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Impacts of COVID-19 on mental health of students in Ethiopia: systematic review and meta-analysis

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Abstract

Introduction Coronavirus disease 19 (COVID-19) has had different public health problems among students. During COVID-19 outbreak, students were distant from scholastic area and social collaboration and affected by different mental health problems. A comprehensive analysis on the impact of COVID-19 pandemic on the mental health of students in Ethiopia is limited. The aim of this study is to explore and summarize the impact of COVID-19 on students' mental health in Ethiopia.

Materials and methods This systematic review and meta-analysis was conducted in accordance with PRISMA guidelines. PubMed, Cochrane Library, CrossRef, African Journals Online and Google scholar databases were searched from December 2019 to June 2022. Study selection, data extraction and quality assessment of study were done by two authors independently. I^2 statistics was used to assess heterogeneity. A random effect model was used. Stata 16.0 was used for statistical analysis and graphics.

Results Eight studies were incorporated. From 7 studies report, the pooled prevalence of stress was 35% (95% CI 23–48%, $I^2 = 98.20\%$, Tau^2 = 0.03, $p < 0.001$). From 6 studies reported the pooled prevalence of the anxiety was 44% (95% CI 30%-57%, $I^2 = 97.90\%$, Tau^2 = 0.03, $p < 0.001$). From 5 studies reported the pooled prevalence of depression was 44% (95% CI 23%-65%, $I^2 = 99.10\%$, Tau^2 = 0.06, $p < 0.001$). Likewise, the factors of mental illness were summarized.

Conclusion COVID-19 significantly affects mental health of students in Ethiopia. Anxiety, stress and depression were the most reported mental health problems. Timely psychological counseling for students is important to decrease mental health problems during the pandemic situations.

Keywords COVID-19, Mental health, Mental disorders, Students, Systematic review, Meta-analysis, Ethiopia

Introduction

In December 2019, officials in Wuhan City, China, first reported the first human cases of coronavirus virus disease 2019 (COVID-19), the illness brought on by the new coronavirus known as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) that has since spread to many nations, including Ethiopia [1]. Mental health problems such as depression, anxiety and stress among students increased due to the COVID-19 lockdown. College students are substantially burdened with mental health issues. Globally as an indicator of 15 countries, females

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experienced higher levels of anxiety and depression than males [2]. The COVID-19 pandemic's psychological effects are serious mental health issue for everyone in Ethiopia. It was more prevalent among vocational students, and early behavioral interventions to stop COVID-19 were insufficient [3]. Students claimed to be under a lot of stress as a result of COVID-19 [4]. Anxiety, despair, and other psychological effects are brought on due to the pandemic's high infectiousness [5]. Lack of personal protective equipment has an impact on healthcare students [6]. Being alone during the lockdown increases the risk of developing depressive symptoms [7]. University students in the UK were also affected by mental health problems during COVID-19 [8]. Throughout COVID-19, depression levels among Chinese students increased [9]. According to studies conducted during COVID-19, secondary school pupils had anxiety prevalence of 38.1% and obsession prevalence of 40.27% [10]. According to the findings, depression, anxiety, and stress were all prevalent in South-West Ethiopia at respective rates of 21.2%, 27.7%, and 32.5% [11].

A study conducted to assess the association of conflict-affected environment on Ethiopian students' mental health and its correlates during COVID-19 era reported that mental distress was about 59.4% [12]. From a study conducted at the University of Gondar on the prevalence of stress, anxiety, and depression among graduating class students was 22.2%, 39.6%, and 40.2% respectively [13]. Study in Colleges in Amhara regional state of Ethiopia show that 77.2%, 71.8% and 48.5% of students experienced depression, anxiety and stress related psychological problems during the COVID-19 lockdown [14]. Among University students, South West Ethiopia, the magnitude of anxiety, depression, and stress was 35.1%, 30.0%, and 38.2% respectively [15]. Different factors affect the prevalence of mental disorders of students through the pandemic. For instance: being grade 11th and being female [10], not living with their parents, relatives got corona virus and low family income were risk factors for anxiety [11]. Living in urban area, substance use, sedentary lifestyle, and fear of infecting family increase the risk of developing anxiety [13]. Depression; being female, staying at home, history of medical illness, and poor and

Table 1 PubMed Search Strategy

Search number	Details on possible combinations	Results obtained
#1	"mental illness"[Mesh Terms]	107,599
#2	"COVID-19"[MeSH Terms]	169,686
#3	"students" [MeSH Terms]	48,067
#4	"Psychiatric Illness" [Title/Abstract] OR "mental illness" [Title/Abstract] OR "Psychiatric problem" [Title/Abstract] OR "anxiety" [Title/Abstract] OR "depression" [Title/Abstract] OR "psychology problem" [Title/Abstract] OR "mental health effect" [Title/Abstract] OR "psychological disturbance" [Title/Abstract] OR "Mental Disorder" [Title/Abstract] OR "Psychiatric Diseases" [Title/Abstract] OR "Psychiatric Disorders" [Title/Abstract] OR Behavior Disorders" [Title/Abstract] OR "Severe Mental Disorder" [Title/Abstract] AND "prevalence" [Title/Abstract] OR "associated factors" [Title/Abstract] OR "determinants" [Title/Abstract]	1,687
#5	"coronavirus disease 19"[Title/Abstract] OR "2019 novel coronavirus disease"[Title/Abstract] OR "COVID-19"[Title/Abstract] OR "2019 novel coronavirus infection"[Title/Abstract] OR "2019 ncov disease"[Title/Abstract] OR "2019 ncov infection"[Title/Abstract] OR "covid 19 pandemic"[Title/Abstract] OR "covid 19 pandemics"[Title/Abstract] OR "covid 19 virus disease"[Title/Abstract] OR "covid 19 virus infection"[Title/Abstract] OR "COVID19"[Title/Abstract] OR "coronavirus disease 2019"[Title/Abstract] OR "sars coronavirus 2 infection"[Title/Abstract] OR "sars cov 2 infection"[Title/Abstract] OR "severe acute respiratory syndrome coronavirus 2 infection"[Title/Abstract] OR "SARS-CoV-2"[Title/Abstract] OR "2019 novel coronavirus"[Title/Abstract] OR "2019 novel coronavirus"[Title/Abstract] OR "2019- nCoV"[Title/Abstract] OR "covid 19 virus"[Title/Abstract] OR "covid19 virus"[Title/Abstract] OR "SARS coronavirus 2"[Title/Abstract] OR "SARS cov 2 virus"[Title/Abstract] OR "severe acute respiratory syndrome coronavirus 2"[Title/Abstract] OR "Wuhan coronavirus"[Title/Abstract] OR "Wuhan seafood market pneumonia virus"[Title/Abstract]	6,715
#6	"students"[Title/Abstract] OR "University"[Title/Abstract] OR "college"[Title/Abstract] OR "school"[Title/Abstract] OR "high school"[Title/Abstract] OR "preparatory"[Title/Abstract] OR "Ethiopia"[Title/Abstract] OR "Addis Ababa"[Title/Abstract] OR "Amhara"[Title/Abstract] OR "Afar"[Title/Abstract] OR "Oromia"[Title/Abstract] OR "SNNP"[Title/Abstract] OR "Somali" [Title/Abstract] OR "Gambella" [Title/Abstract] OR "Benishangul-Gumuz" [Title/Abstract] OR "Tigrai" [Title/Abstract] OR " Harari" [Title/Abstract] OR "Dire Dawa" [Title/Abstract]	3,370
#7	#1 OR #4	3,317
#8	#2 OR #5	6,743
#9	#3 OR #6	3,653
#10	#7 AND #8 AND #9	42
#11	Limit to "observational studies" OR "cross-sectional"	17

moderate social support increased the risk of depression [11].

Students living in urban area, live with a family, study non-health departments, had confirmed cases in the family and students did not perform physical exercise increased the odds of developing depression [13]. Also students at Universities were more likely to experience stress due to substance use, depression, anxiety, and inadequate social support [11]. Living in an urban setting, leading a sedentary lifestyle, being unable to perform COVID-19 preventive measures, and having a contact history all raise the chance of acquiring stress, female was found to be highly connected with mental distress [12, 13]. It is vital to reduce the pandemic's negative effects on students' mental health, and Ethiopia needs to give emphasis on this. Ministry of Health and the Ministry of Education should join with students to lessen the effects of the pandemic [16].

In Ethiopia, during COVID-19 pandemic, there were a variety of study results on mental problems among students [4, 10–15, 17] and there was also a variation in the reported prevalence across various areas/region and time periods. This study tried to fill the gap by providing thorough summary data by using systematic review and meta-analysis. This examination of COVID-19's effects on students' mental health could lead to more conclusive findings that could be used to develop prevention strategies, supervisory techniques, and programs for students' mental rehabilitation throughout the COVID-19 pandemic. This study tried to answer two research questions. The first is what is the pooled prevalence of mental health problems during

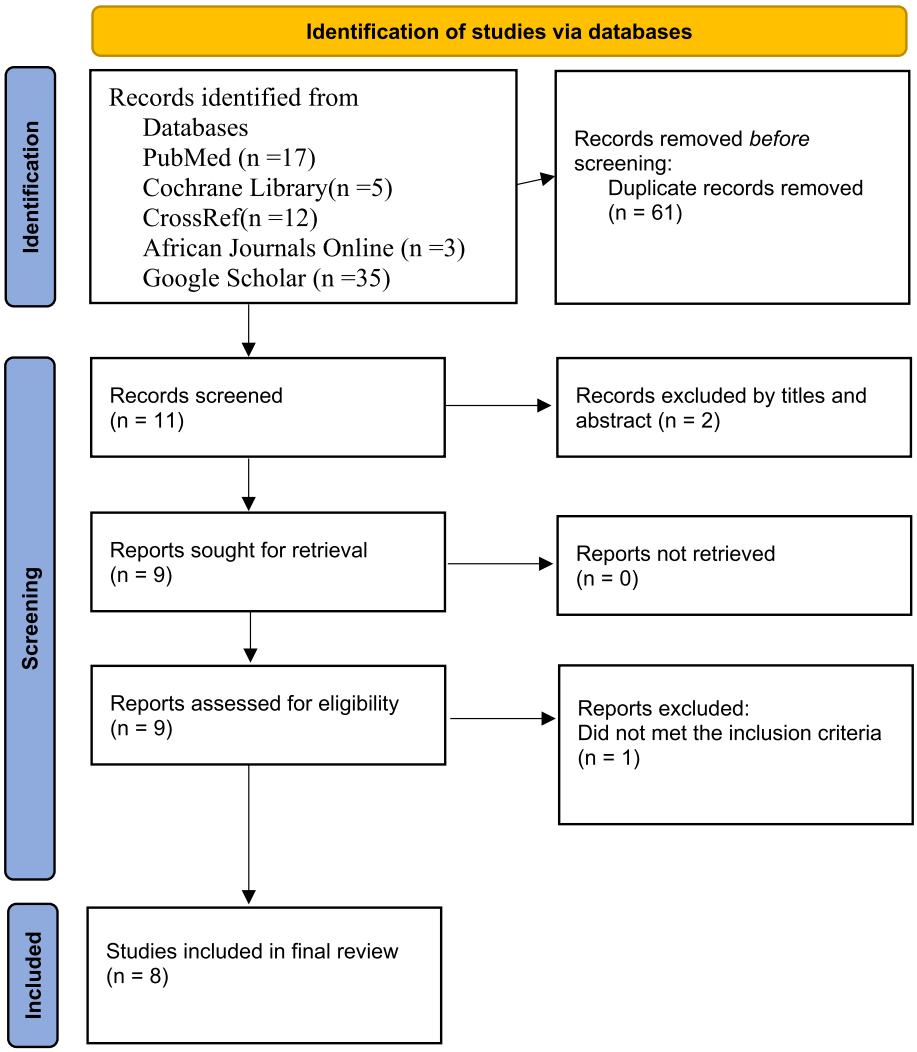

Fig. 1 Preferred reporting items for systematic reviews and meta-analyses (PRISMA 2020) flow chart

Table 2 Summary on key characteristics of the included studies for mental disorders of students during the COVID-19 pandemic in Ethiopia

	Authors (year)	Region	Study design	Data collection period	Gender (male %)	Cases	Sample size (*n*)	Mental Disorders	Instrument used	Prevalence (%)	Quality
1	Mekonen et al. (2021) [13]	Amhara	CS	November 10 to 30, 2020	190(56.2)	78	350	Stress	DASS-21	22.20	8
						139	350	Anxiety	DASS-21	39.60	
						141	350	Depression	DASS-21	40.20	
2	Madoro et al. (2021) [12]	SNNP	CS	April 1 to 30, 2021	412(51.8)	469	795	Stress	K-10	59	8
3	Tadesse et al. (2021) [14]	Amhara	CS	15 April to 15 May 2020	214(52.5)	315	408	Depression	DASS- 21	77.20	8
						293	408	Anxiety	DASS- 21	71.80	
						198	408	Stress	DASS- 21	48.50	
4	Assefa et al. (2021) [15]	SNNP	CS	-	406(57.2)	249	710	Anxiety	DASS-21	35.10	8
						213	710	Depression	DASS-21	30	
						271	710	Stress	DASS-21	38.20	
5	Tesema et al. (2021) [10]	Amhara	CS	November to December 2020	178(48.1)	141	370	Anxiety	CAS	38.10	7
6	Awoke et al. (2021) [4]	Oromiya	CS	August to September 5, 2020	174(51.6)	121	337	Stress	PSS-10	36	7
7	Sahile et al. (2020) [17]	A A	CS	April 27 to May 07, 2020	63(41.17)	78	153	Depression	DAS-21	51	8
						79	153	Anxiety	DAS-21	51.60	
						17	153	Stress	DAS-21	11.10	
8	Aylie et al. (2020) [11]	SNNP	CS	May 15 to June 15/2020	199(63.4)	66	314	Depression	DASS-21	21	7
						85	314	Anxiety	DASS-21	27	
						104	314	Stress	DASS-21	33	

CS Cross-sectional, *AA* Addis Ababa, *SNNP* Southern Nation's Nationalities and People, *PSS-10* Perceived Stress Scale, *K-10* Kessler Psychological Distress Scale, *DASS-21* Depression Anxiety Stress Scale, *CAS* COVID-19 Anxiety Scale

COVID-19 pandemic among students in Ethiopia? The second is what are factors associated with mental health problems during COVID-19 pandemic among students in Ethiopia? The main goal of this review is to provide up to date evidence on the pooled prevalence and associated factors of mental health problems of students during COVID-19 in Ethiopia.

Materials and methods

Registration and reporting

The preferred reporting items for systematic reviews and meta-analyses (PRISMA-2020) [18, 19], was used to guide the development of this study, as shown in Fig. 1. The protocol was entered under the PROSPERO registration code CRD42022313637 in the International Prospective Register of Systematic Reviews.

Search strategy

Between December 2019 and June 2022, literatures were searched in the databases PubMed, Cochrane Library, CrossRef, African Journals Online, and Google Scholar. Observational studies were taken in to account. Every possible combination of keywords were used in this systematic searches. To identify any eligible studies, the reference lists of major full text papers included in the review were examined. The search approach is deemed effective at lowering the possibility of bias in the study selection. Using Mendeley, we removed the duplicate search results.The search terms determined by the Medical Subject Headings(MeSH) and keywords including multiple combinations were used for searching eligible studies. Two authors (AAH and AAS) separately screen titles and abstracts of the studies, and any disagreement between authors was resolved by discussion. The search strategy of PubMed database is presented in (Table 1).

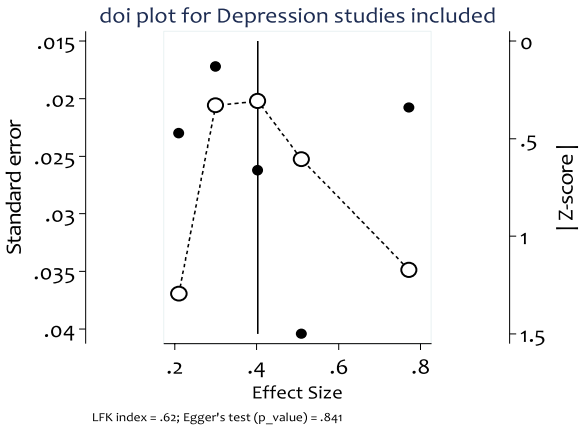

Fig. 3 Doi plot and LFK index for assessing publication bias for depression studies

Inclusion and exclusion criteria

To ease the searching strategy and organization of search terms, this study is conducted following the condition, context and population (CoCoPop) framework.

Condition

Mental disorder's prevalence and associated factors.

Context

During the COVID -19 pandemic in Ethiopia.

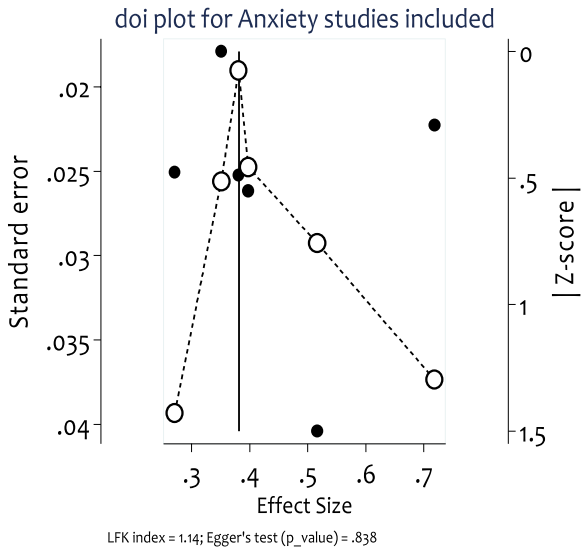

Fig. 2 Doi plot and LFK index for assessing publication bias for anxiety studies

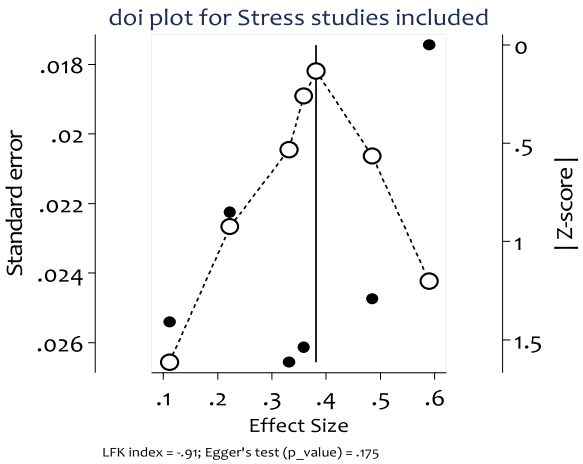

Fig. 4 Doi plot and LFK index for assessing publication bias for stress studies

Population

Students (in secondary/preparatory school and college/university level studies) in Ethiopia during the COVID -19 pandemic.

Study design

Observational studies.

For this review observational studies that focused on students and investigations on the impacts of COVID-19 on the mental health of students and only full text published studies in English language were included. The following types of studies excluded: (1) studies that included whole population; (2) studies with small sample size i.e. $n < 30$; (3) studies that did not have enough statistical information to be extracted; and (4) descriptive reviews, randomized controlled trials, systematic review, meta-analysis, opinion, comments, and conference abstracts were excluded.

Outcome measures

In this study, the prevalence of depression, anxiety and stress among students served as the main outcome indicator. The secondary outcome indicators are associated factors related to students' mental health during the COVID-19 pandemic in Ethiopia.

Data extraction and management

Two authors (AAH and AAM) checked the eligibility of selected publications' titles and abstracts. Full-text publications were screened based on their titles and abstracts. Discussions are used to settle disputes. By using Microsoft Excel software, an extraction sheet is prepared to record details such as the first author's last name, the year of publication, the outcome definition, the study design, sample size, the number of cases, the kind and prevalence of mental disorders, and the associated factors and their effect size.

Methodological quality assessment

Using the nine-star Newcastle-Ottawa Scale (NOS), two authors (AAH and AAS) independently evaluated the included studies' risk of bias [20]. NOS is based on 3 parameters: selection, comparability between the exposed and unexposed groups, and exposure/outcome assessment. Studies with less than 5 stars were considered low quality, 5–7 stars of moderate quality, and more than 7 stars of high quality [21]. Studies with moderate and above quality score were involved in this study. When conflicts related to bias scores arise, the final decision was taken by discussion.

Data synthesis

Stata version 16.0 software was used to conduct this meta-analysis. We calculated the pooled prevalence with the corresponding 95% CI and p-value for each mental disorder reported in the studies by using generic inverse variance method. We also summarized factors of mental

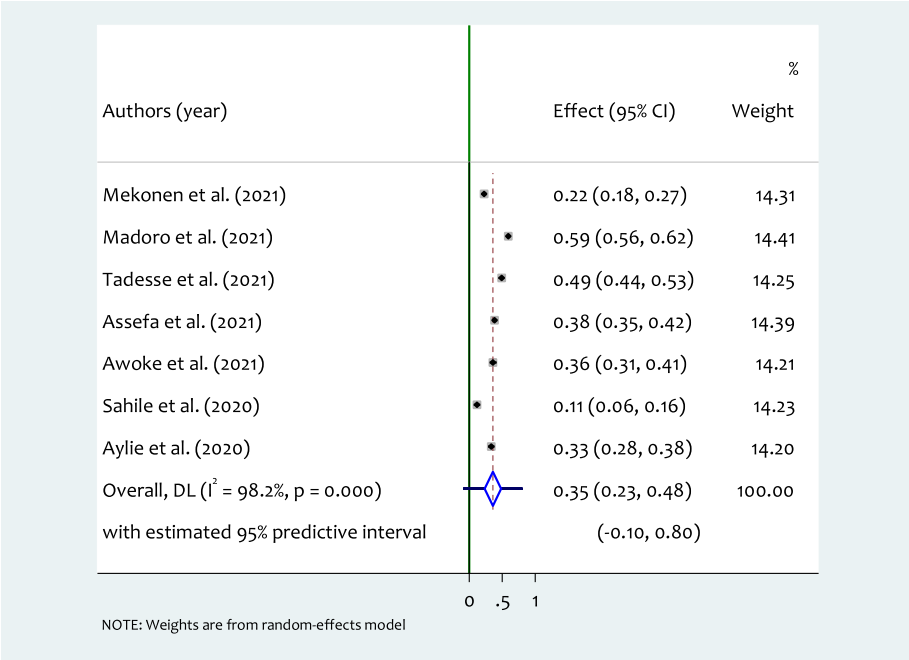

Fig. 5 Forest plot for the prevalence of stress among students during the COVID-19 pandemic. ES, effect size; CI, confidence interval; Weight, weight of each included study (degree of impact on pooled results), the larger the weight is, the greater the influence on the combined result

disorders with their adjusted odds ratio (AOR) among students during the pandemic in Ethiopia. Heterogeneity among included studies was assessed using the I^2 test. If $I^2 > 0.5$ or $p < 0.1$ it is considered there is a significant heterogeneity among the included studies [22]. The random effect model was used for conducting this meta-analysis. To determine the source of heterogeneity subgroup analyses was performed by region and instrument used. Cochran's Q-statistic was used to test the heterogeneity between sub groups [23]. Publication bias was checked by doi plot and Luis Furuya Kanamori (LFK) index, a method of assessing publication bias applicable when the number of studies is small mainly less than ten. According to this method a value out of the interval −1 and 1 were considered asymmetry (publication bias) [24].

Results

A PRISMA diagram demonstrating the steps of data search and refining process for the study of mental health problems of students during COVID-19 pandemic is displayed (Fig. 1). We searched in the databases and got 72 studies. Sixty one studies were removed since duplicated, we examined the titles and abstracts and 2 studies removed. One study removed due to not fulfilling inclusion criteria from full text examination. Finally, we identified 8 studies appropriate to this study.

Study characteristics

In this study we included eight [4, 10–15, 17] articles focusing on the impact of COVID-19 on mental health of students in Ethiopia. When we see the regional distribution, 3 studies [11, 12, 15] are from SNNP region, 1 study [4] is from Oromiya region, 3 studies [10, 13, 14] are from Amhara region, 1 study [17] is from Addis Ababa city administration. Depending on the types of mental disorders reported 6 studies [10, 11, 13–15, 17] reported anxiety, 7 studies [11–15, 17] reported stress and 5 studies [11, 13–15, 17] reported depression. Likewise, the summarized data of the key characteristics of the included studies for mental disorders (stress, anxiety and depression) of students during COVID-19 is presented in (Table 2).

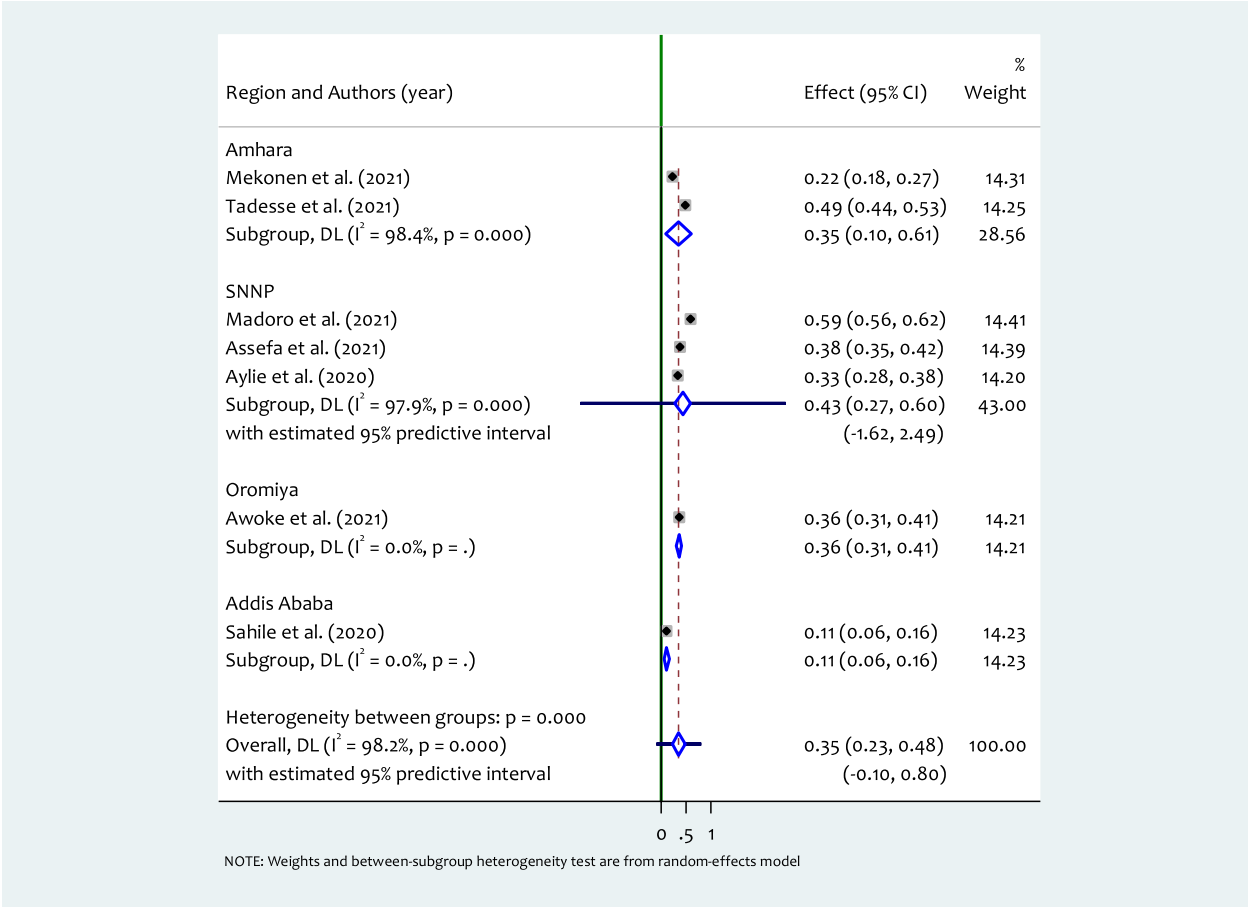

Fig. 6 Subgroup analysis of prevalence of stress among students during the COVID-19 pandemic by region. SNNP, southern nation's nationalities and people; ES, effect size; CI, confidence interval; Weight, weight of each included study

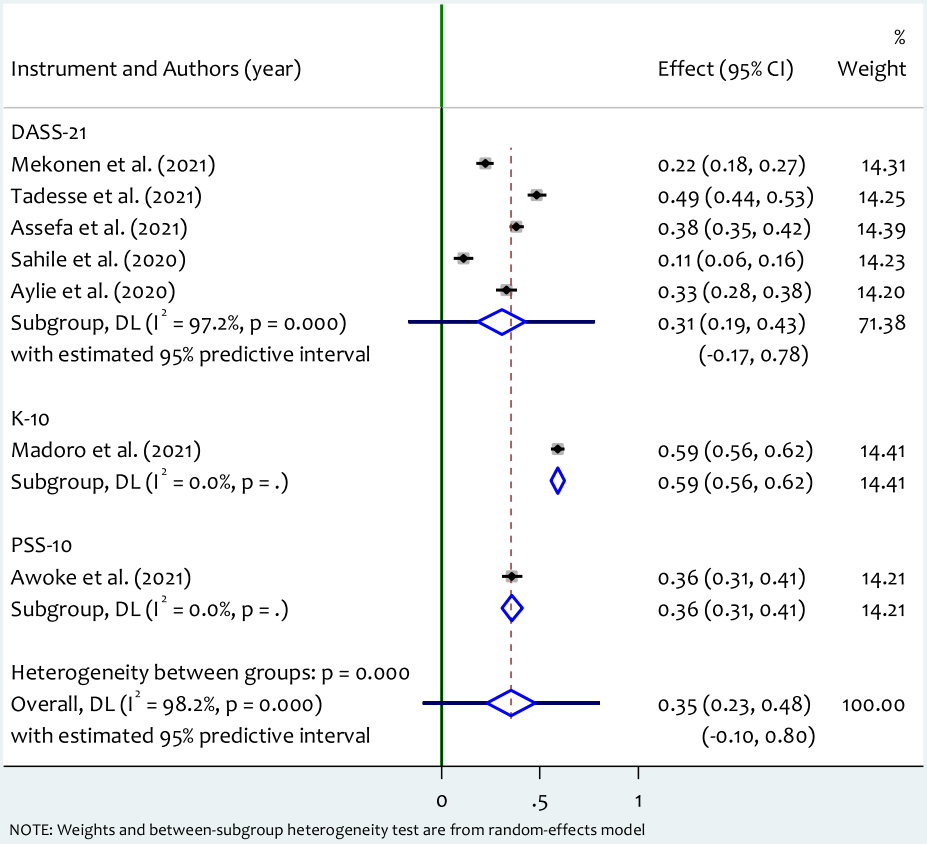

Fig. 7 Subgroup analysis of prevalence of stress among students during the COVID-19 pandemic by instrument. PSS-10, perceived stress scale; K-10, Kessler Psychological Distress Scale; DASS-21, Depression Anxiety Stress Scale

Quality of included studies

A quality score of the eight included studies using Newcastle Ottawa Scale for cross-sectional studies quality assessment tool presented in (Table 2). Accordingly, 3 studies were rated as moderate quality [4, 10, 11] and 5 studies were rated as high quality [12–15, 17] and hence considered for this systematic review and meta analysis.

Publication bias

The publication bias was assessed by the doi plot to picture asymmetry [24] and we used the LFK index to quantify asymmetry of study effects [25] since the number of included studies for each mental disorders are less than ten. No publication bias was existed as showed in Figs. 2, 3 and 4 for anxiety, depression and stress studies respectively. Moreover, there is no asymmetry in all studies since the LFK index were between the interval [-1,1] [25].

Meta analysis on prevalence of mental disorders

Pooled prevalence of stress

A total of 7 studies were reported the prevalence of stress was 35% (95% CI 23–48%, $I^2 = 98.20\%$, Tau^2 = 0.03, $p < 0.001$) as shown in (Fig. 5). The considerable variability of study results has been observed since $I^2 = 98.18\%$.

Subgroup analysis of stress by region

To assess the source of variability in studies subgroup analysis by region was done. From the forest plot (Fig. 6), the pooled prevalence of stress in Amhara, SNNP, Oromiya and Addis Ababa is 35%, 43%, 36% and 11% respectively. Test for heterogeneity among sub-groups

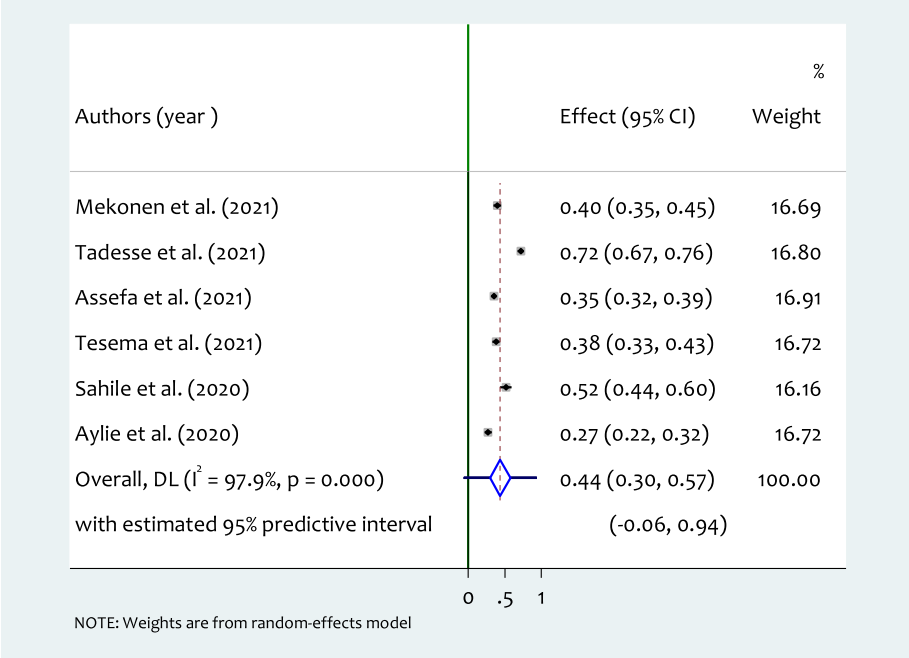

Fig. 8 Forest plot for the prevalence of anxiety among students during the COVID-19 pandemic. ES, effect size; CI, confidence interval; Weight, weight of each included study (degree of impact on pooled results), the larger the weight is the greater the influence on the combined result

(Q = 52.91, df = 3, $p < 0.001$) indicates there is significant variability among regions. The prevalence is higher in SNNP region compared to the others.

Subgroup analysis of stress by instrument

The subgroup analysis by instruments used as shown in the forest plot (Fig. 7) shows the pooled prevalence of stress in K-10, PSS-10 and DASS-21 is 59%, 36% and 31% respectively. Test for heterogeneity among sub-groups (Q = 65.24, df = 2, $p < 0.001$) indicates there is significant variability among instruments used for measuring stress during the COVID-19 pandemic.

Pooled prevalence of anxiety

A total of 6 studies reported the prevalence of anxiety, the pooled prevalence of the anxiety was 44% (95% CI 30%-57%, $I^2 = 97.90\%$, Tau^2 = 0.03, $p < 0.001$). As shown in (Fig. 8), there is significant heterogeneity among study findings on prevalence anxiety among students during the pandemic.

Subgroup analysis of anxiety by region

The subgroup analysis of prevalence of anxiety by region is computed. From the forest plot (Fig. 9), the pooled prevalence of anxiety in Amhara, SNNP and Addis Ababa is 50%, 31% and 52% respectively. Test for heterogeneity among sub-groups (Q = 13.38, df = 2, $p < 0.001$) indicates there is significant variability among regions. The prevalence is higher in Addis Ababa compared to the others.

Subgroup analysis of anxiety by instrument

The subgroup analysis by instrument used was shown in the forest plot (Fig. 10) and the pooled prevalence of anxiety in CAS and DASS-21 is 38% and 45% respectively. Test for heterogeneity among sub-groups (Q = 0.63, df = 1, $p = 0.43$) indicates there is no variability between instruments of anxiety among students in Ethiopia during the pandemic.

Pooled prevalence of depression

A total of 5 studies reported the prevalence of depression among students during the pandemic, and the pooled prevalence of the depression was 44% (95% CI 23%-65%, $I^2 = 99.10\%$, Tau^2 = 0.06, $p < 0.001$) as shown in (Fig. 11). From the heterogeneity test, there is significant heterogeneity observed among individual studies on the prevalence of depression among students.

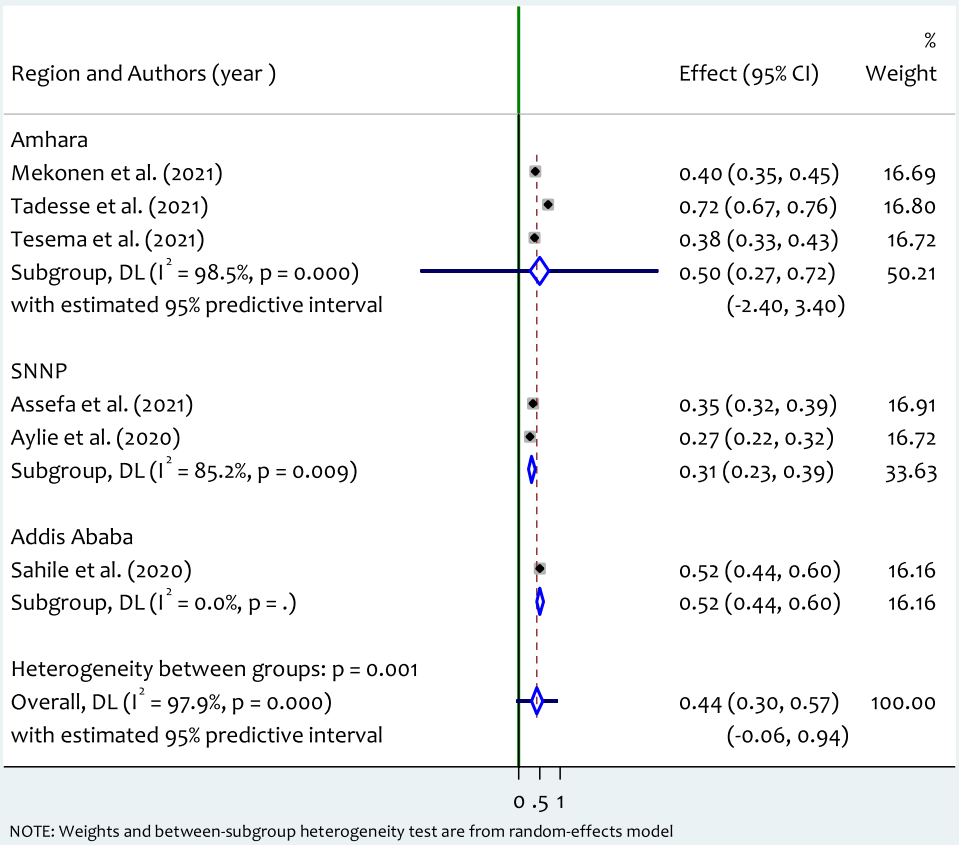

Fig. 9 Subgroup analysis of prevalence of anxiety among students during the COVID-19 pandemic by region. SNNP, Southern nations nationalities and people; ES, effect size; CI, confidence interval; Weight, weight of each included studies (degree of impact on pooled results), the larger the weight is, the greater the influence on the combined result

Subgroup analysis of depression by region

To handle the variability in studies subgroup analysis by region is done. From the forest plot (Fig. 12), the pooled prevalence of depression in Amhara, SNNP and Addis Ababa is 59%, 26% and 51% respectively. Test for heterogeneity among sub-groups ($Q=18.65$, $df=2$, $p<0.001$) indicates there is significant variability among regions. The prevalence of depression on students is higher in Amhara region compared to others.

Systematic review on significant associated factors of mental disorders

There are variety of factors reported that influence the prevalence of mental illness among students during the COVID-19 pandemic in Ethiopia. Of the included studies 5 studies for depression [11, 13–15, 17], 5 studies for anxiety [10, 11, 13–15] and 6 studies for stress [4, 11–15] tried to identify and report significant associated factors and findings are summarized in (Tables 3, 4 and 5). After reviewing articles and assessment of their quality for this stydy, we have summarized the significantly associated variables along with their effect size (adjusted odds ratio). When interpreting the adjusted odds ratio of the primary studies, the assumption is that all other variables in the model are held constant (or adjusted for) while interpreting the effect of each individual variable on the outcome.

Discussion

This study aimed to determine the pooled prevalence and associated factors of depression, anxiety and stress among students due to the COVID-19 pandemic in Ethiopia. We have shown that during COVID-19 the prevalence of stress, anxiety and depression among students

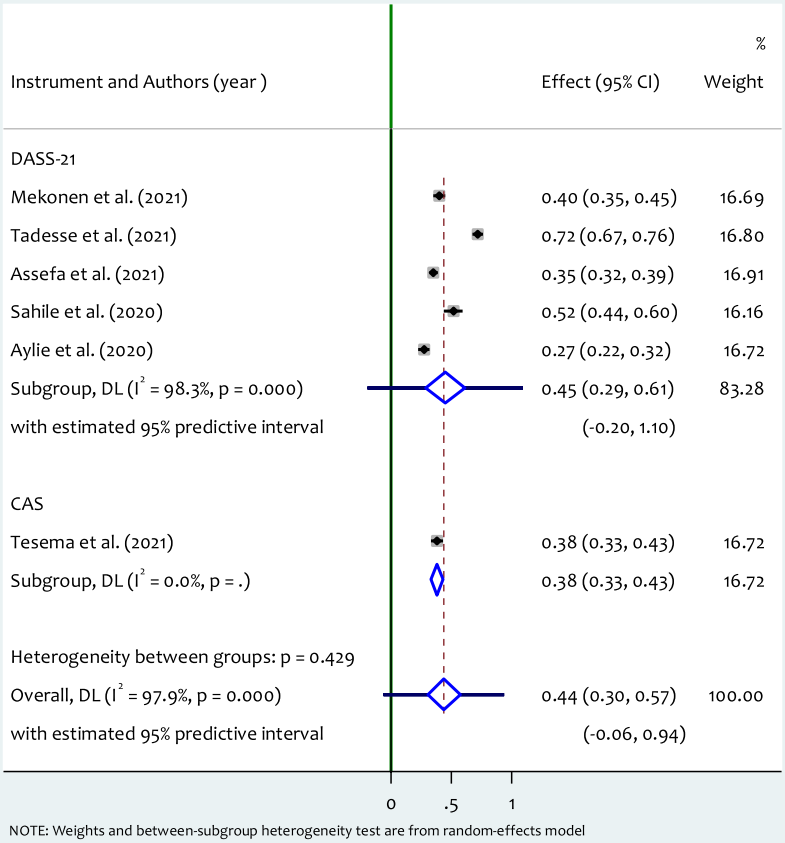

Fig. 10 Subgroup analysis of prevalence of anxiety among students during the COVID-19 pandemic by instrument. PSS-10, Perceived Stress Scale; K-10, Kessler Psychological Distress Scale; DASS-21, Depression Anxiety Stress Scale, CAS = COVID-19 Anxiety Scale

increased in Ethiopia. We included 8 articles [4, 10–15, 17] focusing on the impact of COVID-19 on mental health of students in Ethiopia.

The pooled prevalence of anxiety among students during the COVID-19 pandemic was 44%. This is higher compared to the recent meta-analysis report pooled prevalence of anxiety was 33.8% [26], global prevalence of anxiety among medical students was 37% [27, 28], in Africa 27% [29] and 28.2% [30] in China. From the subgroup analysis by region, the pooled prevalence of anxiety in Amhara, SNNP and Addis Ababa is 50%, 31% and 52% respectively. There is significant variability among regions. This could be due to the low level of awareness of the students on the transmission mechanisms, prevention strategies and reported mortality rates by the pandemic varied across regions. The prevalence is higher in Addis Ababa compared to the others. This might be due to the daily numbers of cases and deaths in Addis Ababa are greater than other regions. Different factors are associated with anxiety among students. Students living in an urban residence, did not use a substance and did not worry about family members are less likely to develop anxiety. On the other hand, female students, not perform physical exercise, inadequate prevention measures, student age ≥ 25 years, students' relative death by COVID-19, students with insomnia case, with COVID-19 obsession and do not living with their parents maximizes the risk of developing anxiety. This is in line with study findings reported in Saudi Arabia, Brazilian and Iranian students [31–33] respectively.

In this meta-analysis, the pooled prevalence of depression among students during the pandemic was 44%. This is higher than study in Chinese medical students 32.74% [34] and worldwide study 31.2% [2]. From the subgroup analysis by region, the pooled prevalence of depression in Amhara, SNNP and Addis Ababa is 59%, 26% and 51% respectively. There is significant heterogeneity among regions on the

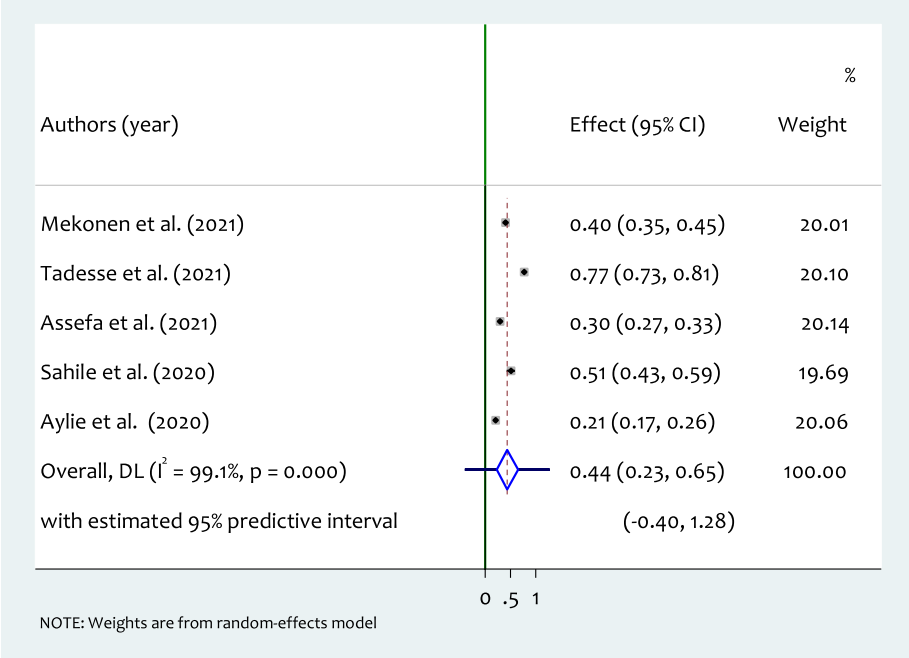

Fig. 11 Forest plot for the prevalence of depression among students during the COVID-19 pandemic. ES, effect size; CI, confidence interval; Weight, weight of each included study (degree of impact on pooled results). The larger the weight is the greater the influence on the combined result

prevalence of depression. The prevalence of depression on students is higher in Amhara region compared to others. This also might be the awareness of the students regarding the infection, transmission, prevention methods and mortality by the COVID-19 differs across regions. Different factors associated with depressive symptom. Students, who live in the urban area, study in non-health science, family monthly income greater than 10,000 birr lowers the risk of developing depression. Whereas, female students, also supported by study on medical students in China [35], staying with their families, having infected cases in the family, did not perform physical exercise, inadequate prevention measures, students who had insomnia, students who stayed at home, students had medical illness, poor and moderate social support increases the risk of developing depressive symptoms among students during COVID-19 in Ethiopia.

In this meta-analysis, the pooled prevalence of stress was 35%. This is higher than study finding worldwide 26.0% [2] lower than study result psychological health problems worldwide general population 41.1% [36]. From the subgroup analysis by region, the pooled prevalence of stress in Amhara, SNNP, Oromiya and Addis Ababa is 35%, 43%, 36% and 11% respectively. There is significant variability among regions. The prevalence is higher in SNNP region compared to the others. Similarly, there is significant heterogeneity between the measurements used in the studies of stress among students in Ethiopia during the pandemic. Different factors were associated with stress among students. Students live in urban areas, living with family, having a family psychiatric history, perception of self/family members being at risk of getting sick decreases the chance of developing stress. Being female student, not practice prevention of COVID-19, students being married, did not perform physical activity, not practice prevention of COVID-19, contact with suspected or confirmed, conflicted related sexual abuse, witnessed shooting, threat to security and safety, poor academic performance, worried about their academic activities, personal perception, rare online talk/chat with friends, presence of confusion due to the inconsistent strategies are associated with increase stress among students. Decreased household income, students who had depression, students who used any substance, students with anxiety and students who had poor social support increases the risk of developing stress among students during the pandemic in Ethiopia.

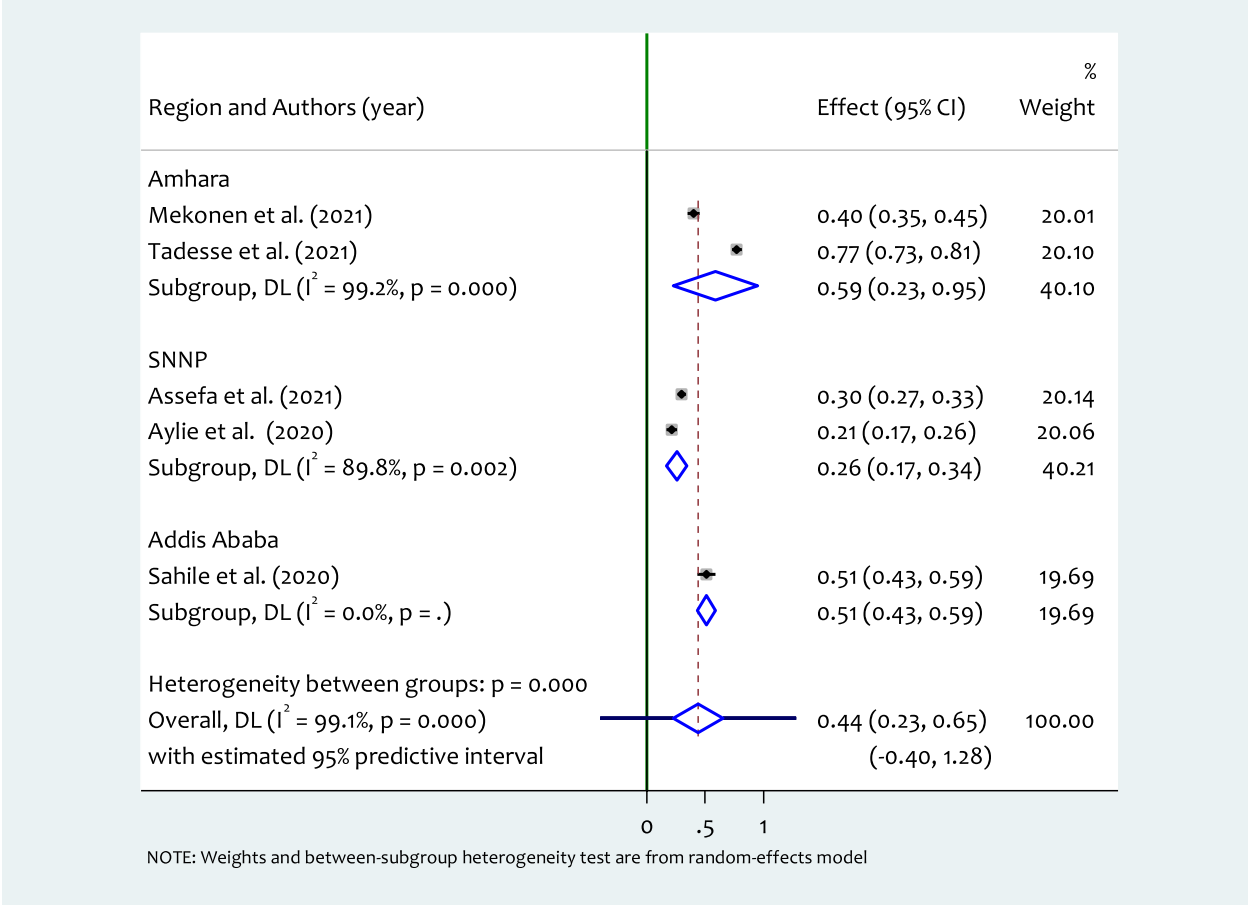

Fig. 12 Subgroup analysis of prevalence of depression among students during the COVID-19 pandemic by region. SNNP, southern nations nationalities and people; the pooled prevalence of stress ES, effect size; CI, confidence interval; Weight, weight of each included study (degree of impact on pooled results), the larger the weight is, the greater the influence on the combined result

This study findings highlight the need to develop appropriate public health interventions to address students mental health needs in Ethiopia during COVID-19, and also to develop suitable programs for students' mental rehabilitation throughout the pandemic. Moreover, further studies in Ethiopia (nationwide) are needed to make more comprehensive conclusion on mental health problems during COVID-19, and to develop and implement interventions for mental health of students.

However, this study has strengths and limitations. To our knowledge, this is the first systematic review and meta-analysis to examine the impact of COVID-19 on the mental health of students in Ethiopia. Two authors performed the data extraction and risk of bias assessment independently, and the quality of included studies was assessed by Newcastle-Ottawa Scale are the strengths. Sensitivity analysis was not assessed due to no influential study was observed in the DOI plot is one of the limitations of this study. Moreover the absence of sufficient studies on the impact of COVID-19 on the mental health of students in Ethiopia, high heterogeneity among the included studies and limited data on factors associated with mental problems and the study is limited in scope to Ethiopia, were among the limitations of this systematic review and meta-analysis.

Conclusion

During COVID-19 students face a variety of mental health problems in Ethiopia. The prevalence of stress, anxiety and depression were significantly high in Ethiopia. There is heterogeneity in the prevalence of mental disorders among students among regions as well as the instruments used. Universities/schools should consider

Table 3 Summary review on significant associated factors of depression among students during COVID-19 pandemic in Ethiopia

No	Authors(year)	Significant associated factors of depression	AOR	Reference category
1	Mekonen et al. (2021) [13]	Students who live in the urban area	0.55	Rural
		Staying with their families	4.06	Staying alone
		Study in non-health science	0.42	Health
		Having infected cases in the family	3.5	No
		Did not perform physical exercise	1.74	Yes
		Have suspected/ infected family	3.47	No
2	Tadesse et al. (2021) [14]	Being female	1.09	Male
		Inadequate prevention practice towards COVID-19	1.74	Adequate
		Living in an urban residence	0.76	Rural
3	Assefa et al. (2021) [15]	Students who always wear a face mask	0.64	No
		Student who took a course in extension	2.05	Regular
		Students who had insomnia	1.74	No
4	Sahile et al. (2020) [17]	Family income of 2001–4999 birr	0.303	< 2000
		Family income greater than 10,000 birr	0.205	< 2000
5	Aylie et al. (2020) [11]	Being female	2.1	Male
		Students who stayed at home	3.6	No
		Students had medical illness	3.10	No
		Poor and moderate social support	2.8 & 1.16	Strong support

AOR Adjusted Odds Ratio

Table 4 Summary review on significant associated factors of Anxiety among students during COVID-19 pandemic in Ethiopia

No	Authors(year)	Significant associated factors of anxiety	AOR	Reference category
1	Mekonen et al. (2021) [13]	Students who live in a urban area	0.36	Rural
		Did not use substance	0.27	Yes
		Did not perform physical exercise	2.12	Yes
		Did not worry about family members	0.51	Worry
2	Tadesse et al. (2021) [14]	Being female	1.68	Male
		Inadequate prevention measures	1.74	Adequate
		Living in an urban residence	0.76	Rural
3	Assefa et al. (2021) [15]	Students age ≥ 25 years	1.76	Younger age (18–24 years)
		Availability of handwashing at the cafeteria, library, and classes	0.58	No
		Students with relatives death by COVID-19	2.60	No
		Students had insomnia	1.81	No
4	Tesema et al.(2021) [10]	Being female	1.6	Male
		Students With COVID-19 obsession	14.51	No
		Grade of students 11^{th}	0.46	Grade 10^{th}
5	Aylie et al (2020) [11]	Don't living with their parents	3.34	Yes
		Students whose relatives got corona	2.40	No
		Family monthly income <2500ETB	2.86	≥ 2500ETB

AOR Adjusted Odds Ratio, *ETB* Ethiopian Birr

Table 5 Summary review on significant associated factors of stress among students during a COVID-19 pandemic in Ethiopia

No	Authors(year)	Significant associated factors of stress	AOR	Reference category
1	Mekonen et al. (2021) [13]	Students live in urban areas	0.44	Rural
		Living with family	0.25	No
		Did not perform physical activity	2.18	Yes
		Poor practice on prevention of COVID-19	1.94	Good
		Contact with suspected or confirmed	6.55	No
2	Madoro et al. (2021) [12]	Conflicted related sexual abuse	4.1	No
		Witnessed shooting	3.49	No
		Threat to security and safety	2.23	No
		Being female	3.01	Male
		Poor academic performance	2.1	Good
3	Tadesse et al. (2021) [14]	Being female student	1.68	Male
		Inadequate prevention practice towards COVID-19	1.74	Adequate
		Living in an urban residence	0.76	Rural
4	Assefa et al. (2021) [15]	Students being married	1.49	Single
		Worried about their academic activities	1.5	No
		Having a family psychiatric history	0.49	No
5	Awoke et al. (2021) [4]	Stressed by the number of COVID-19 cases/deaths in Ethiopia	4.61	Not stressed
		Rare online talk/chat with friends	4.07	Every day
		Presence of confusion due to the inconsistent strategies	2.22	No
		Perception of self/family members being at risk of getting sick	0.53	No
		Changes in household income due to COVID-19 outbreak (decreased)	3.92	Not changed
6	Aylie et al. (2020) [11]	Students who had depression	2.35	No
		Students who used any substance	3.45	No
		Students who developed anxiety	2.79	No
		Students who had low social support	2.86	Strong

AOR Adjusted Odds Ratio

the desires of students during this pandemic and be ready to control the impacts of the pandemic on students' well-being and educational attainment. Timely establishment of awareness-raising programs on the COVID-19 disease, psychological advice and intervention should be executed in order to improve the general mental health problems of students.

Abbreviations

CI Confidence interval
ES Effect size
MeSH Medical Subject Headings
NOS Newcastle-Ottawa Scale

Supplementary Information

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Supplementary Material 1.

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Authors' contributions
All authors have made significant contributions to this study. AAH developed the research question, wrote the first draft, designed the search strategy, analysis, edited and approved the final version of the article. AAS revised the search strategy of databases, developed the data extraction form edited and approved the final version of the article. AAM revised the data extraction form and edited and approved the final version of the article.

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References

1. World Health Organization. Novel coronavirus (2019-nCoV) situation report-1. 2020. Available from: https://www.who.int/docs/defaultsource/coronaviruse/situation-reports/20200121-sitrep-1-2019-ncov.pdf.
2. Batra K, Sharma M, Batra R, Singh TP, Schvaneveldt N. Assessing the psychological impact of covid-19 among college students: an evidence of 15 countries. Healthc. 2021;9(2):1–18.
3. Mengistie Zeleke A, Melkie Bayeh G. Psychological impact, early behavioural response to COVID-19 and predictors among health science students in Amhara Region, Northwest Ethiopia. Eur J Prev Med. 2021;9(5):119.
4. Awoke M, Mamo G, Abdu S, Terefe B. Perceived stress and coping strategies among undergraduate health science students of Jimma University amid the COVID-19 outbreak: online cross-sectional survey. Front Psychol. 2021;12(March):1–11.
5. Adefris D, Moges B. The psychological impact and coping of Covid-19 pandemic among Arsi University students -ethiopia. Curr Psychol. 2021;42:2415.
6. Kisely S, Warren N, McMahon L, Dalais C, Henry I, Siskind D. Occurrence, prevention, and management of the psychological effects of emerging virus outbreaks on healthcare workers: rapid review and meta-analysis. BMJ. 2020;369:m1642.
7. Liu X, Kakade M, Fuller CJ, Fan B, Fang Y, Kong J, et al. Depression after exposure to stressful events: lessons learned from the severe acute respiratory syndrome epidemic. Compr Psychiatry. 2012;53(1):15–23.
8. Knight H, Carlisle S, O'connor M, Briggs L, Fothergill L, Al-Oraibi A, et al. Impacts of the COVID-19 pandemic and self-isolation on students and staff in higher education: a qualitative study. Int J Environ Res Public Health. 2021;18(20):1–16.
9. Lei L, Huang X, Zhang S, Yang J, Yang L, Xu M. Comparison of prevalence and associated factors of anxiety and depression among people affected by versus people unaffected by quarantine during the COVID-19 epidemic in Southwestern China. Med Sci Monit. 2020;26:1–12.
10. Tesema AK, Shitu K, Adugna A, Handebo S. Psychological impact of COVID-19 and contributing factors of students' preventive behavior based on HBM in Gondar, Ethiopia. PLoS One. 2021;16(10 October):1–14. https://doi.org/10.1371/journal.pone.0258642.
11. Aylie NS, Mekonen MA, Mekuria RM. The psychological impacts of COVID-19 pandemic among university students in Bench-Sheko Zone, South-west Ethiopia: a community-based cross-sectional study. Psychol Res Behav Manag. 2020:813–21.
12. Madoro D. Association of conflict-affected environment on ethiopian students ' mental health and its correlates during COVID-19 Era. Neuropsychiatr Dis Treat. 2021;17:3283–92.
13. Mekonen EG, Workneh BS, Ali MS, Muluneh NY. The psychological impact of COVID-19 pandemic on graduating class students at the University of Gondar, Northwest Ethiopia. Psychol Res Behav Manag. 2021:109–22.
14. Tadesse AW, Mihret ST, Biset G, Kassa AM. Psychological problems and the associated factors related to the COVID-19 pandemic lockdown among college students in Amhara Region, Ethiopia: a cross-sectional study. BMJ Open. 2021;11(9):e045623.
15. Assefa ZM, Haile TG, Wazema DH, Tafese WT, Berrie FW, Beketie ED, et al. SAGE Open Nurs. 2021;7:23779608211064376.
16. Silesh M, Tadese M, Haile AB, Moltot T. Perceived Risk of COVID-19 and related factors among university students in Ethiopia during school reopening. Infect Drug Resist. 2021;14:953–61.
17. Tadesse Sahile A, Ababu M, Alemayehu S, Abebe H, Endazenew G, Wubshet M, et al. Prevalence and severity of depression, anxiety, and stress during pandemic of COVID-19 among college students in Addis Ababa, Ethiopia, 2020 a cross sectional survey. Int J Clin Exp Med Sci. 2020;6(6):126.
18. Kamioka H. Preferred reporting items for systematic review and meta-analysis protocols (prisma-p) 2015 statement. Japanese Pharmacol Ther. 2019;47:1177–85.
19. Moher D, Liberati A, Tetzlaff J, Altman DG, Altman D, Antes G, et al. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. PLoS Med. 2009;6(7):e1000097.
20. Peterson J, Welch V, Losos MTP. The Newcastle-Ottawa scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses. Ottawa: Ottawa Hospital Research Institute; 2011.
21. Paddy Ssentongo, Anna E, Ssentongo ESH. Association of cardiovascular disease and 10 other pre-existing comorbidities with COVID-19 mortality: a systematic review and meta-analysis. PLoS One. 2020;15(8):e0238215.
22. Zhu F, Zhang M, Gao M, Zeng C, Wang D, Qianqin Hong WC. Effects of respiratory rehabilitation on patients with novel coronavirus (COVID-19) pneumonia in the rehabilitation phase: protocol for a systematic review and meta-analysis. BMJ Open. 2020;10:e039771.
23. Bowden J, Tierney JF, Copas AJ, Burdett S. Quantifying, displaying and accounting for heterogeneity in the meta-analysis of RCTs using standard and generalised Q statistics. BMC Med Res Methodol. 2011;11:41.
24. Furuya-Kanamori L, Barendregt JJ, Doi SA. A new improved graphical and quantitative method for detecting bias in meta-analysis. JBI Evid Implement. 2018;16(4):195–203.
25. Furuya-Kanamori L, Doi SAR. LFK: Stata module to compute LFK index and Doi plot for detection of publication bias in meta-analysis. 2021. Available from: https://econpapers.repec.org/RePEc:boc:bocode:s458762.
26. Quek TTC, Tam WWS, Tran BX, Zhang M, Zhang Z, Ho CSH, Labrague LJ, McEnroe-Petitte DM, Gloe D, Thomas L, Papathanasiou IV, Tsaras K, et al. A literature review on stress and coping strategies in nursing students. J Ment Health. 2017;26(5):471–80. https://doi.org/10.1080/09638237.20. Int J Environ Res Public Health. 2019;16(15):2735.
27. Sun P, Wang M, Song T, Wu Y, Luo J, Chen L, et al. The psychological impact of COVID-19 pandemic on Health Care workers: a systematic review and Meta-analysis. 2021;12: 626547.
28. Chen J, Farah N, Dong RK, Chen RZ, Xu W, Yin J, et al. Mental health during the COVID-19 Crisis in Africa: a systematic review and meta-analysis. Int J Environ Res Public Health. 2021;18:10604.
29. Zhang H, Li W, Li H, Zhang C, Luo J, Zhu Y, et al. Prevalence and dynamic features of psychological issues among Chinese healthcare workers during the COVID-19 pandemic: a systematic review and cumulative meta-analysis. Gen Psychiatry. 2021;34(3):e10034.
30. Ma Z, Zhao J, Li Y, Chen D, Wang T, Zhang Z, et al. Mental health problems and correlates among 746 217 college students during the coronavirus disease 2019 outbreak in China. Epidemiol Psychiatr Sci. 2020;29:e181.
31. Saddik B, Hussein A, Sharif-Askari FS, Kheder W, Temsah MH, Koutaich RA, et al. Increased levels of anxiety among medical and non-medical university students during the COVID-19 pandemic in the United Arab Emirates. Risk Manag Healthc Policy. 2020;13:2395–406.
32. Nakhostin-Ansari A, Sherafati A, Aghajani F, Khonji MS, Aghajani R, Shahmansouri N. Depression and anxiety among Iranian medical students during COVID-19 pandemic. Iran J Psychiatry. 2020;15(3):228–35.
33. Saraswathi I, Saikarthik J, Kumar KS, Srinivasan KM, Ardhanaari M, Gunapriya R. Impact of COVID-19 outbreak on the mental health status of undergraduate medical students in a COVID-19 treating medical college: a prospective longitudinal study. PeerJ. 2020;8:8.
34. Mao Y, Zhang N, Liu J, Zhu B, He R, Wang X. A systematic review of depression and anxiety in medical students in China. BMC Med Educ. 2019;19(1):1–13.
35. Xiao H, Shu W, Li M, Li Z, Tao F, Wu X, et al. Social distancing among medical students during the 2019 coronavirus disease pandemic in China: disease awareness, anxiety disorder, depression, and behavioral activities. Int J Environ Res Public Health. 2020;17(14):1–13.
36. Wu T, Jia X, Shi H, Niu J, Yin X, Xie J, et al. Prevalence of mental health problems during the COVID-19 pandemic: a systematic review and meta-analysis. J Affect Disord. 2021;281:91–8.

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