

# Mindfulness for Anxiety Management and Happiness: The Role of VR, Metacognition, and Hormones

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**Abstract.** Chronic stress, even at a young age, has become a major health concern with the harmful effects on cognition, mood, and well-being largely underestimated. Mindfulness interventions are well-recognized as effective strategies in stress management. However, we know less about the impact of mindfulness on physiological indicators such as hormones/neurotransmitters. This review study aims to provide representative studies regarding the impact of mindfulness practices on hormones and neurotransmitters, which are responsible for stress regulation, positivity, and wellness. Taking into consideration the difficulties that many people have to follow a conventional mindfulness program, we also investigated the effectiveness of virtual reality as an assistive tool for mindfulness training. The results confirmed our initial hypothesis, according to which mindfulness training reduces stress hormones while increasing hormones/neurotransmitters which induce relaxation along with positivity and self-satisfaction. Virtual reality provides several advantages facilitating training conditions, optimizing the experience, and increasing the effectiveness of interventions. In addition, it strengthens self-control skills. These results indicate also that those physiological parameters, which are considered to be out of human control, can be modified with self-control practices. We conclude that mindfulness practices constitute a form of metacognitive training by which individuals can take control and balance the physiological processes that determine cognition, mood, and well-being. Virtual reality maximizes therapeutic outcomes, especially for people with disabilities or difficulties with conventional interventions.

**Keywords.** Virtual reality, mindfulness, hormones, neurotransmitters, metacognition, stress regulation, positivity

## Introduction

### Stress and hormones

Survival requires the human body to continually adapt to the changing internal and external environmental stressors. Homeostasis is responsible for regulating internal physiological states to keep the human body alive (O'Connor, Thayer, and Vedhara, 2021). The stress system is considered an adaptive mechanism that intends to preserve homeostasis by activating two fundamental systems namely the sympathetic–adrenal–medullary system and the hypothalamic–pituitary–adrenal axis (Yaribeygi et al., 2017; O'Connor et al., 2021). The stress response is inseparably associated with the release of hormones (e.g., cortisol, adrenaline, and noradrenaline) as well as rotations between the two branches of the autonomic nervous system, namely the sympathetic nervous system which is responsible for energy mobilization as well as the fight-or-flight response, and the parasympathetic nervous system for vegetative and restorative functions and with rest-and-digest (O'Connor et al., 2021).

However, under certain circumstances, stress response disturbances can entrain human health in pathological conditions (Yaribeygi et al., 2017). Depending on the nature, duration, and severity of the stressful conditions, stress may cause a variety of responses in the body, ranging from disturbances in homeostasis to life-threatening effects, and diseases. Elevated anxiety, for instance, is associated with cognitive deficits, learning difficulties, and behavioral problems. For instance, systematic observations have revealed a close association between uncontrollable stress and memory deficits, due to the sensitivity of the hippocampus and amygdala as well as due to the action of stress hormones such as cortisol and noradrenaline (Yaribeygi et al., 2017; Kumar et al., 2012; Kim et al., 2015). Other studies have shown that

uncontrollable stress can provoke detrimental alterations in neurotransmitters as well as hormones that keep the organism relaxed, aware, and in a positive mood. For instance, anxiety minimizes the neurotransmitters of relaxation, positive mood, and creativity like gamma-aminobutyric acid (GABA), serotonin, and melatonin (Kumar et al., 2012).

Hormones of stress and happiness comprise a ‘hard-wired’ control system that plays a crucial role in regulating emotions, mood, and behavior. They obey the rules of evolution and survival facilitating one to rapidly make behavioral adjustments according to environmental changes (Lövheim, 2012). Hormonal dysregulation is associated with various disorders such as anxiety, attention deficit hyperactivity disorder, depression and many other behavioral disturbances. Studies have shown that instant changes in neurochemical levels may have a marked impact on our psychobehavior (Choudhury et al., 2018). In addition, hormones determine the smooth function of brain structures responsible for emotion processing such as the amygdala, hippocampus, and prefrontal cortex (Lövheim, 2012). Although each hormone has a special role in health management, several hormones are closely associated with positive mood and sociability such as serotonin and oxytocin, while the elevation of other hormones such as cortisol, and norepinephrine cause heavy anxiety and low mood (Drigas and Mitsea, 2020).

### **Metacognition, Stress, Hormones and Happiness**

Drigas and Mitsea (2020, 2021) define metacognition as the set of regulatory meta-abilities and meta-skills that are consciously applied aiming at the smooth operation of the cognitive & psychophysiological mechanism as a means of achieving functional capability, self-efficacy, independent living & life satisfaction. Metacognition involves consciousness-raising skills and strategies including individuals’ ability to observe, regulate and adapt their internal cognitive processes, recognize the difference between functional and dysfunctional states of mind and consciously choose those states that awaken the full range of their abilities and identity”. According to their theory, metacognition is a matter of systematic training.

Metacognition is related to control processes, higher-order thinking, and awareness of meta-abilities (Drigas and Mitsea, 2020; 2021). Studies have shown that the neural system supporting various aspects of metacognition, such as self-control abilities, are located in the prefrontal cortex, a brain area that is too sensitive to stress-related factors, such as the stress hormone cortisol (Qiu et al., 2018; Arnsten, 2019). Except for prefrontal areas, other studies associate metacognitive abilities with hippocampal microstructures (Allen et al., 2017). As the severity of stress increases, alterations in neurochemicals, synaptic plasticity, neural activity, and neurogenesis in the hippocampus occurs leading to metacognitive impairments, learning and memory deficits, and contributing to psychopathologies (Kim et al., 2015). According to Fan et al. (2015), psychosocial stress induces changes in connectivity between the amygdala and hippocampus, altering the sensitivity to oxytocin, the hormone of positivity and sociability.

According to Drigas and Mitsea (2021), metacognitive abilities are too sensitive to uncontrollable stress. However, according to their study, there is also another option in the relationship between stress and metacognition. As they stated, metacognition, the sympathetic-parasympathetic nervous system, and stress-related hormones create a triangular relationship, while metacognition, the epitome of the highest abilities of the forebrain (executive functions), constitutes the conscious regulator of the networks that activate and deactivate stress. Metacognitive training can be an effective strategy to help subjects voluntarily regulate stress and activate the parasympathetic nervous system which induces relaxation along with the release of relaxation and happiness hormones such as serotonin. Metacognitive skills training, allows people to monitor, observe, recognize and adjust thoughts and emotions, to avoid an

unjustifiable stress response and prolonged sympathetic nervous system activation. By developing this kind of consciousness, one becomes the real “driver” of the centers of fear taking conscious decisions about the sympathetic-parasympathetic nervous system activation and hormones release.

### **Mindfulness as a Metacognitive Strategy for Stress Management**

Mindfulness is defined by Kabat-Zinn et al. (2003) as the consciousness that emerges through paying attention to the present moment and non-judgmentally observing the unfolding of experience moment by moment. Vago et al. (2012) describe the concept as a method for developing a multidimensional skillset for the reduction of self-processing biases which produce psychological anxiety and as a continuous discriminative attentional capacity termed “mindful awareness.

Mindfulness is strongly tied to systematic mental training. In addition, it is used as an intervention strategy. Mindfulness training requires the practice of orienting one’s attention to the present moment and monitoring any thoughts, sensations, and emotions that arise in real-time experience (Tang et al, 2015). Mindfulness training attempts to cultivate self-awareness, the ability of self-regulation along with the cultivation of a healthy relationship between oneself and others (Vago et al., 2018).

Mindfulness therapies, according to Hölzel et al. (2011), are inextricably linked to the following metacognitive components, which attach to the self-regulation system: (a) attention management, (b) bodily awareness, (c) emotion regulation, and (d) change in self-perception.

According to Lutz et al. (2008), the primary mechanism involved in mindfulness practices is attention. Attentional orienting (curiosity, openness, and acceptance), engaging attention, and maintaining-monitoring attention are the major attentional processes involved. Malinowski (2013) highlighted the importance of the attentional control mechanism. Other researchers have found that mindfulness training increases inhibitory control, perhaps alleviating some elements of impulsivity (Soler et al., 2016). Moore and Malinowski (2009) stress the need for mental flexibility. Drigas and Mitsea (2020) take the view that mindfulness and metacognition share a common ground. According to their research, mindfulness practices constitute a form of metacognitive training. For that reason, they developed the 8 pillars metacognitive model of mindfulness, which consists of the following eight components: (1) understanding mindfulness, (2) applied mindfulness, (3) mindful self-observation, (4) mindful self-regulation, (5) flexibility, (6) recognition, (7) discernment and (8) Mnemosyne (remembrance).

### **Virtual reality in Mindfulness**

Virtual reality (VR) can be defined as an interactive 3D “imaginal system” that replaces a real-world environment with a virtual one. VR is different from other media because it induces a sense of presence, the feeling of being inside the virtual experience (Riva et al., 2016). VR technology has various applications in different areas of research (Lan, Li & Cheung, 2021).

Regular mindfulness practice is beneficial for mental health, but mindfulness can be challenging to implement, with environmental and personal distractors frequently identified as obstacles. Virtual reality may address these issues by offering an immersive environment for practicing mindfulness and by assisting the user to orient attention to the present moment within a customized virtual setting (Seabrook, 2020; Kelly et al., 2022; Drigas, Mitsea & Skianis, 2022). Various relaxation techniques could benefit from merging with virtual reality (VR) technologies, as these technologies are easily applicable, involving, and user-friendly (Mazgelytė et al., 2021).

Over recent decades, chronic stress even at an early age has become a worrying health problem with the negative effects on health, cognition, and well-being to be frequently ignored.

Especially for people with learning disabilities, elevated anxiety is considered commonplace (Nelson & Harwood, 2011). Interventions that promote self-awareness such as mindfulness practices are being examined as effective strategies to help people avoid chronic stress (Carro et al., 2022). However, fewer research studies co-examine the physiological parameters such as the impact of mindfulness on hormones/neurotransmitters in addition to anxiety regulation. Even fewer studies review these findings. For that reason, the first aim of this study is to review the literature regarding the impact of mindfulness practices on hormones and neurotransmitters which are responsible for stress regulation and positivity. The initial hypothesis is that mindfulness practices that induce relaxation and positivity, produce physiological alterations in the endocrine system and especially in the hormonal system.

Although mindfulness has been shown to reduce stress and improve mental health, a high percentage of individuals face various difficulties to follow a mindfulness program. Thus, it is a challenging idea to explore the effectiveness of utilizing virtual reality as an assistive technology in mindfulness training for anxiety management.

## 2. Methodology

The purpose of the current review study is to provide representative evidence regarding the impact of mindfulness training on stress and happiness biomarkers as well as to explore the effectiveness of virtual reality mindfulness in stress management skills. To that end, we present a brief, representative, and non-exhaustive literature review.

Three databases were chosen: Scholar google, PubMed and Mendeley using a combination of the keywords. For the first research question, we used the following keywords: mindfulness training, hormones, neurotransmitters, cortisol, serotonin, melatonin, and endorphins. For the second research question, we utilized keywords such as virtual reality mindfulness, stress, and self-regulation. The search was applied to each database from 2000 up until August 2022.

Specific titles and abstracts of the studies retrieved from the three databases were screened based on the following criteria: the studies should incorporate mindfulness interventions with or without virtual reality, studies that measure hormone levels after mindfulness training, VR mindfulness intended to help patients with anxiety. We excluded non-English studies and studies that examined other technologies except for virtual reality. Following the preliminary screening of the titles and abstracts and references to other relevant studies, the studies were assessed to decide if they met the inclusion criteria. Following the preliminary screening of the titles and abstracts and references to other relevant studies, the studies were assessed to decide if they met the inclusion criteria.

## 3. Literature Review

### 3.1 The Effect of Mindfulness Training on Stress and Happiness Biomarkers

#### Cortisol -The hormone of stress and depression

Carro et al. (2022) examined whether mindfulness training can reduce hair cortisol levels and enhance social integration in 7- to 8-year-old children. Thirty-five participants were divided into two groups: 18 participants in the intervention group and 17 in the waitlist group. Cortisol and social integration were assessed in both groups before and after the intervention, which lasted an entire school year (one meeting per week, 28 hours in total). Each session included mindful self-awareness activities as well as practices that enhance socio-affective and socio-cognitive processes implemented in dyads or larger groups. For instance, the participants practiced tai chi and chi kung exercises and breathing awareness, which favored focused

attention and inner perception. The results showed that the experimental group showed a significant reduction in cortisol levels, as well as a significant enhancement of social integration levels, whereas no changes were observed in the wait-list group. The results are confirmed by similar studies by Carro, D'Adamo, and Lozada (2021), who found a decrease in cortisol levels in a similar intervention.

Koncz et al. (2022) conducted a pilot study to examine the effects of a brief mindfulness program on executive functions (i.e. inhibition control, mental flexibility, short-term memory) and cortisol levels and cortisol reactivity in first-grade students. Sixty-one preschoolers participated in this study. It was found that a short, mindfulness-based intervention relaxation training was feasible in helping children in the kindergarten setting to regulate stress and reduce cortisol levels.

### **Epinephrine & Norepinephrine- The hormones of alertness**

Infante et al. (2001) examined the plasma concentrations of epinephrine and norepinephrine of nineteen practitioners of transcendental meditation aged between 18 and 40 compared with sixteen healthy control subjects, with ages ranging from 22 to 35, who had not previously used any relaxation technique. The results showed that morning and evening norepinephrine levels and morning epinephrine levels were significantly lower in the meditation group than in the control subjects.

### **Serotonin – The hormone of positivity**

Bujatti et al (1976) investigated whether a mental relaxation technique known as transcendental meditation can elevate serotonin levels. The researchers analyzed the urine samples of 11 healthy practitioners aged 19 to 61 years, and the data compared to those obtained from the controls, 13 healthy subjects. Of the 11 meditators, samples of 2-hour urine were taken 2 hours before and 2 hours after the start of the 30 minutes practice in the group (3 p.m. to 5 p.m. and 5 p.m.--7 p.m.). It was found that the 5-HIAA serotonin metabolite increased significantly (50%) following 20 minutes of transcendental meditation practice. Already before they started employing the technique, the experimental group's levels were twice as high as the control group's, demonstrating a long-term permanent increase.

### **Oxytocin- The hormone of sociability**

Bellosta et al. (2020) investigated the effects of a brief mindfulness intervention on positive and negative affect, state anxiety, and salivary oxytocin. Sixty-eight students were divided into two groups, the experimental group (n=42) received guided meditation exercises, whereas the control group (n=26) an emotion recognition exercise. The results showed significantly better outcomes for the experimental group compared to the control group. Specifically, it was found a reduction in negative affect and anxiety, while there was also a significant increase in oxytocin levels. These results may explain why mindfulness practices can help people with autism improve empathy and social interaction. In a similar study, Bellosta et al. (2020) examined whether mindfulness could elevate oxytocin levels. Ninety students were divided into three groups: Thirty-seven subjects in the experimental group, twenty-seven in the active control group, and twenty-six in the waiting list group. The results showed increased oxytocin levels for the mindfulness group.

### **Endorphins – The hormone of bliss**

Yadav et al. (2012) examined the efficacy of a mindfulness program in reducing stress and inflammation. Eighty-six patients (mean age of  $24 \pm 5$  years) with chronic inflammatory diseases and obesity took part in a program that included pranayama breathing exercises, asanas

(postures), and other mindfulness practices. The results of the study revealed that, after the intervention, the mean levels of cortisol decreased, while endorphins increased.

Harte et al. (1995) examined whether meditation increases endorphin levels. The neurochemical release of two sets of people, 11 top runners (mean age, 31.3 years) and 12 highly skilled meditators (mean age, 31.6 years), was studied after running and meditation, respectively. The meditation included chants, breathing awareness, and concentration. The findings of this study revealed that not only physical exercise elevated endorphins but also meditation.

### **Dehydroepiandrosterone (DHEA)- The hormone of mood regulation**

DHEA and especially the cortisol/DHEA ratio is considered another biological marker related to chronic stress. Cortisol and DHEA have antagonistic effects. Each time cortisol increases during stressful times, DHEA decreases. Schultchen et al. (2019) examined the effects of an 8-week body scan intervention on perceived psychological stress and hormones in hair (cortisol, dehydroepiandrosterone (DHEA), and its ratio). Forty-seven healthy students were divided into the intervention body scan group (n = 24) and the control group (n = 23). The results showed that the body scan group showed a decrease in cortisol levels, and cortisol/DHEA ratio, as well as an increased level of DHEA compared with the audiobook group. Finally, it was observed a decrease in psychological stress.

### **Dopamine – The neurotransmitter of pleasure and motivation**

Kjaer et al. (2002) tested their hypothesis that endogenous dopamine release increases during the loss of executive control in Yoga Nidra meditation. Yoga Nidra trains practitioners in a relaxed state characterized by reduced conscious control and increased sensory awareness and vivid imagery. Eight experienced meditation teachers aged 31 to 50 years underwent two C-raclopride PET scans: one while listening to a speaker with their eyes closed and one while actively meditating. The data derived from PET scans showed enhanced endogenous dopamine release in the ventral striatum at about 65% during Yoga Nidra meditation. At the same time, it was observed elevated theta brain activity along with a feeling of gratification and reduced arousal. This was the first in vivo demonstration of an association between endogenous neurotransmitter release and regulation of conscious states at a synaptic level.

### **Melatonin- The hormone of deep relaxation**

Tooley et al. (2000) investigated whether mindfulness practices can increase melatonin levels. Two different experiments on two groups of experienced mediators were conducted using a repeated measurement strategy for identifying alterations in plasma melatonin levels at midnight. In the first trial, 11 experienced meditators in transcendental meditation Sidhi were recruited to practice meditation between 00:00 and 01:00 on one of the two nights. On the control night, participants spent time sitting quietly. In the second experiment, seven yoga practitioners meditated for 30 minutes. The results revealed that plasma melatonin levels were greater in the period immediately following transcendental meditation compared to the same period at the same hour on a control night.

### **Gamma-aminobutyric acid (GABA)- The anti-stress neurotransmitter**

Streeter et al. (2020) examined whether a 12-week mindfulness intervention was associated with increased gamma-aminobutyric acid (GABA) levels and decreased depressive symptoms in participants with major depressive disorder. A total of 30 clinically depressed patients were randomly allocated into two groups. Both groups received Iyengar yoga and coherent breathing

with the only difference in duration. The researchers supported the hypothesis that one of the mechanisms through which mindfulness improves mood is by increasing the activity of the GABA system.

Guglietti et al. (2013) employed transcranial magnetic stimulation to examine brain activity before and after a sixty-minute meditation session in a group of thirty-five participants who meditated. They concluded that meditators have higher threshold concentration and emotional regulation capacity because meditation increased activation in the prefrontal cortex and stimulated the reticular nucleus of the thalamus, implicating the production and delivery of the inhibitory neurotransmitter gamma-aminobutyric acid (GABA).

### **3.2 Virtual Reality Mindfulness Training for Anxiety Management**

Mazgelytė et al. (2021) compared the effectiveness of brief VR-based biofeedback-assisted interventions including electroencephalographic biofeedback, mindfulness-based biofeedback, galvanic skin response biofeedback, and respiratory biofeedback. Forty-three healthy volunteers with a mean age of 34.7, comprising were enrolled. The stress hormones were also measured. The results indicated that all VR-based relaxation techniques reduced cortisol levels.

Serra-Pla et al. (2016) designed and assessed the first VR mindfulness therapy for stress management in a sample of ADHD patients. In a preliminary trial, 25 patients enrolled in four 30-minute VR mindfulness sessions, while 25 others were treated with psychostimulants. The findings suggested that the experimental group experienced greater reduced anxiety and better self-management skills.

Lunsky et al. (2022) developed a virtual group-based mindfulness intervention, adapted to the needs of autistic individuals, and assessed its feasibility. Thirty-seven autistic adults aged between 18 to 52 years took part in a six-week program. According to the qualitative feedback, participants reported that they could better regulate anxiety, utilize coping strategies and make connections with other autistic adults.

Cikajlo et al. (2017) investigated whether virtual reality could provide a fertile ground for utilizing mindfulness in anxiety therapy. They designed a cloud-based system, which offered a web interface for the mindfulness coach and remote clients. Each participant joined the virtual mindfulness session through an avatar using a mobile phone and a basic head-mounted VR headset. The coach could give instructions over the web interface with the participants utilizing the headset. The study recruited four employees and four participants with traumatic brain injury for 8 weeks in a mindfulness-based stress reduction course. The results showed that participants achieved better self-regulation of anxiety and attention. Therefore, they felt more self-satisfaction.

In a randomized controlled trial, Modrego-Alarcon et al. (2021) evaluated the effectiveness of a virtual reality mindfulness intervention on students' ability to self-regulate their anxiety. A total of 280 participants were randomly assigned into three groups: VR mindfulness intervention, conventional mindfulness training and relaxation therapy. For six weeks, group sessions with 15 or 16 participants were held once a week for 90 to 75 minutes. According to the findings, VR mindfulness had a better impact on stress control, psychological flexibility, emotional balance, and academic engagement compared to the other two conditions.

In a case study, Nararro-Haro et al. (2016) explored the effectiveness of a VR mindfulness intervention in a 32-year-old female diagnosed with borderline personality disorder, a disease characterized by emotional fragility, aggression, and problematic interpersonal connections. To assist the patient concentrate her attention and practicing DBT® mindfulness skills, she was immersed in virtual reality and observed herself "floating down" a 3D computer-generated river while attending DBT® mindfulness training audios. The virtual reality mindfulness intervention helped the patient better regulate anxiety and develop more positive emotions.

Chavez et al. (2020) intended to assess the feasibility of delivering virtual reality meditation and gathering outcome indicators like depression, anxiety, and physiologic stress (salivary cortisol). A sample of 30 depressed participants was divided into three conditions: (a) VR meditation, (b) audio meditation, or (c) virtual reality imagery. Anxiety levels dropped across all groups, with the virtual reality meditation group experiencing a greater. Although self-reported anxiety was reduced in all groups, salivary cortisol levels did not decline.

Navarro-Haro et al. (2019) conducted a pilot study to examine the efficacy of VR mindfulness on self-regulation under extreme stress. An additional purpose was to assess the impact on depression, emotion management and interoceptive awareness. Forty-two individuals with generalized anxiety disorder were randomly assigned to either conventional mindfulness intervention or VR mindfulness. The VR mindfulness intervention produced considerably improved effects in terms of anxiety and depression symptoms decreased, emotion control, mindfulness, and interoceptive awareness.

Mistry et al. (2020) evaluated the potential therapeutic application of virtual reality meditation in people with posttraumatic stress disorder. In a within-group mixed-methods study, 96 young adults participated in both VR- and non-VR-guided meditations and reported on their affect and perceived satisfaction. Participants in VR mindfulness intervention reported more positive emotions.

Yüksel et al. (2020) investigated the efficacy of VR slow breathing in a sample of high-school teenagers with anxiety and sleep difficulties. Twenty-nine participants aged between 16 and to 18-year-old with and without anxiety were engaged in deep diaphragmatic breathing while passively viewing a relaxing immersive VR environment meant to induce relaxation for about twenty minutes. The VR mindful breathing intervention resulted in a significant immediate increase in perceived relaxation and reduced worry.

## Conclusions

The incorporation of digital technologies in education and in intervention domains is very productive and successful, facilitates and improves the educational procedures via Mobiles [59-68], various ICTs applications [69-101], AI & STEM [102-113], and games [114-119]. Additionally the combination of ICTs with theories and models of metacognition, mindfulness, meditation and emotional intelligence cultivation [120-143] as well as with environmental factors and nutrition [55-58], accelerates and improves more over the educational practices and results and finally improves the wellbeing of the students.

More specifically this current review study aimed to determine the impact of mindfulness practices on hormones and neurotransmitters which are responsible for stress regulation and positive mood. The results indicated that mindfulness training significantly affects the secretion of hormones and neurotransmitters that substantially affect mood and anxiety levels. It was found that mindfulness practices reduce the stress hormones (i.e. cortisol and norepinephrine) and increase hormones that boost self-control, relaxed awareness, and self-satisfaction, namely serotonin, oxytocin, endorphins, melatonin, and gamma-aminobutyric acid. The research studies which were selected provided evidence about the hormones along with psychological modifications, giving a clear enough picture of the reasons that make mindfulness training an effective strategy for reducing anxiety, improving positivity, and developing self-regulated behaviors.

The second objective was to identify the effectiveness of virtual reality as an assistive tool for supporting mindfulness training for anxiety treatment. Although research regarding the usability of virtual reality mindfulness is still at a preliminary stage, the findings from current experimental research are quite encouraging. VR mindfulness therapy can be very helpful for people who have difficulties to follow a conventional mindfulness training.

Future research should focus on designing the context and the content according to which mindfulness practices could maximize positive outcomes for people with anxiety, learning disabilities, and mood disorders. Moreover, additional research is needed with randomized controlled trials to provide additional evidence about the impact of mindfulness practices with or without virtual reality on various physiological parameters.



Fig1. Mindfulness practices reduce stress and elevate hormones of optimism and self-regulation.

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