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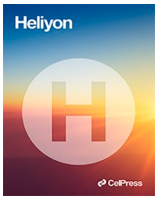

Research article

# Prevalence of test anxiety and its determinants among nursing students in Selangor, Malaysia

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ABSTRACT

The current education system significantly emphasizes tests and evaluations as crucial factors in determining a student's future career path. It has been shown that nursing students have moderate to high levels of Test Anxiety (TA), which results in decreased academic performance, low self-esteem, and an inability to complete the program and pursue a career in nursing successfully. This study aimed to determine nursing students' level of TA and its relationship with demographic characteristics. Four hundred twenty-one nursing students at seven private universities and colleges in Selangor participated in this cross-sectional study. The level of TA was measured using the TA Inventory (TAI). A total of 62.5% of the respondents had mild TA, 25.4% had moderate TA and 2.1% had severe TA. There were significant relationships between TA level and household income ($\chi^2 = 6.70$, $p = 0.035$) and ethnic groups ($F(3,417) = 5.20$, $p = 0.002$) where Chinese and Indians are protective from TA compared to the Malays and other ethnic groups and high anxiety was significant in the Ringgit Malaysia (RM 3000) and below group. The study's findings indicate that a significant percentage of nursing students involved in the research had mild to moderate levels of test anxiety (TA) and there is a significant association between TA and demographic characteristics. The results indicate the importance of early identification of TA and the need for interventions to overcome TA to ensure they are emotionally, physically, and academically successful.

## 1. Introduction

Life as a university student is one of the most demanding stages of a person's life, as it imposes study challenges. In the current educational system, tests and evaluations significantly determine students' future career paths. Behavioral and cognitive symptoms are possible outcomes of prolonged exposure to high levels of stress and anxiety. Prolonged exposure to high levels of stress and anxiety might result in the manifestation of behavioral and cognitive problems. It can impair a student's capacity to focus and remember and may also cause physical. Symptoms such as headaches, diarrhea, increased respiration, and dizziness. In the most extreme instances,

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individuals may have symptoms such as nausea, difficulty breathing, or even a complete panic attack [1], and all this can prevent any learning from taking place, which in turn impacts the student's academic achievement. Students experience various emotions in response to the pressure of tests and examinations, with test anxiety (TA) being the most prevalent. The term TA originated from the concept of anxiety. Test anxiety is defined as the set of phenomenological, physiological, and behavioral responses that accompany concern about possible negative consequences or failure on the examination or similar evaluative situation [2].

The concept of TA has implications for all levels of education. Studies have indicated a relationship between TA and a student's performance, Studies have indicated a relationship between TA and a student's performance, suggesting a possible impact on the exam outcome [3,4]. High levels of cognitive TA are associated with reduced academic performance [5,6], which can lead to an underestimation of their actual performance. The prevalence of TA was found to be 52.3% among medical students in Ethiopia [7], 45.5 % in the United Arab Emirates [8], and 29% among university students in Malaysia [9]. Test anxiety levels will rise as countries become more developed [10].

Nursing students exhibit higher levels of test anxiety compared to students in other disciplines [11,12]. Test anxiety has been identified as one of the types of anxiety experienced by nursing students [13–15]. The concept of TA plays a crucial role in nursing education and the subsequent professional development of nurses [16] as it has a negative impact on learning.

In Malaysia, a study done in a government university reported that the prevalence of anxiety and stress symptoms in nursing students were 81.6% and 43.1%, respectively, and that nursing students also have clinically significant depression (13.2%), anxiety (44.3%), and stress (10.3%) respectively [17]. In another study in Malaysia [18], reported that 58.3% of 60 first-year nursing students in a nursing institution had moderate TA, whereas 3.3% experienced severe TA.

Test anxiety was significantly influenced by the sociodemographic characteristics of the nursing students, including gender and academic standing whereby female students were reported to have higher TA compared to male students [18,19]. While [9,20] senior students were found to exhibit higher levels of TA [21], reported that junior students had higher TA. Ethnicity and the type of housing accommodations students occupy were found to are additional demographic factors that influence TA [9,22,23].

While anxiety is extensively researched in the field of psychology, there is a lack of research that focuses on TA, especially within the context of nursing education. To date, in Malaysia, only one study examined the TA of nursing students, but it only focused on first-year nursing students from a single nursing institution. Furthermore, there has been no research conducted to examine the contributing factors to TA among nursing students in Malaysia.

This study aims to determine the prevalence and level of TA experienced by nursing students in all private nursing institutions in Selangor (a state in Malaysia) and the association between socio-demographic characteristics and the level of TA among nursing students. Since nursing students experience TA, it is necessary to implement effective treatment strategies that utilize complimentary alternative techniques to alleviate the negative effects of test anxiety among nursing students. Therefore, this study also aims to identify nursing students with moderate and high anxiety to allow the researcher to implement complementary therapies to reduce test anxiety.

## 2. Materials and methods

### 2.1. Participants

This study was carried out using a cross-sectional design from March 2022 to July 2022. The estimated sample size for the study to determine the prevalence and level of TA was calculated using the formula developed by Kish (1965). The estimated sample size was calculated to be 398 (362 + 36) subjects using the prevalence estimation formula with a 95% confidence level, a 5% marginal error, and a 5% non-response rate. A purposive sampling technique was carried out as all the samples were homogeneous and similar in characteristics based on the inclusion and exclusion criteria. A letter asking permission to collect data was sent to all ten nursing institutions offering the Diploma in Nursing program in the state of Selangor in Malaysia. However, only seven private nursing institutions consented to participate in the study. This study obtained ethical approval from Universiti Kebangsaan Malaysia, Faculty of Medicine's Research and Ethics committee (Approval number: UKM PPI/111/8/JEP-2021-640) and was carried out in accordance with conducted in compliance with the principles outlined in the Declaration of Helsinki.

The inclusion criteria applied were [1] nursing students who were Malaysian [2], presently enrolled in the Diploma in Nursing program [3], in private nursing institutions in Selangor, and [4] aged 18 years–25 years old. The reason for selecting only private nursing universities and colleges for this study stems from the fact that government nursing institutions can be considered an extraneous variable due to the environmental factors that may have impacted the findings of this study. Private university students have more financial strain compared to government nursing institutions, whereby the students do not have to pay any fees to undergo the three-year Diploma in nursing training.

### 2.2. Procedures

Data was collected by using a two-part self-administered questionnaire over five days, three weeks before the participant's final exam for a particular semester. The data was collected using a Google form, and the link to the Google form was forwarded to the respective coordinators of each nursing institution. The Google form that participants used to participate in the study came with detailed written instructions. Obtaining informed permission was achieved by students' explicit agreement to participate in the study, as shown by their responses to the online survey.

The first segment of the questionnaire comprised demographic information, including age, gender, ethnicity, religion, and year of

study and other demographic factors such as residential status, accommodation, and household income, which may predict nursing students' TA. The socio-demographic factors contributing to test anxiety were selected based on previous studies [12,19,24,25]. The second part of the questionnaire was the TA Inventory (TAI), a self-reporting psychometric scale developed by Spielberger [26].

### 2.3. Instrument

Test Anxiety Inventory (TAI) was available in English version. The authors obtained the approval to use the instrument from the copyright holders. The TAI has twenty [20] items that are divided into three subscales: Worry (TAI-W) and Emotionality (TAI-E), which assess the two main aspects of TA. The subscale comprises eight items, resulting in weighted scores ranging from 8 to 32. The TAI total score ranges from a minimum of 20 to a maximum of 80. The TAI is a Likert-type scale consisting of four points. Students are required to choose one of the four options [1]: Almost Never = 1 [2], Sometimes = 2 [3], Often = 3, and [4] Almost Always = 4. Nevertheless, item 1 is a score that has been reversed [1]: Almost Never = 4 [2], Sometimes = 3 [3], Often = 2, and [4] Almost Always = 1. The average time to complete this questionnaire was 8–10 min. A significance level of 0.05 was chosen. The alpha coefficient reliability values for subscales of the initial version of the TAI were 0.96 for TAI-T, 0.91 for TAI-W, and 0.91 for TAI-E (Spielberger 1980).

As the reliability values of Cronbach's alpha for subscales of TAI were 0.607 for TAI-T, 0.839 for TAI-W, and 0.869 for TAI-E in the previous study (Hamzah et al., 2018) on TA among nursing students in Malaysia, the researcher adopted the TAI and administered this instrument in this study.

### 2.4. Data analysis

The obtained data underwent cleaning, coding, and analysis utilizing Statistical Package for the Social Sciences (SPSS) version 26.0. The categorical variable was represented using frequency and percentage. The outcome variables, TA scores, are presented as means and standard deviation (SD). No anxiety and mild anxiety are categorized as low levels of TA, whereas moderate and severe anxiety are categorized as high levels of TA. The normality of the data was evaluated through visual examination of the normal Q-Q plots, and equal variance in the groups was assessed by Levine's test, $p > 0.05$.

The chi-square test was used to determine the association between the independent and the dependent variable during bivariate analysis. The independent *t*-test was performed to determine the difference in TA mean score (dependent variable) according to independent variables (age, gender, accommodation, and residential status). One-way ANOVA was conducted to determine the

**Table 1**
Sociodemographic characteristics of respondents.

| Variable | Frequency (n) | Percentage (%) |
|---|---|---|
| **Gender** | | |
| **Male** | 15 | 3.6 |
| **Female** | 406 | 96.4 |
| **Age group** | | |
| **18–20 years** | 290 | 68.9 |
| **21 years and above** | 131 | 31.1 |
| **Ethnicity** | | |
| **Malay** | 128 | 30.4 |
| **Chinese** | 186 | 44.2 |
| **Indian** | 48 | 11.4 |
| **Others** | 59 | 14.0 |
| **Religion** | | |
| **Islam** | 135 | 32.1 |
| **Christian** | 116 | 27.6 |
| **Hindu** | 48 | 11.4 |
| **Others** | 122 | 29.0 |
| **Year of Study** | | |
| **Year 1** | 96 | 22.8 |
| **Year 2** | 112 | 26.6 |
| **Year 3** | 213 | 50.6 |
| **Residential status** | | |
| **Hometown (Selangor)** | 117 | 27.8 |
| **Other states** | 304 | 72.2 |
| **Accommodation** | | |
| **Hostel** | 346 | 82.2 |
| **Non- hostel** | 75 | 17.8 |
| **Household income** | | |
| **RM 3000 and below** | 274 | 65.1 |
| **RM 3001 – RM 5000** | 98 | 23.3 |
| **> RM 5001** | 49 | 11.6 |

[a]Other ethnic group refers to Iban, Bidayuh, Melanau, Kelabit, Murut, Kadazan, Penan, and Orang Asli
[b]Other religion refers to Buddhist, Sikh, and other Chinese religions.

difference of more than two TA mean scores according to independent variables (ethnicity, religion, household income, and year of study). A Multivariate analysis was conducted using multiple logistic regression to identify the factors that significantly influencing high TA.

## 3. Results

### 3.1. Characteristics of the respondents

The respondents consist of 421 nursing students from seven private nursing institutions in Selangor. The respondents were predominantly female, 96.4%. The respondents ranged from 18 to 20 years (68.9%) and 21 years and above (31.1%). Chinese comprised 44.2% of the respondents, followed by Malay (30.4%). Islam was the predominant religion of the respondents (32.1%). A total of 82.2% of the respondents stayed in the hostel, and 72.2% of the students were from different states. The majority of the respondents were third-year nursing students (50.6%). The lower income group (Ringgit Malaysia (RM) 3000 and below) made up 65.1% of the respondents, whereas the lowest number of respondents were from the group RM 5001 and above. Sociodemographic data are summarized in Table 1.

### 3.2. Prevalence of TA

As indicated in Table 2, the TAI scores for the total respondents varied from 22 to 77, with a mean of 45.34 (SD 8.98). The TAI worry subscale scores varied from 8 to 32, with a mean of 18.66 (SD 4.12). At the same time, the TAI emotionality subscale scores varied from 8 to 31, with a mean of 17.94 (SD 4.04). The TAI scores were categorized into four levels, with a score of 20–35 (no anxiety), 36–50 (mild anxiety), 51–65 (moderate anxiety) and 65–80 (severe anxiety).

As indicated in Table 3, 10.0% of the respondents reported having no TA, 62.5% had mild TA, 25.4% had moderate TA, with only 2.1% having severe TA. The TA levels were further categorized into low (no anxiety and mild anxiety) (72.4%) and high (moderate and severe anxiety) (27.6%).

### 3.3. Relationship between socio-demographic characteristics and TA level (TAI total categorized into low and high

Table 4 shows the association of the sociodemographic characteristics and TAI Total (Low and high) of the respondents. A significant relationship was seen between TAI level and household income ($\chi^2 = 6.70$, $p = 0.035$), where a significant percentage of those experiencing high anxiety was seen in the RM 3000 and below group (31.4%), followed by the above RM 5001 group (24.5%) and lastly the RM 3001–5000 group (18.4%).

### 3.4. Influence of sociodemographic factors on high TA (TAI total)

A Multivariate analysis using multiple logistic regression shows that only one significant factor, ethnicity, influences high anxiety. Table 5 shows that Chinese and Indians were protective of having TA compared to the Malays and Other ethnic groups - Chinese (OR = 0.47, $p = 0.018$) and Indian (OR = 0.41, $p = 0.046$). There was no significant association found between gender, age, accommodation type, and TA scores.

## 4. Discussion

In Nursing, test anxiety is an important concept. Nursing students are overburdened by assessment and testing of their performance throughout their nursing education and when taking the licensure exam to practice after they graduate from nursing schools. This study provides evidence that test anxiety is a significant health issue that impacts nursing students, where 25.4 % of the nursing students had moderate TA and 2.1% had severe TA. The result of this current study was lower than the previous study in Malaysia, whereby 58.3% of the respondents had moderate anxiety, while a small percentage, namely 3.3%, reported severe anxiety [18]. In Riyadh, Saudi Arabia, 50.9% experienced moderate TA, and 14.4% experienced severe TA [12]. Possible explanations for this discrepancy could be the difference in sample size.

This current study found no significant association between gender and TA (total, worry, and emotionality subscale). This was not in line with previous studies where it was reported that male nursing students exhibit lower levels of TA compared to female nursing students [18,19]. The findings of these studies could have been the result of a gender bias since women made up a disproportionately

**Table 2**
Respondents' response to subscales of TAI (N = 421).

| Subscale | Mean | Standard Deviation | Minimum | Maximum |
|---|---|---|---|---|
| **TAI -T/Total score** | 45.24 | 8.892 | 22 | 77 |
| **TAI-W/Worry** | 17.94 | 4.025 | 8 | 32 |
| **TAI-E/Emotionality** | 18.57 | 4.001 | 8 | 32 |

**Table 3**
Respondent's responses according to their level of TAI (N = 421).

| Tool | Category of anxiety | Frequency (n) | Prevalence (%) |
|---|---|---|---|
| **TA** | **No anxiety** | 42 | 10.0 |
| | **Mild anxiety** | 263 | 62.5 |
| | **Moderate anxiety** | 107 | 25.4 |
| | **Severe anxiety** | 9 | 2.1 |
| | **Low (no anxiety & mild anxiety)** | 305 | 72.4 |
| | **High (moderate anxiety & severe anxiety)** | 116 | 27.6 |

**Table 4**
Relationship of TAI level (high and low) with sociodemographic characteristics (N = 421).

| Characteristics | Low | High | | |
|---|---|---|---|---|
| | n (%) | n (%) | $\chi^2$ | p-value |
| **Age** | | | | |
| **18–20 years** | 209 (72.1) | 81 (27.9) | 0.07 | 0.796 |
| **21 years and above** | 96 (73.3) | 35 (26.7) | | |
| **Gender** | | | | |
| **Female** | 293 (72.2) | 113 (27.8) | 0.45 | 0.505 |
| **Male** | 12 (80.0) | 3 (20.0) | | |
| **Ethnicity** | | | | |
| **Malay** | 88 (68.8) | 40 (31.3) | 7.50 | 0.057 |
| **Chinese** | 143 (76.9) | 43 (23.1) | | |
| **Indian** | 38 (79.2) | 10 (20.8) | | |
| **Others** | 36 (61.0) | 23 (39.0) | | |
| **Religion** | | | | |
| **Islam** | 92 (68.1) | 43 (31.9) | 5.94 | 0.115 |
| **Christian** | 79 (68.1) | 37 (31.9) | | |
| **Hindu** | 38 (79.2) | 10 (20.8) | | |
| **Others** | 96 (78.7) | 26 (21.3) | | |
| **Accommodation** | | | | |
| **Hostel** | 252 (72.8) | 94 (27.2) | 0.15 | 0.704 |
| **Non-Hostel** | 53 (70.7) | 22 (29.3) | | |
| **Residential Status** | | | | |
| **Hometown** | 84 (71.8) | 33 (28.2) | 0.03 | 0.853 |
| **Different state** | 221 (72.7) | 83 (27.3) | | |
| **Year of Study** | | | | |
| **Year 1** | 68 (70.8) | 28 (29.2) | 2.16 | 0.340 |
| **Year 2** | 87 (77.7) | 25 (22.3) | | |
| **Year 3** | 150 (70.4) | 63 (29.6) | | |
| **Household Income** | | | | |
| **RM 3000 and below** | 188 (68.6) | 86 (31.4) | 6.70 | 0.035[a] |
| **RM 3001 – RM 5000** | 80 81.6) | 18 (18.4) | | |
| **>RM 5001** | 37 (75.5) | 12 (24.5) | | |

[a] Significant at $p < 0.05$.

large proportion of study participants, or it can be a fact that usually, females are more likely to acknowledge their anxiety compared to males as they are emotionally expressive than men, who tend to repress their emotions [27].

Studies by Refs. [9,20] reported that as the number of academic years increases, so does TA. Other studies found otherwise, as junior nursing students were found to have higher TA compared to senior students [19,21]. This present study found no significant difference in TA levels among the different years of studies. This may result from the variation in study populations across studies or variation in assessment and evaluations.

The age and residence of the nursing students were found to have no impact on TA in the current study. This was consistent with research on TA among nursing students in Jordan and Belgrade [19,28].

This study also found no significant association between their accommodation in terms of staying at a hostel or off campus. This was in contrast with previous studies where students who stay off-campus were found to be more likely to suffer from anxiety due to the financial constraints they face as a result of the cost of living and travel expenses, as well as the time it takes to travel to the university [9]. This may be because most of the participant (82%) were staying in the hostel instead of off campus. On the other hand [22], identified campus environments as a contributor to social anxiety, which increases study anxiety among these students.

However, in this study specific demographic characteristics were found to influence TA. Household income was found to significantly influence TA level ($\chi^2 = 6.70$, $p = 0.035$), where the highest percentage of high anxiety was seen in the RM 3000 and below group (86 respondents, 31.4%), followed by the above RM 5000 group (12 respondents, 24.5%). This contradicted the findings of the previous study [29], in which the students' family monthly income was found to have no statistically significant influence on their TA scores.

**Table 5**
The sociodemographic factors associated with high TA level.

| Predictors | B | Wald | p-value | OR | 95% C.I | | Cox & Snell R Square | Nagelkerke R Square |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lower | Upper | | |
| **Age** | | | | | | | | |
| **18–20 years** | 0.06 | 0.07 | 0.796 | 1.06 | 0.67 | 1.69 | 0.00 | 0.00 |
| **21 and above (Ref)** | | | | 1.00 | | | | |
| **Gender** | | | | | | | | |
| **Female** | 0.43 | 0.44 | 0.508 | 1.54 | 0.43 | 5.57 | 0.00 | 0.00 |
| **Male (Ref)** | | | | 1.00 | | | | |
| **Ethnicity** | | | | | | | | |
| **Others (Ref)** | | 7.52 | 0.057 | 1.00 | | | 0.02 | 0.03 |
| **Malay** | −0.34 | 1.08 | 0.299 | 0.71 | 0.37 | 1.35 | | |
| **Chinese** | −0.75 | 5.60 | 0.018* | 0.47 | 0.25 | 0.88 | | |
| **Indian** | −0.89 | 3.98 | 0.046* | 0.41 | 0.17 | 0.98 | | |
| **Religion** | | | | | | | | |
| **Others (Ref)** | | 5.75 | 0.125 | 1.00 | | | 0.01 | 0.02 |
| **Muslim** | 0.55 | 3.59 | 0.058 | 1.73 | 0.98 | 3.04 | | |
| **Christian** | 0.55 | 3.39 | 0.066 | 1.73 | 0.97 | 3.10 | | |
| **Hindu** | −0.03 | 0.00 | 0.945 | 0.97 | 0.43 | 2.21 | | |
| **Accommodation** | | | | | | | | |
| **Hostel** | −0.11 | 0.14 | 0.704 | 0.90 | 0.52 | 1.56 | 0.00 | 0.00 |
| **Non-hostel (Ref)** | | | | 1.00 | | | | |
| **Residential Status** | | | | | | | | |
| **Different state** | −0.05 | 0.03 | 0.853 | 0.96 | 0.59 | 1.54 | 0.00 | 0.00 |
| **Hometown (Ref)** | | | | 1.00 | | | | |
| **Year of Study** | | | | | | | | |
| **Year 3 (Ref)** | | 2.08 | 0.353 | 1.00 | | | 0.01 | 0.01 |
| **Year 1** | −0.02 | 0.01 | 0.942 | 0.98 | 0.58 | 1.66 | | |
| **Year 2** | −0.38 | 1.95 | 0.163 | 0.68 | 0.40 | 1.17 | | |
| **Household Income** | | | | | | | | |
| **> RM 5001 (Ref)** | | 6.25 | 0.044 | 1.00 | | | 0.02 | 0.02 |
| **RM 3000 and below** | 0.34 | 0.93 | 0.335 | 1.41 | 0.70 | 2.84 | | |
| **RM 3001 – RM 5000** | −0.37 | 0.75 | 0.387 | 0.69 | 0.30 | 1.59 | | |

Dependent variable: TAI LEVEL (High anxiety = 1, Low anxiety = 0), *Significant at $p < 0.05$.

Ethnicity was found to influence TA in this study, in which Chinese and Indians were protective of having TA compared to the Malays and other ethnic groups. While it is not known precisely how ethnicity influences TA, the disparity in TA levels between races in Malaysia may be attributable to the beliefs and cultural practices of the various races. In certain cultural groups, poor grades can be perceived as being a 'failure' by the family and may be the cause of a particular shame. Similarly, ethnicity was also found to influence depressive symptoms in studies in Malaysia, where ethnic Indians exhibited the highest prevalence of depression symptoms, in comparison to Chinese and Malays [23]. Since there is an absence of any explanation about the mechanisms responsible for these disparities, future investigations must delve into this issue in more detail.

According to a recent review [30], various interventions have been found to be effective in reducing test anxiety among nursing students. These interventions include aromatherapy, Confidence Training for Tests Relaxation (STARS), the Emotional Freedom Technique (EFT), a coping program that utilizes relaxation and soothing techniques, diaphragmatic breathing training, progressive muscle relaxation training with light instrumental music as well as music therapy. Test anxiety symptoms "can have detrimental effects on nursing students' physical and emotional well-being" [31]. Since nursing students experience TA, it is necessary to identify these students and implement some complementary therapies.

The study had several limitations. Firstly, only nursing students from private nursing institutions instead of government nursing institutions were included in this study. Secondly, the study was conducted in only one state in Malaysia. This restriction may have restricted the generalizability of the study results. We agree that there are many other factors, such as medical health issues, family emergencies, lack of studying time, and many others, which may have contributed to the TA of the students but were not studied in this study. Further studies on the other possible contributing factors could be examined.

## 5. Conclusions

This study concludes that nursing students in Selangor experienced TA and that certain demographic factors influence it. There is no doubt that TA will continue to exist if tests are given, but we cannot overlook the problem.

For educators to ensure that students are emotionally, physically, and academically prepared, it is necessary to identify students with TA at an early stage in the program and to implement complementary therapy interventions to help them overcome their anxiety. Further investigation is required to provide a detailed account of the actual experiences of college students and nursing students regarding TA.

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## Informed consent statement

Informed consent was obtained from all subjects involved in this study. Students' responses to the online survey indicated their consent to participate in the study.

## Data availability statement

The data given in this work has not been publicly archived owing to privacy concerns, but it can be obtained by contacting the corresponding author.

## Ethics declarations

This study was reviewed and approved by the Institutional Review Board (or Ethics Committee) of Universiti Kebangsaan Malaysia, Faculty of Medicine's Research and Ethics Committee (UKM PPI/111/8/JEP-2021-640). All participants provided informed consent to participate in the study.

## CRediT authorship contribution statement

**Manjit Kaur Khaira:** Writing – original draft, Project administration, Formal analysis, Conceptualization. **Raja Lexshimi Raja Gopal:** Writing – review & editing, Conceptualization. **Suriati Mohamed Saini:** Writing – review & editing, Supervision, Conceptualization. **Zaleha Md Isa:** Writing – review & editing, Supervision, Conceptualization.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2024.e26236.

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