EFFICACY OF APP-BASED YOGA OF IMMORTALS MEDITATIVE INTERVENTIONS ON THE MENTAL HEALTH OF GLOBAL POPULATION DURING COVID-19 PANDEMIC

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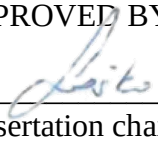

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ABSTRACT

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Amidst the unprecedented challenges posed by the COVID-19 pandemic, mental health issues such as depression, anxiety, and sleep disturbances became pervasive concerns. These issues surged due to heightened stressors and limited access to traditional support systems. Consequently, there has been a pressing need for flexible, home-based meditative interventions that could effectively address and mitigate their escalation. Thus, the problem addressed in this study was how mobile application-based Yoga of Immortals (YOI) meditative interventions can be utilized to improve the mental health of global population during COVID-19. The purpose of this double-blind mixed-method study was to investigate the efficacy and feasibility of YOI meditative modalities in mitigating the symptoms of depression, anxiety, and insomnia. For the study, a total of 1,505 participants (mean age 35.6 years, 40 % male and 60% female) were recruited and engaged with the YOI app for 8 weeks. Three validated questionnaires—the Patient Health Questionnaire (PHQ-8), the Generalized Anxiety Disorder questionnaire (GAD-7), and the Insomnia Severity Index (ISI)— were completed by 1,297 participants at four intervals: before starting, twice during usage (at the 4-week mark and 6-week mark), and once after the 8-week period. A control group of 590 individuals (mean age 34.9 years, 45 % male and 55%

female) completed the same questionnaires without using the YOI app, serving as a comparative reference. YOI users experienced significant reductions in depression and anxiety symptoms. PHQ-8 scores dropped by an average of 50%, GAD-7 by 40–50%, and ISI by 50% compared to baseline. These changes were notably greater than those in the control group ($p < 0.05$). Particularly, participants with prior depression and anxiety diagnoses showed more significant decreases in PHQ-8 and GAD-7 scores ($p < 0.05$) than those without such diagnoses. Consistent YOI app use across 8 weeks substantially reduced depression, anxiety, and insomnia symptoms, indicating its potential as an effective intervention. YOI could serve as a valuable resource in addressing mental health challenges during and beyond the pandemic, especially for individuals with pre-existing mental health conditions. Future research could focus on evaluating YOI's long-term effects on health with a detailed demographic analysis.

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INTRODUCTION

1.1. Introduction

This study delved into the efficacy of app-based meditative interventions centred around 'Yoga of Immortals' (YOI) non-pharmaceutical meditative modalities. The central focus was the potential of these interventions to mitigate the far-reaching mental health ramifications of anxiety, depression and insomnia experienced by individuals worldwide throughout the COVID-19 pandemic.

YOI meditative practices stand out as a combination of disease-preventive wisdom and techniques with modern accessibility (Tunuguntla et al., 2022). Rooted in the tenets of ancient yogic principles, YOI extends beyond physical postures to encompass facets of faith-based intrapersonal exploration (Tunuguntla et al., 2021). Leveraging the technological advancements of the digital era, app-based YOI offers a unique channel for reaching a global audience, transcending geographical barriers and temporal limitations (Currie et al., 2022).

COVID-19 or Coronavirus Disease 2019 is an infectious illness caused by the novel coronavirus SARS-CoV-2 which was first identified in late 2019 in Wuhan, China, and led to a global pandemic. The disease primarily spreads through respiratory droplets and can cause a range of mild respiratory issues to severe illness and, in some cases, death (Ciotti et al., 2020). Its impact has been widespread worldwide, affecting various aspects of life

including mental health and holistic wellbeing (Jackson, Turner and Paterson, 2023; Agorastos and Tsamakis, 2021).

The intervention method in this study involved using ancient yogic modalities and meditation techniques derived from *Indian Knowledge Systems* and was delivered through a mobile application. Indian Knowledge Systems refer to the vast and diverse heritage of philosophical, scientific, and spiritual understanding that has evolved over millennia in the Indian subcontinent. These systems encompass various fields like Ayurveda (medicine), Yoga, Vedanta (philosophy), astronomy, mathematics, and more. They are rooted in ancient scriptures like the Vedas, Upanishads, and other classical texts, emphasizing holistic approaches, interconnectedness, and the pursuit of both material and spiritual well-being (Dutta et al., 2023).

Due to the unprecedented stressors brought about by the pandemic, such as social isolation, economic uncertainty, and health concerns, mental health issues have become prevalent worldwide. The study investigated whether the YOI app-based meditative program could offer significant mental health benefits to individuals grappling with these challenges. The research included participant recruitment, a Control Group receiving wellness articles and relevant materials as an intervention strategy, and the Study Group using the app. Researchers measured mental health outcomes including anxiety, depression, insomnia, stress levels and overall well-being using standardized assessments before and after the intervention period.

The context of the study was crucial—by focusing on a global population, it suggested a broad and diverse participant pool, reflecting the widespread impact of the

pandemic on mental health across various cultural, social, and economic backgrounds. The use of a home-based app intervention also acknowledged the accessibility and convenience of digital platforms in reaching a large and geographically dispersed audience. Ultimately, the study aimed to contribute valuable insights into the potential efficacy of app-based yoga interventions in supporting mental health during a crisis like the COVID-19 pandemic, offering a scalable and accessible solution for improving well-being on a global scale.

Post the COVID-19 era, the world is navigating an unparalleled period of challenges and disruptions. This is casting a spotlight on the imperative need for safeguarding mental and holistic well-being (Lee, Jeong and Yim, 2020; Badinlou, Lundgren and Jansson-Fröjmark, 2022). The global outbreak of the pandemic has ushered in a public health predicament of unprecedented proportions, along with a parallel and pervasive mental health crisis (Hossain et al., 2020; Talevi et al., 2020; Kaufman et al., 2020; Torales et al., 2020). Hence, the significance of innovative non-invasive meditative interventions, designed to combat mental health repercussions, has surged to the forefront (Bringmann et al., 2020; Khandelwal, 2020; Green et al., 2021).

Amidst the backdrop of extended lockdowns, social distancing measures, and uncertainty, mental health became a critical global concern (Kaufman et al., 2020). The cumulative effects of isolation, fear, and disruptions to routine life laid the ground for increasing mental health challenges, including heightened stress, generalised anxiety, sleep disturbances and major depressive disorders (Kyzar et al., 2021; Lippi, Henry and Sanchis-Gomar, 2020). Responding to this pressing need, a diverse array of interventions has been proposed, ranging from traditional therapeutic strategies, e-mental health options, mental

health clinics to contemporary digital platforms (Gaebel and Stricker, 2020; Folk et al., 2022; Rauschenberg et al., 2021; Damiano et al., 2021).

Considering the research gaps and limitations pertaining to the efficacy, affordability and feasibility of existing app-based meditative interventions for clinical anxiety and depression in the global populace (Wang, Markert and Sasangohar, 2021), this study attempted to add empirical evidence through a robust evaluation of YOI. It proposed to bridge a significant gap in the current body of literature by examining the potential of app-based YOI meditative interventions to alleviate the mental health burdens borne worldwide. Through a rigorous analysis of their impact on stress reduction, emotional equilibrium, psychological fortitude, and overall well-being, this study proposed to contribute to a nuanced comprehension of how innovative modalities can substantially enhance mental health outcomes.

Through investigations and dissection of data gathered on validated assessment scales, the study aspired to furnish insights into the efficacy, viability, and acceptability of integrating YOI interventions into the daily lives of a diverse general populace. By evaluating the dynamics of mental health interventions in the digital era, the research substantiated pathways for policymakers, mental health practitioners, and individuals to collaboratively cultivate comprehensive approaches to nurturing mental well-being in the face of modern-day adversities.

1.2. Background

Research on the efficacy of app-based yoga interventions, such as YOI, in addressing the mental health challenges faced by the global population during the COVID-19 pandemic has garnered substantial interest and attention. This interest stems from the profound impact of the pandemic on mental well-being worldwide. The pandemic-induced stress, anxiety, isolation, and uncertainty have led to a significant surge in mental health issues, creating an urgent need for accessible and effective interventions.

Yoga, with its multifaceted approach beyond the physical postures (called *asana*), has long been recognized for its potential to promote mental health and holistic well-being. Its emphasis on building intrapersonal awareness and connection offers a promising avenue for alleviating stress, anxiety, and depression. Furthermore, the holistic approach of yoga, which addresses mental, physical, and emotional aspects of well-being, resonates with individuals seeking comprehensive ways to manage their mental health. This also makes it an attractive and reliable intervention, especially during times of heightened psychological distress.

Not only this but also the accessibility and widespread use of smartphone apps have revolutionized mental health interventions, allowing individuals to access support and guidance remotely. The app with YOI practices provides structured programs, guided sessions, and tools that enable users to practice yoga and meditation at their convenience, potentially enhancing their mental resilience and coping mechanisms. Understanding the

potential benefits of holistic practices like YOI on a global scale holds promise in offering scalable and culturally adaptable tools to support mental health during challenging times.

Amidst this landscape, there's a growing interest among researchers and practitioners in scientifically evaluating the effectiveness of such app-based interventions on mental health outcomes (Chong et al., 2023; Oliveira et al., 2021). This interest aligns with the need to provide empirical evidence supporting the integration of alternative interventions into mental health care strategies. Rigorous scientific inquiry aims to validate and refine these interventions, providing insights into their potential impact on mental health in diverse global contexts.

Mental health is a critical parameter defining optimum quality of life. Impacting lives globally, it has been noted that the COVID-19 pandemic imposed severe psychological challenges on the general population (Wu et al., 2021). Accelerated transmission of the SARS-CoV-2 virus, despite social distancing and travel restrictions, created barriers to accessing medical facilities and intensive care. Increased digital media consumption during lockdowns created enduring sleep disturbances among children and adolescents (Nagata, Abdel Magid and Gabriel, 2020). Uncertainty and fear of loss aggravated stress.

Such continued aftermath of the virus gave rise to a silent global mental health crisis. There have been predictions of somatic symptoms due to COVID-19-related anxiety in the UK population (Shevlin et al., 2020). Prevalence of Generalized Anxiety Disorder and depressive symptoms - with impacted sleep quality - has been observed in China

(Huang and Zhao, 2020). A significant increase in clinical insomnia rates, in comparison to pre-pandemic levels, has been persistent.

Amid the strain on the medical infrastructure, healthcare workers faced anxiety and physician burnout - in addition to personal isolation and fear of transmission to family and the self. Among athletes, changes such as loss of compensation, cancellation of competitive events, and restrictions during trainings led to sports-related performance anxiety, mental distress and eating disorders (Gupta and Mccarthy, n.d.; McManama O'Brien et al., 2021).

In the present times, the general relativity of yoga is done with physical exercises and body postures, also called *asana*. *Asana* recently regained popularity due to their stress-reduction capabilities. However, beyond stress relief, yoga is proven effective in the alleviation of symptoms related to depression and anxiety among COVID-19-positive patients and healthcare workers (Vajpeyee et al., 2021; Sharma et al., 2022).

Practising ancient scientific yogic techniques, as part of non-pharmaceutical meditative interventions, is proven to help by stimulating cognitive responses which in turn reduce anxiety and stress (Wang et al., 2022). Yogic practices and meditation also lead to positive physiological moderations like improved cognition, respiration, cardiovascular performance, body mass index, blood pressure, and diabetes (Ali, Balaji and Varne, 2012).

To alleviate the risks of mental health disorders imposed by COVID-19 through authentic ancient yogic knowledge and techniques, YOI protocols were devised by Dr. Ishan Shivanand. YOI modalities have been curated as per learnings from the training in Indian monasteries, and grounding in ancient Indian Knowledge Systems for over 20 years. As an app-based non-pharmaceutical, non-invasive meditative intervention, YOI

comprises scientific combinations of breath work and disease-preventive yogic techniques. Contributing to preventive and promotive healthcare as part of integrative medicine, a YOI multi-modality initiates a deep metabolic rest that enables cognitive stimulation through awareness, emotional stimulation through positive selective memory processing, positive affirmations with creative visualization, parasympathetic stimulation of brain activity patterns and dismantling of negative neuropathways.

With these benefits of the YOI, regular practice of non-pharmaceutical meditative interventions would help alleviate the mental health concerns evident during the COVID-19 pandemic and further benefit the holistic well-being of the YOI practitioners (Currie et al., 2022).

1.3. Statement of the Problem

A significant problem imposed on Yoga of Immortals is the lack of regular practice of non-pharmaceutical meditative interventions for mental health during COVID-19 (Büssing, Baumann and Surzykiewicz, 2022; Magnavita, Soave and Antonelli, 2021a; Magnavita, Soave and Antonelli, 2021b; Green et al., 2020). People who relied on faith as a resource to cope reduced their practice of meditation and mental activities during the pandemic (Büssing, Baumann and Surzykiewicz, 2022). Due to increased stress levels, physicians also reported a lack of time for meditation, and physical activity, isolation in social and work life and compassion fatigue (Magnavita, Soave and Antonelli, 2021a; Magnavita, Soave and Antonelli, 2021b).

Lancet Global Health (2020) states that lost productivity due to anxiety and depression costs the global economy USD 1 trillion every year. Post-COVID-19, it is now projected to rise to USD 6 trillion by 2030 (The Lancet Global Health, 2020). Additionally, there are significant absenteeism and presenteeism costs associated with workplace productivity for people with depression (Evans-Lacko and Knapp, 2016). Despite meditative interventions like YOI being an effective solution to alleviate these mental health conditions (Tunuguntla et al., 2021; Verma et al., 2021), there has been limited or no regular use of such modalities. Thus, the specific problem that was addressed in this study is how app-based YOI meditative interventions can be used to improve to the mental health of global population. Without these interventions, most of the global population might not see app-based YOI as a driver for mitigating symptoms of depression, anxiety, and insomnia. Consequently, they might not treat these symptoms as important elements of the healthy life (Tunuguntla et al., 2021; Verma et al., 2021).

During the evaluation of studies on the prominent yoga-based pharmacological interventions of 'RISE' (Reeves, 2018; Reeves et al., 2022; Trent et al., 2019; Trent et al., 2018) and 'Kundalini Yoga' (Sarkissian et al., 2018; McMahon et al., 2021; Gabriel et al., 2018; Khalsa and Goldstein, 2021) programs by Sat Bir Singh Khalsa, as well as 'Transcendental Meditation' (Krisanaprakornkit et al., 2006; Eppley, Abrams and Shear, 1989; Burns, Lee and Brown, 2011; Barnes, Rigg and Williams, 2013) it was observed that they lacked usage of validated mental health scales and questionnaires and carried limited sample size. Further, the studies were mainly conducted before the COVID-19 pandemic

which questions their relevance in the post-pandemic complexities concerning mental health.

Multiple studies have been conducted on yoga postures, exercises, breathing techniques, and mindfulness interventions. However, in general, these studies investigate a single technique and mostly require the physical presence of a trainer. Very few studies have been conducted to investigate clinically relevant disease conditions such as clinical insomnia, using a home-based intervention such as using a mobile app. Further, the research on the integration of mobile health apps in clinical practice is at an early stage, leaving pressing knowledge gaps (Asmundson, 2022). Most of the study participants have been limited to giving partially conclusive or inconclusive results. It is also noted that the conduction of most such studies takes a long time to show minimal effects, which causes incompliance and loss of follow-up due to slow effects.

To treat the mental health conditions of depression and anxiety, Cognitive Behavioral Therapy is usually the preferred line of treatment. However, the treatment carries limitations concerning uptake - including medication concerns, shortage of trained therapists, and the stigma around the need for mental health treatments (Firth et al., 2017). While mobile apps are capable of delivering meditative interventions for a range of health issues, there are limited studies that test the efficacy of meditation mobile apps on depression and anxiety among individuals with sleep disturbances (Huberty et al., 2021).

To address these gaps, this research on YOI non-invasive interventions catered to a sample size of 1,297 participants during the pandemic using a software-based asynchronous program disseminated via a mobile app. The study was conducted with a

multidisciplinary research team and approved by the Institutional Review Board for examination.

Home-based interventions offer several advantages, including convenience, accessibility, and potential cost-effectiveness, making them particularly suitable for individuals who may face barriers to traditional clinical care. Understanding the potential benefits and limitations of a home-based intervention using a mobile app for these conditions is crucial for advancing patient care. It can provide individuals with more control over their treatment, enhance engagement and adherence, and potentially reduce healthcare costs.

1.4. Research Purpose and Questions

The purpose statement of this double-blind study was to investigate the efficacy and feasibility of a mobile application-based meditative intervention called Yoga of Immortals in mitigating symptoms of depression, anxiety, and insomnia - among individuals experiencing sub-optimal mental health globally, particularly during the challenges posed by the COVID-19 pandemic - using a mixed-method study design.

To address the research limitations of pre-existing interventions regarding sample size, lack of validated mental health scales, and pre-pandemic research period, the study encompassed a substantial sample size of 1,297 participants, was conducted during the pandemic outbreak, and utilized standardized assessment tools (Annexure A) of Patient Health Questionnaire, 8 items (PHQ-8; Kroenke et al., 2009; Razykov et al., 2012),

Generalized Anxiety Disorder questionnaire (GAD-7; Rl et al., 2006), and Insomnia Severity Index (ISI; Morin et al., 2011). A multidisciplinary research team was employed and Institutional Review Board approvals were adhered to for increased relevance of the study in post-pandemic mental health complexities.

To mitigate the research issues of existing studies predominantly focusing on single techniques requiring physical presence with a trainer, YOI interventions leveraged a software-based asynchronous program disseminated via a mobile app. This was done to enable individuals to practice the modalities at their own pace, and preferred time and location. The study also attempted to add empirical evidence to mitigate the knowledge gaps regarding the integration of mobile health apps in clinical practice.

By exploring the efficacy and feasibility of home-based interventions via a mobile app, the research sought to enable individuals to manage their mental health conditions more effectively, improve engagement and adherence to treatment, and potentially reduce healthcare costs. Understanding the potential benefits and limitations of such interventions was crucial in advancing patient-centred care, especially in the post-pandemic landscape where traditional clinical care might face barriers.

Overall, the study intended to investigate the impact of YOI mobile application-based non-pharmaceutical meditative intervention on mitigating symptoms of depression, anxiety, and insomnia among individuals experiencing sub-optimal mental health globally. It determined whether regular use of the YOI app, over an 8-week period, leads to significant improvements in mental health symptoms, if reported. It assessed YOI as a structured and home-based intervention for enhancing mental well-being during a period

marked by increased prevalence of mental health issues, such as the COVID-19 pandemic. This gap is particularly evident in the context of the pandemic, where traditional in-person interventions may not be feasible or readily available. The app represents a potential solution to this gap, hence, offering an opportunity to explore the efficacy of digital interventions.

The study hypothesized that participants using the app would experience reduced symptoms of depression, anxiety, and insomnia compared to the Control Group. Employing a double-blind approach with both qualitative and quantitative methods, the study randomly assigned participants to either the YOI app Study Group or a Control Group with alternative interventions. Recruitment through social media aimed at diverse demographics among the 1,505 enrolled participants, of whom 1,297 completed all assessments. Participants spanned ages 18 to 80, primarily between 26 and 58, with a balanced gender distribution, mirroring the Control Group.

Data collection involved pre- and post-intervention questionnaires and assessments across the 8-week program. The YOI intervention comprised 112 sessions incorporating physical movements, postures, breathing exercises, meditation, and chants, progressively increasing in complexity. Post-intervention, participants completed the questionnaires again.

For an elaborate understanding of the potential of YOI protocols, the study compared the changes in symptoms observed in participants who engaged with the app to those who did not. This comparative analysis allowed for assessing whether the improvements in mental health symptoms are specific to the YOI intervention or whether

they could be attributed to other factors. It also helped acknowledge the potential impact of personalization by considering participants with prior diagnoses of depression and generalized anxiety. By analyzing their responses to YOI, the research ascertained whether the app's effectiveness varies based on individual backgrounds and experiences. The research questions that guided this study are:

RQ1. How does the regular use of the YOI mobile application impact symptoms of depression among participants, if reported, as measured by the Patient Health Questionnaire, 8 items (PHQ-8)?

RQ2. What is the effect of the YOI app on symptoms of generalized anxiety, as assessed by the Generalized Anxiety Disorder questionnaire (GAD-7), if reported, in comparison to a control group that did not use the app?

RQ3. To what extent does the YOI intervention alleviate symptoms of insomnia, if reported, as measured by the Insomnia Severity Index (ISI), in participants who utilized the app for an 8-week period?

RQ4. Are the reductions in depression, anxiety, and insomnia symptoms reported by participants who used the YOI app significantly greater than those observed in a control group that did not use the app?

RQ5. How do participants with a prior diagnosis of depression and generalized anxiety respond to the YOI intervention in terms of changes in PHQ-8 and GAD-7 scores compared to participants without a previous diagnosis?

1.5. Significance of the Study

Despite considerable literature about the role of yoga-based modalities and their impact on physical and mental health, there is a significant gap in the effectiveness, affordability and feasibility of existing meditative interventions for clinical anxiety, depression and insomnia among the global population using mobile apps (Athanas et al., 2021) . Considering this limitation, there is an urgent need for accessible and adaptable interventions that can effectively address mental health issues, especially during times of restricted social interactions and limited access to traditional therapeutic modalities.

The literature on app-based YOI showed that there is limited knowledge about the conditions under which app-based YOI contribute to mental health. It is to also be noted that the positive effect of remote mental health interventions has been assumed in the study. There has been no empirically proven evidence that this positive effect always exists (Yue et al., 2020). This assumption has led to further growing interest among scholars and practitioners to investigate the question of whether YOI app usage impacts mental health (Verma et al., 2021).

Referring to the discussed research problems and purpose, if this study on the efficacy of the app-based YOI meditative interventions is not conducted, several negative consequences might arise. First, the absence of validated and accessible meditative interventions could perpetuate the ongoing mental health crisis exacerbated by the COVID-19 pandemic. This could lead to persisting anxiety, depression, and other stress-related conditions among individuals, further impacting their daily lives, work productivity, and

overall well-being. The failure to address mental health issues through innovative interventions might also perpetuate the economic burden associated with lost productivity due to anxiety and depression. The estimated trillion-dollar loss to the global economy due to mental health issues could continue to escalate, reaching an alarming projected USD 6 trillion by 2030 (The Lancet Global Health, 2020).

Second, without conducting studies on these interventions, individuals might continue to face barriers to accessing effective mental health treatments. The reliance on conventional therapies, such as Cognitive Behavioral Therapy, could persist, leading to medication concerns, therapist shortages, and the enduring stigma surrounding mental health treatments.

In addition, the lack of updated studies addressing mental health complexities post-pandemic could hinder progress in mental health research. It might limit the understanding of how newer interventions, like mobile app-based meditative programs, could offer scalable, accessible, and effective solutions for widespread mental health issues.

Moreover, the absence of studies evaluating the integration of mobile health apps in clinical practice could slow down the integration of technology in healthcare. This could result in missed opportunities to harness the potential benefits of technology-driven interventions for mental health conditions. The failure to explore and validate home-based interventions through mobile apps might result in reduced patient engagement and adherence to treatment plans. This could lead to a lack of control over their treatment, thereby impacting the overall effectiveness of mental health interventions. Not conducting this study could perpetuate mental health challenges, hinder innovative solutions, and

impede progress in addressing the global mental health crisis exacerbated by the COVID-19 pandemic.

Finally, by targeting symptoms of anxiety, depression, and insomnia, the study addressed a spectrum of mental health issues. If successful, it could pave the way for more holistic approaches to mental health care that encompass a range of common conditions. The shift from in-person teachings of ancient practices to a mobile app indicated scalability. If proven effective, this intervention could be easily disseminated to a broader population, potentially reaching individuals who might not have considered or had access to such practices before. Overall, the study's contributions lay in its attempt to bridge the gap between ancient practices, modern technology, and mental health care, potentially offering a new avenue for accessible, evidence-based interventions.

The study's timing during the COVID-19 pandemic was crucial. It acknowledged the heightened mental health challenges during this period and responded by providing a solution that could be accessed remotely, aligning with the needs arising from prolonged isolation and limited access to traditional support systems. Further, through conducting a trial to quantify the benefits of the YOI mobile app, the study aimed to provide empirical evidence regarding the effectiveness of this intervention. This contributed to the growing body of research on the efficacy of mindfulness and meditation-based practices in mental health settings.

The COVID-19 pandemic emphasised the importance of remote interventions that individuals can access from the comfort of their homes (Devillers-Réolon, Mascret and Sleimen-Malkoun, 2022; Pizzoli et al., 2020). The YOI meditative practices offer a

structured and comprehensive approach to tackling mental health challenges, enhancing their relevance in the context of the current global health landscape (Tunuguntla et al., 2021; Verma et al., 2021).

Emphasizing the potential positive results of the completion of the study, the research addressed the critical research problem of preexisting mental health interventions lacking relevant sample size, validated scales and accessibility restrictions. It explored the effects of the YOI intervention through a mobile app on a diverse group of 1,297 global participants - by utilizing validated assessment tools such as the Generalized Anxiety Disorder questionnaire (GAD-7), the Patient Health Questionnaire (PHQ-8), and the Insomnia Severity Index (ISI).

The study also shed light on the specific demographic factors that influence the effectiveness of the YOI intervention. Improvements in symptoms of depression and generalized anxiety among participants with prior diagnoses were also considered. The insights helped understand the potential of the app-based non-pharmaceutical modalities to serve as an adjunctive intervention for individuals who already face mental health challenges during the pandemic, offering a targeted solution that complements existing treatment strategies.

In the face of exacerbated symptoms and diagnosis of anxiety, depression, and insomnia during COVID-19, there has been a growing interest in exploring alternative, non-pharmaceutical interventions, that can be integrated with modern medicine to effectively mitigate the negative impacts on mental health and foster resilience during times of crisis. As individuals strive to cope with the strains imposed by the pandemic, the

potential of these interventions to provide a holistic approach to mental well-being becomes of paramount importance. By conducting a comprehensive analysis of the impact of these interventions on various mental health dimensions, including stress reduction, anxiety management, emotional regulation, and overall psychological well-being, it contributed insights to both the fields of mental health intervention and digital wellness platforms.

In a broader context, this study aligned with the contemporary shift toward personalized, self-directed approaches to health and well-being. By evaluating the effectiveness of app-based interventions, the study contributed to the ongoing dialogue on innovative strategies for improving mental health on a global scale.

1.6. Objectives

The research aimed to evaluate the efficacy of YOI modalities on anxiety, depression, and insomnia symptoms during COVID-19 restrictions among the global population. The main objective of this study was to quantify the extent of change in symptoms of the mental health conditions, if reported, using the YOI app over an 8-week period - by utilizing standardized assessment tools: the Generalized Anxiety Disorder questionnaire (GAD-7) for anxiety, the Patient Health Questionnaire (PHQ-8) for depression, and the Insomnia Severity Index (ISI) for insomnia. Some of the key research objectives included:

- To evaluate and quantify the advantages that the regular use of the app-based YOI meditative program can offer during COVID-19.
- To test the efficacy of the YOI program particularly in addressing symptoms related to anxiety, depression, and insomnia among the global population.
- To include standard validated questionnaires for anxiety, depression and insomnia for improved authentication and accuracy of results.
- To understand the YOI program as a comprehensive self-help treatment for integrating mindfulness and meditation-based approaches into modern psychotherapy.
- To address the limitations of the current studies on meditation-based mental health interventions curated for the treatment of anxiety and depression.
- To assess whether YOI can be delivered and assessed on-demand, overcoming barriers of cost, time and accessibility.

1.7. Definition of Key Terms

Anxiety: A state of excessive worry, fear, or apprehension about future events or situations. It is often accompanied by physical symptoms such as restlessness, increased heart rate, sweating, trembling, and muscle tension. Anxiety disorders can significantly interfere with daily functioning and well-being (Vanin, 2008).

Control Group: A subset of participants in the study who did not use the YOI intervention but still completed all questionnaires. The purpose of the control group is to

provide a baseline for comparison to evaluate the effectiveness of the YOI intervention in reducing symptoms of depression, anxiety, and insomnia.

Depression: A common mood disorder characterized by persistent feelings of sadness, hopelessness, and a lack of interest or pleasure in daily activities. Individuals experiencing depression may also exhibit symptoms such as changes in appetite and sleep patterns, fatigue, difficulty concentrating, and feelings of worthlessness (McBrien, 2003).

Generalized Anxiety Disorder Questionnaire (GAD-7): A self-administered tool used to assess the severity of generalized anxiety symptoms. It comprises seven items that assess feelings of worry, nervousness, and physical symptoms associated with anxiety (Rl et al., 2006).

Indian Knowledge Systems: The rich and diverse intellectual traditions that have evolved over thousands of years on the Indian subcontinent. These systems encompass various fields such as philosophy, science, medicine, literature, and spirituality. Rooted in ancient texts like the Vedas, Upanishads, and other classical works, Indian Knowledge Systems emphasize a holistic understanding of life, interconnectedness, and the pursuit of both material and spiritual well-being (Dr Eknath Mundhe, 2023). They include disciplines such as Ayurveda, Yoga, Vedanta, and contributions to mathematics, astronomy, and other sciences, forming a comprehensive and integrated approach to knowledge.

Insomnia: A sleep disorder characterized by difficulty falling asleep, staying asleep, or experiencing non-restorative sleep. Individuals with insomnia often report feeling tired during the day, difficulty concentrating, mood disturbances, and impaired performance in various areas of life due to insufficient sleep (Zisapel, 2007).

Insomnia Severity Index (ISI): A self-report measure designed to evaluate the severity of insomnia symptoms and their impact on daily functioning. It consists of seven items that assess the nature and consequences of sleep difficulties (Morin et al., 2011).

Patient Health Questionnaire, 8 items (PHQ-8): A self-report questionnaire commonly used to assess the severity of depression symptoms. It consists of eight items that inquire about various aspects of depressive symptoms, such as mood, interest in activities, energy levels, and sleep patterns (Kroenke et al., 2009).

Study Group: A subset of participants in the study who were invited to practice weekly YOI intervention through a mobile app. To this Group, the YOI interventions were made available in video and audio format in variations of one or two daily sessions for morning and evening practice. The protocols were progressive - building on the earlier one, and changed every week.

Yoga of Immortals (YOI) Intervention: An app-based, structured, progressive non-pharmaceutical meditative intervention curated by Dr. Ishan Shivanand (ShivYog) during COVID-19 (Tunuguntla et al., 2021). It is aimed at improving mental health and well-being through the practice of yoga and related techniques. In the context of the study, the YOI intervention specifically involves the use of a mobile application designed to provide accessible and flexible guidance in practising yoga and mindfulness exercises.

1.8. Summary

The study was designed to explore the efficacy of the YOI mobile application-based meditative intervention in addressing mental health challenges among a diverse global population during the COVID-19 pandemic. Its primary goal was to bridge existing gaps in mental health interventions by employing a mixed-method approach that involved 1,297 participants and utilized standardized mental health assessments. The research aimed to ascertain the impact of a software-based intervention delivered through a mobile app, offering flexibility and accessibility to users.

To fulfil its objectives, the study recruited 1,505 participants, with 1,297 completing all assessments. The participants were randomly assigned to either the YOI app Study Group or a Control Group. This randomization process ensured a fair comparison between individuals who engaged with the app-based intervention and those who did not. Validated assessment tools such as the Patient Health Questionnaire (PHQ-8), Generalized Anxiety Disorder Questionnaire (GAD-7), and Insomnia Severity Index (ISI) were utilized to measure changes in mental health symptoms before and after the 8-week intervention period.

The research questions guided the study's direction, focusing on understanding the YOI app's impact on specific mental health symptoms. These questions explored the effect of regular YOI app usage on symptoms of depression, generalized anxiety, and insomnia among participants. Additionally, the study aimed to assess whether the reductions in these

symptoms reported by individuals using the app were significantly greater than those observed in the Control Group.

The significance of this research lies in addressing the escalating mental health concerns during the pandemic, where traditional therapeutic modalities faced accessibility challenges. By exploring an app-based intervention, the study aimed to provide an evidence-based, accessible solution to alleviate mental health symptoms. Failure to investigate such interventions might perpetuate mental health crises, hinder research progress, and impede the integration of technology in mental healthcare.

The study's objectives and research questions revolved around evaluating the YOI app's efficacy in mitigating symptoms of anxiety, depression, and insomnia during the pandemic. It sought to quantify the changes in mental health symptoms among participants, enhancing the authentication and accuracy of the results through the use of standardized assessment tools.

Overall, the study aimed to address critical gaps in mental health interventions by examining the potential of the YOI mobile application-based intervention to offer accessible, evidence-based support for mental well-being amidst the challenges posed by the COVID-19 pandemic.

CHAPTER II:

LITERATURE REVIEW

2.1. Introduction

The purpose statement of this double-blind study was to investigate the efficacy and feasibility of a mobile application-based YOI meditative intervention in mitigating symptoms of depression, anxiety, and insomnia - among individuals experiencing sub-optimal mental health globally, particularly during the challenges posed by the COVID-19 pandemic - using a mixed-method study design.

The main objective of this study was to quantify the extent of change in symptoms of the mental health conditions, if reported, using the Yoga of Immortals app over an 8-week period - by utilizing standardized assessment tools: the Generalized Anxiety Disorder questionnaire (GAD-7) for anxiety, the Patient Health Questionnaire (PHQ-8) for depression, and the Insomnia Severity Index (ISI) for insomnia.

The study intended to address several research problems, including limitations of preexisting interventions due to sample size, lack of validated mental health scales, and pre-pandemic research periods. Additionally, it aimed to fill gaps in knowledge about the integration of mobile health apps in clinical practice, especially in a post-pandemic landscape where traditional in-person interventions might face barriers.

To expand on the research gaps and limitations of the existing recognized yoga-based mental health interventions, this literature review is structured to initially expound

on the advanced inclusion strategy and criteria of the body of knowledge, followed by applications of the 3 key theoretical frameworks, prevalent in the field of mental health, in the context of the research – Theory of Reasoned Action (TRA), the Stress and Coping Theory, and the Health Belief Model (HBM). Further, it provides a systematic introduction to important themes concerning global mental health during the pandemic, with an overview of the impact of mental health conditions on the global economy, and understanding the mindfulness app industry. This is followed by a critical review of yoga-based interventions of RISE and Kundalini Yoga by Sat Bir Singh Khalsa, and Transcendental Meditation - decoding the research gaps and connecting their limitations with opportunities for the research.

The literature is defined by a comprehensive search using relevant databases aligning with the theoretical frameworks. It primarily includes peer-reviewed scholarly articles, books, and government sources for reliability. The timeframe covers the late 1990s to 2023, with a focus on relevance to the COVID-19 pandemic. Varied academic disciplines, primarily in English, are considered for global applicability. Priority is given to primary research articles adhering to ethical standards. The scope ensures that the selected literature directly addresses research objectives while upholding quality and relevance.

YOI faces a significant challenge due to limited engagement in non-pharmaceutical meditative approaches for mental well-being during the COVID-19 pandemic (Büssing, Baumann, and Surzykiewicz, 2022; Magnavita, Soave, and Antonelli, 2021a; Magnavita, Soave, and Antonelli, 2021b). Individuals who typically relied on their faith as a coping

mechanism also experienced a decline in their meditation and mental wellness practices amidst the pandemic (Büssing, Baumann, and Surzykiewicz, 2022). Furthermore, healthcare professionals, grappling with heightened stress levels, reported a shortage of time for meditation, physical activity, and social and work interactions, and were also susceptible to compassion fatigue (Magnavita, Soave, and Antonelli, 2021a; Magnavita, Soave, and Antonelli, 2021b).

The purpose statement of this double-blind study was to investigate the efficacy and feasibility of a mobile application-based meditative intervention called Yoga of Immortals in mitigating symptoms of depression, anxiety, and insomnia - among individuals experiencing sub-optimal mental health globally, particularly during the challenges posed by the COVID-19 pandemic - using a mixed-method study design.

The study evaluated YOI as a structured, home-based intervention for enhancing mental well-being during a time characterized by a heightened prevalence of mental health challenges, notably the COVID-19 pandemic. This gap in mental health support becomes especially pronounced in the context of the pandemic, where traditional face-to-face interventions may not be practical or readily accessible. The YOI app emerges as a potential solution to bridge this gap, offering an opportunity to investigate the effectiveness of digital interventions.

2.2. Inclusion Criteria

While selecting relevant literature for the review, accuracy, transparency and clarity of expression have been taken into important consideration. Peer-reviewed scholarly articles published in reputable academic journals and books and government sources are considered primarily to ensure quality and reliability. For an elaborate intergenerational purview of foundational and currently relevant non-pharmaceutical meditative modalities, the literature included in this review covers the period from the late 1990s till 2023, while ensuring that it is authentic and pertinent to the research topic. While researching for literature on the latest mental health interventions and their efficacy on mental health issues, an emphasis was laid on the timelines of the COVID-19 pandemic (late 2019-early 2023) for relevance.

Literature from relevant academic disciplines, including but not limited to yoga-based meditation practices, is included to provide a comprehensive perspective on their efficacy and adaptability in the COVID-19 context. It directly connects with the research objectives, addressing the central research questions and themes of the research. Literature written in English is considered due to global applicability and language proficiency.

While there is no geographic restriction, preference is given to literature that addresses global or widely applicable aspects of the research topic. Regional or country-specific studies are also included; given they offer unique insights. Emphasis is placed on primary research articles that present empirical studies, experiments, surveys, or original investigations. Content that does not directly contribute to the research objectives, or is

tangential to the central themes, is excluded. Sources that lack methodological rigour or have significant methodological flaws are also not included in the review.

A comprehensive search was conducted using relevant academic databases, including Google Scholar (Google Scholar, 2023) and Pubmed National Library of Medicine (National Library of Medicine, 2021) to identify eligible literature. The selected literature also aligns with the considered theoretical frameworks relevant to the research. The included studies adhere to the ethical research standards and guidelines, particularly due to the involvement of human subjects and sensitive topics on mental health in the research. Table 2.1 describes the nature and sources of references.

TABLE 2.1 Summary of the nature and sources of references

Author(s)	Nature of References	Sources
Ali, S., Balaji, P. and Varne, S. (2012).	Physiological effects of yoga practices and transcendental meditation in health and disease	North American Journal of Medical Sciences
Burns, J.L., Lee, R.M. and Brown, L.J. (2011)	Effects of meditation on self-reported measures of stress, anxiety, depression, and perfectionism in a college population	Journal of College Student Psychotherapy
Gupta, S. and McCarthy, P.J. (2021)	Sporting resilience during COVID-19: nature of the adversity and how competitive elite athletes adapted	Frontiers
Huberty, J., Puzia, M.E., Green, J., Vlisides-Henry, R.D., Larkey, L., Irwin, M.R. and Vranceanu, A.-M. (2021)	Improvements in depression and anxiety in adults with sleep disturbance through a mindfulness meditation mobile app	General Hospital Psychiatry
Khalsa, S.B.S. (2013)	Yoga for psychiatry and mental health: an ancient practice with modern relevance	Indian Journal of Psychiatry

Khalsa, S.B.S. and Goldstein, M.R. (2021).	Treatment of chronic primary sleep onset insomnia with Kundalini Yoga	Journal of Clinical Sleep Medicine
Morin, C.M., Bjorvatn, B., Chung, F., Holzinger, B., Partinen, M., Penzel, T., Ivers, H., Wing, Y.K., Chan, N.Y., Merikanto, I., Mota-Rolim, S., Macêdo, T., De Gennaro, L., Léger, D., Dauvilliers, Y., Plazzi, G., Nadorff, M.R., Bolstad, C.J., Sieminski, M. and Benedict, C. (2021).	An international collaborative study on Insomnia, anxiety, and depression during the COVID-19 pandemic	Sleep Medicine
Pappa, S., Ntella, V., Giannakas, T., Giannakoulis, V.G., Papoutsi, E. and Katsaounou, P. (2020).	Prevalence of depression, anxiety, and insomnia among healthcare workers during the COVID-19 pandemic	Brain, Behavior, and Immunity
Puzia, M.E., Huberty, J., Eckert, R., Larkey, L. and Mesa, R. (2020)	Associations between global mental health and response to an app-based meditation intervention in Myeloproliferative Neoplasm patients	Integrative Cancer Therapies
Shapiro, D.H. and Walsh, R.N. (2009)	Meditation: Classic and Contemporary Perspectives	New Brunswick: Aldine Transaction
Torous, J., Jän Myrick, K., Rauseo-Ricupero, N. and Firth, J. (2020)	Digital mental health and COVID-19: Using technology to accelerate the curve on access and quality	JMIR Mental Health
Witarto, B.S., Visuddho, V., Witarto, A.P., Bestari, D., Sawitri, B., Melapi, T.A.S. and Wungu, C.D.K. (2022)	Effectiveness of online mindfulness-based interventions in improving mental health during the COVID-19 pandemic	PLoS ONE

Note: Author's work

2.3. Theoretical Framework

This study utilizes three theoretical frameworks to offer a comprehensive theoretical foundation guiding the examination of how intentions, coping mechanisms, and health-related beliefs shape the adoption and effectiveness of YOI interventions. This section explores the theoretical frameworks of the Theory of Reasoned Action (TRA), Stress and Coping Theory, and Health Belief Model (HBM), each applied to the context of app-based YOI meditative interventions during the COVID-19 pandemic.

The Theory of Reasoned Action focuses on the relationship between intentions and behaviours, suggesting that attitudes and subjective norms influence people's actions. Stress and Coping Theory delves into how individuals respond to stress, categorizing coping mechanisms into problem-focused and emotion-focused strategies - highlighting YOI's alignment with the latter through meditation and yogic practices. Lastly, the Health Belief Model explores the factors influencing health-related actions, such as perceived susceptibility, severity, benefits, barriers, cues to action, and self-efficacy, relating these to the adoption and effectiveness of YOI interventions.

Theory of Reasoned Action

The Theory of Reasoned Action (TRA) was introduced by Fishbein and Ajzen (1975) in an attempt to determine differences between intention and behaviour (Staats, 2016). The TRA assumes that people act in accordance with their intentions. It is based on the theory that people decide to act depending on external and internal information in their

minds. Applying TRA to app-based YOI meditative interventions on mental health, it can be seen how beliefs and evaluation of mental health during COVID-19 affect attitudes of emotional distress of the global population. Their attitude and intention to pharmacological and cognitive behavioural therapy are usually the preferred lines of treatment. As a result, positive actions have been taken to solve the problem of the mental health of the global population during the COVID-19 pandemic.

The TRA serves as a foundational framework for comprehending the relationship between intention and behaviour. According to it, individuals are more likely to engage in a particular behaviour if they possess a strong intention to do so. This intention, in turn, is influenced by two primary factors: 1. attitudes and 2. subjective norms (Staats, 2016). The attitudes represent an individual's personal evaluation of a behaviour. In the context of mental health during the COVID-19 pandemic, attitudes might relate to how a person perceives the effectiveness of interventions like app-based YOI meditative practices. A positive attitude towards YOI, for instance, could be influenced by the belief that it helps reduce stress and enhance mental well-being. Subjective norms, on the other hand, refer to an individual's perception of social pressure or expectations related to a specific behaviour. For instance, someone may be more inclined to use YOI if they perceive that their friends, family, or healthcare professionals endorse its effectiveness in addressing mental health challenges during the pandemic.

Applying TRA to the scenario of YOI interventions on global mental health during COVID-19, we can learn the intricate dynamics. Beliefs about the YOI program and its efficacy in promoting mental well-being during a time of crisis can significantly impact

individuals' attitudes. If people believe that YOI is a valuable tool for coping with mental health issues, their attitudes towards using it are likely to be positive. Furthermore, the evaluation of mental health during the COVID-19 pandemic plays a crucial role. Individuals who perceive their mental health as deteriorating due to the pandemic may be more motivated to seek solutions, such as YOI, to improve their emotional well-being. This evaluation of mental health can strongly influence their intention to take action.

In essence, the TRA framework sheds light on the intricate interplay between intentions, attitudes, beliefs, and external influences in the context of addressing mental health challenges during the COVID-19 pandemic. Understanding these dynamics can inform the design of targeted interventions and public health strategies to promote mental well-being and alleviate mental health conditions on a global scale, also through YOI meditative modalities.

Stress and Coping Theory

Stress, in the context of psychological research, is a complex and multifaceted phenomenon. It refers to the emotional and physiological responses individuals experience when they perceive a discrepancy between the demands placed on them and their ability to meet those demands (Epel et al., 2018; Lazarus et al., 1985). During the COVID-19 pandemic, stressors such as fear of infection, social isolation, and uncertainty about the future have become pervasive, contributing to elevated stress levels in the global population. Coping refers to the strategies individuals employ to manage and mitigate the psychological and physiological effects of stress. The "Stress and Coping Theory,"

pioneered by Lazarus and Folkman (1984), posits that individuals engage in various coping mechanisms to navigate stressful situations. These mechanisms can be categorized into problem-focused coping and emotion-focused coping. Problem-focused coping involves taking direct actions to address the stressor, while emotion-focused coping aims to regulate the emotional responses to stress (Lazarus and Folkman, 1984).

In the context of the COVID-19 pandemic, the Stress and Coping Theory provides a valuable framework for understanding how individuals have responded to the unique stressors associated with the crisis. Many have adopted a combination of problem-focused coping (e.g., following health guidelines, seeking information) and emotion-focused coping (e.g., meditation, relaxation techniques) to navigate the challenges posed by the pandemic.

App-based YOI meditative interventions offer a unique approach to coping with pandemic-related stressors. These interventions incorporate elements of breathwork, awareness, visualisation, meditation, and yogic practices, which align with the principles of emotion-focused coping. Engaging in such practices may help individuals regulate their emotional responses, and reduce anxiety, depression and insomnia - enhancing their overall mental well-being. Since this theory distinguishes between problem-focused coping, which involves taking direct actions to address stressors, and emotion-focused coping, which centres on regulating emotional responses to stress, YOI meditative interventions primarily fall into the latter category. They are designed to help individuals acknowledge and manage their emotional reactions to stress, anxiety, depression and insomnia while offering improved quality of life.

Yogic movements, an important element of Yoga of Immortals, combine meditation with bodily postures and controlled breathing. The physical aspect of YOI not only enhances flexibility and strength but also releases endorphins, the body's natural mood elevators – while engaging the Central Nervous System. This engagement alleviates physical tension often associated with stress and contributes to improved metabolism. Moreover, the meditative aspect of YOI engages relaxation techniques to reach a heightened state of non-judgemental awareness. This reduces the physiological responses to stress, such as increased heart rate and cortisol levels – helping individuals delve into deeper states of consciousness.

Another essential aspect of YOI meditative interventions is the cultivation of resilience. Resilience refers to an individual's ability to adapt and bounce back from adversity. By teaching individuals to face challenging situations with equanimity, these interventions empower them to cope more effectively with stressors. Practitioners learn to confront their anxieties, fears, and uncertainties while maintaining a sense of inner stability and balance. Further, YOI provides a convenient platform for individuals to engage in guided practices at their own pace and on their schedule. This accessibility is especially crucial during a pandemic when traditional avenues for seeking mental health support, such as in-person therapy, may be limited or restricted.

Finally, YOI app-based interventions offer personalized experiences, allowing practitioners to choose practices based on their preferred level of difficulty and time duration, hence, aligning with their specific needs and preferences. The app offers a variety

of guided sessions that are progressive, which enhances the relevance and effectiveness of YOI interventions as coping mechanisms.

The Stress and Coping Theory offers a valuable lens through which to examine the impact of app-based YOI meditative interventions on the mental health of the global population during the COVID-19 pandemic. Rooted in ancient practices of yoga-based non-pharmaceutical meditative modalities, YOI provides a holistic and effective approach to coping with pandemic-related stressors. By promoting awareness, offering physical and psychological benefits, fostering resilience, and providing accessibility through mobile apps, these interventions align with the principles of emotion-focused coping within the theory. Further research in this area can shed light on their specific impact on mental health during the COVID-19 pandemic and contribute to the broader discussion of effective coping strategies during times of crisis.

Health Belief Model

The Health Belief Model (HBM), developed by Hochbaum in the 1950s and subsequently refined by Rosenstock (1966), is a widely used framework for understanding health-related behaviours and decisions. The HBM posits that individuals' health-related actions are influenced by their perceptions of the key factors of Perceived Susceptibility, Perceived Severity, Perceived Benefits, Perceived Barriers, Cues to Action and Self-Efficacy (Conner and Norman, 2017).

In the context of the app-based mental health intervention of YOI, Perceived Susceptibility is the belief that one is susceptible to a particular health condition or

problem, such as mental health issues during a pandemic. Perceived Severity is the perception of the seriousness of mental health conditions like anxiety, depression and/or insomnia - including their potential physical, emotional and psychological consequences on well-being and quality of life. Perceived Benefits form the belief that taking a specific action, such as engaging in app-based YOI meditative interventions, will reduce the perceived threats to total health and improve well-being. Perceived Barriers relate to the recognition of obstacles or challenges that may hinder or prevent individuals from regularly engaging with app-based YOI meditative interventions – including lack of digital knowledge, limited access to technology, etc. Cues to Action define the external stimuli or internal factors that prompt individuals to take action such as the availability of the YOI app. Self-efficacy is derived from confidence in one's ability to successfully perform the recommended health behaviour, in our case, performing the progressive YOI meditative modalities regularly and consistently.

In the context of the COVID-19 pandemic, the HBM can provide valuable insights into the efficacy of app-based YOI meditative interventions for improving mental health. The following illustrates how each component of the HBM can be applied to app-based YOI meditative intervention:

Perceived Susceptibility: It refers to individuals' beliefs about their vulnerability to a particular health issue. In the context of the COVID-19 pandemic and mental health, individuals who recognize the stress, anxiety, depression, insomnia and other mental health challenges associated with the pandemic are more likely to perceive themselves as susceptible to these issues. Individuals who acknowledge the impact of the pandemic on

their mental well-being are more inclined to seek out interventions such as app-based YOI meditation as a means to address and mitigate these mental health concerns.

Perceived Severity: It is the perception of the seriousness of a health condition. In the context of mental health, individuals assess the seriousness of the mental health challenges brought about by the pandemic. Understanding the severity of mental health issues during the pandemic is crucial for motivating individuals to take action. If people recognize that untreated stress, anxiety, depression or insomnia can have severe consequences on their overall well-being, they are more likely to consider and engage with app-based interventions like YOI as a solution.

Perceived Benefits: They relate to the belief that taking a specific health action will reduce the threat to health and improve overall well-being. It involves the perception that engaging in app-based YOI meditation can provide relief from pandemic-induced stress and anxiety. Studies can explore how users' perceptions of the benefits of these interventions influence their engagement. Those who believe that meditative practices can effectively reduce stress and improve mental health are more likely to commit to using these apps consistently.

Perceived Barriers: They encompass the recognition of challenges that may hinder individuals from taking recommended health action. For YOI, this could include factors like limited access to technology, lack of time, concerns about the effectiveness of the app, etc. Identifying and addressing these barriers is critical for promoting the adoption of app-based YOI meditation. What can be assessed is how the removal or mitigation of these barriers impacts user engagement and adherence to the adoption of YOI modalities.

Cues to Action: They relate to external stimuli or factors that prompt individuals to take action. Awareness campaigns, recommendations from healthcare providers, sharing personal experiences etc, when performed ethically and consistently, are likely to support higher engagement of the YOI app. Understanding the cues that prompt individuals to start using the app can inform strategies for promoting its adoption. It is noted that effective marketing, healthcare provider endorsements, or timely recommendations can serve as powerful cues to encourage individuals to engage with app-based interventions.

Self-efficacy: It refers to an individual's confidence in their ability to successfully perform a recommended health behaviour. It involves users' confidence in their ability to practice YOI meditation effectively through the app. An insight is the possibility of learning how the YOI intervention can enhance users' self-efficacy. Providing clear instructions, self-paced guided sessions, and tracking progress can boost users' confidence, leading to higher levels of persistence.

By applying the Health Belief Model to the evaluation of app-based YOI meditative interventions during the COVID-19 pandemic, this framework provides a comprehensive understanding of the factors influencing their efficacy in improving the mental health of the global population.

2.4. Mental health during COVID-19

Mental health has become an increasingly prevalent public health concern. The World Health Organization (WHO) predicts that a quarter of the world's population will grapple with mental health challenges at some point in their lifetime (Wang et al., 2007).

Depression and anxiety stand as prevalent psychiatric conditions, affecting between 4% to 20% of people across different demographics (Bandelow and Michaelis, 2015; Kessler et al., 2003). These conditions don't just impact individuals; they extend their reach to families and friends, causing reduced well-being and social functionality. Unfortunately, depression and anxiety often go unnoticed and untreated (Ballenger, 2000), worsening their effects.

The COVID-19 pandemic has heightened mental health difficulties due to prolonged isolation, mortality rates, and associated stressors. Surveys show a notable increase in adverse mental health conditions among the population, with figures spiking up to 40% in some US studies (Czeisler, 2020). Even before the pandemic, accessing mental health services posed a challenge for many. Pandemic restrictions have further limited access to professional services and social support networks.

Yoga of Immortals is a comprehensive meditative program developed by ShivYog that educates on ancient yogic practices. Mindfulness and meditation-based practices have gained traction in modern psychotherapy, offering self-help techniques for anxiety and depression. However, integrating mindfulness meditation into mental health lacks a unified approach and often involves disjointed studies. Traditionally, the complete YOI practices were exclusively taught in person. However, in response to the pandemic, a structured YOI program was created for mobile platforms, widening accessibility to a larger audience. The YOI app provides a comprehensive program accessible via smartphones or mobile devices at any time, overcoming hurdles related to time, expenses, and accessibility.

As the repercussions of the pandemic restrictions with respect to travel, social distancing, and access to healthcare, emotional distress worsened people's underlying psychiatric conditions. A poll conducted by The Kaiser Family Foundation stated that the pandemic had a negative impact on the mental health of nearly 56% of US adults (Panchal et al., 2021). Prolonged stress due to additional challenges of social isolation, financial complications, home-schooling, uncertainties of the future etc. resulted in major impacts on sleep and mental wellbeing (Zitting et al., 2020).

While COVID-19 has had an impact on the health and holistic performance of individuals, multiple studies reflect that the disorders of anxiety, depression and insomnia increased to an all-time peak. In 2021, an international collaborative study concluded high rates of insomnia symptoms (36.7%), anxiety (25.6%), depression (23.1%) and insomnia disorder (17.4%) associated with COVID-19 – additionally indicating that people living in confined environments were at a higher risk for insomnia (Morin et al., 2021). Within a few months of treatment, patients recovering from COVID-19 revealed signs of increased depression (Raman et al., 2021). 23% of participants from the study developed anxiety and/or depression, and 26% informed sleep deprivation and related concerns (Huang et al., 2021).

According to a review and meta-analysis of 13 studies on a total of nearly 30,000 healthcare workers, 23% exhibited anxiety, 22% dealt with depression, and over 38% had insomnia during COVID-19 (Pappa et al., 2020). The study reported that at least 1 in 5 medical professionals recognized symptoms of anxiety and depression, almost 4 in 10 suffered from sleep concerns and/or insomnia, and female healthcare staff had higher rates

of depression and anxiety than their counterparts (Pappa et al., 2020). With the collapse of global healthcare systems during COVID-19, it is clear that healthcare professionals experienced exaggerated levels of emotional and psychological distress due to work, in addition to personal isolation and fear transmission to the self and loved ones. During COVID-19, HCWs were anxious, financially unstable and overworked (Sethi et al., 2020).

Recently, a cross-cultural study evaluated the impact of the pandemic on competitive elite athletes before and during Olympic postponement. While stress responses were captured among athletes before the postponement, after the postponement, they had debilitating responses including burnout syndrome, dismal coping mechanisms, and a decline in intrinsic development (Schinke et al., 2020). This evidenced that high-performing athletes experienced severe mental health challenges, including an impact on appetite, lifestyle disorders, anxiety and depression – confirming the pandemic's negative impact on their total well-being.

As a result of the mental health crisis, the global economy is facing the brunt of enormous losses due to mental health disorders, the prevalence of which increased manifold during COVID-19. Currently, the US estimated USD 30–107 billion as an annual spend on insomnia management (Qaseem et al., 2016; Kraus and Rabin, 2012). In India, according to the World Health Organization, the economic loss due to mental health disorders between 2013 and 2030 is estimated at USD 1.03 trillion (WHO, n.d.).

Lancet Global Health (2020) stated that lost productivity due to anxiety and depression costs the global economy USD 1 trillion every year. Before COVID-19, back in 2010, declining mental health was estimated to cost nearly USD 2.5 trillion to the world

economy in reduced productivity and inadequate health levels. This cost is now projected to rise to USD 6 trillion, essentially more than double, by 2030 (The Lancet Global Health, 2020). These staggering statistics add clarity to the critical reality of the economic losses induced by the ongoing mental health crisis.

During COVID-19, an increase in the use of app-based mental health interventions was observed (Torous et al., 2020). The market of mindfulness-based apps is a small portion of the overall wellness market, which accounted for nearly USD 4 trillion in 2015 (Global Wellness Institute, 2018). The mobile health market has been growing rapidly due to affordability, accessibility and convenience. According to the Wall Street Journal, over 2,000 meditation apps were launched between 2015 and 2018, indicating a sharp increase in both usage and demand for such services (Potkewitz, 2018). By 2017, more than 84,000 app publishers developed apps for the medical, health, and fitness markets (Research2Guidance, 2019).

To treat the mental health conditions of depression and anxiety, pharmacological and cognitive behavioural therapy are usually the preferred lines of treatment. However, both treatments carry limitations with respect to uptake - including medication concerns, shortage of trained therapists, and the stigma around the need for mental health treatments (Firth et al., 2017). Mobile apps allow accessibility to mindfulness exercises with liberty of time and cost (free or low cost) which may not necessarily require a trained therapy provider. Further, behavioural nudges programmed in apps can sustain a long-term practice of the intervention – which is quintessential for the treatment. Mobile apps are capable of delivering meditative interventions for a range of health issues, however, there are limited

studies that test the efficacy of meditation mobile apps on depression and anxiety among individuals with sleep disturbances (Huberty et al., 2021).

Persistent states of anxiety, depression and insomnia, induced by prolonged stress, traumatic incidents or pandemics can lead to frequent dysfunction of sensory, emotional and/or cognitive abilities. Today, the recognition, interpretation, and treatment of the symptoms of mental health conditions are still challenging pertaining to the stigma and misinformation around them (Conner et al., 2010). The COVID-19 pandemic has aggravated the already dominant global mental health crisis, the adversely affected by which are healthcare professionals, athletes and the working population – all of whom also steer multiple roles personally and professionally.

Among frontline workers, the diagnosis of mental health disorders like anxiety and depression is already challenging, as often the patients present somatic concerns over psychiatric symptoms (Ballenger, 2000). During COVID-19, when medical and para-medical staff needed to treat a large number of patients, including complicated cases, in a stipulated time during the high-stress environment provoked by the pandemic - their socio-emotional and cognitive capacities were impacted leading to frequent burnouts. Due to a scarcity of resources, they had to juggle clinical, educational as well as administrative roles during panic situations (Sethi et al., 2020).

Athletes are constantly working to build their performance and recovery. During the pandemic, they experienced loss of compensation, cancellation of sporting competitions internationally, hypervigilance and restrictions during trainings. Such uncertain changes, along with incited panic and fear of loss led to them experiencing mental

distress and eating disorders (Gupta & McCarthy, 2021). Sporting organizations and those associated with them, including coaches and athletes, underwent immediate impacts including infection, challenges with talent development and funding, long-term opportunity loss etc. (Ngaluafe, n.d.) which further led to elevated stress and anxiety. Examining the impact of app-based interventions on mental health outcomes, studies found that app-based interventions, including mindfulness-based stress reduction and cognitive-behavioural therapy, reduced stress, anxiety and depression levels among general population, including Myeloproliferative Neoplasm patients during COVID-19 (Witarto et al., 2022; Hwang and Jo, 2019; Heckendorf et al., 2019; Puzia et al., 2020).

2.5. Meditative programs by Sat Bir Singh Khalsa

Introduction

Yogic practices and meditations have been widely accepted interventions by the general population to invoke mental peace, stability and tranquillity. Practising scientific yogic techniques are proven to help by stimulating specific physical and mental responses, which in turn reduce anxiety and stress., leading to positive changes in one's physiology - improving cognition respiration, reduced cardiovascular risk, body mass index, blood pressure, and diabetes (Ali, Balaji and Varne, 2012).

One of the researches (Khalsa, 2013) by Sat Bir Singh Khalsa states that historically, yoga was also intended to attain an ideal state of optimal 'mind' and body functioning, and psychophysiological health catalyzing contemplative states of

consciousness. As per the study, yoga as a treatment for ailments like schizophrenia was arguable more than 10 years ago, however, yoga therapy is now being explored for conditions including post-traumatic stress disorder, obsessive-compulsive disorder, schizophrenia, attention-deficit disorders, autism and addictive behaviours. Further cited (and supported) in the study is yoga research done by acclaimed Indian Psychiatrist Professor N.S Vahia during the 1970s on psychological conditions and yoga therapies (Vahia et al., 1973) which mentions 'psychophysiological therapy' as a new avenue to explore the prevention and management of psychiatric disorders.

RISE Program

Sat Bir Singh Khalsa has conducted multiple qualitative examinations on Kripalu's 5-day residential yoga-based retreat program designed for professionals and frontline workers, called RISE, which stands for Resilience, Integration, Self-awareness and Engagement (Reeves, 2018; Reeves et al., 2022; Trent et al., 2019; Trent et al., 2018). The evaluations were conducted on a sample size of between 17 to 80 individuals who were housed at Kripalu Center for Yoga and Health, in mostly multiple guest rooms, for the residential program. The interventions were mainly 5 hours of daily sitting meditations, mindfulness practices, yoga postures and breathing techniques – followed by theoretical education on mindful communication, sleep preparation, and eating. The RISE program concluded positive results among participants based on its structure of experiential mindfulness, resilience, multiplier effect, self-care and compassion, and inner resources (Reeves, 2018).

Kundalini Yoga Program

Another program led by Khalsa is the Kundalini Yoga program, a set of yoga postures, meditation, breath work and chanting techniques which are at aimed promoting empowered and inspired living (Kripalu, n.d.b). As part of the research on the program - for school students and adolescents, a 10-week YOGA (Your Own Greatness Affirmed) for Youth program was delivered after school 1 to 2 times per week, and effects of the program on student stress, affect, and resilience, and adolescents' self-reported emotion dysregulation and psychological functioning were examined.

A sample size of less than 119 adolescents and students was considered (Sarkissian et al., 2018; McMahon et al., 2021). Few other studies on Kundalini Yoga are to assess its impact as a treatment for Generalised Anxiety Disorder (Gabriel et al., 2018), and chronic primary sleep onset insomnia (Khalsa and Goldstein, 2021) wherein the participants received 8-week Kundalini Yoga or Sleep Hygiene intervention with initial 60-minute instructions, followed by weekly check-ins. Overall, the program concluded behavioural modification and self-reported improvements among the test participants.

Research Gaps and Limitations

Medically, in public health, it is known that for life-threatening mental health conditions, advanced clinical trials led by experienced teams of doctors and statistical clinicians are indispensable to assess the accurate results of the programs. Similarly, an adequate sample size of at least 1,000 test participants allows room for detailed feedback on the structure and efficacy of the interventions. On the RISE and Kundalini Yoga

programs, while the researches are mainly led by academicians and researchers, the sample sizes consider less than 120 participants, which is a remarkably lower participation to assess the efficacy of the programs with a global mental health perspective.

What might also enable further questioning of the studies is that reasoned and validated mental health parameters/scales like Insomnia Severity Index (ISI), Patient Health Questionnaire-8 (PHQ-8), Generalized Anxiety Disorder (GAD-7) etc. are not taken into account for an elaborate understanding of the respondents' health status. Another exigent observation of these studies is that they were led before the advent of the COVID-19 pandemic. Hence, they do not account for the mental health complexities and complications that the general global population faces today as a result of a 3-year consistent pandemic.

Considering that RISE and Kundalini Yoga programs studied in the research are residential and on-campus interventions – they are highly likely to incur high costs (including marketing, travel of participants and teachers, the fee of educators, accommodation/food and other miscellaneous expenses) with restricted participation of individuals. The results may also showcase bias, as trainers and educators assembling from across the world may carry preconceived notions and perspectives based on the behaviours and cultures of people, as well as educational barriers from their respective locations – leading to individual variations. Since Kundalini Yoga interventions are discovered to be contemporary forms of modern yoga, they do not include standardized use of ancient modalities - which are the premises of authentic science-based yoga.

To mediate these gaps, out of 10,000 practitioners who practised yoga-based non-invasive YOI interventions regularly during COVID-19, a sample size of 1,505 was considered for the study during the pandemic. Having been delivered as a software-based asynchronous program, it was disseminated via a mobile app with a structured approach, to ensure higher participation. With the possibility of nudges and app notifications, engagement with the program was further simplified with timely reminders and evaluation of progress.

Further, a multidisciplinary research team consisting of high-qualified healthcare professionals (psychiatrists, oncologists, integrative healthcare specialists etc), scholars, researchers and statisticians was formed from different countries who have specializations, hands-on expertise, and diverse perspectives in neuropsychiatry, behavioural sciences, psychology, chronic ailments and mental health – hence, eliminating any form of bias. This team was led under the guidance of Dr. Ishan Shivanand, an *Acharya* (yogic scholar and professor) from ancient India's Sanatan Dharma philosophy of Hinduism – also a mental health researcher with authority in integrative medicine. Further, to ensure the inclusivity and credibility of the research findings, the research on YOI modalities was submitted to internationally accredited Institutional Review Board for thorough examination.

2.6. Evaluation of Transcendental Meditation

Introduction

This section discusses Transcendental Meditation (TM) as a form of meditation that aims for a state of "thoughtless awareness" through the recitation of a mantra, emphasizing its origins in Vedic tradition and its structured practice. It further leads to the evidence supporting its benefits for mental health, citing various studies that highlight its positive impact on stress, anxiety, depression, and other conditions. Following this, it addresses the research gaps and limitations within the existing studies, highlighting the lack of recent assessments considering contemporary mental health challenges, the absence of validated mental health parameters used in the evaluation, and the potential adverse effects and contraindications associated with TM.

This is put in contrast with a research study on YOI non-pharmaceutical meditative interventions, which attempts to address these gaps by focusing on larger sample size, relevance to post-pandemic conditions, scientific foundation, and a multidisciplinary team's involvement to ensure thorough investigation and control over protocols. The comparative analysis aims to showcase the strengths and limitations of TM research and how YOI intervention addresses some of these gaps while also outlining potential areas of improvement.

Transcendental Meditation

Meditation is often inferred to as a state of "thoughtless awareness" achieved by self-regulation of attention and streamlining thought patterns. One such widely accepted form of meditation is Transcendental Meditation (TM), a scientific meditative technique based on yogic meditative practices taught by Swami Brahmananda Saraswati and further promoted by Indian scientist and guru Maharishi Mahesh Yogi in the 1950s.

The technique originated from the Indian Vedic tradition and involves the recitation of a mantra (a sound, word or phrase meant for repeated practice) activating a quieter and calmer state of the mind – leading the body to a deep state of rest. As per the official platforms disseminating the meditation modules, the practice is titled "The technique for inner peace and wellness" and structured to be practised for 20 minutes daily twice a day as per personalized instruction by a certified TM teacher (TM.org, n.d.). TM is evidenced by multiple studies to have benefitted mental health concerns of stress and anxiety (Krisanaprakornkit et al., 2006; Eppley, Abrams and Shear, 1989), depression (Burns, Lee and Brown, 2011) and post-traumatic stress disorder (Barnes, Rigg and Williams, 2013). It gained popularity in the 1960s-70s when The Beatles and other global celebrities initiated its practice and gathered immense attention from psychotherapists and researchers to evaluate its benefits and implications (Yunesian et al., 2008).

TM practices result in improvements in cases of anxiety and somatization – independent of the demographics of age, marital status or gender (Yunesian et al., 2008). A controlled randomized study conducted at Harvard controlled for expectation and time spent with the instructor to find that elderly aged between 80 and 89 showed greater

improvement in mental health, systolic blood pressure, cognitive and perceptual flexibility, and self-reported well-being (Schneider et al., 1995). Another study concluded that the program helped reduce psychological distress among teachers, and supported the staff working in a therapeutic school for students with behavioural problems (Elder, 2014). Further, a randomized controlled trial of TM concluded that it reduced stress and improved the quality of life of older women with breast cancer. In light of considering its accessibility and ease of home practice (Nidich et al., 2009).

Research Gaps and Limitations

While there is advanced literature available on the efficacy of Transcendental Meditations on psychological well-being, it is noted that research on the technique took place mainly between 1950 and 2015, which indicates minimal to no academic assessment of the ongoing dissemination practices of TM during nearly the recent decade. The studies, hence, also do not consider the unparalleled mental health impediments and complications that arose due to the outbreak of COVID-19, which is a significant limitation - knowing that the stress levels today are not the same as 8 years ago and that technological advancements have become more progressive than ever before.

Another substantial observation is that similar to yoga-based programs by Khalsa, TM also does not account for reasoned and validated mental health parameters/scales like Insomnia Severity Index (ISI), Patient Health Questionnaire-8 (PHQ-8), Generalized Anxiety Disorder (GAD-7), etc. - raising uncertainty with respect to authenticity of reliability of data as per public health perspective.

The lack of recent evaluation of these modalities may indicate a lack of quality control mechanisms to ensure authentic moderation and supervision of these TM interventions. While there is no suspicion on the efficacy of TM on stress reduction and burnout prevention, there are noted contraindications and adverse effects of TM – making TM subjective, and restrictive for specified mental health conditions. Research elucidates the practice of TM leading precipitation of psychiatric problems under specific circumstances (Lazarus, 1976). An abstract from the book "Meditation" refers to a study conducted at Stanford Research Institute that led to the emergence of a phenomenon called "unstressing" – described as a natural after-effect of practising the initial practices of TM (Shapiro and Walsh, 2009). As per the book, specific meditators termed as "naive" had tendencies of frustration, mental tension, suspiciousness and impulsiveness when they began the practice. Another study clinically analyses the impact of TM practices on epilepsy, investigating it as "a double-edged sword in epilepsy" (Lansky and St. Louis, 2006).

The research on YOI meditative interventions was done on a sample size of 1,297 - making it an important study evading multiple geographical and technological barriers. The study was conducted for 8 weeks, to assess the efficacy of the modalities during COVID-19. This is expected to mitigate the barriers of TM research based on relevance for modern post-pandemic conditions. YOI modalities are based on scientific yogic interventions, including emotional and cognitive stimulation, and thought, breath and body awareness – hence their contraindications, if reported any, are not adverse or damaging in any form. Also, as elaborated earlier, the research is led by a multidisciplinary team, the

panel of which was led by an *Acharya* – leading to the elimination of prejudices or bias and allowing control over moderation, customization and improvement of the standardized protocols. It was submitted to internationally accredited Institutional Review Board for investigation.

2.7. Mental Health Apps: Challenges and Opportunities

Challenges

Several studies have delved into the perspectives and expectations of users concerning mental health mobile apps (Goodwin et al., 2016; Oyebode, Alqahtani and Orji, 2020; Schueller et al., 2018). These investigations contribute valuable insights into the functionalities and factors influencing user experiences with such apps. Users frequently discover mental health apps through online search, social media, or word of mouth rather than professional sources (Schueller et al., 2018). Users prioritize user-friendly apps, that boast visually appealing interfaces (Schueller et al., 2018), and come with affordable subscription plans (Oyebode, Alqahtani and Orji, 2020). Furthermore, users express a preference for apps that offer customizable interfaces, deliver high-quality content, and possess adaptive features catering to individual user needs. Additional features highly sought after by users encompass tracking capabilities, the provision of reports and insights, the option to share data, and timely notifications (Schueller et al., 2018).

User engagement and retention pose significant challenges to the success of mental health applications (Ng et al., 2019). Despite initial downloads driven by moments of

heightened awareness or motivation, maintaining user interest over the long term is a complex task. Generic content may not resonate with individual users, necessitating a move towards personalized experiences that address unique needs, preferences, and challenges. The lack of personalization leads to disengagement as users fail to find relevance in the apps' offerings. Monotony or repetition could contribute to user boredom and disengagement. Moreover, technical barriers, such as limited technological literacy or technical issues, can contribute to disengagement (Balaskas et al., 2022). To mitigate these challenges, the YOI app prioritizes user-friendly interfaces and practitioner support.

The mental health apps need to evolve and offer new, relevant content to prevent users from losing interest (Balaskas et al., 2022). Easy-to-practice content, with an interface that is not too complex, could encourage users. Striking a balance between providing valuable information and preventing information overload is crucial for sustaining engagement. On the strategic front, personalization and tailoring play a pivotal role in keeping users engaged within the YOI app. The ability of the app to adapt to users' preferences, goals, and progress fosters a sense of connection and relevance.

Tailoring mental health interventions to diverse populations is a crucial aspect of ensuring their effectiveness and accessibility (Nikolajski et al., 2023). Mental health conditions are inherently diverse, varying not only among individuals but also across different cultures and communities. Developing interventions that are culturally sensitive and inclusive is essential for reaching a broader demographic. However, this task presents various challenges for YOI that must be addressed to create meaningful impact. One of the key challenges is the inherent diversity within different cultural groups. Each community

has its own set of beliefs, norms, and attitudes towards mental health, which can significantly influence how individuals perceive and seek help for mental health issues (National Library of Medicine, 2021). It is critical to recognize and accommodate diverse worldviews and belief systems. Some cultures may have unique perspectives on mental health, incorporating spiritual or holistic approaches. Tailoring interventions to align with these diverse belief systems ensures that the strategies employed are respectful and congruent with the cultural values of the users. Overall, ensuring inclusivity in the design and development process is fundamental. This involves actively involving individuals from diverse backgrounds in the creation of interventions. Their input can provide valuable insights into the cultural nuances, preferences, and needs of their communities, helping to shape interventions that are more likely to be accepted and effective. Designing interventions that consider these cultural nuances is essential to ensure that the content and strategies resonate with users from various backgrounds.

Language plays a pivotal role in cultural sensitivity. Content in a mental health application should be presented in a way that is not only linguistically accessible but also culturally relevant (Balaskas et al., 2022). This involves using terminology and expressions that align with the cultural context to ensure that users can relate to and understand the information provided. Translating content is not just about converting words; it involves capturing the nuances of cultural expression. Moreover, addressing stigma is critical in diverse populations where cultural or societal norms may contribute to a reluctance to seek mental health support (Kim, Xu and Wang, 2022). The interventions need to incorporate strategies that specifically target the stigma associated with mental health within different

cultural contexts. This might involve leveraging community leaders, influencers, or culturally competent mental health professionals to increase acceptance and understanding.

Overall, while tailoring mental health interventions to diverse populations is undoubtedly challenging, it is a crucial undertaking. By recognizing and addressing cultural differences, linguistic nuances, and diverse belief systems, developers can create interventions that resonate with users from various backgrounds. Culturally sensitive approaches not only enhance the effectiveness of mental health interventions but also contribute to reducing disparities in access to mental health support across diverse populations. Addressing challenges related to user engagement and retention in the YOI app requires a comprehensive approach. By prioritizing personalization, interactive elements, social connectivity, and regular updates, app developers can create a more engaging and supportive environment for users seeking to enhance their mental well-being.

Opportunities

The accessibility aspect of app-based mental health interventions addresses several critical barriers, expanding the reach of mental health support to individuals who might encounter challenges in seeking traditional therapy (Chan et al., 2015). Geographical accessibility is notably improved, as apps eliminate constraints related to location. People residing in remote or underserved areas, where mental health professionals may be scarce, can benefit from these interventions, filling a crucial gap in mental health care provision. This is particularly significant in rural or isolated regions where in-person mental health resources are often limited.

In terms of physical accessibility, individuals with mobility issues, disabilities, or chronic illnesses that limit their ability to travel find app-based interventions highly advantageous (Bunyi, Ringland and Schueller, 2021). Traditional therapy models may require physical presence, posing challenges for those with mobility constraints. Apps provide a solution by enabling therapy and support from the comfort and convenience of one's home, removing the physical barriers associated with seeking mental health care. Overcoming stigma and hesitation is another key dimension of accessibility facilitated by app-based interventions. Mental health stigma often acts as a deterrent to seeking help. Apps allow users to receive support more privately and discreetly, reducing the fear of judgment or stigma associated with traditional therapy (Bunyi, Ringland and Schueller, 2021). The anonymity afforded by these platforms can be a critical factor in encouraging individuals who might otherwise be hesitant to explore mental health services.

Additionally, the flexibility of timing plays a pivotal role in accessibility. Unlike traditional therapy, which operates within specific hours, apps provide round-the-clock availability. Users can access resources, engage in therapeutic activities, or seek support at any time, fitting mental health care into their schedules without the limitations of fixed appointment times. This 24/7 availability enhances flexibility and convenience for individuals seeking support. Financial accessibility is also addressed through digital mental health interventions (Gratzer et al., 2020). These platforms often come with lower costs compared to traditional therapy, making mental health care more financially accessible. This affordability is particularly beneficial for individuals who may face financial constraints or lack insurance coverage for traditional therapeutic services, ensuring that

cost does not become a barrier to mental health support. Furthermore, immediate access to resources provided by apps is crucial, especially in crises. In moments of acute distress, having instant access to mental health resources, including helplines, crisis text lines, or coping mechanisms, can be a lifeline. Apps offer real-time support, responding promptly to individuals' needs during critical times, contributing to more effective crisis intervention and support (Gratzer et al., 2020). Hence, the accessibility offered by app-based mental health interventions addresses a spectrum of barriers, making mental health support more inclusive and adaptable to the diverse needs of individuals. Leveraging technology, these interventions extend the reach of mental health services beyond traditional boundaries, fostering a more inclusive and responsive mental health care ecosystem.

Self-paced learning and practice within app-based mental health interventions mark a significant departure from traditional therapeutic approaches, putting individuals at the centre of their mental well-being journey (McMillen, Hawley and Proctor, 2015). The customization features of these apps play a pivotal role in tailoring learning paths to meet individual needs and goals. Users can focus on specific areas of concern, such as stress management, anxiety reduction, or mindfulness, receiving content that resonates with their unique challenges. Flexibility in scheduling is a key advantage of self-paced learning. Unlike fixed schedules in traditional therapy, app users can engage with mental health resources at their convenience. This adaptability is particularly beneficial for individuals with busy lifestyles, irregular work hours, or diverse commitments, enabling them to seamlessly integrate mental health practices into their daily routines.

The wealth of accessible resources, including articles, videos, exercises, and interactive tools, empowers users with diverse learning materials. These resources are available around the clock, allowing individuals to revisit and reinforce their understanding of mental health techniques whenever necessary (Chan et al., 2015). Progress tracking features enable users to monitor their mental health journey over time. Whether tracking mood changes, completed exercises, or personal reflections, this functionality not only provides a sense of accomplishment but also allows individuals to identify patterns and trends in their mental well-being. Regular prompts, reminders, or notifications serve as gentle nudges, encouraging users to stay consistent with their practice and prioritize mental health amid their daily routines.

Engaging in self-paced learning and practice through mental health apps builds practical skills for managing mental well-being. This empowerment fosters a sense of self-efficacy and resilience, as users acquire a toolbox of techniques that can be proactively applied. By providing individuals with the tools and resources needed to manage stress, anxiety, and other mental health challenges on their terms, app-based interventions redefine how people approach and participate in their mental health journey. Through this approach, individuals are not merely recipients of mental health support; they become active participants in their ongoing well-being.

2.8. Mental Health Apps: Major Trends and Forces

Artificial Intelligence and Machine Learning

The integration of artificial intelligence (AI) and machine learning (ML) into mental health apps signifies a groundbreaking advancement, introducing more sophisticated and adaptive interventions (Hamdoun et al., 2023; Milne-Ives et al., 2022; D'Alfonso, 2020). These technologies revolutionize the landscape by allowing mental health apps to analyze user data comprehensively, leading to personalized insights and tailored support. This data-driven approach is a significant departure from traditional methods, providing a more nuanced understanding of an individual's mental well-being. AI and ML algorithms excel at pattern detection and recognition within user data (Hamdoun et al., 2023). By examining changes in behaviour, responses to interventions, and self-reported feelings, these algorithms can identify subtle patterns that may indicate shifts in mental health. This capability enables mental health apps to go beyond surface-level assessments, offering a deeper and more insightful perspective on an individual's emotional state.

The personalized insights generated through data analysis empower mental health apps to provide targeted recommendations (Götzl et al., 2022). These recommendations are specifically tailored to address the unique needs and challenges of each user. Whether suggesting coping strategies, mindfulness exercises, or other interventions, the app's ability to deliver personalized recommendations enhances its relevance and effectiveness in supporting the user's mental well-being. Machine learning algorithms further contribute to

the predictive modelling capabilities of mental health apps (Graham et al., 2019). By identifying correlations and trends in historical user data, these algorithms can predict potential mental health issues or periods of increased vulnerability. This predictive aspect enables the app to proactively offer interventions or additional support, potentially mitigating the impact of adverse mental health events.

The adaptability of mental health interventions is a notable outcome of AI and ML integration. As users engage with the app, machine learning algorithms continuously learn and adjust intervention strategies based on real-time feedback. This adaptability ensures that the support provided remains aligned with the user's evolving needs, creating a dynamic and personalized mental health experience that evolves with the individual. Some mental health apps take advantage of AI-powered chatbots or virtual assistants (Hamdoun et al., 2023; D'Alfonso, 2020). These digital companions simulate therapeutic interactions, providing immediate responses, empathetic support, and guiding users through exercises tailored to their emotional states. The incorporation of chatbots enhances accessibility, offering users a readily available and responsive source of mental health support.

The continuous improvement facilitated by AI and machine learning is a hallmark of these technologies. As more users interact with the app, the algorithms become refined and accurate in predicting user needs and delivering effective interventions. This ongoing learning process contributes to the app's overall efficacy, ensuring that it remains at the forefront of providing responsive and personalized mental health support. The integration of AI and machine learning into mental health apps represents a paradigm shift, offering a data-driven, personalized, and adaptive approach to mental health interventions. These

technologies empower apps to analyze user data, detect patterns, and offer targeted recommendations, ultimately contributing to more effective and responsive mental health support.

Teletherapy and Remote Support

The COVID-19 pandemic has catalyzed a rapid and profound transformation in mental health care, with the widespread adoption of teletherapy and remote support services (Jo et al., 2023; Ahuvia et al., 2022; Robledo Yamamoto, Voida and Voida, 2021). This shift has fundamentally altered the landscape of mental health interventions, providing individuals with newfound flexibility and convenience in accessing professional help. Teletherapy facilitated through various mental health apps, has emerged as a crucial lifeline for users seeking support from the safety and comfort of their homes. The primary advantage of this paradigm shift is the substantial increase in accessibility to mental health services (Jo et al., 2023).

Geographical barriers are significantly diminished, empowering individuals in remote or underserved areas to connect with mental health professionals without the constraints of location. This expanded accessibility has the potential to address disparities in mental health care, reaching populations that may have struggled to access traditional in-person therapy. The flexibility and convenience offered by teletherapy are pivotal aspects of its appeal. Users can schedule and attend counselling sessions without the need for time-consuming commutes, integrating mental health support seamlessly into their daily lives. This flexibility is especially beneficial for those with demanding schedules,

work commitments, or other responsibilities that might have hindered their ability to engage in traditional face-to-face therapy (Al-Mahrouqi et al., 2022).

In addition to breaking down geographical and scheduling barriers, teletherapy contributes to overcoming the social stigma associated with mental health care (Mohd Altaf Dar et al., 2023). The private and confidential nature of remote sessions creates a more comfortable environment for users to engage in open and honest discussions about their mental health. The destigmatization of seeking help is a crucial step towards fostering a culture of mental well-being.

Teletherapy is not a standalone solution but is often seamlessly integrated with digital platforms and mental health apps. This integration enriches the user experience by providing a comprehensive ecosystem where individuals can access a variety of mental health resources, ranging from self-help tools to real-time support. The synergy between teletherapy and digital platforms represents a holistic and user-centric approach to mental health care. The diverse modalities offered by teletherapy, including video calls, phone calls, and text-based communication, cater to individual preferences and comfort levels. This flexibility ensures that users can choose the mode of communication that aligns with their unique needs, facilitating a more personalized and user-friendly therapeutic experience.

Focus on User Experience

The evolution of mental health apps is witnessing a notable shift as developers increasingly prioritize user interface (UI) and user experience (UX) in their designs (Amol

Pakhale and Kashyap, 2023; R. Hatcher Danny et al., 2023). This emphasis extends beyond aesthetic considerations, encompassing a holistic approach to creating platforms that are engaging, user-friendly, and equipped with interactive features. The overarching goal is to enhance the overall impact of mental health interventions and ensure that users have a positive and effective experience with these applications.

Engaging interfaces serve as the visual gateway to mental health apps, capturing the user's attention and setting the tone for their experience. Thoughtfully designed interfaces leverage colour schemes, typography, and visual elements to create a welcoming atmosphere (Amol Pakhale and Kashyap, 2023; R. Hatcher Danny et al., 2023). Beyond aesthetics, the goal is to establish an emotionally positive environment, recognizing the sensitive nature of mental health discussions.

User-friendly designs form the backbone of effective mental health apps. Intuitive navigation, clear layouts, and logical information architecture are prioritized to ensure that users can easily understand and interact with the app. In the realm of mental health, where users may be navigating emotional challenges, a user-friendly design becomes paramount, simplifying the user journey and promoting accessibility.

Interactive features play a crucial role in maintaining user engagement and fostering a sense of agency. Quizzes, progress trackers, journals, and interactive games and exercises contribute to a more enjoyable experience and provide users with a sense of accomplishment (Alqahtani and Orji, 2020). These features go beyond static content, creating a dynamic and immersive environment that can simulate real-world scenarios relevant to mental health challenges. The integration of personalization options

acknowledges the diverse and individualized nature of mental health needs. Users can customize their experience based on preferences, goals, and comfort levels. Whether choosing themes, guided exercises, or interface settings, personalization fosters a stronger connection between the user and the app, promoting a sense of ownership over their mental health journey.

Accessibility considerations are integral to the user experience of mental health apps. Developers prioritize inclusivity, ensuring that the apps are accessible to users with diverse needs, including those with visual or auditory impairments (Sien, 2023). Features like text-to-speech functionality and adjustable font sizes make these interventions available to a broader audience, reinforcing the commitment to inclusivity (Muñoz, Camacho and Torous, 2021). Seamless integration of features is essential for a cohesive user experience. Developers strive to create a platform where different elements work seamlessly together, preventing disruptions and ensuring a fluid transition between various sections or activities. This cohesion contributes to a sense of continuity in the user's mental health journey, minimizing potential barriers to engagement.

A feedback loop is established within mental health apps, allowing users to provide insights into their experiences, preferences, and the effectiveness of interventions (Alqahtani and Orji, 2020). This mechanism ensures continuous improvement, as developers can adapt and refine the app based on user feedback. The incorporation of feedback mechanisms reinforces a collaborative approach, where users actively contribute to the evolution of the app. The increasing focus on user experience in mental health apps represents a shift towards user-centric and compassionate design. Lastly, the integration of

mindfulness apps with wearable devices, such as smartwatches or fitness trackers, adds a layer of functionality. Users can receive real-time feedback on metrics like heart rate or stress levels, providing a tangible connection between their mental and physical well-being during mindfulness sessions.

By integrating engaging interfaces, user-friendly designs, interactive features, personalization options, accessibility considerations, seamless feature integration, and feedback mechanisms, developers strive to optimize the user experience. This holistic approach recognizes the nuanced nature of mental health support and aims to provide individuals with a supportive, empowering, and effective digital platform.

Gamification Elements

The infusion of gamification elements into mental health apps is a strategic move to enhance user engagement and promote consistent utilization of mental health interventions (Six et al., 2021; Litvin et al., 2020; Cheng, 2020). By borrowing concepts from the gaming realm, developers aim to create an enjoyable and interactive user experience that facilitates effective mental well-being support. Gamification often incorporates reward systems within mental health apps (Six et al., 2021; Cheng, 2020). Users are motivated to participate in various activities such as completing mindfulness exercises, tracking mood patterns, or achieving specific goals. Successful completion of these tasks results in users receiving virtual badges, points, or other digital incentives. Beyond positive reinforcement, these rewards instil a sense of accomplishment, serving as a powerful motivator to sustain mental health routines.

The introduction of challenges and missions adds excitement and purpose to mental health apps (Miloff, Marklund and Carlbring, 2015). Users are presented with specific tasks or objectives aligned with their mental health goals. Whether it's daily meditation goals or mood-tracking missions, the structured nature of challenges provides users with a clear sense of direction, transforming the pursuit of mental well-being into a dynamic and goal-oriented experience.

Gamification often integrates robust progress-tracking mechanisms (Litvin et al., 2020). Users can visually monitor their achievements, mapping their progress over time through graphs, charts, or visual representations of milestones. This tangible feedback not only fosters a sense of accomplishment but also reinforces the idea that positive change is achievable through consistent effort. Emulating traditional gaming structures, mental health apps incorporate the concept of levelling up and unlocking achievements. Users advance through different levels or unlock achievements as they engage with the app and meet specific milestones. This progression system introduces an element of competition, even if it's with oneself, enhancing motivation and the overall sense of accomplishment.

Gamification extends beyond individual achievements by incorporating social elements. Users can share progress, and achievements, or participate in challenges within a community of like-minded individuals (Miloff, Marklund and Carlbring, 2015). This social interaction fosters a supportive environment where users connect, share experiences, and provide encouragement. The communal aspect adds accountability and encouragement, reinforcing the notion that mental health is a shared journey. Some mental health apps infuse gamification with storytelling elements (Litvin et al., 2020). Users

navigate through a narrative or storyline that unfolds as they progress in their mental health journey. This narrative approach provides context to challenges and achievements, creating a more immersive and engaging experience. Users become part of a compelling story within the app, potentially increasing their investment in their mental health goals.

To bridge the gap between the digital and real worlds, gamification elements may extend into users' daily lives. Users might be encouraged to practice mindfulness in specific real-world settings or engage in activities aligned with their mental health goals. This integration promotes the application of mental health practices beyond the confines of the app, fostering a holistic approach to well-being. Gamification elements within mental health apps transform the user experience into a dynamic and interactive journey. Rewards, challenges, progress tracking, levelling up, social interaction, storytelling, and real-world integration collectively contribute to making mental health interventions more engaging, enjoyable, and conducive to fostering positive habits. Gamification not only motivates users to adhere to their mental health routines but also contributes to a sense of empowerment and accomplishment in their overall well-being journey.

Popularity for Mindfulness and Stress Reduction

The surge in awareness about mental well-being has given rise to the widespread popularity of apps dedicated to mindfulness, meditation, and stress reduction (Baumel et al., 2019; Coelhoso et al., 2019; Flett et al., 2018). These applications serve as accessible and user-friendly tools, offering individuals effective ways to manage stress, improve mental health, and cultivate mindfulness in their daily routines. One prominent feature of

these apps is the provision of guided exercises, which often include structured sessions guiding users through meditation, breathing exercises, and progressive muscle relaxation. These guided exercises cater to users, whether they are beginners or experienced practitioners, providing a supportive framework for their mindfulness journey.

Furthermore, mindfulness and stress reduction apps often incorporate a diverse array of relaxation techniques (Coelhoso et al., 2019). These techniques, ranging from deep breathing exercises to visualization and body scan sessions, are designed to alleviate stress and induce a state of relaxation. By incorporating these practices into their routines, users can develop a heightened awareness of their bodies and foster a sense of calmness and tranquillity amidst life's daily pressures. Central to these apps is the emphasis on mindfulness practices, encouraging users to cultivate a non-judgmental awareness of the present moment (Gál, Ștefan and Cristea, 2020). Mindfulness exercises may include mindful breathing, mindful walking, or observing one's thoughts without attachment. Regular engagement with these practices helps users reduce mind-wandering, stay present, and foster a greater sense of inner peace, contributing to their overall mental well-being.

Many mindfulness apps go beyond individual practices and offer structured stress reduction programs (Lau et al., 2020). These programs guide users through a series of sessions, incorporating evidence-based approaches to progressively reduce stress levels. Users can track their progress, fostering a sense of accomplishment and motivation to continue their stress-reduction journey over time. Daily mindfulness reminders are a common feature, encouraging users to integrate mindfulness exercises into their daily routines. These reminders prompt individuals to take short breaks throughout the day for

quick mindfulness sessions, reinforcing the habit of incorporating mindfulness into their busy lives. Consistent engagement with these reminders contributes to long-term stress reduction and improved mental resilience.

Recognizing the diversity of user preferences, mindfulness apps often provide a variety of meditation styles. Users can choose from guided meditations, loving-kindness meditations, body scan sessions, or mindfulness practices with different themes. This variety ensures that individuals can find practices that resonate with their personal preferences and align with their specific objectives. Progress tracking and analytics features further enhance the user experience. Users can monitor their engagement, track the duration of their mindfulness sessions, and gain insights into their practice habits. These features contribute to a sense of accountability and motivation, encouraging continued use and fostering a deeper commitment to mindfulness practices.

Integration with Traditional Mental Health Services

The collaborative integration of mental health apps with traditional mental health services signifies a pivotal shift in the approach to mental health care (Koh, Tng and Hartanto, 2022; Chan and Honey, 2021; Miralles et al., 2019; Hilty et al., 2018). This strategic alliance seeks to overcome challenges in accessibility by extending support to individuals in remote or underserved areas through widely accessible digital platforms. The seamless transition between digital interventions and in-person therapy ensures continuity of care, allowing users to experience a comprehensive and holistic approach to their mental health journey.

Personalized treatment plans are a key advantage of this integration, as mental health professionals can leverage both traditional and digital resources to tailor interventions to individual needs (Koh, Tng and Hartanto, 2022; Hilty et al., 2018). The synergy between these services facilitates a nuanced and adaptive treatment approach, optimizing the overall effectiveness of mental health care. Integration also enables the monitoring of user progress across both digital and traditional services (Hilty et al., 2018). Mental health apps provide tools for users to track mood, behaviours, and engagement with therapeutic exercises, offering valuable insights to mental health professionals during in-person sessions. This collaborative data-sharing contributes to a more informed and cooperative treatment strategy.

The integration extends beyond monitoring, fostering enhanced therapeutic engagement (Koh, Tng and Hartanto, 2022; Miralles et al., 2019). Users can actively participate in managing their mental well-being between traditional therapy sessions, leveraging the continuous support provided by mental health apps. This dynamic engagement empowers users to play a more active role in their mental health journey. Mental health apps bring additional therapeutic tools to the collaborative table, complementing traditional therapeutic methods. Guided meditations, mood-tracking features, and interactive exercises broaden the toolkit available to mental health professionals, allowing for a diverse range of interventions tailored to the unique needs of each individual.

The collaborative approach improves accessibility for diverse populations, addressing barriers faced by those with mobility issues, individuals in rural areas, or those

with scheduling constraints. The digital component enhances inclusivity, reaching a broader audience with varying needs and preferences, thus making mental health support more universally accessible. The collaborative integration between mental health apps and traditional mental health services represents a transformative approach to mental health care. By addressing accessibility challenges, promoting continuity of care, enabling personalized treatment plans, monitoring progress, enhancing engagement, providing augmented therapeutic tools, improving accessibility for diverse populations, supporting remote and teletherapy services, and incorporating data-informed treatment, this collaborative model aims to offer individuals a versatile, holistic, and well-rounded approach to mental health support.

2.9. Potential Benefits of Yoga of Immortals

As an app-based, non-pharmaceutical, non-invasive meditative intervention derived from Indian Knowledge Systems, Yoga of Immortals can offer several benefits for mental health. Pranayam, or controlled breathing exercises, is a fundamental aspect of yoga that plays a crucial role in stress reduction (Rathore, 2023; Noventi et al., 2022). Techniques such as deep belly breathing and alternate nostril breathing activate the parasympathetic nervous system, leading to a state of relaxation and a reduction in stress hormones like cortisol.

Meditation, a central component of YOI, involves being present in the moment without judgment. Regular mindfulness practice can foster emotional regulation, decrease

reactivity to emotions, and contribute to an overall improvement in emotional well-being (Joshi et al., 2022). Yogic modalities include dharana, or concentration techniques, which can significantly enhance focus and concentration (Halsall, Werthner and Forneris, 2015). Whether it's focusing on a specific point, repeating a mantra, or concentrating on the breath, the YOI practices improve cognitive function and attention.

YOI incorporates relaxation techniques and other guided relaxation practices that help individuals unwind and prepare their bodies for a restful night's sleep, addressing issues related to insomnia or disrupted sleep patterns (Tunuguntla et al., 2021). The physical postures (asanas) in yoga promote a heightened awareness of the body and its sensations. This mind-body connection allows individuals to identify and release physical tension associated with stress, fostering a deeper understanding of their own bodies (Rivest-Gadbois and Boudrias, 2019). Introspective practices, such as meditation and mindfulness exercises, encourage self-reflection and self-awareness. These practices help individuals understand their thoughts and emotions, leading to greater self-acceptance and a more positive relationship with oneself.

Beyond mental health, yogic practices provide various physical benefits through its diverse range of postures and movements. These practices contribute to improved flexibility, strength, and balance, enhancing overall physical well-being. The convenience of app-based yoga interventions allows individuals to schedule sessions at their own pace and from any location with internet access. This accessibility makes it easier for users to integrate the intervention into their daily lives (Bunyi, Ringland and Schueller, 2021), despite physical impairments, disabilities or restrictions (Sien, 2023).

Yoga-based interventions are often cost-effective compared to certain pharmaceutical treatments (Tew et al., 2023). This affordability increases accessibility, making holistic well-being practices available to a broader population. Finally, rooted in ancient Indian traditions, yoga-based modalities offer a holistic approach to health that encompasses physical, mental, and spiritual aspects (Csala, Springinsfeld and Köteles, 2021). For individuals who appreciate its cultural and spiritual significance, yoga can provide a more profound sense of purpose and connection to a broader philosophical framework.

2.10. Summary

During COVID-19, anxiety, depression and insomnia induced by prolonged stress and traumatic incidents lead to dysfunction of the sensory, emotional and/or cognitive abilities of the general population. Healthcare professionals needed to perform their duties in exceptionally high-stress environments which impacted their socio-emotional and cognitive capacities - leading to frequent burnout. For athletes, loss of compensation, cancellation of sporting competitions internationally, hypervigilance and restrictions led to mental distress and eating disorders. Considering the scope of yoga-based interventions to treat and manage mental health disorders, the research examined the efficacy of app-based YOI non-pharmaceutical non-invasive meditative protocols on the mental health of the global population during COVID-19.

Utilising the Theory of Reasoned Action (TRA) as a framework for examining the context of YOI meditative interventions during COVID-19, intricate learnings are made. The beliefs individuals hold concerning the YOI program and its effectiveness in improving mental well-being during a crisis period can exert a profound influence on their attitudes. If individuals perceive the YOI program as a valuable resource for addressing mental health challenges or experience a deterioration in their mental well-being due to the pandemic, it is likely to have positive attitudes toward its adoption as a regular practice.

Further, the COVID-19 pandemic has introduced widespread stressors like fear, isolation, and uncertainty. Coping strategies, as explained by the Stress and Coping Theory, include problem-focused (addressing stressors directly) and emotion-focused (managing emotional responses) approaches. App-based YOI meditative interventions, aligning with emotion-focused coping, incorporate breathwork, meditation, and yogic practices that regulate emotional responses, reduce anxiety, depression, and insomnia, and enhance mental well-being.

The Health Belief Model (HBM) is another framework for understanding health-related behaviours, encompassing factors like Perceived Susceptibility, Perceived Severity, Perceived Benefits, Perceived Barriers, Cues to Action, and Self-Efficacy. In the context of YOI, applying HBM to YOI interventions helps understand their impact on mental health during the pandemic, providing a comprehensive assessment of their efficacy.

The limitations of previous studies on the yoga-based mental health interventions of RISE and Kundalini Yoga programs by Sat Bir Singh Khalsa, and Transcendental Meditation indicate lack of usage of validated mental health scales and questionnaires, and

limited sample size. Further, the studies were mainly conducted before the COVID-19 pandemic which questions their relevance in the post-pandemic complexities concerning mental health. To address these gaps, the study on yoga-based YOI non-invasive interventions during COVID-19 is done on a sample size of 1,297 participants using a software-based asynchronous program disseminated via a mobile app. It is conducted during 8-week periods, assessing the efficacy of the modalities during COVID-19.

Learning the challenges and opportunities for YOI, users prefer mental health apps that are user-friendly, visually appealing, and affordable, with customization options and high-quality content. Challenges include maintaining user engagement and addressing technical barriers. Tailoring interventions to diverse populations requires cultural sensitivity and overcoming stigma. Opportunities arise from the accessibility of app-based interventions, addressing geographical, physical, and financial barriers, and offering self-paced learning and practice. The empowerment of individuals through personalized mental health journeys highlights the shift from traditional therapeutic approaches. Despite these opportunities, challenges such as personalization and cultural sensitivity must be effectively addressed for a more inclusive and responsive mental healthcare ecosystem.

Identifying major trends and forces of mental health apps - the integration of artificial intelligence (AI) and machine learning (ML) into mental health apps brings a data-driven, personalized approach. These technologies analyze user data for subtle patterns, allowing for personalized recommendations and adaptive interventions. Teletherapy, accelerated by the COVID-19 pandemic, enhances accessibility and is seamlessly integrated with digital platforms.

User experience is prioritized, with engaging interfaces, user-friendly designs, and interactive features. Gamification elements, like rewards and challenges, boost engagement. Mindfulness apps have gained popularity for stress reduction, offering guided exercises and structured programs. Collaborative integration with traditional mental health services provides a versatile and holistic approach, addressing accessibility challenges, enabling personalized treatment plans, and enhancing user engagement.

CHAPTER III:

METHODOLOGY

3.1. Introduction

A significant problem imposed on YOI is the lack of regular practice of non-pharmaceutical meditative interventions for mental health during COVID-19 (Büssing, Baumann and Surzykiewicz, 2022; Magnavita, Soave and Antonelli, 2021a; Magnavita, Soave and Antonelli, 2021b; Green et al., 2020). People who relied on faith as a resource to cope reduced their practice of meditation and mental activities during the pandemic (Büssing, Baumann and Surzykiewicz, 2022). Due to increased stress levels, physicians also reported a lack of time for meditation, and physical activity, isolation in social and work life and compassion fatigue (Magnavita, Soave and Antonelli, 2021a; Magnavita, Soave and Antonelli, 2021b).

The purpose statement of this double-blind study was to investigate the efficacy and feasibility of a mobile application-based meditative intervention called Yoga of Immortals in mitigating symptoms of depression, anxiety, and insomnia - among individuals experiencing sub-optimal mental health globally, particularly during the challenges posed by the COVID-19 pandemic - using a mixed-method study design.

The study intended to address several research problems, including limitations of preexisting interventions due to sample size, lack of validated mental health scales, and pre-pandemic research periods. Additionally, it aimed to fill gaps in knowledge about the

integration of mobile health apps in clinical practice, especially in a post-pandemic landscape where traditional in-person interventions might face barriers.

The study was designed to investigate the efficacy of an 8-week meditative intervention utilizing the YOI mobile app as a resource to improve the mental well-being of a diverse group of global participants. It addressed the increasing prevalence of mental health concerns, including depression, anxiety, and insomnia, which have had significant public health implications, especially during the COVID-19 pandemic. Given the growing importance of digital interventions in addressing mental health issues, it sought to evaluate the impact of the YOI app on participants' mental health outcomes.

To comprehensively assess the participants' baseline mental health status and demographic characteristics, validated screening tools and demographic questionnaires were employed before the intervention. These included the Patient Health Questionnaire-8 (PHQ-8; Kroenke et al., 2009), the Generalized Anxiety Disorder 7-item (GAD-7; Rl et al., 2006) scale, and the Insomnia Severity Index (ISI; Morin et al., 2011). These tools were utilized to gauge the presence and severity of depression, symptoms of anxiety, and insomnia, respectively. Additionally, participants provided information on demographic variables, including age, race/ethnicity, marital and employment status, education, occupation, psychiatric diagnoses, and the use of mental health services.

The primary research questions addressed in this study were:

RQ1. How does the regular use of the YOI mobile application impact symptoms of depression among participants, if reported, as measured by the Patient Health Questionnaire, 8 items (PHQ-8)?

RQ2. What is the effect of the YOI app on symptoms of generalized anxiety, as assessed by the Generalized Anxiety Disorder questionnaire (GAD-7), if reported, in comparison to a control group that did not use the app?

RQ3. To what extent does the YOI intervention alleviate symptoms of insomnia, if reported, as measured by the Insomnia Severity Index (ISI), in participants who utilized the app for an 8-week period?

RQ4. Are the reductions in depression, anxiety, and insomnia symptoms reported by participants who used the YOI app significantly greater than those observed in a control group that did not use the app?

RQ5. How do participants with a prior diagnosis of depression and generalized anxiety respond to the YOI intervention in terms of changes in PHQ-8 and GAD-7 scores compared to participants without a previous diagnosis?

The hypothesis evaluated in this study was that participants who engage in the YOI app intervention during COVID-19 would experience a significant reduction in symptoms of depression, anxiety, and insomnia compared to the control group. Also, demographic variables, such as age, gender, and baseline mental health status, would moderate the effects of the YOI app intervention on mental well-being outcomes.

To adhere to the research problem and purpose, the main objective of this study was to quantify the extent of change in symptoms of the mental health conditions, if reported, using the YOI app over an 8-week period - by utilizing standardized assessment tools: the Generalized Anxiety Disorder questionnaire (GAD-7) for anxiety, the Patient Health Questionnaire (PHQ-8) for depression, and the Insomnia Severity Index (ISI) for

insomnia. The study also aimed to understand the YOI program as a comprehensive self-help treatment for integrating meditation-based approaches into modern psychotherapy and address the limitations of the current studies on meditation-based mental health interventions.

To provide a comprehensive overview of the study's methodology, this chapter starts with an outline of the research design, population and sample, and methods of data collection, processing and analysis. This is followed by an overview of the response sets of the assessment scales for depression symptoms (PHQ-8), anxiety symptoms (GAD-7) and insomnia symptoms (ISI). Lastly, the chapter discusses the limitations of the methodology and ethical assurances adhered to for data protection.

3.2. Research Design

The research was a double-blind study. A double-blind study is a research design commonly used in scientific and medical experiments, particularly in clinical trials, to minimize bias and ensure the integrity of the study's results. Neither the participants (subjects) nor the researchers involved in a double-blind study know which participants are receiving the experimental treatment (or intervention) and which are receiving a control or placebo (National Institutes of Health, 2017; Cancer Research UK, 2014). The key elements of a double-blind study are Blinded Participants and Blinded Researchers.

The Blinded Participants are randomly assigned to one of two or more groups, typically an experimental group receiving the treatment or intervention being studied and

a control group receiving a placebo or standard treatment. Importantly, the participants do not know which group they belong to. This helps prevent psychological biases or placebo effects in the study. The Blinded Researchers, including doctors, scientists, and data collectors, who interact with the participants or assess the study's outcomes are also unaware of which group every participant is in. Double-blind studies are particularly important in clinical trials and drug testing to assess the safety and efficacy of new treatments or medications.

This methodology was adequate for this study as it prevented researcher bias and influence on the study's results. The double-blind design helped ensure that the results of the study were as unbiased and objective as possible. It reduced the risk of conscious or unconscious influences from either the participants or the researchers that could impact the findings.

In this study, mixed research methodology, including both qualitative and quantitative research methods, were utilized. On a random criterion, the participants were assigned to one of the two groups. The first group, called the Study Group, was invited to practice weekly YOI non-pharmaceutical meditative interventions through a mobile app. To this Group, the YOI interventions were made available in video and audio format in variations of one or two daily sessions for morning and evening practice. The protocols were progressive - building on the earlier one, and changed every week. The second group, called the Control Group, received other interventions such as wellness articles, and related reading materials as an intervention strategy.

In the course of the research, the endeavour was to solicit participants through a web link disseminated across prominent social media platforms. This approach was instrumental in achieving a diverse and inclusive participant pool, thereby enhancing the generalizability of the findings. Before the implementation of the intervention, rigorous assessments were conducted to comprehensively evaluate different aspects of the participants' mental health and demographic attributes.

To gauge the mental health status of the participants, three validated and widely recognized screening instruments were administered: the Generalized Anxiety Disorder 7-item (GAD-7) scale for anxiety, the Patient Health Questionnaire-8 (PHQ-8) for depression, and the Insomnia Severity Index (ISI) for insomnia symptoms. These instruments demonstrated psychometric soundness in varying settings and were employed routinely for large-scale mental health screenings.

The baseline assessment included a range of demographic variables, including age, race/ethnicity, marital status, education level, employment status, and occupational engagement. Additionally, participants were inquired about any pre-existing psychiatric diagnoses and the utilization of mental health services, including psychotherapy or the use of psychotropic medications such as antidepressants. The comprehensive profiling explored potential associations between the demographic factors and the outcomes of the YOI app intervention.

The eligibility criteria ascertained that all participants must be a minimum of 18 years old, and have the linguistic capacity to comprehend and respond in English. The criteria were intentionally meant to be broad in scope to facilitate the recruitment of a

diverse, heterogeneous study population. It is imperative to note that the research design was conceived as an inaugural pilot study, primarily intended to serve as an initial exploration of the YOI app's effectiveness in improving mental well-being.

The successful completion of the study was dependent on participants' diligent adherence to the study protocol, which included responding to all questionnaires throughout the 8-week intervention period. Those participants who met this criterion were categorized as the Final Analysis Group, encompassing both participants and controls.

Finally, an analysis was made to ascertain whether any meaningful demographic variations came out between the original cohort of recruits, and the ultimate group of participants and controls who successfully completed the study. The statistical analyses revealed that neither mean age, age distribution, nor the proportion of male-to-female participants exhibited significant discrepancies between the initial recruitment pool and the cohort that diligently followed through to the study's conclusion.

3.3. Population and Sample

Population

Two study populations and samples were employed: the Study Group and the Control Group. The Study Group population represented participants who practised weekly YOI non-pharmaceutical meditative interventions through a mobile app. It consisted of 1,505 participants. The Control Group population represented participants who received

other interventions such as wellness articles, and related reading materials as an intervention strategy for the 8-week study period. It consisted of 1,300 participants.

The age distribution within the participant cohort exhibited diversity, spanning from individuals as young as 18 to those as elderly as 80, with a prominent concentration (80%) falling within the age range of 26 to 58 years. Furthermore, gender distribution approached equilibrium, with 51% of participants identifying as female and 49% as male.

In parallel, the Control Group adhered to identical eligibility criteria. Control subjects were subjected to the same set of questionnaires as the participants, and were supplied with articles focused on mental well-being as an alternative intervention strategy. The analysis significantly revealed that the Control Group's demographic characteristics closely mirrored those observed within the participant cohort, ensuring a robust basis for comparative analysis.

Sample

The sample of the Study Group consisted of 1,297 participants who satisfactorily fulfilled all questionnaire requirements and, consequently, were included in the Final Analysis Group. They were selected because they met the following criteria: they aged a minimum of 18 years old and had the linguistic capacity to comprehend and respond in English.

The sample of the Contol Group consisted of 591 participants. They were selected because they met all questionnaire prerequisites and were integrated into the Final Analysis

Group. It is to be noted that the Control Group abstained from engaging with the YOI app for the 8-week study period.

3.4. Data Collection, Processing and Analysis

For this double-blind study, the primary data collection techniques employed were: 1. Questionnaires shared with the participants, 2. YOI mobile app utilized by Study Group participants, and 3. Gathering of baseline demographic and clinical information.

The study population was recruited through a link distributed on various social media platforms. Firstly, the eligible participants were required to complete the Patient Health Questionnaire-8 (PHQ-8), the Generalized Anxiety Disorder 7-item (GAD-7) scale, and the Insomnia Severity Index (ISI), which are all commonly used for population screening of insomnia, symptoms of depression, and symptoms of anxiety.

Secondly, a mobile application, the YOI app, played a crucial role in delivering the intervention. This app provided a platform for participants to engage in 112 structured sessions over eight weeks, involving yogic practices, meditation, and breathwork. It streamlined data collection by capturing participants' interactions with the program.

Lastly, the study gathered baseline demographic and clinical information from participants. Demographic variables, such as age, race/ethnicity, marital and employment status, education, occupation, history of psychiatric disorders, and use of mental health services or medications, were also collected. The participants had to be at least 18 years

old and proficient in English, with broad inclusion criteria aimed at ensuring a diverse study population.

The completion of the study required participants to respond to all questionnaires over an 8-week intervention period, leading to the formation of the Final Analysis Group. Out of 1,505 enrolled participants, 1,297 completed all questionnaires. The age of participants ranged from 18 to 80 years, with a significant proportion falling between 26 and 58 years old. The gender distribution was approximately equal. Subjects of the Control Group completed the same questionnaires and were provided with articles on mental well-being as their intervention. They did not use the YOI app during the 8-week study period. Out of 1,300 control subjects recruited, 591 completed all questionnaires, and they demonstrated similar demographic characteristics to the participant group.

The four phases of the participant recruitment process proposed by Berger et al. (2009) were applied in this study. These phases include: 1. Generating Initial Contacts, i.e., activities to identify potential participants, 2. Screening, which means determining whether or not potential participants are eligible for study participation, 3. Consenting, which indicates informing potential participants about the study, including its risks and benefits, and 4. Enrolment or Retention, that is enrolling eligible participants and retaining them in the study (Berger, Begun and Otto-Salaj, 2009).

Applying this recruitment process to the study, 1. Generating Initial Contacts: Study participants were initially recruited through a link distributed on common social media platforms. 2. Consenting: Before the intervention, all participants were required to provide consent and complete a set of questionnaires, including the Patient Health

Questionnaire-8 (PHQ-8), the Generalized Anxiety Disorder 7-item (GAD-7) scale, and the Insomnia Severity Index (ISI). 3. Screening: These questionnaires served as screening tools to assess insomnia, symptoms of depression, and symptoms of anxiety. Additionally, demographic information, psychiatric diagnoses, and the use of mental health services were collected as part of the baseline assessment. 4. Enrolment and Retention: Participants were considered to have completed the study if they responded to all questionnaires over the entire 8-week intervention period. The Final Analysis Group included participants who met this criterion and were eligible for the analysis.

Analysis was conducted to assess potential demographic differences between the initial recruitment group and the final participants and controls who completed the study. No significant differences were found in terms of mean age, age range, or gender distribution. The intervention involved participants using the YOI app, which comprised 112 sessions over 8 weeks. Each session lasted 30 minutes and required participants to read associated instructions. Upon completing the final session, participants filled out all screening questionnaires for the fourth and final time, alongside their study surveys. Data quality was ensured through human verification, attention checks, and visual inspection for irregular responses suggestive of automation.

Participants were given access to the YOI app via a download link, while control subjects were not granted access. Controls were questioned about engagement in any other yoga or mindfulness practices during the intervention period, with those who did being excluded from the final control group analysis. The study employed assessment scales, including PHQ-8 for depression symptoms, GAD-7 for anxiety symptoms, and ISI for

insomnia severity. Cutoff points defined severity levels, facilitating the assessment of symptom changes following the intervention.

Assessment Scales

The assessment scales were related to three major symptoms: anxiety, depression, and insomnia. The purpose of this assessment was to provide the evaluation path of these symptoms. To identify anxiety disorders, the 7-item Generalized Anxiety Disorder GAD-7) scale was used. The depressive symptoms were evaluated by the 8-item version of the Patient Health Questionnaire (PHQ-8). The severity of insomnia symptoms was assessed using the Insomnia Severity Index (ISI).

Anxiety Symptoms

In this research, anxiety symptoms were evaluated using the 7-item Generalized Anxiety Disorder scale (GAD-7, 21; Rl et al., 2006). The GAD-7 consists of seven items that inquire about the frequency with which individuals have been "bothered" by specific symptoms listed in the questionnaire. Responses were rated on a four-point Likert scale, ranging from 0 (indicating "not at all") to 3 (indicating "nearly every day"). Individual item scores were then aggregated to compute a total score, which ranged from 0 to 21 points. Similar to the PHQ-8, specific cutoff points of 5, 10, and 15 were interpreted as indicative of mild, moderate, and severe levels of anxiety respectively. This was based on previously established high sensitivity and specificity for identifying anxiety symptoms (Rl et al., 2006).

Depression Symptoms

The assessment of depressive symptoms was utilized in the 8-item version of the Patient Health Questionnaire (PHQ-8; Kroenke et al., 2009). The PHQ-8 instrument employed a standardized and modified response set, based on a four-point Likert scale ranging from 0 to 3, where a score of 0 to 1 corresponded to "not at all" for 0 to 1 day, 2 to 6 days were categorized as "several days," 7 to 11 days were classified as "more than half the days," and 12 to 14 days were denoted as "nearly every day."

To calculate the total score, the scores for each item were summed, yielding a composite score between 0 and 24 points. These total scores were categorized into the following ranges: 0 to 4 indicated the absence of significant depressive symptoms, 5 to 9 represented mild depressive symptoms, 10 to 14 indicated moderate symptoms, 15 to 19 corresponded to moderately severe symptoms, and 20 to 24 signified severe symptoms. Current depression symptoms were defined as a PHQ-8 score equal to or greater than 10 (Kroenke and Spitzer, 2002) and typically indicative of clinically significant depression, irrespective of diagnostic status (Corson, Gerrity and Dobscha, 2004; Kroenke, Spitzer and Williams, 2021).

Insomnia Symptoms

The severity of insomnia symptoms was assessed using the Insomnia Severity Index (ISI; Morin et al., 2011), a questionnaire comprising seven questions designed to evaluate current sleep quality and characteristics within the preceding two weeks. The first

three questions focused on aspects related to sleep maintenance, sleep initiation, and early morning awakening. Further questions assessed the extent to which the current sleep pattern interfered with daily functioning, the degree of satisfaction or dissatisfaction with the current sleep pattern, the level of concern associated with the current sleep problem and the perceived noticeable impairment attributed to the sleep problem. Responses to these items were rated on a five-point Likert scale, with "0" indicating “none or not at all” and "4" indicating “very much”.

Total scores on the ISI ranged from 0 to 28, with higher combined scores indicating more severe insomnia symptoms. Participants were categorized into specific total score groups: 0–7 represented the absence of clinically significant insomnia, 8–14 indicated subthreshold insomnia, 15–21 signified clinically significant insomnia at a moderate level, and 22–28 denoted clinically significant insomnia at a severe level (Kim, Lee and Duffy, 2013).

3.5. Yoga of Immortals Intervention

During the research, the study participants were tasked to practice Yoga of Immortals meditative intervention facilitated through the YOI mobile application. With a total of 112 sessions, the intervention spanned 8 weeks. Over this time frame, the content of each session varied – from week to week. The participants were requested to acquaint themselves with preparatory audio and video instructions for these weekly sessions, each of which had a standardized duration of 30 minutes. Importantly, participants were required

to engage in two sessions daily, one in the morning and another in the evening. The study's data collection took place during the period from April to June in the year 2020.

The two daily sessions were designed to emphasize distinct techniques. The morning sessions incorporated a blend of comprehensive physical movements, postural elements, and yogic respiratory exercises, particularly focusing on cyclically controlled breathing practices, including abdominal breathing. These practices were harmonized with meditation and vocalized chants. Conversely, the evening sessions centred on a slower yet profound yogic respiratory regimen, complemented by meditative practices. Notably, the complexity of these sessions escalated progressively from one week to the next, building upon the foundations laid in the preceding weeks.

Upon completion of the final session, participants were directed to re-administer all screening questionnaires for a fourth and concluding instance, in addition to completing study-related surveys. Stringent measures were implemented to ensure data integrity, involving human verification and attentional assessments at various points within the survey. Additionally, a visual inspection of the data was conducted to identify any irregularities suggestive of automated responses or bot involvement.

Access to the YOI application was granted to participants through a designated download link, which was exclusively extended to participants and withheld from control subjects. Consequently, control participants were denied access to the YOI intervention. However, control subjects were inquired about their involvement in any alternative yoga or mindfulness practices during the intervention period. Control participants who admitted to such engagement were excluded from the final dataset used for analysis.

3.6. Limitations

While this study employed a comprehensive approach to its methodology, some limitations were identified. One limitation of the recruitment strategy was that it relied on common social media platforms. With the global population to be reached under lockdowns during COVID-19, individuals without internet access or who did not use social media could not be reached directly to gauge participation. Since the study depended on self-reported data, including responses to questionnaires assessing depression, anxiety, and insomnia symptoms, there was a likelihood for participants to underreport or overreport their symptoms.

Another limitation was that the research was conducted in English. This may have excluded individuals who are not proficient in this language, which might limit the generalizability of the findings. Also, since the broad inclusion of the global population introduced heterogeneity into the sample, it was difficult to capture the impact and effects of YOI meditative intervention among specific groups or geographies.

Although a substantial number of participants enrolled in the study, there was a dropout rate of nearly 13.86%, with 1,297 out of 1,505 participants completing all questionnaires, which can be well addressed in future research. During the prolonged COVID-19 lockdown period of April to June 2020, the gathered sample could be utilised to assess the effects of the intervention immediately after completion. However, it could not include long-term follow-up data to determine the persistence of any observed changes

over time. Lastly, despite efforts to ensure data quality, some response irregularities may not have been detected during the visual inspection.

While this study intends to provide insights into the effects of the YOI app intervention on the mental health of the global population during COVID-19, the mentioned limitations should be considered when interpreting the results and generalizing them to broader populations or contexts. Further research with more diverse recruitment methods and longer-term follow-up can help expand upon the findings.

3.7. Ethical Assurances

Throughout the study, ethical considerations were observed to safeguard the rights and well-being of the participants. These ethical practices played a central role in maintaining the study's integrity and credibility. Informed consent was a foundational ethical principle. Before enrolling in the study, all potential participants were provided with elaborate informed consent information with explanations of the study's objectives, procedures, potential risks, and benefits. Importantly, participants were informed of their right to decline participation or withdraw from the study at any point.

Voluntary participation was a core to the ethical framework. Participation was voluntary, with participants exercising their autonomy to choose whether to engage in the study based on their willingness and interest. No form of coercion or undue influence was exerted on any participant at any stage of the study. Further, to protect participants' privacy and confidentiality, collection measures were implemented. Data collected from participants were securely anonymized and stored to prevent unauthorized access. These

measures were vital in maintaining the privacy and confidentiality of participants' sensitive information. Also, to ensure data accuracy and integrity, the study incorporated multiple quality assurance measures. These measures included human verification and attention checks within the survey instrument. Additionally, data underwent visual inspection to identify any response irregularities that might suggest automated or inauthentic responses.

Broad inclusion criteria were intentionally adopted to promote fairness and non-discrimination. This approach aimed for diversity and inclusivity within the study population, reducing the risk of exclusion based on specific demographic or background factors. Both the Study and Control Groups were treated with equal ethical considerations. Control Group participants were provided with an intervention strategy focused on mental well-being, ensuring that they were not denied access to mental health resources during the study period.

It was also ensured that the study maintained transparency in communicating the exclusion criteria related to engagement in other yoga or mindfulness practices during the intervention period. This was to provide clear guidance to participants regarding their eligibility. Hence, ethical assurances were essential for the protection of participants' rights and welfare throughout their involvement in the study - upholding its credibility and quality standards.

3.8. Summary

This research was aimed at investigating the effectiveness of an 8-week meditation program using YOI mobile app to improve the mental well-being of a diverse group of participants from around the world. The study was motivated by the rising prevalence of mental health issues, particularly depression, anxiety, and insomnia, which have been exacerbated by the COVID-19 pandemic. The primary research questions (RQ1 to RQ4) focused on measuring the impact of the YOI app on depression, anxiety, and insomnia symptoms, and whether these improvements were greater than a control group that did not use the app. RQ5 aimed to understand how participants with prior diagnoses of depression and anxiety responded to the YOI app compared to those without such diagnoses.

The study hypothesized that participants using the YOI app during the COVID-19 pandemic would experience significant reductions in depression, anxiety, and insomnia symptoms compared to the control group. The research objectives included evaluating the benefits of using the YOI app during COVID-19, testing its efficacy in addressing symptoms of anxiety, depression, and insomnia, and using standardized questionnaires for accuracy. The study aimed to integrate meditation-based approaches into modern psychotherapy and to address limitations in existing research on meditation-based mental health interventions.

The research design was double-blind, using both qualitative and quantitative methods. Participants were randomly assigned to either the Study Group, which used the YOI app, or the Control Group, which received alternative interventions. The recruitment

process aimed for diversity through social media platforms, and participants' baseline mental health and demographics were assessed using standardized tools and questionnaires. The study enrolled 1,505 participants, with 1,297 completing all questionnaires. The participants' ages ranged from 18 to 80, with a majority between 26 and 58, and a near-even gender distribution. The Control Group mirrored these demographics.

Data collection involved questionnaires and assessments at the beginning and end of the 8-week intervention. Data quality was ensured through human verification and attention checks. Control subjects were asked about engagement in other mindfulness practices. The YOI intervention comprised 112 sessions over 8 weeks, with participants practising twice daily. Sessions included physical movements, postures, breathing exercises, meditation, and chants. The complexity of sessions increased progressively. After the final session, participants completed all questionnaires again.

The study's limitations included recruitment through social media, potential language barriers for non-English speakers, a dropout rate of 13.86%, and the absence of long-term follow-up data. Despite efforts to ensure data quality, some irregularities might not have been detected. Ethical considerations included informed consent, voluntary participation, privacy protection, and transparency in exclusion criteria. Both Study and Control Groups received equal ethical treatment.

In conclusion, this study investigated the impact of the YOI app on mental health during the COVID-19 pandemic, using a rigorous research design and ethical safeguards.

The findings can provide insights into the effectiveness of digital meditation interventions for global populations facing mental health challenges.

CHAPTER IV:

RESULTS

4.1. Introduction

The purpose statement of this double-blind study was to investigate the efficacy and feasibility of a mobile application-based meditative intervention called Yoga of Immortals in mitigating symptoms of depression, anxiety, and insomnia - among individuals experiencing sub-optimal mental health globally, particularly during the challenges posed by the COVID-19 pandemic - using a mixed-method study design.

The study determined whether regular use of the YOI app, over an 8-week period, leads to significant improvements in mental health symptoms, if reported. This research also quantified the extent of change in symptoms by utilizing standardized assessment tools: the Generalized Anxiety Disorder questionnaire (GAD-7) for anxiety, the Patient Health Questionnaire (PHQ-8) for depression, and the Insomnia Severity Index (ISI) for insomnia. The study assessed YOI as a structured and home-based intervention for enhancing mental well-being during a period marked by increased prevalence of mental health issues, such as the COVID-19 pandemic.

The study utilized the Theory of Reasoned Action (TRA), Stress and Coping Theory, and the Health Belief Model to analyze the impact of app-based YOI meditative interventions on the mental health of the global population during the COVID-19 pandemic. TRA provided a foundation for understanding the relationship between

intention and behaviour, highlighting the role of attitudes and subjective norms in shaping individuals' intentions. In the context of mental health during the pandemic, TRA underscored the significance of beliefs about YOI and the evaluation of mental health as factors influencing individuals' attitudes and intentions, informing the design of targeted interventions to promote mental well-being during times of crisis.

The Stress and Coping Theory offered insights into how individuals coped with pandemic-related stressors. It distinguished between problem-focused coping and emotion-focused coping, emphasizing the latter's role in regulating emotional responses to stress. App-based YOI meditative interventions aligned with emotion-focused coping by incorporating practices that promoted emotional regulation and reduced stress-related symptoms. The study showed how these interventions effectively addressed the unique stressors associated with the COVID-19 crisis, offering a valuable coping mechanism for individuals.

The Health Belief Model (HBM) provides a comprehensive perspective on health-related behaviours and decisions. It analyzed individuals' past perceptions of susceptibility, severity, benefits, barriers, cues to action, and self-efficacy in relation to their mental health during the pandemic. For YOI interventions, these components of the HBM played a pivotal role. Individuals who perceived the seriousness of mental health issues during the pandemic were more likely to have engaged with YOI, believing that it could provide benefits such as stress reduction and enhanced well-being. The HBM also addressed the barriers that individuals may have faced in adopting YOI, such as limited access to

technology, and highlighted the importance of cues to action, like awareness campaigns and healthcare provider recommendations, in promoting app engagement.

Five research questions were used as a descriptive framework for gathering qualitative and quantitative data. Two study populations were employed: The Study Group and the Control Group. The Study Group population represented participants who practised weekly YOI non-pharmaceutical meditative interventions through a mobile app. It consisted of 1,505 participants. The Control Group population represented participants who received other interventions such as wellness articles, and related reading materials as an intervention strategy for the 8-week study period. It consisted of 1,300 participants. For this double-blind study, the primary data collection techniques employed were: 1. Questionnaires shared with the participants, 2. YOI mobile app utilized by Study Group participants, and 3. Gathering of baseline demographic and clinical information.

The data presentation was organized to provide a clear structure for understanding the research methodology, findings, and results. It began with Statistical Analysis which outlined the statistical methods used for data analysis. The software employed, Statistical Package for Social Science, has been discussed, and the statistical tests and procedures applied have been described - setting the stage for a systematic approach to data analysis. The Descriptive Statistics focused on the presentation of demographic parameters. This involved expressing results as numbers and percentages, essential for characterizing the study's participants. Additionally, normality tests such as the Shapiro-Wilk test indicated rigorous data quality assessment.

Then, the Exploratory Analysis delved into the initial analysis, showcasing the statistical techniques used for within-group comparisons. Paired t-tests and Chi-squared tests have been introduced as tools for exploring data trends. The significance level of $p < 0.05$ was established as the threshold for determining statistical significance. Further, Two-Way ANOVA has been explained as a more advanced analytical approach to test for changes in mean scores and subitem scores across various factors. This included participant vs. control and pre vs. post-intervention comparisons. Post-hoc tests have been also explained, underscoring the need for multiple comparison corrections to maintain statistical integrity. Later, the Regression Analysis explored how specific factors like age and gender interacted with one another and influenced the normalized mean score. The inclusion of covariates in the regression analysis was highlighted, adding depth to the statistical exploration. Approval from the Institutional Review Board and informed consent were obtained from study participants, denoting the ethical framework of the study.

Finally, the results of the study's findings were presented. They began with a discussion of the demographic makeup of the study participants, providing context for the subsequent discussions on depression, anxiety, and insomnia symptoms. For every research question, related to depression, anxiety, and insomnia symptoms, the baseline and post-intervention scores have been indicated for both the control group and participants.

Specific subitem scores have been discussed, emphasizing significant decreases and their implications. The Regression Analysis further augmented the understanding of how factors such as age, gender, and self-reported diagnoses influenced the outcomes, contributing to a comprehensive interpretation of the findings. Overall, the data

presentation is intended to be a well-structured and coherent narrative to guide through the research process, from methodology to results, and the potential avenues for future investigation.

4.2. Organization of Data Analysis

The statistical analysis for this study was conducted using the Statistical Package for Social Science (SPSS). To describe demographic parameters, descriptive statistics were utilized to present results as numbers and percentages. In addition, the assumption of normality was assessed for total scores and other variables through the Shapiro-Wilk test (with a threshold of $p > 0.1$). The data for Insomnia Severity Index (ISI), Patient Health Questionnaire-8 (PHQ8), and Generalized Anxiety Disorder Scale-7 (GAD-7) were expressed as mean values with standard deviations. Similar normality testing was performed for demographic and other variables.

An initial exploratory analysis was performed in which paired t-tests were used to compare within-group data. A two-sided p-value of less than 0.05 was considered statistically significant. Additionally, chi-squared tests were applied to compare percentage scores between the pre and post-YOI intervention scales. This exploratory analysis was conducted to identify overall trends in the data.

To robustly test for changes in mean scores and subitem scores across grouping factors, a two-way analysis of variance (ANOVA) was employed. This analysis aimed to identify factors contributing to both between-group differences (participant vs. control) and

within-group differences (pre vs. post-intervention). The normalized mean scores and means for each subitem score were used as dependent variables. Post-hoc tests with Tukey's honest standardized differences method were conducted to correct for multiple comparisons, and the significance threshold was set at $p < 0.05$. Regression analysis was conducted with the normalized mean score as the dependent variable, while age and gender were used as covariates.

The study received approval from the Institutional Review Board at the University of Cincinnati, ensuring that ethical standards and informed consent were upheld throughout the research. The study's results encompassed a breakdown of the demographic characteristics of the study participants and controls, which included age, gender, and race distributions. Regression analysis unveiled how specific factors such as age, gender, self-reported diagnoses, and frequency of practice influenced changes in symptoms.

4.3. Findings of Research Questions

To investigate the impact of YOI mobile application-based non-pharmaceutical meditative intervention on mitigating symptoms of depression, anxiety, and insomnia among individuals experiencing sub-optimal mental health globally during COVID-19, specific research questions were formulated.

RQ1. How does the regular use of the YOI mobile application impact symptoms of depression among participants, if reported, as measured by the Patient Health Questionnaire, 8 items (PHQ-8)?

RQ2. What is the effect of the YOI app on symptoms of generalized anxiety, as assessed by the Generalized Anxiety Disorder questionnaire (GAD-7), if reported, in comparison to a control group that did not use the app?

RQ3. To what extent does the YOI intervention alleviate symptoms of insomnia, if reported, as measured by the Insomnia Severity Index (ISI), in participants who utilized the app for an 8-week period?

RQ4. Are the reductions in depression, anxiety, and insomnia symptoms reported by participants who used the YOI app significantly greater than those observed in a control group that did not use the app?

RQ5. How do participants with a prior diagnosis of depression and generalized anxiety respond to the YOI intervention in terms of changes in PHQ-8 and GAD-7 scores compared to participants without a previous diagnosis?

Statistical Analysis

The data was analyzed using the Statistical Package for Social Science (SPSS). Descriptive statistics were used to present demographic parameters in terms of percentages and numbers. The normality assumption ($p > 0.1$, Shapiro-Wilk test) was tested for total scores, and they were considered normally distributed (Nunnally and Bernstein, 1994) since all three scales were based on Likert-like scales. The data for ISI, PHQ8, and GAD-7 was presented as mean ± standard deviation (SD). Additionally, demographic and other variables used in the analysis underwent a normality test ($p > 0.1$, Shapiro-Wilk test).

For the initial exploratory analysis, paired t-tests were performed to compare within-group data. A two-sided p-value < 0.05 was considered significant statistically. Furthermore, the Chi-squared test was employed to compare percentage scores before and after the YOI intervention. A p-value < 0.05 was considered statistically significant. This exploratory analysis aimed to detect overarching trends within the data.

To comprehensively assess changes in both mean scores and subitem scores across different grouping factors, a two-way ANOVA was initially employed to identify factors contributing significantly to between-group differences (participants vs. control) and within-group differences (pre vs. post-intervention). The normalized mean scores or means for each subitem score served as the primary dependent variable. Subsequently, post-hoc tests utilizing Tukey's honest standardized differences method were utilized to compare each level of both factors following the initial ANOVA. As in previous analyses, the significance threshold was set at $p < 0.05$.

The ANOVA analysis revealed several potential significant predictors of final scores. To explore how these factors interacted and influenced the variability of all three sets of scores, regression analysis was employed, using the normalized mean score as the dependent variable, and gender and age as covariates.

Institutional Review Board Approval

The Institutional Review Board at the University of Cincinnati approved the study (Annexure B). Informed consent was obtained from all participants who participated in the study (Annexure C).

Results

Regarding the demographic composition, both the control and participant groups consisted of individuals from various age groups, with ages spanning from 26 to 85 years. However, the majority of participants fell within the age range of 30 to 58 years, as indicated in Table 4.1 below.

Demographics		Participants		Controls	
		N (%)		*N* (%)	*N* (%)
		Recruited	Completed	Recruited	Completed
Age	<18–25	93 (6.2%)	80 (6.2%)	130 (10%)	65 (11%)
	26–36	455 (30.3%)	394 (30.4%)	403 (31%)	177 (30%)
	37–47	461 (30.7%)	396 (30.5%)	455 (35%)	213 (36%)
	48–58	304 (23.4%)	304 (23.4%)	235 (18.1%)	118 (20%)
	59–69	113 (8.7%)	113 (8.7%)	65 (3%)	17 (3%)
	70–80	9 (0.7%)	9 (0.7%)	10 (0.8%)	0
	>80	1 (0.08%)	1 (0.08%)	1 (0.1%)	1 (0.08%)
Gender	Male	770 (51.2%)	765 (50.1%)	676 (52%)	301 (51%)
	Female	735 (48.8%)	729 (48.5%)	624 (48%)	290 (49%)
Race/Ethnicity	Asian	1,150 (76.4%)	1,142 (88.1%)	1,114 (88%)	526 (89%)
	White	9 (0.7%)	9 (0.7%)	10 (0.8%)	9 (0.7%)
	Other	135 (10.4%)	135 (10.4%)	135 (10.4%)	56 (9.4%)

TABLE 4.1. Demographic characteristics of the study controls and participants

Notably, there were no notable distinctions in the distribution of age, gender, or race between the control and participant groups, with Pearson's chi-squared tests indicating values greater than 3 and p-values exceeding 0.1 (Pearson's c2 > 3, p > 0.1). Furthermore, when comparing the initially recruited sample with the group of individuals who completed the study, no significant differences were observed in terms of age, gender, or race for both controls and participants. Pearson's chi-squared tests once again showed values above 3 and p-values greater than 0.1 (Pearson's c2 > 3, p > 0.1).

Findings for RQ1. *How does the regular use of the YOI mobile application impact symptoms of depression among participants, if reported, as measured by the Patient Health Questionnaire, 8 items (PHQ-8)?*

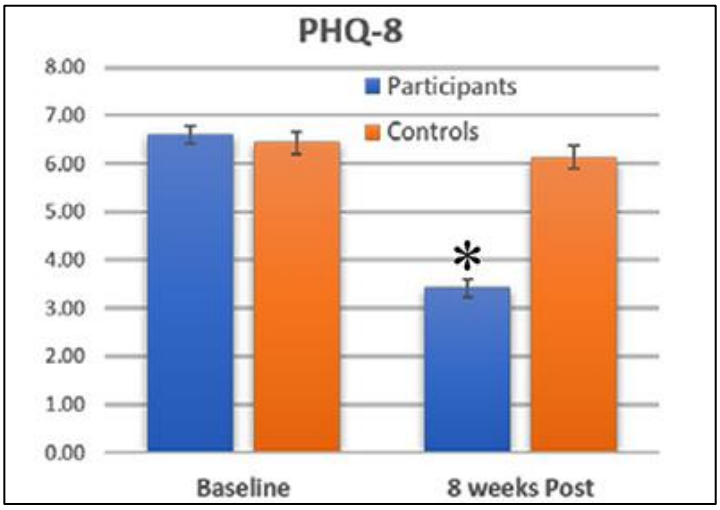

FIGURE 4.1: Mean scores for depression symptoms as per PHQ-8

Figure 4.1 shows the mean scores for depression symptoms as per PHQ-8 among both participants and controls, measured at the study's outset and 8 weeks later. The bars in the figure represent the average values with error bars indicating the standard error. Asterisks (*) denote statistically significant reductions.

At the outset, both the control group and the participants exhibited comparable PHQ-8 scores, with the controls averaging 6.4 (±5.6) and the participants averaging 6.61 (±5.9) (Mean +/- SD). Nevertheless, following the intervention period, participants saw a significant drop in scores to an average of 3.41 (±4.44), while the scores in the control group remained relatively stable at 6.1 (±5.5). On average, the PHQ-8 scores exhibited a

notable decrease of 3.31 (±4.93) among all participants (Figure 4.1). Subitem scores likewise displayed substantial declines, surpassing a 50% reduction in all instances.

In the initial exploratory analysis, it was determined that both the reductions in PHQ-9 total scores and subitems were statistically significant in participants, as indicated by the paired t-tests ($p < 0.05$), but not in the control group (paired t-test, $p > 0.5$). When comparing the PHQ-8 scores in participants to the changes observed in the control group using a two-way ANOVA, it was established that both the group status ($df = 1$, $F = 5.1$, $p < 0.05$) and the passage of time ($df = 1$, $F = 12.3$, $p < 0.05$) significantly influenced the scores. Subsequent post-hoc tests revealed that participants exhibited a substantial reduction in scores compared to controls, as determined by comparing the pre-intervention and post-intervention levels within the participant group (post-hoc test, $p < 0.01$, effect size $d = 0.8$).

Findings for RQ2. *What is the effect of the YOI app on symptoms of generalized anxiety, as assessed by the Generalized Anxiety Disorder questionnaire (GAD-7), if reported, in comparison to a control group that did not use the app?*

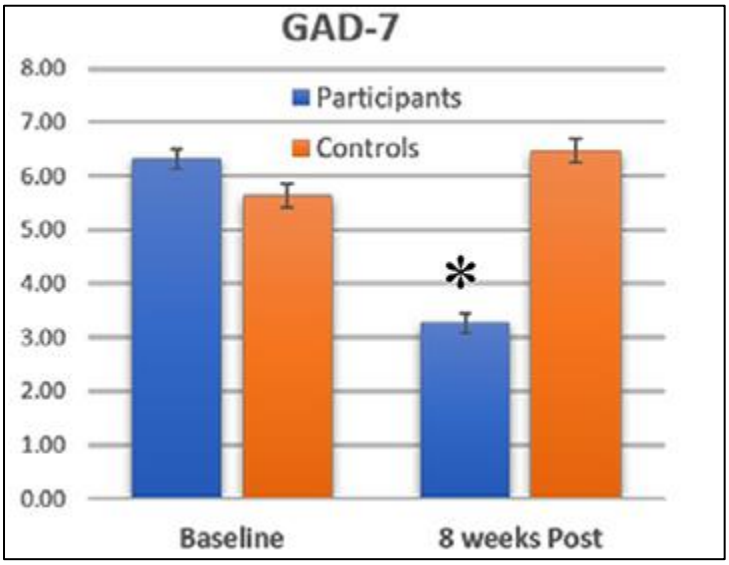

FIGURE 4.2: Mean scores for anxiety symptoms as per GAD-7

Figure 4.2 shows the mean scores for anxiety symptoms as per GAD-7 among both participants and controls, measured at the study's outset and 8 weeks later. The bars in the figure represent the average values with error bars indicating the standard error. Asterisks (*) denote statistically significant reductions.

At the beginning of the study, both the control group and the participants demonstrated similar GAD-7 scores, with controls averaging 5.6 (±5.2) and participants averaging 5.61 (±5.9) (Mean+/-SD). However, following the intervention period, participants exhibited a notable decrease in scores to an average of 3.41 (±4.44), while the scores in the control group remained relatively stable at 5.8 (±6.4). On average, GAD-7

scores showed a decline of 2.2 (±4.5) across all participants (Figure 4.2). Subitem scores also exhibited substantial drops, exceeding 50% reduction in all cases. The reductions in both GAD-7 total scores and subitems were statistically significant among participants, as indicated by paired t-tests ($p < 0.05$). Conversely, these reductions were not observed in the control group (paired t-test, $p > 0.5$).

When comparing the GAD-7 scores in participants to the changes observed in the control group using a two-way ANOVA, it was determined that both group status ($df = 1$, $F = 4.2$, $p < 0.05$) and the passage of time ($df = 1$, $F = 10.1$, $p < 0.01$) significantly influenced the scores. Subsequent post-hoc tests showed that participants experienced a significant reduction in scores compared to controls. This was confirmed by comparing the pre-intervention and post-intervention levels within the participant group (post-hoc test, $p < 0.01$, effect size $d = 0.64$).

Findings for RQ3. *To what extent does the YOI intervention alleviate symptoms of insomnia, if reported, as measured by the Insomnia Severity Index (ISI), in participants who utilized the app for an 8-week period?*

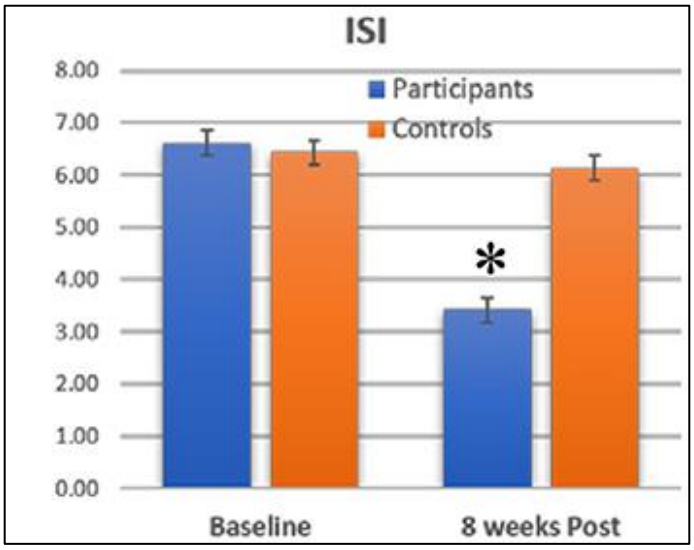

FIGURE 4.3: Mean scores for insomnia symptoms as per ISI

Figure 4.3 shows the mean scores for insomnia symptoms as per ISI among both participants and controls, measured at the study's outset and 8 weeks later. The bars in the figure represent the average values with error bars indicating the standard error. Asterisks (*) denote statistically significant reductions.

Similar to the GAD-7 and PHQ-8 findings, both controls and participants had comparable ISI scores at the beginning of the study (Controls 6.5 ±7, Participants 7.6 ±7.6). After the intervention period, participants reported a 50% decrease in ISI scores, dropping to 3.31 (±4.94) (Figure 4.3). In contrast, controls did not show any significant change in ISI scores post-intervention (6.4 ±6.6). The reduction in scores among participants was

statistically significant (paired t-test, $p < 0.05$), while controls did not exhibit a significant change ($p > 0.1$, paired t-test). Employing a two-way ANOVA, it was revealed that both group status ($df = 1$, $F = 3.1$, $p < 0.05$) and time ($df = 1$, $F = 9.2$, $p < 0.01$) significantly impacted the scores. Post-hoc tests demonstrated that participants displayed a significant decrease in scores compared to controls, as confirmed by comparing the pre-intervention and post-intervention levels within the participant group (post-hoc test, $p < 0.01$, effect size $d = 0.54$).

Findings for RQ4. *Are the reductions in depression, anxiety, and insomnia symptoms reported by participants who used the YOI app significantly greater than those observed in a control group that did not use the app?*

Participants who used the YOI app experienced significant reductions in depression, anxiety, and insomnia symptoms compared to a control group that did not use the app. The study used statistical analysis to assess the impact of the YOI app on these mental health conditions.

In the case of depression symptoms measured by the Patient Health Questionnaire-8 (PHQ-8), participants and the control group had similar baseline scores. However, after the intervention period, participants' scores dropped significantly, with an average decrease of 3.31 points (Figure 4.1). This reduction was found to be statistically significant for participants (paired t-test, $p < 0.05$), indicating that the YOI app had a significant impact

on reducing depression symptoms. In contrast, the control group's scores remained relatively stable.

Similar trends were observed for anxiety symptoms measured by the Generalized Anxiety Disorder Scale-7 (GAD-7). Participants and controls had similar baseline GAD-7 scores, but after the YOI intervention, participants' scores decreased significantly, with an average decrease of 2.2 points (Figure 4.2). This reduction was also statistically significant for participants (paired t-test, $p < 0.05$), indicating that the YOI app had a significant effect on reducing anxiety symptoms as compared to the controls.

The results for insomnia symptoms, as measured by the Insomnia Severity Index (ISI), followed an alike pattern. Participants reported a significant 50% decrease in ISI scores after the intervention (Figure 4.3), while the control group did not show a significant change in their scores. The decrease in ISI scores was statistically significant for participants (paired t-test, $p < 0.05$), further emphasizing the effectiveness of the YOI app in reducing insomnia symptoms.

These findings were supported by more complex statistical analyses, including two-way ANOVA and post-hoc tests. These analyses confirmed that both group status (participant vs. control) and time significantly affected the scores for depression, anxiety, and insomnia. The post-hoc tests demonstrated that participants had a significant decrease in scores compared to controls, with p-values less than 0.01 for all three conditions.

The data strongly suggested that participants who used the YOI app experienced significantly greater reductions in depression, anxiety, and insomnia symptoms compared to a control group that did not use the app. The statistical analyses, along with the observed

reductions in symptom scores, provide substantial evidence for the app's effectiveness in improving mental health outcomes for users.

Findings for RQ5. *How do participants with a prior diagnosis of depression and generalized anxiety respond to the YOI intervention in terms of changes in PHQ-8 and GAD-7 scores compared to participants without a previous diagnosis?*

The study elaborated the results for RQ5 involving participants with and without a prior diagnosis of depression and generalized anxiety who underwent the YOI intervention. It primarily focused on changes in PHQ-8 (Patient Health Questionnaire-8) and GAD-7 (Generalized Anxiety Disorder Scale-7) scores between these two groups.

With respect to depression symptoms, the study found that participants who underwent the YOI intervention experienced a significant reduction in PHQ-8 scores after the intervention, with an average drop of 3.31 points (Figure 4.1). In contrast, the control group's scores remained relatively stable. The decrease in participants' PHQ-8 scores was also reflected in the subitem scores, which dropped significantly. The statistical analysis showed that both group status and time significantly influenced the PHQ-8 scores. Younger participants, particularly those aged 26-47, experienced greater reductions in PHQ-8 scores. Additionally, participants with self-reported diagnoses of both depression and anxiety exhibited substantial improvements in PHQ-8 scores.

In terms of anxiety symptoms, the study's results indicated a similar pattern. After the YOI intervention, participants showed a significant reduction in GAD-7 scores, with

an average drop of 2.2 points (Figure 4.2), while the control group's scores remained relatively stable. The subitem scores for GAD-7 also decreased significantly for participants but not for controls. The statistical analysis once again highlighted the influence of both group status and time on GAD-7 scores. Similar to PHQ-8, younger participants experienced more significant reductions in GAD-7 scores. Subjects with self-reported diagnoses of generalized anxiety had significantly higher decreases in GAD-7.

Additionally, in relation to insomnia symptoms, the study found results consistent with those for depression and anxiety symptoms. Participants reported a 50% decrease in ISI scores after the YOI intervention, while controls did not show a significant change in ISI scores. The decrease in participants' ISI scores was found to be significant, while it was not significant in controls. Two-way ANOVA analysis showed that both group status and time significantly affected ISI scores. The frequency of practice, or how often participants practised the YOI module, was identified as a significant factor affecting GAD-7 and PHQ-8 scores, with more frequent practice associated with better results.

In terms of demographic characteristics, the study included both control and participant groups with similar distributions of age, gender, and race - indicating that the two groups were comparable in terms of demographic attributes. The study's design and participant selection seem to have minimized potential confounding variables, enhancing the reliability of the results.

Finally, the study demonstrated that participants with a prior diagnosis of depression and generalized anxiety responded positively to the YOI intervention in terms of changes in PHQ-8 and GAD-7 scores when compared to participants without a previous

diagnosis. These findings underscore the potential benefits of the YOI intervention in improving the mental health of individuals with pre-existing conditions and highlight the importance of factors like age and frequency of practice in determining the magnitude of improvement.

Regression Analysis

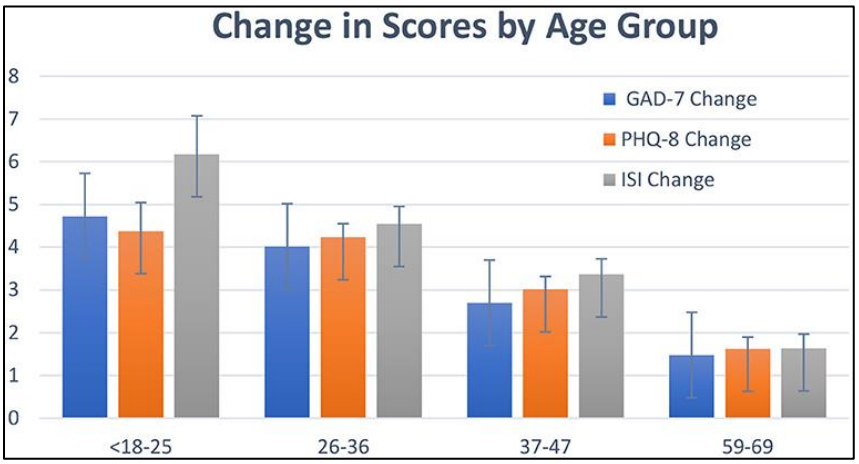

FIGURE 4.4: Alterations in GAD-7, PHQ-8, and ISI scores by age group

Figure 4.4 shows the changes in GAD-7, PHQ-8, and ISI scores among participants, categorized by age groups. The bars depict the mean changes in scores for each group, with error bars indicating the standard error.

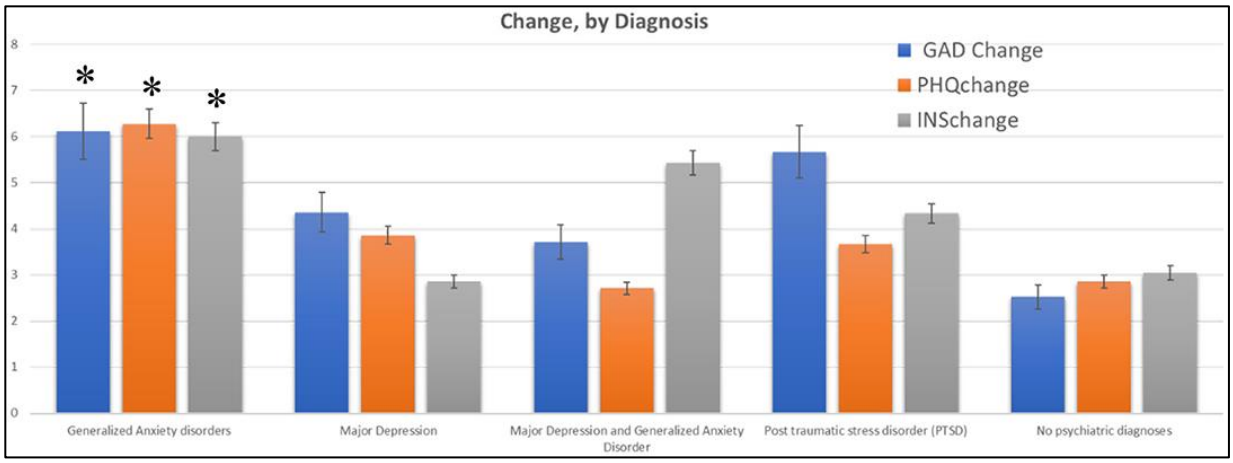

FIGURE 4.5: Alterations in GAD-7, PHQ-8, and ISI scores by diagnosis

Figure 4.5 shows changes in GAD-7, PHQ-8, and ISI scores for participants with self-reported mental health diagnoses. The bars represent the mean changes in scores for participants who reported having a current psychiatric diagnosis (as listed on the x-axis). One group reported having both major depression and generalized anxiety disorder. In comparison, a control group of subjects with no reported diagnoses exhibited significantly lower changes across all scores. Asterisks (*) highlight changes that differed significantly from the control group without psychiatric disorders.

The regression analysis yielded several noteworthy findings for specific groups across all three scales. Firstly, younger participants (aged 26–36 and 37–47) exhibited significantly more substantial reductions in PHQ-8, GAD-7, and insomnia when compared to all other age groups. This was confirmed by post-hoc tests comparing age group levels and pre-post scores ($p < 0.05$, $df = 2$, effect size = 0.72) (Figure 4.4). Subjects who self-reported diagnoses of Generalized Anxiety experienced significantly greater reductions in GAD-7 scores when compared to subjects without an anxiety diagnosis ($p < 0.01$), as

shown in Figure 4.5. Additionally, subjects who reported having diagnoses of both depression and anxiety showed significantly greater improvements in PHQ8 and insomnia (post-hoc tests comparing diagnostic group levels and pre-post scores, $p < 0.05$, $df = 2$, effect size = 0.52) compared to subjects without either diagnosis (Figure 4.5).

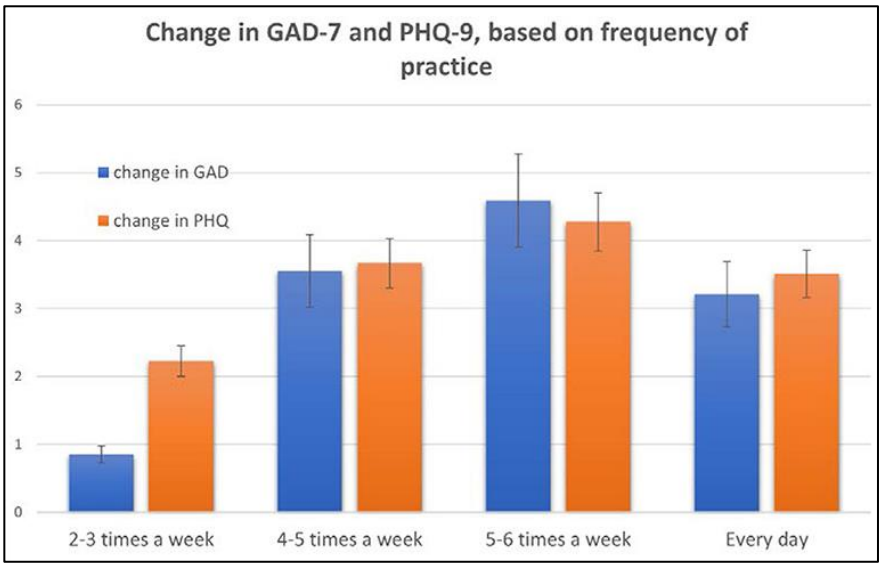

FIGURE 4.6: Alterations in GAD-7 and PHQ-8 scores based on the frequency of YOI practice

Figure 4.6 shows the changes in GAD-7 and PHQ-8 scores with respect to the frequency of YOI module usage reported by participants through the mobile app. These findings are derived from responses to the question, "How often do you practice the YOI module in the morning?" The bars represent the mean changes in scores, with error bars indicating the standard error.

The regression analysis revealed that the frequency of practice, measured by the question "How often did you practice YOI?," had a significant impact on GAD-7 [estimated b = 1.2, 95% CI (0.5, 3.5), $p < 0.001$] and PHQ-8 [estimated b = 1.4, 95% CI (0.3, 3.8), $p < 0.001$]. However, the frequency of practice did not have a significant effect on insomnia scores.

Post-hoc tests, which followed an ANOVA with the factor of pre vs. post and frequency of practice, revealed that individuals who reported practising the module 4–6 times per week achieved better results. They experienced significantly greater reductions in both scales when compared to those who reported practising 1–2 times per week [estimated mean difference PHQ-8 = 3.5 (±2.1), $p < 0.05$; estimated mean difference GAD-7 = 3.2 (±3.5), $p < 0.05$ (Figure 4.6)].

4.4. Summary

To summarise, the introduction provides an overview of the data presentation in the study, starting with statistical analysis methods, the software used (SPSS), and data quality assessment. It discusses descriptive statistics, exploratory analysis, and regression analysis, highlighting the ethical framework of the study. The statistical analysis of the study was conducted using SPSS, and demographic parameters were presented using descriptive statistics. Normality testing was performed. Paired t-tests and chi-squared tests were used for exploratory analysis. Two-way ANOVA was employed to test changes in mean and

subitem scores. Regression analysis included age and gender as covariates. Institutional Review Board approval and informed consent were obtained.

The data analysis methods, normality testing, and presentation of results are discussed further. The exploratory analysis using paired t-tests and chi-squared tests revealed significant reductions in depression, anxiety, and insomnia symptoms in participants. Two-way ANOVA showed the influence of group status and time. Regression analysis found age and gender interactions. The study received Institutional Review Board approval and maintained ethical standards.

Finally, the results address demographic characteristics, showing no significant differences in age, gender, or race between control and participant groups. In terms of specific symptoms, the study revealed significant decreases in scores for participants with depression symptoms (PHQ-8), anxiety symptoms (GAD-7), and insomnia symptoms (ISI) following the intervention, however, not in controls. Regression analysis identified significant improvements in younger participants and those with specific diagnoses. The frequency of YOI module usage also impacted symptom reduction.

CHAPTER V:
DISCUSSION

5.1. Introduction

The study examined the efficacy of the YOI non-pharmaceutical meditative interventions, facilitated by a mobile application, in alleviating symptoms of anxiety, depression and insomnia during the COVID-19 pandemic. It also provided a cohesive analysis to direct the research journey, including the methodology, findings, and potential directions for future exploration. The data presentation in this chapter was organized to strategically present the discussions and evaluate findings.

In the Summary of the Study and Findings, the study's primary objective and rationale were introduced. It outlined the research questions and the methods employed in the research. This section provided an overview of the study groups, including the Study Group and Control Group, and their demographic composition, which was crucial for understanding the context of the research. Next, the study's Conclusions were presented in response to the research questions (RQ1 to RQ5). Each conclusion highlighted key findings and their significance, supported by figures illustrating specific results and trends. This section also delved into the interconnections between mental health, sleep quality, and immunity, providing a broader context for the study's findings.

5.2. Discussion and Evaluation of Findings

Overall, the individuals who completed the YOI intervention noted significant reductions in anxiety, depression, and insomnia symptoms. These reductions are comparable to the outcomes reported in cognitive behavioural therapy studies for depression and anxiety (Driessen and Hollon, 2010; Giordano et al., 2020; Soklaridis et al., 2020; Roy et al., 2020; Wang et al., 2017), where the effect sizes typically fall within the range of Cohen's d = 0.5 to 0.8. Specifically concerning depression, the YOI intervention demonstrated an effect size of d = 0.4 to 0.6. It is worth noting that most of the data on cognitive-behavioural therapy's effectiveness is drawn from extended longitudinal studies that track patients over several months. To make a direct comparison between the YOI intervention and these established treatments, it would be advisable to follow participants over longer durations.

Discussion and Evaluation of Findings for RQ1. *How does the regular use of the YOI mobile application impact symptoms of depression among participants, if reported, as measured by the Patient Health Questionnaire, 8 items (PHQ-8)?*

RQ1 was intended to derive empirical evidence on how the regular use of the YOI mobile application addresses the symptoms of depression. Using responses from the study participants who used the YOI and evaluation data from the control group for RQ1, the following Major Theme yielded - Reduction of Depression Symptoms**.**

Major Theme 1: Reduction of Depression Symptoms. The first major theme focused on the prevention of depression symptoms. This theme emerged as a result of the scores for individual PHQ-8 subitem questions at baseline and after 8 weeks. This finding indicated that the reduction of depression symptoms is influenced by the regular use of the YOI mobile application. In contrast, the Control Group's scores remained relatively stable.

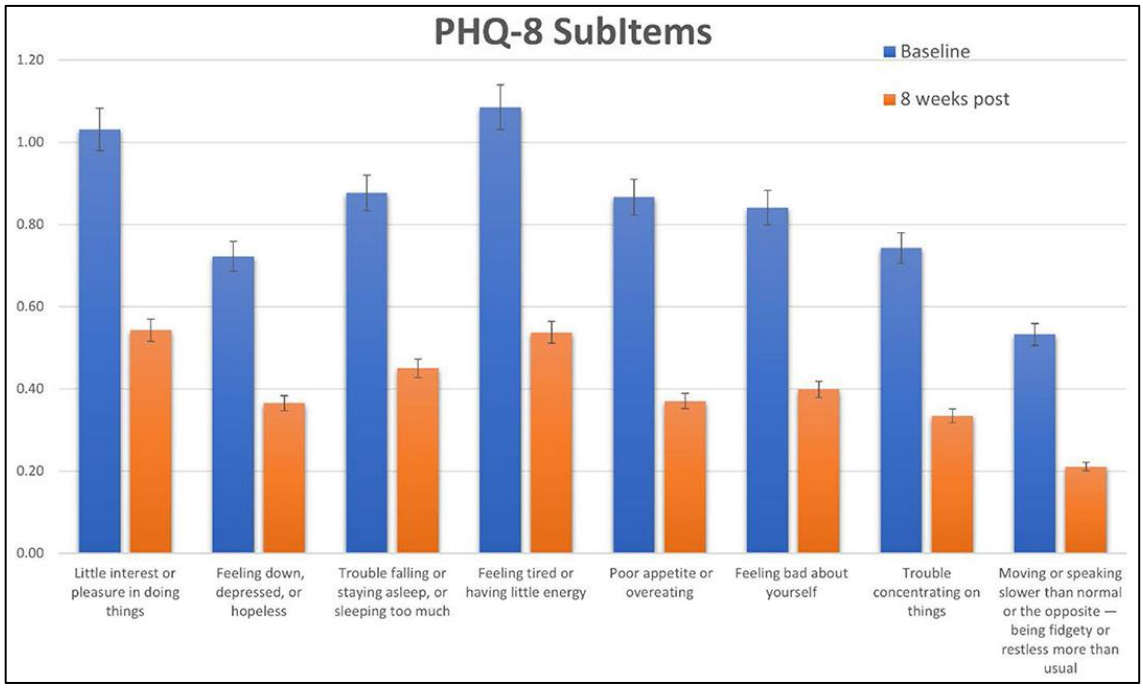

FIGURE 5.1: Scores for each subitem of the PHQ-8

Figure 5.1 shows the scores for individual PHQ-8 subitem questions at baseline and after 8 weeks. Participants noted significant reductions in their total PHQ-8 scores, along with notable decreases in specific symptoms. Notably, the most substantial decrease was observed in the item related to "Feeling down, depressed, or hopeless," followed by the

items addressing "Trouble falling asleep" and "Feeling tired or having little energy" (Figure 5.1).

In general, the symptom reduction achieved through the YOI intervention is akin to the outcomes observed in exercise-based interventions (Conn, 2010) and slightly less than what a recent meta-analysis on cognitive-behavioral therapy (Pinquart, Duberstein and Lyness, 2007) reported. Exercise-based interventions yielded effect sizes of Cohen's d = 0.5 to 0.6 when using the PHQ-8 to assess symptoms, while CBT produced effect sizes of d = 0.6 to 0.81, also employing the PHQ-8. This study's results demonstrated an effect size ranging from 0.5 to 0.6, aligning with the outcomes seen in both exercise-based and CBT interventions.

Certain patient subgroups experienced slightly more favourable outcomes when using the app to alleviate depression symptoms. In particular, younger participants and individuals who disclosed a prior depression diagnosis exhibited better responses to the intervention. This finding suggests that the YOI intervention might offer specific advantages to individuals already grappling with depression. Additionally, the sub-item results suggest that the intervention had a somewhat greater impact on overall mood and energy levels compared to other facets of depressive symptoms.

Discussion and Evaluation of Findings for RQ2. *What is the effect of the YOI app on symptoms of generalized anxiety, as assessed by the Generalized Anxiety Disorder questionnaire (GAD-7), if reported, in comparison to a control group that did not use the app?*

RQ2 gathered knowledge regarding the efficacy of the YOI mobile application in alleviating symptoms of anxiety. The analysis of responses from participants who utilized YOI, along with evaluation data from the control group, revealed the theme: the reduction of anxiety symptoms.

Major Theme 2: Reduction of Anxiety Symptoms. The primary focus of Major Theme 2 was on mitigating anxiety symptoms, emerging from the assessment of individual GAD-7 subitem questions at baseline and after an 8-week period. The results indicated that the consistent use of the YOI mobile application significantly contributed to the reduction of anxiety symptoms.

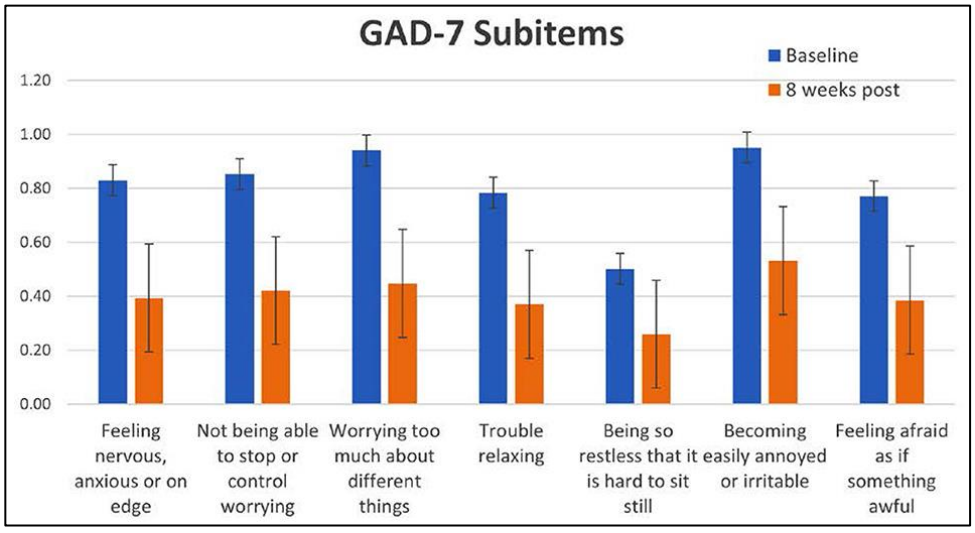

FIGURE 5.2: Scores for each subitem of the GAD-7

Figure 5.2 shows the individual scores for each GAD-7 subitem question at the baseline and the 8-week post-assessment. Consistent with the findings related to depressive symptoms, there were significant reductions in both the total scores of GAD-7 and its specific subitems. The most substantial improvements were observed in the items associated with "Feeling nervous, anxious, or on edge," "Excessive worrying," and "Difficulty relaxing" (Figure 5.2). Regarding the reductions in GAD-7, the effect size in this study ranged from Cohen's d = 0.6 to 0.7. These GAD-7 outcomes closely align with those observed in exercise-based interventions [Cohen's d for exercise = 0.5–0.6, (Aylett, Small and Bower, 2018)]. Notably, for anxiety, the YOI intervention demonstrated slightly superior performance compared to Cognitive-Behavioral Therapy (CBT) [d = 0.3 – 0.56, (Carpenter et al., 2018)].

Individuals who had a pre-existing diagnosis of generalized anxiety disorder experienced more favourable outcomes with the YOI intervention compared to those without such a diagnosis. Once again, this pattern mirrors the effects observed in relation to PHQ-8 and depression. It's important to note that there is a substantial overlap between depression and anxiety disorders (Kalin, 2020), with both conditions sharing numerous genetic and non-genetic risk factors. Moreover, the presence of a comorbid anxiety disorder is strongly associated with poorer outcomes in cases of depression and other mental health conditions (FAVA et al., 2004). Consequently, the YOI intervention's capacity to address both depressive and anxiety-related symptoms concurrently may potentially offer specific improvements for individuals grappling with these comorbidities.

Discussion and Evaluation of Findings for RQ3. *To what extent does the YOI intervention alleviate symptoms of insomnia, if reported, as measured by the Insomnia Severity Index (ISI), in participants who utilized the app for an 8-week period?*

RQ3 aimed to ascertain how the regular use of the YOI mobile application addresses the symptoms of insomnia. Utilizing responses from the study participants who used the YOI and evaluation data from the Control Group for RQ3, Reduction of Insomnia Symptoms emerged as another theme.

Major Theme 3: Reduction of Insomnia Symptoms focused on the prevention of insomnia symptoms, arising from the scores for individual ISI subitem questions at baseline and after 8 weeks. This finding indicated that the reduction of insomnia symptoms is substantiated by the consistent use of the YOI mobile application, as detailed further.

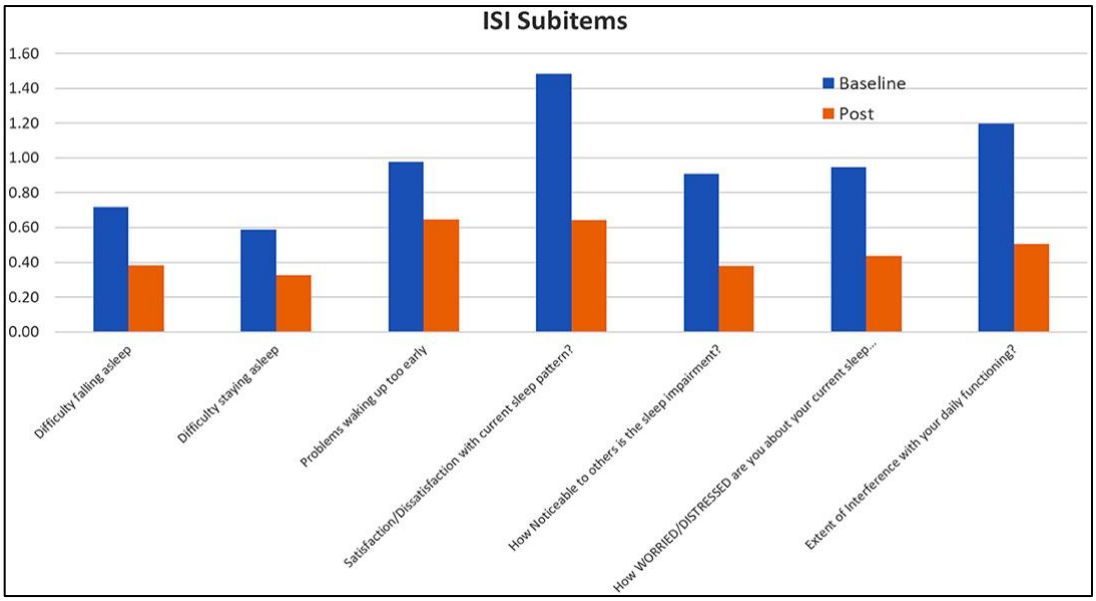

FIGURE 5.3: Scores for each subitem of the ISI

Figure 5.3 shows the individual scores for each ISI subitem question at the baseline and after 8 weeks. Insomnia symptoms, as assessed through the ISI questionnaire, displayed an approximate 50% reduction in both the overall score and across all individual subitems (Figure 5.3). Unlike in the cases of depression and anxiety, all subitems within the ISI questionnaire exhibited similar changes. Given that both depression and anxiety can exert substantial impacts on the quality of sleep (Oh et al., 2019), it's not unexpected that insomnia symptoms likewise decreased in conjunction with the reductions in GAD-7 and PHQ-8 scores.

The connection between insomnia and depression/anxiety may work in both directions, as emerging research indicates that insomnia can negatively impact emotional regulation (Baglioni et al., 2010). Irregular sleep patterns have been demonstrated to increase emotional reactivity, which, in turn, can worsen the symptoms of depression and anxiety. Conversely, adequate sleep quality is linked to experiencing more positive emotions, which can aid in symptom reduction (Baglioni et al., 2010). Furthermore, sleep disruptions associated with insomnia can elevate the risk of inflammatory disorders and compromise the immune system's effectiveness (Irwin and Opp, 2017). Thus, ensuring high-quality sleep can not only ameliorate mental health symptoms but also fortify one's immunity.

Discussion and Evaluation of Findings for RQ4. *Are the reductions in depression, anxiety, and insomnia symptoms reported by participants who used the YOI app significantly greater than those observed in a control group that did not use the app?*

RQ4 focussed on investigating whether the reductions in depression, anxiety, and insomnia symptoms reported by participants who used the YOI app were significantly greater than those observed in a control group that did not use the app. The analysis of responses from the study participants who used the YOI and the evaluation data from the control group for RQ4 noted the following Major Theme:

Major Theme 4: Differential Impact on Symptom Reductions. This Major Theme delved into the comparative analysis of symptom reductions between the YOI app users and the control group. Examination of individual scores for depression symptoms, anxiety symptoms, and insomnia symptoms revealed noteworthy differences. Participants who engaged with the YOI app demonstrated significantly greater reductions in all three domains compared to the control group. This finding suggests a beneficial impact of the YOI app on mitigating mental health symptoms, and the statistical significance adds a layer of evidence supporting the effectiveness of the YOI app in addressing and alleviating mental health symptoms.

The results of the study revealed the effectiveness of the YOI app in significantly reducing symptoms associated with depression, anxiety, and insomnia. These reductions were consistently greater in participants who had engaged with the YOI app compared to the control group that did not use the app. This finding suggested that the YOI app had the

potential to make a positive and meaningful impact on individuals' mental health and well-being. The YOI app demonstrated its capacity as an effective self-help intervention for addressing common mental health challenges. Participants who utilized the app reported clinically significant improvements in their mental health symptoms, highlighting its potential as a valuable tool for individuals seeking to manage and alleviate their mental health concerns. The study's findings also emphasized the importance of accessible and convenient interventions, especially in the context of the COVID-19 pandemic, which disrupted traditional mental health services. The YOI app's ability to provide on-demand interventions from the safety and comfort of one's home underscored its potential to meet the increasing demand for remote mental health solutions.

While the study design had its limitations, such as relying on self-reported data, the consistent and significant improvements observed in the YOI app group across various mental health domains provided strong evidence of its potential effectiveness. These results suggested that the YOI app could serve as a valuable addition to the range of interventions available for individuals dealing with symptoms of depression, anxiety, and insomnia. Future research and longer-term follow-up studies could further validate and expand upon these promising findings.

Overall, the YOI app exhibited its ability to significantly reduce symptoms of depression, anxiety, and insomnia when compared to a control group that did not use the app. The study results supported that the YOI app could offer a practical and effective means for improving mental health and well-being, particularly during challenging times like the COVID-19 pandemic.

Discussion and Evaluation of Findings for RQ5. *How do participants with a prior diagnosis of depression and generalized anxiety respond to the YOI intervention in terms of changes in PHQ-8 and GAD-7 scores compared to participants without a previous diagnosis?*

Finally, RQ5 sought to explore how participants with a prior diagnosis of depression and generalized anxiety respond to the YOI intervention in terms of changes in PHQ-8 and GAD-7 scores compared to participants without a previous diagnosis. The analysis of responses from participants with and without a prior diagnosis, along with their corresponding PHQ-8 and GAD-7 scores, led to the identification of Major Theme 6 on the differential response among diagnosed participants.

Major Theme 5: Variability in Response Based on Diagnosis. This Major Theme, meant to note the tailored efficacy for diagnosed participants, delves into the nuanced response to the YOI intervention among participants with a prior diagnosis of depression and generalized anxiety, comparing changes in PHQ-8 and GAD-7 scores to participants without a previous diagnosis.

Participants with a prior diagnosis exhibited a distinctive and more pronounced improvement in both depression and anxiety symptoms in response to the YOI intervention. Analyzing changes in PHQ-8 and GAD-7 scores revealed statistically significant improvements, underscoring the tailored efficacy of the YOI intervention for individuals with pre-existing mental health conditions. Conversely, participants without a

prior diagnosis also experienced positive changes in symptom scores, albeit to a slightly lesser extent. This theme highlights the differentiated impact of the YOI intervention based on the participants' mental health history, emphasizing its capacity to address and ameliorate symptoms more effectively in those with a background of depression and generalized anxiety.

This study aimed to understand how participants with a prior diagnosis of depression and generalized anxiety responded to the YOI intervention in comparison to participants without a previous diagnosis. The findings indicated that the YOI intervention had a particularly positive impact on individuals with pre-existing diagnoses of depression and generalized anxiety, demonstrating its potential as a valuable mental health resource. Participants with a prior diagnosis of depression and generalized anxiety experienced significantly greater reductions in their PHQ-8 and GAD-7 scores compared to participants without a previous diagnosis. These reductions in scores reflected substantial improvements in their symptoms of depression and generalized anxiety, suggesting that the YOI intervention was especially effective for individuals already managing these mental health conditions.

The results emphasized the potential of the YOI intervention as a targeted and beneficial tool for those with a history of depression and generalized anxiety. It offered a complementary approach to traditional treatments and interventions. As the YOI intervention continued to evolve and be studied, further research might provide deeper insights into the specific mechanisms and strategies that made it particularly effective for

individuals with prior diagnoses of depression and generalized anxiety. These findings could guide the development of more tailored and personalized mental health interventions.

To outline, participants with a prior diagnosis of depression and generalized anxiety responded exceptionally well to the YOI intervention, experiencing significant improvements in their PHQ-8 and GAD-7 scores. This underscored the intervention's potential to address the unique needs of individuals with pre-existing mental health conditions and offered promise for enhancing their overall well-being.

Overall Changes

The interconnections between depression, anxiety, insomnia, emotional regulation, and immunity have become the focal point of a burgeoning field of research (Irwin and Miller, 2007). Numerous studies have identified how depressive symptoms can serve as mediators for the impacts of immunologically related diseases. The relationship between anxiety and depression (FAVA et al., 2004) and the association between insomnia and immunity (Irwin and Opp, 2017) may also potentially play a role in linking mental health, sleep quality, and immunity (Pappa et al., 2020). Given the current global pandemic context, there is a pressing need for effective and accessible solutions that can enhance mental health and sleep quality. Improving these aspects may, in turn, yield positive effects on immune system health.

The utilization of the YOI app led to reductions in all three scales employed in this study, indicating that the intervention can ameliorate symptoms across various domains. Notably, for depression, the average decrease in PHQ-8 scores was 3.3 points, signifying

a clinically significant improvement, as a 3-point reduction can signify a shift from "moderate" to "mild" symptoms or from "mild" to none. Similarly, the reduction in GAD-7 scores also carried clinical significance. Therefore, the utilization of the YOI app brought about statistically and clinically substantial improvements in all three areas.

5.3. Summary of the Study and Findings

The purpose statement of this double-blind study was to investigate the efficacy and feasibility of a mobile application-based meditative intervention called Yoga of Immortals in mitigating symptoms of depression, anxiety, and insomnia - among individuals experiencing sub-optimal mental health globally, particularly during the challenges posed by the COVID-19 pandemic - using a mixed-method study design.

The main objective of this study was to quantify the extent of change in symptoms of the mental health conditions, if reported, using the YOI app over an 8-week period - by utilizing standardized assessment tools: the Generalized Anxiety Disorder questionnaire (GAD-7) for anxiety, the Patient Health Questionnaire (PHQ-8) for depression, and the Insomnia Severity Index (ISI) for insomnia. It evaluated YOI as a structured, home-based intervention to enhance mental well-being during a time characterized by a heightened prevalence of mental health challenges, such as the COVID-19 pandemic.

The research incorporated the Theory of Reasoned Action (TRA), Stress and Coping Theory, and the Health Belief Model to assess the impact of YOI's app-based meditative interventions on the mental health of the global population amid the COVID-

19 pandemic. 1. TRA underscored the importance of beliefs about YOI and the evaluation of mental health as factors influencing individuals' attitudes and intentions, guiding the creation of targeted interventions to promote mental well-being in times of crisis.

2. The Stress and Coping Theory offered insights into how individuals dealt with stressors related to the pandemic. App-based YOI meditative interventions aligned with emotion-focused coping by incorporating practices that facilitated emotional regulation and reduced stress-related symptoms. The study demonstrated how these interventions effectively addressed the unique stressors associated with the COVID-19 crisis, providing a valuable coping mechanism for individuals.

3. The Health Belief Model (HBM) offered a comprehensive perspective on health-related behaviours and decisions, analyzing individuals' past perceptions of susceptibility, severity, benefits, barriers, cues to action, and self-efficacy in relation to their mental health during the pandemic. Individuals who recognized the seriousness of mental health issues during the pandemic were more likely to engage with YOI, believing it could offer benefits such as stress reduction and improved well-being.

As part of the methodology, the Study Group, consisting of 1,505 participants who engaged in weekly YOI non-pharmaceutical meditation interventions through the mobile app, and the Control Group, consisting of 1,300 participants who received alternative interventions, such as wellness articles and related reading materials, during the 8-week study period. In this double-blind study, data collection methods included questionnaires distributed to participants, the utilization of the YOI mobile app by Study Group participants, and the collection of baseline demographic and clinical information.

The study's findings offered significant insights into the impact of the YOI mobile application on mental health, particularly in relation to depression, anxiety, and insomnia symptoms. In terms of the study's demographic composition, the control and participant groups encompassed a diverse range of ages, genders, and racial backgrounds. The majority of participants fell within the 30 to 58 years age range. Importantly, there were no notable distinctions in the distribution of age, gender, or race between the two groups, as confirmed by Pearson's chi-squared tests. This ensured that the study's results were not confounded by demographic variables.

With respect to specific findings, the study's results for RQ1 (Depression) demonstrated that participants using the YOI app experienced a significant reduction in depression symptoms, as measured by the PHQ-8, in comparison to the control group. The reduction was statistically significant, with an average decrease of 3.31 points. Subitem scores also exhibited substantial declines. The findings underscored the app's effectiveness in reducing depression symptoms, supported by the influence of group status and time on the scores.

For RQ2 (Anxiety), similar trends were observed. Participants using the YOI app showed a significant reduction in anxiety symptoms, as measured by the GAD-7, compared to the control group. The reduction was statistically significant, with an average decrease of 2.2 points. Subitem scores also displayed significant reductions, further emphasizing the app's effectiveness in reducing anxiety symptoms, as substantiated by the influence of group status and time on the scores.

RQ3 (Insomnia) revealed that participants using the YOI app reported a significant reduction in insomnia symptoms, as measured by the ISI, in contrast to the control group. This reduction was statistically significant, with a 50% decrease in ISI scores. The control group did not show a significant change in their scores. The findings indicated that both group status and time significantly influenced the scores, highlighting the app's effectiveness in reducing insomnia symptoms.

RQ4 (Combined Symptoms) confirmed that participants who used the YOI app experienced significantly greater reductions in depression, anxiety, and insomnia symptoms compared to the control group. Complex statistical analyses, including two-way ANOVA and post-hoc tests, substantiated the significant impact of the app on all three mental health conditions.

Finally, for RQ5 (Prior Diagnoses), the study found that participants with prior diagnoses of depression and generalized anxiety responded positively to the YOI intervention, exhibiting significant reductions in PHQ-8 and GAD-7 scores. Younger participants and those with self-reported diagnoses experienced greater improvements, emphasizing the app's potential benefits for individuals with pre-existing conditions.

The regression analysis provided additional insights. Younger participants, particularly those aged 26–36 and 37–47, exhibited significantly more substantial reductions in symptoms. Those with self-reported mental health diagnoses, particularly both depression and anxiety, experienced greater improvements. The frequency of YOI module practice was positively correlated with reductions in PHQ-8 and GAD-7 scores, with participants practising 4-6 times per week achieving the best results.

To sum up, this study aimed to investigate the impact of the YOI mobile application on alleviating symptoms of depression, anxiety, and insomnia globally, particularly during the COVID-19 pandemic. The research used standardized assessment tools to measure changes in these symptoms among participants who used the YOI app for 8 weeks. It also incorporated psychological theories to understand the app's effects, including the Theory of Reasoned Action (TRA), Stress and Coping Theory, and the Health Belief Model (HBM). Lastly, the study involved a diverse group of participants (Study Group) and a Control Group. The findings showed that the YOI app significantly reduced depression, anxiety, and insomnia symptoms compared to the control group. It was especially effective for individuals with prior mental health diagnoses, younger participants, and those who practised the app's modules 4-6 times per week.

5.4. Conclusion

This chapter presents a detailed discussion and evaluation of findings, which are presented in light of major themes identified in the data analysis process. It is presented based on the Theory of Reasoned Action (TRA), Stress and Coping Theory, and the Health Belief Model (HBM), as well as compared and contrasted against relevant information from previous studies and research in the field of mental health for holistic wellbeing.

Analysis of the aggregated data derived from answers to four research questions yielded five major themes: 1. Reduction of Depression Symptoms, 2. Reduction of Anxiety

Symptoms, 3. Reduction of Insomnia Symptoms, 4. Differential Impact on Symptom Reductions, and 5. Variability in Response based on Diagnosis.

The first major theme identified in this study, *Reduction of Depression Symptoms*, indicated a noticeable decrease in depression symptoms among YOI users, particularly in items related to feeling down, trouble falling asleep, and low energy levels. The reduction in depression symptoms through YOI use was similar to results seen in exercise-based interventions and slightly less than those observed in cognitive-behavioural therapy (CBT) based on effect size comparisons. Interestingly, certain subgroups, such as younger participants and those with a prior depression diagnosis, seemed to respond more positively to the YOI intervention.

The second major theme, *Reduction of Anxiety Symptoms*, showcased a notable decrease in anxiety symptoms among YOI users, particularly in items related to feeling nervous, excessive worrying, and difficulty relaxing. Notably, participants with a pre-existing diagnosis of generalized anxiety disorder exhibited more positive responses to the YOI intervention compared to those without such a diagnosis. This parallels the findings observed in relation to depression, suggesting that YOI might offer specific advantages to individuals dealing with comorbidities of anxiety and depression.

The results for the third major theme, *Reduction of Insomnia Symptoms*, indicated a substantial reduction in insomnia symptoms among YOI users, showcased by an approximate 50% decrease in both the overall ISI score and across all individual subitems. Unlike depression and anxiety assessments, all subitems within the ISI questionnaire exhibited similar changes, which aligns with the interconnectedness of depression, anxiety,

and sleep quality. By improving sleep patterns, the YOI intervention potentially contributes to enhancing emotional well-being and fortifying one's overall health by bolstering immunity.

The fourth major theme, *Differential Impact on Symptom Reductions*, focused on the comparison between YOI app users and a control group, examining individual scores for depression, anxiety, and insomnia symptoms. The findings indicated that participants engaging with the YOI app experienced significantly greater reductions in all three domains compared to the control group. This observation highlights the substantial and meaningful impact of the YOI app in mitigating mental health symptoms.

Finally, as per the fifth major theme, *Variability in Response Based on Diagnosis*, participants with a prior diagnosis exhibited a more notable improvement in both depression and anxiety symptoms in response to the YOI intervention. Analyzing changes in PHQ-8 and GAD-7 scores revealed statistically significant improvements, emphasizing the tailored efficacy of the YOI intervention for individuals with pre-existing mental health conditions. On the other hand, participants without a prior diagnosis also experienced positive changes in symptom scores, though slightly less pronounced. The findings underscored the YOI intervention's particularly positive impact on individuals with pre-existing diagnoses of depression and generalized anxiety.

CHAPTER VI:

SUMMARY, IMPLICATIONS, AND RECOMMENDATIONS

6.1. Summary

This research delved into addressing the pressing concerns surrounding mental health, especially amid the backdrop of the COVID-19 pandemic. Mental health issues, like depression and anxiety, have been global concerns even before the pandemic struck. The study took note of the escalating mental health challenges induced by the pandemic, including the impact of prolonged physical distancing, stay-at-home orders, and the increased morbidity and mortality rates associated with the disease.

The Yoga of Immortals program emerged as a comprehensive approach developed by ShivYog to tackle these mental health challenges. What set this program apart was its adaptation into a mobile application, making ancient yogic practices accessible and tailored to contemporary needs. Given the constraints imposed by the pandemic, this adaptation addressed the limitations of accessing traditional in-person sessions and mental health services.

The study recruited 1,505 participants and 1,300 control subjects who completed various validated screening questionnaires related to mental health symptoms before and after an 8-week intervention period using the YOI app. The focusing on yogic practices, meditation, and breathing exercises.

Notably, the intervention involved 112 sessions, which were delivered through the app. They comprised a series of yoga postures, meditation, and controlled breathing exercises. The findings revealed a significant reduction in symptoms related to depression, anxiety, and insomnia among those who engaged with the YOI app compared to the control group.

Some noteworthy findings include the observation that younger participants and those already diagnosed with anxiety and depression experienced more substantial improvements. Additionally, a higher frequency of YOI practice correlated with greater reductions in symptoms, indicating a potential dose-response relationship between engagement with the app and symptom relief. Moreover, the study hinted at the interconnectedness between mental health, sleep quality, and immune system function. This interplay underscores the significance of addressing mental health concerns, especially during a pandemic, not only for psychological well-being but also for bolstering overall health, including immunity.

However, the study did acknowledge limitations, such as relying on self-reported data and the absence of detailed information on certain health factors. Nevertheless, the research marks a significant stride in understanding the potential benefits of yoga-based interventions, delivered conveniently through mobile applications, in ameliorating mental health issues during challenging times.

This study's contributions to the field of mental health have been significant on several fronts, further addressing the research problem and purpose. The adaptation of ancient yogic practices into a structured mobile application addressed accessibility barriers.

It offered a solution for individuals facing challenges accessing traditional in-person mental health services due to constraints like time, cost, or geographic location. Additionally, the integration of mindfulness and meditation-based practices into a comprehensive program like YOI signified an innovative approach to mental health interventions. It explored the potential of these practices as self-help tools for managing symptoms of anxiety, depression, and insomnia.

The findings of this study are anticipated to have multifaceted implications. They could offer individuals struggling with the challenges of the pandemic an evidence-based resource for enhancing their mental health and building resilience. Extending beyond academia, the research outcomes could inform mental healthcare professionals, policymakers, and app developers about the potential benefits of integrating app-based YOI practices into existing mental health support frameworks. In a culmination, the study's outcomes have implications for both research and clinical practice, offering an avenue for improving individuals' psychological well-being in an increasingly digital and interconnected world.

Overall, this study underscored the promising role of accessible, comprehensive yoga-based interventions like YOI, especially in the context of a global health crisis, by offering a viable means to address and potentially alleviate symptoms of anxiety, depression, and insomnia.

6.2. Implications

Theoretical Implications

The research was based on three theoretical frameworks, namely, the Theory of Reasoned Action (TRA), the Stress and Coping Theory and the Health Belief Model (HBM). In the context of TRA, attitudes play a pivotal role in shaping individuals' evaluations of a specific behaviour. Applied to the YOI app program, this involves understanding and fostering positive attitudes toward the app's potential to address mental health concerns. Effective communication about the app's benefits, its user-friendly nature, and its potential impact on mental well-being can contribute to the formation of positive attitudes among users. Additionally, ensuring that the program aligns with users' values and preferences can further enhance positive attitudes.

Another crucial element in TRA is subjective norms, which refer to perceptions of social expectations and approval regarding a behaviour. For the YOI app, creating an environment that supports and encourages engagement with mental health interventions is essential. This can involve reducing stigma around mental health discussions and interventions, fostering open conversations, and promoting positive attitudes toward seeking help through apps like YOI. Perceived Behavioral Control, the third component of TRA, focuses on individuals' beliefs about their ability to perform a behaviour successfully. In the case of the YOI app, it is crucial to ensure that users feel confident and capable of incorporating the program into their routine. Clear instructions, user-friendly interfaces,

and addressing potential barriers can contribute to an increased sense of perceived behavioural control, encouraging sustained engagement.

The Stress and Coping Theory directs attention to how individuals identify stressors and employ coping mechanisms. Understanding specific stressors prevalent during the pandemic, such as isolation and uncertainty, allows for tailoring interventions like YOI to address these specific challenges. Positioning YOI as a coping strategy designed to alleviate pandemic-related stressors can enhance its relevance and effectiveness. Coping mechanisms, as emphasized by the theory, vary among individuals. Aligning YOI with existing coping strategies or introducing new coping tools within the app can enhance its effectiveness. For instance, if individuals typically engage in physical activities to cope with stress, the yoga and movement components of YOI may resonate well with their established coping mechanisms.

The Health Belief Model (HBM) underscores the importance of perceived susceptibility, severity, benefits, barriers, cues to action and self-efficacy in influencing health-related behaviours. In the context of mental health and the YOI app:

Perceived susceptibility in the context of the YOI app involves individuals recognizing their vulnerability to mental health issues, particularly during the COVID-19 pandemic. By communicating the increased risk of anxiety and depression associated with prolonged physical distancing and pandemic-related stressors, the YOI program can effectively influence individuals' perceptions of their susceptibility. Highlighting the prevalence of mental health challenges worldwide and the potential impact on their well-

being can motivate individuals to actively engage with the YOI app as a preventive measure.

Perceived severity emphasizes individuals' understanding of the seriousness of mental health issues. For the YOI app, conveying the potential consequences of untreated symptoms on overall well-being is crucial. Information about the adverse effects of prolonged anxiety and depression, not only on mental health but also on physical health, relationships, and daily functioning, can enhance the perceived severity. This understanding encourages individuals to view the YOI program as a valuable intervention to address and mitigate the potential severity of mental health challenges.

Perceived benefits assess individuals' evaluation of the positive outcomes associated with a specific health action. Emphasizing the benefits of using the YOI app is essential in promoting engagement. The program's potential to enhance mood, improve sleep quality, and alleviate symptoms of anxiety and depression should be communicated clearly. Sharing success stories, testimonials, or illustrating concrete improvements in mental well-being can reinforce the perceived benefits, making individuals more inclined to actively participate in the YOI program.

Perceived barriers involve individuals' assessment of the obstacles or challenges hindering the adoption of a recommended health behaviour. In the case of the YOI app, potential barriers could include concerns about the time commitment, perceived complexity of the program, or scepticism about the effectiveness of virtual interventions. Addressing these barriers through clear communication, providing user-friendly interfaces,

and offering evidence-based information on the program's efficacy can help mitigate perceived barriers, facilitating greater acceptance and adoption.

Cues to action refer to external prompts or stimuli that trigger individuals to engage in a health-related behaviour. Incorporating strategic cues within the YOI app, such as regular reminders, progress-tracking features, or personalized messages, can serve as effective prompts. Additionally, aligning the program with existing health campaigns, awareness days, or public health initiatives can create external cues that encourage individuals to initiate and maintain their participation in the YOI program.

Self-efficacy focuses on individuals' confidence in their ability to successfully perform a health-related behaviour. Ensuring that individuals feel capable of integrating the YOI program into their daily lives is crucial. Providing clear instructions, offering introductory sessions, and addressing potential challenges can enhance self-efficacy. Creating a supportive and encouraging environment within the YOI community further contributes to individuals' confidence in their ability to effectively use the app for mental health improvement.

In summary, these theoretical frameworks provide a comprehensive understanding of the cognitive and social factors influencing individuals' engagement with the YOI app. By addressing attitudes, social norms, coping mechanisms, and health beliefs, interventions can be designed to align more effectively with individuals' motivations and needs, ultimately enhancing their impact on mental health.

Implications for RQ1. *How does the regular use of the YOI mobile application impact symptoms of depression among participants, if reported, as measured by the Patient Health Questionnaire, 8 items (PHQ-8)?*

The results and discussions of depression symptoms in the research provided several important research implications. Firstly, the study found that the YOI intervention was effective in reducing depression symptoms among participants. Specifically, it demonstrated a significant reduction in PHQ-8 scores and specific depressive symptoms. This suggests that the YOI intervention holds promise as an approach for managing and alleviating depressive symptoms.

Comparatively, the study indicated that the YOI intervention's effect size (Cohen's d = 0.5 to 0.6) was on par with exercise-based interventions and slightly lower than cognitive-behavioural therapy (CBT). This implies that YOI could be considered an effective alternative or adjunctive intervention for individuals with depression, providing an additional option for treatment.

In terms of specific symptom reduction, the study highlighted that certain symptoms showed more significant improvement with the YOI intervention. Notably, the symptoms "Feeling down, depressed, or hopeless," "Trouble falling asleep," and "Feeling tired or having little energy" saw the most substantial reductions. This indicates that the YOI program might be particularly beneficial for individuals experiencing these specific depressive symptoms. Furthermore, the research suggested that the YOI intervention may be more effective for specific subgroups of patients, including younger participants and

those who had already been diagnosed with depression. This finding emphasizes the potential of tailoring the intervention to specific patient profiles or demographics to enhance its efficacy.

The study also suggested the need for further investigation into the long-term effects and sustainability of the YOI intervention. Although significant improvements in depression symptoms were observed over the 8-week intervention period, the long-term implications of these findings remain an important area for future research. Long-term follow-up studies could provide insights into the durability of the YOI intervention's benefits. Beyond the individual level, the research may have broader clinical and public health implications. The YOI intervention's potential to reduce depressive symptoms could contribute to the development of cost-effective and accessible interventions for individuals with depression. This has the potential to reduce the burden on healthcare systems and improve overall mental health in the population. Overall, the research offered valuable insights into the effectiveness of the YOI intervention for reducing depression symptoms. These findings suggest that the YOI intervention is a promising approach, providing a foundation for future research and potential clinical applications in the field of depression management.

Implications for RQ2. *What is the effect of the YOI app on symptoms of generalized anxiety, as assessed by the Generalized Anxiety Disorder questionnaire (GAD-7), if reported, in comparison to a control group that did not use the app?*

The study demonstrated the efficacy of the intervention in reducing anxiety symptoms, as indicated by a significant decrease in GAD-7 scores in the participants' group. This suggested that the intervention had a positive impact on individuals with anxiety disorders. This information is crucial for clinicians and researchers looking for effective treatments for anxiety. The study also highlighted specific anxiety symptoms that showed the largest reductions, including "Feeling nervous, anxious, or on edge," "Worrying too much," and "Trouble relaxing." Understanding which symptoms are most responsive to the intervention can help tailor treatments to address these specific concerns, providing more targeted and effective care to those in need.

The effect size of Cohen's d = 0.6 to 0.7 for the reductions in GAD-7 scores suggested a moderate to large clinical effect. This indicates that the intervention had a substantial impact on reducing anxiety symptoms in the participants, making it a valuable option for those seeking relief from anxiety. Comparing the results with other interventions, such as exercise-based interventions and cognitive-behavioral therapy (CBT) for anxiety, provided valuable insights. The finding that the YOI intervention performed slightly better than CBT for anxiety suggested that it might be a promising alternative or complement to traditional therapeutic approaches, offering patients more choices for effective treatment.

Notably, participants with a pre-existing diagnosis of generalized anxiety disorder reported better results with the YOI intervention than those without such a diagnosis. This implies that the intervention may be particularly beneficial for individuals who already have a diagnosed anxiety disorder, emphasizing its potential as a targeted treatment for this specific population.

The discussion also pointed out the comorbidity between depression and anxiety, underlining the importance of addressing both simultaneously. The intervention's ability to target both depressive and anxiety-related symptoms concurrently was a crucial finding. It could provide significant relief for individuals with comorbid depression and anxiety, as these conditions often co-occur and share common risk factors, making the intervention a promising option for those with dual diagnoses. These insights have direct clinical implications and can guide future research efforts in the field of anxiety treatment, offering hope for better care and outcomes for those dealing with these conditions.

Implications for RQ3. *To what extent does the YOI intervention alleviate symptoms of insomnia, if reported, as measured by the Insomnia Severity Index (ISI), in participants who utilized the app for an 8-week period?*

The research findings on insomnia symptoms presented in this study yielded implications for both research and clinical practice. One of the key findings was the effectiveness of the intervention in reducing insomnia symptoms among the participants. The study demonstrated that the intervention, which was described in more detail within the research, had the potential to be a promising approach for managing insomnia. Researchers interested in developing interventions for insomnia could draw inspiration from the components and strategies employed in this study. A noteworthy aspect of the research was the differential impact on the control group. Unlike the participants who experienced a significant reduction in ISI scores post-intervention, the control group did not show a substantial change. This specific effect of the intervention on insomnia underscored the need for further research to understand the reasons behind the differential response between the two groups, which could provide valuable insights for the design of future interventions.

The research also delved into the bi-directional relationship between insomnia and depression/anxiety. It emphasized the importance of considering sleep quality in mental health interventions. The study suggested that addressing insomnia could not only reduce insomnia symptoms but also potentially alleviate depression and anxiety, which often co-occur. Future research endeavours might explore the underlying mechanisms of this

relationship and develop interventions that simultaneously target sleep disturbances and mental health symptoms.

An interesting facet of the research was the analysis of individual subitems within the ISI questionnaire. This provided a nuanced understanding of how various aspects of insomnia were affected by the intervention. This granularity could serve as a valuable reference for researchers seeking to comprehend which specific dimensions of insomnia were most impacted by the intervention. Further studies could explore the differential effects of various interventions on specific subitems of insomnia.

The research also drew the connection between sleep quality and the immune system, shedding light on the broader health implications of addressing insomnia. Sleep quality was found to be intricately linked to the immune system, and good sleep quality could not only improve mental health but also enhance immunity. This finding underscored the holistic nature of well-being and hinted at potential avenues for research into the relationship between sleep, immunity, and mental health.

While the research focused on changes over an 8-week intervention period, it hinted at the need to assess the longer-term effects of such interventions on insomnia and mental health. A logical extension of this work would involve longitudinal studies to determine the durability of the observed improvements and whether the positive effects persist over an extended period.

Finally, the research emphasized the importance of considering the generalizability of the findings. It encouraged researchers to explore whether the results held true in diverse

populations and settings. This consideration would be crucial in determining the potential applicability of the intervention in various contexts and populations.

Implications for RQ4. *Are the reductions in depression, anxiety, and insomnia symptoms reported by participants who used the YOI app significantly greater than those observed in a control group that did not use the app?*

The research demonstrated that participants who used the YOI app experienced significant reductions in depression, anxiety, and insomnia symptoms compared to a control group that did not use the app. These findings have implications for mental health interventions and their potential impact on well-being. One significant implication is that the YOI app has proven to be an effective intervention for improving mental health. After an eight-week intervention period, participants reported substantial decreases in symptoms of depression, anxiety, and insomnia. These reductions were statistically significant and clinically meaningful. For instance, the decrease in PHQ-8 scores resulted in a shift from "moderate" to "mild" or "mild" to no symptoms, representing a substantial improvement in mental health. The YOI app's effectiveness in reducing symptoms is comparable to established cognitive-behavioral therapy (CBT) treatments for depression and anxiety.

Moreover, the positive impact of the YOI app extends to multiple areas of mental health. The research showed that participants experienced improvements across depression, anxiety, and insomnia, indicating the intervention's broad reach. This suggests that the app can have a comprehensive influence on various aspects of mental well-being.

The study also identified specific subgroups that may benefit more from the YOI app. Younger participants and those with pre-existing diagnoses of depression or generalized anxiety disorder reported better results. This implies that the app may be particularly beneficial for individuals with certain characteristics or pre-existing conditions, such as youth or specific mental health diagnoses.

The frequency of app usage was another significant factor affecting outcomes. Participants who practised the app module 4-6 times per week showed better results than those who used it 1-2 times per week. This underscores the importance of consistent and frequent app use in achieving positive outcomes, emphasizing the potential for real-world application. The research also raised the intriguing possibility that improving mental health and sleep quality through the YOI app could positively impact immune system health. The connections between depression, anxiety, insomnia, emotional regulation, and immunity are subjects of growing research, and addressing mental health and sleep quality may have broader health implications.

Implications for RQ5. *How do participants with a prior diagnosis of depression and generalized anxiety respond to the YOI intervention in terms of changes in PHQ-8 and GAD-7 scores compared to participants without a previous diagnosis?*

The research revealed that participants with a prior diagnosis of depression and generalized anxiety responded positively to the YOI intervention in terms of changes in PHQ-8 and GAD-7 scores compared to participants without a previous diagnosis. The implications drawn from these findings have significant implications for the field of mental health and well-being.

One notable implication is the positive impact of the YOI intervention on depression symptoms. Participants who completed the intervention experienced substantial decreases in depression symptoms, as measured by PHQ-8 scores. The effect size observed was comparable to that of cognitive-behavioral therapy (CBT) for depression and anxiety. This implies that the YOI intervention can serve as an effective alternative or complement to traditional therapeutic approaches for individuals struggling with depression. Similarly, the YOI intervention demonstrated a positive impact on anxiety symptoms. Participants experienced significant reductions in anxiety symptoms, as indicated by GAD-7 scores. Interestingly, the YOI intervention outperformed CBT for anxiety, suggesting its potential to effectively address both depression and anxiety symptoms concurrently.

Moreover, the research findings indicate that individuals with pre-existing diagnoses of generalized anxiety disorder or depression experienced even more significant improvements in their respective symptoms. This highlights the YOI intervention's

potential to specifically benefit individuals with comorbid conditions or those diagnosed with specific mental health disorders. The research also pointed to the YOI intervention's effectiveness in improving sleep quality. Participants reported a 50% decrease in ISI scores, indicating a substantial improvement in insomnia symptoms. Given the well-established connection between sleep disturbances and mental health, this finding suggests that the YOI intervention can contribute to overall mental well-being by enhancing sleep quality.

The frequency of engagement with the YOI module was identified as a significant factor affecting outcomes. Participants who practised the module 4-6 times per week experienced better results, emphasizing the importance of consistent engagement with the intervention for optimal benefits. The research findings also highlighted a potential link between mental health, sleep quality, and immunity. Improving mental health and sleep quality through the YOI intervention may positively impact the immune system. This has particular relevance in the context of the global pandemic, where the well-being of both mental health and immune health has become a paramount concern.

The research outcomes suggest that the YOI intervention has the potential to significantly improve depression, anxiety, and sleep quality, and these findings have important implications for mental health treatment and well-being. Further research is needed to explore the long-term effects and sustainability of the YOI intervention, especially in comparison to traditional therapeutic approaches.

6.3. Recommendations

The research highlights the demonstrated effectiveness of YOI in alleviating symptoms of anxiety, depression, and insomnia. Overall, mental health professionals are encouraged to introduce the YOI program as a supplementary tool within existing interventions, providing information about the YOI app and its features to offer individuals a more comprehensive approach to managing their mental health. Given the context of the COVID-19 pandemic and the importance of remote interventions, the research suggests promoting the YOI mobile app as a solution to overcome social distancing measures and travel restrictions. Mental health professionals are advised to recommend YOI to clients facing barriers to in-person sessions, enhancing accessibility to mental health practices from the safety of their homes.

The research also emphasizes the importance of frequency and regularity in practising YOI, as indicated by regression analysis showing greater benefits for those who engage more frequently. Mental health practitioners are encouraged to stress the significance of consistent practice to their patients, promoting routine and stability. Demographic considerations are brought into focus, with the research suggesting that mental health professionals tailor their recommendations based on demographic characteristics. For instance, younger participants and those with pre-existing mental health diagnoses may experience more significant improvements with the YOI intervention. This personalized approach ensures that the intervention is not only effective but also relevant to the unique needs of different populations.

For future research, the study suggests longitudinal studies to extend the observation period beyond the initial 8-week intervention, providing insights into the sustainability of YOI's impact on mental health. Comparative studies against traditional interventions are proposed to position YOI within the broader landscape of mental health interventions, contributing to evidence-based information on relative efficacy. The exploration of YOI's impact across diverse demographic groups is highlighted as imperative, with a focus on age, gender, and cultural backgrounds. Understanding how these factors influence the effectiveness of the intervention can guide customization and tailoring for accessibility and relevance across varied populations.

The research also suggests investigating the underlying mechanisms through which YOI influences mental health, incorporating objective measures alongside self-reported data for a more robust assessment. Personalized or customized YOI interventions are seen as a promising avenue for future research, along with qualitative methods to capture participants' subjective experiences. The potential synergies between the YOI program and conventional mental health treatments are recommended for assessment, exploring whether YOI acts as a complementary or augmentative strategy. Finally, the research calls for studies beyond symptom reduction, exploring the impact of YOI on functional outcomes such as daily functioning, work productivity, and social interactions.

Recommendations for Practical Applications

Mental health programs encompass diverse therapeutic approaches to address varying needs. With the demonstrated effectiveness of the YOI program in alleviating

symptoms of anxiety, depression, and insomnia, mental health professionals should consider integrating YOI into their treatment plans. This involves introducing the YOI program as a supplementary tool within existing mental health interventions. Providing information about the YOI app, its features, and potential benefits can offer individuals a more comprehensive and holistic approach to managing their mental health.

The COVID-19 pandemic underscored the significance of remote and accessible mental health interventions. YOI's mobile app, designed for on-demand use, addresses the challenges posed by social distancing measures and travel restrictions. Mental health professionals can play a crucial role in promoting the use of the YOI app as a remote intervention tool. By recommending YOI to clients facing barriers to in-person sessions, practitioners enhance accessibility, allowing individuals to engage in mental health practices from the safety and comfort of their homes.

Like any therapeutic intervention, the effectiveness of YOI may be closely tied to the frequency and regularity of practice. The regression analysis indicates that individuals who engage more frequently with the YOI program experience greater benefits. Mental health practitioners should emphasize the importance of consistent practice to their patients. Encouraging a routine of YOI sessions, both morning and evening as recommended, enhances the likelihood of sustained improvements in mental health symptoms, fostering a sense of routine and stability.

Further, the study's findings highlight that certain demographic groups, such as younger participants and those with pre-existing mental health diagnoses, may experience more significant improvements with the YOI intervention. Mental health professionals can

tailor their recommendations based on these demographic characteristics. For instance, they may emphasize the potential benefits of YOI for younger individuals or those with specific mental health diagnoses. This personalized approach ensures that the intervention is not only effective but also relevant to the unique needs of different populations. By incorporating these recommendations, mental health practitioners can optimize the integration of YOI into their practice, promoting holistic mental well-being.

Mental health practitioners should consider YOI as a complementary component within holistic treatment plans. This involves collaborating with patients to integrate YOI practices alongside existing therapeutic modalities, creating a synergistic approach to mental health care. The YOI app can serve as a valuable tool to enhance overall well-being and complement traditional psychotherapy. Recognizing the diverse needs of individuals, mental health professionals can explore tailoring YOI programs based on specific mental health concerns. Customization may involve adjusting the frequency, duration, or specific components of YOI sessions to address individualized therapeutic goals. This personalized approach ensures that YOI effectively meets the unique needs of each patient.

Practitioners leading group therapy sessions can incorporate YOI practices into their sessions. This could involve guiding patients through YOI techniques collectively, fostering a sense of community and shared mindfulness. Group-based YOI sessions may enhance social support and create a positive, collaborative therapeutic environment. Additionally, providing patients with educational resources about the science and philosophy behind YOI practices can empower them to better understand the intervention. Mental health practitioners can share articles, videos, or written materials that elucidate the

principles of YOI, reinforcing the evidence-based nature of the program. This knowledge can enhance patients' engagement and commitment to the intervention.

Implementing regular assessments of patients' progress with the YOI intervention allows mental health professionals to track improvements and make informed adjustments. Periodic check-ins can involve revisiting mental health questionnaires, discussing subjective experiences, and adapting the YOI program based on the patient's evolving needs. This dynamic approach ensures ongoing effectiveness. Encouraging patients to integrate YOI principles into their daily lives fosters the continuity of meditative practices. Mental health practitioners can guide patients in applying YOI techniques during everyday activities, promoting a mindful approach to stressors. This integration enhances the sustainability of positive mental health outcomes.

These practical recommendations aim to enhance the seamless integration of YOI into mental health practices, promoting a comprehensive and patient-centred approach to well-being.

Recommendations for Future Research

Future research endeavours should prioritize the implementation of longitudinal studies to extend the observation period beyond the initial 8-week intervention. This longitudinal approach would provide valuable insights into the sustainability of the YOI program's impact on mental health and sleep patterns. Understanding the enduring effects and potential variations over an extended duration is crucial for informing the development

of maintenance strategies and offering comprehensive insights into the program's long-term efficacy.

Comparative studies constitute another essential avenue for future research. Conducting thorough benchmarking analyses against traditional psychotherapeutic approaches or pharmacological interventions will contribute to positioning the YOI program within the broader landscape of mental health interventions. Comparative effectiveness studies can serve as a valuable resource for clinicians and individuals seeking evidence-based information on the relative efficacy of different intervention strategies.

An exploration of the YOI program's impact across diverse demographic groups is imperative. Analyzing how age, gender, and cultural backgrounds influence the effectiveness of the intervention can guide the customization and tailoring of the program to ensure its accessibility and relevance across varied populations. Such a nuanced understanding of demographic variations can enhance the intervention's effectiveness and inclusivity. Delving into the underlying mechanisms through which the YOI program influences mental health is a crucial direction for future research. Investigating changes at the neurobiological, hormonal, and neural levels can provide a comprehensive understanding of the physiological and psychological pathways through which the intervention produces its effects. Uncovering these mechanisms is essential for refining and optimizing the intervention for enhanced efficacy.

To enhance the validity of research findings, future studies should consider incorporating objective measures alongside self-reported data. Utilizing wearable devices or physiological monitoring tools can provide more accurate and comprehensive

assessments of participants' mental health and sleep patterns. This integration of objective measures minimizes reliance on subjective reporting, offering a more robust foundation for evaluating the intervention's impact.

An exploration of personalized or customized YOI interventions represents a promising avenue for future research. Assessing whether tailoring the program to individual preferences, needs, or specific mental health profiles enhances its effectiveness and acknowledges the diversity in individuals' responses to interventions. This personalized approach has the potential to optimize the intervention's impact on various mental health outcomes. Further, qualitative research methods, including interviews and focus group discussions, should be incorporated to capture participants' subjective experiences with the YOI program. Qualitative data can offer rich insights into motivation, challenges faced, and perceived benefits. This qualitative dimension adds depth to the understanding of participants' lived experiences, complementing quantitative assessments.

Investigating the potential synergies between the YOI program and conventional mental health treatments is an essential consideration. Assessing whether the YOI intervention acts as a complementary or augmentative strategy to standard treatments for anxiety, depression, and insomnia can inform integrated treatment approaches. Understanding the interplay between the YOI program and conventional treatments contributes to a more holistic approach to mental health care.

Finally, future research should extend its focus beyond symptom reduction and explore the impact of the YOI program on functional outcomes. Assessing improvements in daily functioning, work productivity, and social interactions provides a more

comprehensive perspective on the real-world significance of the intervention. This broader evaluation of outcomes ensures a more nuanced understanding of the intervention's overall impact on individuals' lives.

Collectively, these recommendations set the stage for future research initiatives, aiming to deepen our understanding of the YOI program's effectiveness, mechanisms, and potential integration into diverse mental health contexts.

6.4. Limitations

The findings of this study were derived from self-administered questionnaires, which might possess inherent bias due to the probability of participants exaggerating or downplaying specific symptoms. However, these self-reported questionnaires are commonly employed in psychology research and have been rigorously validated. The study also depended on participants' willingness to adhere to the intervention and complete all questions, which might introduce some bias, as those who experienced more favourable outcomes might have been more motivated to continue their participation. The inclusion of a control group, however, helped mitigate this bias to some extent.

One notable limitation of this initial study was the timeframe in which it was conducted, during the early stages of the COVID-19 pandemic shutdowns in April-June 2020. This compelled the use of self-reported questionnaires as the primary data source. Participants may not have provided completely accurate information about their health status. Furthermore, information about disease diagnoses was obtained from survey

responses only, with no additional confirmation from medical records. Participants were instructed to list any psychiatric diagnoses they had received from their doctors. However, the study aimed to demonstrate the intervention's effectiveness in a broad population, as evidenced by the consistent reduction in self-reported symptoms. Additionally, regression analysis was used to explicitly assess the impact of specific variables, such as the presence of psychiatric diagnoses and other health conditions.

Notably, the surveys did not collect data on weight, BMI, or details related to sleep hygiene. High BMI can lead to sleep apnea, and poor sleep hygiene can contribute to disrupted sleep. If these factors were present in the study population, they could have influenced the results. Future studies employing the YOI intervention will aim to gather more comprehensive and detailed information.

A potential future direction for research involves comparing YOI with other mindfulness-based yoga practices. YOI is a unique combination of yogic positions, breathing exercises, and meditation, which may pose a challenge in finding appropriate interventions for comparison. However, YOI could be compared to other interventions involving physical activity to investigate whether the specific type of physical activity in YOI contributes to the observed effects on depression and anxiety scores. Overall, future research data could further confirm the sustainability of the observed results and whether continued use of the YOI app can serve as a preventive measure against symptoms of depression, anxiety, and insomnia.

6.5. Conclusion

The purpose statement of this double-blind study was to investigate the efficacy and feasibility of a mobile application-based meditative intervention called Yoga of Immortals in mitigating symptoms of depression, anxiety, and insomnia - among individuals experiencing sub-optimal mental health globally, particularly during the challenges posed by the COVID-19 pandemic - using a mixed-method study design.

The study utilized standardized assessment tools and incorporated psychological theories to evaluate the impact of YOI on participants' mental health. The research encompassed two main groups: the Study Group, consisting of 1,505 participants using the YOI app, and the Control Group, consisting of 1,300 participants who received alternative interventions. Data collection methods included questionnaires, app usage tracking, and baseline demographic and clinical information.

The study's findings revealed that the YOI app effectively reduced symptoms of depression, anxiety, and insomnia, with effect sizes comparable to established treatments. Notably, younger participants and individuals with prior mental health diagnoses experienced more significant improvements. The YOI app also demonstrated potential as a preventive tool for mental health issues, particularly during times of crisis like the COVID-19 pandemic.

The positive results of the study suggested that mobile-based meditative interventions like YOI could play a vital role in supporting individuals' mental well-being, especially in populations with limited access to traditional mental health services. The

study recommended future research to focus on long-term effects, comparative studies with other interventions, demographic analysis, and more detailed data collection. Furthermore, the YOI app could be integrated into clinical settings to provide more comprehensive and personalized mental health care. Policymakers and public health officials should consider the potential of digital interventions in addressing mental health challenges in their planning and resource allocation. Finally, the study highlighted the need for further exploration of the gender-specific effects of the YOI app on mental health to tailor interventions to the specific needs of different gender groups.

The study's limitations included the reliance on self-reported data and the fact that it was conducted during the early stages of the COVID-19 pandemic. Future research should consider alternative data sources and explore the specific components of YOI. It should also aim to confirm the sustainability of the observed results and investigate the YOI app's potential as a preventive measure for mental health issues. In addition, future studies could focus on specific mental health diagnoses, separate from depression, anxiety, and insomnia, to offer a more refined understanding of how the YOI app impacts distinct conditions. This could lead to more personalized interventions for different mental health disorders, improving the precision of treatment. Furthermore, research could delve into the interplay between mental health and sleep quality to understand the underlying mechanisms behind the YOI app's positive effects and its potential to enhance overall well-being.

To enhance the study's reliability, future research could incorporate additional measures for validation, such as clinical assessments, medical records, or physiological

data. This more rigorous approach could reduce potential biases and enhance the evidence base for the YOI app's effectiveness. Finally, researchers should consider making their raw data available to the scientific community to promote transparency and further scientific progress.

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APPENDIX A: STANDARDIZED ASSESSMENT SCALES

Patient Health Questionnaire – 8 items (PHQ-8)

SMRC
Self-Management
Resource Center

Personal Health Questionnaire Depression Scale (PHQ-8)

Over the **last 2 weeks**, how often have you been bothered by any of the following problems?
*(circle **one** number on each line)*

How often during the past 2 weeks were you bothered by...	Not at all	Several days	More than half the days	Nearly every day
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed, or hopeless	0	1	2	3
3. Trouble falling or staying asleep, or sleeping too much	0	1	2	3
4. Feeling tired or having little energy	0	1	2	3
5. Poor appetite or overeating	0	1	2	3
6. Feeling bad about yourself, or that you are a failure, or have let yourself or your family down	0	1	2	3
7. Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8. Moving or speaking so slowly that other people could have noticed. Or the opposite – being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3

Scoring

If two consecutive numbers are circled, score the higher (more distress) number. If the numbers are not consecutive, do not score the item. Score is the sum of the 8 items. If more than 1 item missing, set the value of the scale to missing. A score of 10 or greater is considered major depression, 20 or more is severe major depression.

Characteristics

Tested on 1165 subjects with chronic conditions.

No. of items	Observed Range	Mean	Standard Deviation	Internal Consistency Reliability	Test-Retest Reliability
8	0-24	6.63	5.52	.86	NA

Source of Psychometric Data

U.S. National Chronic Disease Self-Management Study. Study described in Ory MG, Ahn S, Jiang L, et al. National study of chronic disease self-management: six month outcome findings. Journal of Aging and Health. 2013 [in press].

Comments

This is an adaptation of the PHQ-9 scale. Since this scale is self-administered in our studies, question #9, "How often during the past 2 weeks were you bothered by thoughts that you would be better off dead, or of hurting yourself in some way?", was deleted. This scale available in Spanish.

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Self-Management Resource Center
711 Colorado Avenue
Palo Alto CA 94303
(650) 242-8040
smrc@selfmanagementresource.com
www.selfmanagementresource.com

Generalized Anxiety Disorder – 7 items (GAD-7)

Generalized Anxiety Disorder 7-item (GAD-7) scale

Over the last 2 weeks, how often have you been bothered by the following problems?	Not at all sure	Several days	Over half the days	Nearly every day
1. Feeling nervous, anxious, or on edge	0	1	2	3
2. Not being able to stop or control worrying	0	1	2	3
3. Worrying too much about different things	0	1	2	3
4. Trouble relaxing	0	1	2	3
5. Being so restless that it's hard to sit still	0	1	2	3
6. Becoming easily annoyed or irritable	0	1	2	3
7. Feeling afraid as if something awful might happen	0	1	2	3
Add the score for each column	+	+	+	
Total Score *(add your column scores)* =				

If you checked off any problems, how difficult have these made it for you to do your work, take care of things at home, or get along with other people?

Not difficult at all _____
Somewhat difficult _____
Very difficult _____
Extremely difficult _____

Source: Spitzer RL, Kroenke K, Williams JBW, Lowe B. A brief measure for assessing generalized anxiety disorder. *Arch Inern Med.* 2006;166:1092-1097.

Insomnia Severity Index

The Insomnia Severity Index has seven questions. The seven answers are added up to get a total score. When you have your total score, look at the 'Guidelines for Scoring/Interpretation' below to see where your sleep difficulty fits.

For each question, please CIRCLE the number that best describes your answer.

Please rate the CURRENT (i.e. LAST 2 WEEKS) SEVERITY of your insomnia problem(s).

Insomnia Problem	None	Mild	Moderate	Severe	Very Severe
1. Difficulty falling asleep	0	1	2	3	4
2. Difficulty staying asleep	0	1	2	3	4
3. Problems waking up too early	0	1	2	3	4

4. How SATISFIED/DISSATISFIED are you with your CURRENT sleep pattern?

Very Satisfied	Satisfied	Moderately Satisfied	Dissatisfied	Very Dissatisfied
0	1	2	3	4

5. How NOTICEABLE to others do you think your sleep problem is in terms of impairing the quality of your life?

Not at all Noticeable	A Little	Somewhat	Much	Very Much Noticeable
0	1	2	3	4

6. How WORRIED/DISTRESSED are you about your current sleep problem?

Not at all Worried	A Little	Somewhat	Much	Very Much Worried
0	1	2	3	4

7. To what extent do you consider your sleep problem to INTERFERE with your daily functioning (e.g. daytime fatigue, mood, ability to function at work/daily chores, concentration, memory, mood, etc.) CURRENTLY?

Not at all Interfering	A Little	Somewhat	Much	Very Much Interfering
0	1	2	3	4

Guidelines for Scoring/Interpretation:

Add the scores for all seven items (questions 1 + 2 + 3 + 4 + 5 +6 + 7) = _____ your total score

Total score categories:
0–7 = No clinically significant insomnia
8 14 = Subthreshold insomnia
15–21 = Clinical insomnia (moderate severity)
22 28 = Clinical insomnia (severe)

APPENDIX B: INSTITUTIONAL REVIEW BOARD APPROVAL

University of CINCINNATI
Institutional Review Board
FWA #: 000003152

EXEMPT DETERMINATION

August 18, 2020

Abhinav Sidana and Sadhna Verma
COM Surgery Urology

Dear Dr. Sidana and Verma,

Institutional Review Board FWA #: 000003152

EXEMPT DETERMINATION

Type of Submission: Continuing Review	
Title:	Survey on use of various mindfulness interventions (YOI) on general health.
Investigator: Abhinav Sidana and Sadhna Verma	
IRB ID: CR01_2020-0494	
Funding: None	
Documents Reviewed: None	
Type of Review: Exempt	
Review Category: • (2)(ii) Tests, surveys, interviews, or observation (low risk)	

On **8/18/2020**, the IRB reviewed the above submission and determined that this protocol meets the criteria for exemption from IRB review in accordance with 45 CFR 46.104.

PI Notification

Ongoing IRB review and approval by this organization is not required. This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these activities impact the exempt determination, please submit a new request to the IRB for a determination. **Note:** The exemptions at 45 CFR 46.101(b) do not apply to research involving prisoners, fetuses, pregnant women, or human in vitro fertilization, Subparts B and C. The exemption at 45 CFR 46.101(b)(2), for research involving survey or interview procedures or observation of public behavior, does not apply to research with children, Subpart D, except for research involving observations of public behavior when the investigator(s) do not participate in the activities being observed.

Thank you for your cooperation during the review process.

College of Medicine
Department of Radiology
Diagnostic Radiology
Section of Body Imaging
University of Cincinnati Medical Center PO
Box 670761
Cincinnati, OH 45267-0761

June 24, 2020

Dear Prof. Ishan Shivanand,

Thank you for efforts to initiate the clinical trials on Yoga of Immortals meditative intervention for the mental health of global population during the ongoing COVID-19 crisis.

I'm pleased to inform you that today, our application process for the University of Cincinnati Institutional Review Board (IRB) has been completed. The IRB approval has been received for *"2020-0494: Survey on use of various mindfulness meditations during the COVID-19 pandemic."*

A reference from rap.irb.uc.edu validating the same has been attached herewith for your review.

We're eager to initiate the project on the efficacy of Yoga of Immortals intervention on the symptoms of depression, insomnia and anxiety under your kind leadership and guidance.

Sincerely,

Sadhna Verma MD, FSAR
Professor of Radiology
Adjunct Professor of Urology and Radiation Oncology
Chair of Quality & Performance Improvement
Director of Prostate Cancer Imaging Program
Midwest Center of Excellence
University of Cincinnati College of Medicine
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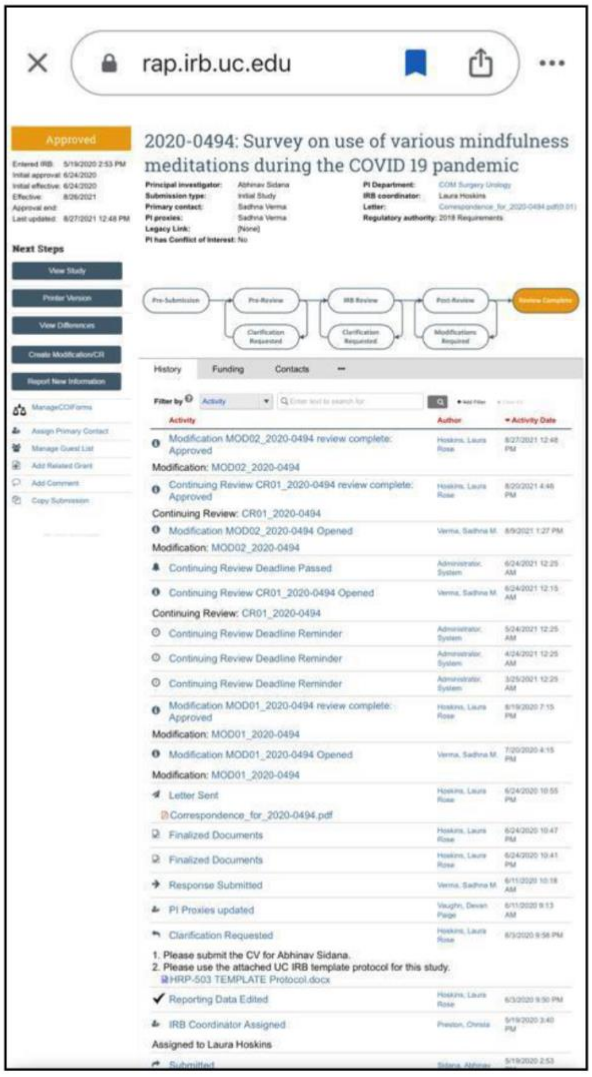

APPENDIX C: CONSENT FORM DECLARATION

Consent Form Declaration

Please read the consent form carefully before you decide whether you want to participate in this study.

Study on the use of Yoga of Immortals meditations on mental health during COVID-19

Thank you for your interest in participating in our research study on mental well-being. The COVID-19 pandemic has enormously disrupted daily life and has greatly increased medical and economic risks to our whole society. Thus, we are forced to deal with greater amounts of stress, in the face of isolation and loneliness. Evidence is increasing that meditation can be effective in improving emotional well-being. Our study deals with an ancient, structured program of meditation and breathing exercises, collectively known as Yoga of Immortals (YOI). A YOI protocol has been developed (30 minutes long) that can be learned online and made widely available to the public. The protocol was not developed for any particular problem or situation, but we are seeking to understand if it may have an impact on symptoms of anxiety, insomnia, and depression in this background of severe disruption from COVID-19. If you would like to join the study, please carefully read the following information before giving your consent for the study. Your participation is strictly voluntary, and we thank you for your help in understanding this crisis.

What does the study entail?

The study involves taking multiple surveys. These surveys will ask questions about your mental and physical health. If you agree to participate, you will first complete surveys prior to the beginning of the intervention. After you finish this first set of surveys you will receive an email prompt regarding access to guided SY protocols (30 minutes long). This process will repeat every week until the end of the study. We ask that you complete each survey within 24 hours of receiving the email so that we can measure your recent experience around a particular time. If you forget to fill out a survey, you will receive one reminder email, after which you will have 3 hours remaining to complete the survey.

What risks are there?

There are no foreseeable risks. However, we will ask you to examine your physical and mental state (for example, how anxious you feel). It is possible that you may find this stressful, given the nature of ongoing events. If you feel any distress, discomfort, or anxiety about answering any of the questions, completing the surveys, or any other aspect of the study you are free to withdraw immediately. You may stop the study at any time, for any reason, without needing to justify your reason for stopping. Any data you provide can inform the study, even if you decide to withdraw, and if you do decide to withdraw, you may ask to have your data deleted from the study at that time.

Who can participate?

Anyone over the age of 18, who is fluent in English may participate. Unfortunately, we are only able to provide the survey in English, so you must be able to understand and respond to all prompts in this language. We apologize for this limitation.

What data will you keep, and what will you do with it?

To provide you with each survey, your email address will be stored in a secure database, which only the research team can access. This data will only be stored while you are participating in the study, afterwards, your information will be deleted. When we are ready to publish a scientific article from the project, we will upload a full record of the anonymized data for analysis.

By clicking "Submit", you indicate that you have read and understood the above consent and agree to participate in the study

APPENDIX D: APPROVAL LETTER FOR RESEARCH PROBLEM CITATIONS

To:

Prof. Ivica Katavic
Swiss School of Business and Management
Geneva

Friday, 7th April 2023

Subject: [Request for approval] Reconsideration of the citations added in Research Problem

Dear Prof Katavic,

Thank you for your thoughtful guidance and support on my assignments for the Doctor of Business Administration so far.

As you rightly pointed an area of improvement, since my empirical research was conducted in year 2020, the research problem must also include relevant citations from the same year along with (Büssing, Baumann and Surzykiewicz, 2022; Magnavita, Soave and Antonelli, 2021a; Magnavita, Soave and Antonelli, 2021b).

In order to address the approved research problem for Yoga of Immortals, i.e. "the lack of regular practice of non-pharmaceutical meditative interventions for mental health during COVID-19", I'm proposing the addition of the below citation to the research problem:

"Green, J., Huberty, J., Puzia, M. and Stecher, C. (2020). Does persistent meditation and physical activity mediate the relationship between perceptions of COVID-19 and mental health? A cross sectional survey of mobile app users in the United States. doi:https://doi.org/10.21203/rs.3.rs-53798/v1."

The research is among the limited existing literature from 2020 that gives a nuanced understanding of our research problem, with elaborate data references and findings on individuals who reduced or stopped undertaking meditative interventions for their mental health during COVID-19.

Looking forward to your thoughts and kind approval.

Thank you,

Ishan Shivanand

APPROVED BY:

Ivica Katavic, PhD
Mentor