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# Prevalence of Exercise Addiction and Its Correlation with Body Image Dissatisfaction and Eating Disorders among Physiotherapy Students during COVID-19 Pandemic

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**ABSTRACT**

**Background and Objectives:** Exercise addiction (EA) may happen when an individual fails to perform exercise moderately causing exercise to turn into a compulsive behavior. Although there are growing evidence suggested that EA may be comorbid with other issue such as body image dissatisfaction (BID) and eating disorders (ED), however there are limited studies targeted on the Malaysian undergraduate population. Hence, the present study aimed to investigate the prevalence of EA and its relationship with BID and ED among physiotherapy students in Klang Valley, Malaysia during the COVID-19 pandemic.

**Methods:** A cross-sectional study was conducted by sharing the online questionnaires which consists of 3 main components: (i) Exercise Addiction Inventory (EAI) (ii) Body Shape Questionnaire-8C (BSQ-8C) and (iii) Eating Disorder Diagnostic Scale (EDDS) to the physiotherapy students in Klang Valley, Malaysia to assess the risk of EA together with the correlation between EA with BID and EA with ED during the COVID-19 pandemic.

**Results:** A total of 282 students has participated in the study. The prevalence of EA among the physiotherapy undergraduate students during the COVID-19 pandemic was 8.2%. There was a significant correlation between the mean score of EA and BID ($p=0.0.037$, $r=0.124$). The correlation between EA and ED was proved significant in the current study ($p<0.001$, $r=0.224$).

**Conclusions:** The relatively low prevalence of EA (8.2%) among physiotherapy undergraduates in Klang Valley, Malaysia during the COVID-19 pandemic was observed. There are significant but weak correlations between EA with BID and ED.

**KEYWORDS:** COVID-19, Physiotherapy Students, Exercise Addiction, Eating Disorders

## INTRODUCTION

Exercise addiction (EA) is a phenomenon where exercise is being done excessively resulting in the loss of control, constant craving for higher amount of exercise throughout a period of time (1). According to Hamer & Karageoghris (2007), the cytokine IL-6 which associates with behavioral and psychological changes will be produced during exercise (2). With repeated exercise, chronic overproduction of IL-6 may occur and causes cytokin-induced symptoms such as increased anxiety, depression, fatigue, poorer concentration and altered sleep, which is different from the regular exercise benefits. Withdrawal symptoms such as restlessness, fatigue, mood swing, depression, anorexia may be associated with exercise addiction (2). The hypothesis given by Harber et al. (1984) suggest that people may experience and crave for the euphoric feelings due to the release of exercise related endorphin during acute training (3). Individuals with exercise addiction will not stop exercising even when they suffered from physical injury, personal inconvenience or any other disruptions from other activities because their mind are being occupied to chase for the satisfaction brought by the exercise process (4). Exercise addiction can become a "compensatory behavior" used to prevent weight gain, along with self-induced vomiting, and misuse of laxatives, among individuals with the eating disorder bulimia nervosa (5). EA may lead to negative consequences physically, socially and psychologically. Physical injury includes bone fractures and

muscle tension, psychologically EA increases the anxiety level, depressions, detriment the interpersonal relationships and increase debt for the social outcomes (4).

During the COVID-19 pandemic, students perform exercise to relief the extra stress brought by the new changes in their life especially from the academic aspect (6). There are possibilities that the stress coping mechanism may turn into a compulsive behavior. Besides, it is being proven that exercise regularly is able to improve the immunity towards disease, suggesting that it is able to provide extra protection towards the viral contagious disease such as COVID-19 (7). People might even have started to exercise due to this reason during the pandemic. This poses another risk to develop exercise addiction for the amateur in exercise as they lack proper training plans from the coaches and interaction with other exercisers due to the closure of all gym facilities. On the other hand, the extreme exercise behavior can be detected more easily under the restrictive circumstances in lockdown period as the individual with EA will continue to exercise despite the condition.

The obsessive behavior to maintain an ideal body shape is often driven by the society that relates the ideal body shape to success (8). University students are prone to develop body image dissatisfaction (BID) especially during the pandemic due to the increased frequency of social media usage as most of the universities including the universities in Malaysia were practicing online teaching mode, they were forced to learn, communicate and obtain the latest information from social media (9). the problematic usage of social media increases the involvement in appearance concern and body image through social media (10). While most of the studies on eating disorders and body image mainly targets on female population, it is important to take note that the social pressure applies to the male population as well. The society is being educated in a way that the perfect body for a male should be very muscular and fat percentage should be low enough for the visible abs and achieving V-shape figure, whereas female should have thin body figure (11) (12). Research has shown a greater tendency for students studying a sport related degree to develop exercise dependency (13)(14). Physiotherapy students having a higher exposure to the knowledge of exercise prescriptions to improve one's physical function and quality of life compared to other degrees (15) become a risk factor to get addicted to exercise. The results from a previous study on the exercise dependence and eating disorders among undergraduates studying nutrition and dietetics has shown that even with a considerable knowledge of nutrition, the students are still prone to develop eating disorder due to the perceived pressure to fit the image that is congruent with the profession (16).

To recent, there are limited studies about prevalence of EA in Malaysia among university student population. Prevalence of exercise addiction in other countries is notable, ranges from 2 to 42 % among endurance sports practitioner in a systematic review (Nogueira et al., 2018). The results are suggesting that there are no consistent data obtained in each study and are influenced by many other factors. It is also unclear that exercise addiction correlates with ED and BID. The results of this study may provide an idea on how widespread EA among the university student population is, and its correlation with negative issues affecting the modern students' lifestyles with the aim to correct the faulty mindset and promote healthy motivations to exercise. Hence the objective of the study is to: To analyse the prevalence of exercise addiction among physiotherapy students during the COVID-19 pandemic. To analyse the correlation between exercise addiction and body image dissatisfaction among physiotherapy students during the COVID-19 pandemic. To analyse the correlation between exercise addiction and eating disorder among physiotherapy students during the COVID-19 pandemic. The null hypothesis will be exercise addiction is not prevalent among physiotherapy students during the COVID-19 pandemic. Exercise addiction has negative or no correlation with body image dissatisfaction among physiotherapy students during the COVID-19 pandemic. Exercise addiction has negative or no correlation with eating disorders among physiotherapy students during the COVID-19 pandemic.

## METHODOLOGY

The study used a descriptive cross-sectional study design that focus on the prevalence of exercise addiction, and its correlation with eating disorders and body image dissatisfaction among physiotherapy students during the COVID-19 pandemic. This study has received ethical approval by the Scientific and Ethical Review Committee (SERC) of UTAR (U/SERC/232/2021). Data collection started on 21st October 2021 after the approval of ethical committee. This study was conducted electronically through an online google survey for 3 weeks and ended on 11th November 2021. The sample size is calculated with the reference from the article by Farchakh, Hallit & Soufia (2019) studying association between orthorexia nervosa (ON) tendencies and behaviors, eating attitudes and anxiety among medical students in Lebanese (17). Using the Krejcie and Morgan table, the sample size of 239 +/- is obtained. The Krejcie and Morgan table is constructed using the equation, s = X2 NP(1-P) ÷ [e2 (N-1)+ X2 P(1-P)] (18). 15% of the dropout rate is included in the sample size using the formula N= No/ (1-DRP). The sample size estimated in the study was 282. Convenience sampling method was utilized for this study. The target participants for the research are the undergraduates studying a physiotherapy degree in private universities in Klang Valley, Malaysia.

Full time undergraduate students pursuing physiotherapy degree in Klang Valley, Malaysia and individuals are staying in Malaysia since MCO (March 2020) are included for the study. Individuals who do not have a

basic English language understanding, do not agree to the participation in the study and individuals taking the second degree on Physiotherapy were excluded. Instruments used were Exercise Addiction inventory (EAI), Body Shape Questionnaire-8C (BSQ-8C), Eating Disorder Diagnostic Scale (EDDS).

The 3 instruments, EAI, EDDS, and BSQ-8C were selected based on the validity, reliability and practicability on the components measured. A self-administered questionnaire was developed by compiling the 3 instruments together with the demographic data, Personal Data Protection (PDP) statement and consent form. The distribution of questionnaire started on 21st October 2021 after obtaining the approval of the university's ethical review committee. The online questionnaire link was sent to the participants through online communication platform such as WhatsApp, Microsoft Teams, Facebook Messenger and Instagram. The participants were requested to share the questionnaire to other physiotherapy students. A brief introduction on the eligible criteria and the purpose of the study was explained to the participants including physiotherapy undergraduates studying in UTAR, MAHSA, INTI and UOC. Similarly, the questionnaire was attached with the invitation link, and was sent to the physiotherapy related Facebook groups and pages to reach more eligible participants. The consent of participants was gained before they participated in the survey. The data collection period last for 3 weeks, the reminders to fill in the questionnaire were sent out every five days for two weeks. A total of 282 participants were recruited at the end of the data collection period.

Data analysis started after the completion of data collection. The data from the survey was transferred to Statistical Package for the Social Sciences (SPSS) software version 23 for analyzing. The data collected were organized and coded systematically in SPSS. The mean and percentage of the demographic data were calculated. The data of EAI, and BSQ-8C were coded in SPSS and the mean was calculated. The algorithm of EDDS was adapted into the SPSS syntax and the data of EDDS were transferred to the SPSS to detect the individual at risk of ED and also the types of ED. Shapiro-Wilk test was utilized to perform test the normality of the data after the demographic analysis. The correlation between EA with ED, EA with BID, and EA with the demographic data were determined using Spearman's rank-order correlation. All analyses were performed at a confidence interval of 95%.

## RESULTS

### Demographic Data

A total of 282 physiotherapy undergraduate students with the mean age of 21 ± 1.48 years from 4 private universities located in Klang Valley, Malaysia have participated in the study and filled in the online questionnaire titled "Prevalence of Exercise Addiction and Its Correlation with Body Image Dissatisfaction and Eating Disorders Among Physiotherapy Students During Covid-19 Pandemic.

From the study population, more than 50% of participants were female participants (n= 204, 72.3%) when compared to male (n=78, 27.7%). 54.6% of the study participants were aged from 19 to 21, 43.3% aged between 22 to 24, and 6% of the remaining respondents were aged within 25 to 27. BMI analysis showed that majority of the participants (53.5%) fall under the normal category of Asian BMI (Consultation, 2004) with the mean BMI of 21.17 ± 3.65, followed by underweight (23.8%), overweight (16.7%) and obese (6.0%). A significant number of the participants came from UTAR (47.5%) followed by other universities. Year of study analysis showed that 15.2% were from year 1, followed by year 2 (23.8%), and more participants from year 3 (28%) and year 4 (33.0%).

### Distribution of the variables data

Table 1 shows the Shapiro-Wilk test on the demographic data including gender, year of study, BMI, age and the mean scores of EA, BID and ED. The test has revealed that all of the components are not normally distributed (p-values < 0.05) Thus, non-parametric test, Spearman's rank order correlation was used to analyse the correlation between variables.

**Table 1: Shapiro-Wilk test on EA, BID and ED mean scores**

| Variables | Shapiro-Wilk Test | | |
|---|---|---|---|
| | Statistic (W) | Degree of freedom (df) | Significance level (p) |
| Gender | 0.559 | 282 | <0.001 |
| Year of Study | 0.851 | 282 | <0.001 |
| BMI | 0.909 | 282 | <0.001 |
| Age | 0.934 | 282 | <0.001 |
| EAI mean score | 0.962 | 282 | <0.001 |
| BSQ-8C mean score | 0.983 | 282 | 0.002 |
| EDDS mean score | 0.971 | 282 | <0.001 |

Note: EAI= Exercise Addiction Inventory, BSQ= Body Shape Questionnaire, EDDS= Eating Disorder Diagnostic Scale

**Exercise Addiction**

***Distribution on components of EAI***

The responses to each component in EAI from the study participants are summarized in Table 2. Out of the total 6 components of EAI, majority of the study participants reported "Agree" to Salience and Mood modification components. The mean score of the 2 components are also the highest, which is 3.5 ± 0.98 and 3.6 ± 1.00 respectively. Besides, most of the study participants have reported "Neither agree nor disagree" to the components of Tolerance (n=98,34.8%) and Relapse (n=90, 31.9%). The component of Conflict in EAI has the highest responses on "Strongly disagree" n=107, 37.9%. The component of Withdrawal symptoms has gained most of the responses of "Disagree" (n=77, 27.3%) and "Neither agree nor disagree" (n=74, 26.2%).

**Table 2:** Distribution of respondents on components of EAI

| EAI items | Descriptions | Respondents, *N*(%) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Strongly agree (5) | Agree (4) | Neither agree nor disagree (3) | Disagree (2) | Strongly disagree (1) | Mean± SD |
| Salience | "Exercise is the most important thing in my life" | 41 (14.5) | 117 (41.5) | 82 (29.1) | 34 (12.1) | 8 (2.8) | 3.5 ± 0.98 |
| Conflict | "Conflicts have arisen between me and my family and/or my partner about the amount of exercise I do" | 5 (1.8) | 36 (12.8) | 59 (20.9) | 75 (26.6) | 107 (37.9) | 2.1 ± 1.12 |
| Mood modification | "I use exercise as a way of changing my mood (e.g. to get a buzz, to escape etc." | 44 (15.6) | 130 (46.1) | 71 (25.2) | 24 (8.5) | 13 (4.6) | 3.6 ± 1.00 |
| Tolerance | "Over time I have increased the amount of exercise I do in a day" | 15 (5.3) | 84 (29.8) | 98 (34.8) | 60 (21.3) | 25 (8.9) | 3.0 ± 1.04 |
| Withdrawal symptoms | "If I have to miss an exercise session I feel moody and irritable" | 11 (3.9) | 53 (18.8) | 74 (26.2) | 77 (27.3) | 67 (23.8) | 2.5 ± 1.16 |
| Relapse | "If I cut down the amount of exercise I do, and then start again, I always end up exercising as often as I did before" | 12 (4.3) | 81 (28.7) | 90 (31.9) | 62 (22.0) | 37 (13.1) | 2.9 ± 1.1 |

**Note:** EAI= Exercise Addiction Inventory, N= number of respondents

***Prevalence of EA***

Overall, the prevalence of individuals at risk of EA among a total of 282 physiotherapy students in the current study has reported a value of 8.2% (n=23). Majority of the study participants (79.4%) have categorized under the symptomatic group of EA, showing some symptoms of EA according to the score of EAI. The asymptomatic group has the least number of participants, n=35 (12.4%).

In terms of gender, 9% of the male participants have reported the EAI score more than 24, and are categorized under the group at risk of EA. The result showed a slightly higher percentage compared to female, where 7.8% of the female are at risk of EA. Both male and female presented the highest number of respondents under the category symptomatic of EA, which are n=64 (82.1%) and n=160 (78.4%) respectively within gender.

According to the analysis on the year of, the prevalence of individuals at risk of EA is the highest among the year 2 students (11.9%), followed by the second highest year 4 students (9.7%), and year 3 students (6.3%). Comparatively, the year 1 freshman students made a contrast with the other year students, having only 2.3% (n=1) at risk of EA. Similarly, majority of the study participants according to the year of study are categorized under the symptomatic group of EA.

In terms of BMI, the prevalence of individuals at risk of EA peaks the highest among the individuals having a BMI score

higher than 27.5, which is categorized as obese (11.8%), followed by normal (9.3%), overweight (8.5%) and finally underweight (4.5%) category. Need not to mention that there are significant number of physiotherapy students are categorized as underweight (23.8%). There are no sample under the obese category is asymptomatic of EA, indicating all obese study participants showed some symptoms of EA, and fall under category symptomatic or at risk of EA.

According to the analysis on the age groups study participants in the age group 22-24 are at risk of EA, 79.5% reported symptomatic of EA and 11.5% reported asymptomatic of EA. The age group 19-21 reported slightly lower prevalence of all three categories of EA, in which 7.1% of the participants from this age group was at risk of EA, 79.2% are symptomatic and 13.6% are asymptomatic. Among all the 3 age groups, 25-29 age group has the least number of participants (n=6). Only 1 one of them are at risk of EA, while none of them falls under category of asymptomatic.

**Prevalence of BID**

Overall, there were minority of the study participants (n=74, 26.2%) are at free risk of BID, majority of the participants either have a mild risk (30.5%), moderate risk (20.2%) or at risk of BID (23.0%). With a huge contrast, majority of the study participants at risk of BID made up of the female participants (82.7%), the male only made up of 12.3% of the group at risk of BID. Similarly, the highest percentage of the female participants (27.9%) fall under the category at risk of BID, while the highest percentage of male participants (34.6%) fall under the category of no risk of BID.

The trend of the prevalence of individuals at risk of BID increases from year 1 students (n=5, 11.6%) to year 4 students (n=28, 30.1%). Generally, there are less than half of the percentage within the year of study showed no risk of BID for every year students. The year of study with the highest percentage among the year of study with no risk of BID is year 2 (35.8%).

In terms of BMI groups, the prevalence of individuals at risk of BID seems to be more severe under the category of Overweight (29.8%) and Obese (58.8%). The results showed an increasing trend in the prevalence of individuals at risk of BID from lower BMI to higher BMI. This indicated the study participants have a higher BMI tend to co-exist BID compared to the study participants having a lower BMI. Besides, there were no obese participants falls under the category of No risk of BID. All of the Obese category participants tend to have a mild to high risk of BID. Similar to the year of study, only minority of the students from each BMI category showed no risk of BID.

**Prevalence of ED**

The prevalence of ED among the study participants is 21.3%, while majority of the study participants (78.7%) are being categorizes as free of ED through the EDDS questionnaire. Among the 3 types of eating disorders including anorexia nervosa, bulimia nervosa and binge eating disorder, the BN have the highest number of participants engaged in (n=31, 51.7%), followed by AN (n=23, 38.3%) and BED (n=6, 10%). Generally, there were more number of study participants diagnosed as sub threshold ED (n=33, 55.0%) compared to full threshold ED (n=26, 45.0%). There are only 8 (13.3%) male participants engaged in ED, while the remaining were female participants (n=52 ,87.7%) diagnosed having either a subthreshold or full threshold ED. Out of all categories of ED, the categories that consist of the greatest number of participants are full threshold BN and subthreshold AN, both consist of 7 participants (7.1%)

There are increasing trend of the prevalence of all 3 types of ED including Anorexia nervosa (AN), Bulimia nervosa (BN) and Binge eating disorder (BED) throughout the year of study. The number of participants diagnosed as ED increases from year 1 (n=9, 15.0%) to year 4 (n=21, 35.0%). The Figure 4.10 has illustrated the trend of 3 types of ED on Year of Study. The finding has suggested that there was an increasing number of participants having Anorexia nervosa as the year of study increases. However, the statistics on the other two eating disorder was not uniform. According to the analysis on the data of ED on BMI categories, the prevalence of ED is not common among the study participants that fall under the underweight category. There are only 5 (8.3%) study participants from this group are diagnosed with an ED. On the other hand, the BMI category that has the highest number of study participants engaging in all types of ED is the Normal category (n=32, 53.3%). Need not to mention that majority (n=10, 58.8%) of the study participants under the category of obese are diagnosed having an ED, while for the other category of BMI, the study participants having no ED made up the majority percentage.

**Correlation of variables**

Figure 1 and 2 have illustrated the scatterplots of the correlation between EA with BID and ED. Table 3 has concluded the correlation results among different variables investigated in the study. Spearman's rank order correlation is used to determine the correlation between EA and Gender, Year of Study, BMI groups, BID and ED. Firstly, for the relationship between EA and other variables, the results show that there is significant relationship between EA and BID ($p=0.037$) with the correlation value, $r=0.124$ indicating a weak positive correlation. In addition, EA shows a significant association with ED ($p<0.001$), showing a slightly stronger correlation ($r=0.224$) compared to EA and BID. The scatter plots of EA with both BID and ED are illustrated in Figure 4.8 and Figure 4.9. There are no significant association between EA and Gender, Year of Study and BMI ($p>0.05$).

Besides, the correlations that involved BID and ED are all significant ($p<0.05$). The association between BID and ED

shows the strongest correlation (r=0.766) followed by BID and BMI (r=0.397), ED and BMI (r=0.397) both indicating a moderate strength of correlations. The other correlation including BID and Gender, Year of Study, ED with Gender and Year of Study show a relatively weak correlations compare to the mentioned variables.

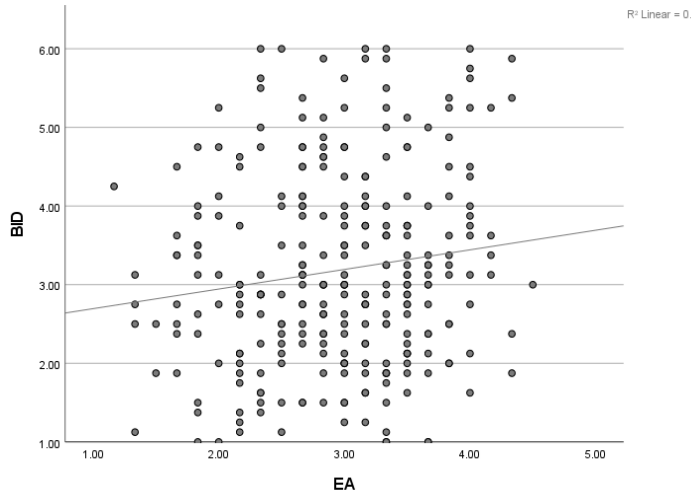


**Figure 1:** Scatterplot of EA and BID

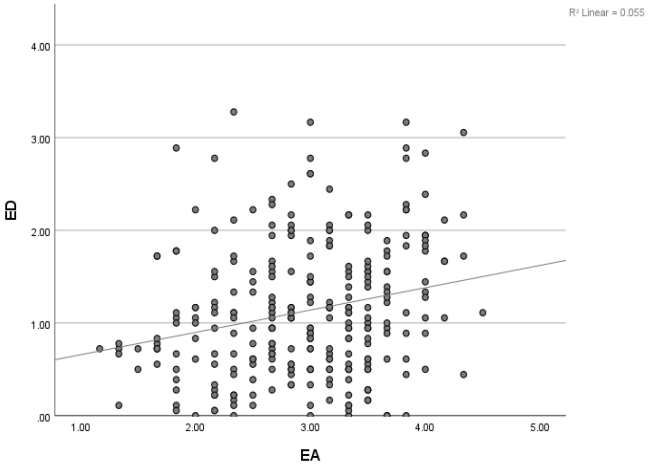


**Figure 2:** Scatterplot of EA and ED

**Table 3:** Correlation of EA and Gender, Year of Study, BMI, BID, and ED

| Relationship of interest between | | Correlation value, r | Significance value, p |
|---|---|---|---|
| EA | Gender | -0.114 | 0.055 |
| | Age | 0.046 | 0.440 |
| | Year of Study | 0.021 | 0.720 |
| | BMI | 0.044 | 0.458 |
| | BID | 0.124 | 0.037 |
| | ED | 0.224 | <0.001 |
| BID | Gender | 0.140 | 0.020 |
| | Year of Study | 0.203 | <0.001 |
| | BMI | 0.412 | <0.001 |
| | ED | 0.766 | <0.001 |
| ED | Gender | 0.134 | 0.024 |
| | Year of Study | 0.136 | 0.022 |
| | BMI | 0.397 | <0.01 |

**Note:** EA= Exercise Addiction, BID= Body Image Dissatisfaction, ED= Eating Disorders, BMI= Body Mass Index

The correlations of EA and BID, EA with ED among various groups are calculated using Spearman's rank order correlation and are listed in Table 4. According to the table, there is no significant association between EA with BID (p=0.105) nor ED (p=0.073) in the male group, and similarly no significant association between EA and BID in the female group (p=0.093). There is only a significant correlation between EA and ED in the female group (p<0.001) with correlation value r=0.239 indicating a weak correlation.

In terms of Year of Study, there is a significant association between EA and ED among year 2 (p=0.012) and year 3 students (0.004). However, the correlation is weak, r=0.305 and r=0.319 respectively. There is no significant relationship between EA and ED, EA and BID among other year students. Lastly, there is a significant association between EA and BID in the underweight category (p=0.020), indicating a weak correlation r=0.285. The relationships between EA and ED are significant among the underweight (p=0.022), normal (p=0.016) and obese (p=0.010) category. All of the mentioned correlations showed a weak correlation except for the obese category (r=0.607) showing a moderate correlation between EA and ED.

**Table 4:** Correlation of EA with BID, ED

| Variable | Category | Relationship of Interest | Correlation value, r | Significance value, p |
|---|---|---|---|---|
| Gender | Male | EA & BID | 0.185 | 0.105 |
| | | EA & ED | 0.204 | 0.073 |
| | Female | EA & BID | 0.118 | 0.093 |
| | | EA & ED | 0.239 | <0.001 |
| Year of Study | 1 | EA & BID | 0.018 | 0.909 |
| | | EA & ED | 0.031 | 0.843 |
| | 2 | EA & BID | 0.126 | 0.310 |
| | | EA & ED | 0.305 | 0.012 |
| | 3 | EA & BID | 0.210 | 0.063 |
| | | EA & ED | 0.319 | 0.004 |
| | 4 | EA & BID | 0.061 | 0.563 |
| | | EA & ED | 0.137 | 0.191 |
| BMI | Underweight | EA & BID | 0.285 | 0.020 |
| | | EA & ED | 0.279 | 0.022 |
| | Normal | EA & BID | 0.044 | 0.592 |
| | | EA & ED | 0.195 | 0.016 |
| | Overweight | EA & BID | 0.141 | 0.343 |
| | | EA & ED | 0.129 | 0.388 |
| | Obese | EA & BID | 0.148 | 0.571 |
| | | EA & ED | 0.607 | 0.010 |

**Note:** EA= Exercise Addiction, BID= Body Image Dissatisfaction, ED= Eating Disorders, BMI= Body Mass Index

## DISCUSSION

The study has examined the prevalence of exercise addiction and its correlation with body image dissatisfaction and eating disorders among physiotherapy students during COVID-19 pandemic. Through this study, the prevalence of EA in the current population is being determined together with two of the possible associated variables, BID and ED. According to the results of investigating EA risk among the undergraduate physiotherapy students in Klang Valley, Malaysia through EAI, majority of the students have chosen "Agree" to the Salience (41.5%) and Mood Modification (46.1%) components in EAI. The findings have indicated that most of the study participants have the potential to engage in EA with the association to the salience and mood modification. Firstly, the physiotherapy background of the study participants may contribute to the significance of exercise to their life as the curricular of physiotherapy includes basic exercise science, prescriptions and testing (19). This is because to the physiotherapy students, exercise is not only an activity to improve well-being but is also a major component of physiotherapy treatment or advice that are usually being prescribed to the patients or clients (20). According to Szabo & Griffith (2007), the sport science students showed higher score in Salience and it may be due to the commitment to their profession. Similarly, this can be applied to the physiotherapy students as well (14). Next, the higher distribution of responses on the component Mood Modification is in agreement to the hypothesis that has been mentioned in the theory model of EA. The feelings of satisfaction after the exercise indirectly associate the risk of EA as the individuals may constantly indulge in the feeling and neglect the other important life events in their life. On the contrary, the sample participants do not seem to engage in EA with the Conflict component in EAI. This indicates that majority of the physiotherapy students are not likely to have conflict with others while performing the exercise. One of the probable reason that may contribute to this finding is due to the high amount of stress from attending online classes due to the COVID-19 pandemic (21). The students may use exercise to cope with the extra stress (22).

The current study has showed the prevalence of exercise addiction (EA), N=23, 8.2% among a sample of 282 physiotherapy students in Malaysia. Previously, there is only one study on the prevalence of EA that has targeted on the occupational therapy students in Australia (16). Comparing the result of the study suggested that the prevalence of exercise addiction among occupational therapy students in Australia is 19%, current study has a comparatively lower prevalence. On the other hand, the study by Lichtenstein et al. (2018) concluded a similar prevalence to the current study, 8.7% among sport school students in Denmark (23). From the previous studies, it is clearly shown that the prevalence of EA varies from different region. It is most likely that the EA behavior is influenced by cultural and social norms that are

being practiced by the local. According to this current study, one possible reason suggested to the result is due to the nature of the physiotherapy course requires students to have certain amount of knowledge on exercise and the awareness of the benefits of exercise. To become the role model for the patients, physiotherapists may have the tendency to engage in high amount of exercise. Besides, the precipitating factor that influence the involvement of students in EA is the COVID-19 pandemic. Due to the various restrictions on the outdoor activities, the physical activity of general population decreased (24). This enhanced the role of physiotherapist or physiotherapy students to encourage more exercise to be done at home to take care of both physical and mental health.

The results of the current study show that, male participants have a higher EAI mean score (18.4%) compared to the female (17.4%). The male participants are having a slightly higher prevalence (9%) compared to female physiotherapy students (7.8%). The result findings are consistent with the study by Szabo et al. (2013) on investigating the role of gender on prevalence of EA among university athletes suggested the similar outcome, it showed that male have a higher EAI score compared to female athletes (25). However, the results from this study contradicted with a few articles for example the study by Gun & Agirbas (2019) showed that the sample of female sport college students has a higher percentage (15.8%) compared to male students (13.2) in Turkey (26); Levit et al. (2018) study showed that female has a higher prevalence of EA (20%) than male (12.1%) among 100 athletes in Israel (27). Firstly, the reason which may contributes to the current result is that there are more than double the number of female participants (72.3%) in the study compared to male (27.7%). This might be explained by the uneven proportion of male and female students pursuing physiotherapy in Malaysia. An official statistic from the Ministry of higher education (MOHE) has stated that the female students enrolled in health and welfare sectors in the private universities in Malaysia are 2.7 times more than male in 2020..

The study observed that year 1 freshman students have a lower prevalence (n=1, 2.3%) compared to the senior year physiotherapy students. Due to the lack of study of EA among the physiotherapy students, the finding cannot be compared to other studies. Firstly, one of the probable reasons of the current results is the senior physiotherapy students are exposed with more clinical experience and have more knowledge on exercise compared to the junior students as the junior students have to focus on the fundamental basic subjects before being posted to the clinical settings (28). The sense of the importance to develop the trust with patients increases through the observation of other professionals and facing real patients during the clinical postings. In terms of BMI, the current results have suggested the prevalence of EA is the highest among the obese category (11.8%), and lowest among the underweight category (4.5%). There are limited results investigating EA with relation to BMI. Firstly, individuals with high BMI have a higher tendency to exercise with a reason to lose weight. People who exercise with the motive to lose weight instead of maintaining a healthy lifestyle are more likely to engage in extreme exercise behavior. The statement is supported by Zeigler-Hill et al. (2021) which associated EA with narcissism, the individuals with the motive to regulate the weight and improve appearance are more prone to EA (29). According to the results of the current study, it shows a slight increasing trend of EA with higher age group. The percentage at risk of EA increases from age group 19-21 (7.1%), followed by 22-24 (9.0%) and the highest is 25-27 (16.7%). The finding is in contrast with the systematic review by Simon Grima et al. (2018) which concluded that EA is more prevalent in younger age group (30). In addition, several studies had also concluded a negative correlation between age and risk of EA (31) (32). Besides, the study by Szabo & Griffith (2007) has reported that the university students (aged 19-23) are prone to EA compared to the general population (14). As the current study only targeted the university students, hence the age difference is not that diverse to create a significant difference. In support of the second hypothesis, the current result shows that there is a significant correlation (p=0.037) between EA and BID. However, the correlation between both variable is relatively weak (r=0.124). The result finding is consistent with most of the studies done on the correlation between EA and BID. One of them is the study by (33) showing a significant and positive correlation between EA and BID. Besides, the result from the study by Beres, Czegledi & Babusa (2017) has also developed a positive correlation between BID and EA suggesting that individual at risk of EA showed to have a better body image satisfaction after aerobic exercise session (34). It can be stated that one of the motives for the students to engage in excessive exercise is due to the dissatisfaction on their body shape. During the COVID-19 pandemic, the university students have a higher tendency to have negative impression on themselves as the implementation of lockdown has reduced the social interaction with their peers or public, in turn they receive input from the social media. One of the potential reasons that causes the situation is that the students are comparing themselves with the popular "influencers" in social media and they develop an unhealthy exercise habit to achieve their body goal faster. Besides, another study by Trott et al. (2020) showed that the relationship between EA and BID is in agreement with the previous justification. It was suggested that EA is a symptom of BID rather than BID caused EA (24). As the current study finding only showed the correlation between both variables, the study cannot conclude the causality of both components. In addition, the association of BID and EA in underweight BMI category showed a

significant relationship (p=0.020). This indicated that the underweight individual is one group of individuals that are more likely to comorbid both of the conditions. However, further study should be carried out to confirm whether the lower BMI score is an effect or the cause of both EA or BID.

In terms of the association between EA and ED, the result of the study shows that there is a significant correlation (p<0.01), showing the third alternate hypothesis is accepted. Need not to mention that the correlation between both variable is also weak (r=0.224), but it shows a higher correlation compared to EA with BID. The study finding is in agreement with most of the previous studies that has proved that there is a correlation between EA with ED (16)(27)(35) (36). A recent meta-analysis has also concluded that EA occurs more than three and a half times as often as a comorbidity to an eating disorder than in people without an indicated eating disorder (24). The possible reason to address the current findings is that there are similarities between the target of both components, which is to lose weight and achieve a slender body figure. In addition, there are some characteristics in both behaviors are in consistent which further deepen the correlation. Moreover, the online teaching method during the COVID-19 pandemic has further increased the students' stress level and in turn increased the risk of problematic eating behavior (37). There may be a possibility that EA and ED are correlated to cope with the stress developed during the COVID-19 pandemic. However, the weak correlation indicates that there are still other factors that has influenced both conditions of EA and ED. Additionally, the association of EA with ED is significant particularly in female group (p<0.001). The result is in line with many of the previous studies (38)(1) with the reason female are prone to exercise and undergo extreme diet to control the body weight and hence developed both conditions.

Although the current study has provided some new insights to the current issue in Malaysia, there are a few limitations on this cross-sectional study. Firstly, the psychological condition of EA, BID and ED are not based on the professional diagnoses on clinical symptoms. Instead, all three conditions are based on self-reported questionnaire without indication or interviews conducted by clinicians or psychologists, hence the results may only provide a surface level of knowledge on the overview of the prevalence. Future research may include the interview by professionals to have a better evaluation of individual at risk of the conditions. In addition, the sampling method in this study is the convenience sampling method, indicating that the sample size may be not representative. Furthermore, the sample size is relatively small and consist of huge difference on the number of female and male respondents for the current study. Hence, future research shall adapt a sampling method that can recruit more representative participants and increase the sample size to obtain a more conclusive result.

## CONCLUSION

The results have shown that there are 8.2% of the undergraduate physiotherapy students in Klang Valley, Malaysia are at risk of EA during the COVID-19 pandemic. The finding has provided a basic information on EA in local area and proved that the EA exists among the physiotherapy students in Malaysia. The study has also proved that there is significant relationship between EA and BID, between EA and ED among the same populations. Additionally, the study has also found out that there is a significant number of students are engaged in BID during the COVID-19 pandemic. This raises the concerns that appropriate measures should be taken to reduce the severity of BID among the university students.

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