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Exploring the Effects of Yoga on Depression Relief in Academically Stressed Students: A Quantitative Analysis Using the SDS and Facial Emotion Recognition Technology

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ABSTRACT

Depression is a prevalent mental health issue among students, particularly those facing academic stress. While conventional treatments like medication and psychotherapy are commonly used, alternative approaches such as yoga have been recognized for their holistic benefits. This study aims to assess the effectiveness of yoga in alleviating depressive symptoms in academically stressed students

BACKGROUND

Depression is a significant concern in mental health, especially among students who experience high levels of academic stress. Conventional treatments like medication are widely used, but alternative therapies like yoga are increasingly being explored for their potential benefits in improving mental and emotional health. This study investigates the effect of yoga on depressive symptoms in students, focusing on emotional well-being using SDS and facial emotion recognition technology.

OBJECTIVES

The primary objective of this study is to determine how yoga can reduce depressive symptoms in academically stressed students. Specifically, the study seeks to assess the impact of yoga on emotional well-being using SDS and facial emotion recognition (FER), and explore whether yoga can improve mindfulness and emotional stability in students.

MATERIALS AND METHODS

A total of 30 students, aged 15–30 years, were randomly assigned to two groups: an experimental group (n=15) and a control group (n=15). The experimental group practiced yoga for 12 weeks, five days per week for one hour each morning. Depressive symptoms were measured pre- and post-intervention using the Zung Self-Rating Depression Scale (SDS), which includes a 4-point scale assessing anxiety and depression levels. Facial emotion recognition (FER) technology was also used to analyse facial expressions and emotional states during both pre- and post-intervention phases.

RESULTS AND DISCUSSION

The Shapiro-Wilk test was used to assess the normality of the data for small sample sizes. The test results indicated that the Yoga Group Post-Test data was non-normal ($p = 0.023$), while the Control Group showed no significant change ($p > 0.05$). The Wilcoxon Signed Ranks Test showed significant improvements in the Yoga Group Post-Test compared to the Pre-Test ($Z = -3.417$, $p = 0.001$), suggesting a substantial reduction in depressive symptoms and emotional instability. In contrast, the Control Group showed no significant changes in SDS scores ($Z = -0.442$, $p = 0.659$). Additionally, The Facial Emotion Recognition (FER) analysis revealed significant emotional improvements in the Yoga Group. Sadness decreased from 42.67 to 18.80, Anger from 20.07 to 7.13, Fear from 6.33 to 2.27, and Neutral emotions from 15.87 to 4.80. Happiness notably increased from 9.33 to 67.07, while Surprise decreased from 6.13 to 1.93. In contrast, the Control Group showed minimal changes in emotional states, with Sadness remaining nearly the same. These findings highlight the positive impact of yoga in improving emotional stability and well-being in students experiencing academic stress.

CONCLUSIONS

This study demonstrates that yoga is an effective intervention for managing depression in academically stressed students. The yoga group showed significant reductions in depressive symptoms and improvements in emotional stability compared to the control group. The findings support the use of yoga as a complementary therapy for enhancing emotional well-being and mindfulness. Further research is needed to explore the long-term effects of yoga and the broader applications of facial emotion recognition in monitoring emotional changes during therapeutic interventions.

Keywords: *Yoga, Depression, Zung Self-Rating Depression Scale (SDS), Facial Emotion Recognition (FER), Academic Stress, Emotional Well-being*

1. INTRODUCTION

1.1 Depression

Depression, also known as major depressive disorder, is a widespread and severe mental health condition that significantly impacts mood, cognition, and daily functioning. According to the World Health Organization (WHO), over 350 million people globally suffer from depression, making it a leading contributor to the global burden of disease (WHO, 2017). Recent surveys indicate that approximately 18% of adults are currently experiencing depression, with a lifetime prevalence of nearly 29% (Kessler et al., 2005). Women and younger adults are disproportionately affected, with many cases beginning in the late teens to mid-20s (Kessler et al., 2012). Depression manifests with a variety of symptoms that persist for at least two weeks, including persistent sadness, loss of interest in activities, changes in sleep and appetite, fatigue, difficulty concentrating, feelings of worthlessness, and recurrent thoughts of death or suicide (American Psychiatric Association, 2022). These symptoms often interfere with personal relationships, work, and overall quality of life. In children and adolescents, depression may present as irritability and academic struggles (Kessler et al., 2005). The growing recognition of depression's prevalence and impact has led to advancements in research and treatment. Multimodal approaches, including psychotherapy, medication, lifestyle interventions, and community support systems, have been shown to be effective (Ferrari et al., 2013,Sudhan et al.,2023). Early intervention and tailored strategies are critical to addressing this complex and multifaceted disorder (Kessler et al., 2012).

1.2 Depression for Academic Students

Academic environments are often highly competitive, requiring students to develop skills to manage stress effectively (Acosta-Gómez et al., 2018). Unmanaged stress can lead to negative outcomes such as depression and anxiety, highlighting the importance of measuring stress levels to enhance students' coping strategies, mood, and overall quality of life. Stress impacts not only students' mental health, such as concentration and sleep patterns, but also their physical well-being, affecting both psychological and physiological aspects (Pranadji & Nurlaela, 2009).Fig.1 show that Depression is a significant concern among academic students, with studies estimating that approximately 40% of students experience symptoms of depression, making it a widespread issue within educational institutions (Rao et al., 2020). This mental health challenge has profound effects on students' academic performance, with about 30% experiencing noticeable declines in their ability to concentrate, retain information, and achieve desired grades due to

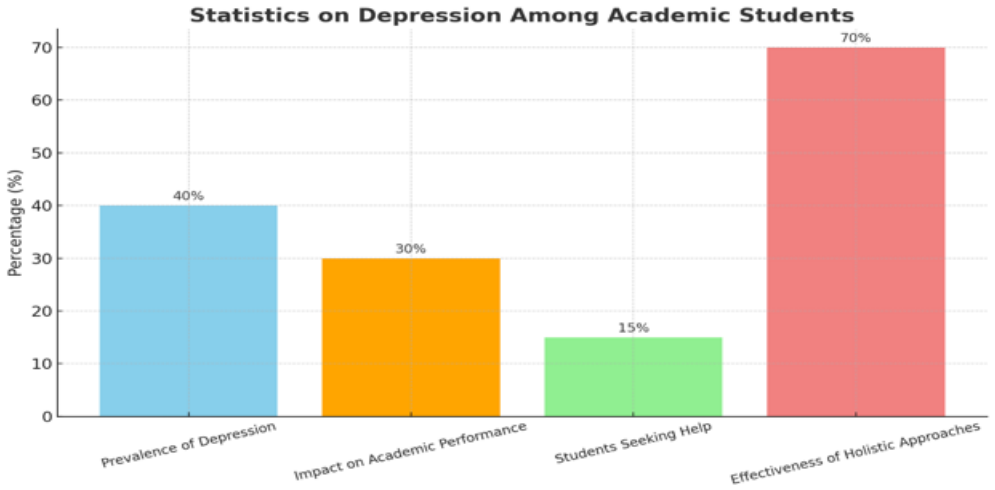


Figure 1.Depression between Academic Students

their depressive symptoms (American College Health Association, 2021). Despite its prevalence, only 15% of affected students actively seek professional help or support, highlighting a gap in awareness and access to mental health resources (Lipson et al., 2019). However, holistic approaches such as yoga have shown remarkable potential in alleviating depressive symptoms. Research indicates that up to 70% of students benefit significantly from these practices, leading to improved emotional well-being and resilience (Field, 2021, Sudhan et al.,2022). Implementing yoga programs in educational settings could play a pivotal role in mitigating stress and fostering holistic mental health among students. Tailored yoga interventions focusing on mindfulness, breathing techniques, and physical postures have shown potential in improving emotional regulation and academic performance, making them a valuable tool for addressing the mental health challenges faced by today's youth.

1.3 Understanding Teacher-Student Dynamics in Real-Time Learning

Various teaching methods such as lectures, discussions, and small-group activities aim to assess and understand the psychological states of students. The way students express themselves in class can vary, with some students speaking more loudly or frequently than others. This variation is often due to differences in individual learning styles and personality traits. For instance, some students may be more reflective learners, taking time to develop ideas and formulate questions internally before sharing them. Conversely, there are students who may feel hesitant or anxious about speaking in front of a group, often due to shyness, especially in the early stages of their academic journey Smith, J. (2021).

1.4 The Five Dimension of Depression

Figure 2. Five Dimension of Depression

Fig. 2 show that Distress, dysfunction, defeat, distance, and disregard are common experiences associated with depression. Emotional signs such as feeling overwhelmed, lost, or stuck often accompany physical symptoms like body aches, poor sleep, or low appetite. These indicators can signal the need for intervention. Engaging in daily physical activity, avoiding alcohol, and maintaining a consistent wake-up time can help manage distress. Dysfunction, seen in poor academic or work performance, often leads to unhealthy coping mechanisms. Seeking support, setting goals, and participating in group activities can help restore functionality. Feelings of defeat and worthlessness can be alleviated by volunteering, staying connected with loved ones, and engaging in creative activities. Social isolation is another consequence of depression, but spending time in social spaces, attending events, or helping others can reconnect individuals with their community. Lastly, disregarding self-care is a dangerous aspect of depression, and regaining care through small steps, like maintaining hygiene, eating well, and finding enjoyment in activities, is crucial for recovery (Hersh, 2022; Taylor, 2023).

2. MATERIALS AND METHODS:

The study examined psychological factors and emotional states through pre- and post-tests in two groups: one experimental group and one control group. A total of 30 academic students experiencing depression, aged between 15 to 35 years, were selected from Tamil Nadu. Participants were randomly divided into two groups: Experimental Group I (n=15): Received Yoga practice. Control Group II (n=15): Did not receive any intervention.

2.1 Historical Context of Facial Expressions and Universal Emotions

Facial expression analysis has long been studied as a tool for understanding emotions, dating back to Charles Darwin's assertion in 1872 that facial expressions of emotion are universal across cultures. Paul Ekman's seminal research in the 1960s classified six universal emotions—**joy, surprise, sadness, anger, disgust, and fear**—with a seventh, **contempt**, sometimes included. His work laid the foundation for analysing emotional states through facial cues like smiles, eyebrow positions, and muscle movements. Recent advances in Human-Computer Interaction (HCI) have explored using smartphone cameras to analyse facial expressions for mental health assessments. For instance, Rui et al. (Wang et al., 2015) developed an app that captured facial images throughout the day but faced challenges due to image quality and algorithmic limitations. Vincent et al. (Tseng et al., 2018) demonstrated the potential of pupil analysis to gauge alertness. More recently, Mood Capture (Nepal

et al., 2024) analyzed facial landmarks, colours, and lighting from smartphone-captured images to distinguish between depressed and non-depressed individuals using machine learning algorithms. While effective, Mood Capture's external data processing raised privacy concerns . Our study advances this field with opportunistic data collection, capturing images during natural smartphone interactions to reflect daily emotional and behavioural patterns more comprehensively. Unlike prior systems, we process all data locally on users' devices, prioritizing privacy. By open-sourcing our framework, we aim to enable further research into behavior modeling through affective signals, extending applications beyond depression detection to cognitive state assessments like alertness

2.2 Advancements in Mobile Sensing for Depression Detection

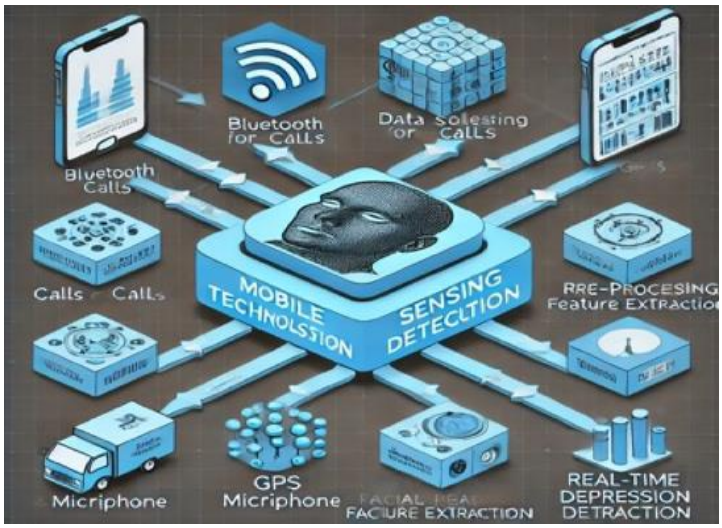


Figure 3. Mobile sensing technologies for depression detection

Fig.3 show that Significant advancements have been made in detecting depression through mobile sensing technologies. Chikersal et al. (2021) utilized the AWARE framework (Ferreira et al., 2015), an open-source context instrumentation tool, to monitor behavioral data such as Bluetooth, calls, GPS, microphone, and screen usage, achieving 85.4% accuracy in identifying depression changes and 85.7% accuracy in detecting post-semester depression over a 16-week study. Similarly, Asare et al. (2022), Alghowinem et al.(2018) used the AWARE frameworkto track sleep, physical activity, phone usage, GPS location, and mood ratings based on the circumplex model of affect, achieving 81.43% accuracy. Despite their success, these systems often face limitations in providing real-time analysis and interventions due to the resource-intensive nature of pre-processing and model development. Unlike previous systems, our approach distinguishes itself by supporting near-real-time facial feature extraction, enabling efficient and timely affective assessments for depression detection. These findings highlight the need for further exploration into real-time capabilities to maximize the potential of mobile sensing frameworks.

2.3 Zung Self-Rating Depression Scale (SDS)

The Zung Self-Rating Depression Scale (SDS) is a widely recognized tool for evaluating the severity of depressive symptoms. Comprising 20 items rated on a 4-point Likert scale, it assesses key symptoms such as sadness, hopelessness, changes in sleep, and energy levels over the past week. The scale's scores range from 20 to 80, with higher scores indicating greater severity of depression: 50-59 indicates mild depression, 60-69 suggests moderate depression, and 70-80 represents severe depression. The SDS is valuable for both clinical assessment and research, offering a straightforward method to gauge depression levels and monitor treatment progress (Zung, 1965). Additionally, depression detection can be enhanced through yoga interventions, where pre- and post-assessment with tools like the SDS can track improvements in mental well-being. Studies show that yoga significantly reduces depressive symptoms by fostering mindfulness, improving mood, and lowering stress (Gothe et al., 2016).

2.4 Yoga as a Holistic Therapy for Depression

Yoga serves as a holistic therapy for depression**,** integrating physical, mental, and spiritual practices to foster self-awareness, stress reduction, and emotional regulation, offering a sense of inner peace and balance (Sharma et al., 2017,Sudhan et al.,2023). Its impact on psychological variables such as stress, anxiety, emotional resilience, self-esteem, and cognitive functioning is profound. By reducing cortisol levels through *pranayama* and promoting relaxation via asanas like *Balasana* and *Savasana*, yoga calms the mind and enhances mental clarity (Field, 2011; Streeter et al., 2010). Techniques like mindfulness meditation (*dhyana*) and loving-kindness meditation encourage self-compassion, counter rumination, and boost emotional regulation (Sharma et al., 2020).Neurobiological benefits include increased serotonin production, endorphin

release, and enhanced neuroplasticity, improving the brain's ability to recover from depressive states (Sharma et al., 2017; Streeter et al., 2012). As an adjunct therapy, yoga may reduce reliance on antidepressants and creates a supportive community through group practices, reducing feelings of isolation often linked to depression (Uebelacker et al., 2010).Philosophical teachings from texts like the *Bhagavad Gita* and *Yoga Sutras* reinforce detachment and the transient nature of emotions, promoting equanimity and inner resilience (Feuerstein, 2008). Ancient Tamil wisdom, as articulated by **Siddhars**, **Thirumoolar**, and **Thiruvalluvar**, emphasized the significance of mental stability, balance, and discipline in managing depression and emotional turmoil. Thirumoolar's *Tirumandiram* highlights the mind-body connection and the transformative power of *pranayama* for mental clarity, while Thiruvalluvar's *Tirukkural* underscores the importance of equanimity and resilience in overcoming adversities (Pillai, 2000; Subramaniam, 1994,Sudhan 2021). These teachings, coupled with specific yogic practices like *Nadi Shodhana*, *Kapalabhati*, and *Trataka*, make yoga a comprehensive and effective approach to treating depression (Khalsa, 2004; Sharma et al., 2020).

2.5 Intervention Plan

The experimental group took part in a **12-week** training program, practicing yoga five days a week. Throughout this period, participants continued with their prescribed treatments alongside the yoga sessions.

The table 1 below gives brief descriptions of the Yoga activity Schedules for Depression Students (Kalibatseva, Z. (2010),Sudhan et al.,2023,2024,2025)

Activity Schedule

Category	Practice	Benefit for Depression
Sukshma Vyayama	Pavanmuktasana	Releases tension, calms the mind.
Dynamic Postures	Surya Namaskar	Boosts energy, reduces fatigue.
Standing Asanas	Tadasana	Improves posture, enhances calmness.
	Utkatasana	Reduces Depression, builds endurance.
	Vrikshasana	Enhances balance, reduces stress.
Sitting Asanas	Gomukhasana	Relieves tension, calms emotions.
	Paschimottanasana	Reduces stress, eases restlessness.
	Ardha Matsyendrasana	Improves digestion, relieves mental dullness.
Supine Asanas	Utthanapadasana	Boosts energy, reduces lethargy.
	Sarvangasana	Improves blood flow, reduces Depression.
	Halasana	Calms the mind, promotes relaxation.
Prone Asanas	Salabhasana	Boosts physical energy.
	Dhanurasana	Improves mood, relieves stress.
Relaxation	Shavasana	Reduces tension, promotes emotional stability.
Pranayama	Nadi Shodhana	Calms the mind, reduces Depression.
	Savithri Pranayama	Promotes relaxation and clarity.
Meditation	AUM Meditation	Reduces negative thoughts, promotes peace.

Table 1. Yoga activity Schedules for Depression

3. RESULT

3.1 Statistical Analysis

The data from the study were analyzed using SPSS version 19.0. Percentages, means, and standard deviations were calculated to interpret the results. SPSS, originally developed as a statistical tool, has become widely preferred by researchers and academics for its versatile features in data analysis(Babu Kaiyaperumal et al.,2022,Sudhan et al.,2022,2023,2024, Ananthan, B et al 2023).

3.2 Face Detection and Emotional State Analysis

Emotion	Pre-Test (Mean ± SD) (Experimental)	Post-Test (Mean ± SD) (Experimental)	Pre-Test (Mean ± SD) (Control)	Post-Test (Mean ± SD) (Control)
Sadness	42.67 ± 4.45	18.80 ± 3.20	43.27 ± 2.87	42.93 ± 2.92
Anger	20.07 ± 2.73	7.13 ± 1.91	20.13 ± 2.14	20.20 ± 2.25
Happiness	9.33 ± 3.02	67.07 ± 4.65	10.00 ± 2.41	10.13 ± 2.44
Neutral	15.87 ± 2.55	4.80 ± 1.75	16.13 ± 2.72	15.80 ± 2.60
Surprise	6.13 ± 1.73	1.93 ± 1.02	5.87 ± 1.65	5.93 ± 1.70
Fear	6.33 ± 1.85	2.27 ± 1.11	6.60 ± 1.75	6.67 ± 1.70

Table 2 Face Detection and Emotional State Analysis

Table 2 show that Facial emotion recognition technology using mobile-based face detection software was utilized to assess participants' emotional states during pre-test and post-test phases, focusing on emotions such as Sadness, Anger, Happiness, Neutral, Fear, and Surprise. In the experimental group (yoga practice), significant reductions were observed in Sadness (42.67 ± 4.45 to 18.80 ± 3.20), Anger (20.07 ± 2.73 to 7.13 ± 1.91), Fear (6.33 ± 1.85 to 2.27 ± 1.11), and Neutral states (15.87 ± 2.55 to 4.80 ± 1.75). Notably, Happiness showed a dramatic increase from 9.33 ± 3.02 to 67.07 ± 4.65, along with a decrease in Surprise (6.13 ± 1.73 to 1.93 ± 1.02), indicating improved emotional stability post-intervention. Conversely, the control group (no intervention) displayed minimal changes, with Sadness (43.27 ± 2.87 to 42.93 ± 2.92) and other emotions remaining relatively unchanged. Additionally, the Zung Self-Rating Depression Scale (SDS) results will confirmed these findings, highlighting the positive impact of yoga in reducing depressive symptoms and enhancing emotional well-being in the experimental group.

3.3 Tests of Normality & Wilcoxon Signed-Rank Test

The tests of normality and rank analysis provide a comprehensive understanding of the data distribution and comparative changes between pre-test and post-test results for both the Yoga Group and Control Group. The **Kolmogorov-Smirnov test** and **Shapiro-Wilk test** were applied to assess the normality of the data, with a sample size of 15 participants in each group.

Group	Test	Statistic	df	Sig.	Ranks Comparison	N	Mean Rank	Sum of Ranks
Yoga Group Pre-Test	Kolmogorov-Smirnov (a)	.176	15	.200*	Negative Ranks (Post < Pre)	15	8.00	120.00
	Shapiro-Wilk	.897	15	.085	Positive Ranks (Post > Pre)	0	.00	.00
Yoga Group Post-Test	Kolmogorov-Smirnov (a)	.211	15	.071	Ties (Post = Pre)	0		
	Shapiro-Wilk	.859	15	.023				
Control Group Pre-Test	Kolmogorov-Smirnov (a)	.164	15	.200*	Negative Ranks (Post < Pre)	7	7.50	52.50
	Shapiro-Wilk	.928	1	.256	Positive Ranks	8	8.44	67.50

			5		(Post > Pre)	
Control Group Post-Test	Kolmogorov-Smirnov (a)	.193	15	.138	Ties (Post = Pre)	0
	Shapiro-Wilk	.921	15	.197		

Note: **Lower bound of true significance. (a) Lilliefors Significance Correction.*

Table 3 Tests of Normality & Wilcoxon Signed-Rank Test

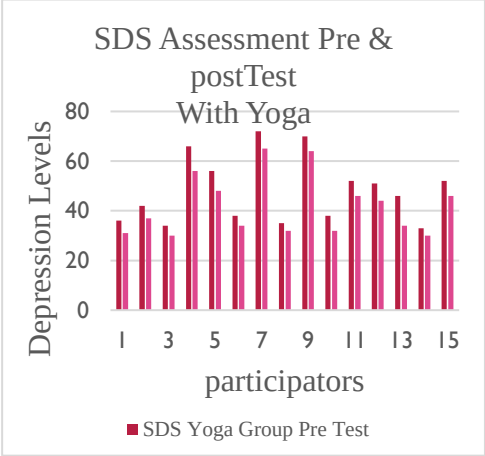
The Shapiro-Wilk test, which is more suitable for smaller sample sizes, was particularly instrumental in identifying non-normality in the Yoga Group's post-test results. For the **Yoga Group Pre-Test**, the Kolmogorov-Smirnov statistic yielded a value of **0.176** (p = 0.200*), and the Shapiro-Wilk statistic was **0.897** (p = 0.085), suggesting that the data followed a normal distribution. However, in the **Yoga Group Post-Test**, the Shapiro-Wilk result was **0.859** with a significance value of **0.023**, indicating a significant deviation from normality. This result highlights the impact of the yoga intervention, which likely introduced considerable changes in scores, causing a non-normal distribution in the post-test phase .In contrast, the **Control Group** demonstrated no significant deviations from normality. For the Control Group Pre-Test, the Kolmogorov-Smirnov value was **0.164** (p = 0.200*), and the Shapiro-Wilk value was **0.928** (p = 0.256). Similarly, for the Control Group Post-Test, the Kolmogorov-Smirnov statistic was **0.193** (p = 0.138), and the Shapiro-Wilk value was **0.921** (p = 0.197), indicating that the control group's data remained normally distributed across both phases.

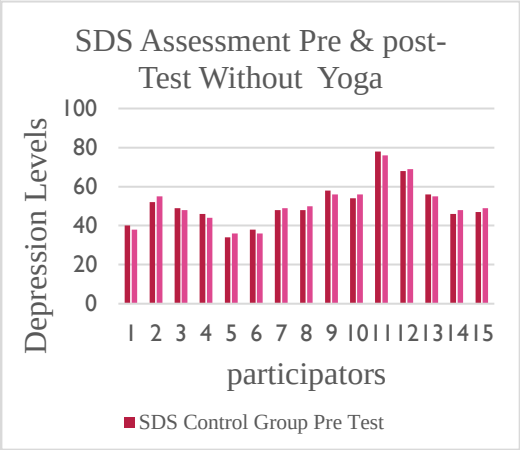
The **Ranks Analysis** was conducted to evaluate changes between pre-test and post-test phases. For the **Yoga Group**, all participants (N = 15) displayed **negative ranks** (Post-Test < Pre-Test), with a mean rank of **8.00** and a sum of ranks of **120.00**. This result reflects a consistent and significant reduction in scores following the yoga intervention. Importantly, there were no positive ranks (Post-Test > Pre-Test) or ties, confirming uniform improvement across the group.Conversely, in the **Control Group**, the ranks analysis revealed mixed results. Out of 15 participants, **7 participants** demonstrated negative ranks (Post-Test < Pre-Test) with a mean rank of **7.50** and a sum of ranks of **52.50**, indicating slight reductions. Meanwhile, **8 participants** showed positive ranks (Post-Test > Pre-Test), with a mean rank of **8.44** and a sum of ranks of **67.50**, suggesting an increase in scores for this subset of participants. Notably, there were no ties, signifying that changes, albeit inconsistent, were observed across the control group

4. DISCUSSION

The initial analysis of both groups revealed one group with significant differences while the other showed no variation, confirming their suitability for the study. After a 12-week intervention, depression levels significantly reduced in the yoga group, as evidenced by post-test results using the Zung Self-Rating Depression Scale (SDS). The SDS, which employs a 4-point scale to assess depression levels, demonstrated notable improvements in the experimental group, while the control group showed no meaningful changes. Facial emotion recognition (FER) technology further supported these findings by analysing participants' emotional states. The yoga group showed significant reductions in sadness, anger, fear, and neutral expressions, with a marked increase in happiness post-intervention. In contrast, the control group exhibited minimal changes, reinforcing the effectiveness of yoga in improving emotional well-being and alleviating depressive symptoms. The improvements in the yoga group can be attributed to enhanced autonomic regulation brought about by yoga practices, which are known to reduce sympathetic activity and improve parasympathetic tone. This shift promotes emotional stability, reduces stress, and fosters a sense of calm, all of which contribute to alleviating depression. Moreover, yoga's focus on mindfulness and breathing techniques likely reduced negative thought patterns and improved self-awareness, which are critical in managing depression. Additionally, the academic background of the participants in the yoga group may have enhanced their compliance and engagement with the intervention, leading to better outcomes. Previous research has shown yoga's effectiveness in reducing depression, anxiety, and stress levels, aligning with the current study's results (Saeed et al., 2010; Streeter et al., 2012).In contrast, the control group, which did not participate in any intervention, displayed no significant changes, underscoring the necessity of structured approaches like yoga for mental health improvement. Overall, the significant reduction in depression scores and emotional markers in the yoga group highlights yoga as a powerful and complementary approach for enhancing mental health and emotional well-being.

4.1 Progress Evaluation: Experimental vs. Control Group





4 (a) Graph-I Depression Pre & Post-Test with Yoga **4(b)Graph-II Depression Pre & Post-Test without Yoga**

The bar graphs shown in Fig.4 (a) and Fig.4 (b) compare Pre-Test and Post-Test Zung Self-Rating Depression Scale (SDS) scores for the Yoga Practice Group (Group I) and the Control Group (Group II)**,** respectively. In Group I**,** the orange bars representing Pre-Test scores are consistently higher than the blue bars for Post-Test scores, indicating a significant reduction in depression levels after 12 weeks of yoga practice. This highlights the effectiveness of yoga in bringing about noticeable psychological improvement, as reflected by lower SDS scores. Categories with the largest differences between Pre-Test and Post-Test scores further emphasize where yoga had the greatest impact on reducing depression. In contrast, Fig.1 (b) for Group II shows minimal changes, with the blue bars (Post-Test) nearly equal to the orange bars (Pre-Test), suggesting little to no reduction in depression levels without yoga intervention. Overall, the comparison demonstrates that participants in the Yoga Practice Group outperformed the Control Group, with the 12-week yoga module causing significant psychological changes and effectively reducing depression, while the control group experienced no substantial improvement.

5. CONCLUSION

The findings from the Zung Self-Rating Depression Scale (SDS) scores and facial emotion recognition analysis clearly demonstrate the effectiveness of yoga practice in reducing depression levels. Participants in the Yoga Practice Group (Group I) exhibited a significant reduction in SDS scores after 12 weeks of intervention, indicating substantial psychological improvements. This was further supported by facial emotion recognition technology, which revealed positive changes in emotional states and expressions post-intervention. In contrast, the Control Group (Group II) showed negligible changes in SDS scores, and their emotional states remained largely unchanged, highlighting the absence of significant improvement without yoga practice. The combined results emphasize that yoga practice is an effective intervention for managing depression, leading to both measurable reductions in SDS scores and improved emotional well-being as captured through facial recognition analysis.

Disclosure Statement

The authors declare no potential conflicts of interest related to this study.

Table 4. Abbreviations and Their Expansions

Abbreviation	Expansion
SDS	Zung Self-Rating Depression Scale
FER	Facial Emotion Recognition
SPSS	Statistical Package for the Social Sciences
df	Degree of Freedom
Sig.	Significance
No. of part.	Number of Participants

Declaration of Competing Interest

The authors have no competing interests to disclose that are relevant to the content of this article.

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Not Applicable.

Data Availability Statement

The data supporting this study are available upon reasonable request, subject to privacy and ethical considerations

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