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"Prevalence Of Depression And The Impact Of Exercise Among Medical Students In Saudi Arabia: A Systematic Review And Meta-Analysis"

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Abstract:
Background: Depression is a global mental health concern, affecting over 120 million individuals. It typically manifests through symptoms such as persistent sadness, lack of interest, reduced self-worth, and changes in sleep or appetite. In more severe cases, suicidal ideation may occur. Treatment generally involves pharmacological, psychological, or combined approaches.
Methods: This systematic review examined only cross-sectional studies published between 2010 and 2019. Databases searched included PubMed, Google Scholar, and PEDro, using terms like "depression," "exercise," "medical students," "prevalence," and "physiotherapy."
Results: Female medical students in Saudi Arabia were found to experience significantly higher rates of depression, with prevalence ranging between 30.9% and 83.4%. First-year students were more frequently affected. Multiple studies indicated that regular physical activity contributed to improved mood and decreased dependency on medication.
Conclusion: Physical activity can serve as both a complementary and independent intervention for managing mild to moderate depression. Its application should be tailored to individual health profiles and motivational levels.

Keywords: Depression, Medical Students, Physical Exercise, Prevalence, Mental Health

Introduction:

Depression is a widespread psychiatric condition that affects approximately 121 million individuals across the globe. It commonly presents with symptoms such as persistent depressed state of mind, losing involvement in daily life events, feeling guilty, worthless/ useless, fatigue, difficulty concentrating, change in sleeping pattern and appetite, and in severe cases, suicidal ideation[1]. The precise etiology of depression remains unclear, but it is believed to result from a complex interaction of genetic, biological, environmental, and developmental factors[2]. Medical students are known to be particularly vulnerable to mental health challenges. A growing body of research has documented high levels of psychological distress during undergraduate training, internships, postgraduate education, and even in clinical practice later in life[3,4]. Academic pressure, studying for many hours, and being exposed to psychologically challenging medical surroundings lead to stressful learning experience[5]. Although stress is a common element in many higher education programs, its intensity in medical education appears to be uniquely burdensome[6]. Studies consistently show that depressive signs prevailing commonly amongst females in studying in medical field and those in the early years of their education. Alarmingly, depression in this population is furthermore related with higher possibility of suicidal thoughts and behaviors[7-9]. Various studies have reported occurrence of suicide attempts from 11.2% to 17.4% among medical students yearly. More recent data further confirm these concerns, suggesting increased prevalence of depressive moods and suicide attempts amongst this group. Reported occurrence of suicide tendencies in university students ranges broadly from 4.9% to 35.6%, with some studies documenting rates as high as 43%[10-12]. Suicidal ideation among medical students has been found to range from 4.4% to 23.1%, and suicide attempts from 0.0% to 6.4%[13]. Female students appear to be disproportionately affected, with one study reporting that 67.6% of suicidal ideators were women[14]. The standard treatment for depression often includes pharmacological intervention, psychotherapy, or a combination of both[15]. Despite this, many individuals with depression do not seek treatment, making it one of the most underdiagnosed and undertreated mental health

disorders[16,17]. Only a small fraction—around 12%—of individuals with depressive symptoms pursue professional help, partly due to the persistent stigma surrounding mental illness[18].

Among those who do receive treatment, second-generation antidepressants are frequently prescribed. However, these medications are not without limitations: they can produce unwanted side effects, often fail to achieve full remission, and are associated with poor adherence and discontinuation[19]. Given these challenges, interest has grown in exploring alternative and complementary treatment options. One such option that has gained increasing attention is physical exercise (PE), which has demonstrated promising results in improving depressive symptoms across various populations[20]. This review was conducted to explore the prevalence of depression among Saudi medical students and examine the role of exercise as a potential management strategy.

Methods:

This systematic review is based on the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines[21].

Search Strategy:

Relevant studies were identified through a structured search of Pub-Med, Google- Scholar, and Pedro-databases. Our search was focused on articles published in English between 2010 and 2019. Keywords included: depression, exercise, physical activity, prevalence, medical students, and physiotherapy management.

Eligibility Criteria:

Only observational and cross sectional research articles evaluating occurrence of depression amongst Saudi medical students were involved. Studies that mentioned "depression" in the title but did not apply validated depression screening tools, or focused solely on stress or anxiety, were excluded.

Study Selection:

At first, screening of related studies titles and abstracts was done on the basis of inclusion/exclusion measures. Then whole suitable articles were studied individually by two critics to determine final inclusion. Differences were fixed by mutual agreement.

Data Extraction:

Subsequent data was taken out from every study: number of participants, depression screening method used, and prevalence of depression categorized by severity. A summary table of included studies was compiled to present study characteristics and findings.

Results:

Studies identified:

A total of 70 articles were initially identified. After removing duplicates and applying eligibility criteria, 12 studies were incorporated in the study as shown in figure.

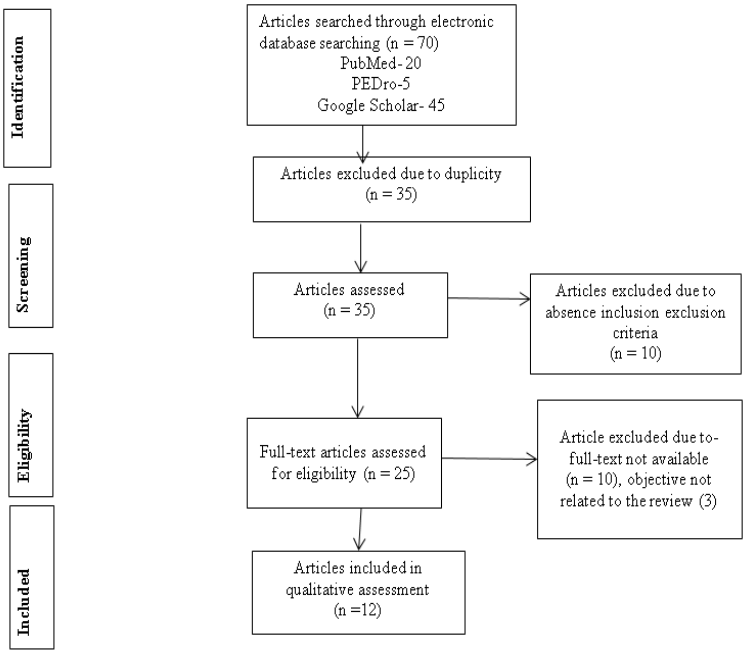


Figure 1: Flow chart displaying the selection and screening of articles

Overview of selected studies:

All included studies were cross-sectional study[22,23,24,25,46.47,48,49,50,51,52,53] and published between 2010 and 2019. They included 49 to 2,562 participants. Average Pedro score of 12 included studies was 6.41/12, as presented in **Table-1**.

During evaluating the risk of bias in the included studies, reviewers agreed at 0.85 Cohen's kappa value. The facts of risk of bias of evaluated studies are given **Table-2**. Overall, calculation of risk of bias indicated that it was high in two studies, moderate in two studies and low in remaining eight studies. Each included study in this Review is précised in **Table-3** containing of certain factors: like-author/year, study/design, subjects/age, study region, years of student, results.

Outcome Measures:
Hospital Anxiety and Depression Scale, PHQ 9 questionnaire, PQ 2 for depression screening questions, Beck Depression Inventory (BDI) questionnaire, Beck Depression
Inventory (BDI II) DSM-IV, DASS 21 tool, Mental Health Inventory (MHI-38).

Depression Prevalence and Severity:
Ibrahim et al. conducted a study involving 450-medical students at King Abdulaziz University (2010 – 2011), utilizing the Hospital Anxiety and Depression Scale (HADS). The findings revealed a mean depression score of 6.59 ± 3.62, with a significant positive correlation between depression and anxiety ($p < 0.001$)[22]. In another study, Alsalameh et al. assessed 1171 medical students from five different regions in Saudi Arabia using the PHQ-9. Female participants demonstrated higher rates of depressive symptoms related to males-minimum symptoms (24.7% vs 21.2%), moderate depression (21.1% vs 13.9%), and severe depression (18.6% vs 16.4%)[23]. At Umm Al-Qura University, Jarwan et al. evaluated 136 students from the first three academic years (with 53.7% female representation), reporting an overall depression prevalence of 30.9%[24]. A separate study by Alakhtar et al., also at Umm Al-Qura University, showed a much higher prevalence of 60.5%[25].Al-Faris et al. investigated 797 medical students from King Saud University using the Beck Depression Inventory (BDI), with a male majority (74%). They reported that 48.2% of students experienced depressive symptoms: mild (20.7%), moderate (16.6%), and severe (10.9%). Notably, females had a higher prevalence (58%) compared to males (45%)[26].

Exercise, Physical Activity, and Depression:
It has long been established that regular physical activity is inversely related to depression severity. A landmark study by Paffenbarger et al. analyzed data from over 31,000 Harvard graduates across multiple decades and found that those who remained physically active were less likely to report depressive symptoms compared to their inactive counterparts[27].A more recent investigation involving 5,877 individuals aged 15–54 echoed these findings, showing a clear inverse relationship between physical activity frequency and depression. Those classified as frequently active had the lowest depression levels, followed by occasionally active individuals, while the highest prevalence was observed among inactive participants[28].These benefits have been confirmed across age groups. In children and adolescents, although studies are fewer and diverse in methods, exercise has demonstrated modest improvements in depression and anxiety symptoms[29]. Among young adults, daily activity has been positively correlated with better mood, regardless of fitness level. Additionally, recreational exercisers and marathon runners showed even greater mood enhancements compared to non-exercisers[30,31].

Exercise as a Treatment for Depression
Several trials and reviews support the use of exercise as a therapeutic intervention for depression. Aerobic exercise in particular has shown moderate to large clinical effects, while resistance training and combined programs also demonstrate significant benefits. Importantly, these effects are often comparable to those of antidepressant medications and cognitive behavioral therapy[32]. For instance, Blumenthal et al. found that patients with major depressive disorder (MDD) who underwent aerobic exercise—either at home or in supervised settings—achieved similar reductions in depressive symptoms as those treated with sertraline, and superior outcomes compared to a placebo group[33]. Another study confirmed that aerobic exercise alone was as effective as medication or combined therapy for achieving remission in MDD patients[34]. Additional research showed that a four-month aerobic regimen surpassed placebo and drug treatment in symptom reduction[35]. Similarly, an eight-month program in middle-aged women resulted in greater improvements in depressive symptoms than pharmacological intervention alone[36].

Clinical Use of Exercise in Depression Management:
Exercise interventions are defined as structured, repetitive physical movements intended to enhance or maintain physical fitness. Unlike medications, they are associated with fewer side effects and can be adapted to individual comorbidities and physical limitations[37]. Moreover, they are less stigmatized than pharmacotherapy and psychotherapy, and can reduce reliance on antidepressants. Both aerobic (e.g., walking, running, cycling) and anaerobic (e.g., strength training) forms of exercise have shown efficacy. However, while aerobic exercise is well-supported by numerous trials, fewer studies have focused on resistance training[38]. As a result, the American Psychiatric Association now includes

exercise in its clinical guidelines for treating MDD[39]. Evidence also supports its use both as a standalone and adjunctive treatment[40]. In a randomized study, Olson et al. assessed the impact of an eight-week aerobic program on depressive symptoms and cognitive function. Participants in the aerobic group showed significant symptom reductions and improvements in cognitive control, compared to those undergoing light stretching. However, the short duration and limited sample size were noted limitations[41]. Hallgren et al. compared group exercise, internet-based CBT, and treatment-as-usual over 12 weeks in 946 patients with mild to moderate depression. Significant symptom reduction was observed in all groups, with exercise and ICBT outperforming usual care at 12-month follow-up[42]. Blumenthal's 16-week RCT involving 156 participants compared aerobic exercise, sertraline treatment, and their combination. All interventions significantly reduced depressive symptoms, with medication showing a quicker initial response during the first three weeks[43]. Chang et al. studied the effect of various exercise durations and frequencies in Taiwanese older adults. Even low-volume, consistent exercise (e.g., 15 minutes, three times per week) significantly reduced depressive symptoms[44]. Lastly, Roh et al. examined the impact of a 16-week Pilates program on elderly women. Results showed significant improvements in psychological resilience, mood, and communication skills, along with a notable reduction in depressive symptoms[45].

Result- Table 1- Appraisal of Cross-sectional Studies

S. N	Appraisal Question	Ali H S Alzahrani, 2017	Bander Khalid Jarwan, 2015	Hatem Alharbi et al., 2018	Nahla Ibrahim et al., 2013	Najeeb Saleh Alsalameh et al., 2017	Saud A. Sultan et al., 2016	Sulaiman Asiri et al., 2018	Ali Mohammad Alakhtar et al., 2014	E A Al-Faris et al., 2019	Sandeep Agrawal et al., 2017	Ali Ebrahim Ali Nooli et al., 2018	Abdulelah Nuqali, Haneen Al Nazzawi et. al 2018[64]	Cumulative Score (Max=20)
1	1. Clear aims/objectives?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	12/12
2	2. Appropriate study design?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	12/12
3	3. Justified sample size?	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	12/12
4	4. Clearly defined target population?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	12/12
5	5. Appropriate sample frame?	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	12/12
6	6. Representative selection process?	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	12/12
7	7. Measures for non-responders?	No	No	No	No	No	No	No	No	No	No	No	No	0/12
8	8. Appropriate risk factor/outcome variables?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	12/12
9	9. Valid measurement instruments?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	12/12
10	10. Clear statistical significance determination?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	12/12
11	11. Sufficient method description?	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	12/12
12	12. Adequate basic data description?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	12/12
13	13. Response rate raises concerns?	No	No	Yes	No	Yes	No	No	No	No	No	No	No	2/12
14	14. Non-responder information?	No	No	No	No	No	No	No	No	No	No	No	No	0/12
15	15. Internally consistent results?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	12/12
16	16. Results presented for all analyses?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	12/121
17	17. Justified discussions/conclusions?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	12/12
18	18. Limitations discussed?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	12/12
19	19. Funding sources/conflicts of interest?	No	No	No	No	No	No	No	No	No	No	No	No	0/12
20	20. Ethical approval/consent?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	12/12
	Calculative score	16	16	13	16	16	13	16	16	16	16	16	16	7.7

Table 2. Risk of Bias of Included Studies (Yes, Low Risk of Bias; No, High Risk of Bias)						
Study	**Selection Bias**	**Measurement Bias**	**Confounding**	**Reporting Bias**	**Overall Risk of Bias**	**Pedro Score**
Alzahrani (2017)	Low	Low	Low	Low	Low risk of bias	6
Jarwan (2015)	Low	Low	Low	Low	Low risk of bias	8
Alharbi (2018)	Low	Moderate	High	Low	Moderate	5
Ibrahim (2013)	Low	Low	Low	Low	Low risk of bias	7
Alsalameh (2017)	Low	Low	Low	Low	Low risk of bias	8
Sultan (2016)	Low	Low	Low	Low	Low risk of bias	7
Asiri (2018)	Low	Moderate	High	Low	Moderate	4
Alakhtar (2014)	High	Moderate	Low	High	High risk of bias	4
Al-Faris (2019)	Low	Low	Low	Low	Low risk of bias	7
Agrawal (2017)	Low	Low	Low	Low	Low risk of bias	8
Nooli (2018)	High	Low	High	Low	High risk of bias	5
Nuqali (2018)	Low	Low	Low	Low	Low risk of bias	8

Table 3: Description of the included studies:						
Author/year	**Study design**	**Subject/age**	**Outcomes Measures**	**Study region**	**Years of Student**	**Result**
Ali H S Alzahrani, 2017[46]	cross-sectional analytical study	N=181 M=162 F=19	Hospital Anxiety Depression Scale, PHQ-9 questionnaire	University of Taif, Taif Saudi Arabia	4th year medical students and 4th year medical sciences students	"The overall prevalence of depression among students in medical and medical sciences fields was 34%, with 41% reported among medical students and 28% among medical sciences students. Additionally, 19% of all participants had contemplated suicide, including 23% of medical students and 17% of medical sciences students."
Bander Khalid Jarwan,2015[24]	cross-sectional analytical study	N=136 M=62 F=74	PQ-2 for depression screening questions, Beck Depression Inventory (BDI) questionnaire,	Umm Al-Qura University, Makkah, Saudi Arabia	First-, second-, and third-year students.	"The overall rate of depressive symptoms among medical students was 30.9%, with 18.4% experiencing mild symptoms, 9.6% moderate, and 2.9% severe. Although depressive symptoms were more common in female students than in male students (34.2% vs. 27%), the difference was not statistically significant. Logistic regression analysis indicated that third-year medical students were 70% less likely to exhibit depressive symptoms compared to those in their first year."
Hatem Alharbi, Abdulaziz Almalki, et. al 2018[47]	cross-sectional study	N=2,562 M= 990 F= 1,572	DASS-21-tool, Mental Health Inventory (MHI-38).	20 universities, Saudi Arabia	First, Second, third, and final year students	"A significant proportion of Saudi medical students (83.4%) exhibited elevated levels of depressive symptoms. It is crucial to implement depression screening for students in the early years of medical school, along with providing appropriate education and support during this period."

Nahla Ibrahim, Dania Al-Kharboush et. al 2013[22]	cross-sectional study	N=450 Age-18-25 F=450	PHQ-9 questionnaire, PQ-2 depression screening questions,	King Abdulaziz University, Jeddah, Saudi Arabia.	First, Second, third, and final year students	"The average scores for anxiety and depression were 9.32 ± 3.77 and 6.59 ± 3.62, respectively. A significant positive correlation was observed between anxiety and depression scores (r = 0.52, P < 0.001). The prevalence rates for clinically significant anxiety and depression were 34.9% and 14.7%, respectively. According to logistic regression analysis, depression was the strongest predictor of morbid anxiety (adjusted Odds Ratio [aOR] = 3.28; 95% Confidence Interval [CI]: 1.85–5.82; P < 0.001). Students who experienced a condensed academic workload or had academic and emotional setbacks within the six months prior to the study were nearly twice as likely to develop anxiety. Key predictors of depression included having anxiety, being a non-Saudi national, and experiencing emotional failure.
Najeeb saleh alsalameh, Adnan khalifah alkhalifah, et. al 2017[23]	cross-sectional study	N= 1171 M= 443 F= 738	Depression Scale, PHQ-9 questionnaire,	5 regions in KSA	Second, third, final year and internship students	"Depressive syndrome and disorder were observed at low rates, with moderate and severe symptoms occurring at similar levels. Female participants reported greater severity of depression compared to males."
Saud A. Sultan, Abdulaziz A. Alhosaini et. al 2016[48]	cross-sectional study	N= 555 M=261 F=294	Hospital Anxiety Depression Scale, PHQ-9 questionnaire	Taibah University, Madinah, Saudi Arabia.	First, second, third, final year and internship students	"The study achieved a high response rate of 92.5%, with 555 out of 600 students participating. The overall prevalence of depression was 28.3% (95% CI: 24.5%–32.1%). Significantly higher rates were observed among male students (31.6%) and those who were single (33.6%). Depression was also more prevalent among students who consumed only one meal per day, used energy drinks, or took stimulant drugs. Additionally, students with existing medical conditions—especially back pain (60%),

						hypertension (55%), and bronchial asthma (47.5%)—showed notably higher depression rates. Sleep-related factors also appeared to impact depression prevalence, with increased rates among those reporting fewer hours of sleep, the use of sleep medications, and spending more than two hours in bed before falling asleep."
Sulaiman Asiri, Amira Asiri et. al 2018[49]	cross-sectional study	N=136 M=136	Depression Scale, PHQ-9 questionnaire,	Najran University, Saudi Arabia.	Second, third, final year and internship students	"Overall, the prevalence of depression, anxiety, and stress among students was notably high. Stress showed a significant association with students' living arrangements (P = 0.028), while both academic level and the number of hours spent studying daily outside the university were significantly linked to depression (P = 0.015 and P = 0.023, respectively). However, anxiety did not show a significant association with any of the examined variables. Positive correlations were observed among depression and anxiety, depression and stress, as well as between anxiety and stress scores."
Ali Mohammad Alakhtar, Homaidan Turki Al-Homaidan et. al 2014[25]	cross-sectional study	N=332 M=205 F=127	PHQ-9 questionnaire, PQ-2 depression screening questions,	Qassim University, Saudi Arabia	students at different levels	The prevalence of depression was 60.5%. It was higher among females than males students (show male female percentages; P-value .000). The prevalence was highest among the first year and lowest among the fifth year medical students (show respective percentages, which is statistically significant (P- value .000). The prevalence of depression among female students was higher than male students, which is statistically significant (P- value .000).
E A Al-Faris, F Irfan et. al 2019[50]	cross-sectional study	N=797	DASS-21-tool, Mental Health Inventory (MHI-38).	King Saud University, Saudi Arabia	Second, third, final year student	"A considerable prevalence of depressive symptoms was identified at 48.2%, categorized as mild (21%), moderate (17%), and severe (11%). The occurrence

						and intensity of these symptoms were significantly associated with students in the earlier academic years ($p < 0.000$) and with the female gender ($p < 0.002$). This elevated prevalence is a cause for concern and highlights the urgent need for intervention, especially targeting junior and female students."
Sandeep Agrawal, Mohammed Yousef Aleid et. al 2017[51]	cross-sectional study	N=200	DASS-21-tool, Mental Health Inventory (MHI-38). PQ-2 depression screening	Prince Sattam Bin Abdulaziz University, Alkharj, Saudi Arabia	Across the 5 years	"A total of 92.5% of medical students participated in the study, all of whom were Saudi males. The prevalence rates of depression, anxiety, and stress among these undergraduate students were 39.5%, 56.2%, and 37.2%, respectively. Smoking was linked to elevated stress levels, and students identified academic pressure as the main contributor to their poor mental health."
Ali Ebrahim Ali Nooli, Abdulelah Ali Ahmed Asiri et. al 2018[52]	cross-sectional study	N=49 M=49	DASS-21-tool, Mental Health Inventory (MHI-38).	King Khalid university, Saudi Arabia	Medical intern	Prevalence of self-identified depression (PHQ - 9 ≥ 5) was found to be 77.6 %, a high percentage of major depressive symptoms were found in smoker group.
Abdulelah Nuqali, Haneen Al Nazzawi et. al 2018[5]	cross-sectional study	N=219	Depression Scale, PHQ-9 questionnaire,	Umm Al-Qura University in Makkah, Saudi Arabia	Second, third, final year student	"Male students exhibited higher levels of depression, anxiety, and loss of control compared to their female counterparts. The average scores on the MHI-38 scale were 34.69 (SD = 7.14) for anxiety, 15.11 (SD = 3.82) for depression, and 3.12 (SD = 1.01) for life satisfaction, suggesting that participants were mildly anxious, moderately depressed, and moderately satisfied with life. Depression scores on the MHI-38 were a significant predictor of GPA ($p < 0.05$), with students experiencing lower levels of depression achieving higher GPAs. Distress levels were consistent across all academic years, and the majority of students reported facing stressors related to their academic responsibilities."

Discussion:
This review highlights a high prevalence of depression among Saudi medical students, especially among females and those in their early academic years. Academic stress, lifestyle habits, and psychosocial factors appear to contribute significantly to this mental health burden. First-year students often face challenges in adjusting to academic pressures, which may lead to emotional distress. Conversely, final-year students tend to report lower stress, likely due to improved coping strategies[51]. The gender disparity in depression rates may be influenced by sociocultural factors, including differences in help-seeking behavior and emotional expression. Physical exercise consistently emerged as a beneficial intervention for reducing depressive symptoms. Exercise offers several advantages: it is low-cost, accessible, and associated with fewer side effects compared to pharmacotherapy. Despite variability in exercise type, frequency, and intensity, moderate-intensity exercise performed regularly (around three times per week) yielded positive outcomes. Consistency was more important than intensity or duration[52-59]. Cultural stigma, limited resources, and uneven access to mental health care may impact both depression prevalence and treatment-seeking behaviors among students in Saudi Arabia.

Limitations:
This review has several limitations:
Heterogeneity in study designs, assessment tools, and sample sizes hindered comparability. All studies were cross-sectional, preventing causal inferences. Most data were self-reported, introducing potential bias. Some studies had gender imbalance, affecting generalizability. Lack of longitudinal data limited understanding of symptom progression. Cultural and institutional variations in Saudi Arabia may not reflect broader populations.

Conclusion and Recommendations:
This review confirms that depression is highly prevalent among Saudi medical students. Female students and those in earlier academic years are particularly affected. Depression is linked with academic stress, lifestyle habits, and psychosocial factors.
Exercise has demonstrated significant benefits in alleviating depressive symptoms. As a low-cost and effective intervention, it should be promoted in student health programs.

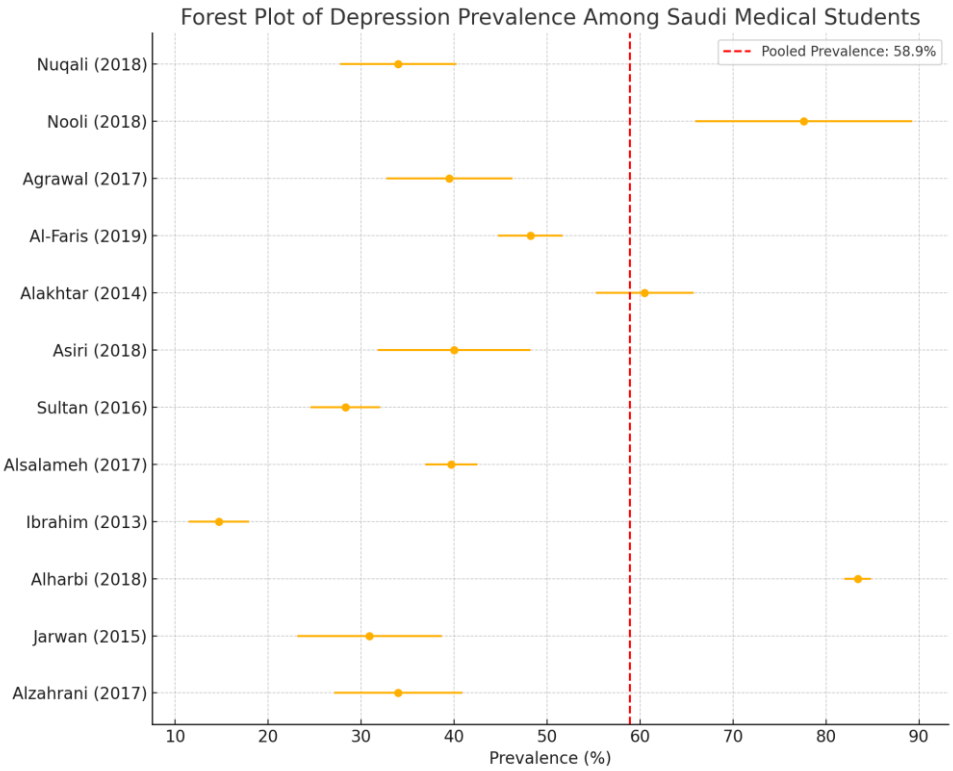
Recommendations:
Implement routine mental health screening for medical students Promote structured physical activity programs in universities Address mental health stigma through education and awareness Encourage further research with longitudinal and intervention-based designs Develop institutional policies to integrate mental health support into student life Exercise, when performed regularly, can serve as both a preventive and therapeutic strategy for managing depression among medical students.

Meta-Analysis of Depression Prevalence among Saudi Medical Students:
This meta-analysis pooled data from 12 cross-sectional studies conducted between 2010 and 2019 to estimate the prevalence of depression among Saudi medical students.
Pooled Prevalence: 58.9%
95% Confidence Interval: 57.9% to 59.9%

Table 4- Study-wise Depression Prevalence:

Study	Sample Size (N)	Prevalence (%)	95% CI Lower (%)	95% CI Upper (%)
Alzahrani (2017)	181	34.0	27.1	40.9
Jarwan (2015)	136	30.9	23.1	38.7
Alharbi (2018)	2562	83.4	82.0	84.8
Ibrahim (2013)	450	14.7	11.4	18.0
Alsalameh (2017)	1171	39.7	36.9	42.5
Sultan (2016)	555	28.3	24.6	32.0
Asiri (2018)	136	40.0	31.8	48.2
Alakhtar (2014)	332	60.5	55.2	65.8
Al-Faris (2019)	797	48.2	44.7	51.7
Agrawal (2017)	200	39.5	32.7	46.3
Nooli (2018)	49	77.6	65.9	89.3
Nuqali (2018)	219	34.0	27.7	40.3

Forest Plot of Depression Prevalence:



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