UNIVERSITY OF PAVIA – IUSS SCHOOL FOR ADVANCED STUDIES PAVIA

Department of Brain and Behavioral Sciences (DBBS)
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The Effects of Mindfulness on Mental Health and Sleep in The Population of Elderly

Supervisor:
Prof. Dr Alessia Rosi

Thesis written by:
Tamara Babić

Co-supervisor:
Prof. Dr Elena Cavallini

Student ID:
513483

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ABSTRACT

Sleep disturbances concern old age. At the same time, changes are happening in cognitive function. The consequences of such variations reflect on mental health. As the world population grows older, demands for proper and accessible treatments are present. The current state of the research guides towards a possible option called mindfulness. Existing data shows promising and optimistic take on this technique as a treatment solution. In the aged population, mindfulness appears to have positive impact on neural, physiological, psychological, and social aspects. At the same time, search for a mechanism behind it, optimal types of exercises, modality, and the extent of its reach, are in the process. Nevertheless, the absence of adversities, and the ability to adapt and implement this practice drives the motivation behind raising awareness about its use. Accordingly, insight into personal statements and experience of the users gives a better understanding of what it is like to be mindful, and truly comprehend the already observed effects, as well as potential directions and adjustments of this technique.

INTRODUCTION

Sleep duration, quality, and sleeping patterns change across the human lifespan due to multiple factors including modern lifestyles, as well as personal circumstances. Nevertheless, one factor is inevitable and not modifiable like the above-mentioned. It is, indeed, aging.

Since it is not something any human can escape, and since growing older is characterized by changes in the structure of sleep function, we can observe low sleep quality, irregular sleep-wake cycles, fragmentation of sleep, and above all – insomnia, in many elderly (Carvalhas-Almeida et al., 2022). Additionally, poor sleep quality has been associated with mental health disturbances (Corbo et al., 2023), namely depression which is prevalent in the older population as well (Cai et al., 2023).

Furthermore, much research has been done on the connection between fragmented sleep and cognitive function decline, resulting in a higher risk for neurodegenerative diseases (Lim et al., 2013). Accordingly, the prediction is that by the year 2050, 153 million people are expected to be living with dementia across the world (Nichols & Vos, 2021).

Consequently, implementing techniques to improve sleep quality might be a good starting point for making important changes and promoting healthy aging. With its focus on practicing and integrating attention, awareness, and meditation, mindfulness techniques emerge as a promising intervention to enhance cognitive resilience and functioning in the elderly.

For that reason, the main topic of this master's thesis will be the effects of mindfulness on overall mental health with a focus on sleep hygiene in the older population. More specifically, the research question will refer to the clinical application of mindfulness techniques in increasing sleep quality and cognitive resilience in the elderly with sleep troubles.

Through the comprehensive examination of the relevant and existing literature, which will include meta-analysis, reviews, experimental studies, and clinical research, the aim is to provide an understanding of the mechanisms through which mindfulness techniques could aid the sleep cycle, decrease insomnia and other sleep disorders symptoms, and improve overall health in the older population. Moreover, it will be crucial to critically assess the contradicting findings between

the studies that are reporting notable improvements with this intervention, and those that are disclosing minimal or no significant results.

Amongst five chapters, additional questions that will be answered allude to whether mindfulness can improve the quality of life in patients with declines in cognition and how mindfulness affects the brain on the neurophysiological level. Furthermore, it will be interesting to discuss how we can make mindfulness exercises more applicable for the elderly, along with the ability of mindfulness to improve overall mental well-being by regulating anxiety levels, decreasing depression-like symptoms, and increasing cognitive clarity.

The main goal of this thesis is not only to provide and expand the existing theoretical knowledge but also to bring forth practical guidelines for the implementation of mindfulness techniques as therapeutical and preventive strategies. It will aspire to shed light on existing issues, as well as new perspectives when it comes to mindfulness, sleep, and cognitive resilience. At the same time, the attention will be on contributing to the creation of holistic strategies for maintaining the mental health of the aged.

Now that all is stated, we will start with the first chapter and dive into the world of, the much-mentioned, mindfulness.

First Chapter

Introduction to Mindfulness

Many consequences come with modern ways of living, both physical and psychological. Burnout, depression, anxiety, heart disease, and cancer are just one of them. In 2023., the World Health Organization reported that there is an enormous "global burden" of mental health conditions as it is estimated that there are over billion world-wide sufferers from different psychological and other related disorders such as substance abuse. This is not surprising since contemporary society is characterized by uncertainty and fast-paced changes. Accordingly, a need for appropriate treatments and interventions comes as a prerequisite. In that case, there might be a possibility for every one of us to protect or at least improve our mental and physical health, even at a minimum cost.

Although this sounds too good to be true, there is a way in which this can be achieved. Indeed, there is a technique available for everyone called - Mindfulness. Ever since its first appearance in the Western media, a contribution which we can assign to Jon Kabat-Zinn, it continues to gain popularity. So much so that now it is not only an interesting topic for researchers, psychologists, or psychotherapists, but it is explored by modern society as well. Famous companies such as Nike, Google, and Microsoft, are including mindfulness practices to promote creative talents, job efficiency, reduce stress levels induced by work demands, and overall well-being of their employees (Montalban, 2023). Apart from all of this, mindfulness is being used for mood improvement, pain management, strengthening of cognitive capacities, and many other things that will be discussed below.

Accordingly, in this chapter, we will see how much work has been done and what has been proven up until this point. We will also observe its influence on different brain structures, and the ability to induce brain plasticity and improve cognitive functioning that ought to decline with aging. Furthermore, we will describe the effects it can have on mental and overall health, as well as practical implications for its use in everyday life. Before we address any of these aspects, we will first mention the distinctive characteristics of mindfulness, starting with its definition and origin.

Definition and Origin of Mindfulness

There are many different, and no universally accepted definitions of mindfulness. For the purpose of this thesis, we will use the most cited definition that comes from the expert in this field, Jon Kabat-Zinn. “To pay attention in a certain way, purposeful, attentively, in the present moment, without judgment,” is how he defines the term. The origin of the word comes from the Pali word “sati”, and it translates to: „awareness, attention, and remembering“ (Didonna, 2009, p. 26). Mindfulness is derived from Buddha ideology where it is part of the “Noble Eightfold path“ (Trammel, 2017), and its utility is placed upon the belief that performing mindfulness allows „growth and development“, for those who practice it, as well as an understanding of the „Four Noble Thruths“ and ultimately „attaining enlightenment“ (Maex, 2011, as cited in Trammel, 2017, p. 370). This idea has been taken and adapted in the Western world. Even though the definition of Jon Kabat-Zinn serves more for the „clinical setting,“ (Anālayo, 2019, p. 12), it still encompasses the original aspect in a way that it refers to the present mode of being, found in the early mindfulness teachings (Anālayo, 2019). Additionally, using mindfulness for pain (Anālayo, 2015, as cited in Anālayo 2019), and to even treat obesity (Anālayo, 2018, as cited in Anālayo 2019), are present in ancient literature as well. But what separates mindfulness from the original Buddhist meditation is that the goal is not to reach a state of freedom without suffering or rebirth. On the contrary, the purpose of it is to help people to become more aware of their body in its present state without trying to achieve relaxation. This is the essence of mindfulness - being fully aware, which involves taking an open-minded approach to life as it unfolds in the present. Therefore, to accept things as they are without demanding that they be different. Mindfulness has expanded from the original pillars, and aside from attention, awareness, and remembering, it now also includes nonjudgement, acceptance, and compassion (Didonna, 2009). Additionally, it is part of several therapeutic approaches such as Mindfulness-Based Stress Reduction (MBSR), Mindfulness-Based Cognitive therapy (MBCT), Dialectical Behavior Therapy (DBT), and Acceptance and Commitment Therapy (ACT). It is important to note that all of these psychotherapeutic practices are based upon the growing body of empirical evidence that looks into the benefits of mindfulness as an intervention for various psychological conditions. Accordingly, the next part is dedicated to the science behind this practice, more precisely neuroscience, psychological, and related mental and physical effects.

Neuroscience Behind Mindfulness and Related Effects

What exactly happens in the brain while practicing mindfulness is what the following pages are dedicated to. The neuroscience behind mindfulness, the neural structures implicated in this process, and its impact are discussed below.

Over the years, a vast number of brain areas were associated with mindfulness practice. Although the mechanisms behind it continue to be explored even to this day, research that has been done still provides us with valuable insights. Accordingly, the impact of mindfulness on improving attention, emotion regulation, self-awareness, cognition, and brain plasticity, as well as stress resilience, has been shown in several research works. The possible explanation for this could be found in changes observed in the insula (Siew & Yu, 2023., Mooneyham et al., 2017), prefrontal cortex (Wheeler et al., 2017), precuneus (Yang et al., 2019), amygdala (Wheeler et al., 2017), hippocampus (Sevinc et al., 2019), and overall changes in the grey (Wheeler et al., 2017, Tang et al., 2020), and white matter volume (Wheeler et al., 2017) of the people who were practicing mindfulness. For example, Wheeler and colleagues (2017) are noting that higher density of the grey matter in those who are "mindful", might account for better interoceptive awareness. Moreover, based on the literature reported in this paper by the authors, anterior cingulate cortex (ACC), as well as primary somatosensory cortex, dorsal right somatosensory cortex, right anterior insular cortex, hippocampus, amygdala, and prefrontal cortex, have been shown to contain more of the gray matter in those who are skillful mindfulness performers (Grant et al., 2010, Lazar et al, 2005; Luders et al, 2009, as cited in Wheeler et al., 2017). Furthermore, a recent study showed that a "brief" mindfulness "Integrative Body Mind Training", had an impact on grey matter in the areas responsible for emotional and cognitive responses, as well as self-awareness, through its effects observed in the ventral posterior cingulate cortex, as noted by the authors (Tang et al., 2020). Important takeout from this study concerns the possible connections between this brain region and aging, since the authors are hinting at the role of this area in cognitive deteriorations that appear at this stage of life. Additionally, the beneficial impact of this technique has been observed in the white matter as well. It appears that individuals who practice mindfulness more regularly have a more efficient white matter which contributes to the better processing of emotional information. The changes of this brain element were detected in the corona radiata, and temporal pole (Tang et al., 2010; Kang et al., 2013 as cited in Wheeler et al., 2017). Moreover, the precuneus is a key

region in the brain responsible for various cognitive functions. In one study, participants who underwent 40 days of mindfulness, and when measured by fMRI's low-frequency amplitude (ALFF), showed thicker cortical regions of precuneus and smaller ALFF in this brain area, as noted (Yang et al., 2019). These findings are important to report for the domain of mental health since the authors state that depression is associated with the amount of ALFF. Hence, by practicing mindfulness it is possible to have effects not only on this specific brain region, but on the more-broad mood scale as well. Additionally, since one of the main aspects of mindfulness are attention capacities, by observing the main brain areas and elements involved in the attention such as: anterior cingulate cortex (ACC), dorsolateral prefrontal cortex (DLPFC), error-related negativity (ERN), ventrolateral prefrontal cortex (VLPFC), and medial prefrontal cortex (MPFC), based on the studies Wheeler et al. (2017) assessed, it could be observed that mindfulness causes changes in such regions. Since each of the structures is involved in either inhibition, attention, executive functions, social cognition, or other forms of cognitive or emotional components, the effects of mindfulness could then account for the better functioning of the attention and mental health in those who practice it. Along with attention, it is also worth mentioning emotion regulation which we cannot talk about without the important role that amygdala has. It appears that that when mindfulness is performed, the impact it produces on amygdala could be seen in reducing the activity of both the HPA axis and the amygdala itself (Wheeler et al., 2017). This ultimately could have effects on mental health by helping people struggling with depression, anxiety, or stress (Wheeler et al., 2017). This is also supported by the findings linking the impact of mindfulness with "strengthened hippocampal circuit" (Sevinc et al., 2019), which authors suggest that could be important for the "extinction learning," hence providing aid in the domain of anxiety disorders, and "fostering stress resilience" The main idea presented in this study states that for optimal psychological functioning, it is important that every individual knows when to and when not to react to "threat signals." Therefore, the authors of this study suggest that to be able to do that, there needs to be the ability of adequately switching the attention to "sensory experience." Hence, mindfulness could contribute to acquiring such skill, as the observed changes in the hippocampus add to the idea of how this intervention could operate as a useful tool when being exposed to real or imagined stressors. What also usually appears in the literature about meditation is the role of default mode network. More precisely, when practicing mindfulness, it helps people not to immerse themselves into their ruminative thoughts so they could have their attention placed on the present

(Wheeler et al., 2017). Lastly, special mention is dedicated to the insula, a brain region responsible for interoception which many believe to be the key mechanism through which people might benefit from mindfulness (Mooneyham et al., 2017). Hence, participants who underwent six weeks of mindfulness intervention, and who were performing better in the dispositional mindfulness, were also the ones with more cortical thickness in the left-posterior insula (Mooneyham et al., 2017). Dispositional mindfulness, when put simply, helps people be more tuned in with the present moment even in the face of distractions. Moreover, the regions of posterior insula such as ventrolateral prefrontal cortex, middle and superior temporal gyri, were impacted with mindfulness resulting in higher functional connectivity of the mindful participants.

To sum up, findings in the domain of neuroscience and mindfulness have shown the impact of this technique in several brain regions. By changing structural and functional aspects of the brain, mindfulness aids many of the brain processes involved in different, but important, brain functions. Accordingly, the effects could be seen in attention, emotion regulation, self-awareness, cognition, brain plasticity, and stress management. Although there is always a need for new studies to replicate, confirm, or question these effects, the current evidence suggests that something does happen in our brains when performing mindfulness. Of course, many factors could influence every one of us, hence the individual differences. But what is important to highlight is that in neither one of the studies, individuals experienced adverse effects because of this training. Changes detected, even if small, remain as the encouragement for new studies to dive into the neuroscience behind mindfulness.

Mind and Body, Physical and Psychological Effects of Mindfulness

Aside from the beneficial impact of mindfulness on our brain, its impact reflects both on our psychological and physical well-being. Mood improvement, cardiovascular health, and cancer are some of the many areas this intervention is being used for which will be discussed in this part.

Studies about happiness have been and are still probably dominating both the scientific community and the public. How to obtain, maintain, induce, and more philosophically, find happiness is still a burning question in our society. There are many ways that people try to achieve all of this, and again to no surprise mindfulness is one of them. Accordingly, one study aimed to

investigate the relationship between happiness and mindfulness (Campos et al., 2016). The focus was placed upon the "frequency of meditation," as noted by the authors, and it could go from either: performing mindfulness every-day to never using this technique. The authors confirmed their initial belief that the more mindful moments are present every day, the better and happier a person feels. More precisely, the authors are naming dispositional mindfulness and self-compassion as the main elements that contribute to these observed results. It is important to note that, like in any study, many factors could influence the results of these findings, but regardless the effect of self-compassion and dispositional mindfulness was still observed in the domain of happiness. In another study, this relationship was investigated among the Spanish hospital staff workers where thirty-four employees participated (Coo & Salanova, 2017). Nineteen of them received mindfulness-based intervention, and the other fifteen were in the waiting list control group. The results showed that mindfulness acted positively on the following aspects: trait mindfulness, happiness, and the performance of the employees, as written by the authors. This effect was additionally confirmed by the control group who showed a "decrease in their well-being and performance scores" (Coo & Salanova, 2017, p. 1706). Some explanations for this the authors derived from the possible frustration and negative emotions of the participants in the control group regarding their inaccessibility to the intervention program. The authors are also adding that their negative emotions provoked by the position in the control group, confirmed the idea that "heightened awareness of negative and stressful experiences" contributes to these negative feelings since these individuals did not have efficient strategies to diminish this effect like the ones in the training group (Coo & Salanova, 2017, p. 1706). Another population subjected to stress is, of course, the population of students. In that case, one research investigated the connection of mindfulness with psychological well-being in three Universities in China (Rehman et al., 2021). Special attention was given to the two elements: social connectedness and self-esteem, since the authors believe that mindfulness could affect psychological well-being through the two. Even though this research relied on self-reports, it managed to confirm the author's hypothesis, as well as previous findings linking mindfulness with psychological well-being. The authors explained that the possible mechanism that could be responsible for the observed results, lies in the ability of mindfulness to help people: "Gain a greater sense of self-esteem and social connectedness and thus raise levels of psychological well-being" (Rehman et al., 2021, p. 11778). The important thing to note is the author's implication for using mindfulness not only to improve the above-mentioned self-esteem or social

connectedness, but to also aid psychological well-being in students when they are "away from family, friends, and society" (Rehman et al., 2021, p. 11778). In the physical health domain, a significant amount of research has also been done associating mindfulness and its effect on different health conditions. Accordingly, a systematic review and meta-analysis were performed concerning the population of cancer affected patients and those who survived this illness (Cillessen et al., 2019). The main interest was in observing the impact mindfulness could have on the mental burden in this population, namely stress. The results were obtained from thirty-eight studies and a strong, but not so big, impact was detected between mindfulness and mental health. The main cause of the distress in the patients was expressed as "fear of cancer recurrence", and according to the authors, MBI not only helped with that type of fear, but it positively impacted "fatigue, sleep disturbances, and pain" (Cillessen et al. 2019, p. 2257). The authors are also implying that different types of mindfulness interventions might be used in this population since they report not to observe any superiority between MBSR, or MBCT. Overall, mindfulness performed well regarding the feeling of mental stress and on the above-mentioned psychological and physical domains in patients with cancer. Another major area of research relates to cardiovascular diseases since they are one of the most prevalent medical conditions in the population and they continue to represent a threat. In one systematic review and meta-analysis, the main interest was dedicated to investigating: "Mindfulness-based intervention for physical and psychological well-being in cardiovascular diseases" (Marino et al., 2021). A major discovery that could be obtained from the studies included is that MBI has an impact on "reducing systolic blood pressure," as well as "heart palpitations and rate" (Marino et al., 2021, p. 15) Additionally, the authors report beneficial effects of mindfulness on the "depression, anxiety, stress, quality of life, styles of coping" (Marino et al., 2021, p. 1) Although the authors state that there are "some methodological differences" between studies, they still find MBI as a promising tool for treating cardiovascular disruptions as "a first-line intervention". The authors advised that future studies could investigate the potential use of MBI in an online format, and that is exactly what could be found in another systematic review (Toivonen et al., 2017). Accordingly, "Web-Based Mindfulness Interventions" for various physical conditions including cancer, chronic pain or fibromyalgia, irritable bowel syndrome (IBS), epilepsy, heart disease, tinnitus, and acquired brain injury, were discussed in this review (Toivonen et al., 2017, p. 1). After the selection of appropriate studies, the analysis was performed. Although the authors could not extract clear evidence of which form of web-based mindfulness is the most

effective, they reported that for each of the above-mentioned physical conditions, the effect of mindfulness was present. “Pain acceptance, stress coping efficacy, family enjoyment, social engagement, depressive symptoms, and fatigue” (Toivonen et al., 2017, p. 11), were found to correlate positively with the use of mindfulness. Accordingly, studies that implemented mindfulness for people with chronic pain and fibromyalgia showed the overall positive impact of this practice when delivered in an online format, as well. For the people with heart disease, those who were included in the web-mindfulness training as opposed to “usual care,” showed: “On the primary outcome, a measure of exercise tolerance (the 6-min walk test), the mindfulness group performed better than control at a difference bordering significance, and the mindfulness group showed lower resting heart rate (d=0.20)” (Younge et al., as cited in Toivonen et al., 2017, p. 9). After further examining this study, the authors of this review concluded that even though there was a distinction between groups, still it was not that big of a difference. Irritable bowel syndrome was another condition examined, and the data of the studies analyzed confirmed “the beneficial effects of a Web-based mindfulness plus CBT treatment for IBS symptoms, quality of life, and psychological distress among people with IBS,” as reported by the authors of this review (Toivonen et al., 2017, p. 10). The important thing to add here is the study of that was included in this review as they have found “IBS quality of life continued to improve at a 3-month follow-up for the intervention group.” (Ljótsson et al. 2010, as cited in Toivonen et al., 2017, p. 9). When looking into two different studies, included in this review, that observed the interaction between online mindfulness and epilepsy (Thompson et al., 2010; Thomspon et al., 2015, as cited in Toivonen et al., 2017), after examining their results, the authors of this review determined that “Web-based MBCT is effective for reducing depressive symptoms among patients with epilepsy…” (Toivonen et al., 2017, p. 10). Similar findings could be observed in the patients with tinnitus, where two forms of mindfulness interventions were included: Acceptance and Commitment Therapy, and CBT (Hesser et al., 2012, as cited in Toivonen et al., 2017). The authors of this review report that: “The primary outcome, tinnitus distress severity, improved more in the ACT condition than control (d=0.68),” as well as that the results were “maintained at a 1-year follow-up.” (Hesser et al., 2012, as cited in Toivonen et al., 2017, p. 10). For the people experiencing the common “mental fatigue” from the brain injury, the authors of this review investigated one study that included this population and their engagement in the online delivered mindfulness for stress reduction (Johansson et al., 2015, as cited in Toivonen et al., 2017). After looking at the results, it was concluded that: “only

mental fatigue reduced significantly more in the Web-based MBSR condition than both the face-to-face and walking control conditions" (Johansson et al., 2015, as cited in Toivonen et al., 2017, p. 10). A study about chronic pain has also reported that implementing "a brief mindfulness exercise" called body scan, which will be described in the last part of this chapter, produced "immediate effects" on the participants (Ussher et al., 2012). The authors imply that it could be beneficial to implement a quick 10-minute body scan exercise, for those who are administered to the clinics seeking relief.

Based on the above, it appears that mindfulness could be used for both physical and psychological conditions. The effects obtained could work in a mutual way, meaning that by improving psychological well-being in people with certain conditions, the physical aspects improve or become tolerable as well, and vice versa. This provides us with a promising, relatively low-cost, or additional alternative for the treatment of different conditions. The old saying goes "Healthy body, healthy mind," but we also see how cultivating a healthy mind provides benefits for the body as well. The good news is that this intervention is not only limited to curing or benefitting existing conditions but, rather, it can be used as a prevention easily implemented in daily routine for every person as we will now discuss.

Practical Use of Mindfulness

Implementing mindfulness as a part of our day can range from formal exercises that require either sitting or lying down, but overall to taking some time out of the day to be completed. On the other hand, the good news is that it is a very flexible technique that can be carried out in any activity during the day. Whether it is formal or informal type, they are all aimed to help cultivate the present moment and use our capacities more effectively. Accordingly, the last part of this chapter explains and describes the use of mindfulness in a practical way, starting from the simplest and seemingly effortless thing we do – breathing.

Formal Mindfulness Meditative Exercises

"So, once you get settled, with your eyes comfortably lowered or closed, you're going to focus in on the sensation that's most prominent to you tied to your breathing. Perhaps it's the coolness of the air in and out of your nostrils, or the abdomen moving up or down, your shoulders, whatever bodily sensation tied to breathing feels most prominent, that's what you will focus on for the period of this formal practice. The second part of this instruction, after you've selected your focus and you've committed to maintaining your attention there, is to pay attention to what arises in the mind. Notice when mind wandering occurs and your attention is moved off of the target for where your attention should be. Notice when there might be thoughts, sensations, memories that arise that aren't about the breath at all. And when this happens, simply return your attention back to the breath-related sensations. Nothing special to do, just simply return the attention back to the breath.That's it! That's the practice." (Jha, 2023).

To understand the concept of mindfulness, the best way is through personal experience, hence exercise. The purpose of this exercise is to help people become more aware of their body in its present state without trying to achieve relaxation, which is what many if not all mindfulness coaches are emphasizing. Although it is possible to experience calmness and relaxation while being in this type of setting, many instructors are stating that the goal should not be that, because it could even produce the opposite effects. More precisely, by focusing too much on relaxation, it can cause tension and self-blame, leading to further stress. Instead, it is expected to experience periods of both tension and relaxation. Additionally, there might be moments where there are many thoughts and other moments where there are just a few. It is important to recognize and accept whatever feelings or thoughts arise without judgment. This is the state of full consciousness, where we are awake and aware of our bodily sensations. It is normal to have to redirect attention many times during exercise. With regular practice, it is expected to become more aware of when the attention has wandered. As stated in the beginning, being fully aware, and taking an open-minded approach to life as it happens in the present is the core principle of mindfulness. Moreover, the effect that this type of breathing exercise can have is not only limited to increasing awareness of our present moment. It seems that it can benefit our overall mind and body connection. Accordingly, it was discovered that 8 weeks of mindfulness-based stress reduction seemed to improve brain and heart synchronicity (Gao et al., 2023). The authors opted for the use of alpha wave frequency (APF) as

the measure, since they are usually shown to be used when exploring processes during meditative states. The results reported in this study, in the words of author's state: "The increased brain-heart connection is most apparent in the middle frontal and also appears in the temporal and occipital regions of the scalp" (Gao et al., 2023, p. 4). The confirmation of these results was also supported by the EEG and ECG measurements reported in this study. All in all, it seems that the frequency of synchronous brain activity may be modulated by mindfulness breathing meditation. Aside from breathing, the next often-used exercise is called "The body scan". The aim is to help become more aware of every part of the body. Since it may be difficult to perform, it is paired with the breathing exercise to bring awareness of each body part by imagining and attempting to feel how our breath moves through the entire body. This requires lying down, and it is usually the type of exercise people first start with when learning mindfulness, and there might be a good reason for that. Due to the idea that different types of meditation techniques might range in their effectiveness, there have now been many studies comparing different exercises and their effects. Accordingly, one study reported that when measuring all the relevant parameters in this research such as self-compassion, concentration, life satisfaction, emotional experience and regulation, the body scan type of exercise was found to benefit the most (Kropp & Sedlmeier, 2019). The possible explanation provided by the authors for these results is that this might be a "superior" exercise due to the observed "stronger rise in acceptance after the intervention" (Kroop & Sedlmeier, 2019, p. 2067). The authors find that the complexity of the exercise itself, as we can see from its above description, could account for its more "superior" impact. Another study aimed to investigate the effectiveness of hatha yoga and body scan and their effect on reducing stress and anxiety which was confirmed in comparison with the wait list control group (Call et al., 2013). Moreover, one study that compared different types of mindfulness-based interventions reported that all three forms including sitting Meditation, body scan, and mindful yoga, produced positive results, in the words of authors: "After the intervention, participants reported decreased rumination, increased tendency to describe experiences, increased self-compassion, and increased psychological well-being regardless of study condition" (Sauer-Zavala et al., 2012, p. 386). This might be the reason why formal mindfulness exercises are paired with at least one or more. For example, the body scan is usually performed with mindful breathing, and so on. To gain better insight into the other practices in the above-mentioned program, another type of formal exercise is known as mindful eating. This form of intervention has also been thoroughly researched as its implications are not only beneficial

for cultivating a more mindful way of eating, but it could be a potential strategy in dealing with another prevalent condition in our society – obesity. Accordingly, one study reported mindful eating paired with treatment as usual (TAU), produced less desire for emotional eating in the participants with weight problems. (Morillo-Sarto et al., 2022). And not only that, but in the words of authors: "The programme produced improvements in secondary outcomes such as external eating, the severity of bulimic symptoms, the frequency of binge episodes, and some mindfulness and self-compassion facets" (Morillo-Sarto et al., 2022, p. 304). In one review, mindfulness and mindful eating interventions appear to be most successful in the reduction of binge eating regardless of weight status (Warren et al., 2017). Aside from the studies included to investigate the effectiveness of this technique, the authors even searched for possible underlying mechanisms. Accordingly, they postulated that higher awareness and responsiveness in interna signals, as well as higher awareness, but lower responsiveness to external signals, might provide the answers (Warren et al., 2017, p. 279-280). In another study, the participants were separated into three groups including an education group that received mindful eating information, a diet group, and a control group (İNÖZÜ & KÖSE, 2023). The results obtained showed that by "Increasing eating discipline by internally through mindful eating, made participants not to deal with negative emotions by eating" (İNÖZÜ & KÖSE, 2023, p. 637). Although the Body mass index did not differ between the groups, participants of the education group still showed improved eating behavior.

Apart from these formal exercises, and thanks to the flexible nature of the technique, there are many opportunities for mindful moments such as when doing daily tasks of driving, cooking, and walking. This could be a plausible solution for those who would argue that they do not have time to sit still for even 5 minutes. Hence, this last part is dedicated to all those who are always in shortage of time.

Mindfulness in Everyday Living

To practice mindfulness, you do not need to dedicate a special time during the day, although it is highly recommended. It can be as simple as picking out one of the routine tasks that every one of us does during the day such as showering, driving, walking downstairs, etc., and instead of

activating our automatic pilot as is usually the case, the goal is to be more mindful and less mindless when performing them.

Accordingly, one study examined the role of mindfulness in dishwashing activity among 51 undergraduate students (Hanley et al., 2014). The authors found that performing dishwashing with a mindful attitude, not only "significantly reduced nervousness and promoted feelings of inspiration" (Hanley et al., 2014, p. 1101), but it implied that by taking the different look at a commonly dull task, people might even enjoy it. Interestingly, it was also noted by the authors that: "mindfully washing dishes affected participants' perception of time, such that they overestimated their dishwashing time when undertaken mindfully" (Hanley et al., 2014, p. 1099). Besides daily chores, another informal mindful exercise could be implemented in a thing such as daily walking. Hence, one study tested the effect of walking meditation and how it could impact "ankle proprioception and balance performance" in elderly women (Chatutain et al., 2019). The authors found that the group that practiced meditative walking was better in both balance and proprioception. It is worth noting that this study included older women who have average physical activity, as well as the fact that this study did not have neuroimaging data to show what happens in the brain when participants were performing this intervention, as noted.

Mindfulness and Decision-Making

As we approach the end of this chapter, a few words will be dedicated to the important domain present in every aspect of our life. It is, of course, decision-making. Accordingly, there is much research being done on how mindfulness can improve this area as well. Since consumerism is a characteristic of our modern society, one study decided to observe the impact of mindfulness on the "Buy now pay later" (BNL) method (Schomburgk & Hoffmann, 2022). The authors wanted to see if this technique can improve "impulsive urges," and help people who have troubles with self-control in the financial domain. Since the authors state that many people rely on BNL, the results imply that such behavior could benefit from the mindfulness practice. Mindfulness and decision-making are not only limited to the financial domain. Other studies have shown its impact in relapse prevention where in a study that examined: "Combined goal management training and mindfulness meditation improve executive functions and decision-making performance in

abstinent polysubstance abusers" (Alfonso et al., 2011). The effects were seen in "… the working memory, selective attention/response inhibition and decision-making skills…" (Alfonso et al., 2011, p. 80) The plausible explanation from the authors is that: "Mindfulness meditation emphasizes the recognition of interoceptive signals putatively involved in the guidance of long-term based decision-making" (Alfonso et al., 2011, p. 80). Another interesting aspect of decision-making refers to the "sunk-cost bias" that many of us are prone to, and which happens when we continue to invest either time, money, or effort even if there is no purpose in doing so anymore. Accordingly, one study decided to analyze the impact of mindfulness on sunk-cost bias by examining one correlational and three experimental studies (Hafenbrack et al., 2013). Surprisingly, the authors state that even a quick 15-minute mindfulness exercise produced an aversion to the sunk-cost bias, hence improving decision-making in participants. In another research (Mirams et al., 2013), the authors assess the use of a "brief body-scan meditation" and its impact on the "somatosensory perceptual decision-making" (SSDT). It was revealed that the training group showed "an increase in sensitivity during the SSDT, compared to a control group who listened to a recorded story" (Mirams et al., 2013, p. 356). The authors are even hinting at the idea that this type of exercise could help people who are dealing with medically unexplained symptoms.

These are just some of the examples of how mindfulness could be implemented in an informal setting, as well as in the domain of decision-making, while still producing positive effects. Whether it is dishwashing, walking, or shopping, mindful moments that we employ in our everyday tasks could benefit us in many ways, especially when we are faced with choices that are presented to us, every day and in almost every situation.

Conclusion of The First Chapter

Based on all the above, we can see how mindfulness has come a long way from the Buddhist teachings to its prominent role in our contemporary society. The ability to direct, focus, and sustain our awareness through regular mindfulness exercises appears to influence many aspects of our being. Our brain's structural and functional abilities are influenced, and susceptible to change with this intervention. That can be observed in the improved functioning of our cognitive, emotional, physical, and overall health. Not only that, but a wide variety of exercises and the possibility of their implementation in almost every part of our day-to-day routines, could foster a promising preventive strategy in facilitating well-being for each person. Many mindfulness exercises are now available online, delivered with guided meditation, making it available for everyone, and at low cost. Accordingly, including various studies containing different populations, occupations, and conditions, the aim was to demonstrate how it can be widely applicable. Therefore, the elderly population is not an exception to these benefits. As we will see, there has been a lot of work done regarding the ability of this technique to aid older people and relieve them from the consequences of aging. Before we dive into how mindfulness can positively impact this population and the extent of these improvements, we will first discuss the mental state of aged people, as it will be a starting point for all the other related processes that appear and develop during this natural course of life.

Second Chapter

Mental Health in the Elderly

From the first breath until the last, every stage of our human life is characterized by different processes and related changes observed in both physical and mental aspects. Despite the popular belief of many that we are completely developed at twenty-five years of age, and that not much can change or improve as we are getting older, science specifically dealing with aging shows us differently. Accordingly, in this chapter we will discuss the processes following aging, both the physiological and psychological aspects, as well as changes observed in cognition, and ultimately how it reflects on the mental health of older population. First, we will get familiar with the aging process itself.

Physiology and Biology behind Aging

Aging, from the biological point of view, is mainly defined as "a persistent decline in the age-specific fitness components of an organism due to internal physiological deterioration" (Rose, 1991, as cited in Rose et al., 2012, p. 1). Over the years there has been much research done in identifying the distinctive characteristics of aging, the so-called "Hallmarks of Aging". In 2013, nine of these elements were suggested (López-Otín et al., 2013), but in the more recent paper, the authors expanded their initial belief, and reported 12 hallmarks of aging (López-Otín et al., 2023). Accordingly, and as written by the authors, the aging process is characterized by: "genomic instability, telomere attrition, epigenetic alterations, loss of proteostasis, disabled macroautophagy, deregulated nutrient-sensing, mitochondrial dysfunction, cellular senescence, stem cell exhaustion, altered intercellular communication, chronic inflammation, and dysbiosis" (López-Otín et al., 2023, p. 243), divided into three groups as primary, antagonistic, and integrative hallmarks In the following part, using the above-mentioned factors, the physiological and biological aspects of aging will be described through reflection on this paper.

Genomic instability refers to the idea that over the years, our DNA forms injuries due to the acquired damages in our genetics. These damages stem from both internal and external causes, and the authors list chemical, physical, and biological components, disruption of DNA replication, oxidation, etc. (López-Otín et al., 2023, p. 244). On the other hand, our body is also designed to handle these ruptures, but that capability ought to decline as we age, hence leading to the accumulation of the above-mentioned impairments. Additionally, the more years pass by in our human life, the more there is opportunity for our DNA to experience such changes with the consequences on our genes. Another important element are telomeres which are referred to as protective areas located at the end of our chromosomes, and each time our cells replicate, they become shorter. Eventually, when they become too short, the cell dies and with that the ability of our body to renew itself slows down too. The rate at which telomers are shortening is influenced by many different factors, as stated in this paper, such as age, lifestyle, genetics, and social factors (López-Otín et al., 2023). Moreover, the changes that telomers go through have been associated with the development of diseases such as pulmonary fibrosis, and aplastic anemia (Alder et al., 2022, as cited in López-Otin et al., 2023). Apart from this, epigenetic changes happen as well. The authors mention some of the main ones which are: "methylation of DNA, abnormal posttranslational modification of histones, aberrant chromatin remodeling, and deregulated function of non-coding RNAs (ncRNAs)" (López-Otin et al., 2023, p. 251). Here, genes are impacted, and it can lead to the occurrence of the most feared disease – cancer, due to the altered gene-expression (López-Otin et al., 2023). Interestingly, when it comes to aging, it is believed that we can even anticipate our life expectancy through DNA methylation (López-Otin et al., 2023). Another hallmark of aging is related to proteostasis, more specifically – it's depletion. The authors explain that the interrupted functioning of the "protein homeostasis," can cause the extracellular amyloid plaques to build-up, which can lead to the onset of commonly present neurodegenerative disorders at the old age - Alzheimer's and Parkinson's disease (López-Otin et al., 2023). Going further, we have disabled macroautophagy. The altered functioning of this important element can cause harm to the organelle turnover, which is "an essential process required for normal cellular homeostasis, growth and development" (N Turcic et al., 2007, p. 67), hence making it yet another important hallmark of aging. Moreover, disrupted autophagy has also been linked to neurodegenerative disorders, cardiovascular problems, pulmonary, ocular, and metabolic disruptions (López-Otin et al., 2023). Furthermore, the "deregulated nutrient-sensing network" has

important consequences, marking it another prominent element of aging. For instance, cell activity is under its influence, and the network itself can be impacted by the stressful and nutritional conditions in our body (López-Otin et al., 2023). Additionally, its function changes across the lifespan meaning that: "In youth, activity of this signaling network thus functions to promote beneficial anabolic processes, but during adulthood, it acquires pro-aging properties" (López-Otin et al., 2023, p. 256). When we talk about the cells, we cannot leave out the role of mitochondria. As it is often noted, mitochondria is the "powerhouse of the cell," but this power is not unlimited, and as we age some changes ought to happen to this element as well. Many factors contribute to this, such as the above-mentioned disrupted proteostasis, organelle turnover (López-Otin et al., 2023), which ultimately leads to the disruptions in functioning of mitochondria. Hence, when mitochondrial functioning is decreased, the activity of all the other cells, and ultimately our organs, decline too. Furthermore, when the organism goes through persistent injuries, we have the presence of cellular senescence. Like many of the other elements, they are also involved in different disorders such kidney diseases, liver steatosis, diabetes, Alzheimer's and Parkinson's disease (López-Otin et al., 2023). Apart from this, the ability of our cells to regenerate declines as we age. Throughout our body there is a presence of stem cells in our tissues, that can divide endlessly, to recharge other cells. But the trick is that they decrease in number with age, which in turn diminishes this important ability to rejuvenate our tissues and organs. This hallmark is known as "stem cell exhaustion" and, indeed: "Aging is associated with reduced tissue renewal at steady state, as well as with impaired tissue repair upon injury …" (López-Otin et al., 2023, p. 260). The declines happen in intercellular communication as well. More specifically, changes in the intercellular communication that happen with aging, involve important domains such as neural, neuroendocrine, and hormonal (López-Otin et al., 2023). Another important characteristic of aging these authors consider is chronic inflammation. This happens because our body, over the years, holds higher levels of "inflammatory cytokines" and "biomarkers" (López-Otin et al., 2023, p. 263), which make our immune system weakened. Furthermore, diminished abilities are observed in the gut microbiome. In the domain of aging, its role is highlighted as the final hallmark known as dysbiosis. As we age, the environment of our gut changes (López-Otin et al., 2023), making the population of the microorganisms living in our gut less diverse, resulting in less ability to preserve our body from different harmful influences. This is observed in a ruptured interaction between bacteria in

our gut and our body, which can ultimately lead to diabetes, weight problems, neurological conditions, etc. (López-Otin et al., 2023).

Lastly, each of these above-described hallmarks, do not act independently, and in the words of authors "All the 12 hallmarks of aging are strongly related among each other. For example, genomic instability (including that caused by telomere shortening) crosstalks to epigenetic alterations (e.g., through the loss-of-function mutation of epigenetic modifiers such as TET2) …" (López-Otin et al., 2023, p. 266). The authors have also suggested that there seems to be a hierarchy among them, as well as that their functions change over the years from initial benefits in early life to the damage to our genome (López-Otin et al., 2023). As stated earlier, in the example of disrupted nutrient-sensing network, in younger period this network promotes positive anabolic processes, but as we are older it is involved in promotion of aging-related aspects (López-Otin et al., 2023). This and many more articles provide valuable information and implications of how these processes occur in a more detailed way (Lemoine, 2021, Barbosa et al., 2019, Guerville et al., 2019), but for the purpose of this thesis we will stop here, and now turn to the psychology behind aging, and respective cognitive changes.

Psychological Aspects of Aging

Aging from the psychological perspective encompasses a more subjective component that is relying upon the feeling of a person in terms of how old they feel they are. Furthermore, it appears to be influenced by many factors such as health, culture, social connections, and personal background (Mitina et al., 2020). Therefore, as much as different physiological and biological processes guide the aging process, the psychological, and social aspects play an important role as well. Accordingly, there has been some research done in observing the connections between perceived age and its influence on different biological and neurological processes. Accordingly, in one research the authors discovered, through the MRI acquired images, "… that elderly individuals who perceived themselves younger than their real age showed not only larger GM volume in the inferior frontal gyrus and the superior temporal gyrus, but also younger predicted brain age" (Kwak et al., 2018, p. 1). On the other hand, those who report feeling older than they really are, might experience problems with information processing (Kwak et al., 2018). Hence, the authors propose that this type of subjective perception might account for decrease in grey matter volume, which

then impacts people's cognitive abilities and results in feeling that they need to put more energy in their day-to-day functioning (Kwak et al., 2018). The implication of these findings, according to the authors, is that people's perception of their own age might even serve as a reliable indicator of cognitive health in the long run. This is in line with the meta-analysis called "Longitudinal Effects of Subjective Aging on Health and Longevity: An Updated Meta-Analysis" (Westerhof et al., 2023). With this study, the authors decided to provide more up to date information as they compare and build upon their previous meta-analysis (Westerhof et al., 2014). The results the authors report consider self-perception of age (SPA) as a more reliable predictor of health over the course of life, but nonetheless subjective age has an important impact on health as well (Westerhof et al., 2023). Furthermore, another important factor that could impact the subjective experience of aging has also been postulated. Due to the many stereotypes associated with aging, predominantly negative, ageism has been assumed to have influence on these subjective feelings. Accordingly, in one study the authors came to interesting findings when exposing their participants to either positive or negative age stereotypes (Kotter-Grühn & Hess, 2012). As many of us would assume, giving people positive information about their age will result in more positive feelings. But to the surprise of authors, although in good physical shape, participants reported older subjective age in the case of positive stereotypes, as well as those in good shape as well, but put in a condition of negative stereotypes (Kotter-Grühn & Hess, 2012, p. 568). The findings of this study are important since the authors highlight the fact that changes in personal experiences of one's age can be influenced, and especially since there is "… widely shared negative image of old age …" (Kotter-Grühn & Hess, 2012, p. 569). Another important area to talk about is how elderly people often have difficulties in decision-making which puts them in risk of being taken advantage, especially in the financial domain, and it seems that ageism and subjective age play important roles in this part as well. Specifically, when "High levels of ageist attitudes and an older subjective age were associated with increased FEV" (Weissberger et al., 2022, p. 1267), and FEV here refers to Financial Exploitation Vulnerability. The important implications stemming from these findings is that both ageist attitudes and older age present risk factors for this population, and the authors suggest that they should be taken into consideration for "financial exploitation prevention programs" (Weissberger et al., 2022, p. 1272). Subjective age has also been linked with frailty among older adults, meaning that the older they felt, the bigger risk for frailty exists (Li et al., 2021). The important takeout in his study is that special attention should be given to older adults who report

older subjective age, as it could be a potential indicator for frailty. Another study examining the domain of frailty specifically focused on social frailty and its link to four domains being social perception, theory of mind (ToM), affective empathy, and social behavior (Henry et al., 2022). "Social frailty refers to an actual or perceived inability to meet basic social needs (Bunt et al. 2017, as cited in Henry et al., 2023, p. 184). After acquiring the results, the authors note that two out of the four aspects of social cognition, affective empathy and social behavior, showed significant associations with frailty. Additionally, the authors found the stable association between social frailty and demoralization, resilience, and life satisfaction. More importantly, resilience was suggested "…. as an important target for successful aging…" (Henry et al., 2022, p. 94). To add to this domain, other authors dealt with social cognition in aging and frailty as well (Henry et al., 2023). In this review, the authors were set on a mission in trying to explain "… what is known and unknown about changes in social cognition in late life …" (Henry et al., 2023, p. 185). For example, wisdom and resilience emerged as two factors that could be still improved in aging (Lam et al., 2020, as cited in Henry et al., 2023). This is important to highlight since social frailty is thought to "reduce the individual's reserves and resilience" (Bunt et al., 2017, as cited in, Henry et al., 2023, p. 184).

Based on all the above, we can conclude that subjective perception of age, ageist attitudes, frailty, and many other related factors, play an important part in the aging process. It has also been postulated that the subjective perception of age can contribute to changes in the neural domain and cognitive functioning (Fernández-Ballbé et al., 2023). With this in mind, we now turn to the cognitive aspects of aging to observe what exactly happens with the overall cognition in this stage of life.

Cognitive Aspects of Aging

Much research has been done in the domains of memory, executive functions, decision making, processing speed, and attention. Furthermore, there are many hypotheses explaining the cognitive changes that occur with aging. For example, and according to the APA dictionary, "Age Differentiation hypothesis" (Garret, 1938., Balinsky 1941) refers to the idea that as we age, our cognitive abilities change, in a way that when we are young our intelligence is more divided and manifests through different abilities, where in old age it goes back to its starting point as a more

"general ability". The "Sensory Deprivation Hypothesis" postulates that troubles with sensation might account for the cognitive changes. (CHABA, 1988; Lindenberger & Baltes, 1994, as cited in Wayne & Johnsrude, 2015). Lastly, a "Common Cause hypothesis" (Baltes & Lindenberg, 1997) proposes that both sensation and cognitive abilities are under the influence of age-related brain changes that this hypothesis considers as a "common cause."

Considering the emerging problem of dementia in the population, it is fair to dedicate a few words to the memory department. First, it is important to differentiate between the types of memory that exist. Memory can be divided into sensory, short-term, and long-term memory. Usually what has been determined is that the Speaking of short-term memory, it appears to be less affected by aging than working memory (Bopp & Verhaeghen, 2005). When it comes to long-term memory, implicit memory, that helps us in our daily tasks, is much less impacted by aging as opposed to explicit memory that requires effort to be able to remember specific information (Ronn & Bruss, 2003). When it comes to declarative memory, changes are observed in episodic, semantic and autobiographical memory. For semantic memory, that helps us with memorizing words and concepts (Tulving, 1972), it appears that above 60 years of age we can notice distortions in this type of memory (Rönnlund et al., 2005). Still, semantic memory performs better than episodic memory, with evidence showing that language and general knowledge are still preserved in old age (Nyberg et al., 2003). On the other hand, episodic memory involves the ability to memorize and recall things that happened at a certain event or a period in time and shows much bigger distortions above the 60 years of age (Rönnlund et al., 2005). When it comes to autobiographical memory, it is hard to investigate it since this type of memory relies upon subjective experience, hence we cannot be sure if people remember correctly situations that took place in their life. Still, there is an interesting phenomenon noticed in the old age called "Reminiscence Bump," (Jansari & Parkin, 1996), which makes people more prone to recall things that happened during their preteen or young adulthood. Additionally, false memories also occur more often in this population. Lastly, another important form of memory, known as prospective memory, helps us to remember what we need to do at a certain point in future. To test this ability, there are two types of tasks that can be used known as time-based and event-based (Einstein & McDaniel, 1990). As the names already suggest, a time-based task would be in the case of remembering to call someone in 20 minutes, while the event-based task would involve throwing away a piece of garbage when passing the garbage can for example. Overall, it seems that a major decrease occurs in prospective memory

of elderly people when compared to the younger population (Koo et al., 2021). Finaly, we cannot finish this part without the mention of the executive functions, since they are responsible for more complex cognitive abilities such as problem solving, decision making, planning, setting and goal fulfilling, etc. All of this plays a crucial role in our everyday life, and it appears that aging leads to a decline in the executive functions due to the changes in the prefrontal cortex (Burke & Barnes, 2006, as cited in Koo et al., 2021).

Based on the previous discussion of the implication of subjective age, and now with the described cognitive aspect of aging, one study specifically investigated the connection between memory, executive functions, and subjective perception of age, with cognitive dysfunction in 50-year-old adults or older (Qiao et al., 2021). The results of this research showed that there was a notable connection between subjective age, assessed at the beginning of the study, and cognitive performance examined 10 years later. More precisely, in the domain of memory and executive functions, those individuals who reported older subjective age had lower scores in these two aspects after 10 years. Moreover, the authors report that based on the previous studies linking subjective age with dementia, they were able to confirm those previous findings with a statistical discovery of 1.7 chances being higher for the development of dementia in those participants who report older subjective age. The authors were not able to pin-point the exact factors contributing to these findings, but inspired by the previous studies, they suggest that differences found in the brain matter, physical status, or even personality, of the people who report feeling older, could account for their results. On the other hand, one study showed how younger subjective age correlates with positive memory functioning and smaller memory decline over a 4-year-period (Stephan et al., 2015). The authors included depressive symptoms and physical activity as the two elements that could account for these findings. Although physical activity did not confirm the author's assumption, better memory functioning was associated with less depressive symptoms over time. All in all, the results from these studies suggest that the subjective age could be a beneficial factor to consider as it can provide indication for possible future cognitive decline, hence it could allow the use of preventive measures in those elderly who perceived their age older than it is.

Due to all the above changes that ought to happen with aging, aside from the physical aspect, it is fair to assume that they impact mental health as well. As we have now seen in this last part, depressive symptoms seem to be involved in cognitive functioning of the aging population, and since the definition of successful aging encompasses physical, social, and mental aspects

(Rowe & Kahn, 1977), a few words will now be dedicated to the component that accounts and interplays with all. We now turn to what is the title of this chapter – mental health in the elderly.

Mental Health in the Elderly

Based on all the above-described processes, and taking into consideration that depression and anxiety are the most common mental disorders, we will mainly discuss them in the following part and see how all the above contributes to the mental health of the older population.

Accordingly, and reflecting on the first part of this chapter, one study examined the association between "Major depression and the biological hallmarks of aging" (Lorenzo et al., 2023). The authors hinted at the possibility that neither of the biological elements directly leads to the onset of Major Depression Disorder (MDD), but rather their combined adverse effects over the years could be involved in this condition. More so, the fact that: "…incidence and prevalence of MDD peak in young adulthood and decrease with older age." (Lorenzo et al., 2023, p. 6), is why the authors do not consider these biological elements as a primary, but rather "… secondary to the emergence of MDD across the lifespan" (Lorenzo et al., 2023, p. 6). Nevertheless, even as secondary elements, they have consequences for physical, cognitive, and mental health domains, as noted by the authors. Lastly, by taking into consideration the above-mentioned usual age of onset, the authors suggest behavioral and social factors as other potential causes between MDD and aging. More precisely, when this mental condition develops at a younger age, it often produces consequences on school achievement, jobs, health, and overall affects their relationship with other, close, people. Furthermore, another study reported that the brain of both genders with diagnosed MDD, presents with "… advanced brain aging of around 1 year" (Han et al., 2020, p. 5132). The authors report that their findings are in line with previous evidence linking biological hallmarks, such as telomers, and the appearance of MDD. According to the authors, by having such noticeable brain differences in this population, there are higher chances of death, as well as contracting different diseases associated with aging. In research that dealt with the impact of: "Accelerated biological aging on the risk for depression and anxiety: evidence from 424,299 UK Biobank participants" (Gao et al., 2023), evidence shows higher chances for both depression and anxiety in those participants who were measured to have higher biological parameters of aging, even after eight years from the initial assessment. Like the previous studies reported, these authors also

include biological hallmarks, as well as physical status, to be involved in these results. In one systematic review and meta-analysis, the role of HPA axis, important for responding to stressful situations, and depression in elderly was investigated (Murri et al., 2014). The results showed that when compared to younger participants, those of older age with depression, have different activity of HPA axis as it operates in a more disturbed way for this population. Interestingly, one research paper took itself upon "Predicting depression in old age: Combining life course data with machine learning" (Montorsi et al., 2024). Important elements in this study include using "biographical information" as an indicator of depression occurrence in the old age, as well as an abundance of "life course information" with the assumption that it will provide accurate prognostic evidence. "Material deprivation in childhood, poor health in childhood and adulthood, and low education" (Montorsi et al., 2024, p. 9), were considered as strong risk factors of depression that could develop in old age, and in both genders. Another important thing discussed referred to entropy, which the authors define as "… frequency of changes in condition over the years" (Montorsi et al., 2024, p. 9). The idea is that people will have higher chances of being depressed if they are exposed to frequent mood, financial, or more basic – biological deprivations. More interestingly, it appears that "Higher entropy in the work sequence and lower entropy in the family sequence increase the probability of depression for men only" (Montorsi et al., 2024, p. 9). Overall, the authors state that both genders are equally impacted by higher probability of depression if they encounter persistent disruptions in different "life domains." One systematic review and meta-analysis focused and highlighted the risk factors for the depression in the old age as "being female, age older than 75 years, being single, divorced or widowed, being unemployed, retired, no educational background, low level of education, low level of income, lack of social support, living with family, current smoker, presence of physical illness, such as diabetes, heart diseases, stroke…" (Zenebe et al., 2021, p. 15). Additionally, the authors note that the calculated prevalence in this population stands at 31.74 Additionally, the authors note that the prevalence of depression in this population is very high, as in 31.74% high, leading them to suggest more occasional assessments of elderly. In the domain of psychological aspect of aging, one meta-analysis confirmed the link between younger perceived subjective age and positive impacts on well-being, cognition, and depression in the sample ranging from 55 to 83 years of age (Debreczeni & Bailey, 2020). The authors report that their findings are in line with the Biopsychosocial Model (Engel, 1977), meaning that psychological component, in this case subjective age, is interconnected and could influence both

biology and overall health. One review dealt with the link between subjective age and depression (Mitina et al., 2020). The authors reported on the previous findings about the possible connection between "self-perceptions of aging, chronological age, and mental health" (Keyes & Westerhof, 2011, as cited in Mitina et al., 2020, p. 18769) that showed how younger perception of one's age produces better psychological outcomes, or as in the words of authors, "flourishing mental health" (Mitina et al., 2020, p. 18769). Additionally, they have also reported on the findings from one longitudinal study (Choi & Dinitto, 2014, as cited in Mitina et al., 2020), that showed connection between increase in depression and those who feel older than they are. And finally, apart from chronological age, feeling older was a reliable predictor of dementia risk in elderly over the course of 4-year interval (Stephan et al., 2018, as cited in Mitina et al., 2020), with depression being partial culprit. All these research findings led authors to conclude that there might be a link between perceived age and cognition. In the domain of emotions, one study examined the use of adaptive and maladaptive emotion regulation strategies (ER) in difficulties encountered with aging (Sardella et al., 2022). The authors found that using reappraisal to regulate emotions could be beneficial for older adults since it helps people to look at negative situations in a more optimistic way (Sardella et al., 2022). This idea was supported by another systematic review that observed decrease of psychological distress in elderly, when there was more use of this strategy (Nowlan et al., 2015, as cited in Sardella et al., 2022). The authors of this study note that this strategy could also be beneficial in the domain of social functioning when people are faced with depression. On the contrary, the authors state that maladaptive strategies caused an increase in both depression and anxiety, namely associated with the use of rumination, expressive suppression, and avoidance. Additionally, rumination was found to have several implications on the mental health of the elderly. More precisely, daily and leisure activities suffered, especially in those who have both depression and they show more use of this strategy. The authors suggest that chronic illnesses could also benefit from the use of adaptive emotion regulation strategies in this population. By using the example of the recent pandemic of COVID-19, the authors summarized findings from different studies (Rossi et al., 2020; Sardella et al., 2021, as cited in Sardella et al., 2022), and concluded that adaptive approach to emotional regulation made elderly even more adjusted to such unfortunate situation. Apart from depression, the often-comorbid condition that is mentioned is anxiety. While it is hard to separate these two, in this part we will shed more light on the anxiety itself. Accordingly, one study went on the search for prevalence and factors related to anxiety and

depression among the elderly (Curran et al., 2020). The results found significant number in both genders of those who experience "anxiety only." Moreover, the factor of loneliness appeared to be involved in both mental conditions, but in a different way. Therefore, the authors raise awareness and highlight the importance of taking into consideration those individuals who have both chronic illnesses and more manifestations of loneliness. Speaking of loneliness, one study was interested in examining the role of social disconnectedness, isolation, and their involvement with the symptoms of anxiety and depression in the elderly (Santini et al., 2020). The results of this study show all three elements to influence each other in the following pattern: social disconnectedness = perceived isolation = depression and anxiety. Therefore, the authors suggest that communities could promote and offer activities that would give the opportunity to the elderly to participate and make social connections. Correspondingly, since the digital age is impossible to escape, one research paper decided to test: "Online social engagement, depression, and anxiety among older adults" (Hofer & Hargittai, 2021). The authors note that more experiences of depression are connected to online activities such looking into the cases of people going missing, or when people are answering online questions. But not all is negative, because the authors suggest that online presence could play a positive role in reducing loneliness by helping people stay connected with others. One longitudinal study investigated: "Anxiety, depression and quality of life in older adults: Trajectories of influence across age" (Ribeiro et al., 2020). The authors state that depression is shown to be the main culprit responsible for unfavorable future trajectories regarding the quality of life, as well as that level of education and anxiety have an impact as well. Another interesting study decided to observe the interplay between personality, interpersonal problems and anxiety in the population of the elderly (Noel et al., 2021). The authors discovered the prominent role of anxiety in personality disorders (PD), a few aspects of Big Five personality traits, as well as interpersonal issues. According to the authors, only histrionic PD did not show any significant results, while all the other types show connections to anxiety in older adults. When it comes to the Big Five features, neuroticism had the strongest relation with anxiety, and even more so the fact "… that this relationship persists in later life" (Noel et al., 2021, p:668). Lastly, when observing the connection between interpersonal issues and anxiety, the authors note to have found a strong association as well. More precisely, anxiety was notably related to "non-assertiveness" as well as "social inhibition." Since the authors are assuming the bidirectional effect of all the above factors and anxiety, the suggestion is that they should be examined in the individuals presenting with

anxiety. Authors of one study decided to investigate past depression and see the role of anxiety itself on subjective cognition and functioning of older adults (Divers et al., 2021). The results of this study showed that cognitive functioning of elderly was impacted by their levels of worry and anxiety that goes, in the word of authors, "beyond general symptoms of depression and anxiety" (Divers et al., 2021, p. 2300). One study found a positive connection between health worries, ageism, and symptoms of anxiety during COVID-19, especially in older adults who reported higher ageism (Bergman et al., 2020). The authors also report that the explanation for these results might lie in the "Stereotype Embodiment Theory" (Levy, 2009) where in the words of authors they: "… may perceive their health both reduced and prone to threats and may therefore be at a higher risk for displaying a stronger connection between the COVID-19 health concerns and anxiety symptoms" (Bergman et al., 2020, p. 1374). One literature review examined this population during COVID-19 and noted important consequences of the pandemic on the elderly observed "… in the form of stress, anxiety, fear, depression, loneliness, and panic bordering on PTSD" (Seckman, 2022, p. 110). The author based its conclusion by looking into elderly population across the globe. By using the concept of "Socioemotional Selectivity Theory" (Carstensen et al., 1999), the author explains and confirms the observation made in different studies that "… older adults employed various coping strategies along with technology use to foster psychosocial well-being" (Seckman et al., 2022, p. 110).

To conclude this part, it is undeniable that mental health plays an important role in every stage of our life, and that it is especially important when we are being exposed to all the different processes and changes that occur with aging. Both depression and anxiety emerge from different situations, relations, and context that we experience throughout our lives, and vice versa. Hence, health in all its physical, mental, and social domains, is an important area for implementing preventive interventions as we have seen how it all accumulates and affects our future functioning.

Conclusion of The Second Chapter

In this chapter we observed how the aging process develops from biological and physiological perspective, as well as its psychological and cognitive aspects. Great emphasis was placed upon the impact of these changes on the mental health in the elderly, where depression and anxiety come up as the most frequent ones. We have also seen how this all could be intertwined with cognitive functioning, and a risk for its decline, as well as overall quality of life in the older people. To combat these changes, or at least prevent them to a certain degree, there are many different interventions, techniques, and activities that could intervene, slow down, and contribute to healthy aging. Of course, and as stated, various factors could influence and contribute to our mental well-being, therefore it is important to build a strong base for the later functioning. Although this may appear discouraging since there are many of those who were not lucky enough to build more firm foundation, or that believe that there is not much that can be done as we come to a certain era of our life, the next chapters of this thesis will try to bring in more optimism as we look into the possibility of training our mind regardless of the age. Accordingly, we will investigate the influence of mindfulness on mental health and overall cognitive functioning, its impact and the effects it could provide. But before we do that, we need to introduce another vital component without whom our organism could not function at all, making it important for our overall wealth, and which is certainly being affected by aging. It is, of course, sleep.

Third Chapter

The Issue of Sleep on Cognitive Functions and Sleep Disorders in the Elderly

Sleep is an important part of physiology not only in humans, but in many other organisms. Newborn babies sleep for 16 hours a day, which we know is a crucial aspect for proper physical and neural development (Paruthi et al., 2016). As we grow older, the quality and quantity of our sleep changes, and this issue has been thoroughly researched, but still some mysteries about this process remain, such as the most elementary one - why do we even need it. There are several theories that explain this necessity, for example it is needed to accomplish optimal metabolic clearance (Xie et al., 2013), or to support neural processes involved in learning by helping with the health of our synapses (Tononi & Cirelli, 2006). Regardless of the case, what we all know from our own experience, is that good quality sleep is crucial for optimal physical and cognitive functioning throughout the day. Hence, in this chapter we will observe how this natural process occurs, why it is important, the consequences of its disruption with a special part dedicated to the effect on cognitive functions in the elderly population, as well as the common sleep disorders in old age. Therefore, and without further ado, we will start with the physiology behind sleep.

Physiology, Circadian Rhythms, and Related Effects on Sleep

It appears that there is an internal clock in each human. It is responsible for keeping our biological processes synchronized with our 24-hour Earth-specific changes. This harmonization is due to what is known as circadian rhythms. When it comes to sleep-wake cycles, it is believed that circadian timing has significant importance for cognition, mood, immunity, metabolism, and our overall well-being.

The primitive inward clock that manages sleep is called suprachiasmatic nuclei (SCN) and it controls circadian processes. Its relationship with so-called ‘'timekeepers,” known as clock genes, and proteins (e.g., PER, CRY), explains what is happening in our body during sleep-wake cycles. During the day, the CLK builds up in SCN, activating the genes that alert us to stay awake

(Sotomayor, 2016). Further, as the author explains, their joining with BMAL1 launches the transcription and translation of proteins called PER and CRY, which are responsible for deactivating CLK-BMAL1 activity. Thus, when enough PER accumulates in our SCN - we fall asleep. They work reciprocally, CLK by day and PER by night, keeping each other in balance by enabling and disabling one another, as noted. What is also concerning our SCN, and its judgment of time, are the environmental cues known as "zeitgebers" which translates as "givers of time" (Sotomayor, 2016). Food, light, temperature, and traffic noises are examples of them. Experiments done on temporal isolation in absence of zeitgebers showed the importance of rhythmicity in our bodies. Interestingly, what was discovered in them is while the sleep-wake cycle lengthened, and the accuracy of reported time by the participants was inaccurate to the one in the outside world, the circadian rhythms remained despite the isolation (Dubuc, 2022). Hence, it was concluded that some kind of biological time-teller truly exists. Since most people do not live in isolation, we are inevitably exposed to our surroundings and signals within. In the morning, we receive natural light which then travels through the optic nerve along right hypotropia alerting SCN about our environment. Accordingly, this causes the stoppage of melatonin production, crucial for regulating sleep. Melatonin facilitates sleep onset, and it has been noted to have beneficial impacts on cardiovascular health, as well as people with Alzheimer's disease, if produced adequately (Baltatu et al., 2019; Shukla et al., 2017, as cited in Pandi-Perumal et al., 2022).Nevertheless, our modern ways of living surely interfere with these processes and cause sleep-circadian disruption, consequently creating inflammatory, metabolic, sleep, neuropsychiatric disorders and many other health problems. Although it is still not certain what is the exact function of sleep, the idea of metabolic waste clearance leads the way. Recent findings on astrocytic glial cells highlight their role in the regulation of the blood-brain barrier and "influence the clearance of metabolic waste in mammals" (Pandi-Perumal et al., 2022, p. 7). Research done on healthy adults showed that after total sleep deprivation there were cognitive, neurophysiological, and endocrine changes (Klumpers et al., 2015). Regardless, many of us express restricted or inconsistent sleeping patterns conditioned either by work or psychosocial requests. When it comes to our metabolism, there is significant interaction between sleep restriction and dietary choices. Sleep restriction increases satiety hormone called ghrelin (Spiegel et al., 2004), and concentrations of the orexigenic endocannabinoids 2-arachidonoylglycerol and 2- oleoyl glycerol, thus contributing to larger intake of high-calorie foods (Hanlon et al., 2016). While there are some benefits of the artificial lightning

usage, it is inevitably affecting lives and causing circadian disruptions. As one authors report, there is some degree of phase delay present by using electrical light at night, thus resulting in shorter sleep (Meyer et al., 2022). The authors mention the effect of shift work as well and add that shift work employees are experiencing higher risk for developing different types of health problems. Moreover, the connection between circadian rhythm and sleep-wake disorders is also observed by these authors where the main ones are delayed, advanced, irregular, and non-24-hour sleep-wake disorders. The delayed sleep-wake disorder, as explained in this study, illustrates problems with falling asleep and struggles with waking up at socially convenient times. The possible pathophysiological explanations include CRY1 mutations (Patke et al., 2017, as cited in Meyer et al., 2022), as well as PER3 allele being short (Archer et al., 2003, as cited in Meyer et al., 2022). Quite the opposite, advanced sleep-wake disorder involves problems that start in the evening as the person has troubles in being awake, but then the following morning is waking up too early, as noted by the authors. Probable explanations are linked to mutations in PER3, CRY2, and TIMELESS (Ashbrook et al., 2020, as cited in Meyer et al., 2022). Irregular sleep-wake disorder presents itself as having to take naps during the day due to the person feeling sleepy, but then at the same time at night it is not able to maintain sleep. The plausible explanation includes weakened circadian volume and the lack of its "input to sleep-regulatory centers", which is linked to different dysfunctions of the SCN (Wang et al., 2015; Skene et al., 2003, as cited in Meyer et al., 2022).

Lastly, the non-24-hour sleep-wake disorder involves: "Most commonly, progressive 1–2 h delays in sleep onset and wake times each day are observed" (Meyer et al. 2022, p. 1070), caused by PER 3 polymorphisms (Hida et al., 2014, as cited in Meyer et al., 2022). Nevertheless, those suffering from alternated sleep-wake cycle show difficulties in their everyday lives that require vigilance. The same research states a relation between sleep-wake phase disorder and neuropsychiatric conditions. Depression, bipolar disorder, and ADHD are correlated with a delayed sleep-wake disorder, and neurodegenerative disorders (involving Alzheimer's disease) are associated with the irregular type of sleep-wake disorder, as noted in this study. In addition, it was found that mice with clock gene mutation act in a way that corresponds to the manic part of bipolar disorder (Roybal et al., 2007, as cited in Pandi-Perumal et al., 2022). When it comes to depression, one research showed that those with non-24 sleep-wake disorder are prone to depression (Hayakawa et al., 2005, as cited in Meyer et al., 2022). Additionally, depression has been linked with changes in seasons correlated with reduced periods of daylight found by Wirz-Justice et al. (2019). For the same reason,

therapeutic approaches emphasizing the role of light are dominantly used. Techniques such as blue-blocking lenses, wake therapy, use of melatonin and its derivates are one of the examples. Another type of intervention includes endocrine profiling "to assess chronotype and determine the correct therapeutic treatment window" (Koop & Oster, 2021, p. 6551). These authors also pointed out light hygiene and light therapy as beneficial for patients suffering from major depression. Similarly, sleep hygiene, which includes "regular timing of sleeping, prebedtime routines and undisrupted, sufficient sleep", performed useful as well (Koop & Oster, 2021, p. 6551). Regardless, there is still a need for more examination in the domain of intervention and therapies, with an emphasis on the consideration of individual differences. Apart from this, recent study has reported noticeable changes in sleeping patterns caused by Coronavirus (Kumar et al., 2022). Isolation, lack of exposure to bright light, and restricted movement combined with stress and anxiety certainly contributed to those alterations. This research also stated that disturbed sleep
can affect vaccination process as well as that: "timing of vaccination is important as immune response follows a circadian pattern, being greater if vaccine is given in the morning hours" (Benedict & Cedernaes, 2021, as cited in Kumar et al., 2022p. 47).

Given the above, how our circadian rhythm synchronizes according to our daily routine impacts our welfare. Subsequently, the consequences can be identified in many areas of our physiology and psychology. To conclude, we should be aware of potential harm of sleep disruptions as it seems that our inner clock doesn't apply the 'time heals all wounds' saying.

The Architecture of Sleep

Apart from the physiological aspect of sleep, there is a certain structure of this process that is also impacted by age. In the science and research about sleep there are terms that are used to describe and differentiate between different phases we go through during this state. They are known as the stages of sleep, and together they define what is known as the "Sleep Architecture." It is believed that there are two principal stages known as the Non-Rapid Eye Movement (NREM), that encompasses three subphases, and Rapid Eye Movement phase (REM). By using the EEG, we can observe how each one of them is characterized by specific activity patterns that occur as we are sleeping, and it helps us to distinguish between NREM and REM aspects (Lewis, 2021). For example, in the NREM stage, we can observe spindles, and slow waves (Lewis, 2021), which are

suggested to have a role in memory and cognitive functions (Klinzing et al., 2019, as cited in Lewis, 2021). The first subphase of NREM starts when we close our eyes, and it encapsulates about 5% of our total sleep (Baranwal et al., 2023, p. 59). Next, the second subphase occurs when there is no more eye movement, and further it is characterized by the decrease of our body temperature and heart rate (Baranwal et al., 2023). Sleep here is a bit deeper than in the previous phase, and on the EEG, we can observe sleep spindles and k-complexes (Baranwal et al., 2023, p. 59). It is assumed that the function of this stage is in the strengthening of our memory (Baranwal et al., 2023). Delta waves, slow in nature, are the main characteristic of the deep sleep that occurs in subphase three, and it usually encompasses 20-25% of the night (Baranwal et al., 2023). It is noted that at this stage, the body repairs itself, and our immune system is being nourished as well (Baranwal et al., 2023). This stage is also important to highlight for the interest of this thesis since it is postulated that as we age, there is a lack of deep sleep (Baranwal et al., 2023, p. 59). When it comes to the brain areas, the key ones that are responsible for NREM include part of hypothalamus known as the ventrolateral preoptic area (VLPO) and median preoptic area (MNPO) (Falup-Pecurariu et al., 2021). REM sleep, the fourth stage, is observed on the EEG with wave patterns that show asynchrony (Lewis, 2021), and as we can tell from the name itself one of the characteristics is rapid eye movements, as well as lower muscle tone. This characteristic of our muscles during REM is played out by the neurons contained close to the locus coeruleus (Falup-Pecurariu et al., 2021). Brain activity of this stage reminds of the one we observe in the awaken brain. The REM stage is believed to take up 20% of our sleep in the "second half of the night" (Baranwal et al., 2023, p. 59). This is also known as the part of sleep where dreams happen, and more importantly, where, as hypothesized, strengthening of our memory occurs (Baranwal et al., 2023). Additionally, unlike the previous stages, heart rate and breathing become faster, and less synchronized (Baranwal et al., 2023). Moreover, in sleep disorders the quantity of REM sleep might not be sufficiently attainable (Baranwal et al., 2023). More specifically, if REM stage of sleep is left out, it could have consequences for learning and remembering, emergence of depression, as well as difficulties in problem-solving and domain of creativity (Kim et al., 2021; Palagini et al., 2013; Lewis et al., 2018). Apart from this, it is also worth mentioning the consequences that could follow the lack of adequately achieved NREM that are observed in domains of attention, metabolism, executive functions, immunity, as well as cognition (Léger et al., 2018).

Based on the above, it is therefore crucial to go through all the stages adequately to make sure that our physical and mental capacities are being well replenished. Of course, and as stated in the beginning, sleep ought to change as we age, and therefore we will now go into more detailed consequences of the effects of sleep on the cognitive functions in old age.

The Effects of Sleep on Cognitive Functions in the Elderly

As we have seen in the previous chapter, changes in cognition are related to the aging process, but there is also another aspect that could affect this deterioration in cognition – sleep. When it comes to the elderly population, some observations related to changes in sleep have been made. Accordingly, one research decided to look into: "Sleep Quality and Cognitive Function in the Elderly Population" (Mousavi et al., 2020). A notable negative connection was discovered between the two such as that: "… the lower the sleep quality in the elderly is, the poorer the cognitive function is." (Mousavi et al., 2020, p. 23). And not only that, but this type of relationship was noticed by the authors in all facets related to sleep quality, for example between subjective sleep quality and cognition (Mousavi et al., 2020, p. 24). It is worth mentioning that the authors admitted that since this was a correlational study, the results should be interpreted with caution. Regardless, this is not the only study who has found such relations. To add to this domain, another research group observed the connection between sleep, inflammation, and cognition in the population of middle-aged and older adults (Hu et al., 2021). Main discovery reported by the authors was that those with sleep duration between six to seven hours have better cognition, as well as those who take naps during the day that are under 30 minutes. Moreover, aspects of inflammation were also investigated since, according to the authors, it could have an impact on the cognitive functions, and contribute to cognitive disturbances (Tegeler et al., 2016, as cited in Hu et al., 2021, p. 121). In this research, it seems that inflammation arbitrates between sleep and cognitive functioning. Accordingly, one meta-analysis was reported in this study to have found higher levels of C-reactive protein in those who sleep too much or too little (Irwin et al., 2016, as cited in Hu et al., 2021). On the contrary, the authors state that they were not able to observe such strong connection in their study, and that due to such contradictory findings, there needs to be more research on the involvement of different factors of inflammation in the relation between sleep and cognitive functions. Additionally, the authors of this study decided to measure white blood cells,

since they are important for our immune system, and have been previously reported to have negative connection with sleep quantity (de Heredia et al., 2014 as cited in Hu et al., 2021, p. 120). The authors found that the white blood cells only to some extent intervene the connection between sleep, both during night and day, and cognitive aspects. It is worth mentioning that one longitudinal study of 12 years, that was included in this article, found those who were taking naps longer than 2 hours "were 66% higher likelihood of developing cognitive impairment in 12 years" (Leng et al., 2019, as cited in Hu et al., 2021, p. 123). This leads us to talk about specific type of cognitive impairment known as subjective cognitive decline since it is assumed to be preclinical stage experienced by the people who will develop dementia. Although it is difficult to detect it since neuropsychological tests do not show that there are problems in objective cognitive functioning, nevertheless, it remains an area of concern. Regarding the domain of sleep, one research paper decided to investigate the connection between sleep and subjective cognitive decline (SCD) in older people with preserved cognition (Tsapanou et al., 2018). It was discovered that sleep disturbances were found to relate to many domains of cognition apart from orientation (Tsapanou et al., 2018, p.1). More importantly, authors reported that this effect was observed "regardless of objective cognition" (Tsapanou et al., 2018, p. 2). The credibility of this study, as noted by the authors, lies in the fact that the findings were obtained and repeated in two cohorts that are different in both genetics and culture. Moreover, when looking at these 2 cohorts, the relationship between sleep and complaints were observed in the memory, naming, and calculations, as noted by the authors (Tsapanou et al., 2018, p. 5). What is also worth mentioning is the fact that the authors are hypothesizing if poor sleep causes more decline in subjective cognition. The explanation they provide might lie in the fact that since they included participants without objective problems in cognition, those with lower sleep quality still reported worse cognitive functioning throughout the day, as noted by the authors. Therefore, the main implication of this paper is suggesting that more attention should be given to sleep department of those who present with self-reported problems in cognition since it could also be considered as early sign of the potential risk for its decline. In addition to this study is another research paper that investigated the association between subjective complaints in cognition and altered sleep quality (Kang et al., 2017). After dividing participants in two groups either being "poor sleepers" or "good sleepers", based on their scores on Pittsburgh Sleep Quality Index (PSQI), it was noted by the authors that: "Poor sleepers reported more depressive symptoms and more use of sleep medication, and showed higher SMCQ scores than

good sleeper…" (Kang et al., 2017, p. 532). Moreover, it was observed that both sleep and symptoms of depression were connected to the self-reported problems in the memory, but interestingly the same could not be said for the use of sleep medication, as noted in this study. The overall conclusion of the authors is that sleep quality should be considered and taken care of in this population especially since it has been observed to present a risk in people with subjective complaints who might develop dementia.

Like the aging process itself, sleep could contribute to cognitive changes and disturbances, which can be a risk factor for many different functions. Of course, changes in both the cognition, which was the topic of previous chapter, and sleep, are considered part of normal aging process, Nevertheless, it is also important to take into consideration that there is another side of those changes that can make this natural process more difficult for the elderly. Hence, we now turn to the next part where the manifestation of these difficulties is presented in the form of sleeping disorders.

Sleep Disorders at The Old Age

Although it was previously described how circadian rhythms affect our sleep-wake cycle, as well as the consequences of its disruption, there is still something to be said when specifically focusing on its association with sleep disorders in the elderly. By combining the results from both human and animal studies, one research paper provides us with the entanglement of these two factors in neurodegenerative disorders (Shen et al., 2023). The overall conclusion of the authors is that it appears that there is disruption in the circadian system of people with neurodegenerative conditions that causes: "… deterioration of health and quality of life in patients inflicted with neurodegenerative diseases" (Shen et al., 2023, p. 16). More specifically, for the Parkinson's disease, the most frequent non-motor symptom of this disorder is found in sleep disorders, and it appears that it involves majority of them such as insomnia (being the most common), paired with "… sleep fragmentation and early awakening" (Shen et al., 2023, p. 5). Furthermore, it appears that in people with Parkinson's disease, disruption of circadian activity is noted in the abnormal functioning of autonomic nervous system, and dysrhythmias of neuroendocrine secretion, as written by the authors. When it comes to Alzheimer's disease, it was discovered that sleep issues are present even in the phase of Mild Cognitive Impairment which precedes diagnosis of this type of dementia (Hita-Yañez et al., 2013, as cited in Shen et al., 2023, p. 13). Moreover, the authors

note that the usual type of sleep disorders in AD involve insomnia, restless leg syndrome, excessive daytime sleepiness, and sleep disordered breathing. The asynchronous state of circadian system is observed in rest-activity rhythm, meaning that there is a breach of it manifested as higher wakening during the night, as well as lower activity during the day as stated in this study. When it comes to physiological changes, they are the same as in Parkinson's disease and as the authors note they include disruptions in autonomic nervous system, and hormone secretion. Furthermore, the authors are hinting at the numerous previous studies that suggest the two-way relation happening between sleep disorders, circadian rhythm and neurodegenerative diseases. Taken together, these neurodegenerative conditions could have a common cause found in gene mutations, as it was based on the findings supported by the animal models discussed in this research. Nevertheless, it is worth noting that even with the common symptoms of circadian disruptions, the disorders are differentiating when it comes to neuropathophysiological aspects. Examples for this notion, which were stated by the authors, include the fact that altered functioning of SCN in AD appears especially prematurely through prodromal phase of the disease. On the other hand, in Parkinson's SCN appears to have optimal function until the "early symptomatic phases…" (Shen et al., 2023, p. 16). Apart from this population of the elderly, these disruptions are common in those without such conditions. Another research paper investigated the "growing challenge" of disrupted sleep conditions in old age (Gulia & Kumar, 2018). As stated in this paper, overall sleep duration according to the authors shows to be stable when we are adults. On the contrary, the architecture of sleep and its profundity are altered as we age resulting in having more of light sleep phases, which leads to frequent wakings throughout the night., as noted by the authors. If we were to reflect on the part where sleep architecture was described, according to these authors, there is a decrease of fast spindle and k-complex density, as well as weaker strength of delta waves which have been assumed to be responsible to having trouble in sleep onset (Carrier et al., 2001; Mander et al., 2013; Klerman et al., 2008, as cited in Gulia & Kumar, 2018).On the other hand, beta waves display rising, and are assumed to be responsible for cortical arousal as stated in this paper (Carrier et al., 2001, as cited in Gulia & Kumar, 2018). The cause of these changes the authors, like the previous ones, are finding in the circadian system. Accordingly, reduced melatonin ascendancy, and the fact that older adults show more of the advanced sleep phase, is prescribed to our previously discussed "zeitgebers" in a form of light exposure. Moreover, the ancient SCN clock could be another factor, as noted by the authors, contributing to these changes with its decline in the efficiency (Tranah et

al., 2017, as cited in Gulia & Kumar, 2018), as we age leading us to have troubles with disrupted sleep, having earlier sleep onset as well as earlier waking up (Gibson et al., 2009; Scarbough et al., 1997; 26, Valentinuzzi et al., 1997; Mattis & Seghal, 2016, as cited in Gulia & Kumar, 2018). The authors proceed even further explaining these changes on cellular level. And if we were to reflect on the previous chapter where the hallmarks of aging were described, we know that the telomers are becoming shorter as we grow older. For the purpose of this discussion, the authors note that telomeres in peripheral blood mononuclear cells have been reported to contribute to insomnia and add that troubles in sleep could lead to advanced aging on a cellular level (Carroll et al., 2016, as cited in Gulia & Kumar, 2018, p. 158). On a behavioral level, the commonly related and observable conditions related to disrupted sleep, and as stated in this paper, include insomnia, depression, and anxiety, cardiovascular disorders, pain, dementia, as well as physical disability. When it comes to depression, it has been noted by the authors that not only does the altered sleep leads to the appearance of depression, but this connection has been observed both "cross-sectionally and longitudinally" (Buysse 2014, Yu 2010, Ferrie et al. 2007, as cited in Gulia & Kumar, 2018, p. 159). In the domain of pain, those with moderate-to-severe levels had worse depressive symptoms, more fatigue, and insomnia when compared to those individuals who experience lower pain (Rissling et al., 2016, as cited in Gulia & Kumar, 2018). Sex differences were also reported, and when it comes to the prevalence and number of pain location, they are being greater in women (Patel et al., 2013, as cited in Gulia & Kumar, 2018). Cardiovascular diseases are also worth mentioning since the data reported in this study from different continental sources showed that sleeping below for to five hours, or longer than 10 – chances for mortality rise (Ferrie et al. 2007, Ikehara et al. 2009, and Sabanayagam et al. 2011, as cited in Gulia & Kumara, 2018). While on the contrary, those with sleep duration of 7-8 hours were less represented in the domain of cardiovascular disease (Sabanayagam et al., 2011, as cited in Gulia & Kumara, 2018). To add to another prevalent condition in the elderly, dementia, and as seen in the study from beginning of this part, having troubles with sleep appears as one of the earliest reported symptoms of Alzheimer's. While referring to another study, the authors report that those in the early phases of AD who report having troubles with sleep, show also more behavioral and psychological manifestations associated with disease (Kabeshita et al., 2017, as cited in Gulia & Kumara, 2018), observed as having more "anxiety, euphoria, disinhibition, and aberrant motor behavior" (Gulia & Kumara, 2018, p. 160). Of course, physical disability has an impact on the individuals' sleep, as

well as their caregivers (McCrae et al., 2016, as cited in Gulia & Kumara, 2018). The overall conclusion of this paper leaves us with the discovery that due to "frequent arousals", elderly are experiencing problems in falling asleep as well as maintaining their sleep throughout the night. Hence, the authors provide indications for proper education about the changes of sleeping patterns at the old age, as well as optimistic message that: "Growing older does not always mean sleeping poorly, but sleeping well can certainly improve overall health" (Gulia & Kumara, 2018, p. 161). In another paper, other contributors of aging and their connection to low sleep quality are discussed (Roepke & Ancoli-Israel, 2010). Starting with the primary sleep disorders, three of them the authors are listing as being the most frequently seen in this population: "sleep disordered breathing (SDB), restless legs syndrome (RLS)/periodic limb movements in sleep (PLMS), and REM sleep behaviour disorder (RBD)" (Roepke & Ancoli-Israel, 2010, p. 303). Here, we can go into more detailed description of these, such as that the authors consider risk markers for SDB to usually be: "age, gender, obesity, and symptomatic status", as well as using "sedating medications, alcohol consumption, family history, race, smoking, and upper airway configuration" (Roepke & Ancoli-Israel, 2010, p. 303). Two main symptoms of SDB include snoring and excessive daytime sleepiness (EDS), as noted by the authors as well, and they add SDB to usually be accompanied with: "insomnia, nocturnal confusion, and daytime cognitive impairment including difficulty with concentration, attention, and short-term memory loss" (Roepke & Ancoli-Israeli, 2010, p. 303). EDS, another aspect of SDB that the authors report, has the consequences on the daily functioning because it can cause "… frequent unintentional naps or fall asleep during activities such as reading, watching television, having conversations, or even while driving" (Roepke & Ancoli-Israel, 2010, p 304). Then, to no surprise, problems in alertness and cognition are present in EDs, which represents additional threat to those who already have problems with their cognitive functioning (Ancoli-Israel & Ayalon, 2006, as cited in Roepke & Ancoli-Israel, 2010, p. 304). When it comes to Restless legs syndrome (RLS), the authors note that its occurrence" increases with age", and that is: "usually described as "pins and needles" or a "creepy and crawly" sensation in the legs that is only relieved with movement" (Roepke & Ancoli-Israel, 2010, p. 304). A more professional explanation provided in this paper, and that accounts for these sensations, is dysesthesia. Moreover, its usual comorbidity is with PLMS observed in about 70 % of individuals as the authors report, while this comorbidity is not as high the other way around in those who present with PLMS primary. Like the previous authors, part of the changes in sleep is explained by circadian rhythms

as well, and the authors explain that aging can contribute to a decline in the volume of the circadian rhythm and ultimately result in more arousals during night, as well as frequent wakings and EDs the following day (Vitiello, 1996, as cited in Roepke & Ancoli-Israel, 2010). Apart from the physiological factors that contribute to these changes, that the authors note to be temperature of the body, amount of light exposure, or genetic factors, it is also worth noting how social aspects could play a role too. As it was explained in this study, older people might "… feel pressure from societal norms to stay up later in the evening, despite begin sleepy and despite continuing to wake up too early in the morning" (Roepke & Ancoli-Israel, 2010, p. 307). Finaly, in RBD, the main thing that happens is the deprivation in muscle atonia that we have seen is representative characteristic of REM. The proposed cause is a decline in the functioning of brain stem (Jaqua et al., 2023), and the ultimate consequences include potential injury and altered sleep, as stated in this article. More importantly, it has been reported from previous research that over 70% of individuals who acquire RBD will also have some type of neurodegenerative problem in 12 years from diagnosis (Praharaj et al., 2018; McCarter et al., 2012, as cited in Jaqua et al., 2023). And last, but not least, to add to the domain of sleep troubles, it was found that ultimately SBDs are commonly not being taken care of, and that people can have them" for -3–8 years before diagnosis" (Jennum et al., 2013, as cited in Jaqua et al., 2023, p. 130). This calls upon the awareness of medical professionals in considering the effects sleep could have in elderly since we have already seen and discussed many consequences it carries. Therefore, the domain of frailty is not spared from these adversities. One research group investigated the impact of distinct types of sleeping disorders on the aspect of frailty in old age (Sun et al., 2022). This systematic review also conducted a meta-analysis with the main goal to quantify the effects of sleep on frailty. The results of eighteen studies led authors to observe that older adults who have some sort of sleep disorder, present with increased probability for frailty. More specifically, they note factors such as: feeling sleepy during the day, altered sleep duration and latency, as well as previously discussed – SDB, to be associated with frailty in old age. It was observed by the authors that long sleep duration dominated among the above-mentioned factors when it comes to its relationship with frailty. Although it is worth mentioning that the authors underlie the fact that the studies they included differed between each other due to diverse types of sleeping disorders described, study designs, and the detected correlation between sleep disorders and frailty, as well as assessment tools for frailty used in the studies. Nevertheless, the authors report that after they have "adjusted for these factors", they still observed connections between

sleep disorders and frailty in this age. There are several explanations mentioned by the authors used from the previous studies such as that inflammation or altered endocrine system could account for sleep disorders (Ritter et al., 2013, as cited in Sun et al., 2022). Additionally, it could be explained through comorbidities such as depression (Fugate Woods et al., 2005, as cited in Sun et al., 2022), or as they note that others would suggest that the adipokines might be associated with frailty (Lana et al., 2017; Nagasawa et al., 2018; Tsai et al., 2013, as cited in Sun et al., 2022). The overall conclusion of this study is that it found an association between frailty and diverse sleep disorders observed in low quality of sleep, excessively long sleep duration, and latency, disordered breathing of sleep, and feeling sleepy during the day. Like other studies we have seen, the authors are also highlighting the importance of addressing these alterations by medical professionals. Since all the above presented discussed different risks and factors that could contribute to these diverse sleep conditions, now is the time to introduce a more optimistic part in this domain. One research paper decided to investigate the role of cognitive reserve and its effect on sleeping disorders in aging (Colombo et al., 2023). Indeed, the authors reported that in their cross-sectional study**,** having higher cognitive reserve (CR) was associated with lower scores on PSQI. When looking into the association between CR and depression, as the authors have anticipated, the greater the depressive symptoms, the ability of CR to protect is lower. Nonetheless, increased CR was still having positive influence: “even with high levels of depression, in reducing the need for sleep medications and reducing self-reported sleep disturbances” (Colombo et al., 2023, p. 77). The overall conclusion and the implication of this study are highlighting the fact that CR can also be enhanced in any stage of life (Mondini, et al., 2016; Stern, 2013; Cheng, 2016; Colombo et al., 2022, as cited in Colombo et al., 2023), therefore the authors indicate that by boosting CR, the occurrence of sleep disorders as well as other side effects related to poor sleep could be improved.

Insomnia in The Older Age

While going through the mentioned articles, it is highly noticed that insomnia is the most prevalent sleeping disorder mentioned, that is why this last part will be dedicated to insomnia specifically.

This type of sleeping issue is defined by having troubles in both initiating and maintaining sleep, as well as related daytime functioning, and to receive diagnosis, sleep problems must be

present minimum 3 times a week, and for minimum 3 months (Seow et al., 2018, as cited in Jaqua et al., 2023). It can also appear in several different forms such as sleep onset insomnia, psychophysiologic insomnia, sleep maintenance insomnia, and early morning insomnia, with the last to mainly troubling elderly population (Roepke & Ancoli-Israel, 2010, p. 305). Some statistics reported show that about 35% to 60% of the elderly have problems in initiating, as well as 50% to 70% in its maintenance (Jaqua et al., 2023). Here, sex differences also exist and troubles with sleep are more observed in women regardless of age, as reported in this article. Moreover, there are about 25% cases reported of nonrestorative sleep (Jaqua et al., 2023). Aside from the most frequent types, insomnia can be also categorized according to its length such as: transient insomnia, short-term, and chronic type of insomnia with, all impacted by stress (Roepke & Ancoli-Israel, 2010, p. 305-306), with these authors adding the fact that although insomnia can affect any age, it puts much more weight on elderly since it is associated with other common conditions that we previously discussed such as weak physical health, deficits in cognition, and higher risk of mortality. Not only that, but it has high comorbidity "… with medical or psychiatric illnesses, medication use, circadian rhythm changes, and other sleep disorders" (Roepke & Ancoli-Israel, 2010, p. 306). In the domain of mental health, it is usually found in depression (Roepke & Ancoli-Israel, 2010, p. 306). Apart from depression, it is also associated with panic disorder and generalized anxiety disorder (Ohayon & Roth, 2001 as cited in Roepke & Ancoli-Israel, 2010). We have also seen how some neurodegenerative disorders are impacted by poor sleep quality, and now specifically focusing on insomnia, it is well documented that it is part of pathology in Alzheimer's disease. Support for this notion comes from animal and human experiments, that found how lack of sleep leads to higher Aβ (Lucey et al. 2018, Xie et al. 2013, as cited in Shen et al., 2023), which is key aspect of this disorder. Another contributor is altered circadian rhythm functioning which we have previously seen how it affects this disease. When it comes to PD, the situation is different and different types of insomnia can switch in individuals with PD (Tholfsen et al. 2017, as cited in Shen et al., 2023). Some studies even noted that it can disappear in people with Parkinson's, when observed in prolonged follow-up (Schrag et al., 2015; Lysen et al., 2019, as cited in Shen et al., 2023).

This all leads us to dedicate a few sentences to managing insomnia. A popular trend in resolving this type of sleep disturbance is taking certain pharmacological aids. The most common types are: **"…** sedative-hypnotics, antihistamines, antidepressants, antipsychotics, and anticonvulsants" (Roepke & Ancoli-Israel, 2010, p. 306), and yet the authors note that there is still

no firm data that any of these medications used are helpful for treating insomnia. More importantly, adversities are higher than the actual benefits of taking these types of medication (Roepke & Ancoli-Israel, 2010). On the other hand, what is reported as the most effective approach by the authors is Cognitive-Behavioral Therapy (*Sleep*, 2005, as cited in Roepke & Ancoli-Israel, 2010), that consists of educating individuals about the techniques of good sleep hygiene and combining other behavioral interventions. The usual duration of the therapy is 6-8 weeks, but as we are trying to find the most effective and convenient intervention, the good news is that even two sessions could produce positive effects (Germain et al., 2007, as cited in Roepke & Ancoli-Israel, 2010).

Conclusion of The Third Chapter

Whether the sleep is needed for metabolism clearance and regulation of blood-brain barrier, or synaptic health, one known truth remains- sleep helps us with the overall physical and cognitive functions and the consequences of its disruption could lead to higher risks of frailty, dementia, cardiovascular problems, as well as mortality. Moreover, different types of sleeping disorders exist, and although they can affect any age, the population of elderly is highly susceptible to these disruptions, affecting these individuals in both physical and mental domains. We have also seen how many factors could influence the occurrence of these problems, as well as the high number of comorbidities that follow. Although common, there is still need for raising awareness in addressing the potential risk of poor sleep quality and the consequences it carries if not treated timely. Additionally, in the domain of intervention, when treating sleeping problems, the popular solution is to reach out for pharmacological substances. Even though it might appear as “easy fix” recommendation, some of the medications have more adverse than beneficial effects. Since the main interest of this thesis is in implementing a non– pharmacological approach for both cognitive and sleeping issues that occur in aging, the next chapter is dedicated to investigating connections between mindfulness and sleep in the elderly.

Fourth Chapter

Research done on the Connections between Sleep and Mindfulness

Although mindfulness is not something new, and the tradition of cultivating mindful moments has been practiced in eastern cultures, it appears that now we are becoming more familiar with the idea of "being aware of the present moment", and all other aspects that were discussed in the first chapter of this thesis. Even though much research has been done on the effects of mindfulness, they were mainly focused on the domain of mental health. In this chapter, research done on exploring how mindfulness interventions could relate to sleep, and serve as an aid at the old age, will be presented and discussed, as well as their implications in the domain of prevention, intervention, and possible formats of use.

Research Papers on the Connections between Mindfulness Intervention and Sleep

As we have seen in the previous chapter, altered sleep quality presents increased risk for different declines not only observed in sleep disorders, but in cognitive functioning as well. Hence, the main aim of many papers was to raise awareness to the health care professionals to take into consideration poor sleep quality as a risk factor for such changes. In a recent systematic review and meta-analysis, the core interest was in observing the impact of mindfulness-based intervention (MBI) on the population of cognitively preserved elderly regarding their cognition and sleep (Lannon-Boran et al., 2023). The main finding reported by the authors was that they did not observe any improvements in cognition, but notable impact of MBI was detected in the domain of sleep. And if we also reflect on the previous chapter of this thesis, we could see that there is a connection between sleep and cognitive functions, such as that poor sleep quality has the potential to impair cognition and be a risk marker for future neurodegenerative diseases, for instance -Alzheimer. The authors have also pointed out this observation that disturbed sleep could serve as the sign of future cognitive decline, hence improvements in the quality of sleep might have positive effects for cognition. Moreover, the fact that this was population of cognitively healthy elderly, these results

could be used in the domain of prevention by using mindfulness techniques as a way of facilitating sleep and maintaining optimal cognitive functioning. It is important to note that these authors state that they were one of the first to investigate cognitively healthy elderly. Therefore, and as noted by themselves, there is still a need for future research to replicate, test, and shed more light on those who are not affected cognitively, but who report sleep disturbances. Additionally, and to reflect upon the observation made by authors from previous studies, that older people may have problems in acquiring mindfulness since their attention capacities are declining (Glisky, 2007; Reuter et al., 2019; Vallesi et al., 2021, as cited in Lannon-Boran et al., 2023), we should not discard the fact that an old age is not characterized by all declines and there is evidence of neural plasticity happening in this stage of life as well. To support this argument, and in addition to the domain of mindfulness, study with the title: "Mindfulness-based therapy improves brain functional network reconfiguration efficiency" decided to acquire neuroimaging data of participants that practiced this type of intervention as opposed to those who were assigned the sleep hygiene program (Yue et al., 2023). The significance of this study lies in the fact that the authors are dedicating their attention to exploring if brain activity will be rearranged with mindfulness in "rest and breath-counting task" conditions in this population. Moreover, they included individuals that have self-reported troubles in sleep. By following the rule of randomization, the sample was divided into either training or active control group for 8 weeks, with 2 hours of intervention given to both groups of participants. Mindfulness assigned individuals were reported to have participated in activities of mindful eating, movement and meditation, guided by the certified mindfulness teacher. On the other hand, the sleep hygiene group was being taught about habits and environments that aid sleep quality, as well as exercises such as breathing and muscle relaxation, as noted by the authors. They also state to have matched the groups on all relevant aspects, such as the amount of provided sleep information. The authors also add that the groups did not differ in their results on Pittsburgh Sleep Quality Index (PSQI), or Five Facet Mindfulness Questionnaire (FFMQ) before interventions. The neuroimaging data was acquired through functional magnetic resonance imaging (fMRI) by using the breath counting task to obtain "functional brain measures of mindfulness" (Yue et al., 2023, p. 3). As described by the authors, the participants had to push down the button to specify sum of breaths from 1 to 8, in each series, while also using separate button to register breath number 9. There was also an additional button that can be pressed if the participants missed or lost count, as reported by the authors. Moreover, and as commonly used, the above-mentioned FFMQ was given to acquire

behavioral measures of mindfulness. The authors found notable enhancements in the mindfulness group on default mode, salience networks, and executive control functions. These results go in favor to the argument about neuroplasticity, because it appears that mindfulness helps in moving the "brain's configuration: near "mindful awareness", as stated by the authors, as well as the fact that FFMQ "observing subscale" showed positive changes only for the experimental group. Providing more detailed and understandable explanation, the authors are stating that the effects mindfulness produced on "rest-task functional network reconfiguration" made it less challenging for the mindful individuals to switch between restful to mindful condition when doing BCT (Yue et al., 2023, p.5). It was also noted that it appears that mindfulness and sleep hygiene education have different mechanisms of operating since the active control group did not show any of these effects. The overall conclusion of this study suggests that neuroplasticity can be achieved through mindfulness based on the neuroimaging data that showed brain's reorganization after practicing this type of intervention. This and other studies (Chao et al., 2020; Pauwels et al., 2018) give us evidence and opportunity to observe plasticity that can be achieved in this population as well. In another article, research of different authors decided to compare mindfulness intervention for insomnia (MBIT) with sleep hygiene, education, and exercise program (SHEEP), as well (Shaif et al., 2022). The main interest was to observe the effects they could produce on the noted incongruency between subjective and objective sleep reports in the elderly. The interventions were balanced on their duration and delivery method, meaning that they both were performed for 8 weeks, in duration of 2 hours, and were practiced "face-to-face" as reported by the authors of this study. Since the authors considered the difference in subjectively reported sleep by the individuals and what the objective measures show, for that part they referred to using the following: sleep diaries and PSQI for subjective perspective of sleep, and polysomnography and actigraphy - a gadget that is put around wrist to detect movement, for the objective measures. Then, to calculate the mismatch between the subjective and objective aspects, the authors subtracted the diary intakes of sleep onset latency (SOL)/waking after sleep onset (WASO) from the data obtained on polysomnography and actigraphy of SOL/WASO (Dzierzewski et al., 2019; Williams et al., 2013, as cited in Shaif et al., 2022). Additionally, "breath counting tasks" (BCT) was added to ensure adequate observational measure of "meta-awareness" and "mindfulness" (Levinson et al., 2014; Wong et al., 2018, as cited in Shaif et al., 2022, p. 5). The overall results showed that mindfulness produced effects in both SOL with polysomnography and SOL with actigraphy. On the contrary,

SHEEP only produced a decline on SOL with actigraphy. Moreover, to the author's surprise, more wakings after sleep onset, measured with actigraphy, showed to even rise in the SHEEP group. And lastly, better sleep in the mindfulness group was assigned to MBTI as well, since the authors observe it had effect on SOL, more precisely – in lowering its "discrepancies" (Shaif et al., 2022, p. 11). The possible explanation of the greater gains in mindfulness group, the authors are deriving from previous studies and the fact that MBTI is based on metacognition that is associated with optimistic mood as well as less of rumination, reported and noted from the prior studies (Desbordes et al., 2012; Hassirim et al., 2019; Jain et al., 2007; Jankowski &Holas, 2014; Ong et al., 2012, as cited in Shaif et al., 2022). Moreover, the authors are adding to have included behavioral factors of CBT training such as "sleep consolidation", and "stimulus control", and are stating that by giving attention and treating both behavior and cognition, it can be the solution for the "sleep discrepancy" (Shaif et al., 2022, p. 9). But it is worth noting that SHEEP also produced certain improvements by providing better sleep and managing insomnia, as the authors state. That is why they also, like the previous article we saw, are suggesting that there are probably different mechanisms happening in the background of these two types of interventions, such as the above-mentioned metacognition in mindfulness training. Overall, the authors are calling on future studies to address sleep disparities as a valuable element. Regardless, the findings reported show a promising non-pharmacological way of managing sleep disturbances in this population, with mindfulness producing the positive effects. To add to this domain, and on previous discussion on how medication, although practical, is not potentially the best option for treating sleeping problems due to adversities, another group of authors opted for looking non-pharmacological interventions for treating disturbances in sleep (MacLeod et al., 2018). This was a literature review, and one of the interests was in investigating Mindfulness-Based Intervention, more specifically, Mindfulness-Based Stress Reduction (MBSR), due to the prevailing idea that long lasting stress is main culprit behind sleep problems (Kalmbach et al., 2018; Lo Martire et al., 2020). By looking into different studies, and since the MBI is aimed at managing the negative impact of stress, the idea of one research reported was to test mindfulness awareness practice (MAP), as opposed to already mentioned Sleep Hygiene Education (SHE) (Black et al., 2015, as cited in MacLeod et al., 2018). The participants, randomly assigned to each group, participated in this study for over 6 weeks, in a clinical environment. The overall results showed that MAP group surpassed the SHE regarding the quality of sleep, as reported by the authors. More importantly, for the interest of this thesis, one other study also observed mindfulness

to be quite beneficial for the elderly population and especially those individuals who are more open to try this program and show compliance, as the authors state (Barkan et al., 2016, as cited in MacLeod et al., 2018). By possessing these qualities, the authors add that those individuals could gain the most out of this intervention. Of course, for any great change there needs to be enough time and dedication to ensure those positive effects, but still certain benefits remain such as that mindfulness exercises can be performed at any place and time, in different modalities, which was also noted by the authors. Like in many other research papers, the need for raising awareness, educating patients about different possibilities they have when treating sleep disturbances, as well as a need for more research in this domain, remains a prerequisite. Since we have also seen how mindfulness is implemented in many different physical and psychological conditions, it is no surprise that there are also many different types of this technique being tested. Accordingly, in one systematic review with meta-analysis and moderator analysis of RCTs, the effects of mindfulness-based movement (MBM) intervention for managing sleep (Yang et al., 2022). Findings in this study showed that MBM benefited sleep. More precisely, better results were observed in those conditions where this intervention lasted over three months, with sessions occurring two or more times per week, and ultimately the duration of overall intervention to be more than 24 hours, when compared to other types of protocols as the authors stated. Furthermore, it was also observed by the authors that both healthy individuals and elderly were the ones who obtained more benefits from MBM. More interestingly, the authors are hypothesizing the possible reason as to why this technique could be quite beneficial for older age such as that retirement decreases the amount of stress and activity related to work (Parra et al., 2019, as cited in Yang et al., 2022). Hence, this type of mindful movement provides them with a new form of activity as well as the solution in managing anxiety, which taken together, benefit the sleep (Parra et al. 2019, as cited in Yang et al., 2022). The main implication of this systematic review and meta-analysis is in encouraging the use of MBM as either alternative or corresponding type of therapy in the domain of sleep with a suggestion of the above-mentioned duration and intensity of the program: over 3 months, 2 or more times per week, with overall duration longer than 24h for the best results. Apart from mindfulness, it is fair to mention that exercise is also commonly recommended to help with sleep issues (Cassim et al., 2022; Silva et al., 2022). That is why here, we will now investigate one study that decided to compare these non-pharmacological interventions to seek out which one would produce greater gains in adults from 30 to 69 years of age (Barrett et al., 2020). The authors reported that their sample included

those who did not have the habit of performing either meditation or exercise regime, as well as those who do not report having sleep disturbances. The MBSR program, as we already know, was assigned to experimental group for 8 weeks, and the control group received adequate exercise training to be balanced with the experimental condition. Additionally, the authors included a wait-list control group, which does not perform any type of intervention, but is given training (in this case MBSR) after both experimental and control group. Moreover, in this study, there were several time-points measured of the PSQI, including: baseline, one, three, five, and seven months after the interventions. The ultimate results of the study showed different effects exercise and MBSR produced on the sleep. As stated by the authors, in the aspect of global PSQI scores, exercise training produced more pronounced effects, while MBSR did to a small extent. But both measures impacted self-reported sleep quality, and MBSR showed to improve the daily disturbances in functioning. While both interventions did not produce effects on the element of the sleep efficiency, the obtained benefits from MBSR and exercise were preserved at the 7-month follow-up. Since the participants of this study did not show major troubles with sleep, and they were the sample of healthy functioning adults, the fact that the authors reported improvement of sleep in these participants could serve in the field of prevention to cultivate healthy habits that could contribute to better sleep management in the later-life since we have seen the amount of population affected with sleep disturbances in the old age. The overall conclusion remains that both types of interventions were shown to be beneficial for sleep, and authors are suggesting that the next aim should be concentrated on combining the two interventions to observe the effects of such cooperation. Of course, when introducing these types of interventions or even their proposed combination, we cannot exclude the opinion of the targeted population, in this case – the elderly. That is why one study decided to gather opinions and their point of view when it comes to starting off with these activities (Parra et al. 2019). It was qualitative research that included older adults from 65 to 85 years of age, and who have as of lately been practicing either Mindfulness Based Stress Reduction (MBSR), exercise, or both, as reported by the authors. To gather the individual's perspective, they used an interview containing "open-ended questions" that were referring to both pros and cons of such interventions, as well as how they think it could be implemented in their communities and maintained for their personal use, as noted by the authors. There were three groups formed in this study: mindfulness, mindfulness and exercise, and exercise group. The results obtained in this study showed some interesting points and ideas. For example, mindfulness-based

group reported on gains in mental domain, while the exercise participants referred to mainly physical and social aspects, and the combination of the two interventions contributed to advantages in all 3 domains, as stated by the authors. Since the interview was an important part of this study, the authors reported on the words of participants themselves, such as in the mindfulness group: experiencing more moments of relaxation, awareness, decrease of tension and stress, as well as reporting to find it easier to fall asleep as *"... my mind is not wandering anymore"* (Parra et al., 2019, p. 5). For the exercise group, the benefits were not absent, and the participants reported to have learned to do exercises correctly, improve their form, and being familiarized with, to them, new equipment for exercising, and the fact that they could feel soreness the following days reminded them that "… those muscles were working" (Parra et al., 2019, p. 5). Therefore, to no surprise, those that used the combination of both reported on improved strength, confidence, balance, flexibility, overall energy, and patience, as stated by the authors. Interestingly, one individual reported to have found mindfulness as superior to exercise because it helped to change his attitude, letting go, and the fact that: *"... Physical changes throughout the years have decreased no matter what I do, but my mind can improve."* (Parra et al., 2019, p. 5). Another important part that was investigated in this study concerned the social connections, where the exercise group found attending the training as a nice way to meet new people and make friends, and mindfulness group reported on having positive effects on their spouses as well as experiencing stronger connection within their group. Apart from the obtained benefits, it is fair to report on the perceived barriers in incorporating these interventions. Time was the main obstacle for some individuals when trying to do mindfulness, and in the exercise group the main problem was to continue the exercise routine at home since there were no trainers present and therefore the feedback was missing, as noted by the authors. Generally, the authors observe that the presence of instructors, trainers, and other personnel was not only perceived beneficial for organization and coordination of activities, but also as an important motivational component for the participants. More specifically, the trainer was the main support perceived for the exercise group, the staff for MBSR, and the training itself for MBSR and exercise combined. Furthermore, other participants listed travelling and home interruptions, as well as fear of falling, and social shyness as obstacles they experienced. When participants were asked how they would keep up with exercise and mindfulness, feedback and positive reinforcement were mainly recognized for the maintenance of the exercise group, as noted by the authors. As for mindfulness, many said that the benefits they

feel from mindful exercises serve as enough encouragement to continue, while others even suggest changing them from time to time to avoid repetition and potential disinterest. Interestingly, the authors state that one participant said that these interventions could be introduced by the local area, for everyone to participate regardless of age, and with emphasis to start using them as early as possible. The authors are reporting that a limitation to their study would be the fact that the participants free-willingly attended the focus groups meaning that they were already positively under impression of these interventions and could also be the ones who were engaged in them more strongly. The authors also suggest that many of their participants were already those with good social network, therefore they suggest investigating the same effects but on those who are more socially isolated. Overall, the positive contribution of this study remains in the fact that the authors included opinions, ideas, and first-hand experience of the participants in these programs that also showed themselves to be beneficial for the elderly. Apart from exercise, there is also another therapeutic, yet non-pharmacological option used. It is well documented that music is a pleasant way of incorporating in different types of treatments due to its potential to strengthen different neural pathways, and to produce neuroplasticity (Zaatar et al., 2024; Chatterjee et al., 2021). That is why in one study, the authors decided to combine mindfulness and music to treat sleep disturbances in the elderly population (Nanthakwang et al., 2020). The study was in a form of randomized-control design, structured to have intervention group that received mindfulness exercises such as body-scan and deep-breathing, paired with music. As the usual program goes, these individuals were participating for 8 weeks in the study. In the first month they took part in learning these exercises on a weekly basis in duration of 30 minutes at the facility, as reported by the authors. Then, the authors note that everyone was provided with a Bluetooth speaker powered with music and directed body-scan meditation, with special recommendation to use this device daily for the two mindfulness exercises for half an hour before sleep. In a more detailed explanation, the whole intervention was pictured as lying down with closed eyes, and to listen through the Bluetooth speaker the instructed body scan and music while also practicing the deep breathing, as it was described by the authors. Moreover, to establish conformity in participants, the authors said to give "daily performance record" that needed to be completed every day as soon as they wake up. On the contrary, the control group was participating in the education on sleep hygiene for 4 weeks and the authors add that they would meet in the second part of the month twice a week to share their

personal impressions after receiving "guidelines for sleep hygiene". Like usual, PSQI was used to measure the quality of sleep. As it was assumed, the authors have found that the training group performed superior on the global PSQI, as well as the elements of PSQI refereeing to the: "… sleep efficiency, perceived sleep quality and daily disturbance…" (Nanthakwang et al., 2020). The authors also note that their study found the aspects of sleep quality such as personal perception of sleep, sleep latency and medication in their training group to be better after implementing the program. Some possible explanations as to why this intervention could produce such benefits were already proposed in this thesis, but now for the music part, the authors are providing their assumptions. For example, they state that: "Low-frequency music (low intensity of sound) causes alpha brainwaves, which lead to relaxation, thus allowing older adults to fall asleep more easily" (Nanthakwang et al., 2020, p. 237). Not only that, but they add: "When music is played continuously, the parasympathetic nervous system is stimulated and endorphin hormone secretions produce feelings of happiness, calm, and can relieve pain" (Nanthakwang et al., 2020, p. 237). Additionally, the authors are stating that their study showed that mindfulness exercises together with music, not only aids sleep, but: "… physical, the cognitive, the social functional, the affective and the self-esteem significantly improved after the intervention, …" (Nanthakwang et al., 2019, p. 238). Moreover, these types of intervention are highlighted as being practical since they can be effortlessly implemented to use in the comfort of one's own home environment. The authors are also implying the need for more longitudinal observations, but nevertheless they are proposing this combination to be used in the health services for the elderly. Another interesting aspect of mindfulness is the fact that the underlying mechanism of how it potentially produces its effects remains a mystery. That is why one study suggested that a potential mediation model of rumination and anxiety could be behind the connection between mindfulness and the quality of individual's sleep (Zhu, 2021). In the study, the author included sample of 522 participants of about 66 years of age. There were 3 main hypotheses being tested. First the author assumed the negative association between mindfulness and rumination. The second hypothesis of the author was that rumination is a moderator in the association of mindfulness and sleep. Lastly, the third hypothesis suggested that anxiety is the other moderator of this relation. All the aspects of this study were measured with the appropriate questionnaires, such as Five Facet Mindfulness Questionnaire, PSQI that is often mentioned, Self-Rating Anxiety (SAS), and Ruminative Responses Scale (RRS). The results of the study managed to confirm the author's hypothesis that both anxiety and rumination act as

moderators in the relation of mindfulness and sleep. Based on these findings the author is suggesting that attention should be also given to managing rumination in elderly, through mindfulness, apart from just using it to improve sleep. When it comes to the anxiety as another potential moderator, by practicing the awareness of the present emotions, without attaching to the former events, anxiety levels could be managed and in turn help elderly to sleep better with less worry on their mind. With all said, the implication of this study is that it could be more efficient to include both rumination and anxiety as targets in treatment when implementing this type of technique. There were several limitations pointed out such as the need for more diverse samples, the fact that this was cross-sectional study, and results were based on the questionnaires. Regardless, the overall findings provide an important area to explore when searching for the potential mechanisms behind mindfulness and sleep, as well as encouraging the possibilities of this intervention. Accordingly, one other research study introduced priorly another potential mechanism behind mindfulness. The authors have examined elements of sleep quality on PSQI as a potential arbitrator between mindfulness and a construct that was not introduced before in this thesis – subjective vitality, in the population of the elderly (Visser et al., 2014). Like the subjective perception of age, mentioned in the second chapter, people have also their own observation of the amount of energy they feel to have, as well as "aliveness" **(**Ryan and Frederick 1997, as cited in Visser et al., 2014). And as it was reported in this paper by the authors, psychological and physical aspects (Ryan & Frederick 1997; Vlachopoulos & Karavani 2009, as cited in Visser et al., 2014) impact subjective vitality. More importantly, by cultivating positive mental outtake on one's own physical status, in this case through mindfulness, it could aid subjective vitality even in the case of physical decline as it was pointed out in this study. This is plausible since we have also previously seen how much positive or negative subjective feeling of one's having age impacts their well-being. The main components of this study, mindfulness, subjective vitality, and sleep quality, were measured by the following questionaries reported by the authors: The Subjective Vitality Scale (SVS), Mindful Attention Awareness Scale (MASS), and Pittsburgh Sleep Quality Index (PSQI). The results of the study, performed on individuals ranging from 64 to 91 years, showed that when it comes to the connection between mindfulness and subjective vitality, sleep acts moderately as an arbitrator of that connection. The main aspects of sleep that contribute to these observed results were found to be "habitual sleep efficiency" and "sleep-related problems experienced during the daytime", as stated in this study. The explanation of the authors for the effects of mindfulness is

that it appears that mindfulness impacts sleep in a way that it facilitates falling and staying asleep. This in turn accounts for having better sleep quality which acts positively on the component of subjective vitality. Of course, and as the authors have suggested, more longitudinal data is needed as well as for the research to investigate other potential moderators. Accordingly, one study introduced another mechanism operating between sleep and mindfulness (Lau et al., 2017). More precisely, it was the "acceptance" that is proposed to impact the relation between awareness, psychological distress, and sleep. More precisely, the authors state and indicate that awareness and acceptance are two main elements that help sleep (Lau et al., 2017, p. 553). When it comes to the insomnia, which was given special attention in the previous chapter, there was a study who reported to be the first ones to examine the use of MBSR therapy in the population 75 years of age and over for the treatment of chronic insomnia in a form of RCT (Zhang et al., 2015). It was a single-blind study, with the training and wait-list control group. The authors decided to test the impact of this intervention on comorbidities such as depression and anxiety, which we have heavily discussed in the previous chapter, as well. Therefore, the questionnaires used in this research contained: PSQI, SAS, GDI. The program that the training group performed followed the standard plan of 8 weeks, and the participants were also provided with the 45-minute audio recording of the mindfulness exercises to be performed daily. The exercises included "body-scan, standing, sitting, and walking meditations", and due to the age of participants hatha yoga was excluded as the authors stated (Zhang et al., 2015, p. 182). For the wait-list control group, after 8 weeks had passed, the authors said that they were given an option to also receive this training, but only if they expressed the desire. The findings of the study were interesting. Although the authors reported that the groups did not differentiate at the "baseline" measures, the post-test showed different results. Accordingly, notable effects were detected in the relation between the MBSR and insomnia. More precisely, the results of PSQI were lower for the training group after the treatment when compared to wait-list control participants. The same was observed for depression on GDI questionnaire, but surprisingly the significant influence of mindfulness on anxiety was not observed. Nevertheless, the obtained results from this study show that there is use of mindfulness intervention if nothing else, then at improving the quality of sleep which is what the aim of this thesis chapter is. The authors also state the important fact, mentioned above, that due to physical constraints of participants, yoga was excluded, hence they prescribe these results solely to the MBSR. Of course, like in any study, there are certain limitations reported such as there was no follow-up and the measures were subjective

in nature and that there is a need for physical assessments that could give more unbiased answers, also admitted by the authors. As we remain in the domain of insomnia, one study did their research on elderly individuals, residing in nursing homes, and the effects a mindfulness therapy, performed in the group could produce on their sleep (Li et al., 2020). After employing the mindfulness therapy for the duration of 8 weeks, as well as including semi-structured interviews to gather insight into the personal experience of the participants, the authors observed interesting changes. For example, the experimental and control group did not differ at the baseline regarding their sleep, but after including mindfulness the training group showed notable improvements that were measured on PSQI. And not only that, but specifically regarding the factor of PSQI, that we have already mentioned in the previous studies, it is in line that mindfulness is beneficial for the optimal functioning during the day. Additionally, by including semi-structured interviews, the authors reported the following statements from the participants*: "I used to feel depressed because I couldn't sleep in the middle of the night. Now, in this way, it can help me to fall asleep through self-awareness, and make it easier to fall asleep after the emotional relief*" (Li et al., 2020, p. 111), and: *"In the past, I was always in a bad mood, easy to complain, and feel sleepy, which make me do not want to go out for activities…*" (Li et al., 2020, p. 111) or: *"In the past, I often feel depressed because of the pain. After mindfulness training, I can feel the pain is less than before"* (Li et al., 2020, p. 112). When it comes to the use of medication, the authors note that some elderly said to use less of sleeping pills, while others report on splitting pills in half instead of taking the whole. Additionally, the authors considered the outside elements such as noise, and the consequences it could cause on both duration and effectiveness of sleep, and the observations in this study reported improvements for these aspects in the group that practiced mindfulness. The possible mechanism underlying the mindfulness that could contribute to these results, and that the authors report, reflects upon the already introduced idea of mindfulness helping with the stress management and negative emotional experiences, which is achieved by takin in the present moment of being and accepting whatever shows up in the mind and the environment. All in all, the overall conclusion of the authors is that mindfulness practiced in the group setting is deserving of more attention, exploration, as well as being included for as an intervention. Another study decided to test whether the "mindfulness-based cognitive therapy: will produce improvements in the domain of sleep disorders in the "healthy", and "non-institutionalized" elderly (González-Martín et al., 2023). The authors performed a thorough search for the most adequate studies which resulted in a total of 10

out of 177, due to the rigorous inclusion criteria such as the studies had to be: RCT, containing objective sleep measures, with either "mindfulness-based cognitive therapy" or "mindfulness-based therapy as a treatment: González-Martín et al., 2023, p. 2). After examining the methodological quality of the studies, the findings showed that mindfulness-based therapies are not only producing positive effects, but even being favorized against medications. More specifically, the authors are reporting that performing mindfulness for either 16 or as little as 2 months, produced effects that were kept even after 2 to 4 months after the program has ended (Irwin et al., 2014; Wong et al., 2017; Gallegos et al., 2018; Lee et al., 2022, as cited in González-Martín et al., 2023). Hence, this provides us with the piece of evidence that we can add to all the previously mentioned studies of this chapter calling for more longitudinal data. Moreover, the authors are pointing out the fact that: "... these types of interventions provide feedback to patients, motivating them to fully accept their new experiences" (González-Martín et al., 2023, p. 13). That is why the authors are suggesting the use of mindfulness especially in this age when health is usually more affected. Furthermore, the authors are also reflecting upon the other type of intervention that we have mentioned to be commonly suggested – exercise, but they are pointing out that there are not enough available findings that could be used to determine exercise as a way of producing lasting sleep improvements (Yang et al., 2012; Alessi et al., 2011; Wahbeh et al., 2016, as cited in González-Martín et al., 2023). Despite some limitations, which authors are noting to be studies included in English language, hence they state that generalization of their findings could be constrained, the fact that this type of intervention was found to have positive effects as well as that it can be easily accessible to people, and at small price, it is therefore worth considering it as a promising non-pharmacological method to treat disturbed sleep, and insomnia, as stated in this study. Another research group investigated the effects of mindfulness, more precisely mindfulness of everyday living, and SHE program (Black et al., 2015). The former program included meetings on a weekly basis, for 2 hours, in a group setting consisting of 6 sessions, as noted. The main exercises of this group included: "mindful sitting meditation, mindful eating, appreciation meditation, friendly or loving-kindness meditation, mindful walking, and mindful movement" (Black et a., 2015, p. 496). Moreover, aside from the instructions and discussions performed in a group, the participants were given a mindfulness book and guided meditation on CD (Smalley et al., 2010, as cited in Black et al., 2015). Additionally, the individuals also had homework consisting of 5-minute daily practice, in the beginning, but which then gradually is being prolonged to 20

minutes. The program, that was already introduced in this chapter, was matched with the MAP in terms of duration, group setting, as well as expected gains from the program, as stated by the authors. Here, the participants were given the opportunity to learn about biological aspects of sleep, troubles that can happen with sleep, as well as to differentiate between good and less effective sleep. They were also provided with information on stress, how to track sleep behavior, what are the relaxing methods used to help with sleep, as well as sleep hygiene techniques, as reported by the authors. The results of this study showed that the MAP appears to be notably effective and is producing instant positive effects at post intervention than SHE, as noted by the authors. The reported effect size of this intervention was 0.89, which authors deemed to be: "… large and of clinical relevance considering that effect sizes obtained from all types of behavioral interventions…" (Black et al., 2015, p. 499). The explanation coming from this group of authors is referring to the cognition, behavior, and "intrapsychic processes" in mindfulness that act on the levels of excitation resulting in better sleep quality and daily functioning. Additionally, the authors also report to have found positive effects on the Beck's Depression Scale, as well as changes on the inflammatory marker induced by both interventions. Additionally, it was also pointed out that since they included population with "moderate sleep disturbances" and were not in the position to perform objective measure, there is of course need for more studies to examine MBI as a preventive method, but also as a treatment in those elderly who have received diagnosis of insomnia. Nevertheless, the implication of the authors is that this could be a beneficial form of treatment for those elderly who experience average sleep disturbances, especially since these types of programs are broadly available in different modalities, as well as they are at a lower price than other types of treatments.

Speaking of different modalities and taking into consideration the fact that not everyone might have access to standard form of care, mindfulness instructors, or abilities to attend the program, not all hope is lost. Luckily, modern innovations are helping us bridge the gap in the domain of accessibility of healthcare services. For example, telemedicine provides promising results from delivering health services via technology, in a remote setting (Bernini et al., 2021). When it comes to treating neurodegenerative disorders, there is an option for a treatment that can be carried out in the comfort of one's own home. It is called "HomeCore,"and refers to*:* "a patient-tailored intervention aimed at stimulating several cognitive abilities (e.g., logical-executive functions, attention/processing speed, working memory, and episodic memory) through a series of

sessions of 2D exercises planned remotely for multiple advantages for therapists and patients" (Bernini et al., 2021, p. 5). Apart from the ability to follow and participate remotely, the benefits are reflected in time consumption, as well as adaptive difficulty level, as noted by the authors. The data on usability and user experience in people with probability of developing dementia shows that individuals are satisfied with this way of care, and it does not affect their prior level of familiarization with technology (Bernini et al., 2023). Hence, this type of care is worth mentioning as we will now turn to the technological possibilities that could deliver mindfulness remotely as well.

Digitalized Mindfulness for Improving Sleep

Accordingly, there are certain technological applications available for the usage in improving sleep quality. One group of authors reported their findings on the "Calm" meditation app and its effects on both sleep and mental health (Huberty et al. 2021). Enrolled participants presented themselves with experiencing one or more problems with sleep and at least one type of mental health issue such as depression, anxiety, and PTSD being the most frequent. In the area of sleep, the authors are listing the following problems: initiating sleep, maintaining sleep, obtaining effective rest with sleep, and a certain portion of individuals reported having problems with early waking-ups. The findings were obtained from the 90-day usage of the Calm app, and distinctive characteristics of this application were associated with certain improvements. For example, in the domain of sleep, there are "sleep stories", and they were mainly used by the participants in this study, as the authors state. Moreover, the authors report that those individuals who were experiencing serious troubles in the sleep domain, were found to gain more positive effects when implementing sleep stories, sleep meditations, and general meditations. The portion of participants that was mentioned to have problems in waking up too early, reported more improvements when implementing two types of meditations – sleep and common type. Nevertheless, the authors state that every single element of this app showed positive effects on the overall sleep. If we were to talk in numbers, the statistics reported by the authors was the following: 90.0% of participants described having better ways to initiate sleep, 69.7% of them reported firm sleep, and 79.2% accounted for restful sleep, and only 39.6% of those who experienced too early waking-ups, said

to have experienced upgrade in their sleep (Huberty et al., 2021, p. 6). When it comes to the improvements in the mental health domain, amongst those who reported having a diagnosis when they initially downloaded "Calm", many participants said to have sensed change for the better in either their condition or symptoms. The most benefits were observed in the anxiety, more specifically 90.5% was reported by the authors, then depression with 80.3% improvements, and lastly in PTSD - 70.2% (Huberty et al., p. 8, 2021). Unlike in the sleep department, sleep stories did not contribute to these positive effects in either of mental health conditions. On the other hand, and as observed in analyses of individual "Calm" components, general meditation showed to produce benefits to all the above diagnosis. The authors were fair, and they reported the main limitations of their study as not having representative sample, which consisted of: "mostly white, non-Hispanic females who were educated and mostly employed, limiting the generalizability of our findings" (Huberty et al., 2021, p. 13), and the fact that this was cross-sectional survey. Additionally, for maximum benefits they suggest a longitudinal design. Nevertheless, the findings represent a promising new path for popularization and accessibility of non-pharmacological sleep aids to those who need it. Regarding our population of interest, this could be a good tool in providing help to those not able to attend, access, or who would prefer to perform their mindfulness tasks in the comfort of their own home. By creating easy to use platforms, this type of intervention could be widespread. Adding to the digital domain, another group of authors investigated the use of smartphone apps based on mindfulness in treating both clinical and subclinical factors of insomnia (Low et al., 2020). The participants in this study were divided randomly into either a group that practiced mindfulness, or those who received muscle relaxation (PMR). Both training courses were delivered via phone app, in the duration of 40 to 60 days, without knowing which group they belonged to – single blind design of the study. The main assumption of the authors was that the individuals in the mindfulness group would show more improvement in their insomnia state. The condition they were put in was composed of using "Headspace" app for 60 days. There are 60 mindfulness exercises in that application, each lasting 10 minutes. For this study, the authors instructed individuals that in the first 30 days they were to practice key mindfulness abilities in the feature of the app called "Foundation Pack", and then for the remaining 30 days they used techniques focusing on sleep found in the "Sleep Pack" (Low et al., 2020, p. 3). On the other hand, the control group for all 60 days was instructed to apply exercises via PMR app by "Headspace". As described by the authors, these types of exercises include learning to breathe more steadily

while they are targeting the loosening of muscles. Additionally, actigraphy was also employed as an objective measure of sleep. It is important to note that both groups were told to perform only one exercise daily and were also ordered: “not to use the smartphone application as a direct method to fall asleep (i.e., at least two hours before bed)” (Low et al., 2020, p. 4). In the last 2 weeks of the study, all individuals were filling in, every day, their Sleep Diary, the same thing they did at the baseline as well. Ultimately, when it comes to insomnia, the levels of its intensity were measured by the Insomnia Severity Index (ISI). The overall results of this research showed more gains in the individuals who practiced mindfulness for the SOL, as well as a bit better sleep regulation. Still, both types of intervention, after some time, produced changes in sleep, as noted by the authors. Nevertheless, this type of media provided via smartphones supported the use of mindfulness in a more approachable and accessible way. This adds to the previous research and provides additional implications for considering these types of apps as an option that could be given to those who experience modest or even subclinical levels of insomnia, as the authors said.

Taken together with the previous discussion on telemedicine, telerehabilitation, and other forms of remote service, it would be interesting to see how this would be translated on the population of elderly. There are many mindfulness exercises available online, with guided meditation, and since “HomeCore” provides personalized plans, it would be possible to include mindful exercises as a supplement to their given treatment plan. Moreover, taking in the fact that “HomeCore” is targeting people with neurodegenerative disease, it could be also possible to test the impact of mindfulness on its already discussed implications as an intervention for cognitive functioning and declines.

Conclusion of The Fourth Chapter

As we have seen in this chapter, there has been much research done in the domain of sleep and mindfulness in the population of elderly people. The present findings from different studies suggest that mindfulness has the potential for not only short, but long-term effects on sleep quality on those who practice it regularly. Moreover, since mindfulness itself is a versatile technique that can be used for many different physical and mental conditions, it is also encouraging to see that the modality of its use can be also adapted to the individual's needs. Therefore, not only face-to-face condition is needed, but mindfulness can be practiced in the comfort of one's own home and utilized through even mobile apps. Additionally, this type of intervention is open to combination with other types of techniques used for sleep such as exercise and music, hence accounting for its susceptibility to adapt to personal preferences of people, as well as their physical constraints and mobility. Of course, there is still many things that need to be confirmed, replicated, and updated regarding the current findings, but the fact that it is continuing to gain interest in the research, especially since no adversities from this type of intervention were noted, opens a promising pathway for it's improvement, customization, and ultimately accessibility as an alternative option to those who would opt for more non-pharmacological or even life-long solution regarding their sleep difficulties. Finaly, since the improvements were observed in the population experiencing some sort of disturbances of sleep, it would be also beneficial to consider it as a prevention method that could be used not only for managing when there is existing condition, but rather as a technique to be practiced by any age for the optimal sleep and the future aging.

Fifth Chapter

Research Done on the Connections between Mindfulness and Mental Health in the Elderly

When it comes to mental health, we have seen in the second chapter of this thesis about the most frequently reported struggles found in this population, as well as their impact on the overall well-being and quality of life of the elderly. On the other hand, it has been also reported that mindfulness was heavily researched for its use in combating such psychological conditions, often in the domain of psychotherapy. Therefore, in this final chapter, we are exploring the effects of mindfulness on the mental health in the population of older adults, the extent of its reach and the ability to adapt this intervention to the capacities and needs in the latter life.

Research Papers on the Connection between Mindfulness and Mental Health in the Elderly

In one systematic review, the authors decided to look into the population of elderly that presented with some type of chronic health condition (Kayser et al., 2023). This review included nine eligible studies, and the authors have reported that when analyzing them, there was an association found between mindfulness and the mental health outcomes for certain conditions. For example, stroke, cancer, and type two diabetes were all positively affected by mindfulness in individuals who suffer from these diseases, as observed by the authors. Ultimately, they concluded that chronic pain is the main condition that was found to be the most impacted by mindfulness. Overall, the opinion of the authors is that the use of this technique, and in this type of population, might be beneficial when implemented as a multifaceted treatment solution. This could be plausible since a deeper dive into literature about chronic pain and mindfulness, offers research where the personal statements of the participants were taken in the form of "diary entries", on the impact of this intervention (Morone et al., 2008). The benefits were found in multiple domains including attention, sleep, short-term and long-term well-being. Although the study is of older date, it is worth briefly noting the statements made by the participants, and reported by the authors, such as: *"The pain is still with me; however, it just doesn't feel as intense as it was. I feel results of the study and*

the practice is having a positive effect", or: *"By using meditation I have been able to reduce the feeling of pain*." (Morone et al., 2008, p. 844). This gives us a more personal insight of how some people feel after mindfulness, and the experienced effects of this practice. In one other systematic review, a frequently used mindfulness technique for reducing stress - MBSR, has been investigated for its impact on the depression in this population (Lindayani et al., 2020). After examining the literature, five studies were selected by the authors for drawing conclusions on this subject. The main implication of this review provides an optimistic take in the use of this intervention in the elderly who show depressive symptoms. More positive findings are coming from another study that compared mindfulness and health education programs, although this time, the population of interest included older people with a cognitive decline already mentioned in this thesis – MCI (Klainin-Yobas et al., 2019). The duration of experimental and control condition was nine months. Both types of treatments showed positive results for depression, but when it comes to anxiety, the health program was reported to have performed notably better. Still, the authors themselves are stating the possible factors that could produce such findings, mainly being self-reports and the fact that participants in the mindfulness group had "higher baseline levels of anxiety," which might affect the outcome obtained. Nevertheless, both types of interventions are deemed as positive by the authors, with their suggestion of combining the two for the most beneficial outcome.

But how mindfulness could potentially influence the brain of elderly, and what happens on the neural plan in those older individuals who practiced mindfulness was also investigated (Fam et al., 2020). Like the previous study, here again, the authors are testing this technique in the intermediate phase that could ultimately develop into dementia – MCI. By applying the rule of random allocation, the participants received either mindfulness awareness intervention (MIND), or health education. What was discovered by fMRI, was that the participants of mindfulness group showed differences in those parts of the brain that help with better information processing, which was also confirmed on the cognitive plan in the verbal memory recognition, as noted by the authors. Ultimately, it appears that mindfulness used in this study could influence the way different brain regions communicate and interact to provide optimal functioning in this stage of life. The preserved cognitive functioning is not only beneficial for the cognitive functioning per se, but we know by now that elderly people tend to lose confidence in their own abilities which could affect their mental health, and the way they perceive themselves. Hence, having studies like this one, fighting against negative age stereotypes that stem from society becomes easier, and at the same time makes people

feel more optimistic about the aging process because as this study shows – changes can happen. To add more to the neuroscientific domain, one group of authors with a review titled: "Three potential neurovascular pathways driving the benefits of mindfulness meditation for older adults", suggest that factors like higher blood flow, more functional connectivity in default mode network, as well as the top-down-control, might be responsible for the impact of mindfulness on either direct or indirect neurovascular pathways (Pommy et al., 2023). Another study dealing with the above-mentioned type of cognitive deficit decided to test MBSR against Cognitive Training, for depression, cognitive abilities, as well as immunity in the elderly (Marciniak et al., 2020). There were three time points measured for the above-mentioned factors of interest in both groups: at the beginning of the study, after eight weeks, and after six months from the end of the study. The authors report to observe improvements in depression scores induced by MBSR, as well as in psychomotor speed, but no other significant changes on cognition were registered with mindfulness training. The assumption of the authors is that this could be due to the length of program, hence they are still allowing the possibility for mindfulness to act more effectively on cognition. It is also worth mentioning that both interventions produced changes in the immunity of participants, more precisely: "… the activation status (assessed through the expression of CD86) was decreased in classical monocytes in both groups, while in the MBSR group, this was also true in the intermediate monocyte subset" (Marciniak et al., 2020, p. 1374). Still, there should be some concerns mentioned like the fact that the authors state they had small sample, as well as more pronounced depressive symptoms in the MBSR group, and other characteristics such as different etiologies of MCI, and the physical status of participants being confused with anxiety. Nevertheless, the authors note that this type of mindfulness was well received by their participants. Moving forward, an interesting title of another study goes: "Older and more mindful? Age differences in mindfulness components and well-being" (Mahlo & Windsor, 2020). By including the age range from 18 to 84 years, the authors of this study gathered a broader view of how much and if different age groups show unique levels of mindfulness. Their results demonstrated that: "As expected, present-moment attention, nonjudgment, acceptance, nonattachment, and decentering were all found to be positively associated with age…" (Mahlo & Windsor, 2020, p. 1328). The authors came to this conclusion based on the questionnaires that examined such mindful qualities, and they also provided several possible explanations as to why age might account for all of this. For example, anyone interested in aging knows about the, already mentioned, Socioemotional Selectivity Theory, that postulates

that older people appreciate more time they have because they look at it as becoming shorter due to aging (Carstensen, 2006, as cited in Mahlo & Windsor, 2020). Hence, these authors believe that this theory could explain such results, but they also note that their study showed that this perception might not start that later in life. On the contrary, even as early as 40 years of age is when this perception of time might appear based on what they observed in their sample. An additional explanation for this notion is the idea of authors that two main things cross paths in the middle age: goals that were set earlier in life and changes of those goals if they are not achieved after some time. That is why the authors believe that age acts differently on people when assessing mindfulness because in their words: "[Theoretically], decentering may be a capacity that develops over time due to experiencing and understanding life's changeability…. "(Mahlo & Windsor, 2020, p. 1328). The overall conclusion of the authors is that the connection with these mindful qualities and age can impact prosperity and influence aging in both mid-life and older stages.

In the beginning of this thesis, it was described how mindfulness could be performed both formally and informally. Still, in these last two chapters, research papers reported usually contain formal mindfulness programs. To investigate mindfulness in an informal modality, one study used "FOVEA" program (Shankland et al., 2021), that the authors describe to be based on "Vittoz method" (Vittoz, 1925, as cited in Shankland et al., 2021, p. 66), which includes "flexibility" and "open monitoring" that aids "experiential awareness", hence makes it close to mindfulness itself (Shankland et al., 2021, p. 66). The main idea of the authors was to test the effects of mindfulness by including its core qualities of intentional and non-judgmental attention, but instead of a usual way that involves taking a time out of the day, the idea was to include these qualities in daily activities. Four main mental-health instances were being observed: depression, anxiety, perceived stress, and satisfaction with life. The study also involved training and wait-list control group that received the FOVEA intervention two and a half months later, as reported by the authors. The overall results showed that mindfulness acted beneficial on the above-mentioned mental health instances, with the effects lasting even two and a half months later, as it was noted. Although the mean age in this study was 46.18 years, there were diverse age groups who participated ranging from 18 to 76 years of age, and the authors note that participation in this program was high, hence making it appropriate for different ages and populations. Like in any study that uses self-report type of questionnaires, this was one of the limitations that was reported, but the authors still see informal mindfulness as both beneficial and good for "… a first step towards more formal practices

once the motivation to practice has been enhanced by the perceived benefits of brief practices" (Shankland et al., 2021, p. 63). On the other hand, one systematic review and meta-analysis raises some caution when it comes to the effects a mindfulness intervention can have (Galante et al., 2021). This paper was aimed at analyzing published RCTs on mindfulness interventions, and it was concluded that like any "feel-good practices", as the authors call them, mindfulness did not outshine them, and did not produce superior effects. More precisely, the authors indicate that mindfulness has observable effects on stress, anxiety and depression, but when is compared with "doing nothing", and in those people who experience more distress. Still, this study is in line with some of the previous notions made in this thesis such as the fact that there were no adversities of mindfulness detected, as well as the idea that mindfulness can be paired with exercise for optimal results. Additionally, these authors also note that shorter mindfulness programs are equally effective, and that cultural differences may impact the effect size since "… MBPs may be taught in subtly different ways depending on the culture in which they are modified and delivered" (Galante et al., 2021 p. 20). All of this led authors to conclude that mindfulness might not be universally effective and that it should be further investigated by other researchers in which settings, communities, and types of mindfulness programs would work best for different populations. Similarly, one other study shares their view. Accordingly, in a healthy population of elderly, this research group decided to perform RCT to examine the effects of mindfulness (Fiocco, et al., 2019). The authors report that their sample was randomly divided into either group that practiced mindfulness or the group that was given relaxation program. Although the authors do not discard the potential of mindfulness to help with stress, still they state that they did not observe it to perform better "… than a combined book club and relaxation program" (Fiocco et al., 2019, p. 745). Still, they report to have noticed that the mindfulness group gained from the program observed in: "… a significant increase in threat minimization…" (Fiocco et al., 2019, p. 745), which for the authors is an indicator that these individuals grasped the essence of mindfulness being: "… non-judging, letting go, and acceptance." (Fiocco et al., 2019, p. 745).

Mindfulness, Loneliness, Depression, and Anxiety

As was mentioned before, mindfulness is a versatile technique, and we have seen that it can be performed either in groups, individually at home, or even by using online tools. In the previous chapter, many of the mentioned studies reported using group setting when administering mindfulness training. If we reflect on Socioemotional Selectivity Theory again and add the fact that older people have more meaningful connections at this age (Carstensen et al., 1999), to no surprise, loneliness has been linked with the detrimental effects on this population. More so, one study found that the loneliness had more aversive effects on the women (Hackett et al., 2012). Another study examined the role of mindfulness and loneliness and have found the beneficial use of MBSR not only for this matter, but the authors also added observation that: "… MBSR can significantly down-regulate the expression of inflammation-related genes in parallel with reductions in loneliness." (Creswell et al., 2012, p. 1100). Depression is often the companion of loneliness, and when speaking of it, one longitudinal study tested the impact of mindfulness in the population of elderly who are dealing with some levels of Alzheimer's disease (Quintana-Hernández et al., 2023). This research lasted for two years and included three types of intervention groups, control group, and a pharmacological therapy consisting of donepezil, as reported by the authors. The type of mindfulness treatment being used was "Mindfulness-based Alzheimer's stimulation" (MBAS) (Quintana-Hernández, 2016, as cited in Quintana-Hernández et al., 2023). The other two experimental groups performed either Cognitive Stimulation Therapy (CST), or Muscle Relaxation Treatment (PMR). After 2-year period, the authors report that the mindfulness group showed remarkable results on all the measures assessing depression – Geriatric Depression Scale (GDS), Hamilton Depression Rating Scale (HDRS), as well as Neuropsychiatric Inventory (NPI-Q) that measures neuropsychiatric symptoms such as agitation, delusions, etc. And not only that, other types of treatment not only performed worse, but they also showed an increase in the above-mentioned scores on such scales. Accordingly, the authors note the following: "[Therefore,] it is necessary to address all mental processes involved in the psychopathology of elderly people with AD and not only to attribute the changes to the loss of cognitive abilities" (Quintana-Hernández et al., 2023, p. 479). Although the authors state that they were not able to implement some sort of neuroimaging tool to add to their findings, still their decision to test mindfulness against other forms of therapies that avoid the use of medicines, ultimately crowns it as the superior

treatment in this study and for this population. Going further, one study included elderly staying in nursing homes, and tested mindfulness effects for both depressive symptoms, and cognitive functioning (Aisenberg-Shafran & Harmatz, 2023). Here, the interest of the authors was to see the effects a shorter version of mindfulness could potentially have by comparing it to the regular length of the program. The authors observed that both shorter and longer, versions acted positively in the domain of depression and cognition, while improvements were not observed in the control group that received "care-as-usual". But the authors remind that their study was just a pilot study, and that the results should be interpreted more carefully when it comes to larger application of this intervention. Nevertheless, the authors share an optimistic look on mindfulness and its possibility to be used as another treatment option for the elderly. A more comprehensive take comes from one review that analyzed and gathered data of the previous studies, from 2008 to 2019, on the impact of mindfulness on depression in elderly (Reangsing et al., 2021). The findings of this review are based on nineteen studies, and with the above-mentioned range of years between them, we are able to observe if what was previously discussed confirms the overall finding that mindfulness to some degree helps. Accordingly, the authors of this review found that mindfulness-based interventions work, and not only that but they concluded that even under 5 weeks of mindfulness, especially if there is experienced trainer to give instructions, has the biggest impact. Since this review included many studies, the authors were able to observe how people living in different parts of the world respond to this intervention. Interestingly, they noted that Asian culture, because of longer tradition of meditation, has more gains from this mindfulness than both Europeans and North Americans. What this research team particularly highlights are the use of "a priori power analysis" that was found in some of the studies, as they had larger effects of mindfulness on depression scores (Reangsing et al., 2021, p. 1188). Of course, and as always, certain limitations exist in this review as well. The authors note that they only considered studies in English language, they had lack of racially diverse sample, as well as the fact that the studies included did not have long-term data. Regardless, the suggestion remains that mindfulness could be a part of or even alternative intervention program for depression in this age group. On the other hand, longitudinal data is coming from one study that decided to test the effects of 18-month meditation on mental health in this population (Schlosser et al., 2023). The authors state that the goal of meditation was in: "… developing mindfulness, kindness, and compassion to support healthy ageing and to skillfully meet the physical and psychological challenges associated with ageing." (Schlosser et al., 2023, p. 6).

This was compared to the no-training group, as well as the group that received "English language training", with the authors assumption that this will benefit only cognitive domain (Schlosser et al., 2023, p. 6). The overall findings of this study were that mindfulness proved to perform better only in distinct domains such as awareness and insight, as the authors note. Although there were many possible limitations, and factors responsible for these results, still the authors observe mindfulness as a potential treatment alternative to usual pharmacological aids.

In one study, the authors specifically focused on the female participants and their mental health (Ahmadpanah et al., 2017). Although the reason for including only one gender stems from the technicalities reported in this study, and not to disregard the fact that both genders are worthy of investigating, we also must keep in mind the fact that men and women do not have same coping strategies. As we have seen in the study about loneliness, women tend to be more affected by it. Therefore, it is also interesting to include studies only focusing on one gender to see if there are separate effects as well. Additionally, in this sample, the authors included women who have Major Depressive Disorder (MDD), and they were either in the group that practiced "detached mindfulness", or in the control group that received organized "leisure" activities. The logic behind detached mindfulness is interesting since it teaches people to observe their thoughts and feelings just as that – thoughts and feelings, that are neither true, false, harmful, or anything that we tend to label them, but rather just a product of our mind that does the only thing a mind knows and can do – produce them. In the end, it was observed that both depression and anxiety were lower in the experimental group, while the situation remained same for participants doing leisure activities, symptoms did not change for better or for worse. The authors also report that gains from detached mindfulness stayed even at a four-week follow-up. The main implication of these findings for the authors is that mindfulness shows a potential for treating MDD. As stated earlier, both genders are deserving of attention, and one research investigated mindfulness in only male participants (Kang & Jang, 2021). Although this was population of middle-aged men, still it is worth noting the results of this research since this thesis is looking into effects of mindfulness as a preventive intervention as well. Therefore, in this study, the authors report to have found that mindfulness benefited training group on several instances including depression, self-esteem, and quality of life, as opposed to control group who did not participate in any activities. Therefore, these authors indicate that mindfulness is beneficial, and they also conclude that there needs to be more awareness about its effects given to the male population. Now, returning to and including both genders, one study

decided to compare mindfulness with Cognitive Behavioral Therapy (CBT), regarding emotional distress, as well as the impact they could have on the willingness of elderly to be open to reach out to mental health services (Aisenberg-Shafran & Shturm, 2022). This study included mindfulness, CBT, and control group that received "care-as-usual," in the nursing home setting. Overall, the authors report that both mindfulness and CBT were able to change attitudes in the elderly participants regarding their openness towards mental health services, but on the domain of anxiety, they acted differently. More precisely, the authors state that mindfulness training was able to reduce levels of worry, while CBT showed to be better in reducing anxiety. However, the authors note: "… the lack of a significant decrease in anxiety in the MBIS group may be because the applied study model mandated very little practice" (Aisenberg-Shafran & Shturm, 2022, p. 8). Moreover, the authors also add that they did not observe significant impact of mindfulness on depression, but this they attribute to the potential "floor effect" and the fact that this was not a clinical sample (Aisenberg-Shafran & Shturm, 2022, p. 8). Additionally, the authors noticed interesting interactions between education levels of participants, subjective age, attitude on mental health services, worry, anxiety, depression, as well as the amount of time participants spend with their grandchildren. As expected, increased worry was associated with more depression and anxiety, but less years of education resulted in less worry, younger subjective age, and more positive attitude towards mental health services. Additionally, the authors state that the amount of time individuals spend with their grandchildren results in less negative attitude toward mental health services. Overall, this study adds to the previous ones that recommend mindfulness as a good and inexpensive option to be used for this population. Staying in the domain of anxiety, which was recognized as another frequent occurrence in this population in the second chapter of this thesis, one systematic review specifically investigated how mindfulness acts on this condition that also appears later in life (Hatch et al., 2023). By choosing seven appropriate studies, the authors based their conclusion on the data provided in them. Accordingly, they report that mindfulness is beneficial when it comes to anxiety in this stage of life, even though they admit that the studies differed based on the type of mindfulness that was used.

Mindfulness, Spirituality, Serenity, and Religious Beliefs

One randomized control trial was able to find the effects of mindfulness on anxiety, but in this study, elderly residing in nursing homes had some forms of disabilities (Hsiung et al., 2023). The spirituality was also added in the mix, and a specific mindfulness program used was "Mindfulness-Based Elder Care" (MBEC) (McBee, 2008, as cited in Hsiung et al., 2023). While participants in this study benefited from this program regarding anxiety and spirituality, the authors did not observe the effects on depression. They state several possible reasons for such results in the domain of depression with one of them being duration of the program and the fact that their sample did not contain high levels of this mood disorder. Interestingly, the authors admit to have visited control group participants every week for 10-15 minutes to avoid "attrition." That is why they believe that the observed decreases of depression and anxiety in this group as well, still less impactful than in mindfulness group, could be attributed to this social interaction. Therefore, and apart from the recommendation on the use of mindfulness, the authors also imply this alternative in those situations where there are not enough resources to provide the program itself. Lastly, there is no better way to demonstrate the results of this study without the reports from the participants themselves. As the authors note, and one participant states: "*I feel peace and tranquility while practicing mindfulness… I used to feel lonely and abandoned"* (Hsiung et al., 2023, p. 10). Since religion, religious beliefs, and tradition are frequently present in this population, and not to discard its role in the life of many elderly, there has been also some research done in exploring both mindfulness and religion and their effects on mental health in this population. One study decided to investigate both practices and their relationship with serenity (Naz et al., 2020). According to the Cambridge Dictionary, serenity is defined as "the quality of being peaceful and calm." In this study it was revealed that serenity was strongly connected with older age and both mindfulness and religious coping. This is in line with another study on mindfulness and religious coping that also confirmed the combined effect of the two on the mental well-being in this population (Itqoniah & Adriani, 2021). To no surprise, we can see as to why so many people are or become religious as they grow older. Uncertainty that follows what happens after our time on Earth is coming to an end, turns people to different coping strategies, and for some people religion is the source of peace

in such times. And after we have seen its combined effect with mindfulness, it adds to the notion of this thesis that mindfulness can be implemented and adapted in many, if not all, areas of our personal lives.

Mindfulness for Caregivers of Elderly

Not to forget those who care for their family members with certain conditions, one study dedicated its attention to informal caregivers of dementia patients (Tahsin et al., 2020). In this research, mindfulness training consisted of one 15-minute session with only six individuals included in this study. The authors observed the following factors as being the main ones that sparked interest in the participants to familiarize with this technique: "participants' perceived self-efficacy", positive outcome expectancies," and "risk perception." And thanks to the authors of this study, we have insight into the personal statements of the participants as well, with one of them being: *"I think it is very beneficial to be able to de-stress and this is one of the ways you can de-stress. I have heard different ideas in the past. This is the first time I heard of mindfulness."* (Tahsin et al., 2020, p. 394). More importantly the authors highlight that there were no perceived barriers in using this technique by the participants. The only downside reported, and noted was that: "*I didn't think it (mindfulness session) was too long, you need a longer time to learn something. I would like it longer…when I practice it alone, I would practice it for longer maybe…"* (Tahsin et al., 2020, p. 394), as well as the fact that the authors reported two participants questioning the religious implications in mindfulness. Nevertheless, the authors include many positive experiences of the individuals in this study, and call for other researchers to include bigger, and more diverse samples, as well as longer application of this technique, and more longitudinal studies. Hence, other studies with interest in informal caregivers, with larger samples, also confirmed the positive findings on mindfulness for this population. In one meta-analysis it was discovered that mindfulness helped informal caregivers of patients with dementia in both depression and caregivers' burden (Collins & Kishita, 2018). One systematic review wondered if the training of caregivers and the people they care for is even beneficial (Aksoydan et al., 2019). In this review, various types of training available to the caregivers were assessed such as mindfulness meditation, psychotherapy, telephone, in-person visits, group psychoeducational intervention (PIP), etc. The authors note that telephone, emails, meditation, as well as psychotherapy, were considered to have

an impact in benefiting caregivers quality of life. Still, the authors emphasize that their conclusion is based on not so many studies, and who also show "controversial" findings. Therefore, as always, there is a need for more research in this field. Luckily, there are more studies in this domain, and in the following text, two of them who utilized the use of at home online services will be discussed. One of those studied was a randomized, single-blind and control type of study that implemented MBSR provided to caregivers, and progressive resistance training program (PRT) to people they care for, in a home setting (Lang et al., 2023). Additionally, a wait-list control group was also included. The authors wanted to help caregivers in two ways: to enable them to provide exercise training to their loved one, and at the same time to help them in managing stress with mindfulness. Since this was all played out in the home setting, interventions were encompassed in the "HOMeCARE" term, where caregivers received supervision and support from a distance and through video calls every week with the researchers (Lang et al., 2023, p. 3). Of course, the participants were provided with the needed equipment consisting of an iPAD that contained all the instructions and both mindfulness and resistance training exercises, as stated by the authors. Before the beginning of the study, caregivers received in person instructions, at their home, on what exactly to do, from a research assistant. The overall findings of this study were multiple. The authors report improvements for both caregivers mindfulness, and mobility in the people they care for. Still, the authors state that they did not notice any differences in caregiver burden. Regardless, in their words: "The fact that these requirements did not increase burden relative to waiting list control informal caregivers is an extremely novel and important finding" (Lang et al., 2023, p. 9). Ultimately, the authors state that this at home solution is safe and possible to use in a home environment even with distance supervision, as noted. By recognizing the inconvenience of "in-person attendance" for caregivers who already have a busy schedule, one study decided to test mindfulness remotely, but this time the program was only organized for caregivers and delivered online (Hudson et al., 2020). The authors opted for MBSR, as well as "Mindful Self-Compassion", and the duration of intervention was 7 weeks. To make sure not to further hamper the participants' ability to attend the program, those who were not able to join weekly live online sessions, led by a trainer, still had the ability to access "drop-in sessions" (Hudson et al., 2020, p. 2). Taking in also the fact that in this study, average age reported by the authors was 72, we have also the sample of elderly in the role of caregivers. For example, the authors report words of one participant that stated: "*I just wanted the patience to accept that we're both aging, and we can't hear and see as well as we used to.*

Sometimes it's hard to, you know, be patient." (Hudson et al., 2020, p. 5). Apart from this, sample differentiated in their caregiving roles, some cared either for a partner, parent, or siblings, as noted in this study. The overall results could be interpreted from the words of participants themselves. One of those positive experiences was described in the as: "*I was ready to take on the day. I was ready to take on whatever challenge presented itself. And I felt like I had taken care of myself. I had done an hour of self-care, so I was ready to go back to taking care of everybody around here"* (Hudson et al., 2020, p. 6). This, and the other gains from the mindfulness that the authors report are: "… subjective improvement in sleep, reduction in stress and anxiety, and increased calm." (Hudson et al., 2020, p. 7). Another important thing that was noted was the fact that in this study self-compassion was included, which authors found especially beneficial for this population where a lot of "sacrifices" need to be made. Of course, some limitations, noticed by the authors themselves, included the fact that the sample was not selected based on the "caregivers' burden", and although individuals in this study appreciated the social support, the authors also state that: "… it may not be ideal for all older adults, particularly those who are lonely and may benefit from interactions outside the home" (Hudson et al., p. 8).

Possibilities of Online Delivered Mindfulness for Mental Health in the Elderly

But using online mindfulness for mental health does not stop here. Rather, there has been much research done on investigating this type of modality in the population of elderly. Frequent headlines of the studies referred to the time during COVID-19 when social contact was limited, hence making it more convenient to test this type of accessibility to mindfulness intervention. Accordingly, MBSR zoom sessions were given to one group of elderly during the pandemic (Pacini et al., 2022), and after the program ended, the author organized focus groups to gain insight into opinion on this type of intervention. Three main topics of the focus groups included: "… reasons for applying, experience of mindfulness therapy and connecting at home…" (Pacini et al., 2022, p. 4). The results of this study are promising for utilizing this type of intervention, and in this modality, since the authors report that their participants felt more at ease by doing this in their own home. Additionally, even the sense of belonging to the group was strong and an interesting observation derived from the authors is that "… participants felt that they had been invited into each other's

homes. They were able to see, for example, photographs, décor and pets…" (Pacini et al., 2022, p. 9). Even though the sample in this study might not be representative since the authors note that it was predominantly white, female gender, living at home, and with some encountering problems with technology, still the opinions gathered were positive for both mindfulness and the conveniency of its application making people dedicate their attention to own thoughts, feelings, joy, etc. (Pacini et al., 2022, p. 5). Another study examined the preferences between mindfulness delivered online or in person, in the group of elderly individuals during COVID-19 (Vseteckova, 2020). The author reports that their participants had accessibility, as well as knowledge on how to use online services. Therefore, they admit that it might be the reason why they did not find significant preferences between the two modalities of use. Regardless, the fact that the elderly individuals were interested to participate because they recognized the potential of mindfulness for their mental health and well-being, and even thorough an online platform, remains a good indicator for those who would organize this intervention more practically with this population. Additionally, the authors state that their study goes against popular belief that elderly are "… both unable and unwilling to engage with online activities and health interventions…" (Anderson & Perrin, 2017, as cited in Vseteckova et al., 2020, p. 23915). Still, there needs to be additional awareness not to generalize this belief since there are some elderly who are not familiar with technology or have their own reasons when it comes to its use. Therefore, one study decided to specifically investigate what are the obstacles to using digital technologies for mental health services in this population (Pywell et al., 2020). To gain insight into opinions and experiences, this study opted for semi-structured interviews and investigated individual, interpersonal, institutional, and macro levels. The main reasons for the lack of open approach to digital aps on the individual level, found in their 10 elderly participants, were regarding their knowledge and trust in mobile apps to deal with mental health issues, followed with the lack of confidence in their own skills to use technology as well as estimating that they would need to put too much effort and then not receive much from engaging in the digital apps. On the interpersonal level, the authors found that the participants feel more at ease and trust when they are "face-to-face" with a therapist, rather than potentially going through the app in the time of distress. When it comes to the institutional level, they reported that the dominant attitude of the participants was negative when it comes to their general practitioner (GP) in discussing mental health issues mainly because of the factor of time their healthcare provider has for such concerns. Finaly, on the macro level, some shared worries about personal information that could be hacked or leaked if

individuals opted for digital services, while others said to be more open to use them if they could be anonymous when engaging with them. Of course, since these were personal beliefs and opinions, the authors report it as a possible limitation, as well as the fact that these participants did not try out any of the digital apps shown. Nevertheless, the overall conclusion of the authors is that interpersonal level comes up as the main obstacle, as well as trust, which for this population the authors note to be of crucial importance when it comes from their GP. Therefore, the authors see the possibility of encouraging elderly in the more open attitude towards digital world through their GPs and National Health Service websites, and in the words of authors: "Participants suggested that their GP and the NHS were trusted sources and also require some kind of recommendation from these trusted sources to facilitate use." (Pywell et al., 2020, p. 11). Another look into personal experiences comes from the study that also tested the online use of mindfulness targeting depressive symptoms (Wahbeh, 2018). The author of this study had a larger sample and included a wait-list control group. While there were many positive observations made regarding depressive symptoms, stress, sleep, pain, and even spirituality that was previously discussed in this chapter, still some of the participants did not find it to be as much helpful, and in the words of one of them: "I appreciate your efforts, it did not impress me and it was confusing at times" (Wahbeh, 2018, p. 8). Still, the author notes that there were many positive experiences gained from the program, and one of them being: "Listening to guided meditations has become an everyday practice" (Wahbeh, 2018, p. 8). Moreover, the author states that the above-mentioned gains from the program lasted even 7weeks after the study ended.

But long before these modern ways of use, In the "Clinical Handbook of Mindfulness" (Didonna, 2009), it was specifically addressed and described, in one of the chapters, different ways of how mindfulness could be adapted for various types of elderly. This book considered home-bound elderly, those residing in dementia unit, and nursing homes, informal and formal caregivers, and for all case adaptations are proposed. For example, for the elderly in the nursing homes, possible physical and mental impairments are taken into consideration, and shorter duration of sessions are proposed, as well as "gentle yoga exercises" for individuals in wheelchairs. Additionally, it was described how sense of independence can be induced, because: "MBEC practices remind participants of what is still under their control" (Didonna, 2009, p. 435). When it comes to residents in dementia unit, a strong emphasis is placed upon using breathing exercises, music, and aroma therapy especially if the sessions are being held during dining hours because:

“Aromatherapy and music help create a sacred space in the midst of a noisy hospital dining room where confused residents often wander in and out” (Didonna, 2009, p. 435). For isolated elderly, solutions are made in a form of one-on-one sessions, or if someone is physically limited than exercises are adapted in a form of gentle yoga stretches. Even for the people who are at the end of their life, it was noted that “aromatherapy” and “gentle hand massages” work best for both caregiver and the person receiving care, as well as breathing exercises in cases where communication is limited. And lastly, for the home-bound elderly, mindfulness modalities are available in the form of session over telephone, CDs, and video tapes, that could have double effect on both homebound elderly and their caregivers as it was explained: “Both benefit by the shared experience of listening to the CDs together and practicing the mindfulness exercises” (Didonna, 2009, p. 437). With all this being said, probably the most impactful statement made in this book is that: “Given the broad adaptations of mindfulness skills, there is no reason to exclude anyone who can safely participate from MBEC” (Didonna, 2009, p. 441).

Conclusion of The Fifth Chapter

In this chapter, research done on the impact of mindfulness in the mental health of the elderly population was explored. By including different studies, and different areas of its application, once again, the versatility of this technique was demonstrated. Not only that, but in many papers the positive gains from diverse mindfulness programs and techniques seem to benefit both mental and overall well-being of this population. Depression, anxiety, feelings of distress, but also serenity, were all affected and in many personal statements, derived from the participants themselves, mindfulness was perceived as a helpful intervention. Additionally, by dedicating one part of this chapter to the people who care for their loved ones, it was observed that it helps them cope better with the demands of their role as caregivers. Hence, mindfulness could create a more relaxed and positive environment for both provider and receiver of help, as well as more opportunities for bonding between them. Furthermore, in a part dedicated to digitalization of mindfulness, it was observed how it can be also adapted and delivered in times of major outbreaks like the pandemic for example. And not only that, but it provides more possibilities and options for different preferences of people. To be fair, there were some studies who did not find major

improvements, and as is usually the case, every study has its own limitations, concerns, and barriers ranging from technical to methodological. Even more so, not all participants in some of the studies showed preferences for mindfulness. Not to discard personal rights, opinions or feelings of these individuals, but in the last part of this chapter we could see how mindfulness could be adapted and creatively organized for different preferences and capacities of people. Hence maybe the way some studies were planned and delivered impacted the less optimistic perception of those participants. Regardless, the fact that there are so many research papers exploring mindfulness and its use for the elderly population, and who are still recommending, referring and needing more data on this topic, remains as an encouragement and indicator that there are still more things to be examined in order to fully understand the mechanisms and possible adaptations of mindfulness for everyone.

CONCLUSION

After going through much of the literature, and looking into different types of studies, research papers, and reviews, now in the final statements, the most critical parts of the previously gathered information will be presented once again.

Accordingly, by looking back at the beginnings of mindfulness, and its preservation in the modern world, it is safe to assume that there is a reason as to why this practice is still being used. Apart from its positive impact on both our brain and body, in the first chapter of this thesis, it was demonstrated how mindfulness can also easily be a part of our daily routine, starting from washing the dishes to more complex tasks such as decision-making. Hence, the practical use of mindfulness, described with formal breathing exercise in the same chapter, is one of the examples of what it takes to perform it. Going forward, in the second chapter, the focus was placed upon observing the trajectories of the aging process on both physiological, psychological, and cognitive levels. Special attention was dedicated to the mental health of the older population, and at the same time it demonstrated how it can relate and affect cognition as well. More precisely, there were studies reporting on the connection with cognitive decline and risks for dementia. Similarly, third chapter presented biological aspects of sleep, as well as the impact on cognitive functioning in this population. Hence, from the studies reported it could be interpreted that sleep disturbances are both common, as well as harmful for physical and cognitive functioning, and ultimately well-being of elderly. Additionally, one part was dedicated to presenting different sleep disorders, and insomnia was the most common type that affects many older people across the world. After describing all the processes associated with aging, as well as changes in different aspects that occur, the fourth chapter was able to focus and address the main interest of this thesis – the effects of mindfulness on sleep. By going through different studies, their designs, methodology, strengths and limitations, the first thing that can be noticed is that mindfulness was and is still being much researched. Still, it seems that there are more things to be explored, leaving each study with future research recommendations. Finaly, in the fifth chapter, another interest of this thesis was described as the connection between mindfulness and mental health of the elderly. Here as well, various studies and authors were reported, and different domains of research were included ranging from the overall impact on well-being to more specific topics that dealt with spirituality, specific mood disorders, caregivers, as well as online modality of use. After a brief reminder on what was discussed, now it

would be fair to reflect on the goals and objectives that were presented in the introductory part of the thesis, as well as additional questions that were aimed to be answered. Accordingly, and starting from the topic itself, this thesis addressed its main aspects – mindfulness, sleep, and mental health of the aged population. Additionally, by including different types of studies, several mechanisms were proposed regarding the way in which mindfulness works when it comes to both sleep and well-being. Hence, some of the studies suggested rumination, anxiety, subjective vitality, acceptance, or more general – stress management, to be potential components that are behind this process. Furthermore, another important notion made in the introduction referred to the expected contradicting findings, and this could be also observed since some studies reported on mindfulness performing very well, while others did not find any significant differences or superiority of mindfulness against other types of intervention. Even more so, some participants of the studies did not give as much praise as others to this program, which was noted in some statements written in this thesis. Here it is also important to note that while trying to remain neutral and objectively assess the studies, still it can be noticed that there are more of them reporting on benefits of mindfulness included in this thesis, as opposed to those that did not observe such effects. Nevertheless, the opposing studies agreed upon the same thing – mindfulness did not produce adverse effects. When it comes to the additional questions, it was stated that it would be interesting to see if mindfulness can improve quality of life of elderly with deteriorations in cognition, as well as how does mindfulness influences our brain. In this thesis, both aspects were addressed, and mindfulness was shown to cause changes in our neural system, with some studies reporting on plasticity of the brain achieved through this technique. Regarding elderly who show decline in cognitive abilities, mindfulness was noted to work for patients with both subjective and mild impairments, as well as on the population of elderly who have some type of dementia, through targeting both sleep and mental health domains, with depression and anxiety being the most common. Finaly, the main goal was to report on the existing data in this field, but at the same time, to provide practical guidelines observed in the first chapter through different ways of how mindfulness could be practiced both formally and informally. Additionally, creative possibilities in the adaptation of mindfulness to different needs and capacities of elderly were described in the last part of the thesis. The reason for including various studies exploring different themes such as mindfulness and spirituality, religion, decision-making, connection with the music, or digitalized way of use, was to show that it could be a part of every aspect and therefore tailored to personal

preference. Accordingly, mindfulness was also referred to as both potential treatment and preventive technique, and while the main emphasis was on the population of elderly, still this thesis tried to raise awareness about its possibility to serve to anyone, anywhere, and of any age. Moreover, the fact that some of the studies included personal opinions and statements of the participants gives a better idea of what it is like to be mindful. Even more the fact that this type of intervention, which involves willingness and effort to practice, is still being favorized against pharmacotherapy, observed in some studies, goes in favor of the argument that there still needs to be more awareness among the public when it comes to the possibilities of mindfulness as a treatment option. While some things remain to be answered, such as what type of mindfulness technique works best for this population, or to verify existing data with more longitudinal research, better methodology, and sample selection, the most recent studies in this thesis provide optimistic look, as well as motivation to continue exploring mindfulness.

Therefore, by addressing what was done and what still needs to be worked on, in the true essence of mindfulness, we will stop here, in this present moment, in which only one thing is proven to work for everyone, everywhere, and that is most definitely important aspect of this practice – breathe.

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