Structured slow deep breathing: Comparing the differences between practicing in an individual setting versus a group setting and its impact on well-being

Structured slow deep breathing: Comparing the differences between practicing in an individual setting versus a group setting and its impact on well-being

Danielle Devarney

A Thesis in the Field of Psychology

for the Degree of Master of Liberal Arts in Extension Studies

Harvard University

May 2024

Abstract

This study investigated whether a 5-day slow deep breathing (SDB) protocol (between 4-10 cycles of breath per minute) with extended exhalations, a type of body-oriented psychotherapy (BOP), impacted short-term (5 days post-intervention), and long-term (30 days post-intervention) well-being. Additionally, this study examined the impact of environment (e.g., individual vs. group) on the efficacy of the SDB protocol. BOP utilizes verbal and non-verbal body techniques to enhance self-awareness and foster patient communication. Group-based BOP has been shown to be particularly effective at promoting self-understanding and interpersonal connection. SDB has been associated with positive physiological changes and improved emotional regulation, immune function, heart rate variability, stress, anxiety, depression, and overall well-being. To assess the impact of (SDB) in individual and group environments, a between-subjects study was conducted comprised of 134 participants from multiple countries. Multiple aspects of the participants' well-being were measured, including self-reported anxiety, depression, stress, mental and physical quality of life, and sleep. These standardized questionnaires were carried out at three different time points: pre-intervention, post-intervention, and after 30 days. The analysis involved examining the entire participant sample independently and comparing the effects within two distinct environments, group versus individual. The study's findings revealed that after five consecutive days of a 20-minute slow deep breathing (SDB) protocol with extended exhalations, perceived states of well-being significantly increased across all participants, regardless of the intervention

environment. Furthermore, these results remained significant 30 days post-intervention. However, comparing the group to the individual setting did not yield significant results for performing better within a particular environment. Substantially higher compliance rates in the group setting suggest that social dynamics, including shared experiences and support, may enhance commitment to therapeutic practices and, by extension, yield better outcomes. Future research should aim to incorporate a broader range of methods, participant demographics, and an extended duration of study to fully understand the long-term effects and potential advantages of somatic interventions in varied settings.

Author's Biographical Sketch

Danielle Devarney is a seasoned educator and guide, having spent over 20 years teaching, studying, leading retreats, and practicing lifestyle medicine through yoga, breathwork, dance, photography, and motherhood. She has been featured twice in USA Today for her work training and rehabilitating professional athletes with therapeutic yoga and breathwork. More recently, as a polyvagal informed practitioner of the Safe and Sound Protocol (SSP) and a certified life coach, Danielle has combined her passion for mental health, music, neuroscience, exercise, therapy, and coaching into a holistic private practice called Wellness Walks. Ultimately, her goal with this research and beyond is to contribute to bridging the gap between different fields of psychology and expand the understanding of somatic interventions, group therapies, and their potential to accelerate healing.

Dedication

I dedicate this work to my husband, Reis, for his unwavering support and encouragement; I could not have done it without him. To my daughters, Lennox and Sinclair, thank you for understanding that moms pursue dreams too. To my mother, father, and stepparents, who have always been avid learners, for inspiring me to seek higher education. And to my dearest friends Lauren Duke, Verity Hoskins, Tristan Prettyman, Libby Carstensen, and Elise Purcell, for listening, encouraging, providing study spaces and childcare, and celebrating every step of this journey with me. It really does take a village.

Acknowledgments

I want to thank all my professors, with a special appreciation for my thesis director, Dr. Beth Frates, for her guidance, support, and inspiring Lifestyle Medicine course that led me to embark on a new career path. I am thankful to Dr. Shelley Carson, whose encouragement pushed me to pursue my thesis, and to Dr. Adrienne Tierney, my research advisor, whose expertise guided me through the research proposal and thesis writing process. Thanks to her, I have grown as a writer. I am especially grateful to my professional tutor, Dr. Kaitlyn May; without her help, I could never have gotten through the statistical analysis portion or imagined I could gain such a comprehensive understanding. This new understanding of the arduous research process has made this contribution to the field of Somatic Psychology even more meaningful to me.

I would like to extend my acknowledgment and appreciation to Gather Encinitas, Our Breath Collective (OBC), and the Health and Human Performance Foundation (HHP) for their support in promoting the study. Lastly, I am grateful to the research participants worldwide whose contributions made this study possible.

Table of Contents

List of Tables

List of Figures

Chapter I.

Introduction

Body-oriented psychotherapies (BOP) are a branch of somatic psychology that may use non-verbal body techniques to enhance self-awareness, assist with behavior modification, and use insight-driven problem-solving. It has also been shown to strengthen communication between the client and therapist regarding their perceptions and experiences (Cohen, 2011; Röhricht, 2009). In addition, principles related to all psychotherapies also apply to BOP, beginning with a reliable and trustworthy relationship between the client and therapist to facilitate improvement in the quality of the patients' lives. Like other forms of psychotherapy, BOPs are a systemized process responsible for maintaining high standards for protocols, conduct, and services (Cohen, 2011; Röhricht, 2009).

Multiple studies on slow deep breathing (SBD) show positive physiological changes such as decreased heart rate, blood pressure, and increased heart rate variability (HRV). These markers often simultaneously correspond to psychological responses relating to improvements in emotional regulation, immune function, anxiety, depression, well-being, resilience, quality of sleep, and more (Busch et al., 2012; Kanchibhotla et al., 2021; Gerritsen & Band, 2018; Jerath et al., 2006; Lalande et al., 2011; Lin et al., 2014; Ma et al., 2017; Magnon et al., 2021; Sepalla et al., 2014; Zaccaro et el., 2018; Zhang et al., 2019). Using breathwork, precisely slow deep breathing (SDB), as BOP in an individual therapeutic setting, has been widely and successfully applied (Bentley et al., 2023., Gholamrezaei et al., 2020). Emerging research has found that BOP delivered in a group therapy environment may be more effective than when delivered in a one-on-one environment (Piper et al., 1979; Renjilian et al., 2001). For instance, Kimmel and Gockel (2018) report that using a BOP in a group therapy setting may enhance the therapeutic potential of the individual because it increases the ability to understand and relate to oneself and others. One of the participants in their study explained that using the body within the group "added clarity and opened things up" (Kimmel & Gockel, 2018, p. 273).

Breathwork, especially slow deep breathing (SDB), utilizes the Autonomic Nervous System (ANS) by manipulating the breath to improve health. The underlying mechanisms are unclear but operate through changes in biology and the ANS through the vagus nerve and its influence on HRV and CVA (Laborde et al., 2019, 2021). For example, stimulating the vagus nerve through slow deep breathing lowers the heart rate (Gerritsen & Band, 2018.) Moreover, the vagus nerve innervates all the organs, oversees digestion, respiratory heart rate, and specific reflex actions such as coughing, sneezing, swallowing, and vomiting (Camara & Griessenauer, 2015; Breit et al., 2018; Porges, 2009; Tindle & Tadi, 2022).

According to the Polyvagal Theory (PVT), the vagus nerve is also responsible for helping us access cues in our environment for safety or danger, both physically and emotionally (Porges 2004, 2007, 2022). The vagus nerve is at the heart of the PVT, the longest cranial nerve in the body, with the broadest distribution containing 75% of the parasympathetic nervous system's nerve fibers. It is a bidirectional nerve that runs from the brain, through the face, and down to the colon, touching every organ and carrying sensory and motor signals. PVT theorizes that the vagus nerve serves as a tool to navigate the effects of stress and well-being on our minds and bodies by being responsible for sending information to brain regions critical to the stress response. For example, when the vagus nerve gets stimulated, it increases the vagal tone, slows one's heart rate and breath, and calms the nervous system, which may serve to provide a sense of safety and well-being. In addition, this nerve pathway is theorized to be involved in perceiving and expressing different physical symptoms and feelings characterized by stress-related disorders. (Breit et al., 2018). The PVT focuses on the interactive process between the body and the nervous system.

Body-oriented psychotherapies (BOP) and the principles of somatic psychology emphasize the connection between physiological states and psychological well-being. By incorporating slow deep breathing techniques into therapy, whether in individual or group environments, the Autonomic Nervous System (ANS) can be leveraged to impact resilience positively. PVT sheds light on the function and role of the vagus nerve and its influence on our stress response and emotional well-being. It provides a framework for how these therapeutic techniques can bring about changes in individuals. By activating the vagus nerve through breathwork, people can significantly improve their ability to regulate emotions, leading to a greater sense of safety and overall well-being. This suggests that body-centric or somatic healing may be personal and communal. Individuals may benefit from the intervention by itself or from the dynamic of a shared experience in group therapy.

Statement of the Problem

In the field of BOP, the efficacy of slow deep breathing (SDB) techniques has been demonstrated by numerous studies. However, an aspect yet to be explored is the application of SDB for a significantly brief period with lasting effects and environmental settings. Moreover, breath therapies used in individual therapeutic settings and other types of BOPs used in group therapeutic settings have been utilized as two different strategies that have been shown to reduce symptoms associated with various stress-related conditions and increase a sense of well-being (Cohen, 2011; Rohricht, 2009; Van Diest et al., 2014). To my knowledge, no other studies have specifically evaluated the effects and implications of breathwork in a group setting compared to an individual one. The current research addresses these problems by examining a brief application of a structured SDB protocol in two separate settings.

It has been widely documented that daily breathwork exercises may lead to an improved sense of well-being and a decrease in anxiety. The current study asks: 1) Is it possible to increase a person's sense of well-being after only five days of a consecutive 20-minute per day of a slow deep breathing (SDB) breathwork intervention? 2) Does the positive impact remain sustained after 30 days? and 3) Will the participants in the group setting experience a greater sense of well-being compared to the individual setting?

The study hypothesizes that (1) both groups (individual versus group environment) participating in daily consecutive 20-minute breathwork exercises for five consecutive days will experience a sense of improved well-being after five days. The second hypothesis was that an increased sense of well-being would be sustained after 30 days without continued practice. The third hypothesis proposed that the breathwork intervention within the group setting (individual versus group environment) would experience a greater sense of well-being than in the individual setting. These hypotheses are based on evidence suggesting that BOPs may provide a greater capacity for growth and improvement for the individual within a relational environment (Cohen, 2011).

This study may contribute information regarding different protocols and environments to integrate simple yet effective somatic practices, such as breathwork, that can facilitate, enhance, or accelerate therapeutic progress. Breathwork is a cost-effective and accessible intervention that can be used as an alternative to medication or other more invasive treatments. This could potentially reduce healthcare costs and increase access to care for those who may not have the resources to access other forms of treatment. In addition, breathwork has been shown to improve mental and physical health outcomes such as reducing stress, improving emotional regulation, and reducing blood pressure and inflammation, which may lead to better overall productivity, well-being, and reduced health care costs for society as a whole (Strupf et al., 2023). Finally, if the implementation of breathwork is as successful in a group setting as it is in an individual setting, this could inspire further research on this topic, leading to new, innovative interventions for managing mental health conditions. Ultimately, the broader implications of this study may implore the field of psychology to expand its understanding of the role of somatic interventions and group therapies separately and together.

Literature Review

Breathwork is a process that involves intentionally controlling one's breath and has been considered a therapeutic modality within the realm of wellness and psychotherapy. SDB techniques used in a therapeutic sense are designed to enhance physical, mental, and spiritual health. While Eastern societies have used the regulation of breath as an approach to well-being for centuries, the West is more recently exploring its uses (Dhaniwala et al., 2020). In 2020, Gholamrezaei and colleagues reported that adults use slow deep breathing techniques as one of the most common complementary practices to improve health. With decades of research, it has become an increasingly popular experiential approach in psychotherapy that claims positive mental health outcomes. These positive outcomes include reduced stress, improved emotional regulation and immune function, increased self-awareness, an enhanced sense of well-being, and reduced anxiety (Feldner et al., 2004; Gerritsen & Band, 2018; Lalande et al., 2011; Zhang et al., 2019).

The beneficial effects of slow, deep breathing (SDB) or slow-paced breathing (SPB) and extended exhalations are a common thread that has emerged in several studies (Bentley et al., 2023). While the mechanism behind the improved autonomic functions is not thoroughly understood, evidence demonstrates that deep, slow breathing and extended exhalations can reduce heart rate and activate the parasympathetic or (calming) nervous system (Bentley et al., 2022; Busch et al., 2012, Gholamrezaei et al., 2020, Jafari et al., 2020, Perciavalle et al., 2017). In addition, it has been shown that these breathing exercises also affect the cardio-respiratory system by increasing heart rate variability (HRV), the fluctuating interval of time between heartbeats (Bae et al., 2021; Kulur et al., 2009; Magnon, 2021; Russo, 2017; Van Diest et al., 2014). Increasing the HRV is another positive outcome associated with recruiting the parasympathetic nervous system and is associated explicitly with health longevity (Zulfiqar et al., 2010). Furthermore, because HRV reflects the activity of the ANS, an increased HRV indicates an individual's capacity to adapt emotionally and physically to changing environments (Petrocchi & Cheli, 2019).

In contrast, a low HRV indicates being vulnerable to the effects of stress and disease. For example, a low HRV is reported as a marker for cardiovascular and stress-related disorders, including coronary heart disease, anxiety, immune dysfunction, and depression (Carney & Freedland, 2009; Haensel et al., 2008; Magnon, 2021; Thayer & Brosschot, 2005; Wheat & Larkin, 2010). The use of HRV measures can be registered by a decrease in Respiratory Sinus Arrhythmia (RSA), an increased heartbeat during inhalation, and a decreased heartbeat during exhalation while in synchrony with the HRV (Grossman & Taylor, 2007). In a recent study, Magnon and colleagues (2021) showed a significant reduction in state anxiety and an increase in HRV index for both younger and older adults after engaging in an SDB protocol. However, the increase in HRV was even more significant in older adults. These results provide evidence that while SDB may be more beneficial to an older population to restore vagal outflow, it is still beneficial for all ages to improve health markers and well-being.

In another study examining alternative approaches to help veterans with PTSD, Seppala et al. (2014) used a breathing protocol that reported significant success. The breathing techniques employed in the study, Sudarshan Kriyq, involved slow, medium, and fast cyclical and rhythmic patterns of breath with specific counts and sequences. After randomly assigning 21 veterans to an active or waitlist control group, the group that practiced the breathing protocol showed reduced anxiety symptoms, respiration rates, and PTSD scores, while the control group did not show any reductions in symptoms (Seppala et al. 2014). The breathing intervention used was only seven days but reported benefits that continued one year later. It is unknown if the participants continued these protocols between the last day of the protocol, seven days, and the long-term assessments at one year. This research is relevant to this present study as the intervention was only one weeklong, with impacts lasting up to one year and possibly more.

In summary, breathwork has been shown to have multiple benefits, both physiologically and psychologically, that are complex, intertwined, and difficult to disentangle. While the mechanistic underpinning behind the enhanced autonomic functions remains unclear, evidence demonstrates that slow breathing techniques can have a positive impact on our nervous systems. This profound effect simultaneously provides benefits to support our health and continue to improve our well-being.

Group Therapy

Few studies to date have conducted research on slow breathing techniques within a group setting. The American Psychological Association (2019) defines group therapy settings as one or more therapists that lead a group of approximately five to fifteen patients. Research on group therapy suggests that it may provide several benefits that individual therapy cannot offer and may significantly increase the effectiveness of the treatment (Piper et al., 1979; Renjilian et al., 2001). For instance, other group members may act as a support network, holding a person accountable along the way, and listening to others may help give words to feelings or put feelings in perspective (McCarthy et al., 2013). Finally, sharing feelings within a group may help relieve stress and pain and keep a person from feeling isolated (Levi et al., 2017).

A study comparing individual therapy to group therapy for obesity found that post-treatment, group therapy produced significantly greater weight and body mass reductions than individual therapy (Renjilian et al., 2001). Moreover, in opposition to their hypothesis, matching the participants to their choice of a preferred group, either group therapy or individual therapy, did not improve their outcome in any way. In the context of obesity, this study demonstrated a clear advantage of group therapy over individual therapy, providing more evidence of the potential effectiveness and benefits of group settings. Moreover, these findings suggest that group therapy may be a powerful tool to address other needs, such as overall well-being.

While it is a complex process, Badenoch and Cox (2010) explain that group dynamics in therapy may offer patients a place to decrease shame and increase emotional regulation and sense of well-being, called interpersonal neurobiology (IPNB). IPNB is a complex scientific theory and process developed by Dr. Daniel Siegel that sheds light on how interpersonal relationships, environment, awareness of memories, and neuroplasticity shape the brain (Sak, 2018; Siegel, 2010). IPNB also theorizes that the group dynamic becomes a constant source of interaction and regulation for each other through mirror neurons. In contrast to functioning in isolation based on an individual's goals and intentions, mirror neurons respond to the environment. It's been shown that mirror neurons represent a category of brain cells that react when an individual performs an action and when they observe someone else performing the same action. Moreover, when individuals observe the actions, emotions, and intentions of others within the group, it can lead to a kind of empathetic or shared psychological state (Bonini et al., 2022., Iacoboni, 2009). This discovery has profound implications for understanding how individuals in groups may regulate each other's psychological states and opens the door to creating therapeutic interventions leveraging the power of group dynamics to enhance overall well-being.

Group Therapy Using Somatic Modalities

While the evidence documenting the effects of somatic therapy performed in group settings is in its infancy, interesting work has been reported by Kimmell and

Gockel (2017). Together, they interviewed 20 practitioners across the United States engaging in group work using BOP. Kimmel & Gockel (2018) used thematic analysis (TA) to identify how integrating this type of work impacted the nature of a group environment. Thematic analysis is a method "for systematically identifying, organizing, and offering insights into patterns of meanings (themes) across a dataset" (Braun & Clark, 2012). The 20 clinicians from various locations participating in the study were all licensed therapists, psychologists, and one psychiatrist. Overall, they were experienced practitioners who had been working in the field for an average of 20.7 years. They had experience leading groups for clients with a range of disorders, including anxiety and depression, PTSD, addiction, and eating disorders.

The somatic or BOP analyzed in Kimmel and Gockel's (2017) review included Bioenergetics, Focusing, Hakomi, Rubenfeld Synergy, Somatic Experiencing, and Sensorimotor Psychotherapy. For example, Somatic Experiencing practitioners ask a person to explain the physical sensations a person felt during the traumatic event to resolve that trauma. Similarly, bioenergetic analysts help to release chronic muscular tensions or heal sexual difficulties. Participants agreed that it helped to engage the relationship between the mind and the body. "One participant explained that using the body in a group deepened the quality of human contact between two people" (Kimmell & Gockel, 2017). Overall, using these therapies within a group setting was reported to enhance the individual's therapeutic potential and deepen the group process by adding a sensory experience. In addition, it increases one's ability to relate to themselves and others (Cohen, 2011; Kimmell & Gockel, 2017). While research in this area is ongoing and more rigorous research needs to be completed, the objective observations of 20 clinicians with 20-plus years of experience are a promising start and warrant more research in the field.

In a rigorous evidence-based review, Rohricht (2009) reports a few quantitative studies confirming the efficacy of BOPs and non-verbal intervention techniques in group settings to reduce symptoms and improve functioning for clients with depression, anxiety, and PTSD. The overarching theme of these modalities centers around clients reaching an inter-relational embodiment through focused self-awareness and reconditioning, emotionally and physically (Rohricht, 2009).

Rohricht (2009) asserts that the most important investigation on the efficacy of BOPs was conducted by Koemeda-Lutz and colleagues between 2005-2009, which included 8 different schools of BOP. At the intersection between neuroscience and psychotherapy, Rohricht (2009) suggests that BOP or somatic therapies have the potential to be a principle psychotherapeutic approach used in clinical care with more qualitative research. The BOPs included Hakomi, Experimental Psychology, Biodynamic Psychology, Biosynthesis, Integrative Body Psychotherapy, Unitive Body Psychotherapy, Biodynamic Psychology, and Bioenergetic Analysis. A comparison was made between 342 patients using BOP to other patients not using BOP. Evaluations took place at three different time points pre-intervention, after six months, and post-therapy, spanning a maximum duration or two years. The instrument used to measure responses was SCL-90-R, a widely used self-reporting questionnaire on psychological distress and various aspects of psychopathology. After six months of therapy ($N = 253$), the participants showed significant improvement with small to moderate effect sizes. After two years ($N = 160$), large effect sizes were achieved in all scales. This study claimed to provide evidence to support the effectiveness of BOP methods classified as phase IV and level I evidence. In the context of clinical research and healthcare of evidence-based medicine, these terms refer to the highest quality of evidence. It typically refers to data obtained from systematic reviews or meta-analyses of randomized controlled trials (RCTs), which are considered the gold standard in clinical research. (Burns et al., 2011). While the study design did not allow for generalizable results or conclusions, the overall results of BOPs are correlated with positive outcomes regarding various mental and physical problems and symptoms. Although more rigorous research is needed, these findings suggest encouraging possibilities for the integration of BOPs or somatic therapies into clinical care, providing more holistic and preventative approaches to mental and physical challenges.

The Polyvagal Theory

PVT is another possible theory that may explain success in group settings and breathwork as separate interventions. The theory was introduced in 1994 by Stephen Porges (2004) and emphasizes the vital role that the autonomic nervous system (ANS), especially the vagus nerve, plays in regulating our health and behaviors.

Three key principles that define the PVT are a hierarchy of the nervous system, neuroception, and co-regulation (Porges, 2004). The theory was developed by identifying two branches of the vagus nerve that provide motor and sensory pathways between the brainstem and the body's internal organs. Only mammals have this nerve. The PVT suggests that new structures were added to, and older ones were modified in the human nervous system, highlighting not only the evolution of the neuroanatomy of the ANS from vertebrates to their subgroup of mammals but also proposing specific behaviors linked to these changes. It is a framework proposing the evolution of the autonomic nervous system (ANS) via the vagus nerve and how it relates to our current behaviors, including emotional regulation and social connection (Porges, 2022).

The theory provides a deeper understanding into how changes in our nervous systems development through evolution are connected to a range of our adaptive behaviors. These behaviors can either enhance or limit the expression of social behavior in different contexts (Porges & Furman, 2011).

The Vagus Nerve

According to the PVT, the vagus nerve plays a vital role in helping us interpret our nervous system by assessing environmental cues for safety or danger. The nerve performs this function through its four main functions: sensory, special sensory, motor, and parasympathetic. The vagus nerve stretches down both sides of the body, from the brain down to the colon, connecting to sensory fluctuations in the middle ear, tongue, vocal cords, lungs, heart, diaphragm, and all the organs. The vagus nerve activates the parasympathetic nervous system, called "rest and digest." This branch of the autonomic nervous system (ANS) oversees mood, digestion, heart rate, breathing, blood pressure, and salivation. Activation of the parasympathetic nervous system branch slows down the heart rate, decreases blood pressure, and creates a feeling of ease in the body and mind. The nerve has a dorsal (back) and ventral (front) side, and both are activated during "neuroception," a process Dr. Porges introduced by which our nervous system evaluates risk in our environment and then determines whether people or situations are safe or dangerous (Porges, 2004, 2007, 2009, 2022). Dr. Porges has referred to this process as the "science of feeling safe." Intertwined with neuroception in shaping our perception is the concept of interoception. Interoception refers to the ability to sense and perceive internal bodily signals and emotional states (Chen et al., 2021). Neuroception influences our physiological state, which then can affect our interoceptive awareness. For example, when we perceive a threat (through neuroception), our body may respond with an increased heart rate, which we can then sense internally (through interoception). While neuroception and interoception are distinct concepts, they are connected in a way that influences our perception of safety and bodily awareness. When we feel safe, we can connect with others through facial expressions, eye contact, the prosody of our voice, body language, and other nonverbal means. This bidirectional relationship between the environment and the nervous system (via the vagus nerve) promotes social engagement, self-regulation, enhanced well-being, and decreased anxiety (Gerritsen & Band, 2018; Porges, 2004, 2007, 2009, 2022; Porges & Furman, 2011).

Emotion and the Vagus Nerve

Emotion in a group environment also correlates to the vagus nerve. Further research is needed to understand the relationship between specific emotions and vagal activity. However, it is suggested that the vagus nerve strengthens the connectivity among brain networks involved in emotional regulation (Mather & Thayer, 2018). One study found that compassion is associated with elevated vagal activity compared to neutral or other prosocial emotional states, including warmth, pride, tenderness, trust, and inspiration (Stellar et al., 2015). Across four studies, the respiratory sinus arrhythmia (RSA), a measure of cardiac vagal function, of 74 undergraduates (33 male, 41 female) was compared during positive emotional states. Results indicated that participants had higher RSA levels while feeling compassion, a social emotion, than when experiencing pride or inspiration, a self-focused emotion. Finally, a 5-year observational investigation by Aaronson et al. (2017) explored patients with treatment-resistant depression undergoing vagus nerve stimulation (VNS) in comparison to those receiving the usual treatment. Patients in the vagus nerve stimulation (VNS) group showed significantly better outcomes. Cumulative response rates were recorded over a 5-year period with the VNS group surpassing the comparison group, approximately 67% versus 40%. Additionally, the remission rate was higher in the VNS group compared to the control group, approximately 43% versus 25%. This study is the largest and longest naturalistic investigation of its kind, providing evidence that vagus nerve stimulation enhances emotional well-being. Important to this study is that breathwork also stimulates the vagus nerve. The existing research provides promising results and suggests a significant connection between the vagus nerve, emotional regulation, and mental health. However, it is also essential for ongoing research to support a deeper understanding of these mechanisms that could inform therapeutic interventions in the future.

Multiple studies confirm that taking deep breaths slows the heart rate and increases the heart rate variability (HRV), which stimulates the vagus nerve (Gerritsen & Band, 2018; Laborde et al., 2019, 2021; Lin et al., 2014; Magnon et al., 2021; Porges, 2007; Russo et al., 2017; Van Diest et al., 2014; You et al., 2021; Zaccaro et al., 2018). Specifically, Van Deist and colleagues report that the PVT recommends using HRV measures because emotional and stress-related disorders are associated with decreased vagal activity to the heart (Van Diest et al., 2014). In their study using slow deep breathing patterns, the participants reported increased relaxation, stress reduction, and positive energy. Thus, increased levels of HRV are associated with lower anxiety and rumination and correspond with higher levels of emotional well-being (You et al., 2018). In 2019, Laborde and colleagues explored the impact of a 30-day slow-paced breathing exercise on sleep quality and cardiac vagal activity compared to social media use. Sixty-four healthy participants were randomly assigned to either the breathing or control groups using social media (e.g., Facebook, Instagram, Whatsapp). The results indicated that the slow-paced breathing techniques enhanced sleep quality and increased overnight cardiac vagal activity (CVA) compared to social media use. CVA reflects the influence of the vagus nerve on the heart, and the increase in vagal activity via CVA is crucial to stress management, emotional regulation, cognitive performance, social interactions, and overall health (Laborde et al., 2019, 2021).

Group Therapy and Breathwork

As previously cited, previous research validates that group therapy and breathwork as independent interventions can successfully enhance one's sense of well-being, decrease anxiety, and more. Additionally, evidence suggests that combining the two interventions may even work to accelerate the therapeutic process. Therefore, it is possible that integrating breathwork into a group setting may lead to increasing one's sense of well-being more significantly than doing breathwork in an individual setting. In this research, combining breathwork into a group setting is a form of somatic group therapy work. Few studies to date have specifically evaluated the effects of breathwork in a group setting. While RSA and HRV measures were not used in this current study, understanding their relationship to the vagus nerve, breathing, and well-being are essential indicators of current and future health problems. More specifically, one area of interest within this study was to evaluate differences in well-being by measuring levels of anxiety, stress, depression, resilience, sleep, and quality of life through the application of breathwork in a group setting compared to an individual setting. Finally, this study may be used as a preliminary step towards using physiological measures such as RSA and HRV to be compared across different environments. Using physiological measures also raises the possibility of monitoring groups' heart rates to assess whether they synchronize under different conditions.

Therapy in a group setting may have more benefits than in an individual setting. As such, having a method to measure the effects of breathing together with a therapeutic intention has implications for developing a more diverse set of simple, cost-efficient protocols for mental health providers and another way of identifying mechanisms of somatic therapies in a group.

Chapter II.

Methods

The research design was a randomized pre-post, between-subjects study of a control group (Individual therapy) and an experimental group (Group Therapy), using breathwork and environment setting as two separate interventions. The Institutional Review Board for Harvard Extension School approved this study. The data was collected between July and August 2023 from participants who attended in-person breath classes or received virtual audio recordings of the same breath classes through email.

Participants

Participants were recruited to this study through three businesses: a local yoga studio called Gather Encinitas, Our Breath Collective, an international Breath School, and The Health and Human Performance Foundation (HHP), an internationally recognized non-profit health organization, via an email and one social media post (i.e., Instagram). The first email and social media post gave information describing the study, asked if they were interested, and included a link to fill out a preliminary participant information form to determine eligibility and express interest. Exclusion criteria included those with acute or chronic pain, cardiovascular, respiratory, or neurological diseases, psychiatric disorders, pregnancy, regular medication use other than contraceptives, current smoking, and any other nicotine consumption. Those who met the selection criteria and were determined to be eligible were emailed a consent form. Healthy volunteers aged 18 to 70 were invited to participate in the study. While the SDB protocol in the study is not associated with any known risks, out of an abundance of caution, the exclusion criteria were as strict as they have been in past studies involving any breathwork. The exclusion for this study was determined by replicating criteria used in other similar studies (Laborde et al., 2019; Lin et al., 2014; Magnon et al., 2021; Russo et al., 2017; Seppala et al., 2014; You et al., 2021; Van Diest et al., 2014).

The study enrollment was stopped after three days when 359 people from over 20 countries completed the preliminary participant form. After confirming eligibility and intent to participate from interested participants, 309 people completed the consent form and were enrolled. Due to incomplete data and participants not completing all three time points of the study, the final analysis included 134 participants. The final sample represented various countries, including the U.S., UK, Switzerland, Netherlands, Mexico, Canada, Norway, Sri Lanka, Italy, Spain, France, Australia, Singapore, Africa, Costa Rica, and Germany.

Procedure

The study used straightforward methods to ensure the participants would comprehend the implications of their voluntary involvement. This included providing comprehensive study information, consent forms, and questionnaires. The materials covered aspects such as the study's purpose, research description, potential risks and benefits, confidentiality, compensation, exclusion criteria, study protocol, questionnaire details, and duration requirements. All participants were asked to complete a set of standardized questionnaires measuring mental states of anxiety, depression, stress, resilience, and quality of life and sleep at three different time points during the study: pre-intervention, immediately post-intervention (day 5), and 30 days after the final practice.

Questionnaires were emailed and completed 24 hours before the first intervention and 24 hours post-intervention. The final set of assessments at the third time point were emailed 30 days post-intervention and collected within 3 days. One of the questionnaires, the Pittsburgh Sleep Quality Index Scale, was not assessed at the five-day mark post-intervention, only pre-intervention and 30 days post-intervention. Data collection was collected online via Qualtrics. All participants were contacted through email.

Participants were assigned to one of three groups: Group Class A (local and in person), Group Class B (local and in person), or Group C (individual protocol delivered virtually), locals and non-locals. Those assigned to group classes A and B were notified of the date and location of the classes. Those assigned to group C were also provided with the dates on which the audio recordings of the same protocol would be emailed to them.

Materials and Measures

The primary material used in this study was a combination of slow deep breathing (SDB) techniques with extended exhalations (Appendix 1). Slow deep breathing techniques include breath cycles between four and ten cycles of breath per minute. Extended exhalations were also included, where the exhalation relative to the inhalation may build up to twice as long.

Three of the 4 measures used to examine the differences in well-being between a group setting and an individual setting in this study were replicated from another study conducted by Kanchibhotla et al. (2021). Participants in the study were evaluated using a standardized set of questionnaires to measure their levels of depression, anxiety, stress, quality of sleep, resilience, and quality of life (mental and physical). These assessments were administered at three different time points: 24 hours before the intervention, immediately after the intervention was completed (within 24 hours), and after 30 days of the practice (48 hours to complete the final set of assessments). The data was collected using online questionnaires through Qualtrics. See Table 1.

Table 1. Assessments Overview

Resilience	Connor-Davidson Resilience Scale-10 (Vaishnavi et al., 2007)
Depression, Anxiety, Stress	Depression, Anxiety, and Stress Scale (Basha, & Kaya, 2016; Lovibond & Lovibond, 1995)
Quality of Life	Short Form Health Survey-12 (Ware et al., 1995, 1996)
Sleep Quality	Pittsburgh Sleep Quality Index (Buysse, 1989)

Connor-Davidson Resilience Scale-10 (CD-RISC-10)

The CD-RISC-10, a measure of resilience, consists of 10 items. This measure was initially developed by Connor & Davidson (2003). Each item is answered on a 0-4 Likert scale, with higher scores indicating greater resilience. The total score can range from 0 to 40 and is calculated by summing the individual item scores. This measure has been shown to be reliable and valid in previous research (Campbell-Sills & Stein, 2007; Vaishnavi et al., 2007). The specific items in this measure are listed in Appendix 2.

Depression, Anxiety, and Stress Scale (DASS-21)

The DASS-21 is a set of three self-report scales designed to measure the emotional states of depression, anxiety, and stress. Each scale consists of seven items, and each item is answered on a 0-3 Likert scale. The summative score for each domain ranges from 0 to 21, with higher scores indicating stronger negative emotional states. Normal ranges for depression are indicated in scores between (0-9), anxiety (0-7), and stress (0-14). Mild ranges for depression are indicated in scores for depression between (10-13), anxiety (8-9), and stress (15-18). Moderate levels of depression are indicated in scores between (14-20), anxiety (10-14), stress (19-25). Severe levels of depression are indicated as scored between (21-27), anxiety (15-19), and stress (26-33). Finally, extremely severe levels of depression are indicated as levels scored between (28+), anxiety (20+), and stress (37+; Brumby et al. 2011). The DASS-21 has been shown to have high internal consistency and is commonly used to measure changes in emotional states over time Basha & Kaya, (2016). The specific items in this measure are listed in Appendix 3.

Pittsburgh Sleep Quality Index (PSQI)

The PSQI, measuring the quality of sleep, is a standardized sleep questionnaire used with various populations and in multiple languages. It consists of 19 questions that assess seven components of sleep, including quality, latency, duration, habitual sleep efficiency, sleep disturbances, the use of sleep medication, and daytime dysfunction. Each component is scored on a 0-3 Likert scale, and the scores are summed to calculate a global PSQI score. A global score of 5 or more indicates poor sleep quality (Buysse et al., 1989). In this study, a substantial amount of data collected for the PSQI had to be excluded due to inconsistencies in the methods of self-reporting and scoring. Specifically, one of the self-reporting questions, “How many hours do you sleep a night?” allowed participants to fill in the blank without providing guidance on specificity. As a result, several participants reported a range of hours, such as “5-7” or “6-8,” making it difficult to determine a precise score based on the scoring key. A similar issue arose with another open-ended question: “How many hours do you spend in bed?” which differed from inquiring about the actual hours of sleep. These inconsistencies in responses and scoring challenges led to the exclusion of this data from the analysis. The specific items in this measure are listed in Appendix 4.

12-Item Short Form Health Survey (SF-12v2)

The SF-12, measuring general mental and physical health, is a health-related quality of life questionnaire. This questionnaire comprises 12 questions designed to assess eight different health domains, including mental and physical well-being. The mental health dimensions include vitality (V), social functioning (SF), role emotional (RO), and mental health (MH). Meanwhile, the physical health aspects include general health (GH), physical functioning (PF), role physical (RP), and body pain (BP). The SF-12 has been extensively studied and is recognized as a valid tool for measuring health-related quality of life across various population groups. Using norm-based methods, two summary scores are recorded from the SF-12: a mental component score (MCS) and a physical component score (PCS). Both scales are converted to have a mean of 50 and a standard deviation of 10 in the U.S. population. All scores above and below 50 are above and below the average in the U.S. population (Ware et al., 1995, 1996).

Intervention

In the group setting, I, the principal investigator and a certified breath guide, led participants once a day in the evening at 7:30 pm through a 20-minute slow deep breathing (SDB) protocol that culminated in extended exhales for 5 consecutive days.

Every day of the intervention, all participants were instructed to do the breathing practice comfortably seated or lying down with back support while breathing through their nose or mouth. Either variation (nose or mouth) instructed an equal inhalation to exhalation ratio to a gradual slowing of the breathing pace over 5 days (e.g., progressing from a 3-second inhale and 3-second exhale on the first day to 4 and 6, 5 and 7, 6 and 8, respectively, by the last day).

In addition to guiding the precise counts of the breath technique, a precise, computer-generated tone created by Our Breath Collective played in the background for both groups (in person and virtually). The tone aligned with measured seconds that ascended during inhalation and descended during exhalation to match the specific protocol of the study, creating a rhythmic guide.

All breathing participants were encouraged to stay with the pace suggested to the scope they were comfortable with. They were also invited to attempt breathing through their nose to the extent that it did not add any stress or discomfort. Finally, the participants were reminded that they were in complete control and that even if they did not stay precisely with the guided pace, there was no right or wrong and that they would still benefit from breathing slowly.

At the end of the protocol each day, all participants (group and individual) were prompted to sit or lie in silence with their eyes closed for approximately 3 minutes and then optionally invited to speak one word aloud describing their current internal felt sense. Participants in the group classes who did not wish to speak their internal felt sense aloud were instructed to stay silent and think of their word. The entire process took approximately 35 minutes each day.

After completing the final assessment (30 days after the last practice), all participants were offered a free one-month membership to Our Breath Collective, an online community with access to daily live guided breath sessions and other breath-related workshops.

Those who were assigned the individual protocol received daily audio recordings of the same breath protocol delivered to the group for 5 consecutive days via email. The email was delivered in the morning, but they were instructed to listen to the recording in the evening if possible.

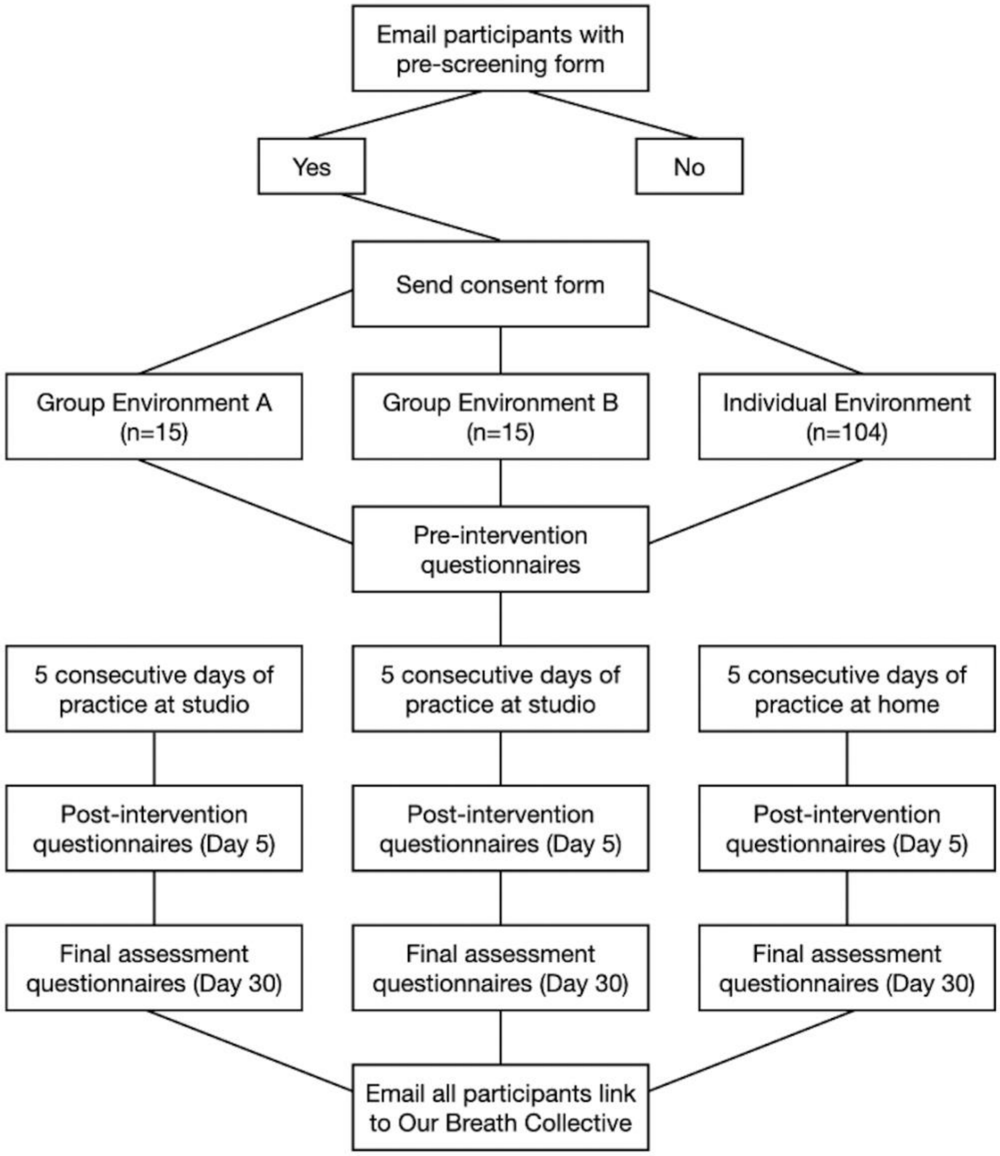

Figure 1. Flow Chart of Procedure.

Chapter III.

Results

There were three intentions of this study. The first was to determine if a 5-day, once daily, 20-minute slow deep breathing (SDB) with extended exhales breathwork intervention would have significant results on well-being after 5 days. The second intention was to determine if the breathing protocol had significant results after 30 days. The third intention was to compare the effectiveness of the breathwork intervention in a virtual individual environment versus an in-person group environment.

Data Analysis

There were three groups participating in the study. Groups A and B each included 15 participants breathing together (group environment), and group C included 132 participants breathing alone, representing the individual environment setting. Due to constraints adhering to the American Psychological Association's recommendation for group therapy size to be limited between 5 and 15 people, the decision was made to use two separate groups to be combined later to augment the effect size and enhance statistical power. To ensure meaningful and consistent results, both groups were designed to be homogenous. Randomized assignment was implemented, and there is no evidence suggesting systematic differences between the groups. After consulting with a statistician, it was determined that combining the groups in this manner was a reliable approach to achieving more accurate and robust results.

A paired samples t-test was used to compare the differences in scores between the pre-intervention, post-intervention, and day 30 time points. The Pearson correlation coefficient was calculated to measure the linear correlation between the variables in all the scales. Descriptive statistics were used to summarize the demographic characteristics of the participants, including age, sex, marital status, level of education, and nationality, as well as the mean, range, and standard deviation of the outcome measures. An F-test was also performed to assess the assumptions of normality. This analysis allowed us to determine whether there were significant differences in the scores across the three time points. Cohen's d value was calculated to determine effect size. Portions of this analysis plan are reproduced from data analysis used in a recent study conducted by Kanchibhotla et al. (2021).

Data Collection

Data was collected using Qualtrics. It was then transferred to Excel files where it could be sorted and transposed for transfer into SPSS. After being transferred into SPSS, the data was analyzed to test the three hypotheses of the study. To ensure privacy and security, all participants were coded with ID numbers before the data was analyzed in SPSS.

Participants

A total of 134 participants completed the study. Eighty percent of the participants in the study identified as female (n = 108), and 18.8% (n = 25) identified as male. One participant identified as non-binary (n = 1). A majority of the participants, 76%, identified as white or Caucasian (n = 102), and 32 participants identified as other races, including Black or African American, American Indian, Native American, Alaska Native, Asian, multiple races, or other. Most of the participants, 49.6 %, were married (*n* = 66), (*n* = 31) participants had never been married, and all others (*n* = 37) identified as either living with a partner, divorced, separated, or widowed. Additionally, 55 participants, 41%, graduated college with a bachelor's degree, while (*n* = 49) earned a graduate or professional degree.

Next, 100 participants, 76%, had never smoked, and (*n* = 34) were previous or occasional/ non-daily smokers. Finally, most participants (*n* = 125) were either paid employees or self-employed, and (*n* = 25) identified as not working from being laid off, retired, or for other reasons such as having a baby, changing careers, or taking a sabbatical. See Table 2 below.

Table 2. Demographic Data.

Characteristics	Type	All Participants
Gender	Male	25 (18.8%)
	Female	108 (80.4%)
	Non-Binary	1 (.9%)
Age (years)	Mean (*SD*)	44. 6 (*SD* = 10.41)
	Min	20
	Max	70
Marital Status	Never been married	*N* = 31 (23.3%)
	Married	*N* = 66 (49.6%)
	Living with Partner	*N* = 21 (15.8%)

	Divorced/ Separated	*N* = 14 (10.5%)
	Widowed	*N* = 1 (.8%)
Race	Caucasian or White	*N* = 102 (76.1%)
	Multiple Races or Other	*N* = 32 (22. 4%)
Education	High School Diploma or GED	*N* = 2 (1.5%)
	Some college but no degree	*N* = 17 (12.8%)
	Associate or Technical degree	*N* = 9 (6.8%)
	Bachelor's degree	*N* = 55 (41.4%)
	Graduate or Professional degree	*N* = 49 (36.8%)
	Prefer not to say	*N* = 1 (.8%)
Employment Status	Working (Paid employee)	*N* = 60 (44.8%)
	Working (Self-employed)	*N* = 65 (48.5%)
	Not working (temp lay-off)	*N* = 2 (1.5%)
	Not working (retired)	*N* = 3 (2.2%)
	Not working (Other)	*N* = 4 (3%)
Smoking Status	Previous smoker	*N* = 21 (15.8%)
	Non-daily, occasional, social	*N* = 12 (9%)
	Never	*N* = 100 (75.2%)

Descriptive Statistics

Research questions 1 and 2 involved investigating the short-term effects of a 5-day Slow Deep Breathing (SDB) protocol with extended exhales on an individual's well-being. Additionally, the study examined whether these positive effects could be sustained 30 days later.

Mean baseline scores on the primary research measures at timepoint 1, pre-intervention, were collected from all participants. To begin, on the CD-RISC 10, a resilience survey, the average score for participants was 29.22 (*SD* = 5.14). Scores range between 0-40, and higher scores indicate greater resilience. On the SF-12 health survey, participants averaged 41.99 (*SD* = 9.10) on the mental health sub-score and 53.53 (*SD* = 6.65) on the physical health sub-score. Because the SF-12 is scored such that the mean of the U.S. population is a score of 50 on both sub-measures, the current sample scored below average in mental health and slightly above average in physical health.

The DASS-21 survey assesses three domains: depression, anxiety, and stress. The survey is reverse scored such that lower scores on reflect more positive mental states. DASS-21 scores are classified as normal, mild, moderate, severe, or extremely severe. The average score for depression was 9.52 (*SD* = 8.65), representing mild depression. Lastly, the average score for anxiety was 6.89 (*SD* = 6.80), representing a normal level of anxiety. The average score for stress for all participants was 15.48 (*SD* = 10.28), representing a mild level of stress.

On the final measure, the PSQI, measuring sleep quality, the average score for the participants was 7.2 (*SD* = 3.85), indicating poor sleep quality. Scores range between 0-21, with higher scores indicating worse sleep quality. Scores higher than 5 indicate poor quality of sleep. In summary, according to our baseline sample, participants exhibited normal levels of resilience, mild depression, normal anxiety, mild stress, below-average mental health, above-average physical health, and poor sleep quality.

Correlation Analysis

Correlations were conducted between age and all research measures. Age was significantly correlated with all research measures such that well-being across all metrics also increased as age increased. The exception to this was the correlation between age and physical well-being (r = .098, p = .068). Note that some of the significant correlations were negative because these measures were reverse-scored such that a lower score indicates higher well-being. They still represent a positive relationship between age and the various metrics.

Correlations were also conducted between all research measures to determine whether each health measure was multicollinear.

Table 3. Correlation Table.

Variable 1	Variable 2	R-value	P value
CD. Risc	SF. Health Mental	.53	<.001
CD. Risc	SF. Health Physical	.004	.96
CD. Risc	DASS. Depression	-.58	<.001
CD. Risc	DASS. Anxiety	-.38	<.001
CD. Risc	DASS. Stress	-.47	<.001
CD. Risc	PSQI	-.27	.03
SF. Health Mental	SF. Health Physical	-.34	<.001

SF. Health Mental	DASS. Depression	-.69	<.001
SF. Health Mental	DASS. Anxiety	-.51	<.001
SF. Health Mental	DASS. Stress	-.59	<.001
SF. Health Mental	PSQI	-.36	.002
SF. Health Physical	DASS. Depression	.06	.50
SF. Health Physical	DASS. Anxiety	-.19	.03
SF. Health Physical	DASS. Stress	-.02	.80
SF. Health Physical	PSQI	-.28	.02
DASS. Depression	DASS. Anxiety	.62	<.001
DASS. Depression	DASS. Stress	.69	<.001
DASS. Depression	PSQI	.53	<.001
DASS. Anxiety	DASS. Stress	.72	<.001
DASS. Anxiety	PSQI	.44	<.001
DASS. Stress	PSQI	.52	<.001

Research Question 1: Full Sample Scores – 5 days Post-Intervention – (Time Point 2)

The mean scores five days after the intervention indicated a significant enhancement in all participants' perceived sense of well-being. To begin, resilience scores on the CD-RISC significantly improved from time point 1 (M = 29.22, SD = 5.14) to time point 2 (M = 31.82, SD = 5.31), $t(258) = -4.02$, $p < .001$, $d = -.50$.

The mean scores on the SF-Health survey assessing general mental and physical health significantly improved in one sub-score and remained unchanged in the second sub-score. Scores on the first component, mental health, significantly improved from time point 1 (M = 41.99, SD = 9.10) to time point two (M = 44.08, SD = 8.58), $t(265) = -1.93$, $p = .05$, $d = -.24$. The average mean scores assessing physical health remained the same between time point 1 (M = 53.53 SD = 6.65) and time point two (M = 53.31, SD = 6.38), $t(265) = .27$, p = .79, $d = .03$.

Scores on the DASS-21 survey assessing stress significantly improved by 5 points from time point 1 (M = 15.48, SD = 10.28) to time point 2 (M = 10.74, SD = 7.63), $t(260) = 4.24$, $p < .001$, $d = .52$. Note, lower scores indicate less perceived stress. Scores on the survey assessing anxiety significantly improved from time point 1 (M = 6.89, SD = 6.80) to time point 2 (M = 4.08, SD = 5.34), $t(257) = 3.69$, $p < .001$, $d = .46$. Note that lower scores indicate less perceived stress. Lastly, scores on the survey assessing depression significantly improved by 4 points from time point 1 (M = 9.52, SD = 8.65) to time point 2 (M = 5.89, SD = 6.18), $t\ (254) = 3.86$, $p < .001$, $d = .48$. Note that scores indicate less perceived depression.

The mean scores, as assessed by the Global PSQI survey, were not obtained at time point 2 in this study. According to Buysse et al. (1989), this self-rated questionnaire assesses the quality of sleep over a 1-month time interval, indicating that scores would not be an accurate measurement after only 5 days. However, sleep quality scores were collected at the study’s final time point, 30 days later and are presented in the following sections.

In conclusion, all participants engaged in a 5-day breathwork protocol involving Slow Deep Breathing (SDB) with extended exhales. At time point 2, 5-days post-intervention, all participants showed significant improvement in scores across five of the six measurements, including resilience, depression, anxiety, stress, and general mental health. The other measurement, general physical health, remained stable before and after intervention. Notably, stress and depression scores demonstrated the most significant increase in a sense of well-being, with an average improvement ranging between 4 and 5 points.

Research Question 2: Full Sample -30 days Post-intervention- (Time point 3)

The mean scores thirty days after the intervention for all participants indicated a significant enhancement in their perceived sense of well-being. To begin with, scores on the CD-Risc, assessing resilience for the full sample of participants, significantly improved from time point 1 (M = 29.22, SD = 5.14) to time point three (M = 31.65, SD = 5.39), $t(231) = -3.32$, $p = .001$, $d = -.46$. See Figure 2 below.

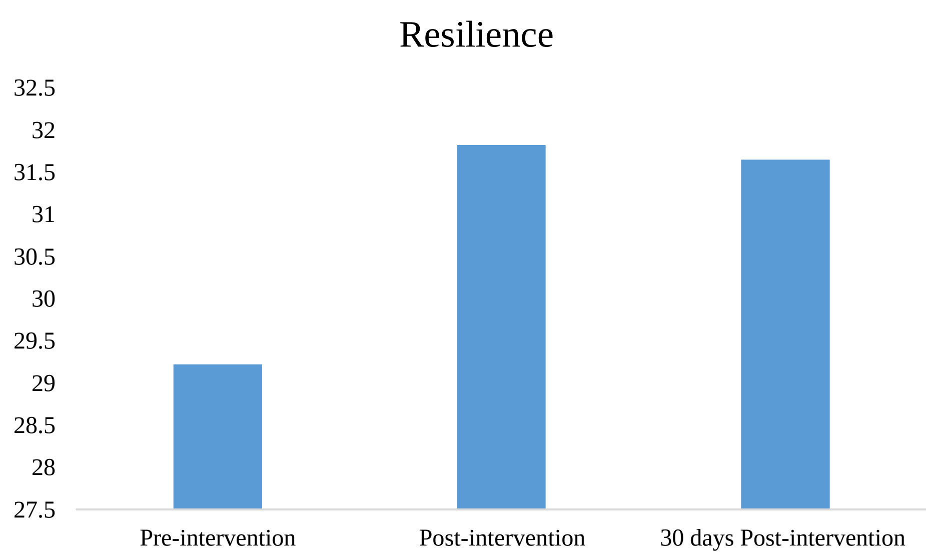

Figure 2. Mean Resilience Scores Across Time Points.

Figure 2 is a visual representation of the mean scores of the full sample of the participants' perceived sense of resilience across all three time points. Scores increased significantly between time point one and time points two and three indicating an enhanced sense well-being.

Next, the SF-Health survey measuring general mental and physical health, is a health-related quality of life questionnaire composed of 2 separate component scores. The mean scores assessing mental health significantly improved by nearly 3 points from time point 1 (M = 41.99, SD = 9.10) to time point 3 (M = 45.49, SD = 8.91), $t(213) = -3.32$, $p = .006$, $d = -.39$. See Figure 3 below.

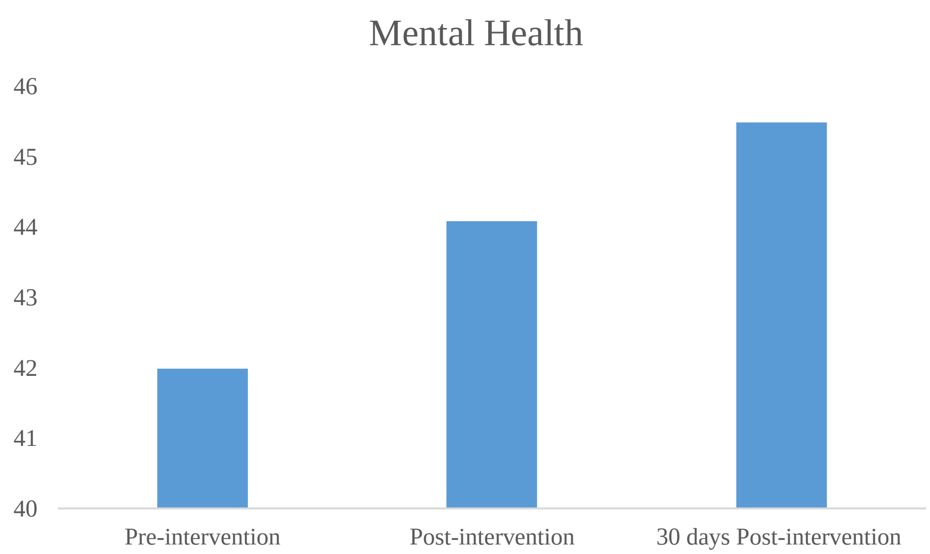

Figure 3. Mean Mental Health Scores Across Time Points.

Figure 3 is a visual representation of the mean scores of the full sample of the participants' perceived sense of general mental health across all three time points. Scores increased significantly between time point one and time points two and three indicating an enhanced sense of mental well-being.

Scores assessing general physical health represent the second component score of the SF- Health survey. Scores averaged the same between time point 1 (*M* = 53.53, *SD* = 6.65) to time point three (*M* = 52.76, *SD* = 6.65), $t(217) = .83$, $p = .406$, $d = .1$. See Figure 4 below.

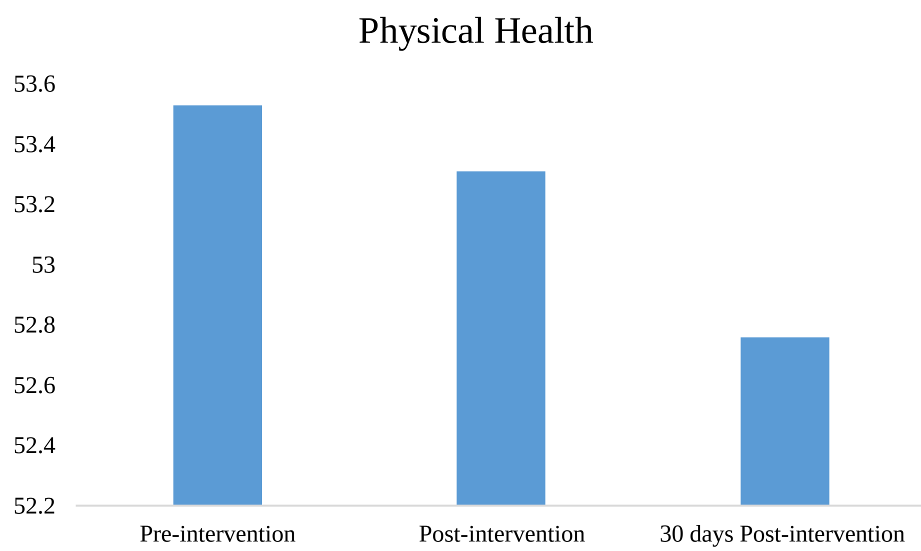

Figure 4. Mean Physical Health Scores Across Time Points.

Figure 4 is a visual representation of the mean scores of the full sample of the participants' perceived sense of general physical health across all three time points. Scores decreased between time point one and time points two and three indicating a decreased sense of physical well-being.

Scores on the DASS-21 survey assessing depression, anxiety, and stress are composed of three separate component scores. First, scores assessing depression improved on average by 2 points from time point 1 (*M* = 9.52, *SD* = 8.65) to time point 3;

however, this increase was not significant (*M* = 7.45, *SD* = 9.54), *t*(210) = 1.64, *p* = .103, *d* = .23. Note that lower scores indicate less perceived depression such that all scores indicate improvement. See Figure 5 below.

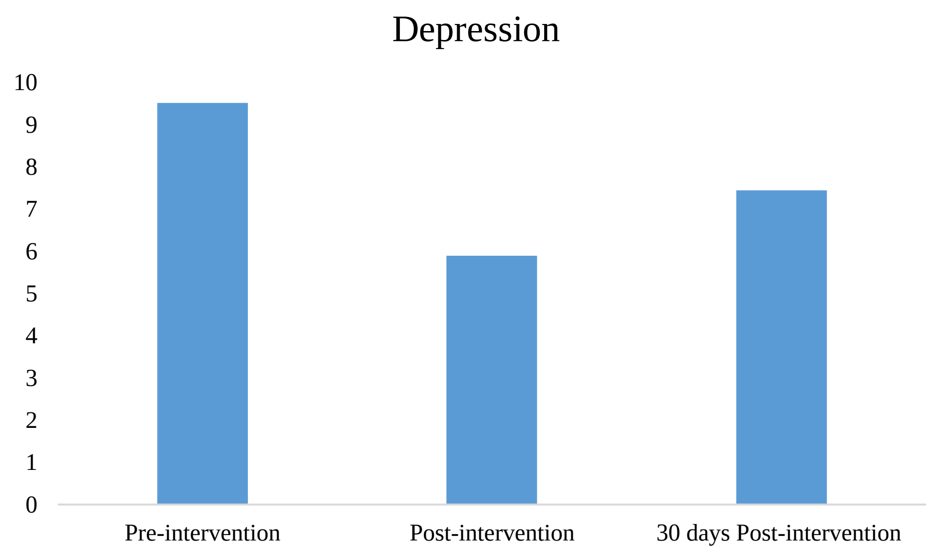

Figure 5. Mean Depression Scores Across Time Points.

Figure 5 is a visual representation of mean scores of the full sample of the participants' perceived sense of depression across all three time points. Scores significantly decreased between time point one and time point two. Scores between time point 2 and time point 3 also decreased but are not considered significant. Lower scores indicate improvement, a decrease in perceived depression.

Next, scores assessing anxiety significantly improved from time point 1 (*M* = 6.89, *SD* = 6.80) to time point 3 (*M* = 3.90, *SD* = 5.01), *t*(213) = 3.46, *p* < .001, *d* = .48. Note that lower scores indicate less perceived anxiety such that all scores indicate improvement. See Figure 6 below.

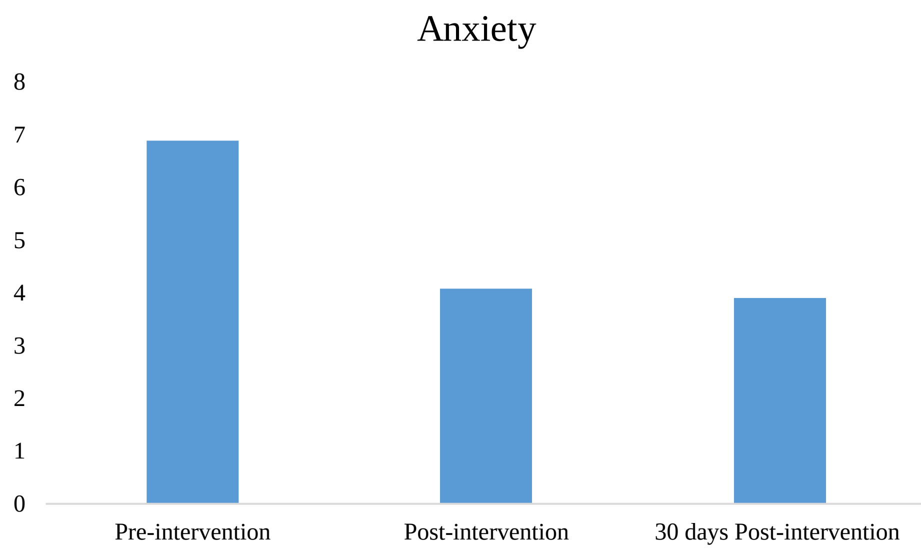

Figure 3. Mean Anxiety Scores Across Time Points.

Figure 6 is a visual representation of the mean scores of the full sample of the participants' perceived sense of anxiety across all three time points. Scores significantly decreased between time point one and time points two and three. Lower scores indicate improvement, a decrease in perceived anxiety.

Lastly, scores on the DASS-21 survey evaluating stress significantly improved by nearly 4 points from time point 1 (M = 15.48, SD = 10.28) to time point 3 (M = 11.93, SD = 10.45), $t(214) = 2.46$, $p = .015$, $d = .34$. Note that lower scores indicate less perceived stress such that all scores indicate improvement. See Figure 7 below.

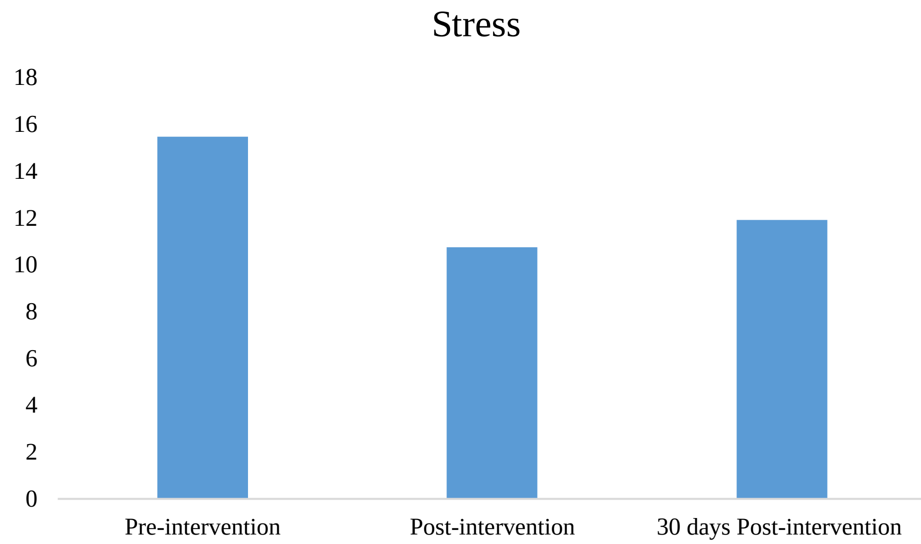

Figure 7. Mean Stress Scores Across Time Points.

Figure 7 is a visual representation of the mean scores of the full sample of the participants' perceived sense of stress across all three time points. Scores decreased between time point one and time points two and three. Lower scores indicate improvement, a decrease in perceived stress.

On the final survey, the PSQI, which assesses quality of sleep, the average scores significantly improved by two points between time point one (M = 7.20, SD = 3.85) and time point three (M = 5.94, SD = 3.44), $t(146) = 2.11$, $p = .036$, $d = .35$. A decrease in score indicates higher sleep quality. Noteworthy, this improvement moved the participants out of a “poor” sleep quality into the “normal” range, as noted in the measurement ranges. See Figure 8 below.

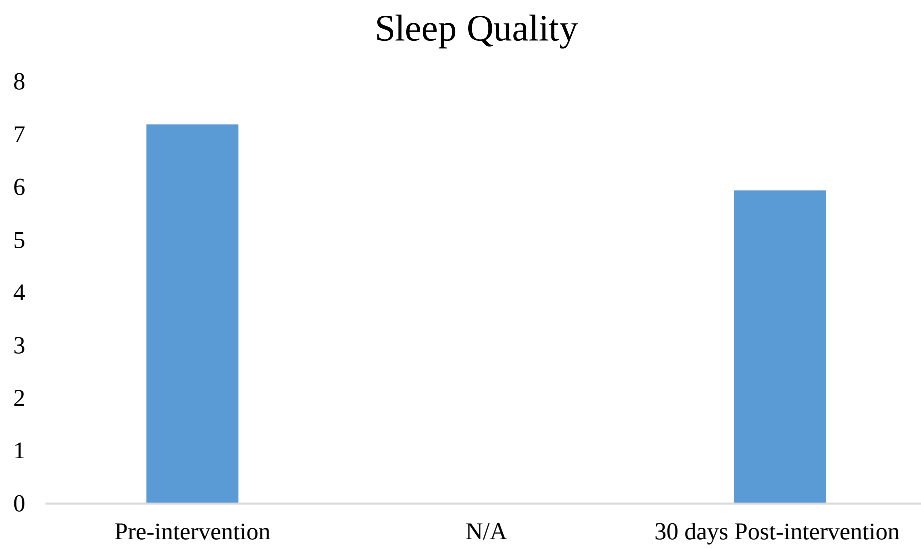

Figure 4. Mean Sleep Quality Scores at Time Points 1 and 2.

Figure 8 is a visual representation of the mean scores of the full sample of the participants' perceived quality of sleep between time points 1 and 3. Scores significantly decreased between time point one and time point three. Lower scores indicate an improvement of sleep quality.

In summary, after a 5-day Slow Deep Breath (SDB) protocol, scores were gathered at a third time point, four weeks post-intervention, to assess the sustainability of improvement to well-being. Over the period between time point one to time point three, 30 days, aspects of anxiety, stress, resilience, general mental health, and quality of sleep all remained significantly improved. However, average scores for depression slightly declined from significant improvement at time point 2 to not significant at time point 3. The final average physical health score also slightly declined between time points 2 and 3. This slight decline may be attributed to the fact that the focus of the measurements included were designed to evaluate mental perception rather than physical perception. See Figure 9 and Table 3 below.

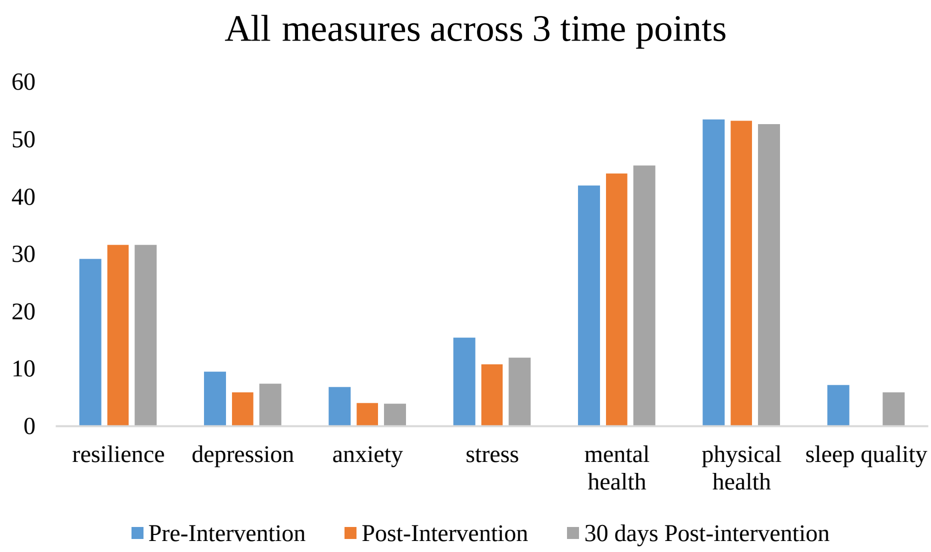

Figure 5. Mean Well-being Scores Across Time Points.

Figure 9 is a visual representation of the mean scores of the full sample of the participants' perceived sense of well-being across all three time points as assessed by all measurements, including resilience, depression, anxiety, stress, general mental and physical health, and quality of sleep.

Table 3. Mean Scores, Standard Deviation, and *p*-Values for All Three Time Points.

Scale	Pre (Mean and *SD*)	Day 5 (Mean and *SD*)	Day 30 (Mean and *SD*)	P Value (Pre-post)	P Value (pre-day 30)
Depression	9.52 (8.65)	5.89 (7.45)	7.45 (9.54)	$p< 0.001$**	$p = .103$
Anxiety	6.89 (6.80)	4.08 (5.34)	3.90 (5.01)	$p< 0.001$**	$p < 0.001$**
Stress	15.48 (10.28)	10.74 (7.63)	11.93 (10.45)	$p< 0.001$**	$p = .015$*
Resilience	29.22 (5.14)	31.82 (5.31)	31.65 (5.39)	$p< 0.001$**	$p = 0.001$**
Sleep Quality	7.20 (3.85)	N/A[1]	5.94 (3.44)	N/A[1]	$p = 0.036$*
Mental health	41.99 (9.10)	44.08 (8.58)	45.49 (8.91)	$p= .05$*	$p = .006$**
Physical health	53.53 (6.65)	53.31 (6.38)	52.76 (6.65)	$p= .79$	$p = .406$

*1 Sleep Quality data was not collected at time point 2. *Statistically significant at p <.05. **Statistically significant at p <.001.*

Research Question 3: Does the Environment of a Breathwork Protocol Significantly Impact Well-Being?

The third focus of the study involved assessing the effectiveness of breathwork in an individual environment versus a group environment. Does one environment work better to increase a sense of well-being than the other? The differences were gathered across all measurements at all 3 time points: pre-intervention, post-intervention, and again at 30 days post-intervention. Scores were assessed between time points one and two (spanning 5 days), then again between time points one and three, 30 days post-intervention.

Mean Baseline Scores by Environment: Group vs Individual at Time Point 1

An independent samples t-test was conducted before the intervention to ensure that both groups started at the same level. The t-tests showed no significant differences between the groups (individual versus group). The mean baseline scores on the first measurement assessed, the CD-RISC, evaluating resilience, were not significantly different between groups at time point one. Group AB scored (*M* = 29.23, *SD* = 5.43) and group C scored (*M* = 29.22, *SD* = 5.07), *t*(130) = .02, *p* = .99, *d* = .003.

Next, scores on the SF-Health survey, assessing general mental and physical health with two separate component scores were not significantly different between groups. Scores on mental health in group AB were (*M* = 40.59, *SD* = 5.43) and group C (*M* = 42.40, *SD* = 8.81, *t*(132) = -.96, *p* = .34, *d* = -.20 at time point 1, pre-intervention. Although group C averaged 2 points higher to begin with, there was no significant difference. The scores on second component of the SF- Health survey, assessing physical health, were not significantly different between group AB (*M* = 53.51, *SD* = 6.31) and group C (*M* = 53.53, *SD* = 6.78), *t*(132) = -.12, *p* = .99, *d* = -.004 at time point 1, pre-intervention.

The third measurement used was the DASS- 21 survey, evaluating three separate components: depression, anxiety, and stress. The average mean scores of the first component, depression, were found to be similar between group AB (*M* = 10.28, *SD* = 10.18) and group C (*M* = 9.30, *SD* = 8.19), *t*(127) = .53, p = .59, *d* = .11 at time point 1, pre-intervention. Although group AB averaged one point higher, there was no significant difference in scores. On the second component, assessing anxiety, there was no significant difference between group AB which scored (*M* = 7.47, *SD* = 6.15) and group C which scored (*M* = 6.71, *SD* = 7.00), *t*(129) = .53, *p* = .75, *d* = .1 at time point 1, pre-intervention. Lastly, on the third evaluated component of the DASS-21, the average scores of stress were not significantly different between groups at time point 1. Group AB scored (*M* = 15.60, *SD* = 9.56) and group C scored (*M* = 15.45, *SD* = 10.52), *t*(130) = .07, *p* = .95, *d* = .01.

The final measurement used was the Global PSQI survey, evaluating the quality of sleep. Scores averaged the same at time point one for both groups indicating no significant difference between groups at time point 1. Group AB scored (*M* = 7.81, *SD* = 4.86) and group C scored (*M* = 7.02, *SD* = 3.53), *t*(68) = .72, *p* = .47, *d* = .21.

Mean Baseline Scores by Environment: Group vs Individual at Time Point 2

Scores on the CD-Risc, assessing resilience, were not significantly different for each environment. Group AB scored (*M* = 32.62, *SD* = 4.38) and group C scored (*M* = 31.60, *SD* = 5.54), *t*(126) = .89, *p* = .38, *d* = .19. Although group AB averaged one point higher, there was no significant difference in scores at time point two, post-intervention.

Next, scores on the SF-Health survey, evaluating general mental health for each environment were not significantly different. Group AB scored (*M* = 43.40, *SD* = 9.23) and group C scored (*M* = 44.28, *SD* = 8.42, *t*(131) = -.50, *p* = .62, *d* = -.10. The second component of the SF- Health survey, assessing physical health, were also not significantly different at time point two for each environment. Group AB averaged (*M* = 53.17, *SD* = 7.09) while group C scored (*M* = 53.35, SD = 6.19), *t*(131) = -.14, *p* = -.03, *d* = -.03.

The third measurement used, DASS-21, evaluating depression, scores were not significantly different for each environment. Group AB scored (*M* = 5.93, *SD* = 6.14) and group C scored (*M* = 5.88, *SD* = 6.22, *t*(125) = .03, *p* = .97, *d* = .01. Next, the scores assessing anxiety on the second component of the DASS-21 survey were determined not to be significantly different between environments. Group AB scored (*M* = 3.79, *SD* = 4.34) and group C scored (*M* = 4.16, *SD* = 5.59, *t*(126) = -.33, *p* = .75, *d* = -.07. Lastly, scores representing stress on the DASS-21 survey were not significantly different between each environment. Group AB scored (*M* = 9.21, *SD* = 6.19) and group C scored (*M* = 11.16, *SD* = 7.95, *t*(128) = -1.20, *p* = .23, *d* = -.26.

The final measurement used in the study, the PSQI, evaluating sleep quality was not measured at the second time point due to an inadequate measure of time needed to properly assess it. Although the differences are not considered significant, the group environment setting showed higher scores than the individual environment, indicating a higher sense of well-being in aspects of resiliency, stress, anxiety, mental health, and physical health at the second time point, post-intervention.

Mean Well-Being Scores at Time Point 3 by Intervention Environment

All average scores were assessed at time point three, 30 days after the intervention, between the individual environment (Group C) and the group environment (Group AB). All measurements were determined not to be significantly different between groups at time point 3. First, scores on the CD-RISC, assessing resilience, were determined not to significantly different for each environment. Group AB scored (*M* = 30.35, *SD* = 3.98) and group C scored (*M* = 32.06, *SD* = 5.73), *t*(81) = -1.24, *p* = .22, *d* = -.32.

Scores on the SF-Health survey, which evaluate general mental and physical health for each environment are separated by two different component scores. Both scores were determined not to be significantly different at timepoint 3. On the mental health score, group AB scored (*M* = 43.41, *SD* = 8.22), and group C scored (*M* = 46.03, *SD* = 9.10), *t*(83) = -1.02, *p* = .31, *d* = -.26. The second component score, assessing physical health, was also not significantly different between both environments at time point 3. Group AB scored (*M* = 53.35, *SD* = 5.90) and group C scored (*M* = 52.58, SD) = 6.89, *t*(83) = .46, *p* = .65, *d* = .12.

The DASS-21 measurement, which has three components scoring depression, anxiety, and stress were all evaluated determining no significant differences between group environments at time point 3. To begin, the average scores for depression for group AB were (*M* = 7.90, *SD* = 8.81) and group C (*M* = 7.30, *SD* = 9.81), *t*(81) = .24, *p* = .81, *d* = .06. Next, scores for anxiety for each environment were not significantly different at time point 3. Group AB scored (*M* = 3.70, *SD* = 3.91) and group C scored (*M* = 3.97, *SD*

= 5.33, $t(82) = -.21$, $p = .84$, $d = -.05$. The last score on the DASS-21 survey measuring stress for each environment was not significantly different at time point 3. Group AB scored ($M = 10.80$, $SD = 8.91$) and group C scored ($M = 12.28$, $SD = 10.93$), $t(82) = -.55$, $p = .58$, $d = -.14$.

The final measurement used was the Global PSQI, measuring the sleep quality. The scores averaged similarly for both groups. Group AB scored ($M = 5.80$, $SD = 3.61$) and group C ($M = 5.98$, $SD = 3.41$), $t(76) = -.20$, $p = .84$, $d = -.05$. It was determined that sleep quality was not significantly different between either group at time point 3.

In summary of the third research question, at 30 days post-intervention (time point 3), scores on all measurements were not significantly different between the group and individual environments. However, it is noteworthy to highlight that while not considered significant, the group setting outscored the individual setting in aspects of mental health, depression, anxiety, stress, and quality of sleep, indicating a higher sense of well-being. See Table 4 below.

Table 4. Group vs. Individual Environment. Mean Scores, Standard Deviation, and *p*-Values for All Three Time Points.

Scale	Environment	Pre (Mean and SD)	Day 5 (Mean and SD)	Day 30 (Mean and SD)	P Value (pre-post day 5)	P Value (pre-post day 30)
Depression	Group	10.28 (10.18)	5.93 (6.14)	7.90 (8.81)	$p = .97$	$p = .81$
	Individual	9.30 (8.19)	5.88 (6.22)	7.30 (9.81)		
Anxiety	Group	7.47 (6.15)	3.79 (4.34)	3.70 (3.91)	$p = .75$	$p = .84$
	Individual	6.71 (7.00)	4.16 (5.59)	3.97 (5.33)		
Stress	Group	15.60 (9.56)	9.21 (6.19)	10.80 (8.91)	$p = .23$	$p = .58$
	Individual	15.45 (10.52)	11.16, (7.95)	12.28 (10.93)		
Resilience	Group	29.23 (5.43)	32.62 (4.38)	30.35 (3.98)	$p = .38$	$p = .22$
	Individual	29.22 (5.07)	31.60 (5.54)	32.06 (5.73)		
Sleep Quality	Group	7.81 (4.86)	N/A[1]	5.80 (3.61)	N/A[1]	$p = .84$
	Individual	7.02 (3.53)	N/A[1]	5.98 (3.41)		
Mental health	Group	40.59 (10.08)	43.40 (9.23)	43.41 (8.22)	$p = .62$	$p = .31$
	Individual	42.40 (8.81)	44.28 (8.42)	46.03 (9.10)		
Physical health	Group	53.51 (6.31)	53.17 (7.09)	53.35 (5.90)	$p = .89$	$p = .65$
	Individual	53.53 (6.78)	53.35 (6.19)	52.58 (6.89)		

1 Sleep Quality data was not collected at time point 2.

Chapter IV.

Discussion

This study investigated the effects of a daily 20-minute slow deep breathing (SDB) intervention that lasted 5 days and compared the impact within different environments. The research aimed to answer three key questions: (1) Can a 20-minute 5-day slow deep breathing (SDB) intervention enhance an individual's perceived sense of well-being? (2) Does a 20-minute 5-day slow deep breathing protocol continue to influence an individual's perceived sense of well-being after 30 days? The study included a 30-day follow-up to evaluate whether results were sustained after a brief 5-day, 20-minute breathwork intervention. In exploring the third question, the study investigated whether the environmental setting of the SDB intervention, group versus individual, had a different impact on outcomes.

The first hypothesis posited that a 20-minute, 5-day SDB intervention could enhance an individual's perceived sense of well-being. The study's findings rejected the null hypothesis, and participants showed significant improvement in resilience, depression, anxiety, and stress immediately after the intervention. The results suggest that even short-term interventions can positively impact mental health, highlighting the potential for SBD as a quick and effective tool for enhancing well-being.

The second hypothesis examined whether the effects of the 20-minute 5-day SDB would persist after 30 days. Again, the null hypothesis was rejected. Improvements in resilience, stress, anxiety, and mental health were sustained 30 days post-intervention, with an additional enhancement in sleep quality. The durability of the intervention's benefits indicated that SDB could be a lasting therapeutic practice with long-term advantages, potentially reducing the need for ongoing therapy.

The third hypothesis explored whether the setting of the SDB intervention, group versus individual, affected the outcomes. Here, the null hypothesis could not be rejected, meaning there was no substantial evidence to support the claim that group settings yield more significant positive results than individual settings.

Despite the lack of statistical difference in well-being outcomes between group and individual settings, the study found a staggering difference in compliance rates, with significantly fewer dropouts in the group setting. Compliance is a critical factor in the success of therapeutic interventions. A group setting may enhance compliance compared to an individual setting. Within the individual setting of this study, approximately 62%, 173 out of 277 participants, dropped out or failed to complete post-study forms. In contrast, only 6%, 2 of 32 participants, dropped out of the group setting. In addition, both participants emailed to inform me they would not be there. One woman was sick, and the other had physically injured herself and could not drive to the studio. Both women expressed disappointment in leaving the study and asked to be contacted if another similar study or class would take place. These results may imply that while the interventions' efficacy after 30 days is similar in both contexts, group settings and a study with a longer duration might offer better adherence.

In a recent study aimed at addressing low compliance and stigma among individuals suffering from Major Depression Disorder (MMD), Tong et al. (2020) compared the effectiveness of group cognitive behavioral therapy (GCBT) to a control group receiving cognitive behavioral therapy (CBT) alone. Initially, no notable distinctions were observed, but after eight weeks, significant improvements in both treatment adherence and therapeutic effectiveness were evident in the GCBT compared to the control group. These findings suggest that when the same intervention is applied in both environments, the group dynamic has the potential to enhance compliance, leading to increased benefits of the intervention.

Another investigation suggests that within a therapeutic environment, group settings may also be a strategy to enhance compliance due to communal support. Cameron (1996) posits that factors believed to influence compliance within the context of a mental health intervention are shared experiences, social support, social isolation, and the quality of interaction. These factors are similarly reported to enhance the individuals' therapeutic progress by increasing their capacity to relate to themselves through others (Kimmel and Gockel (2018).

Limitations and Future Directions

This study has several limitations that warrant consideration. Firstly, the sample size in the group setting compared to individual setting was notably lower, potentially limiting the generalizability of the findings from the group intervention. Additionally, the homogeneity of the population was characterized by an unusually high education status, employed individuals, and an unequal ratio of women to men, with women comprising 80 percent of the sample. The majority of the participants were also of Caucasian ethnicity. Implications of this mean that the findings may not be applicable to more diverse populations or people with different educational backgrounds and may include gender-related biases that could affect the interpretation of results. Lastly, the lack of physiological measures included in the study limits the depth of understanding regarding the physiological mechanisms underlying the observed effects. This aspect highlights the need to incorporate such measures in future research for a more comprehensive evaluation of the interventions. Overall, this type of research has a need for more diverse demographics that include various racial backgrounds, education and employment levels, age groups, and genders to ensure relevance of the findings.

Next, while all measurements used in this study are standardized and exhibit internal consistency, none completely capture or reflect the individual's entire felt experience or satisfaction, which could significantly influence their perceived sense of well-being. After each session in this study, participants were asked to describe their felt sense with a single word. Although not audio recorded, responses included feelings such as freedom, connection, ease, relaxation, peace, calm, unity, community, groundedness, and inspiration. Future studies could explore participants' satisfaction with their experience and offer invaluable insights into their overall well-being. A mixed methods approach, including qualitative data, could provide a more comprehensive understanding of the individual experiences in both individual and group settings.

Subsequent research should consider long-term randomized control studies with detailed follow-ups using different therapeutic modalities in group environments and minimum effective doses and durations of time. Would 10- or 15-minutes work? Or could breaking up the 20 minutes throughout the day be as effective and more practical? Furthermore, it is possible that if the virtual audio recordings sent to the participants in the individual setting had been a video recording with a guide leading them face-to-face, there may have been greater adherence attributed to a more relational environment similar to an in-person environment.

With over twenty years of personal experience in this domain, leading retreats, and being a holistic therapist to individuals, I maintain support of the third hypothesis- that group therapy, compared to individual treatment, may increase the success of the intervention. Based on the evidence in previous studies reported above by Tong et al. in 2020, the effects of a group environment may significantly improve outcomes more than the individual environment in the study when the duration of the study is longer and uses additional measurements. I aim to run another version of this study with a minimum of an eight-week duration including additional measurements continuing to add research to the nature of group therapies in somatic psychology.

In conclusion, within the last few years, there has been an explosion of similar research regarding breathwork therapy and SDB that has been shown to be effective and worthwhile within the individual population, but there are many future considerations and possibilities. This study examined the effects of a mind-body intervention, a specified slow deep breathing (SDB) protocol, that lasted only five days with a significant positive lasting impact after 30 days. All participants experienced less stress, anxiety, and depression with an enhanced sense of resilience, quality of life, and sleep. Notably, this is the first study to compare a breathwork intervention in different environments. Through these intentions, this study aims to contribute insights into the potential impact and duration of effects using SDB within individual and group therapies. Finally, this research aims to encourage the field of psychology to expand its understanding of how somatic or mind-body interventions can be used individually and together to promote psychological well-being.

Appendix 1.

5 Day Breath Therapy Protocol

Slow Deep Breathing (SDB) with emphasis on extended exhalation

A trained professional breath guide from Our Breath Collective will guide all participants. In the group setting, participants will be asked to organize themselves in a circle and to either sit or lie down when they enter the studio. Participants listing via audio recording will also be asked to sit or lie down before starting the breath protocol in the individual setting. Next, they will be guided through the same protocol listed below for five consecutive days. At the end of each 20-minute breathwork session, they will be instructed to sit silently for 5 minutes. Finally, in no order, they will be asked to speak aloud one word of their internal felt sense following the breath therapy session. If they do not wish to participate, they may say stay silent. The entire session will be approximately 35 minutes. The logistical goal and direction of this 5-day breath therapy is learning to breathe in equal ratios between 6-10 breaths per minute through the nose or mouth to breathing 6 or fewer breaths per minute with extended exhales. By the last two days, participants were also invited to attempt breathing through the nose, providing there was no discomfort or added stress.

Day 1. Equal inhale/exhale ratios between 6 and 10 breath cycles per minute

5 minutes- 3 second inhale / 3 second exhale

5 minutes- 4 second inhale / 4 second exhale

5 minutes- 5 second inhale / 5 second exhale

5 minutes- 6 second inhale / 6 second exhale

Day 2. Equal inhale/exhale ratios between 6 and 10 breath cycles per minute

5 minutes- 3 second inhale / 3 second exhale

5 minutes- 4 second inhale / 4 second exhale

5 minutes- 5 second inhale / 5 second exhale

5 minutes- 6 second inhale / 6 second exhale

Day 3. One second increase to exhale ratio

5 minutes- 3 second inhale/ 4 second exhale

5 minutes- 4 second inhale/ 5 second exhale

5 minutes- 5 second inhale/ 6 second exhale

5 minutes- 6 second inhale/ 7 second exhale

Day 4. One second increase to exhale ratio

5 minutes- 3 second inhale/ 4 second exhale

5 minutes- 4 second inhale/ 5 second exhale

5 minutes- 5 second inhale/ 6 second exhale

5 minutes- 6 second inhale/ 7 second exhale

Day 5. Building to two second increase to exhale ratio

5 minutes- 3 second inhale/ 4 second exhale

5 minutes- 4 second inhale/ 6 second exhale

5 minutes- 5 second inhale/ 7 second exhale

5 minutes- 6 second inhale/ 8 second exhale

Appendix 2.

Connor-Davidson Resilience Scale-10 (CD-RISC-10)

Not true at all (0), rarely true (1), sometimes true (2), often true (3), and true nearly all the time (4)

1)	Able to adapt to change	0	1	2	3	4
2)	Can deal with whatever comes	0	1	2	3	4
3)	Tries to see the humorous side problems	0	1	2	3	4
4)	Coping with stress can strengthen me	0	1	2	3	4
5)	Tends to bounce back after illness or hardship	0	1	2	3	4
6)	Can achieve goals despite obstacles	0	1	2	3	4
7)	Can stay focused under pressure	0	1	2	3	4
8)	Not easily discouraged by failure	0	1	2	3	4
9)	Thinks of self as strong person	0	1	2	3	4
10)	Can handle unpleasant feelings	0	1	2	3	4

Appendix 3.

Depression, Anxiety, and Stress Scale (DASS-21)

DASS21

Name: *Date:*

Please read each statement and circle a number 0, 1, 2 or 3 which indicates how much the statement applied to you *over the past week*. There are no right or wrong answers. Do not spend too much time on any statement.

The rating scale is as follows:

0 Did not apply to me at all
1 Applied to me to some degree, or some of the time
2 Applied to me to a considerable degree, or a good part of time
3 Applied to me very much, or most of the time

1	I found it hard to wind down	0	1	2	3
2	I was aware of dryness of my mouth	0	1	2	3
3	I couldn't seem to experience any positive feeling at all	0	1	2	3
4	I experienced breathing difficulty (eg, excessively rapid breathing, breathlessness in the absence of physical exertion)	0	1	2	3
5	I found it difficult to work up the initiative to do things	0	1	2	3
6	I tended to over-react to situations	0	1	2	3
7	I experienced trembling (eg, in the hands)	0	1	2	3
8	I felt that I was using a lot of nervous energy	0	1	2	3
9	I was worried about situations in which I might panic and make a fool of myself	0	1	2	3
10	I felt that I had nothing to look forward to	0	1	2	3
11	I found myself getting agitated	0	1	2	3
12	I found it difficult to relax	0	1	2	3
13	I felt down-hearted and blue	0	1	2	3
14	I was intolerant of anything that kept me from getting on with what I was doing	0	1	2	3
15	I felt I was close to panic	0	1	2	3
16	I was unable to become enthusiastic about anything	0	1	2	3
17	I felt I wasn't worth much as a person	0	1	2	3
18	I felt that I was rather touchy	0	1	2	3
19	I was aware of the action of my heart in the absence of physical exertion (eg, sense of heart rate increase, heart missing a beat)	0	1	2	3
20	I felt scared without any good reason	0	1	2	3
21	I felt that life was meaningless	0	1	2	3

Appendix 4.

Pittsburgh Sleep Quality Index (PSQI)

Name:____ Date: _________________

Pittsburgh Sleep Quality Index (PSQI)

Instructions: The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month. **Please answer all questions.**

1. During the past month, what time have you usually gone to bed at night? ___________________
2. During the past month, how long (in minutes) has it usually taken you to fall asleep each night? __________
3. During the past month, what time have you usually gotten up in the morning? ___________________
4. During the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spent in bed.) ___________________

5. During the past month, how often have you had trouble sleeping because you…	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
a. Cannot get to sleep within 30 minutes				
b. Wake up in the middle of the night or early morning				
c. Have to get up to use the bathroom				
d. Cannot breathe comfortably				
e. Cough or snore loudly				
f. Feel too cold				
g. Feel too hot				
h. Have bad dreams				
i. Have pain				
j. Other reason(s), please describe:				
6. During the past month, how often have you taken medicine to help you sleep (prescribed or "over the counter")?				
7. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?				
	No problem at all	Only a very slight problem	Somewhat of a problem	A very big problem
8. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?				
	Very good	Fairly good	Fairly bad	Very bad
9. During the past month, how would you rate your sleep quality overall?				

	No bed partner or room mate	Partner/room mate in other room	Partner in same room but not same bed	Partner in same bed
10. Do you have a bed partner or room mate?				
	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
If you have a room mate or bed partner, ask him/her how often in the past month you have had:				
a. Loud snoring				
b. Long pauses between breaths while asleep				
c. Legs twitching or jerking while you sleep				
d. Episodes of disorientation or confusion during sleep				
e. Other restlessness while you sleep, please describe:				

Appendix 5.

Short Form-12 Health Survey (SF-12)

SF-12 Health Survey

This survey asks for your views about your health. This information will help keep track of how you feel and how well you are able to do your usual activities. **Answer each question by choosing just one answer**. If you are unsure how to answer a question, please give the best answer you can.

1. **In general, would you say your health is**:

☐1 Excellent ☐2 Very good ☐3 Good ☐4 Fair ☐5 Poor

The following questions are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

	YES, limited a lot	**YES, limited a little**	**NO, not limited at all**
2. **Moderate activities** such as moving a table, pushing a vacuum cleaner, bowling, or playing golf.	☐1	☐2	☐3
3. Climbing **several** flights of stairs.	☐1	☐2	☐3

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

	YES	**NO**
4. **Accomplished less** than you would like.	☐1	☐2
5. Were limited in the **kind** of work or other activities.	☐1	☐2

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

	YES	**NO**
6. **Accomplished less** than you would like.	☐1	☐2
7. Did work or activities **less carefully than usual**.	☐1	☐2

8. **During the past 4 weeks, how much did pain interfere with your normal work (including work outside the home and housework)?**

☐1 Not at all ☐2 A little bit ☐3 Moderately ☐4 Quite a bit ☐5 Extremely

These questions are about how you have been feeling during the past 4 weeks.
For each question, please give the one answer that comes closest to the way you have been feeling.

How much of the time during the past 4 weeks…

	All of the time	Most of the time	A good bit of the time	Some of the time	A little of the time	None of the time
9. Have you felt calm & peaceful?	☐1	☐2	☐3	☐4	☐5	☐6
10. Did you have a lot of energy?	☐1	☐2	☐3	☐4	☐5	☐6
11. Have you felt down-hearted and blue?	☐1	☐2	☐3	☐4	☐5	☐6

12. **During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting friends, relatives, etc.)?**

☐1 All of the time ☐2 Most of the time ☐3 Some of the time ☐4 A little of the time ☐5 None of the time

References

Aaronson, S. T., Sears, P., Ruvuna, F., Bunker, M., Conway, C. R., Dougherty, D. D., Reimherr, F. W., Schwartz, T.L., Zajecka, J. M. (2017). A 5-year observational study of patients with treatment-resistant depression treated with vagus nerve stimulation or treatment as usual: comparison of response, remission, and suicidality. *American Journal of Psychiatry*, 174(7), 640-648. https://doi.org/10.1176/appi.ajp.2017.16010034

American Psychological Association., (2019). Psychotherapy: Understanding group therapy. https://www.apa.org/topics/psychotherapy/group-therapy

Bae, D., Matthews, J. J. L., Chen, J. J., & Mah, L. (2021). Increased exhalation to inhalation ratio during breathing enhances high-frequency heart rate variability in healthy adults. *Psychophysiology*, 58(11), e13905–n/a. https://doi.org/10.1111/psyp.13905

Basha, E., & Kaya, M. (2016). Depression, Anxiety and Stress Scale (DASS): The Study of Validity and Reliability. *Universal Journal of Educational Research*, 4(12), 2701–2705. https://doi.org/10.13189/ujer.2016.041202

Bentley, T. G. K., Seeber, C., Hightower, E., Mackenzie, B., Wilson, R., Velazquez, A., Cheng, A., Arce, N. N., & Lorenz, K. A. (2022). Slow-breathing curriculum for stress reduction in high school students: Lessons learned from a feasibility pilot. *Frontiers in Rehabilitation Sciences*, 3. https://doi.org/10.3389/fresc.2022.864079

Bentley, T. G., D'Andrea-Penna, G., Rakic, M., Arce, N., LaFaille, M., Berman, R., ... & Sprimont, P. (2023). Breathing practices for stress and anxiety reduction: conceptual framework of implementation guidelines based on a systematic review of the published literature. *Brain Sciences*, 13(12), 1612. https://doi.org/10.3390/brainsci13121612

Bonini, L., Rotunno, C., Arcuri, E., & Gallese, V. (2022). Mirror neurons 30 years later: implications and applications. *Trends in Cognitive Sciences*, 26(9), 767-781. https://doi.org/10.1016/j.tics.2022.06.003.

Braun, V., & Clarke, V. (2012). Thematic analysis. *APA Handbook of Research Methods in Psychology*, Vol 2: Research Designs: Quantitative, Qualitative, Neuropsychological, and Biological., 57–71. https://doi.org/10.1037/13620-004

Breit, S., Kupferberg, A., Rogler, G., & Hasler, G. (2018). Vagus nerve as modulator of the brain-gut axis in psychiatric and inflammatory disorders. *Frontiers in Psychiatry*, 9, 44–44. https://doi.org/10.3389/fpsyt.2018.00044

Brumby, S., Chandrasekara, A., McCoombe, S., Torres, S., Kremer, P., & Lewandowski, P. (2011). Reducing psychological distress and obesity in Australian farmers by promoting physical activity. *BMC Public Health*, 11(1), 1-7. https://doi.org/10.1186/1471-2458-11-362

Burns, P. B., Rohrich, R. J., & Chung, K. C. (2011). The levels of evidence and their role in evidence-based medicine. *Plastic and Reconstructive Surgery*, 128(1), 305. https://doi.org/10.1097/prs.0b013e318219c171

Busch,V., Magerl, W., Kern, U., Haas, J., Hajak, G., & Eichhammer, P. (2012). The effect of deep and slow breathing on pain perception, autonomic activity, and mood processing-An experimental study. *Pain Medicine*, 13(2), 215–228. https://doi.org/10.1111/j.1526-4637.2011.01243.x

Buysse, D. J., Reynolds III, C. F., Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh Sleep Quality Index: A new instrument for psychiatric practice and research. *Psychiatry Research*, 28(2), 193-213. https://doi.org/10.1016/0165-1781(89)90047-4

Cameron, C. (1996). Patient compliance: recognition of factors involved and suggestions for promoting compliance with therapeutic regimens. *Journal of Advanced Nursing*, 24(2), 244-250. https://doi.org/10.1046/j.1365-2648.1996.01993.x

Campbell-Sills, L., & Stein, M. B. (2007). Psychometric analysis and refinement of the connor–davidson resilience scale (CD-RISC): Validation of a 10-item measure of resilience. *Journal of Traumatic Stress*: Official Publication of The International Society for Traumatic Stress Studies, 20(6), 1019-1028. https://doi.org/10.1002/jts.20271

Carney, R. M., & Freedland, K. E. (2009). Depression and heart rate variability in patients with coronary heart disease. *Cleveland Clinic Journal of Medicine*, 76(Suppl 2), S13. https://doi.org/10.3949/ccjm.76.s2.03

Chen, W. G., Schloesser, D., Arensdorf, A. M., Simmons, J. M., Cui, C., Valentino, R., ... & Langevin, H. M. (2021). The emerging science of interoception: Sensing, integrating, interpreting, and regulating signals within the self. *Trends in Neurosciences*, 44(1), 3-16. https://doi.org/10.1016/j.tins.2020.10.007

Cohen. (2011). Coming to our senses: The application of somatic psychology to group psychotherapy. *International Journal of Group Psychotherapy*, 61(3), 396–413. https://doi.org/10.1521/ijgp.2011.61.3.396

Connor, K. M., & Davidson, J. R. (2003). Development of a new resilience scale: The Connor-Davidson resilience scale (CD-RISC). *Depression and Anxiety*, 18(2), 76-82. https://doi.org/10.1002/da.10113

Dhaniwala, N. K. S., Dasari, V., & Dhaniwala, M. N. (2020). Pranayama and breathing exercises- Types and its role in disease prevention & rehabilitation. *Journal of Evolution of Medical and Dental Sciences*, 9(44), 3325-3331. https://doi.org/10.14260/jemds/2020/730

Feldner,M., Zvolensky, M., & Schmidt, N. (2004). Prevention of anxiety psychopathology: A critical review of the empirical literature. *Clinical Psychology*, 11(4), 405–424. https://doi.org/10.1093/clipsy.bph098

Gerritsen, R.J.S., & Band, G. P. H. (2018). Breath of life: The respiratory vagal stimulation model of contemplative activity. *Frontiers in Human Neuroscience*, 12, 397–397. https://doi.org/10.3389/fnhum.2018.00397

Gholamrezaei, A., Van Diest, I., Aziz, Q., Vlaeyen, J. W., & Van Oudenhove, L. (2020). Psychophysiological responses to various slow, deep breathing techniques. *Psychophysiology*, 58(2), e13712. https://doi.org/10.1111/psyp.13712

Grossman, P., & Taylor, E. W. (2007). Toward understanding respiratory sinus arrhythmia: Relations to cardiac vagal tone, evolution and biobehavioral functions. *Biological Psychology,* 74(2), 263-285. https://doi.org/10.1016/j.biopsycho.2005.11.014

Haensel, A., Mills, P. J., Nelesen, R. A., Ziegler, M. G., & Dimsdale, J. E. (2008). The relationship between heart rate variability and inflammatory markers in cardiovascular diseases. *Psychoneuroendocrinology,* 33(10), 1305-1312. https://doi.org/10.1016/j.psyneuen.2008.08.007

Iacoboni, M. (2009). Imitation, empathy, and mirror neurons. *Annual Review of Psychology,* 60, 653-670. https://doi.org/10.1146/annurev.psych.60.110707.163604

Jafari, H., Gholamrezaei, A., Franssen, M., Van Oudenhove, L., Aziz, Q., Van den Bergh, O., Vlaeyen, J. W. S., & Van Diest, I. (2020). Can slow deep breathing reduce pain? An experimental study exploring mechanisms. *The Journal of Pain*, 21(9–10), 1018–1030. https://doi.org/10.1016/j.jpain.2019.12.010

Jerath, R., Edry, J. W., Barnes, V. A., & Jerath, V. (2006). Physiology of long pranayamic breathing: Neural respiratory elements may provide a mechanism that explains how slow deep breathing shifts the autonomic nervous system. *Medical Hypotheses*, 67(3), 566–571. https://doi.org/10.1016/j.mehy.2006.02.042

Kanchibhotla, D., Saisudha, B., Ramrakhyani, S., & Mehta, D. H. (2021). Impact of a yogic breathing technique on the well-being of healthcare professionals during the COVID-19 pandemic. *Global Advances in Health and Medicine*, 10, 2164956120982956. https://doi.org/10.1177/2164956120982956

Kimmell, A., & Gockel, A. (2017). Embodied connections: Engaging the body in group work. *Qualitative Social Work: Research and Practice*, 17(2), 268–285. https://doi.org/10.1177/1473325016681066

Kulur, A. B., Haleagrahara, N., Adhikary, P., & Jeganathan, P. S. (2009). Effect of diaphragmatic breathing on heart rate variability in ischemic heart disease with diabetes. *Arquivos Brasileiros de Cardiologia*, 92, 457-463. https://doi.org/10.1590/s0066-782x2009000600008

Laborde, S., Hosang, T., Mosley, E., & Dosseville, F. (2019). Influence of a 30-day slow-paced breathing intervention compared to social media use on subjective sleep quality and cardiac vagal activity. *Journal of Clinical Medicine*, 8(2), 193. https://doi.org/10.3390/jcm8020193

Laborde, S., Iskra, M., Zammit, N., Borges, U., You, M., Sevoz-Couche, C., & Dosseville, F. (2021). Slow-paced breathing: Influence of inhalation/exhalation ratio and of respiratory pauses on cardiac vagal activity. *Sustainability*, 13(14), 7775. https://doi.org/10.3390/su13147775

Laborde, S., Allen, M. S., Borges, U., Dosseville, F., Hosang, T. J., Iskra, M., Mosley, E., Salvotti, C., Spolverato, L., Zammit, N., & Javelle, F. (2022). Effects of voluntary slow breathing on heart rate and heart rate variability: A systematic review and a meta-analysis. *Neuroscience & Biobehavioral Reviews*, 138, 104711. https://doi.org/10.1016/j.neubiorev.2022.104711

Lalande, L., Bambling, M., King, R., & Lowe, R. (2011). Breathwork: An additional treatment option for depression and anxiety? *Journal of Contemporary Psychotherapy*, 42(2), 113–119. https://doi.org/10.1007/s10879-011-9180-6

Levi, O., Shoval-Zuckerman, Y., Fruchter, E., Bibi, A., Bar-Haim, Y., & Wald, I. (2017). Benefits of a psychodynamic group therapy (PGT) model for treating veterans with PTSD. *Journal of Clinical Psychology*, 73(10), 1247-1258. https://doi.org/10.1002/jclp.22443

Lin, I. M., Tai, L. Y., & Fan, S. Y. (2014). Breathing at a rate of 5.5 breaths per minute with equal inhalation-to-exhalation ratio increases heart rate variability. *International Journal of Psychophysiology*, 91(3), 206-211. https://doi.org/10.1016/j.ijpsycho.2013.12.006

Lovibond, S. H., & Lovibond, P. F. (1995). Depression anxiety stress scales. Psychological Assessment. https://doi.org/10.1037/t01004-000

Ma, X.,Yue, Z.-Q., Gong, Z.-Q., Zhang, H., Duan, N.-Y., Shi, Y.-T., Wei, G.-X., & Li, Y.-F. (2017). The effect of diaphragmatic breathing on attention, negative affect, and stress in healthy adults. *Frontiers in Psychology*, 8, 874–874. https://doi.org/10.3389/fpsyg.2017.00874

McCarthy, O., Hevey, D., Brogan, A., & Kelly, B. D. (2013). Effectiveness of a cognitive behavioural group therapy (CBGT) for social anxiety disorder: immediate and long-term benefits. *The Cognitive Behaviour Therapist*, 6, e5. https://doi.org/10.1017/s1754470x13000111

Mather, M., & Thayer, J. F. (2018). How heart rate variability affects emotion regulation brain networks. *Current Opinion in Behavioral Sciences*, 19, 98-104.https://doi.org/10.1016/j.cobeha.2017.12.017

Magnon, V., Dutheil, F., & Vallet, G. T. (2021). Benefits from one session of deep and slow breathing on vagal tone and anxiety in young and older adults. *Scientific Reports*, 11(1), 19267. https://doi.org/10.1038/s41598-021-98736-9

Perciavalle, V., Blandini, M., Fecarotta, P., Buscemi, A., Di Corrado, D., Bertolo, L., Fichera, F., & Coco, M. (2017). The role of deep breathing on stress. *Neurological Sciences*, 38(3), 451–458. https://doi.org/10.1007/s10072-016-2790-8

Petrocchi, N., & Cheli, S. (2019). The social brain and heart rate variability: Implications for psychotherapy. *Psychology and Psychotherapy: Theory, Research and Practice*, 92(2), 208-223. https://doi.org/10.1111/papt.12224

Piper, W. E., Doan, B. D., Edwards, E. M., & Jones, B. D. (1979). Co-therapy behavior, group therapy process, and treatment outcome. *Journal of Consulting and Clinical Psychology*, 47(6), 1081–1089. https://doi.org/10.1037//0022-006x.47.6.1081

Porges, S. W. (2004). Neuroception: A subconscious system for detecting threats and safety. *Zero to Three (J)*, *24*(5), 19-24.

Porges. (2007). The polyvagal perspective. *Biological Psychology*, 74(2), 116–143. https://doi.org/10.1016/j.biopsycho.2006.06.009

Porges, S. W. (2009). The polyvagal theory: new insights into adaptive reactions of the autonomic nervous system. *Cleveland Clinic Journal of Medicine*, 76(Suppl 2), S86. https://doi.org/10.3949/ccjm.76.s2.17

Porges, S. W., & Furman, S. A. (2011). The early development of the autonomic nervous system provides a neural platform for social behaviour: A polyvagal perspective. *Infant and Child Development*, *20*(1), 106-118. https://doi.org/10.1002/icd.688

Porges. (2022). Polyvagal theory: A science of safety. *Frontiers in Integrative Neuroscience*, *16*, 871227–871227.https://doi.org/10.3389/fnint.2022.871227

Renjilian, D. A., Perri, M. G., Nezu, A. M., McKelvey, W. F., Shermer, R. L., & Anton, S. D. (2001). Individual versus group therapy for obesity. *Journal of Consulting and Clinical Psychology, 69*(4), 717–721. https://doi.org/10.1037//0022-006x.69.4.717

Röhricht, F. (2009). Body oriented psychotherapy. The state of the art in empirical research and evidence-based practice: A clinical perspective. *Body, Movement and Dance in Psychotherapy*, 4(2), 135–156. https://doi.org/10.1080/17432970902857263

Russo, M. A., Santarelli, D. M., & O'Rourke, D. (2017). The physiological effects of slow breathing in the healthy human. *Breathe, 13*(4), 298-309. https://doi.org/10.1183/20734735.009817

Sak, W. (2018). Daniel J. Siegel, The developing mind: How relationships and the brain interact to shape who we are, Guilford Press, New York–London 2012, pp. 506. *Kultura i Edukacja*, 120(2), 217–222. https://doi.org/10.15804/kie.2018.02.14

Seppälä, E. M., Nitschke, J. B., Tudorascu, D. L., Hayes, A., Goldstein, M. R., Nguyen, D. T. H., Perlman, D., & Davidson, R. J. (2014). Breathing-based meditation decreases posttraumatic stress disorder symptoms in U.S. military veterans: A randomized controlled longitudinal study. *Journal of Traumatic Stress*, 27(4), 397–405. Portico. https://doi.org/10.1002/jts.21936

Siegel, D, (2010). Commentary on "Integrating interpersonal neurobiology with group psychotherapy": Reflections on mind, brain, and relationships in group psychotherapy. *International Journal of Group Psychotherapy*, *60*(4), 483–485. https://doi.org/10.1521/ijgp.2010.60.4.483

Stellar, J. E., Cohen, A., Oveis, C., & Keltner, D. (2015). Affective and physiological responses to the suffering of others: compassion and vagal activity. *Journal of Personality and Social Psychology, 108*(4), 572. https://doi.org/10.1037/pspi0000010

Strupf, M., Hoell, A., Bajbouj, M., Böge, K., Wiechers, M., Karnouk, C., Kamp-Becker, I., Banaschewski, T., Meyer-Lindenberg, A., Rapp, M., Hasan, A., Falkai, P., Habel, U., Heinz, A., Plener, P., Kaiser, F., Weigold, S., Mehran, N., Übleis, A., & Padberg, F. (2023). Shared sorrow, shared costs: Cost-effectiveness analysis of the empowerment group therapy approach to treat affective disorders in refugee populations. *The British Journal of Psychiatry*, 9(4). https://doi.org/10.1192/bjo.2023.504

Tindle, J., & Tadi, P. (2022). Neuroanatomy, parasympathetic nervous system. In *StatPearls [Internet]*. StatPearls Publishing. https://doi.org/10.53347/rid-154401

Tong, P., Bu, P., Yang, Y., Dong, L., Sun, T., & Shi, Y. (2020). Group cognitive behavioral therapy can reduce stigma and improve treatment compliance in major depressive disorder patients. *Early Intervention in Psychiatry*, 14(2), 172-178. https://doi.org/10.1111/eip.12841

Thayer, J. F., & Brosschot, J. F. (2005). Psychosomatics and psychopathology: looking up and down from the brain. *Psychoneuroendocrinology*, *30*(10), 1050-1058. https://doi.org/10.1016/j.psyneuen.2005.04.014

Vaishnavi, S., Connor, K., & Davidson, J. R. (2007). An abbreviated version of the Connor-Davidson Resilience Scale (CD-RISC), the CD-RISC2: Psychometric properties and applications in psychopharmacological trials. *Psychiatry Research*, *152*(2-3), 293-297. https://doi.org/10.1016/j.psychres.2007.01.006

Van Diest, I., Verstappen, K., Aubert, A. E., Widjaja, D., Vansteenwegen, D., & Vlemincx, E. (2014). Inhalation/exhalation ratio modulates the effect of slow breathing on heart rate variability and relaxation. *Applied Psychophysiology and Biofeedback*, *39*(3), 171-180. https://doi.org/10.1007/s10484-014-9253-x

Ware, J. E., Keller, S. D., & Kosinski, M. (1995). *SF-12:* How to score the SF-12 physical and mental health summary scales. Health Institute, New England Medical Center.

Ware, J. E., Kosinski, M., & Keller, S. D. (1996). A 12-Item Short-Form Health Survey: construction of scales and preliminary tests of reliability and validity. *Medical Care*, *34*(3), 220-233. https://doi.org/10.1097/00005650-199603000-00003

Wheat, A. L., & Larkin, K. T. (2010). Biofeedback of heart rate variability and related physiology: A critical review. *Applied Psychophysiology and Biofeedback*, *35*(3), 229-242. https://doi.org/10.1007/s10484-010-9133-y

You, M., Laborde, S., Zammit, N., Iskra, M., Borges, U., & Dosseville, F. (2021). Single slow-paced breathing session at six cycles per minute: Investigation of dose-response relationship on cardiac vagal activity. *International Journal of Environmental Research and Public Health*, *18*(23), 12478. https://doi.org/10.3390/ijerph182312478

Zaccaro, A., Piarulli, A., Laurino, M., Garbella, E., Menicucci, D., Neri, B., & Gemignani, A. (2018). How breath-control can change your life: a systematic review on psycho-physiological correlates of slow breathing. *Frontiers in Human Neuroscience*, *12*, 353. https://doi.org/10.3389/fnhum.2018.00353

Zhang, W., Ouyang, Y., Tang, F., Chen, J., & Li, H. (2019). Breath-focused mindfulness alters early and late components during emotion regulation. *Brain and Cognition*, *135*, 103585–103585. https://doi.org/10.1016/j.bandc.2019.103585

Zulfiqar, U., Jurivich, D. A., Gao, W., & Singer, D. H. (2010). Relation of high heart rate variability to healthy longevity. *The American Journal of Cardiology*, *105*(8), 1181-1185. https://doi.org/10.1016/j.amjcard.2009.12.022