis that individuals who experienced higher acculturative stress levels had greater effects on their OHRQoL, and better oral health perceptions are related to better OHRQoL. This study also confirmed the inverse relationship between social support and stress (acculturative stress and perceived stress).

This study is the first that specifically examined the relationship between acculturative stress measured by a multidimensional scale and OHRQoL among international student population. The vast majority of previous studies are relating acculturation to different oral health outcomes among immigrants and ethnic minority groups.[13,14] Most of the research on oral health was based on unidimensional acculturation proxies, which resulted in contradictory findings revealing only one direction.[14]

As it was expected, the acculturative stress in this study not only directly affects OHRQoL but also indirectly affects it through the perceived stress. The results of the SEM indicated that acculturative stress significantly predicted OHRQoL. It can be interpreted that as one's acculturative stress increases, the OHRQoL becomes poor. Explaining the possible

mechanisms that link acculturative stress to OHRQoL is beyond the scope of this study. Nevertheless, one of the possible pathways through which the acculturative stress might affect OHRQoL is via the adoption of unhealthy behaviors, for example, diet and smoking. This assumption is supported by findings of studies linking different kinds of stressors with the deterioration of oral health outcomes.[25-28] The assessment of such risky health behaviors that were not included in the present model may have added more clarity to the results and provided a complete picture.

This model also indicated another possible pathway to better understand the relationship between OHRQoL and acculturative stress. The findings support that perceived stress might be one pathway through which acculturative stress contributes to the impact on

Table 1: Cutoff pointsfor PLS assessment criteria		
A. Measurement model		
Assessment	**Criterion**	**Note**
Item reliability	Item loading on parent factor.	Min. of 0.50 Hair et al.,[45]
Convergent validity	1. indicator loading on parent factor, and Loadings with sig. *p*-value	Min. of .050 $p < 0.05$ Hair et al.,[45]
	2.Composite reliability	> 0.70 Hair et al.,[45]
	3.Average variance extracted (AVE)	> 0.50 Hair et al.,[45]
Discriminant validity	Heterotrait-monotrait ratio (HTMT)	< 0.85 Henseler et al.,[46]
Reliability	Cronbach's alpha	>0.70 Hair et al.,[45]
Multi- collinearity	Variance inflation factor (VIF)	< 3 Kock,[47]
B. Structural model		
Bootstrapping	T value	>1.96 Hair et al.,[45]
	Coefficient of determination (R^2)	R^2 value of 0.10 as a minimum acceptable level. Falk and Miller,[48] >0.26 substantial >0.13 moderate 0.02-0.12 weak Cohen,[43]
	Path coefficient	Magnitude Sign p-value Hair et al.,[45]
	Predictive relevance (Q^2)	>0 0.02 weak 0.15 moderate 0.35 strong Cohen,[49]

OHRQoL. However, other factors, for example, type of personality, coping ability, and support sources, have a key role in appraising the impact or severity of the same stressful event experienced by different individuals.[29]

Table 2: The sample's characteristics	
Characteristics	***n* (%)**
Age (years)	
<29	97 (27.6)
30–40	169 (84.1)
>40	46 (13.1)
Gender	
Male	201 (64.4)
Female	111 (35.6)
Marital status	
Single	119 (38.1)
Married	191 (61.2)
Divorced/widowed	2 (0.6)
Origin country	
Arabic countries	202 (64.7)
Asian countries	77 (24.67)
African countries	32 (10.2)
USA	1 (0.3)
Financial source	
Scholarship/funding	94 (30.1)
parents/family	111 (35.6)
Personal earning/saving	88 (28.2)
Others (more than one source)	19 (6.1)
Duration of stay	
6 months –1 year[1]	76 (24.4)
1–3 years[1]	110 (35.3)
>3 years	126 (40.4)
Prior travelling experience	
Yes	251 (80.4)
No	61 (19.6)
Degree	
Diploma	4 (1.3)
Master	129 (41.3)
PhD	179 (57.4)
Study discipline	
Humanities	54 (17.3)
Social science	78 (25.0)
Natural science	28 (9.0)
Formal science	33 (10.6)
Applied science	119 (38.1)
Experiencing academic problems	
Yes	201 (64.4)
No	111 (35.6)

[a]Recoded into one group (less than 3 years)

One of these relevant factors that have been prominently addressed in the literature and implicated as a resource for reducing stress is social support. According to the gathered evidence, social support was revealed as a key player in maintaining health and reducing the detrimental effects of stress. Consistent with previous studies, social support was inversely correlated with each of perceived stress and acculturative stress, and high social support predicted lower perceived/acculturative stress.[30-33]

Contrary to our expectations, the direct impact of social support on OHRQoL was not significant. However, the indirect path analysis revealed social support as a mediator between OHRQoL and perceived stress. Our analysis supports that the effects of social support might be through reducing the stress and indirectly affecting OHRQoL. These results are in accordance with previous studies that have reported the indirect role of social support on OHRQoL.[8,17] The protective role of social support on oral health was argued to be either by mediating the sense of coherence (SOC) or indirectly by influencing SOC in coping with stress.[8]

Surprisingly, neither acculturative stress, perceived stress, nor social support, had any significant effect on oral health perceptions. However, the direction of relationships generally supports other research showing the negative relationships between stress and favorable self-rating oral health[34-37] and the positive association with social support.[38,39] Nevertheless, the lack of significance could indicate that such factors, that is, acculturative stress, appeared less critical to self-rated oral health status compared to OHRQoL, which in turn provides a possible answer to why a lot of the variation in the oral health perceptions left unexplained.

The path coefficients between oral health perception and OHRQoL was the strongest ($\beta = 0.385$), which lend it to be the most important predictor in our model. Consistent with other studies, our results indicated that students who rated their oral health favorably had better OHRQoL than those who rated their oral health unfavorably.[40,41] The current model showed that oral health perceptions had the most substantial influence on OHRQoL, suggesting that oral health perceptions contribute to OHRQoL as both reflect the individuals'

Table 3: α-Coefficient, score range, mean, and median of study variables					
	α Coefficient	**Min–Max**	**Mean (SD)**	**95% CI**	**Median (IQR)**
OHRQoL	0.92	0–48	5.47 (9.1)	4.2–6.1	1 (7.75)
Acculturative stress	0.94	36–174	95.1 (26.1)	92.2–98.0	95.5 (37.7)
Perceived stress	0.61	0–16	7.26 (3.0)	6.9–7.6	7.0 (4.0)
Social support	0.89	12–84	64.3 (13.3)	62.8–65.7	66 (19.7)

perception of oral health. This finding confirms what has been recommended by Locker and Allen[42] to use the global oral health rating concurrently with OHRQoL measures to better assess " the broader meaning and significance of the functional and psychosocial impacts."

Overall, the included variables explained 27.1% of the variance in OHRQoL, which is considered substantial according to the cut-off points set by Cohen.[43] Oral health perceptions and acculturative stress were the most significant predictors that contributed the largest amount to the model. This finding reflects their potential role in explaining OHRQoL, specifically in the international student population. Perceived stress and social support contributed less to the overall explanatory power of the model, and both had significant indirect effects on OHRQoL.

Results also revealed that the predictive power of the OHRQoL construct was medium ($Q^2 = 23\%$).[43] The Q^2 values represent an evaluation criterion for the cross-validated predictive relevance of the model out-of-sample.[44] The result refers to the adequate ability of

the current model to predict out of the sample, which further adds to the current model validity.

In this study, individual characteristics (sociodemographic and situational characteristics) were modeled as moderators of the relationships [Figure 1]. Their moderating effects on the entire model relationships were assessed by multigroup analysis (PLS-MGA), which compares the effect of every structural path across different groups, for example, males vs. females. However, the results of this robust analysis were not included here and discussed elsewhere.

Besides adding to the existing body of knowledge, the findings of this study could provide data to the Malaysian Ministry of Higher Education (MOHE) to promote and realize its plans for the current internationalization policy. Especially in terms of a conducive environment in which a friendly and supportive environment must be facilitated by universities for international students. Promoting international students oral health might better target psychological/social wellbeing. For instance, stress reduction, which becomes an integral

Table 4: Correlation matrix of study variables				
Study variables	1	2	3	4
OHRQoL	1.000			
Acculturative stress	0.200**	1.000		
Perceived stress	0.218**	0.383**	1.000	
Social support	−0.134*	−0.155**	−0.256**	1.000
OH perception	−0.483**	−0.094	−0.170**	0.128*

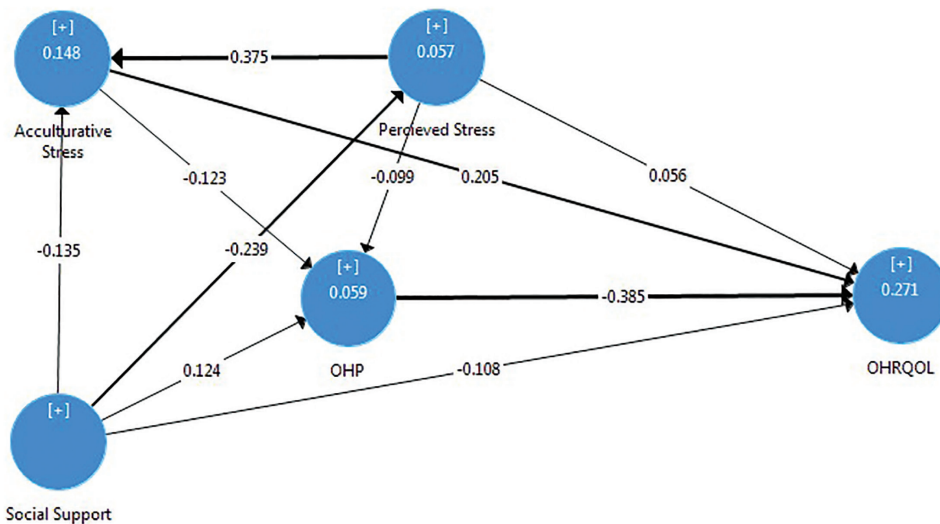Spearman's correlation is significant at *0.05 and **0.01 levels (two-tailed)

Figure 2: Structural model results. Numbers on the arrow (β), the path coefficients; numbers inside the circle (R^2), the explained variance; the thickness of the arrow indicates the path coefficients weight to rank their relative statistical importance; OHP = oral health perceptions

Table 5: Path coefficient and significance of the research hypotheses (direct effect)

Hypo	Relationship	β	T Value	P Value	Decision
H1	ACS –> OHRQoL	0.205	2.63**	0.009	Supported
H2	SS –> OHRQ0L	−0.108	1.352	0.176	Not supported
H3	SS –> ACS	−0.135	2.502**	0.007	Supported
H4	ACS –> OHP	−0.123	1.441	0.15	Not supported
H5	OHP –> OHRQOL	−0.385	5.55***	0.001	Supported
H6	SS –> OHP	0.124	1.312	0.19	Not supported
H7	SS –> PS	−0.239	2.642**	0.008	Supported
H8	PS –> OHRQoL	0.056	0.656	0.512	Not supported
H9	PS –> OHP	−0.099	0.911	0.362	Not supported
H10	PS –> ACS	0.375	4.26***	0.001	Supported

ACS = acculturative stress, PS = perceived stress, SS = social support, OHP = oral health perceptions

$T > 1.96$ at $P < 0.05$

Table 6: The bootstrapping analysis of indirect effect (mediating effect)

Path	β	T Value	P Value	IV–> mediator (Path a)	Mediator –> DV (Path b)	SD	Bootstrapped CI 95% LL – UL
ACS –> SS –> OHP	−0.024	1.67	0.095	–	–	–	–
PS –> SS –> OHP	−0.034	1.82	0.069	–	–	–	–
ACS –> SS –> OHRQoL	0.032	1.78	0.075	–	–	–	–
PS –> SS –> OHRQoL	0.046	2.23	0.026	−0.247	−0.186	0.021	0.004 0.087
ACS –> PS –> OHRQoL	0.05	2.35	0.019	0.414	0.126	0.022	0.0090.095
PS –> ACS –> OHRQoL	0.12	2.50	0.012	0.383	0.308	0.047	0.0250.210

ACS = acculturative stress, PS = perceived stress, SS = social support, OHP = oral health perceptions

$T > 1.96$ at $P < 0.05$

element of systemic healthcare promotion approaches, i.e., the common risk factor strategy. In addition, to emphasise social support by improving the quality of social support and networks via encouraging national students to interact with international students, e.g. organising social events that aim to bring local and international students together. Interventions that address the stress reduction and social support might be a new promising way for enhancing oral health as both are modifiable and responsive to interventions.

LIMITATIONS AND SUGGESTIONS FOR FURTHER RESEARCH

Our findings should be interpreted within the limitation of this study. First, the nature of the study instrument (self-reported) might subject the results to social desirability or random responses. However, to minimize the effects of bias, the researchers addressed this concern before data collection (*ex ante*), through the careful design of the study's instrument, where different scale response options and anchor labels were used. The confidentiality and anonymity of the participants were also guaranteed. The participants were informed that there is no correct or preferred answer.

Second, the cross-sectional design of data collection scientifically less rigorous than the longitudinal studies. It would be more suitable in future studies to identify the causal relationships and to explore the findings' stability over time using longitudinal data.

Third, although the participants were drawn from five different public universities that constitute the largest public recognized universities in Malaysia, because of the employed sampling method, it is questionable whether or not the participants are proportionately representative of students attending higher education institutions in Malaysia. As a result, the generalizability of our findings was limited. Hence, it is recommended to apply sampling methods that ensure target population representation, for example, stratified random sampling.

CONCLUSION

Although clinicians aim to improve OHRQoL through dental treatments, researches emphasize the role played by other factors in the broader context. Our findings show that international students with high acculturative stress levels had a greater impact on OHRQoL. These results warrant a greater emphasis on the significant role of psychosocial factors in predicting and explaining subjective oral health outcomes. Individuals like international students who are experiencing stressful lives may differentially need vigilant maintenance of their oral health more than which is needed in less-stressed individuals. Our findings also highlight the importance of psychosocial research to facilitate the planning and development of targeted strategies and further enhance OHRQoL.

CONFLICTS OF INTEREST

There are no conflicts of interest.

AUTHORS CONTRIBUTIONS

Both authors had contributed to study conception and design First author: data collection, data acquisition, data analysis & interpretation, manuscript writing and editing. Second author: manuscript editing and review.

ETHICAL POLICY AND INSTITUTIONAL REVIEW BOARD STATEMENT

The Institutional Review Board approval was obtained From the Medical Ethics Committee, Faculty of Dentistry, University of Malaya (DFCO1815/0089P).

PATIENT DECLARATION OF CONSENT

Participants were informed that completing and submitting the questionnaire indicates consenting to be part of the study.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the author Dr.Hala BenGhasheer (Ladyhala_1984@gmail.com)

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Supplement 1: Outer weights, statistical significance, and collinearity assessment (VIF) of the formative Constructs

Second Order Construct	First Order Construct (Dimensions)	Item	Outer Weights	t Value	P Values	VIF
Acculturative Stress (Formative)	Perceived Discrimination	AS-3	0.741	2.42	0.001	1.257
		AS-9	0.740	5.45	0.001	1.204
		AS-11	0.667	3.604	0.001	1.741
		AS-14	0.725	5.113	0.001	1.977
		AS-17	0.784	3.337	0.001	1.267
		AS-23	0.806	3.762	0.001	2.003
		AS-26	0.828	4.118	0.001	2.259
		AS-29	0.590	2.014	0.03	1.625
	Homesickness	AS-1	0.578	2.282	0.023	2.141
		AS-6	0.918	8.409	0.001	1.55
		AS-21	0.506	2.245	0.041	2.08
		AS-35	0.712	2.832	0.005	1.257
	Perceived Hate	AS-4	0.666	5.39	0.001	1.68
		AS-15	0.796	2.494	0.013	1.516
		AS-20	0.823	6.154	0.001	1.385
		AS-24	0.856	3.489	0.001	2.155
		AS-33	0.814	4.320	0.001	3.092
	Fear	AS-7	0.673	1.991	0.01	2.578
		AS-18	0.790	4.618	0.001	2.848
		AS-27	0.769	4.803	0.001	1.862
		AS-31	0.837	7.736	0.001	1.626
	Guilt	AS-10	0.723	3.83	0.001	1.946
		AS-34	0.927	9.295	0.001	2.181
	Cultural Shock	AS-2	0.542	2.117	0.034	1.698
		AS-13	0.846	10.09	0.001	1.439
		AS-22	0.835	8.196	0.001	1.949
	Miscellaneous	AS-5	0.366	3.068	0.002	2.57
		AS-8	0.535	3.903	0.001	1.204
		AS-12	0.792	6.072	0.001	1.547
		AS-16	0.679	4.446	0.001	1.337
		AS-19	0.673	3.411	0.001	1.396
		AS-25	0.774	3.212	0.001	1.241
		AS-28	0.669	4.436	0.001	1.354
		AS-30	0.649	3.339	0.001	1.82
		AS-32	0.736	4.410	0.001	1.385
		AS-36	0.516	2.726	0.006	1.933
Perceived stress (Formative)	Perceived Helplessness	PS1	0.896	11.38	0.001	1.364
		PS4	0.843	8.954	0.001	1.364
	Perceived self- efficacy	PS2	0.92	11.95	0.001	1.169
		PS3	0.712	5.92	0.001	1.169
OHRQoL (Formative)	Physical dimension	OIDP-1	0.715	3.754	0.001	1.207
		OIDP-2	0.892	6.223	0.001	1.881
		OIDP-3	0.792	3.454	0.001	1.793
	Psychological dimension	OIDP-4	0.785	5.486	0.001	1.321
		OIDP-5	0.857	3.51	0.001	2.277
		OIDP-6	0.870	3.237	0.001	2.343
	Social dimension	OIDP-7	0.972	5.303	0.001	1.735
		OIDP-8	0.811	2.399	0.017	1.735

Note: VIF: Variance inflation factor <3, *t* value <1.96, *P* < 0.05

Constructs	Items	Reliability	Convergent Validity			Discriminative Validity		
		Cronbach α	Loading	CR	AVE	HTMT		
Social support from family (SSFM)	SS-3	0.847	0.728	0.849	0.585	SSFM	SSFR	SSSO
	SS-4		0.794					
	SS-8		0.723					
	SS-11		0.811					
Social support from friends (SSFR)	SS-6	0.885	0.796	0.887	0.662	0.433		
	SS-7		0.67					
	SS-9		0.887					
	SS-12		0.807					
Social support from significant others (SSSO)	SS-1	0.882	0.772	0.883	0.654	0.493	0.665	
	SS-2		0.843					
	SS-5		0.838					
	SS-10		0.779					

Supplement 2: Reliability, convergent and discriminant validity of social support constructs

Cutoff values: Cronbach α > 0.7, Loadings > 0.7, CR >0.7, AVE >0.5, HTMT<0.85