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Review Article

Factors associated with mental health disorders in undergraduate students: A meta-analysis

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Abstract

Mental health disorders are a significant issue, yet there is currently no consistent data regarding the factors that may contribute to their occurrence. The aim of this study was to identify the factors that may influence the occurrence of mental health disorders in the undergraduate student population. This meta-analysis, registered in PROSPERO, was conducted as of September 5, 2024. The systematic searches were conducted on three databases (Scopus, Embase, and PubMed). Data on factors related to the occurrence of mental health disorders in undergraduate students were collected to calculate pooled point estimates using the Mantel-Haenszel test. Out of 6,837 articles, 16 articles were included in the analysis. Our findings revealed that female students had a higher chance of experiencing mental health disorders compared to male students (OR: 1.43; 95%CI: 1.14–1.80; *p*-Egger of 0.1041; *p*-Heterogeneity of <0.0001; *p*=0.0020). The chance of having mental health disorders was also higher among single students compared to those in relationships (OR: 1.20; 95%CI: 1.02–1.43; *p*-Egger of 0.0535; *p*-Heterogeneity of 0.1130; *p*=0.0180). This study did not find any associations between age group, family income, smoking, living arrangements, years of study, or regularity of physical activity with the occurrence of mental health disorders. These findings could serve as a basis for improving policies aimed at reducing the rates of mental health disorders in undergraduate students.

Keywords: Mental health disorders, predictor, risk factor, undergraduate student, meta-analysis

Introduction

Mental health disorders, a serious concern worldwide, are complex conditions that affect an individual's mental processes and behavior [1]. These conditions can lead to significant emotional distress and disruption in daily functioning [2]. Mental health disorders encompass a wide range of conditions, including stress, depression, anxiety disorders, mood disorders, eating disorders, personality disorders, psychotic disorders, trauma-related disorders, dissociative disorders, and obsessive-compulsive disorders [3]. The prevalence of mental health disorders varies, ranging from 22.8% to 49.5%, with 22.2% of these cases classified as severe mental health disorders [4]. The incidence of suicide among individuals with mental health disorders also varies depending on the type of disorder [5]. For instance, the suicide rate in the depressed population is about 27%; approximately 22% in the anxiety disorders population and 8% of suicides occur among

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those with bipolar disorders [6]. Because mental health disorders are closely related to the severity of stressors, their incidence depends on the population context, such as healthcare workers, the unemployed, and undergraduate students [7]. Interestingly, among these populations, undergraduate students are a particularly important group to study, given the recent increase in reported suicide cases within this group [8].

Undergraduate students are defined as those pursuing a bachelor's or diploma degree at a college or university [9]. This population faces a high risk of mental health disorders due to the significant stressors they encounter, such as academic pressures, social challenges, lifestyle factors, pre-existing conditions, stigma surrounding mental health, and environmental stressors [10,11]. This is a serious concern given the high prevalence of mental health disorders in the undergraduate population, ranging from 2.0% to 75.2% [12]. Theoretically, there are many factors that may contribute to the development of mental health disorders among undergraduate students. These factors include age, sex, educational grade, residence, family size, smoking status, physical exercise, increased internet browsing time, and dissatisfaction with sleep [10,13,14]. However, according to evidence, there is currently no concrete report on specific factors that directly affect the occurrence of mental health disorders in the undergraduate student population. Therefore, the aim of this study was to identify factors that may influence the occurrence of mental health disorders among undergraduate students using a meta-analysis approach. The results of this study are expected to serve as a first step in emphasizing which students with specific characteristics require targeted interventions to reduce the incidence of mental health disorders.

Methods

Study design

A meta-analysis study was conducted to determine the factors influencing the occurrence of mental health disorders in undergraduate students. To identify these factors, data from articles in Scopus, Embase, and PubMed were searched and collected. The data were collected and used to determine pooled point estimates. The protocol of this study was registered in PROSPERO (No. CRD42024599962). All procedures in this study adhered to the preferred reporting items for systematic reviews and meta-analyses (PRISMA) checklist [15].

Eligibility criteria

To obtain articles relevant to the objectives of our study, several eligibility criteria were established prior to the systematic search. Articles considered for inclusion in our study were those with an observational study design that investigated factors influencing mental health disorders in undergraduate students. Furthermore, the data in those articles had to contain the points necessary for us to calculate pooled point estimates. Additionally, articles excluded from the study were those with topics not relevant to our study and articles classified as reviews or commentaries.

Quality assessment

To ensure that the included articles were in accordance with the PRISMA protocol, the Newcastle-Ottawa Scale was used to assess the quality of the articles. Some elements evaluated by this method included outcome, comparability, and sample selection. The lowest score from this method was 0, while a score of 9 represented the highest rating. The article with a score of 0–3 was classified as having low quality; a score of 4–6 indicated moderate quality, while a score of 7–9 indicated that the article had good quality [16]. Additionally, we conducted a grading of recommendations, assessment, development, and evaluations (GRADE) evaluation on each article. This GRADE assessment includes several points: risk of bias, publication bias, consistency, imprecision, and indirectness of evidence [17].

Search strategy

Three databases (Scopus, Embase, and PubMed) were used as sources for articles. The search was limited to articles published in English and the publication date as of September 5, 2024. The keywords used in this study were "risk factor" OR "determinant" OR "predictor" AND "mental health disorder" OR "depression" OR "anxiety" OR "stress" AND "undergraduate student." The

searches for articles from the reference lists of related articles were also conducted to obtain additional articles.

Screening and data extraction

During the article selection process, titles and abstracts were reviewed to identify articles eligible for inclusion in our study. The articles were gathered using EndNote X9 software (Clarivate, London, UK), which automatically removed duplicate entries. The remaining articles were then thoroughly reviewed in full text and evaluated based on the study's inclusion and exclusion criteria.

Data from each article were collected to determine the pooled point estimates. The collected data included the name of the principal investigator, the year the article was published, the location where the study was conducted, the study design, the age of the study sample, the type of mental health disorders, the evaluated predictors, the Newcastle-Ottawa Scale score, and the sample proportions in the groups with mental health disorders and those without. Four investigators (DK, SA, VW, and HDW) were responsible for carrying out the data extraction process, which was carried out collaboratively.

Risk factors

The occurrence of mental health disorders was the outcome variable in our study. Mental health disorders in this study included depression, anxiety, and stress. Depression was assessed using the Beck Depression Inventory [18], anxiety was evaluated using the Beck Anxiety Inventory [19], and stress was measured using Cohen's Perceived Stress Scale [20]. Furthermore, the predictor variables in this study included age, sex, relationship status, family income, smoking, living with family, years of study, and having regular physical activity. We established these predictor variables after conducting preliminary data searches and ensuring that these variables had complete data for the calculation of pooled point estimates.

Statistical analysis

To identify potential publication bias, the Egger test was used, with the presence of potential publication bias indicated if the Egger *p*-value was <0.05. If the potential publication bias was detected, the trim and fill method was used to adjust the pooled point estimates [21]. Additionally, the Q statistic and I^2 were employed to identify potential heterogeneity in the data. If the presence of potential heterogeneity was indicated (*p*-value for the Q statistic <0.10 or I^2 >50%), a random effects model was used to determine the pooled point estimates. Conversely, if no potential heterogeneity in the data was found, the calculation of pooled point estimates was performed using a fixed effects model [22]. Furthermore, the Mantel-Haenszel test was used to identify the factors influencing mental health disorders in undergraduate students. The pooled point estimates in this study were presented as odds ratios (ORs) in a forest plot [23]. All analysis processes in this study were conducted using Comprehensive Meta-Analysis software (Biostat Inc., New Jersey, USA) and Review Manager version 5.2 (Cochrane, London, UK).

Results

Article selection

The systematic search on the Scopus, Embase, and PubMed databases yielded 6,837 articles. From this total, 1,543 were duplicated articles and therefore excluded. Subsequently, 5,160 articles that were not relevant were also excluded. This selection process left 134 articles for full-text evaluation. Out of these 134 articles, 16 were review articles, and 102 articles had no control group; therefore, they were excluded. Ultimately, 16 articles met the eligibility criteria for this study and were included in the analysis [24-39]. The article selection process for this study according to the PRISMA protocol is outlined in **Figure 1**. The basic characteristics of the 16 articles are presented in **Table 1**.

Characteristics of the studies

Out of 16 included articles (**Table 1**), four studies were conducted in Bangladesh [29,31,32,35], other four studies in the USA [28,30,34,38], two studies from China [37,39] and Saudi Arabia [25,26], and one study each was conducted in Iran [24], Portugal [36], Serbia [27], and Tanzania

[33]. The participants' ages ranged from 17 to 28 years. The sample sizes varied from 53 participants [24,37] to 15,543 participants [29]. Eight studies focused on medical student populations [24,26,27,30,35-37,39], while the other eight studies involved mixed student populations [25,28,29,31-34,38]. Regarding the context of mental health disorders, six articles reported cases of stress [25-28,33,34], four articles reported depression [36-39], three articles reported both depression and anxiety [31,32,35], and one article each reported anxiety [29], burnout [24], and suicidal ideation [30].

Quality of studies

Based on the Newcastle-Ottawa Scale used to assess the quality of the articles, five were classified as high-quality [31,32,35,38,39], and 11 were rated as moderate quality [24-30,33,34,36,37]. In the evaluation of the Newcastle-Ottawa Scale regarding article selection, all studies reported case definitions and included representative cases [24-39]. However, the selection of controls was only reported by five studies [31,32,35,38,39], and the definition of controls was reported by 13 studies [24,26,27,30-39]. All studies demonstrated adequate comparability [24-39]. Regarding outcomes, all studies reported the non-response rate [24-39]. As for the GRADE recommendation, the risk of bias was reported by 14 studies [24-28,30-32,34-39], all of which had a low risk of publication bias. Two studies exhibited imprecision [24,29], seven studies showed inconsistency [30–36], and concerning the indirectness of evidence, 13 articles displayed uncertainty [24-26,28-33,35-37,39] (**Supplementary files**).

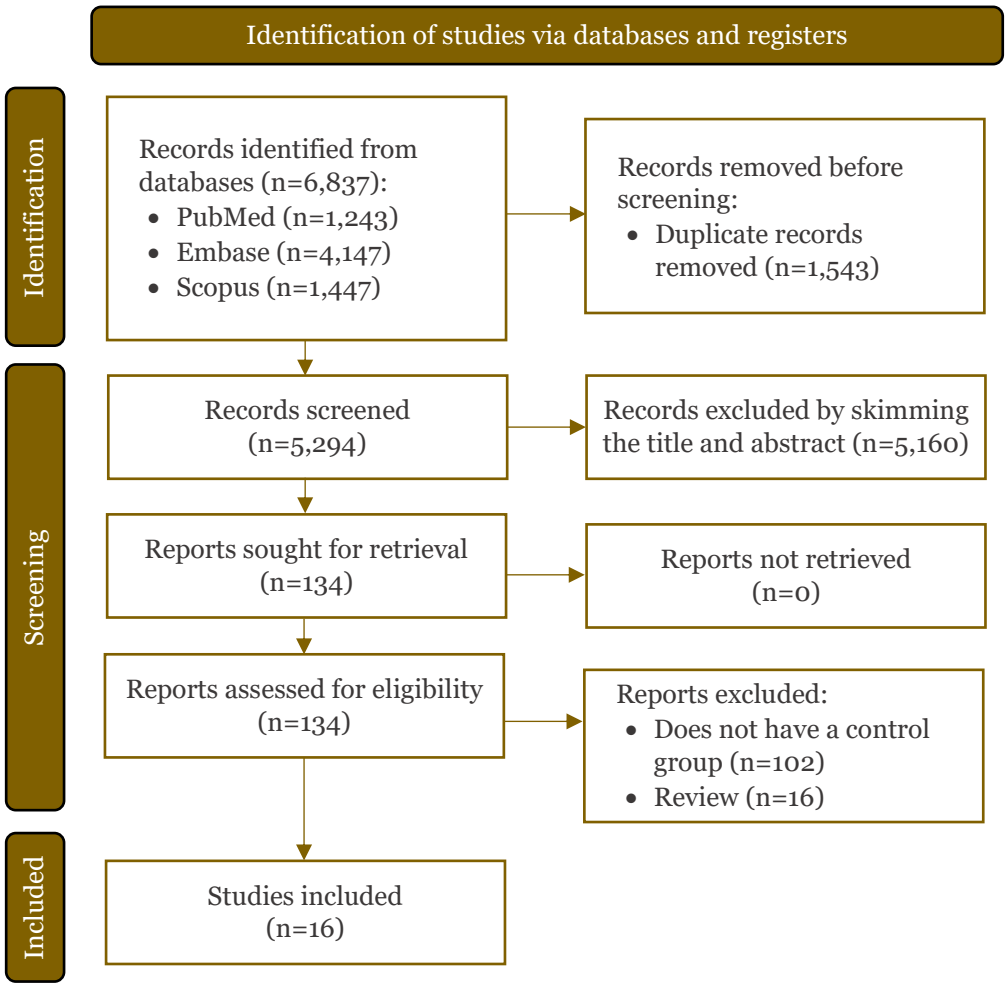

Figure 1. PRISMA diagram outlining the process of article selection.

Factors associated with mental health disorders in undergraduate students

Our data indicated that the prevalence of the mental health disorders among undegraded students was 33.9% (95%CI: 24.0–45.4; *p*-Egger: 0.744; *p*-Heterogeneity <0.001; I^2: 99.67%;

p=0.007). Among evaluated variables (age, sex, relationship status, family income, smoking, living with family, years of study, and having regular physical activity), our data identified that gender and relationship status were associated with the occurrence of mental health disorders in undergraduate students. Female students had an increased risk of experiencing mental health disorders compared to male undergraduate students (OR: 1.43; 95%CI: 1.14–1.80; *p*-Egger of 0.104 with *p*-Heterogeneity of <0.0001 and *p*=0.002) (**Figure 2**). The risk of mental health disorders was greater among single undergraduate students than among those with partners (OR: 1.20; 95%CI: 1.02–1.43; *p*-Egger of 0.053 with *p*-Heterogeneity of 0.113 and *p*=0.018) (**Figure 3**). Our study did not show any association between other variables, such as age group, family income, smoking, living with family, years of study, having regular physical activity and the occurrence of mental health disorders (**Table 2**).

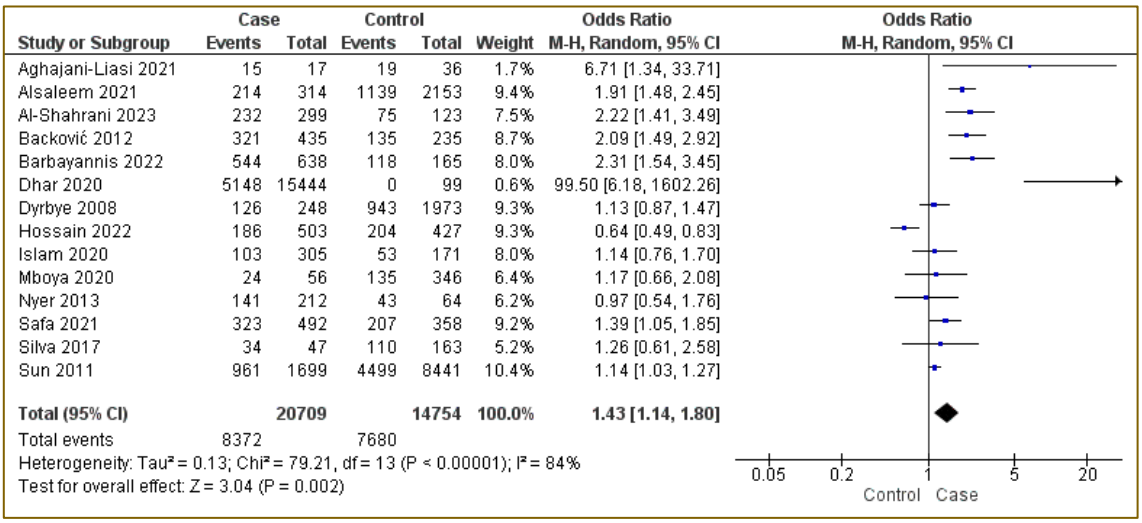

Figure 2. Forest plot illustrating the relationship between female sex and the risk of mental health disorders among undergraduate students (OR: 1.43; 95%CI: 1.14–1.80; *p*-Egger of 0.104 with *p*-Heterogeneity of <0.0001 and *p*=0.002).

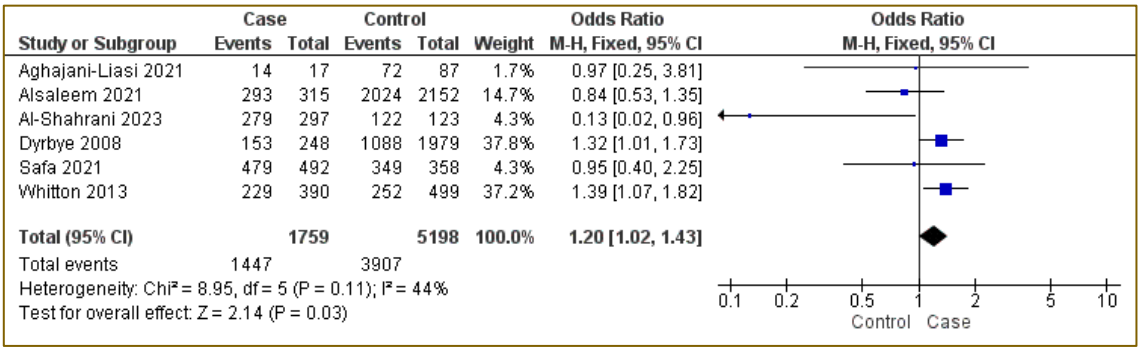

Figure 3. Forest plot showing the relationship between single status and the increased risk of mental health disorders in undergraduate students (OR: 1.20; 95%CI: 1.02–1.43; *p*-Egger of 0.053 with *p*-Heterogeneity of 0.113 and *p*=0.018).

Heterogeneity across studies and potential publication bias

The Egger test indicated that no potential publication bias was found for the variables of age, sex, relationship status, family income, smoking, living with family, and years of study (*p*>0.05). For the variable of having regular physical activity, the Egger test was not conducted due to data limitations. Potential heterogeneity was found for the variables of age group, sex, family income, smoking, and living with family. Therefore, the calculation of pooled point estimates for these variables used a random effects model. The calculation of pooled point estimates for the variables of relationship status, years of study, and regular physical activity utilized a fixed effects model, as no potential heterogeneity was detected in these data. A summary of the potential publication bias and data heterogeneity is presented in **Table 2**.

Table 1. Baseline characteristics of studies included in the analysis

Study	Country	Design	Age	Sample size	Students	Predictors	Mental health disorders	Quality assessment
Aghajani-Liasi *et al.*, 2021 [24]	Iran	Cross-sectional	24.4±0.9	53	Medical	Sex, relationship status, family income	Burnout	Moderate
Alsaleem *et al.,* 2021 [25]	Saudi Arabia	Cross-sectional	21.6±1.6	2467	Mixed	Age, sex, relationship status, smoking status, family income, academic levels, GPA score	Stress	Moderate
Al-Shahrani *et al.,* 2023 [26]	Saudi Arabia	Cross-sectional	22 (18–28)	422	Medical	Age, sex, academic year, GPA score, living with family, relationship status, smoking status, physical activity.	Stress	Moderate
Backović *et al.,* 2012 [27]	Serbia	Cross-sectional	24.8±1.9	670	Medical	Sex	Stress	Moderate
Barbayannis *et al.,* 2022 [28]	US	Cross-sectional	18–30	803	Mixed	Sex, ethnicity, academic year	Stress	Moderate
Dhar et al., 2020 [29]	Bangladesh	Cross-sectional	NR	15543	Mixed	Sex, place of residence, financial condition, living with family	Anxiety	Moderate
Dyrbye *et al.,* 2008 [30]	USA	Cross-sectional	25–30	2221	Medical	Age, sex, relationship status, having children, academic year	Suicidal ideation	Moderate
Hossain *et al.,* 2022 [31]	Bangladesh	Cross-sectional	22 (20–23)	930	Mixed	Age, sex, university type, academic year	Depression and anxiety	High
Islam *et al.,* 2020 [32]	Bangladesh	Cross-sectional	17–24	476	Mixed	Age, sex, physical activity, living with family, place of residence	Depression and anxiety	High
Mboya *et al.,* 2020 [33]	Tanzania	Cross-sectional	24.0±2.4	402	Mixed	Age, sex, place of residence, alcohol, smoking, vacation, class workload	Stress	Moderate
Nyer *et al.,* 2013 [34]	USA	Cross-sectional	19.8±1.9	276	Mixed	Age, sex, academic year, living situation, ethnicity, family income	Stress	Moderate
Safa *et al.,* 2021 [35]	Bangladesh	Cross-sectional	22.0±1.8	850	Medical	Age, sex, relationship status	Depression and anxiety	High
Silva *et al.,* 2017 [36]	Portugal	Cross-sectional	NR	210	Medical	Sex, academic achievement, social support	Depression	Moderate
Sun *et al.,* 2011 [37]	China	Cross-sectional	19.6±1.3	53	Medical	Age, sex, academic year, family characteristics, family income	Depression	Moderate
Whitton *et al.,* 2013 [38]	USA	Cross-sectional	18.9±1.3	889	Mixed	Sex	Depression	High
Yang *et al.,* 2014 [39]	China	Cross-sectional	17–24	200	Medical	Place of residence, family income, parental education level	Depression	High

NR: not reported

Table 2. Summary of the analysis of factors associated with mental health disorders among undergraduate students

Factors	Sample size, n (%)		Model	NS	OR	95%CI	*p*-Egger	*p*-Het	I^2 (%)	*p*-value
	Case	Control								
Age										
<20 years	992 (31.79)	4739 (41.88)	Random	5	1.04	0.73–1.49	0.054	<0.001	87.24	0.825
≥20 years	2128 (68.21)	6576 (58.12)	Random	5	0.96	0.67–1.38	0.054	<0.001	87.24	0.825
Sex										
Male	12337 (59.57)	7074 (47.95)	Random	14	0.70	0.56–0.88	0.104	<0.001	83.39	0.002
Female	8372 (40.43)	7680 (52.05)	Random	14	1.43	1.14–1.80	0.104	<0.001	83.39	0.002
Relationship status										
Single	1447 (82.26)	3907 (75.16)	Fixed	6	1.20	1.02–1.43	0.054	0.113	43.78	0.018
Coupled	312 (17.74)	1291 (24.84)	Fixed	6	0.81	0.69–0.97	0.054	0.113	43.78	0.018
Family income										
Low–middle income	7635 (44.37)	8701 (76.70)	Random	6	1.43	0.90–2.28	0.424	<0.001	82.62	0.127
High income	9574 (55.63)	2643 (23.30)	Random	6	0.70	0.44–1.11	0.424	<0.001	82.62	0.127
Smoking	81 (12.86)	314 (12.77)	Random	3	1.17	0.67–2.03	0.926	0.070	62.35	0.587
Living with family	12448 (79.29)	664 (69.75)	Random	4	0.84	0.30–2.36	0.081	<0.001	92.11	0.738
Years of study										
≤3 years	1399 (66.65)	3441 (66.70)	Fixed	6	1.08	0.94–1.23	0.847	0.125	42.04	0.269
>3years	700 (33.35)	1754 (34.00)	Fixed	6	0.93	0.81–1.06	0.847	0.125	42.04	0.269
Having a regular physical activity	279 (40.38)	87 (42.03)	Fixed	2	0.96	0.70–1.33	NA	0.489	0.01	0.821

CI: confidence interval; NA: not available; NS: number of studies; OR: odd ratio; *p*-Het: *p*-Heterogeneity

Discussion

This meta-analysis was conducted to identify factors associated with the occurrence of mental health disorders among undergraduate students. This study revealed that female students and single students had an increased risk of mental health disorders compared to male and coupled undergraduate students. This is the first study to identify factors related to the occurrence of mental health disorders in undergraduate students using a meta-analysis. Previous meta-analyses only reported prevalence data [40,41]. The first meta-analysis found that the prevalence of mental health disorders in undergraduate students ranged from 7.0% to 75.2% [40] while another meta-analysis reported a prevalence between 2% and 29% [41]. Prior studies investigating factors contributing to mental health disorders among undergraduate students employed only a systematic review approach without meta-analysis [10,13]. The first systematic review found that the increased occurrence of mental health disorders was influenced by age, sex, educational grade, residence, family size, smoking status, physical exercise, more internet browsing time, and dissatisfaction with sleep [13]. Meanwhile, another systematic review identified that the factors associated with mental health disorders in undergraduate students included academic factors, lifestyle, social interaction, and financial conditions [10]. Nevertheless, our study had advantages over previous studies. Our study used meta-analysis calculations to draw conclusions, unlike previous studies that relied solely on a systematic review approach without meta-analysis calculations [10,13].

The reasons why female students are more vulnerable to developing mental health disorders compared to males cannot be clearly elucidated yet. However, some explanations might explain this result. The increased risk among female students may be due to biological predispositions, psychological tendencies toward emotional expression, and sociocultural pressures [42-44]. Biologically, it has been noted that females undergo hormonal changes related to menstrual cycles and these changes have been found to affect mood and emotion and could further lead to depression or anxiety [42]. Psychologically, it has been argued that females are more likely to express their problems openly, unlike males. This indirectly contributes to the higher reporting of mental health disorders among females compared to males [44]. Additionally, with regard to sociocultural stresses, female students are most often faced with high expectations related to academic performance, career ambition, and personal relationships; these have been found to trigger depression and anxiety [43].

The higher incidence of mental health disorders among single students, as compared to their coupled counterparts, may be attributed to several factors, including a lack of social support, challenges in emotional regulation, dissatisfaction with relationships, increased loneliness, and societal pressures [45-47]. Regarding the deficit in social support, research indicates that romantic partnerships often provide a sense of social support that is critical for psychological well-being [46]. Studies have shown that individuals in relationships tend to experience lower levels of anxiety and depression due to the emotional and social support provided by a significant other [46,47]. In terms of emotional regulation, single students may lack the emotional support typically offered by a partner. This absence could present specific challenges, potentially exacerbating feelings of depression and anxiety [46]. Concerning relationship dissatisfaction, single students are often found to have weaker social connections. This lack of fulfilling relationships can lead to loneliness, which is closely linked to the development of anxiety and depression [36]. Finally, societal pressures can further compound the stress experienced by single students. Social expectations regarding relationships may heighten stress levels among single individuals, thereby contributing to their increased vulnerability to mental health disorders [45,46]. These factors collectively provide a plausible explanation for the findings of this study, which suggest that single students are at greater risk of developing mental health disorders compared to those in romantic relationships.

The results of this study did not demonstrate an association between age, family income, and years of study with the risk of mental health disorders. The exact reasons for these findings remain unexplained. However, several points may provide a basis for our results. Regarding age and years of study, evidence on the influence of these factors on the incidence of mental health disorders among undergraduate students is still unclear. Although some studies have reported that older age and longer years of study were associated with a reduced risk of depression [48,49],

other studies found that the relationship between depression risk and age or years of study was inconsistent [50,51]. This is because younger students or those in earlier years of study had their own burden in adapting to the university environment [49]. Furthermore, studies indicated that the predisposing factors for mental health disorders among students were not age or years of study, but rather the stressors they faced [10,28]. Regarding family income, while this factor has been associated with an increased risk of mental health issues in a broader context, its role in influencing mental health disorders among undergraduate students remains unclear [52]. This is because undergraduates from different economic backgrounds face similar stressors related to academic demands and adjustment to the university environment [10]. Therefore, financial stress does not always lead to mental health issues if students can develop effective coping strategies or receive adequate support from the university environment [53].

This study also showed no association between smoking, living with family, and having regular physical activity with the occurrence of mental health disorders. Regarding the smoking factor, it is known that smoking behavior and mental health disorders have a complex relationship [54]. Although smoking is often associated with an increased risk of anxiety and depression, many students engage in smoking as a coping mechanism for the stress they face rather than as a causal factor for mental health disorders [10]. Thus, smoking itself may not independently increase the risk of mental health issues; rather, it reflects underlying stress or coping strategies employed by students [55]. Moreover, regarding the factor of living with family, the role of this factor in the risk of mental health disorders among undergraduate students is difficult to explain. Indeed, living arrangements can influence student well-being; however, the effect of living with family varies significantly among individuals [56]. Studies showed that living at home with family could provide emotional support and mental stability, potentially reducing stress levels [57,58]. Conversely, other studies indicated that it could exacerbate feelings of dependency or limit students' independence, thus potentially increasing anxiety [10,59]. Therefore, the overall impact on mental health depends on individual circumstances rather than a straightforward association [51]. Finally, regarding the factor of having regular physical activity, although this factor is known to influence mental health in the general population, its role among undergraduate students is still inconsistent [60]. Various factors such as motivation, access to exercise facilities, and individual preferences play significant roles in whether students engage in physical activity regularly. Consequently, the absence of regular exercise does not directly correlate with an increased risk of mental health disorders, especially if other protective factors are present in students' lives [61].

This meta-analysis study has several benefits to the understanding of mental health. It is the first meta-analysis to evaluate the factors associated with the occurrence of mental health disorders in undergraduate students. The results may contribute to the scientific understanding of mental health disorders in this population. Additionally, these findings could serve as a foundation for more comprehensive future studies. Given that the results indicate that female students are a vulnerable population for mental health disorders, attention is needed to prevent these issues among this group. Furthermore, and importantly, the results also reveal that single students are another group at risk for experiencing mental health disorders. Therefore, this group also requires serious attention. As is well known, single students often face bullying related to their single status [62]. With the findings of this study, there may be a need to emphasize the prohibition of bullying against this group.

Although the results of this study provide very important information regarding mental health disorders in the undergraduate student population, some limitations also need to be considered when interpreting these findings. First, as is well known, meta-analyses depend on the availability of data from previous publications, therefore we could not evaluate other factors that might contribute to the occurrence of mental health disorders in the undergraduate student population, such as living situation, social support, academic pressure, and campus resources. Second, the sample sizes among the 16 included articles varied of which some articles had small sample sizes, which may have influenced the final results of our study. This study only involved articles with observational study designs. Future studies involving articles with intervention designs on specific variables may yield better results.

Conclusion

The present meta-analysis identified that female and single undergraduate students have a higher risk of experiencing mental health disorders. These results may serve as a foundation for developing interventions specifically aimed at the female and single student populations to prevent the occurrence of mental health disorders.

Ethics approval

Not required.

Acknowledgments

None.

Competing interests

All the authors declare that there are no conflicts of interest.

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Underlying data

Derived data supporting the findings of this study are available at https://doi.org/10.6084/m9.figshare.28182365.v1.

Declaration of artificial intelligence use

This study utilized artificial intelligence (AI) tools in the following capacities: ChatGPT and Quillbot were employed for language refinement, including improving grammar, sentence structure, and readability of the manuscript. We confirm that all AI-assisted processes were critically reviewed by the authors to ensure the integrity and reliability of the results. The final decisions and interpretations presented in this article were made solely by the authors.

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