

Dissertation

Religiosity and Spirituality in Pain Medicine

submitted by
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Statutory Declaration

I hereby declare that this thesis is my own original work and that I have fully acknowledged by name all of those individuals and organizations that have contributed to the research for this thesis. Due acknowledgement has been made in the text to all other material used. Throughout this thesis and in all related publications I followed the „Standards of Good Scientific Practice and Ombuds Committee at the Medical University of Graz“.

Disclosures

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I confirm that all co-authors have explicitly agreed to the use of their data in the thesis.

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Terminology and Abbreviations

AdR	Degree of religiosity
AR	Subscale general religiosity of the questionnaire multidimensional inventory of religious and spiritual well-being (MI-RSB-48)
AL	Subscale allconnectedness of the MI-RSB-48
BIS	Questionnaire brief symptom inventory
BS	Subscale experience of sense and meaning of the MI-RSB-48
CPTest 1	Cold pressor test before
CPTest 2	Cold pressor test after
CDT	Cold detection threshold
CDTa	Cold detection threshold after
CDTb	Cold detection threshold before
CPT	Cold pain threshold
CPTa	Cold pain threshold after
CPTb	Cold pain threshold before
FSB G	Questionnaire multidimensional inventory of religious/spiritual well-being total score (MI-RSB-48)
Gef G	Subscale feelings of God of the SGrC
HPT	Heat pain threshold
HPTa	Heat pain threshold after
HPTb	Heat pain threshold before
HI	Subscale hope imminent of the MI-RSB-48
HR	Heart rate
HT	Subscale hope transcendent of the MI-RSB-48
IOB	Intensity of belief
IdS	Intensity of spirituality
MI-RSB-48	Questionnaire multidimensional inventory of religious and spiritual well-being
Neg Cop	Negative religious coping of the SGrC
PaG	Passive God
Pos Cop	Positive religious coping of the SGrC
PPT	Pressure pain threshold
PPT_bCPTest1	Manometer before cold pressor test 1

PPT_aCPTest1	Manometer after cold pressor test 1
PPT_aCPTest2	Manometer after cold pressor test 2
QST	Quantitative sensory testing
Rel Cop	Subscale of religious coping of the SGrC
SGrC	Scale of the relationship with God and religious behavior
SOC	Questionnaire sense of coherence
VAS	Visual analog scale
VkG	Connection to the ecclesial community of faith
VE	Subscale forgiveness of the MI-RSB-48
Verh G	Behavior of God of the SGrC
VT	Subscale hope transcendent of the MI-RSB-48
WDT	Warm detection threshold
WDTa	Warm detection threshold after
WPIa	Widespread pain index heat after
WPIb	Widespread pain index heat before
Z10	Centrality scale

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Zusammenfassung

Schlüsselwörter: Spirituality – Religion – Pain – Painmanagement – Cold Pressor Test

Hintergrund/ Ziel:

Schmerz gilt als ein wichtiges klinisches, soziales und ökonomisches Problem in dieser Welt. Laut Studien leben jedoch viele Menschen mit Schmerzen ohne adäquates Schmerzmanagement aufgrund dessen konzentrieren sich die neueren Forschungen auf die Effizienz und Effektivität von komplementäre Ansätzen zur Schmerzlinderung. Die Forschung der letzten Jahrzehnte hat gezeigt, dass psychologische, Sozial- und Verhaltensfaktoren die Wahrnehmung von Schmerzen modulieren können.

Neueste Studien unterstützen die salutogene Funktion religiös spiritueller Themen und Interventionen bei Schmerz. Dennoch ist die Datenlage in Bezug auf die Wirksamkeit von religiös spirituellen Interventionen im Bereich des Schmerzes noch spärlich.

Die Absicht dieser Arbeit ist es, die Wirkung einer Meditation im Gegensatz zu Entspannung auf den experimentelle induzierten Schmerz (Schmerzwahrnehmung, Schmerzintensität, Schmerztoleranz) wissenschaftlich zu untersuchen. In der vorliegenden Studie wird versucht, mittels einer angeleiteten Meditation die Wirkung auf die unterschiedlichen individuellen Schmerzempfindungen, die Schmerzwahrnehmung, Schmerzintensität, Schmerztoleranz, Schmerzverarbeitung und die kardiovaskuläre Reaktivität auf diese Reize sowie auf das religiös spirituelle (Wohl-)Befinden (RSWB) respektive auf das psychische Befinden und deren Veränderungen in einem experimentellen Design zu untersuchen. Es wird vermutet, dass die angeleitete Meditation einen höhere physischen, psychologischen und religiösen spirituellen Mehrwert bei gesunden Untersuchungsteilnehmern gegenüber der Entspannungsbedingung aufweist. Weiters wird untersucht inwieweit die Intervention die, physischen, psychischen und religiös spirituellen Gesundheitsergebnisse der Untersuchungsteilnehmer beeinflusst. Zusätzlich wird untersucht, in welchem Zusammenhang die unterschiedlichen subjektiven Schmerzempfindungen, sowie die kardiovaskuläre Reaktivität auf diese Reize und deren Veränderungen, mit dem Ausmaß der Religiosität /Spiritualität sowie den Copingstrategien der Untersuchungsteilnehmer steht.

Methode: 128 gesunde Studienteilnehmer, im Alter von 18 bis 70 Jahren vollendeten eine Prä-Post Testbatterie zu verschiedenen Bereiche der Religiosität/Spiritualität (z.B. Mehrdimensionales Inventar für religiös spirituelles (Wohl-)Befinden; MI-RSB-48), in

Kombination mit Selbstbeurteilungsinventaren für Schmerz (McGill Pain Questionnaire) für psychiatrischer Symptome (Brief Symptom Inventory; BSI) sowie visuelle Analogskalen zum subjektiven Empfinden (von Schmerz, Stress, Entspannung und Spiritualität). Im Anschluß daran wurden diese randomisiert zu den Interventionsgruppen Meditations- versus Entspannungsbedingung zugeteilt. Mittels einer Prä-Post quantitativer sensorischer Testung (QST) inklusive einem Cold Pressor Test wurden Schmerzwahrnehmungsschwellen, Schmerzintensität und Schmerztoleranz von einem experimentell induzierten Schmerz erhoben. Zusätzlich wurde die Herzrate als Indikator für Stress sowie weitere visuelle Analogskalen zum subjektive Empfindungen (Stress, Schmerz, Entspannung und Spiritualität) erfaßt. Außerdem wurden sozio-anamnestische Daten aller TeilnehmerInnen miterhoben. Abschließend wurde die Fragebogenbatterie wie initial ohne den soziodemografischen Teil vorgegeben.

Ergebnisse: Die Ergebnisse zeigen, dass die Meditationsgruppe im Vergleich zur Entspannungsgruppe in einer 20-minütigen Meditation eine höhere Schmerztoleranz beim Cold-Pressor-Test sowie eine geringere Schmerzempfindung bzw. eine geringere Schmerzintensität beim Wärmeschmerzwert entwickeln. Zusätzlich wies die Meditationsgruppe ein höheres religiös spirituelles (Wohl-)Befinden (RSWB) auf, hatte mehr religiös spirituelle Bewältigungsressourcen zur Verfügung, konnte anderen Menschen leichter vergeben und blickten optimistischer und zuversichtlicher in die Zukunft, fühlte sich mit anderen Menschen und der Natur verbundener und fühlte sich spirituell erlebter. Weiters konnte in der vorliegenden Studie gezeigt werden, dass ein höheres religiös spirituelles (Wohl-)Befinden, mehr religiös spirituelle Bewältigungsressourcen der Untersuchungsteilnehmer sowie positive Gefühle wie Zufriedenheit, Sicherheit, Optimismus, Hoffnung, Zufriedenheit und ein Gefühl in etwas Größeres eingebunden zu sein mit einer höheren Schmerztoleranz im Allgemeinen in Verbindung steht. Vorallem je stärker das Gefühl der Transzendenz - einer spirituellen Verbindung mit Gott bzw. dem Göttlichen, Mitmenschen und der Natur - wahrgenommen wird, desto höher ist die Schmerztoleranz der Personen.

Fazit: Die Meditation bietet somit eine anerkannte und validierte Methode zur Veränderung der Schmerztoleranz sowie der Schmerzintensität (für Wärme). Es scheint, dass diese Methode bei Personen mit relativ geringem Aufwand unabhängig vom Ausmaß der Religiosität bzw. Spiritualität der Teilnehmer eine bemerkenswerte Schmerzreduktion erbringt. Die Meditation kann weiters eine Reihe verschiedener Bereiche beeinflussen, die Auswirkungen auf die Schmerzempfindung und Schmerztoleranz haben bzw. mit einer geringeren Empfindlichkeit der affektiven und sensorischen Dimensionen des Schmerzes einhergehen.

So deuten die aus der vorliegenden Studie gewonnenen Informationen darauf hin, dass die Meditation sowohl die physische als auch die psychisch religiös spirituelle Gesundheit fördern kann. Jedoch sind zusätzliche Studien erforderlich, um festzustellen, ob die Meditation ähnliche Implikationen für Schmerzpatienten enthält.

Abstract

Key words: Spirituality – Religion – Pain – Pain management – Cold Pressor Test

Purpose: Pain is considered to be an important clinical, social, and economic problem in this world. According to studies, many people live in pain without adequate pain management. As a result, recent research has focused on the efficiency and effectiveness of complementary approaches to pain relief. Research of the past decades has shown that psychological, social, and behavioral factors can modulate the perception of pain.

The latest research supports the salutogenic function of religious/spiritual themes and interventions in pain. Nonetheless, the data available with regard to the effectiveness of religious/spiritual intervention in the area of pain is limited.

The aim of this paper is to scientifically examine the effect that meditation as opposed to relaxation has on experimentally induced pain (pain perception, pain intensity, pain tolerance). By means of a guided meditation in an experimental design, the present study attempts to examine the effects on the different individual pain sensations, pain perception, pain intensity, pain tolerance, and pain processing as well as the cardiovascular reactivity to these stimuli and the religious spiritual well-being (RSWB) and the psychological state and its changes. It is assumed that the guided meditation has a higher physical, psychological, and religious/spiritual added value in healthy research participants compared to the relaxation condition. Furthermore, the paper investigates to what extent the intervention influences the physical, psychological, and religious/spiritual health outcomes of the research participants. Additionally, the paper investigates what the connection between the different subjective pain sensations as well as the cardiovascular reactivity to these stimuli and their changes is to the degree of religiosity/spirituality and the coping strategies of the research participants.

Methodology: 128 healthy participants aged 18 to 70 completed a pre/posttest battery for various areas of religiosity/spirituality (e.g. multidimensional inventory of religious/spiritual well-being; MI-RSB-48) in combination with self-assessment inventories for pain (McGill Pain Questionnaire) for psychiatric symptoms (Brief Symptom Inventory; BSI) as well as visual analog scales for subjective perception (of pain, stress, relaxation, and spirituality). Subsequently, the participants were randomly assigned to the intervention groups meditation versus relaxation condition. By means of pre-post quantitative sensory testing (QST) including a cold pressor test, the pain perception thresholds, pain intensity, and pain tolerance were surveyed by an experimentally induced pain. In addition, the heart rate was

recorded as an indicator of stress as were further visual analog scales for subjective perception (stress, pain, relaxation, and spirituality). Furthermore, social anamnestic data was collected for all participants. The questionnaire battery was then given without the socio-demographic part, as was initially the case.

Results: The findings show that during a 20-minute meditation, the meditation group developed a higher pain tolerance for the cold pressor test and a lower pain sensation/lower pain intensity for the widespread pain index for heat compared to the relaxation group. The meditation group also showed a higher religious/spiritual well-being (RSWB), had more religious/spiritual coping resources, was able to forgive others more easily, was more optimistic and confident about the future, felt a closer connection to other people and nature, and felt more spiritually alive. Moreover, the present study shows that a heightened religious/spiritual well-being, and more religious/spiritual coping resources of the research participants as well as positive feelings such as satisfaction, security, optimism, hope, and a feeling of being a part of something larger than oneself are linked to a higher pain tolerance overall. In particular, the stronger the feeling of transcendence is perceived – a spiritual connection with God or the Divine, fellow human beings, and nature –, the higher the pain tolerance of the person.

Conclusion: Meditation thus offers a recognized and validated method for changing pain tolerance and pain intensity (for heat). It seems that this method results in a remarkable pain reduction in people with relatively little effort, regardless of the participants' degree of religiosity or spirituality. Meditation can also influence a number of different areas that have an impact on pain sensation and pain tolerance, i.e., are associated with a lower sensitivity of the affective and sensory dimensions of pain.

The information obtained from this study suggests that meditation can promote both physical and psychological religious/spiritual health. Further studies are required, however, to determine whether meditation has similar implications for pain sufferers.

1 Introduction

1.1 Pain – Acute and Chronic Pain

For most people, pain can be a part of everyday life. Pain serves as an important and possibly even vital warning function for the body and occurs whenever various influences such as mechanical, chemical, and thermal stimuli threaten to cause damage to the body or have already occurred (Treede, 2013). They are supposed to protect the body from harm caused by strain (Maier, Enax-Krumova & Rolke et al., 2017). The International Association for the Study of Pain (IASP) defines pain as follows: “An unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage.” (Merskey & Boduk, 1994). Accordingly, pain is only loosely associated to tissue damage, thus excluding the idea that pain is a purely sensory experience (Traue, Horn, Kessler & Jerg-Bretzke, 2005). Newer definitions state that “pain is a stressful experience that goes hand in hand with an actual or potential tissue damage, including sensory, emotional, cognitive and social components” (Williams & Craig, 2016).

In general, a distinction is made according to the duration of the pain: sudden, acute pain, and chronic pain. Acute pain appears in conjunction with injuries and diseases and is temporary. In contrast to chronic pain, acute pain can usually be attributed to a physiological cause of pain, thereby functioning as a warning signal (Maier, Enax-Krumova & Rolke et al., 2017). Chronic pain is the result of acute pain that keeps arising or that persists or is very intense, due to, for example, not being sufficiently treated (Nilges, 2013). Chronification occurs when the healing process after an acute event lasts longer than usual, in general, when the pain lasts for three months or longer (Caudill, Holman & Turk, 1996; Maier, Enax-Krumova & Rolke et al., 2017) and curbs physical and mental well-being in the persons concerned. International studies point out that 20% of the world population suffer from chronic pain such as fibromyalgia, arthritis or rheumatism, back pain, or migraine headaches (Breivik et al., 2006). Contrary to acute pain, chronic pain affects not only the body but also the psyche and social surroundings (Maier, Enax-Krumova & Rolke et al., 2017). Chronic pain has lost its function as a warning signal and thus its biological necessity. Therefore, it is

no longer a side effect of an illness but has become an independent clinical picture. The pain has thus outlasted its original cause, becoming a illness in its own right and growing into a complex biopsychosocial problem. Often, this pain is accompanied by pain-specific anxieties, unfavorable or obstructive coping strategies, emotional suffering, subclinical impairments of well-being that do not yet meet the criteria of a mental disorder, and often also comorbid psychiatric diseases (Nilges, 2013a). The psychosocial interaction between an individual, his or her family, and his or her environment determines the origin, progression, and prognosis of the chronic pain disorder (Koenig, Bing & Carson, 2012 p. 512 et seq.; Maier, Enax-Krumova & Rolke et al., 2017).

Engel coined the term biopsychosocial model (1977). This pain model integrates biological, psychological, and social factors into a complex system of pain generation and maintenance.

In the 1960s, the gate control theory, a complex psychobiological pain model by Mellzack and Wall, brought about a far-reaching change in concept (Sollgruber, Bornemann-Cimenti, Szilagyi & Sandner-Kiesling, 2018). The core argument of this model was the integration of physiological and psychological components as basically simultaneous and equivalent factors. The model was inspired by the idea that cognitive processes modify nociceptive sensory information. Evaluations, expectations, convictions, perceptions of pain, and emotions influence afferent information. The gate control theory thereby clarified that the central nervous system is not a passive system but rather an extremely active one, capable of filtering, modulating, and selecting incoming information (Mellzack & Wall 1965). Although many hypotheses derived from this could not be confirmed, the result was an integrated pain assessment that understands biological, psychological, and social factors in a complex information processing system (Nilges, 2013a). This theory underlines the significance of psychological factors such as attention, expectation, and emotion (Siddall, Lovell & Macleod, 2015), which were considered in pain processing (Melzack & Wall 1965; Nilges, 2013). This meant that in the last years rapid developments could be observed in the interaction between physiological processes and psychological factors of an individual that are connected to pain.

Cognitive intervening variables such as attributions, expectations, beliefs, self-efficacy, personal control, attention, problem-solving strategies, coping strategies, self-assessments, and imaginations have been brought to the fore in other diverse and influential research (Flor & Hermann, 1999). Experimental studies have confirmed that these factors are decisive for the differences in the persons' response even to identical physical pain stimuli (Hirsch & Liebert, 1998). The pain can be modulated in both directions - increasing and decreasing (Traue et al., 2005).

While the gate control theory was a fundamental development to understanding pain, it could not answer all questions. Ronald Melzack then revolutionized the understanding we have of pain in 1999. He theorized that pain arises in connection with a neuromatrix. This theory suggests that pain is a complex, multidimensional process with various overlapping determinants (Melzack, 2001). The brain acts as an active participant in the pain process through a series of neural networks with ascending (pain) and descending pathways from the cognitive, emotional, and behavioral "centers" of the brain (Wachholtz, 2006). Processing and synthesizing the incoming information in the neuromatrix produces a certain neuronal output pattern coded for a specific somatosensory quality. It is called a neurosignature. If these neuronal networks are activated, they integrate information and patterns from various areas of the body, including emotional, physical, and cognitive areas, in order to modulate the subjective feelings of pain with regard to an increase or a decrease in the pain (e.g. cultural factors, past experiences, personality parameters, and situational parameters of the pain experience) (Melzack 2001, Sollgruber et al., 2018).

Simply put, pain consists of many fundamental aspects. The first is a sensory aspect and is connected to the perception of pain. It allows the pain to be pinpointed. Other aspects are vegetative, affective, and cognitive ones that characterize the psychological response to the previous pain stimulus. These pain components are mainly subjective (Nilges, 2013b), making the pain a personal, internalized and multi-level experience, which is why the sensation of pain is different for each person (Turk & Monarch, 2002; Thorn, 2004). As a result, studies were able to show that the severity of pain is more closely connected to the psychological and physical well-being than localization of the pain is (Bair et al., 2003; Ang, Kroenke & McHorney, 2006, Sollgruber et al., 2018).

Breivik et al. (2006) tried to survey the prevalence of chronic pain in Europe and examined how individuals perceive their pain, what impact it has on their lives, their perception (Breivik, Collet, Ventafridda, Cohen et al. 2006), and their attitude towards their fellow human beings. Another focus was put on the perception of the treatments and their suitability. This extensive, computer-based telephone interview study found that 19% of the 46,394 questioned had been in pain for six months, had suffered pain in the past month, and a few times in the past week (Breivik et al. 2006). On a scale of 1 to 10 (whereby 1 = no pain, 10 = worst pain imaginable), their pain intensity in the last episode was given five points. In-depth interviews with 4,839 persons suffering from chronic pain showed: 66% had moderate pain (NRS = 5–7), 34% had severe pain (NRS = 8–10), 46% had constant pain, 54% had intermittent pain, 59% had been suffering from pain for the past two to 15 years. 21% were diagnosed with depression on account of their pain, 61% were not or only sometimes capable of working away from their homes, 19% had lost their jobs, and 13% had switched jobs as a result of their pain (Breivik et al., 2006). Two thirds were making use of “non-

pharmaceutical treatments” such as massages (30%), physical therapy (21%), or acupuncture (13%). Nearly half of those questioned took over-the-counter analgesic drugs, and two thirds took prescription drugs. Yet 40% of those questioned reported inadequate pain management (Breivik et al., 2006). The illness is usually viewed as a (senseless) disturbance to life (Büssing et al., 2010), suggesting the intention of wanting a specialist to quickly and efficiently remedy it (Lysne & Wachholtz, 2011). According to Breivik et al. (2006), only a few participants of this study were treated by pain specialists, and although differences could be observed in the 16 countries, this study shows that pain is a health care problem in Europe that should not be disregarded (Breivik et al., 2006).

As this study suggests, many people suffering from chronic pain are no longer capable of performing everyday activities. Two thirds of those questioned stated that they were suffering from insomnia due to their pain. Approximately two fifths have problems in their sexual relationships, a third felt incapable of living an independent lifestyle (Breivik et al., 2006), and two fifths of the people stated that they felt helpless on account of their pain. One in five of those questioned felt inadequate as husbands or wives or partners; a similar proportion said they had been diagnosed with depression as a result of their pain (Breivik et al., 2006). The findings of the study by Breivik et al. (2006) illustrate important aspects of the heavy strain individual patients suffer because of pain and also shows that this is a complex biopsychosocial problem. Other studies were able to show that agonizing pain suffered over the years leads to people questioning the meaning of life, thoughts of suicide, family conflicts, problems at work, social isolation, consequently leading to loneliness, depression, and aggressiveness (Wachholtz & Pargament 2008; Koenig, Bing & Carson, 2012 p. 512 et seq.). A study conducted by Bair et al. (2003) demonstrates that depression makes the treatment of patients suffering from pain more difficult. Depression is connected to worse outcomes, increased discomfort, to greater intensity of pain and longer duration of pain, to cumulative issues and functional restrictions as well as a higher probability of not getting well. Those affected by pain face tremendous psychological strain and increased difficulty in dealing with everyday life. Many aspects of daily life, working life, somatic, emotional and social well-being, and quality of life are clearly affected (Breivik et al., 2006) in most people that are in pain. In summary, chronic pain of moderate to severe intensity that seriously diminishes the quality of social and professional life was seen in 19% of adult Europeans, thereby making pain and especially chronic pain a serious health problem in Europe (Breivik et al., 2006, Sollgruber et al., 2018).

1.2 Religiosity and Spirituality in the Context of Disease

According to studies, religiosity and spirituality are relevant for psychological and physical parameters of health and illnesses. Former definitions of health understood health to be the absence of an illness. However, besides physical and psychological aspects, health also constitutes other aspects of life. The definition of health was officially extended in 1948 by the World Health Organization (WHO), which established health to be a “state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” (Lipke & Renneberg, 2006). The biopsychosocial model has been given increased attention since the 1970s (Reimann & Hammelstein, 2006). Health was defined as a “positive, functional general state in the sense of a dynamic, biopsychological state of equilibrium that must be maintained or at least always generated again.” The model explicitly takes into account psychological and social dimensions besides biological/somatic ones. They are given equal attention on a conceptual level. Furthermore, the health-disease continuum is assumed, whereby in addition to clinical judgements made by the practitioners in charge, subjective indicators are also used in the diagnosis (Lipke & Renneberg, 2006). A main advocate of this concept was Antonovsky, who developed the so-called HEDE continuum, which stands for “health ease/dis-ease,” in 1979. He assumed that a fluent transition existed between “health” and “disease.” He also addressed the central question of why and how humans are healthy and which factors play a role in maintaining a person’s position on the health-disease continuum or steering an individual towards a healthy direction (cf. the model of salutogenesis). The focus lies on the characteristic of coherence as an expression of a person's life orientation (Antonovsky, 1997).

The latest research, however, suggests that the biopsychosocial model is not comprehensive enough, calling for a spiritual component to be considered that should be integrated into the biopsychosocial model as a fourth dimension (Pargament, 2007; Huguelet & Koenig, 2009). This addition is recommended because religiosity and spirituality can influence and also link the social, psychological, and even biological aspects of a human’s life (Huguelet & Koenig, 2009, Sollgruber et al., 2018).

The past two decades have seen a considerable rise in interest regarding the significance of religiosity and spirituality on health (Utsch & Klein, 2011). Klein, Berth and Balck (2011) reported a skyrocketing increase in publications since the 1990s on religion i.e. spirituality and psychological and physical health in medical and psychological and nursing science literature.

But first, the terms religion, religiosity, and spirituality must be defined, which will be based on the definition of the *APA Dictionary of Psychology* (2009). Religion describes a system of spiritual beliefs or practices of faith or both, which are typically designed to worship an almighty deity (or deities). It follows practices such as prayer, meditation, and participating in public rituals. Further general characteristics of organized religion is the belief that certain moral teachings have a godly authority; certain persons, places, writings, or objects are revered as “holy” or “godly.” Religiosity adheres to religion as a characteristic and describes the extent to which an individual feels connected to a certain belief system. Spirituality is considered to be a form of belief that goes beyond convictions and faith in the sense of a certain religious community. Spirituality can be linked to a belief system, but does not have to be. It rather describes a non-traditional form of faith that is not bound to a denomination.

Often, spirituality is defined as the experience of transcendence, of connection, and of the meaning of life, thereby integrating the search for the sacred (Dedeli & Kaptan, 2013). These definitions mirror a construction of spirituality which is individualized and not necessarily associated with traditional religion. Such a secularization of spirituality reflects a growing trend in western societies of maintaining some aspects of religiosity such as transcendence while at the same time rejecting institutional and doctrinaire aspects of organized religion (Pargament & Mahoney, 2005, Dedeli & Kaptan, 2013). According to Pargament (1999), religiosity and spirituality often overlap in content, which is why they should be examined in relation to each other but also as independent concepts (Sollgruber et al., 2018).

People faced with an illness often turn to religion or spirituality in order to cope (Huguelet & Mohr, 2009). Religiosity and spirituality play an important role for many sick people as they are not only helpful in providing meaning to these people's lives but also in offering them support so as to be able to deal with the strain of the stress associated with the illness and to buffer it. The influence of religious and spiritual beliefs on physical health was examined and confirmed in recent years in a number of empirical, mainly international studies (George, Ellison & Larson, 2002). Numerous studies were able to confirm a general positive connection of religiosity and spirituality to mental health (Bush 1999; Rippentrop et al., 2005a; Unterrainer et al., 2010).

Smith, McCullough and Poll (2003) were able to demonstrate in their meta-analysis of 147 independent studies on religiosity and symptoms of depression that religiosity seems to be a protective element against depression (Wachholtz, 2006). They examined to what extent the effects are related to the stress levels. One of the main findings of this study was that the negative correlation between religiosity and symptoms of depression was stronger the more stress a person had. At lower stress levels, this negative correlation between religiosity and symptoms of depression was still relevant, but it was weaker than at times of

heavy strain. Thus, religiosity acts as a highly-effective buffer in times of high stress levels and less so in times of low stress levels. This positive effect of religious or spiritual coping strategies in different stress situations was already shown in numerous studies (Pargament, 1997), also concerning the physiological correlates of the stressful life (Maselko et al., 2007). According to Schumacher (2002), a pronounced sense of coherence acts as a protective factor against stress-induced illness because this enables the individual to tap into resources, thereby helping to better cope with the strain.

It has also become apparent that people with high religious spiritual well-being are more optimistic, have higher self-esteem and can adapt better, which in turn has an impact on mental and physical health (Siddall et al., 2015).

1.3 Religiosity and Spirituality in the Context of Pain

Though pain is a universal and individual phenomenon, there are differences in perception, in expression, and in pain tolerance due to a number of internal and external influences such as gender or social and cultural factors (Koenig et al., 2012 p. 512 et seq.). Research of the past decades has even shown that psychological, social, and behavioral factors can not only modulate the perception of pain (Sollgruber et al., 2018) but have an influence on the development, progression, and prognosis of the chronic pain disorder (Miller & Newton, 2006; Moreira-Almeida & Koenig 2008).

Rashiq and Dick (2009) examined these factors in Canada and found pain disorder clusters in the elderly, low-income persons, people with poor schooling, smokers, sedentary people, and persons with an alcohol addiction. An essential part of this survey was that the risk of developing chronic pain decreased when spirituality and faith played an important role in the person's life. A current overview of research in this area showed that prayer was the strategy used most often to cope with the pain; more than 60% of the patients suffering from chronic pain indicated that they used prayer to this effect (Wachholtz & Pearce, 2009). Glover-Graf et al. (2007) reported that 61% of 59 patients with chronic pain specified that they prayed often in response to the pain; another 61% stated that they relied more heavily on God or on spiritual practices, or they applied them since the onset of the pain. Thus, praying was the second most commonly used strategy after taking medication to deal with pain.

Meisenhelder and Marcum (2004) had similar findings. In a collaboration with 841 ministers of the Presbyterian church, they examined post-traumatic stress and religious and

non-religious coping strategies with regard to positive religious experiences in the light of the September 11 attacks. Turning to God for support, strength, and guidance was the most commonly used strategy; the second most common strategy was increased prayer. Furthermore, the study was able to show a connection between increased positive religious spiritual coping strategies and fewer severe stress symptoms, numbness, and avoidance as well as higher positive religious spiritual results.

Ano and Vasconcelles (2005) conducted a meta-analysis of 49 studies, which tested the efficiency of religious coping for people in stressful situations with a total of 105 effect sizes. The findings of the study generally supported the hypothesis that positive religious/spiritual coping strategies are related to a positive psychological adjustment to stress (Raiya, Pargament, Mahoney & Stein, 2008).

Smith, McCullough and Poll (2003) were able to demonstrate with their meta-analysis of 147 independent studies on religiosity/spirituality and symptoms of depression that religiosity/spirituality protects against depression, especially in times of great strain. These findings were also confirmed in a study on chronic pain. Patients who reported more religiosity/spirituality also reported more positive, better mental health when experiencing severe pain (Rippentrop, 2005). These findings are in line with those of a study conducted by Dezutter et al. (2011a), which showed that the value placed on transcendence or spirituality was crucial in determining to what extent it acted as a buffer against the effect of the pain intensity on overall satisfaction of life. It examined the connection between the centrality or the value placed on religiosity/spirituality or transcendence with the duration of pain, pain intensity, and satisfaction in life for 207 patients with chronic pain. The study found that a strong positive correlation exists between the centrality (low and high value) of transcendence in the value system and overall life satisfaction for the group of patients with pain (Dezutter et al, 2011a). Patients with pain who placed great importance on religion or spirituality reported a higher satisfaction with life compared to patients with pain for whom religion or spirituality was not important. A more detailed analysis showed that the level of pain negatively influenced life satisfaction when a lower importance was placed on religiosity or spirituality. Conversely, the intensity of pain did not negatively influence the patients' life satisfaction if they reported a central transcendental value system. The findings suggest that the extent to which religiosity/spirituality is experienced and integrated centrally in people's lives is decisive for the extent to which it serves as a buffer for chronic pain and whether it serves as a resource to these patients with pain and helps in maintaining the quality of life.

Another study by Dezutter et al. (2010a) with 136 patients with chronic pain examined the connection between a positive and negative image of God and happiness as well as the extent to which the cognitive re-evaluation of this image of God functioned as a mediator variable in patients with chronic pain. The findings showed a relevant connection between a

positive image of God and happiness. Furthermore, the study was able to show that a positive image of God was particularly relevant in predicting happiness both directly and indirectly through the way of interpreting the illness, regardless of the level of pain intensity. These findings seem to indicate that patients with a positive image of God are better able to evaluate their pain and disease experiences positively. In other words, prayer leads to a psychological or cognitive process of re-evaluation, which consequently changes the effect that pain has on daily activities (Sollgruber et al., 2018). It is logical to assume that people concentrate more on the growth and learning opportunities as well as on the meaning in this situation and less on the threatening and harmful characteristics of the situation.

In a subsequent study, Dezutter et al. (2011) were able to show with the help of 202 patients with chronic pain that prayer was positively related to pain tolerance but not to pain intensity. The study was able to show that the relationship between prayer and pain intensity as well as between prayer and pain tolerance depends on the religiosity of the patients in pain (believers vs. non-believers). That means that believers who pray often live with a lesser pain intensity, which was not the case for non-believers. Moreover, the group of believers who prayed often showed a higher pain tolerance. The findings demonstrate that prayer can only function as a support in the sense of a cognitive re-evaluation for pain sufferers for pain management if they are religious and if this religiosity is already an integral part of their value system.

Wiech et al. (2008) examined psychological and neurological mechanisms in connection with religious belief systems and experimentally induced pain in fMRI. Twelve religious people and twelve agnostics (male and female) aged 25 were examined. Each group received 20 electric shocks on the back of their hands. During these electric shocks, each research participant was presented with an image of a praying Virgin Mary or an image of Leonardo da Vinci, an image without any religious connotation. After each pain exposure, the research participants made a note of the pain intensity on a visual analog scale from 0 (not painful at all) to 100 (very painful). Additionally, the neuronal activity in the brain, especially the right ventrolateral prefrontal cortex, which plays a suppressive role in pain processing, was observed during this pain exposure. The study was able to demonstrate that religious research participants felt a lower pain intensity during pain exposure while simultaneously being shown religious images, whereas the secular group noted the same pain intensity, regardless of which image they were viewing. The fMRI also showed that the pain exposure in both groups led to the same activation in the brain areas associated with pain. The religious group did, however, show an activation of the right ventrolateral prefrontal cortex (VLPFC) while being exposed to the religious image as opposed to the secular group. These findings suggest that the pain modulation depending on the religious image is

connected to the activation of the VLPFC and the resulting emotion-regulating perception of pain.

1.4 Meditation

Religious and spiritual approaches to pain management are varied. These can include different approaches from prayer and participating in religious services to spiritual rituals, meditation, mindfulness meditation, and Reiki (Sollgruber et al., 2018). Some of these approaches are explicitly religious approaches, others are more worldly or spiritual in nature but rooted in religious traditions. Therefore, non-religious or spiritual people can more easily access or adopt these techniques. Mindfulness meditation has its roots in Buddhism, for example, but is used separately from the Buddhist tradition in Western culture (Bear, 2003).

The custom of using meditation for healing and enlightenment is not a novel idea as all religious traditions practice different forms of meditation. This is how the practice of meditation with the goal of enlightenment on the one hand (e.g. Buddhism, Hinduism) and the goal of divine experience on the other hand (e.g. Christianity, Judaism) has prevailed throughout human history among the different cultures (Walsh, 1999).

The word “meditation” stems from the Latin “meditari,” meaning “to practice contemplation or reflection.” It also has the same Greek and Latin root as the word “medicine” (Hussain & Bhushan, 2010).

Manocha (2000) describes meditation as a discrete and well-defined experience of a state of “thoughtless consciousness” or of spiritual silence, in which the brain activity is minimized without reducing alertness. Walsh and Shapiro (2006) define meditation from a cognitive and psychological perspective as being a technique of self-regulatory practices (Hussain & Bhushan, 2010) that focuses on attention and awareness in order to bring mental processes under voluntary control, thereby developing general mental well-being and/or specific abilities such as calmness, clarity, and concentration (Walsh & Shapiro, 2006). Western definitions emphasize that meditation is a self-regulatory strategy focusing on the training of attention.

As it turns out, there are many definitions of meditation, but it was not until the Delphi study (Bond et al., 2009, Sollgruber et al., 2018). that an adequate consensus definition as well as a taxonomy was worked out. In this multi-stage survey process, in which seven experts in the field of meditation research participated, the following three points were considered necessary for meditation: 1) A defined technique must be used. 2) The type of relaxation

must be logical. 3) A self-induced state must be achieved. Furthermore, the experts agreed that a meditation practice must 4) include a state of psychophysical relaxation at some point in the process, 5) use a self-focusing component or an anchor, 6) involve a changed state or a state of consciousness, a mystical experience, or a suspension of logical thinking processes, 7) be embedded in a religious, spiritual, or philosophical context, and 8) entail an experience of spiritual silence (Bond et al., 2009).

Consequently, meditation describes the process of bringing about a certain state of consciousness by means of utilizing certain techniques (posture, breathing, concentration, repetition of certain linguistic formulas, images, etc.). According to Walsh & Shapiro (2006), this definition distinguishes meditation from a variety of other therapeutic and self-regulatory strategies, such as self-hypnosis and visualization. In general, they do not focus primarily on attention and awareness (Walsh & Shapiro, 2006). Rather, they are aimed above all at changing spiritual content (objects of attention and awareness) such as thoughts, images, and emotions (Walsh & Shapiro, 2006).

Many meditation techniques are currently practiced according to these criteria. Yet these can be divided into two basic approaches that differ in the following respects:

- 1) Concentrative meditations, which aim at a single continuous focus, especially on an object such as a sound, an image, or a feeling, in order to reach a higher awareness.
- 2) Mindfulness/open meditations, which aim at directing attention to several objects selected in sequence (Walsh & Shapiro, 2006).

“Transcendental Meditation”™ is the most popular form of concentration meditation and was developed by Maharishi Mahesh Yogi in 1958. By concentrating the mind on a mantra, an attempt is made to achieve a transcendental state of consciousness. Mindfulness meditation on the other hand includes attentive openness to continuously arising thoughts, images, emotions, and feelings without identifying with them. This practice helps in developing a “non-reactive state” of the mind, forming the basis for a calm and peaceful state of consciousness. Attention is drawn to the entire field of consciousness and not on narrowing the focus of the practitioner. Vipassana and the Buddhist Zen meditations belong to this category of mindfulness meditation (Hussain & Bhushan, 2010).

Concentration meditation and mindfulness meditation thus differ in the type of the attention given.

Furthermore, a distinction can be made between cognitive processes during the meditation and its goals. Some practices observe cognitions and perceptions while others consciously modify them. Some aim to promote general mental development and well-being. Still others concentrate on the development of specific mental qualities like concentration, love, or wisdom (Walsh & Shapiro, 2006).

Mindfulness meditation is a widespread technique; the construct of mindfulness is most often associated with the formal practice of mindfulness meditation. Mindfulness is more than meditation, however, as it is a state of consciousness and the meditation is just a “framework” for developing mindfulness, according to Kabat-Zinn (2005).

In this state of consciousness, there is a profound shift in the relationship to thoughts and emotions, resulting in greater clarity, perspective, objectivity, and ultimately equanimity (Walsh & Shapiro, 2006, Sollgruber et al., 2018). This process is similar to the concept of cognitive defusion devised by Hayes, Strosahls and Wilsons (1999), in which the emphasis is put on changing the relationship to thinking instead of changing the thought content itself. According to Bear (2006), mindfulness is closely associated with special qualities of attention and awareness, which can be cultivated and developed with the help of meditation.

Empirical studies concerning mindfulness and the use of mindfulness techniques in clinical practice have been continuously developed in the past decades. The effectiveness of the mindfulness-oriented intervention such as mindfulness-based stress reduction (MBSR, Kabat-Zinn 1990) and mindfulness-based cognitive therapy (MBCT, Segal, Williams & Teasdale 2002) has been examined many times (Grossmann, Niemann, Schmidt & Walach 2004; Hoffmann, Sawyer, Witt & Oh, 2010, Davis & Hayes, 2011). At the moment, researchers are increasingly concentrating on the mechanisms through which mindfulness exerts positive influence on mental and physical well-being (Coffey & Hartman, 2008). This fact, however, calls for a consensual definition and the operationalization of mindfulness.

Bishop et al. (2004) proposed a two-component model for mindfulness consisting of 1) the self-regulation of attention in order to direct the focus on the present moment, and 2) a particular orientation on the present moment, which includes openness, curiosity, and acceptance.

The first component includes self-regulation of attention so that it is sustained by the immediate experience, enabling an increased perception of mental events in the present. The second component includes the assumption of a certain orientation towards the experiences of the present moment – an orientation marked by curiosity, openness, and acceptance. This means that this attitude of accepting the experience is not a passive, resigned attitude towards the present circumstance but rather an inviting experience that one encounters openly and which – even if difficult – is not seen as a problem but rather as a challenge for the person (Bishop, 2004).

When looking at other definitions in scientific literature, further aspects could be added to the second component of open, curious, accepting orientation, according to Shapiro and Walsh (2006). These aspects are: a non-judgmental and open-hearted attitude, in which one does not identify with the experiences but participates, shows understanding, and adopts a decentralized attitude (in the sense of a meta-level), and takes part in the experience

(Brown & Ryan, 2004; Kabat-Zinn, 1994, 2003; Lau et al., 2006; Marlatt & Kristeller, 1999; Teasdale et al., 2002).

According to Quaglia et al. (2015), the scholars described this state of mindfulness as “alertness” or “clear awareness of every experience that presents itself.”

1.5 Meditation and Pain

In recent years, much of spirituality research has focused on clinical intervention studies to investigate the effectiveness of mindfulness-based interventions such as the Mindfulness-Based Stress Reduction (MBSR) program (Kabat-Zinn, 1990, Shonin, Van Gordon & Griffiths, 2013). These studies have led to promising data suggesting that MBSR is an effective intervention for the treatment of psychological and physiological symptoms (Baer, 2003, Shonin, Van Gordon & Griffiths, 2013).

Correlation and experimental studies suggest that mindfulness-based interventions can reduce the pain intensity. Higher levels of mindfulness in patients with chronic pain are accompanied by lower assessments of pain intensity (Carmody & Bear, 2008, McCracken & Thomson, 2009). A meta study on mindfulness-based interventions that often contain a meditation component determined that most studies report a reduction in pain intensity (Reiner, Tibi & Lipsitz, 2013).

A neuroimaging study by Grant and Reinvile (2009) showed that Zen meditation is accompanied by a low sensitivity to the affective and sensory dimensions of pain. The people meditating showed a significantly lower sensitivity to pain than the control group, which was also accompanied by a thicker cortex in brain regions associated with pain processing. The findings suggest that the sensitivity to pain is related to the cortical thickness of the brain regions associated with pain processing and that the lower sensitivity observed in people meditating may be the product of changes in brain morphometry from long-term practice.

John et al. (2007) compared a Hindu-based yoga therapy with a control group. For this purpose, 72 migraine patients were randomly assigned. The yoga group practiced asanas (yoga poses), pranayamas (breathing techniques), relaxation, and meditation for 60 minutes, five days a week for a duration of three months. They also implemented kriyas (nose cleansing) once a week. The control group participants met once a month for a lesson. In this lesson, they received a handout and were informed about the use of medications, about avoiding triggers such as changes in sleep, and about eating habits. In addition, they were instructed to keep a migraine diary on the frequency of migraine attacks, pain intensity,

and the general state of pain. The yoga group saw a significant decrease in pain frequency, pain duration, and pain intensity, whereby the control group saw an increase in all parameters except for the pain duration. Furthermore, a direct comparison of the groups resulted in a significant difference with regard to the pain rating index and the intensity of the pain.

Zeidan et al. (2009) examined the effects of short mindfulness meditation on electrically induced pain stimulation. In the first experiment, the research group used a 3-day mindfulness meditation (20 minutes per day). The widespread pain index was measured before and after the intervention. The participants' pain assessment to "low" and "high" electrical stimulation significantly decreased after meditation training, as did sensitivity to pain, measured by the stimulus intensity thresholds (pain thresholds). In a second experiment, Zeidan et al. (2009) were able to show that a distraction by means of a math problem reduced high widespread pain indexes but the relaxation conditions did not. There was no reduction in sensitivity to pain in these participants. Then they directly compared the effects of meditation with a math distraction and a relaxation condition. The findings showed significant effects for both the meditation as well as the math distraction, but no in the relaxation group. In accordance with what was observed in the first experiment, these participants also showed a reduction in the sensitivity to pain after the meditation training. The change in mindfulness and the assessment of anxiety signify that the pain-reducing effect of meditation is related to reduced fear and an improved capability to concentrate on the present moment (Sollgruber et al., 2018).

In a study with 42 students, Kingston et al. (2007) examined the effects of a mindfulness training compared to a guided imagination on pain tolerance, on mental well-being and on the pulse, blood pressure, and the development of the mindfulness capability. The participants of the mindfulness training received six one-hour mindfulness sessions; the control participants were offered two one-hour guided imagination sessions. Both groups were given a CD with tutorials and were asked to practice these on a daily basis. Unlike during the guided imagination, pain tolerance was improved during the mindfulness training, though no significant differences with regard to the pulse and the blood pressure or the capability of developing mindfulness were shown. The diastolic blood pressure dropped significantly under both conditions. Mindfulness training therefore increased pain tolerance, which was not associated with acquiring mindfulness capabilities.

In general, it has been shown that meditation has a positive effect on mental and physical health (Alexander, Rainforth & Gelderloos, 1991; Astin, 1997). Although prior research has shown this, spiritual meditation seems to include one additional unique component for reducing the negative affects as well as anxiety (Wachholtz & Pargamet, 2008). In a longitudinal study, Keefe et al. (2001) examined the role of daily spiritual

experiences and the daily religious/spiritual coping strategies in pain patients with rheumatoid arthritis (RA). Thirty-five people with rheumatoid arthritis were asked to keep a structured diary for 30 days. This diary included standardized procedures for measuring religious/spiritual experiences, religious/spiritual coping strategies as well as the awareness of these strategies and their effectiveness, measurement of pain, mood, and perceived social support. The research participants increasingly reported spiritual experiences and the feeling of being touched by the beauty of creation or the desire to be closer to or in union with God (Keefe et al. 2001). They also reported the increased use of mainly positive religious/spiritual coping strategies as opposed to negative religious/spiritual coping strategies. Persons who had more spiritual experiences every day were more in a better mood and less in a bad mood and had an increased social support in all areas.

Wachholtz and Pargament (2005) reached similar conclusions. In their studies on the role of spirituality and the health effects of meditation, they showed that spiritual meditation among students leads to a greater reduction in anxiety and depression as well as to a better mood and higher pain tolerance. In a first phase of the study, the participants were randomly assigned to one of three conditions: "spiritual meditation" or "secular meditation" or "relaxation group." In the spiritual meditation condition, the participants chose one of four mantras ("God is peace," "God is joy," "God is good," or "God is love") for their meditation. If the word was not in harmony with their subjective spiritual attitude, they could change the word into, for example, "Mother Earth." In "secular meditation," participants were able to choose from the four phrases "I am happy," "I am content," "I am joyful," and "I am good." The relaxation group had a rest condition and was instructed to avoid negative stressful thoughts and not to sleep. The participants practiced their respective techniques alone at home in a quiet place once a day for 20 minutes and kept a diary. After practising the meditation/relaxation daily, the participants were again examined two weeks later. First, the research participants were allowed to arrive and rest for five minutes, then the baseline of the heart rate was raised, and the participants were allowed to practice their intervention for 20 minutes while their heart rate was measured at 10-minute intervals (one baseline before meditation, one after ten minutes, and one after meditation). Subsequently, the research participants were asked to place their hand in two-degree-Celsius-cold water; the duration the hand stayed in the water was measured during this cold water condition as well as the heart rate.

The group with the spiritual meditation showed a significantly stronger improvement in their mood and spiritual well-being as well as pain tolerance compared to the other two groups.

The participants of the spiritual meditation had to endure the cold-induced pain twice as long as the group of the secular-based technique. While the participants evaluated the

stimulus equally as painful, using the religious/spiritual technique, however, seemed to promote a higher tolerance or endurance towards this cold-induced pain. (Wachholtz & Pargament, 2005).

Another study conducted by Wachholtz and Pargament (2008), which examined the effectiveness of meditation in migraine patients, was able to show that the positive effect of meditation depended on a spiritual focus. The 83 participants were assigned to one of four conditions: "spiritual meditation," "internal secular meditation," "external secular meditation," or a relaxation group (progressive muscle relaxation), and practiced these for 30 days. With this study, Wachholtz and Pargament were able to show that spiritual meditation went hand in hand with a fundamental improvement of physical, mental, and emotional health. Furthermore, the participants of the spiritual meditation technique reported having a feeling of control over the pain, which stands in contrast to the nonspiritual techniques. In addition, the participants reported a significant increase in daily spiritual experiences and an increased sense of connection with all things "sacred," which was also accompanied by increased religious/spiritual well-being and meaning in their own lives. When people utilized religious or spiritual coping strategies during pain treatment, they reported stronger feelings of religious or spiritual support from God (Keefe et al., 2001) and more spiritual experiences. These spiritual experiences are also observed in secular meditation, though empirical studies show that they don't arise as often and with less intensity than with religious or spiritual meditation (Wachholtz & Pargament, 2008). This suggests that a lesser sensitivity to pain can be associated with religious/spiritual experiences.

Integrating religious and spiritual content into meditation can help the individual develop a higher pain tolerance, reduce depression and anxiety, and improve mental health, which leads to an improvement in the quality of life. In addition, religious/spiritual meditation had a significant positive effect on the relaxation of the cardiovascular system (Wachholtz & Pargament, 2005). According to Koenig, McCullough & Larson (2012), religious/spiritual meditation has been shown to reduce physiological and psychological stress excitation, and there is no doubt that stress can contribute to pain and is a robust predictor of chronic pain. The influence that stress has on back pain is the best researched. Based on data from a cross-sectional and longitudinal study with 372 subjects without and 209 subjects with pain, Linton (2005) came to the conclusion that psychosocial stress increases the risk of pain 13-fold. In the pain-free subjects, the risk of suffering from pain doubled one year later due to stress, and unfavorable or negative coping strategies tripled the risk.

Stress causes a variety of physiological changes in the body, including increased cortisol levels and an increased heart rate. In the long term, this leads to permanent negative health consequences. The spontaneous reactions to stress serve as a good predictor for future problems such as hypertension but also mental health problems (Koenig et al., 2012,

p. 74 et seq.).

Alexander et al. (1991) and Astin (1997) were able to show that meditation suppresses these stress reactions and can even reverse some of the negative consequences such as chronic pain caused by prolonged exposure to a stressor. In a meta-analysis by Alexander et al. (1991) on transcendental meditation, 18 studies with 1,200 participants were examined with a meditation experience of five weeks to five years. They were able to show that within three days the mood among the participants was more positive, and there were physical changes such as lower blood pressure. Consequently, this spiritual experience, or access to additional spiritual resources, helps with coping more easily with stress, and in turn leads to even better mental and physical health. According to Creswell and Lindsay (2014), mindfulness meditations through the resulting “mindfulness stress buffering account” reduce stress, have an effect on the promotion of resilience and thus also on a wide range of physiological health outcomes. Furthermore, this “stress buffering account” helps to counter experiences with acceptance, and the resulting ability to regulate emotions can be understood in the sense of stress-scoping strategies that promote stress resistance (Sollgruber et al., 2018). Thereby, the risk of negative effects of stress on stress-related illnesses can be reduced. Spiritual meditation thus alters the autonomous stability during stress situations and, according to a study by Infante et al. (1998), also the endocrine reaction to it. These findings are also consistent with other studies that used spiritual meditation to lower the heart rate and arterial blood pressure (Murphy & Donovan, 1988; Wenneberg et al., 1997). The researchers assume that the physiological advantages of meditation lie in the qualitative experience or in the qualitative difference and that it is not just a physical or educational experience (Alexander, 1991; Alexander, Rainforth & Gelderloos, 1991).

In addition, studies indicate that religious and spiritual practices reduce anxiety and depression and have a positive effect on health (cf. Koenig, McCullough & Larson, 2012). According to Orme-Johnson (1987), people who meditate need to be admitted to a hospital 50 to 70% less frequently, and the number of doctor’s visits are also fewer.

Spiritual and religious meditation can therefore influence a number of different areas that have an impact on pain sensation and pain tolerance. Thus, spiritual meditation correlates with feelings of spiritual support, spiritual connection, peace, quiet (cf. Alexander et al., 1991; Carlson et al., 1988, Unruh, 2007, Dedeli & Kaptan, 2013), optimism and less anxiety, and improves the mood (Wachholtz & Pargament, 2008). A more positive mood is associated with reduced sensitivity to pain and a higher ability to cushion the resulting negative consequences. Moreover, spiritual meditation can increase the feeling of an inner locus of control (Ferguson 1980) and self-efficacy (Keefe et al. 2001) and reduce the focus

on the body so that a person can withstand discomfort for a longer amount of time (Wachholtz, 2006).

1.6 Summary

According to Breivik et al (2006), traditional pain therapies do not always alleviate pain and rarely improve the quality of life (Sollgruber et al., 2018). Thus, according to Rosenberg et al. (2008), recent research concentrates on the efficiency and effectiveness of complementary approaches to pain relief. In recent years, some new studies have examined the connection between religiosity or spirituality and pain and the effects of religious or spirituality interventions on pain. These studies show that access to religious/spiritual resources goes hand in hand with improved pain tolerance for acute pain (Wachholtz & Pargament, 2005), for chronic pain (Bush et al., 1999; Keefe et al., 2001; Wachholtz & Pearce, 2009), for arthritis pain (Keefe et al. 2001), for migraine pain (Wachholtz, 2008, Wachholtz, Malone & Pargament, 2017), as well as for experimental and clinical pain (Zeidan et al., 2015). Through resource activation, the patient is supported in his or her ability to accept the illness or the pain, thus influencing the pain perception and consequently the handling of this pain and suffering (Unruh, 2007; Sidall et al., 2015; Koenig, McCullough & Larson, 2012).

In various types of negative life events, especially under heavy strain, religious coping strategies seem to be accompanied by a better adaptation and less anxiety and depressiveness. Studies have shown that religiosity and spirituality have a positive effect on overall health and decrease depression and mortality among the ill (Koenig, McCullough & Larson, 2012). There seems to be a positive connection between a community-based religiosity and a favorable adaptation process. Having a connection to the religious or spiritual community has a positive effect on physical and mental health in the sense of the theory of social support (Koenig, 2004).

In the course of dealing with an illness, patients question their own possibilities and try to change their habits. Researchers of the biopsychosocial model have conducted many studies in order to understand pain and to discover coping strategies that can be used to reduce or tolerate the pain and increase the quality of life.

Studies regarding religious or spiritual coping behavior, for example, offer promising empirical starting points in this respect (Murken, 2010). According to Pargament (1997), religiosity and spirituality offer patients the possibility in contrast to secular forms of coping to counter the feeling of one's own ineffectiveness more effectively. Numerous qualitative

studies have shown that if other sources for lending support fail and previous explanations are no longer perceived as being satisfactory, religiosity and spirituality offer possible explanations or a feeling of control (Wachholtz & Pearce, 2009).

In the past, religiosity and spirituality were perceived as negative passive coping strategies; however, current findings show that religiosity or spirituality can be viewed as active and positive coping strategies with advantageous effects (Büssing et al., 2009).

Positive religious coping strategies reflect a secure, trusting relationship with God or the Divine, a belief that there is greater meaning to be found and a sense of spiritual connection with others. Negative religious coping strategies on the other hand reflect a disastrous world view, a quarrel with God or the Divine who punishes and tests, and consequently a religious struggle must therefore be found and preserved. It was possible to demonstrate that positive religious and spiritual coping proves to be extremely helpful in the different stress situations influences how pain is dealt with and has an effect on the course of pain chronification (Rashiq & Dick, 2009; Büssing et al., 2009).

Patients who are religious or spiritual and/or pursue religious or spiritual activities are able to better cope with the pain, are physically more robust, have fewer pathological states of exhaustion, better mental well-being, and more life satisfaction (Koenig, 2004; Koenig, McCullough & Larson, 2012; Siddall et al., 2015; Rippentrop, 2005a). Studies have shown that religiosity and spirituality are accompanied by a lower pain intensity, pain perception, and reduced pain frequency and pain duration (John et al., 2007; Moreira-Almeida & Koenig, 2008; Turner & Clancy, 1986).

Through the power of faith, the ability to cope with pain is improved and depression and anxiety are reduced (Wachholtz & Pargament, 2005, 2008).

The evaluation process of religious and spiritual belief systems supports the development of hope, optimism, and self-efficacy (Lysne & Wachholtz, 2011). People can thus view potentially stressful situations not as a threat to personal identity but as opportunities for spiritual growth and learning or as part of a broader divine plan (Unruh, 2007).

1.7 Conclusion

Pain is considered to be an important clinical, social, and economic problem in this world (Henschke et al., 2015). According to the study by Breivik et al. (2006), many people in pain are living without adequate pain management. Pain – especially chronic pain – is therefore a

serious health problem affecting millions of people. Research in the past decades has shown that psychological, social, and behavioral factors can modulate the perception of pain (Sollgruber et al. 2018) and also has an impact on the process of acute pain turning into chronic pain (Linton & Shaw, 2011; Miller & Newton, 2006; Moreira-Almeida & Koenig 2008). Only a few studies have focused on protective or salutogenic factors and their effectiveness and on dispositional coping resources in relation to pain.

The above-mentioned positive psychological and physiological effects indicate that a meditation technique, especially one with religious/spiritual content, can give people suffering from pain support and help them deal with the strain of the stress (Sollgruber et al., 2018). However, the question is how exactly meditation with religious/spiritual content or personal religiosity or spirituality achieves this buffering effect. In an attempt to clarify this component, early meditation research compared meditation to other clinical strategies, including visualization, self-hypnosis, biofeedback, progressive muscle relaxation, and autogenic training (Meichenbaum & Cameron, 1974; Paul, 1969). The findings of many research projects are controversial and often suffer from inconsistencies or small or unrepresentative samples. Wong (2009), for example, was not able to find a difference between mindfulness-based meditation in the sense of “mindfulness-based stress reduction” (MBSR) and an active control group in a study of 100 patients with chronic pain. Both groups actually changed in a similar way. Shapiro concluded that meditating for clinical issues is equally, but not more effective, than other self-regulation strategies (Shapiro, 1982, 1985), whereas Holmes argued that meditation was not more effective than sheer peace and quiet (1984, 1987).

Other studies, however, concluded that religious/spiritual components are crucial in meditation (Wahchholtz & Pargament, 2008, 2015). These studies suggest that religiosity and spirituality work in conjunction with other secular strategies for coping with strain within the regulation of emotions and behavior. The connection between spiritual support and indicators of subjective well-being proved to be complex in many research studies (Znoj et al., 2004, Sollgruber et al., 2018). Since the specificity of religious or spiritual emotions lies in their cognitive component, i.e., in their convictions and evaluations, spiritual transocial support should probably be searched for in emotionally significant cognitions and corresponding behaviors (Grom, 2007). The explanation for why there is a connection between religiosity or spirituality and less pain or physical health can also stem from the fact that religious/spiritual convictions and behavior allow people to deal with stress and thus buffer the negative effects that stress has on physiological and psychological functions and on health.

Religion or spirituality is multidimensional (Idler, 2004) and is about beliefs, practices, experiences, and relationships. Knowing exactly how people are religious or spiritual can have a more significant impact on health than knowing if someone is religious. It also makes a big difference how people manifest their religion in the most stressful times of their lives (Pargament & Raiya, 2007).

As can be seen, pain as well as religiosity or spirituality is very complex and individual, both are multifaceted in nature, leaving many questions unanswered.

According to Pargament (2007), religious or spiritual coping is a complex phenomenon that cannot be accredited to a single characteristic. People can express their religion in a number of different ways or use several religious or spiritual techniques to achieve their goals. As such, no research method alone and no single questionnaire can adequately capture the full essence and effect.

Many methods and tools are therefore necessary for creating a clearer picture of the different manifestations of religiosity or spirituality on pain.

As already mentioned, meditation research has suffered from considerable methodological and conceptual limitations (Baer 2003; Canter & Ernst, 2003) and these will now be considered in this study. These limitations can be represented in different categories.

Design problems are noticeable in small unrepresentative sample sizes, which mostly come from student samples. In addition, these often have suboptimal controls, or there are relatively few spatially controlled studies available. As with many self-regulatory strategies, adherence and compliance as well as the duration of the meditation play an important role in this area; spatially controlled studies and a sufficiently large number of randomly selected study participants are important.

Apart from this, the consideration of effects of different variables is relevant. Variables of varying kinds such as age, gender of the person meditating, the duration of the meditation, and the level of stress, as well as mental health can have profound effects on the findings and should be taken into account i.e. controlled. These effect modifiers were usually neglected in studies and thus limit the generalization of the results (Baer 2003; Canter & Ernst, 2003).

According to Bear (2003), meditation can be seen as an art form and not just a technique. Some people are open to this technique and can benefit from it, others are against it and reject these methods. Some can thus dive deeply into meditation and relax, thereby receiving all the benefits, while others feel disturbed by this intervention and therefore cannot relax or profit from it. Such individual differences and subjective

experiences and feelings should also be taken into account when drawing conclusions on the benefits of meditation (Baer, 2003; Canter & Ernst, 2003).

In addition, some studies do not explicitly indicate the type or details of meditation used; so far there have been few comparisons of different types of meditation or meditation with other self-regulation strategies (Keng, Smoski & Robins 2011).

Furthermore, most studies examined experienced practitioners and only a relatively small number of beginners, although the predominant effects of classical reports occur in advanced practitioners (Baer, 2003; Canter & Ernst, 2003).

The data available with regard to the effectiveness of interventions in the area of pain is still limited. While previous studies have consistently observed positive psychological and physical salutogenic results under meditation techniques (Grossman, Niemann, Schmidt & Walach, 2004), only a few studies have attempted to investigate their influence on pain with regard to pain perception, pain intensity, pain tolerance, and pain processing in detail with an experimental design and to unravel the different mechanisms of religiosity or spirituality (coping, emotions, cognitions, etc.) on which they are based (Sollgruber et al., 2018).

The aim of this paper is to scientifically examine the effect that meditation as opposed to relaxation has on experimentally induced pain (pain perception, pain intensity, pain tolerance).

In the current study, and by means of a guided meditation, the effect on the different individual pain sensations, pain perception, pain intensity, pain tolerance, pain processing, and cardiovascular reactivity to these stimuli as well as to the religious/spiritual well-being or on the mental state and its changes in an experimental design is examined by means of guided meditation (Sollgruber et al., 2018). Therefore, the primary question arises: "Is there a difference in the change in individual pain experience between the meditation group and the relaxation group?".

This study is based on the hypothesis that the guided meditation has a significant added value for the different pain sensations as well as their cardiovascular reactivity, religious/spiritual well-being, and the mental state, which lies beyond the relaxation condition.

In this sense, a reduced sensation of pain or a higher pain tolerance through the presence of religiosity or spirituality after a meditation is expected.

There is also the question of how the different subjective pain sensations (pain perception, pain intensity, pain tolerance), the cardiovascular reactivity to these stimuli (Sollgruber et al. 2018) and their changes are connected to the degree of religiosity/spirituality and the underlying mechanisms such as religious/spiritual emotions, cognitions, and coping strategies of the research participants. Consequently, the secondary question arises: "Is there a connection between religiosity/spirituality and the individual pain experience?". A further hypothesis is that religious/spiritual subjects with positive religious/subjective coping

strategies have a reduced subjective pain experience.

1.8 Questions and Hypotheses of the Study

1.8.1 Primary Questions and Hypotheses of the Study

Question 1: Is there a statistically significant difference in the change in individual pain experience between the meditation group and the relaxation group?

a) Perception:

H0: There is no statistically significant difference between the groups in the change in perception.

H1: There is a statistically significant difference between the groups in the change in perception.

b) Pain detection threshold for heat and cold:

H0: There is no statistically significant difference between the groups in the change in the pain threshold.

H1: There is a statistically significant difference between the groups in the change in the pain threshold.

c) Pain intensity/widespread pain index for heat and cold:

H0: There is no statistically significant difference between the groups in the change in the widespread pain index/pain intensity.

H1: There is a statistically significant difference between the groups in the change in the widespread pain index/pain intensity.

d) Pain tolerance:

H0: There is no statistically significant difference between the groups in the change in pain tolerance.

H1: There is a statistically significant difference between the groups in the change in pain tolerance.

e) Pressure pain:

H0: There is no statistically significant difference between the groups in the change in pressure pain.

H1: There is a statistically significant difference between the groups in the change in pressure pain.

Question 2: Is there a statistically significant difference in the progression of descending pain inhibition between the meditation group and the relaxation group?

H0: There is no statistically significant difference between the groups in the progression of descending pain inhibition.

H1: There is a statistically significant difference between the groups in the progression of descending pain inhibition.

1.8.2 Secondary Questions and Hypotheses of the Study

Question 3: Is there a statistically significant difference in the change in religious/spiritual well-being between the meditation group and the relaxation group?

H0: There is no statistically significant difference between the groups in the change in religious/spiritual well-being.

H1: There is a statistically significant difference between the groups in the change in religious/spiritual well-being.

Question 4: Is there a statistically significant difference in the change in the visual analog scales with regard to stress and pain between the meditation group and the relaxation group?

a) Subjective experience of pain:

H0: There is no statistically significant difference between the groups in the change in the subjective experience of pain.

H1: There is a statistically significant difference between the groups in the change in the subjective experience of pain.

b) Subjective experience of stress:

H0: There is no statistically significant difference between the groups in the change in the subjective experience of stress.

H1: There is a statistically significant difference between the groups in the change in the subjective experience of stress.

Question 5: Is there a statistically significant difference in the subjective experience of spirituality and the subjective experience of relaxation between the meditation group and the relaxation group?

a) Subjective experience of relaxation:

H0: There is no statistically significant difference between the groups in the subjective experience of relaxation.

H1: There is a statistically significant difference between the groups in the subjective experience of relaxation.

b) Subjective experience of spirituality:

H0: There is no statistically significant difference between the groups in the subjective experience of spirituality.

H1: There is a statistically significant difference between the groups in the subjective experience of spirituality.

Question 6: Is there a statistically significant connection between religiosity/spirituality and the individual pain experience (pain detection thresholds for heat and cold, pain intensity for heat and cold, pain tolerance, and pressure pain)?

H0: There is no statistically significant connection between religiosity/spirituality and the individual pain experience.

H1: There is a statistically significant connection between religiosity/spirituality and the individual pain experience.

Question 7: Is there a statistically significant connection between religiosity/spirituality and the change in individual pain experience (pain detection threshold for heat and cold, pain intensity for heat and cold, pain tolerance, and pressure pain)?

H0: There is no statistically significant connection between religiosity/spirituality and the change in individual pain experience.

H1: There is a statistically significant connection between religiosity/spirituality and the change in individual pain experience.

Question 8: Is there a statistically significant connection between religiosity/spirituality and the heart rate?

H0: There is no statistically significant connection between religiosity/spirituality and the heart rate.

H1: There is a statistically significant connection between religiosity/spirituality and the heart rate.

Question 9: Is there a connection between religiosity/spirituality and the change in heart rate?

H0: There is no statistically significant connection between religiosity/spirituality and the change in heart rate.

H1: There is a statistically significant connection between religiosity/spirituality and the change in heart rate.

2 Method

2.1 Study Design

The intervention group was recorded as an independent variable (UV).

- Meditation group (VG)
- Relaxation group (KG)

Individual parameters of quantitative testing (QST) were recorded as dependent variables (AV) for the primary question:

- Perception for cold and heat
- Pain detection threshold for cold and heat
- Pain intensity for cold and heat
- Pain tolerance
- Pressure pain

Individual parameters of spirituality and religiosity as well as of spiritual and religious well-being as well as of coping, visual analog scales for subjective sensation and the heart rate were recorded as dependent variables for the secondary questions.

Besides the main variables, other data such as visual analog scales for religiosity and spirituality, was included as well.

2.1.1 Purpose of the Study

The present study deals with the subject matter spirituality and religiosity in pain medicine. Of interest is the effect of meditation

on the individual pain experience with regard to pain detection thresholds, pain intensity, and pain tolerance.

Besides mental well-being (Blair et al., 2003), stress (Linton, 2005) plays an important role in the area of pain and can influence the handling of pain, thus representing another important aspect of the present survey.

The aim of this survey is to gain information about how meditation works in relation to pain. The subjective feeling of spirituality and relaxation is also collected. According to Bear (2003), individual differences and subjective experiences and sensations of relaxation and spirituality can influence the effects and are therefore taken into account in the present work in order to subsequently link these with the various variables of pain, spirituality, and religiosity. Furthermore, the subjective sensation of pain and stress is also collected and linked to the various variables of pain, spirituality, and religiosity.

According to Pargament (2007), religious or spiritual coping is a complex phenomenon that cannot be accredited to a single characteristic. Consequently, different questionnaires on religiosity and spirituality are specified in this study.

Apart from this, the consideration of the effects of different variables is relevant. Variables of varying kinds such as age, gender of the person meditating, the duration of the meditation can have profound effects on the findings (Baer, 2003). As a result, participants in the study are allocated to the conditions at random.

Consequently, the recent study focuses on two different areas. On the one hand, it focuses on the area of physiological data (pain detection threshold, pain intensity, pain tolerance) and the cardiovascular reactivity (heart rate) to these induced stressors, i.e. pain stimuli, and on the other hand on the participants' subjective response to the pain as well as the intervention through psychological and religious/spiritual variables (Sollgruber et al., 2018). Physiological variables provide detailed objective information about the participants' pain perception and pain tolerance; cardiovascular reactivity served as an objective indicator of the response to the stress experienced, which was experimentally induced through pain testing. In addition, subjective perception of the pain and stress on pain testing with regard to pain processing as well as the subjective perception of relaxation and spirituality with regard to the intervention are collected. Also, the religious/spiritual, mental well-being and sensation of pain are recorded by means of a questionnaire before and after the intervention. By combining the areas of subjective responses and objective measures, the intent is to provide insight into the effects and background mechanisms of the techniques on the different sensations as well as

on perceptions and the individual pain experience (Sollgruber et al., 2018).

Another question aims to clarify which factors of pain are related to the constructs religiosity/spirituality or how or whether spirituality and religiosity and pain are connected regardless of the intervention.

Consequently, parameters of spirituality and religiosity as well as religious/spiritual well-being are recorded in connection with individual dimensions of pain and the heart rate.

Pain patients in particular could possibly benefit from the meditation technique. Pain is known to have deep and lasting effects not only on the affected persons and their family but also on society (Breivik et al., 2006). A possible positive effect of this study could be that in the future, the integration of religious or spiritual techniques and also content will gain importance in the treatment of patients.

2.2 Measuring Instruments

2.2.1 Testing Instruments – Questionnaires

Because the variables of interest are considered “accessible through introspection,” most of the data was obtained by self-assessment using questionnaires that offer good comparability and economic handling (Ruoß, 1997 p. 305).

According to Pargament (1999), religiosity and spirituality often overlap in content, which is why they should be examined in relation to each other but also as independent concepts (Sollgruber et al., 2018). According to Murken et al. (2011), no religious/spiritual questionnaire exists that is equally suitable for each question or for each practical application. Thus, combining an assessment of the general significance of religion and belief with scales, querying specific religious contents, and adapting the measurements to the respective population and question has proved to be successful. In light of the health-related questions, the following five components are particularly relevant (Murken et al., 2011):

1. Religious/spiritual (RS) intensity/centrality
2. Religious/spiritual resources/risks
3. Religious/spiritual needs
4. Religiosity/spirituality in coping with strain
5. Religiosity/spirituality as a facet of health

On this basis, the following religious/spiritual questionnaires were used in the study:

2.2.2 The Centrality Questionnaire

The centrality scale by Huber (2003) was specified for the religious/spiritual (RS) intensity/centrality component. The aim of the centrality scale is to portray the centrality of the personal religious construct system within the personality. Based on this, a distinction can be made between “very religious,” “religious,” and “not religious” individuals. For the Z-10 scale, the general intensities of the five core dimensions (intellect, ideology, public practice, private practice, experience) were collected by two indicators respectively. The total scale thus consists of ten items and has a satisfactory to high internal consistency (Cronbach's α between 0.89 and 0.94). This questionnaire provides information on how religious or spiritual the persons concerned are (Murken et al., 2011).

2.2.3 Religious/Spiritual Visual Analog Scales (VAS)

Furthermore, visual analog scales (VAS) for the “subjective assessment of the intensity of belief” and for the “assessment of the degree of religiosity” are specified for the component religious/spiritual (RS) intensity/centrality. Also, with the help of a VAS, the “intensity of spirituality” as well as the degree to which the research participant feels connected to an ecclesial community of faith were collected. The endpoints represent extreme conditions (“not religious at all” and “very religious,” etc.); the persons were supposed to indicate their subjective sensations by drawing a vertical line on this scale.

2.2.4 The Multidimensional Inventory on Religious/Spiritual Well-Being (MI-RSB 48)

For the component religious or spiritual resources – risks as well as for the components religiosity or spirituality as facets of health, the multidimensional inventory on religious/spiritual well-being (MI-RSB-48) by Unterrainer et al. (2010) is specified. The multidimensional inventory on religious/spiritual well-being is based on the spiritual well-being scale by Ellison (1983, cited from Unterrainer 2010), which measures a person's individual spiritual health. Spiritual well-being is conceived as a two-dimensional construct, whereby on the one hand the spiritual well-being is described by the relationship to God or a transcendent dimension and on the other hand the religious well-being refers to the general meaning of life and life satisfaction – without reference to a higher power (Ledbetter, Smith, Vosler-Hunter & Fischer 1991; cited from Unterrainer 2012). Building on the spiritual well-being scale (Ellison 1983), the multidimensional inventory on the religious/spiritual well-being

(MI-RSWB 48) was developed and supplemented by another concept that encompasses several aspects of mental well-being, focusing above all on the immanent and transcendent perception of persons. The inventory consists of 48 items that are used to form the total score "religious/spiritual well-being." It incorporates six subscales with eight items each that can be conceptually assigned to the two dimensions "immanent" and "transcendent." The dimensions can be described as follows:

General religiosity (AR): This dimension includes the belief in a God who is merciful and to whom a sense of closeness can be established, and includes a sense of satisfaction, security, and trust in God's help. General religiosity requires participation in community religious events as well as the recognition of God's presence in nature. Example item: *"I will be happy once more with the help of God."*

Forgiveness (VE): The items on this scale are straightforward. They measure the willingness of people to forgive and to wish their enemies well as well as measuring the absence of hatred and the avoidance of revenge (cf. McCulloch, Pargament & Thoresen 2000). Example item: *"There are people whom I will never be able to forgive"* (transcoded).

Hope immanent (HI): This is understood as having an optimistic attitude, faith that the future will be exciting, and the feeling that life is going in the right direction. If this is not the case, people with immanent hope assume that things will improve at least in the future. Immanent hope also implies having a clear picture of the future and expecting to experience positive things and having the opportunity to live life as imagined. Example item: *"I think that things will pick up in the future."*

Hope transcendent (HT): While immanent hope focusses on life in the now or in the future, transcendent hope refers to "life after life." It involves the recognition of the transience of life and the hopeful assumption that there is life after death. Transcendent hope also arises from the possibility that someone will remember the deceased after they die. Example item: *"I am afraid of what will happen to me after I die"* (transcoded).

Connectedness (AL): This dimension refers to having the feeling of and experiencing being involved in something greater, e.g., to be reincarnated after death. It is also the feeling of having a supernatural connection with some people and experiencing inexpressible things as well strongly believing in an existence after death. Example item: *"I believe that I will be reincarnated after I die."*

Experience of sense and meaning (BS): This dimension is about experiencing authentic feelings, a deep affection, and a true friendship. It also includes a sufficient understanding of the meaning of life and involves meaningful experiences of openness and honesty as well as the ability to be so absorbed by something that one forgets everything else. Example item: *"I have experienced true friendship."*

The subscales „hope immanent“, „forgiveness“, „experience of sense and meaning“ can be assigned to the immanent sphere, the subscales „hope transcendent“, „general religiosity“ and „connectedness“ can be assigned to the transcendent sphere.

The items are evaluated by the persons themselves on a six-tier rating scale from "does not apply at all" (1) to "fully applies" (6). Cronbach's α of the total scale is 0.89; the internal consistency of the subscales have at least an α of 0.7. Standard values and comparative values exist for clinical and non-clinical samples (cf. Unterrainer 2007). This questionnaire provides information on the extent to which religious/spiritual resources of a social or individual nature are available to the persons for coping with strain. It can also be used to identify religious/spiritual risks. In terms of the component religiosity and spirituality as a facet of health, this questionnaire provides information on how religiosity or spirituality can be described as a facet of subjective health before and after an intervention or in their medical history (Murken et al., 2011).

2.2.5 The Scales of the Relationship with God and Religious Coping

For the components religiosity or spirituality when coping with strain as well as for the components religious/spiritual resources – risks, the scales of the relationship with God and religious coping (SGrC) by Muken et al. (2011) are pre-determined. The scales of the relationship with God and religious coping have been implemented in various studies since 1994 and have been continuously improved. Starting from the psychological dimensions of feeling, thinking, and acting, eight scales with a total of 42 items describe the affective, cognitive, and practical relevance of a person's relationship with God. Accordingly, the items of the questionnaire are categorized into three topics: “feelings toward God,” “behavior of God,” and “religious coping.” The scale “feelings toward God,” which consists of the three subscales “helpful and supportive behavior of God,” “ruling and punishment of God,” and “God’s passivity,” can be used to measure a person's relationship with God. Example items: *“God is with me,” “God is a punishing God,” or “God leaves mankind to fend for itself.”* Another aspect of the relationship with God is the scale “behavior of God” with the three subscales “positive feelings towards God”, “negative feelings towards God” (in relation to oneself) and “negative feelings towards God” (in relation to God). This scale describes behavior attributed to God by believers and thus reflects the cognitive dimension of the relationship with God and the subjective theology of believers (Murken et al. 2011). Example item: *“How often do you experience these feelings toward God: love, guilt, fear?”* The scale religious coping with the two subscales “positive religious coping” and “negative religious coping” indicates the direction of action in relation to psychosocial adaptation factors of the

person. Example item: *"My faith enables me to better activate my powers and possibilities"* or *"Sometimes I have the feeling that God is punishing me."* Depending on the question, individual scales or the complete set of scales can be used. The items are evaluated by the persons themselves on a five-tier rating scale from "not at all" (1) to "very" (5) or "never" (1) to "very often" (5) as well as from "do not agree" (1) to "completely agree" (6). No items are inverted, the subscale scores are therefore formed by simply summing up the individual values of the items. All scales have been tested in numerous studies. The questionnaire is suitable for research and as a screening test in practice. The internal consistencies of the subscales are good (Cronbach's α between 0.76 and 0.97). In terms of the components religiosity or spirituality in coping with strain, this questionnaire provides information on how people use religiosity or spirituality in coping with strain, whether any religious/spiritual coping strategies are used, and whether religiously motivated health behavior exists. Furthermore, this questionnaire provides information on the extent to which religious/spiritual resources of a social or individual nature are available to the persons for coping with strain. It can also be used to identify religious/spiritual risks (Murken et al., 2011).

2.2.6 Sense of Coherence Scale

For surveying the components finding meaning, meaning of life, and coherence, the sense of coherence (SOC) by Aaron Antonovsky (1987) based on the concept of salutogenesis is specified (Murken et al., 2011). The sense of coherence scale by Aaron Antonovsky is a questionnaire for self-assessing coherence. This concept of *sense of coherence* (SOC), which is at the center of Antonovsky's salutogenesis model, is seen as a dispositional coping resource that makes people more resistant to stressors and thus contributes to maintaining and promoting health. To empirically verify his theoretical assumptions, he developed the sense of coherence scale, which incorporates 29 items (SOC-29) that are divided among the three subscales comprehensibility (11 items), manageability (10 items), and meaningfulness (8 items). It is also available as a short form with 13 items (SOC-13). Both scales have been tested theoretically in numerous studies (e.g. Antonovsky 1993). In most cases, satisfactory to good consistency coefficients were found.

2.2.7 The Short-Form McGill Pain Questionnaire

The Short-Form McGill Pain Questionnaire (SF-MPQ) by Melzack (1987) is the short form of the McGill Pain Questionnaire (MPQ) by Melzack (1975), a globally-used questionnaire to measure pain. In this questionnaire, the quality of pain was assigned a significant role, and

three dimensions of pain could be classified: sensory, affective, and evaluative. The SF-MPQ consists of two subscales: the sensory subscale with eleven adjectives and the affective subscale with four adjectives stemming from the MPQ. The adjectives were evaluated by the persons themselves on a three-tier rating scale – “is not felt” (0) to “is strongly felt” (3). In addition, the current pain intensity is represented by a visual analog scale (VAS), and the overall evaluation of the pain intensity is determined by means of a five-point Likert scale from “no pain” (0) to “worst possible pain” (5).

2.2.8 Visual Analog Scale (VAS) for the Intensity of the Subjective Experience of the Spiritual Experience

The intensity of the subjective experience of the spiritual experience is collected by means of a visual analog scale, whose endpoints signify extreme states (“no spiritual experience at all” and “high spiritual experience”). Persons were asked to indicate their subjective sensations by drawing a vertical line on this scale.

2.2.9 Visual Analog Scale (VAS) for the Intensity of the Subjective Experience of Relaxation

The intensity of the subjective experience of relaxation is collected by means of a visual analog scale, whose endpoints signify extreme states (“not relaxed at all” and “very relaxed”). Persons were asked to indicate their subjective sensations by drawing a vertical line on this scale.

2.2.10 Visual Analog Scale (VAS) for the Intensity of the Subjective Current Experience of Stress

The intensity of the subjective current experience of stress is collected by means of a visual analog scale, whose endpoints signify extreme states (“not stressed at all” and “very stressed”). Persons were asked to indicate their subjective sensations by drawing a vertical line on this scale.

2.2.11 Visual Analog Scale (VAS) for the Intensity of the Subjective Current Experience of Pain

The intensity of the subjective current experience of pain is collected by means of a visual analog scale, whose endpoints signify extreme states ("not painful at all" and "very painful"). Persons were asked to indicate their subjective sensations by drawing a vertical line on this scale.

2.2.12 Brief Symptom Inventory

In order to survey the mental strain of the subjects, the brief symptom inventory (BSI) was specified (Derogatis, 2000).

The brief symptom inventory (Derogatis 2000) is a short form of the symptom check list SCI-90-R (Derogatis, 1992). This comprehensive self-assessment inventory consists of 53 items and is therefore an economical variant for collecting information on the symptomatic strain of patients and research participants. Overall, nine different dimensions are collected: "somatization," "obsessive-compulsive", „interpersonal sensitivity“, "depression," "anxiety," "hostility," „phobic anxiety“, "paranoid ideation," and "psychoticism." One example item for the sale depression is: *"How much did you suffer from feelings of worthlessness in the last seven days?"* The items were answered by the persons on a four-tier rating scale from "not at all" (0) to "very strongly" (4). In addition, three global parameters provide information on the response behavior. The GSI (Global Severity Index) measures the basic psychological strain, the PSDI (Positive Symptom Distress Index) measures the intensity of the responses, and the PST (Positive Symptom Total) provides information about the number of symptoms for which the stress is present. Standard values and comparative values exist for clinical and non-clinical samples.

2.2.13 Sociodemographic Data

The social demographic parameters gender, age, education, relationship status, employment, and affiliation to a religious community were collected through a self-constructed questionnaire on socio-demographic data.

2.3 Testing Instruments – Objective Physiological Parameters

2.3.1 Quantitative Sensory Testing (QST)

The standardized quantitative sensory testing (QST) was developed by the German Research Network on Neuropathic Pain (DFNS) (Rolke et al. 2006) and represents a standardized extension of the clinical neurological sensitivity test (Treede, 2013b, Sollgruber et al., 2018). It is a non-invasive, easily reproducible method for measuring sensory and pain perception and records sensitive perception functions in a standardized form (Fruhstorfer et al., 1976; Treede, 2013).

The survey incorporates thermal as well as mechanical stimuli and consists of four tests that measure seven different parameters. These are thermal detection thresholds for the perception of cold or heat, thermal pain thresholds for the perception of cold and heat pain thresholds as well as cold and heat pain indexes for the recording of pain intensity (Sollgruber et al., 2018). The survey additionally consists of mechanical pain thresholds for the perception of pressure pain.

By applying defined thermal and mechanical stimuli to the body surface, perception thresholds and pain detection thresholds as well as the pain intensity are determined (Sollgruber et al., 2018). QST enables complete detection of the function of all somatosensory submodalities.

QST is a psychophysical procedure that depends largely on the patient's cooperation and therefore requires standardized instructions for measurement by the examiner. As a result, the examiner has precise instructions for the implementation of the QST. This includes a standardized wording to explain the procedure to the research participants as well as the standardized procedure of the survey (Rolke et al., 2002).

With standardized and reproducible application, QST provides valid and valuable clinical and scientific information (Backonja et al., 2009). The QST assessment was conducted by means of a thermal sensory analyzer (TSA, Medoc, Israel).

2.3.2 Cold Pressor Test

The quantitative sensory testing was extended by a cold pressor test (CPTest). A cold water test is a common laboratory approach for measuring pain tolerance and pain threshold (Manhas, Gupta & Kalsotra, 2011; Peckerman, Hurwitz, Saab et al., 1994, Sollgruber et al., 2018). This serves to measure both the physical and the psychological reactions with regard

to the pain. In the current study, it consists of two-degree-Celsius-cold water, in which the research participant places his or her hand up to the wrist until he or she feels that it has become unbearably painful. The time that the hand of the research participants remains in the water is measured in seconds, thereby depicting the pain tolerance (Sollgruber, Bornemann-Cimenti, Szilagyi et al. 2018).

2.3.3 Heart Rate and Heart Rate Variability

Measuring heart frequency and heart frequency variability has become a common method in the clinical field (Jonckheer-Sheehy, Vinke & Ortolani, 2012). The heart rate (HR), i.e., the number of heart beats per minute, is most frequently used in psychophysiology as an indicator of cardiovascular events. Almost every change in physical and psychological demands is accompanied by changes in the heart rate (Sollgruber et al., 2018). An increase in heart rate occurs, for example, when in pain or when anxious; a decrease occurs when relaxed or for orientation and attention processes (cf. Manhas, Gupta & Kalsotra, 2011; Peckerman, Hurwitz & Saab et al., 1994).

The heart works especially efficiently in healthy and adaptable people in two respects: On the one hand, it registers sensitive and uninterrupted external and internal signals while simultaneously and immediately reacting to the “measurement results” with finely tuned changes in the heartbeat sequence. This phenomenon is called heart rate variability (HRV) or also heart frequency variability.

The HRV is therefore the ability of the heart to continuously change the time interval from one heartbeat to the next (depending on exertion) and thus to flexibly and rapidly adapt to constantly changing challenges. It is a measure for the overall adaptability of an organism to internal and external stimuli.

The HRV and the HR are regulated by the autonomic nervous system. Parasympathetic activity reduces the heart rate and increases the HRV while sympathetic activity increases the heart frequency and reduces the HRV (cf. Manzey 1998).

The heart rate was captured using a Polar training computer. It consists of a transmitter and a receiver; alternatively, a wristband receiver or a mobile phone with an app can be used. This training computer records the number of heart beats per minute and provides valid and reliable clinical and scientific information (Gamelin, Berthoin & Bosquet 2006; Jonckheer-Sheehy, Vinke & Ortolani, 2012, Sollgruber et al., 2018). The transmitter provided for this purpose is attached to the chest using an elastic band and measures the heart frequency based on the principle of the electrocardiogram (Sollgruber et al., 2018). The electrical signals generated during a heart action are recorded by means of an electrode

surface attached to the chest and are continuously transmitted from the transmitter to the receiver. This provides an accurate and reliable indication of the heart rate (heart rate per minute). The sensitivity of the heart rate to differences in mental stress is considered to be secured. The diagnosticity of the heart rate is considered low; in performance situations, physical and emotional influences cannot be differentiated from changes in the heart rate that can be traced back to mental strain (Manzey 1998 p. 830). The “Polar Bluetooth smart” with the “ithlete pro” app was used to measure the heart rate.

2.4 Experimental Intervention

The experimental intervention is a single session methodology and the meditation as well as the relaxation conditions were individual sessions and had the same procedures, the same duration and settings. The participants were randomly assigned to two experimental conditions (Sollgruber et al., 2018):

2.4.1 Meditation group

The meditation group were headphone-guided during their 20-minute intervention. They were given written instructions about how to relax physically, to sit in any position they like, as long as they would not fall asleep. The meditation group were instructed focus on their meditation and pay attention to their breathing for the duration of the time. If the participants felt themselves losing focus, they were advised just to refocus and continue with their intervention (Sollgruber et al., 2018).

2.4.2 Relaxation group

The relaxation group was given written instructions about how to relax physically, to sit in any position they would like, as long as they would not fall asleep. They were given the same instructions as the meditation group regarding their posture of physically comfortable positions while in eyes-closed relaxation. But unlike the meditation group, the relaxation

group was not given explicit instructions regarding how to mentally occupy themselves during these 20 minutes of eyes-closed rest-time (Sollgruber et al., 2018).

2.5 Developing the Intervention Method Used in the Present Study – Meditation

According to Grom (2007, p. 190), a person can know religious beliefs and agree with them on an intellectual level without experiencing them intensely if practiced without emotional resonance. In a study by Mawn (1975), 96% of Catholic members of a prayer group stated that while they mentally followed the faith of their church, more than 33% said that they did not take their emotional resonance, that is to say their emotional participation, into consideration and that it was only a matter of joyless customs and obligations, making it a mere matter of behavior without emotional participation.

From a psychological view point, the question arises how religious beliefs, which are easier to communicate and change than religious or spiritual experiences, change from “cold” to “warm” emotionally significant cognitions (Grom 2007 p. 191 et seq.) and how these can be conveyed in a meditation.

Here, too, the assumption of Pargament (2007) is reflected that religious or spiritual coping is a complex, multifaceted phenomenon that cannot be accredited to a single property or characteristic. People can express their religion in a number of different ways to achieve their goals. As such, no single research method can adequately capture its full essence. Many methods and tools are necessary for creating a clearer picture of the different manifestations of the expression of spirituality. Therefore, various mindfulness or meditation techniques are required to reach different people. This approach is reflected in the development of the meditation for the current study. Meditation has a long history of association with spiritual and religious practices. Cultures from around the world have integrated meditative practices in their religious and spiritual disciplines, and many of these forms of meditation use meditative phrases in order to focus the soul on religious and spiritual concepts.

In general, meditation can be defined as a large number of different kinds of practices through which awareness and attention are trained (Shapiro, Walsh & Britton, 2003).

There are many definitions for meditation, but it was not until the Delphi study (Bond et al., 2009) that an adequate consensus definition as well as a taxonomy was worked out. The elements of the current study meditation are consistent with the findings of this study. In this multi-stage survey process of the Delphi study, in which seven experts in the field of

meditation research participated, the following three points were considered necessary for meditation: 1) A defined technique must be used, 2) The type of relaxation must be logical, 3) A self-induced state must be achieved.

Furthermore, the experts agreed that a meditation practice must 4) include a state of psychophysical relaxation at some point in the process, 5) use a self-focusing component or an anchor, 6) involve a changed state or a state of consciousness, a mystical experience, or a suspension of logical thinking processes, 7) be embedded in a religious, spiritual, or philosophical context, and 8) entail an experience of spiritual silence (Bond et al., 2009).

Consequently, meditation describes the process of bringing about a certain state of consciousness by means of utilizing certain techniques (posture, breathing, concentration, repetition of certain linguistic formulas, images, etc.).

According to Grom (2007, p. 190 et seq.), it can be assumed that the spiritual experience can be stimulated both by the cognitive component (cognition) and by the emotional component. On the part of the cognitive component, spiritual experience is promoted by the fact that spiritual convictions address existing non-cognitive motifs, build up emotional expectations, and could enable symbolic experiences. These processes are all about achieving and maintaining a sufficient degree of attention to one's own thoughts and feelings.

In order to activate and motivate the experience, emotional expectations must also be built up in connection with spiritual convictions. This should increase the emotional responsiveness by showing this emotional component possible goals on which it can concentrate, namely on the one hand the content direction and on the other hand the desired degree of intensity (Grom, 2007 p. 192 et seq.). In Zen Buddhism, the Buddhist should only seek unity with the Absolute in Zen meditation and not deal with individual contents in a dualistic way, i.e., not with conflicts or visions that want to impose themselves on the Buddhist.

Spiritual convictions can probably also be experienced more intensely by experiencing them pictorially and symbolically. Stressed metaphorical language, which expressed the reference to the Divine or the Spiritual by means of ideograms such as light, heaven, sun, father/mother, or a source, should stimulate the experience more than non-pictorial terminology.

Though meditatively imagined symbols in Tibetan and Chinese Buddhism – here the meditation is supported by detailed visualizations – are communicated linguistically, they are then imagined in the fantasy (Grom, 2007 p. 193 et seq.).

From the non-cognitive side, spiritual experience is probably sensitized and coupled with spiritual convictions by activating either the general emotional responsiveness (emotional component), the expressive behavioral activity (expression or behavioral component), or the neurophysiological component (Grom, 2007 p. 196 et seq.).

Intense spiritual experience seldom succeeds when the hectic pace of everyday life and critical distance prevail at the same time. Therefore, during services, meditations, retreats, days of reflection, etc., one tries to create an atmosphere and attitude among the participants that promote a general emotional willingness to react, which can then be coupled with spiritual content. Often, one usually attempts to increase the emotional responsiveness by retreating to a lonely and quiet place or by adding silence breaks into worship services: One reduces the stimulation through environmental stimuli and also the vigilance towards them so that attention to the outside world can be focused more on the inner world of one's own thoughts and the emotions that they trigger. This goal is also served by closing the eyes during meditation.

The emotional excitement is increased even more if attention is focused on a single content. Different techniques that can be described with the Sanskrit word “mantra” serve to maintain attention. In Hinduism, mantra is a sacral formula that is recited out loud or by soundlessly moving the lips or only meditatively in thought in order to calm and purify the thoughts and unite with the Divine.

Yet one can also concentrate on a single content by first drawing attention to a simple stimulus, to the breath or the heart rhythm, which at the same time promotes the fearless loosening of voluntary control in order to then focus on the object under observation. That is the path these kinds of meditations take that concentrate on breathing and the heart rhythm. This becomes particularly apparent in the Jesus Prayer practiced by the early Christian monks as well as in dhikr, the Islamic Sufi tradition (Grom, 2007 p. 195 et seq.).

In some meditation directions one learns to reduce the breathing rate, in others one should only observe the breath and leave it to its natural rhythm, which usually also leads to a slowing down and calming down. There are different views on the basis of respiratory therapy. What is certain is that emotional states such as anxiety or security are revealed in the way we breathe. Paying attention to breathing can therefore make the person meditating become aware of, for example, existing disturbing inner restlessness. Furthermore, switching to a calmer breathing rhythm can lead to a relaxation which, according to the theory of reciprocal inhibition, favors positive feelings. The self-controlling breathing can also be understood as a symbol of “being carried” by a higher reality, i.e., coupled with the belief in feeling secure in God or the Absolute (Grom, 2007 p. 195 et seq.). From the physical state, spiritual experience is obviously promoted by inducing a state of relaxation either through unspecific or certain techniques in prayer and meditation (Grom, 2007 p. 198).

The developed meditation is a kind of Taoist meditation that bears many similarities to Hindu and Buddhist systems but is less abstract and more “down to earth” than contemplative traditions (Sollgruber et al., 2018). Though mantras are normally associated with Hindu and Tibetan Buddhist practices, Taoists also used them for thousands of years

(Brugnoli, 2009, Sollgruber et al., 2018). The main feature of this meditation is the generation, connection, transformation, and circulation of the inner energy (Sollgruber et al., 2018). It is a combination of concentrative meditation (visualization of a divine or sacred symbol connected to creative power), and open monitoring meditation as well as breathing and body awareness in the sense of mindfulness are also a part of this meditation. The meditation makes use of the approaches mentioned above and can be divided into three areas as follows (Sollgruber et al., 2018):

1) At the beginning of the meditation, the eyes are closed and attention is focused on the rhythm of the breathing. This is supported by breathing in symbols such as the light of the sun, which is associated with creative power (Sollgruber et al., 2018). The persons meditating are supposed to forget themselves in the process and only perceive their own breathing rhythm. In the Vipassana tradition, concentration types of meditation are practiced to strengthen the spirit. This happens through careful observation of the breathing, the body, and physical sensations (Fjorback & Walach 2012).

Spirituality in the sense of self-transcendence: To feel a connection to others requires being able to forgo oneself, to be able to transcend oneself. Self-transcendence was already mentioned by V.E. Frankl 1984. It enables a closer connection to a higher spiritual being but also to fellow human beings (Bucher 2007 p. 30 et seq.). In the Vipassana tradition, concentration types of meditation are practiced to strengthen the spirit. This happens through careful observation of the breathing, the body, and physical sensations (Fjorback & Walach 2012).

2) The research participants direct their attention completely to themselves and to a place of peace within themselves.

The attempt is made to increase emotional responsiveness by mentally withdrawing to a solitary and quiet place. The stimulation through external environmental stimuli and also the vigilance towards them are reduced so that the attention to the outside world can be focused more on the inner world of one's own thoughts and the emotions that they trigger. The state of relaxation thereby induced should promote the religious experience. Only after the mind has become accustomed to directing its attention to objects are other techniques applied, such as observations and mindfulness of spiritual objects or mental activity.

3) The mantra *"I am loved, protected, and guided, embedded in the big picture"* is supposed to help clients focus on one single content.

The emotional excitement is increased even more if attention is focused on a single content. The mantra is intended to support this. In the sense of the theory of religious or spiritual cognitions of anxiety reduction and in the sense of the theory of emotional support and appreciation, it should additionally develop its buffering effect by relativizing goals and performance measures.

After detailed literature research, two meditations were developed according to the mentioned steps. They were identical in structure and composition yet differed with regard to their mantras *“I am loved, protected, and guided, embedded in the big picture”* and *“I am embedded in the big picture.”* The meditation was set in advance for 22 research participants in an independent pilot survey. The research participants had to indicate the intensity of the subjective experience of the spiritual experience, which was induced by meditation by means of a visual analog scale, whose endpoints signify extreme states (“no spiritual experience at all” and “high spiritual experience”). In the pilot survey, the decision was made in favor of the meditation with the mantra *“I am loved, protected, and guided, embedded in the big picture”*.

2.6 Procedure

All tests were single tests and a single-session method. Appointments lasting 2 1/2 hours were made with the research participants via telephone or email. The research participant arrived to his or her appointment and was allowed to rest for the first five minutes. Subsequently, the survey procedure was explained and the subjects informed. After giving written consent, the heart rate chest strap was put on and the research participant received the questionnaire (sociodemographic data, MI-RSB-48, Z-10, SGrC, SOC13, BSI, MCGill) to fill out. After the questionnaires, the EEG cap (electroencephalography cap) was fitted. The EEG recording serves to generate further hypotheses for follow-up studies or as exclusion criterion for sleeping clients during the intervention as well as adherence and compliance in the present study. The resulting EEG data and its results are not included in the current study.

The participant was then allowed to take a seat in a comfortable arm chair. Consequently, the heart rate baseline was recorded.

Because QST is a psychophysical procedure that depends largely on the research participant's cooperation, therefore requiring standardized instructions for measurement by the examiner, the QST was explained and demonstrated in detail at this time. These instructions include a standardized wording to explain the procedure to the research participants; the procedure of the survey was also standardized. All measurements were taken on the non-dominant hand.

At the beginning of the QST survey, cold detection thresholds (CDT) were measured. The thermode cooled down from a base temperature of 32 °C with a speed of 1 °C/s. The research participant was instructed to *“immediately press the stop button when you first feel*

a change in temperature to cold or cooler" (cf. Rolke 2002). Subsequently, the thermode warmed up again to the initial temperature of 32 °C. This procedure was performed four times, from which the arithmetic mean was determined. Furthermore, the threshold values for heat (WDT = warm detection threshold) were determined. For this, the thermode warmed up at a speed of 1 °C/s. The research participant was instructed to *"immediately press the stop button when you first feel a change in temperature to warm or warmer"* (cf. Rolke 2002). Subsequently, the thermode cooled down again to the initial temperature of 32 °C. This procedure was also performed four times, and the arithmetic mean was determined.

Furthermore, the threshold values for cold pain (CPT = cold pain threshold) were determined. The thermode cooled down with a speed of 1 °C/s. The research participant was instructed to *"immediately press the stop button when you first feel a painful sensation in addition to the perception of cold"* (cf. Rolke 2002). Subsequently, the thermode warmed up again to the initial temperature of 32 °C. This procedure was performed a total of three times, from which the arithmetic mean was determined. Then, the pain threshold for heat (HPT = heat pain threshold) was determined. The thermode warmed up at a speed of 1 °C/s. The research participant was instructed to *"immediately press the stop button when you first feel a painful sensation in addition to the perception of heat"* (cf. Rolke 2002). Subsequently, the thermode cooled down again to the initial temperature. This procedure was also performed three times, from which the arithmetic mean was determined.

At the end of the thermal QST test, the widespread pain index for both heat and cold were measured to determine pain intensity. The research participant was told that *"There are no right or wrong pain assessments. The only 'right' pain intensity is the one that you perceive; please enter a number between 0-100 for the perceived pain. 0 = no pain - 100 = worst pain imaginable"* (Nigls, 2013b). For the widespread pain index for cold, the thermode cooled down from the baseline value of 32 °C to 2 °C at a speed of 1 °C/s, remained at this temperature for six seconds and subsequently warmed up again to the baseline value of 32 °C. In these six seconds, the research participant was instructed to depict the intensity of this cold pain stimulus on a scale from 0 to 100. For the widespread pain index for heat, the thermode heated the baseline temperature of 32 °C to 48 °C at a speed of 1 °C/s, remained at this temperature for six seconds and subsequently cooled down again to the baseline value of 32 °C. In these six seconds, the research participant was instructed to depict the intensity of this heat pain stimulus on a scale from 0 to 100. This procedure was conducted once for both the widespread pain index for heat and the widespread pain index for cold.

To characterize deep pain, the pressure pain threshold (PPT) was determined by means of a blunt pressure algometer. This mechanical stimulator has a blunt contact area of 1 cm² and is equipped with a reading possibility for pressure measurement. An intensity of 0.5 kg to 10 kg can be applied. By continually increasing the intensity, 0.5 kg/s, the pressure

pain threshold above the corresponding area was determined. The research participant was hereby instructed to immediately give a signal by saying “now” when the perception of pressure changes its quality with the additional sense of a stinging or a pulling pain, for example. This procedure was repeated three times and the arithmetic mean was determined from this.

Immediately after determining the pressure pain threshold, the heart rate was measured, followed by the first round of the cold pressor test (CPTest1) to determine the pain tolerance.

Because the cold pressor test (CPTest) is also a psychophysical procedure that depends largely on the research participant's cooperation, therefore requiring standardized instructions for measurement by the examiner, the CPT was explained in detail at this time. These instructions included standardized wording. The research participant was instructed to *“place your hand up to the wrist into two-degree-cold water and to take it out immediately as soon as an unpleasant unbearable painful sensation is felt in addition to the cold pain.”*

When the hand came into contact with the two-degree-cold water, the heart rate and the time the hand remained in the water were measured. Subsequently, the pressure pain threshold was again determined by means of a blunt pressure algometer – this was used to detect the decreasing pain inhibition. All pain tests were performed on the non-dominant hand.

The research participant was now asked to depict his or her subjective experience of stress and the subjective experience of pain during these conditions by drawing a vertical line on a visual analog scale.

Afterward, a randomized allocation for the intervention relaxation versus meditation followed. Because the study participant's perception of the instructions for relaxation as well as the perception of the contents of the meditation are of importance for the current study, they were standardized or communicated in writing. After the written instruction, the research participant was allowed to concentrate on his or her breathing in a seated position while wearing headphones and listening to an empty tape, meditating and relaxing without any specific instructions or meditating while listening to a guided meditation through the headphones.

The heart rate was measured at the beginning, after ten minutes, and at the end of the intervention. Subsequently, the research participant was asked to depict both his or her subjective experience of relaxation as well as his or her subjective experience of spirituality during the intervention by drawing a vertical line on a visual analog scale.

Afterward, the same quantitative sensory tests as well as the cold pressor test, heart rate measurements as in the beginning, were performed with the initial instructions. The research participants were, however, not instructed to use relaxation or meditation

techniques during this test.

The detection thresholds for cold and heat stimuli, threshold values for cold pain and heat pain as well as the widespread pain index for heat and cold were measured again, starting from the baseline value of 32 °C.

The deep pain was again characterized by determining the pressure pain threshold using a blunt pressure algometer.

Immediately following this determination, the heart rate and heart rate variability measurement were conducted; then the second cold pressor test (CPTest2) was conducted.

All instructions were performed in a standardized way, and when the hand touched the two-degree-cold water, the heart rate and heart rate variability as well as the time the hand remained in the water were measured. Subsequently, the pressure pain threshold was again determined to detect the decreasing pain inhibition.

The research participant was now asked once more to depict his or her subjective experience of stress and the subjective experience of pain during these conditions on a visual analog scale. This was followed by a final heart rate measurement.

Throughout the entire process, the brain waves of the subjects were recorded under the different conditions. This recording serves to generate further hypotheses for follow-up studies, however, or as exclusion criterion for sleeping clients during the intervention. The resulting EEG data and its results are not included in the current study.

The questionnaire battery was then again given without the socio-demographic part, as was initially the case. The research assistants were not blinded, with regard to the treatment and intervention protocols, but were with regard to the study hypotheses.

Differences in baseline values between the intervention groups are evaluated depending on the scale level either by t-test for independent samples or by Chi² test. Differences in changes in individual pain experience and in psychometric variables between groups are also analyzed using t-tests for independent samples. Group differences in the progression of descending pain inhibition are evaluated by means of a two-factor variance analysis with repeated measurement. All other secondary objectives are evaluated using correlations. The general significance level of the statistical hypothesis tests was set at 5%.

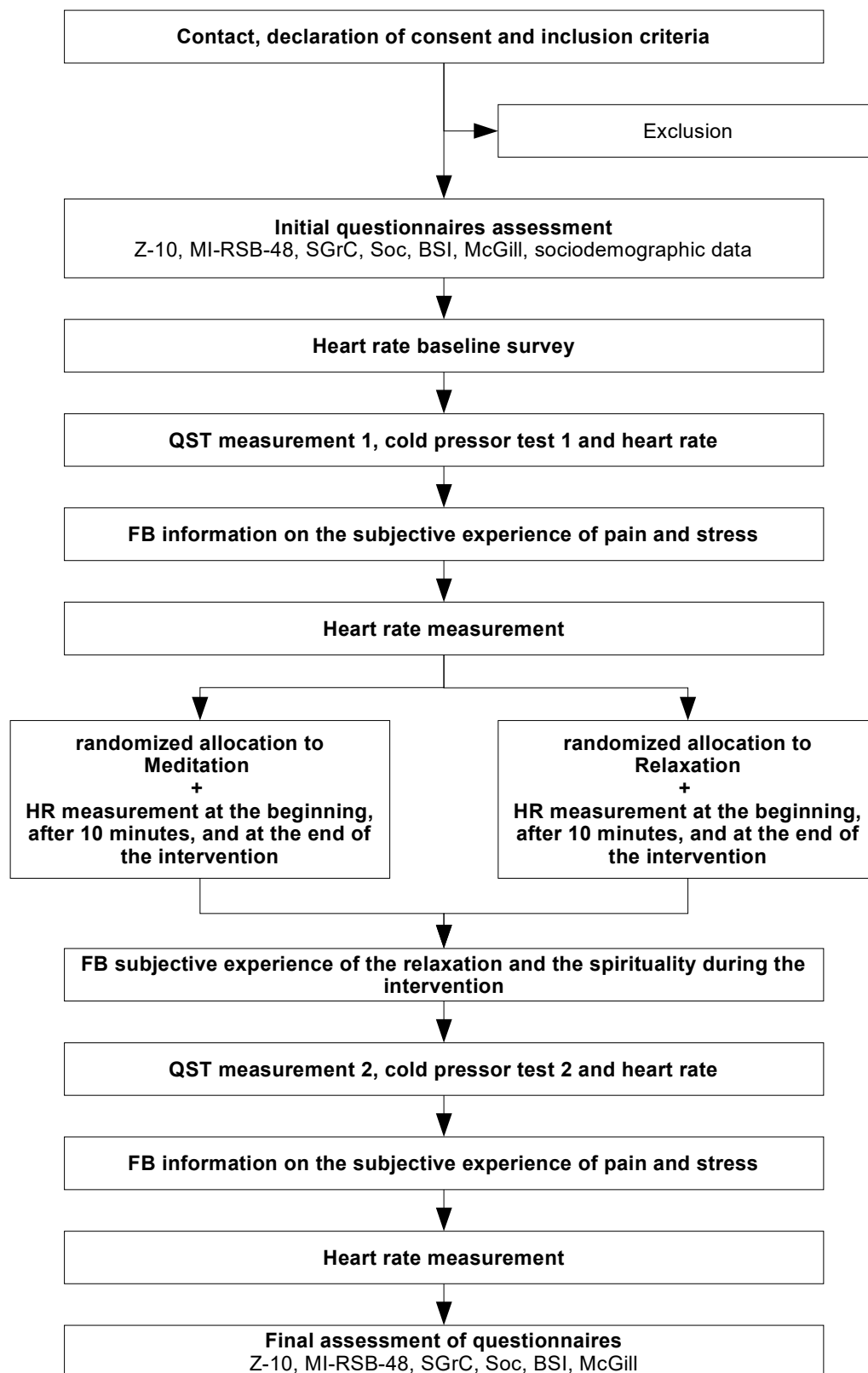


Fig 1: Study flow chart

3 Results

3.1 Sample Description

The total sample consisted of a total of 167 persons, five persons had to be excluded on account of mechanical/technical issues during the heart rate measurement/heart rate variability measurement. Another 34 persons were excluded from the study because their BSI score (brief symptom inventory by Derogatis, 2000 is a psychiatric screening questionnaire) seemed to be clinically relevant. The persons showed values of two standard deviations above the average of the calibration sample in their BSI score. Thus, 128 research participants were part of the study, 86 of them female and 42 male between the ages of 18 and 70.

The period of data collection was from October 2016 to mid-January 2017. A sample of the general population was used. The research participants were recruited through public notices (shops, companies, public places, etc.) and partly through posts on social media.

The essential prerequisite for participating was an overall healthy condition, sufficient knowledge of German, and an understanding of the subject information and instructions, as well as a written consent to participate. Exclusion criteria was a history of acute psychiatric diagnoses/ongoing psychiatric or psychotherapeutic treatment, and being a pain patient. Furthermore, a lack of compliance and participants who were sleeping during the intervention phase were regarded as exclusion criteria. The study was conducted at the University Hospital Graz in individual tests. The ethics commission of the Medical University of Graz has verified and confirmed the ethical justifiability and conduct of this study (EK No.: 28-461 ex 15/16).

After an initial questionnaire test, the research participants were randomly assigned to the intervention groups. The relaxation group consisted of 42 (61.8%) women and 26 (38.2%) men, the meditation group of 44 (73.3%) women and 16 (26.7%) men. 83.6% (56 persons) of the relaxation group were Roman Catholic, 4.5% (3 persons) indicated being Protestant, 9% (6 persons) did not belong to a denomination, and 3% (2 persons) in the relaxation group indicated being brought up in another Christian denomination. In the meditation group, 86.7% (52 persons) were Roman Catholic, 6.7% (4 persons) indicated being Protestant, 3.3% (2 persons) did not belong to a denomination, and 3% (2 persons) in the meditation group indicated being brought up in another Christian denomination.

Sociodemographic data of the subjects such as age, gender, education, relationship status, employment, etc. can be found in Table 1.

Table 1: *Descriptive statistics on the variables age, gender, education, and denomination, depending on the intervention group.*

	Relaxation		Meditation		<i>P</i>
	M	SD	M	SD	
Age	42.71	11.58	43.17	12.00	0.826
	N	%	N	%	<i>p</i>
Gender					0.190
Female	42	61.8%	44	73.3%	
Male	26	38.2%	16	26.7%	
Education					0.381
Primary education	1	1.5%	2	3.3%	
Secondary education	1	1.5%	3	5.0%	
Vocational school	14	20.6%	5	8.3%	
High school	10	14.7%	11	18.3%	
High school with further training	5	7.4%	5	8.3%	
University	37	54.4%	34	56.7%	
Employment					0.264
Currently working	57	83.8%	46	76.7%	
Currently studying/in training	8	11.8%	6	10.0%	
Retired	3	4.4%	6	10.0%	
Unemployed	0	0.0%	2	3.3%	
Marital status					0.737
n/a	1	1.5%	0	0.0%	
Married	28	41.2%	20	33.3%	
Single	14	20.6%	13	21.7%	
Domestic partnership	20	29.4%	21	35.0%	
Divorced/separated	5	7.4%	6	10.0%	
Children					0.597
no	30	44.1%	29	49.2%	
yes	38	55.9%	30	50.8%	
Austrian citizenship					0.498
no	2	3.0%	0	0.0%	

	Relaxation		Meditation		
yes	65	97.0%	60	100.0%	
Denomination raised in					0.591
Roman Catholic	56	83.6%	52	86.7%	
Protestant	3	4.5%	4	6.7%	
Other Christian denomination	2	3.0%	2	3.3%	
No religion	6	9.0%	2	3.3%	
Do you regularly meditate?					0.143
no	38	55.9%	42	70.0%	
yes	30	44.1%	18	30.0%	
If yes, how often?					0.149
Daily	9	28.1%	8	44.4%	
A few times a week	14	43.8%	3	16.7%	
A few times a month	9	28.1%	7	38.9%	

3.2 Findings of the Primary Outcomes

The analyses of the present sample ($N = 128$) was conducted using the data analysis application IBM SPSS Statistics 24. If not specified separately, the prerequisites for carrying out the analyses procedures may be considered fulfilled or negligible.

As the present study is an experimental approach, it is crucial that no differences between the control group and experimental group exist from the very beginning. This verification is carried out in advance.

3.2.1 Differences in Baseline Sociodemographic Data

Below, the t-test for independent samples will be used to determine whether the relaxation group differs from the meditation group with regard to its gender ratio, age, education, religious affiliation, and the intensity of its spirituality and religiosity in the baseline situation.

Table 2: Degree and intensity of religiosity/spirituality or of the connection to the ecclesial community of faith in the baseline data depending on the intervention group

	Relaxation		Meditation		<i>p</i>	Eta ²
	M	SD	M	SD		
Age	42.71	11.58	43.17	12.00	0.826	0.00
Gender = female N (%)	42 (62%)		44 (73%)		0.164	0.12*
Intensity of your belief	55.71	28.97	53.12	25.11	0.595	0.00
Extent of your religiosity	44.69	28.91	41.92	26.03	0.571	0.00
Extent of your spirituality	58.85	24.82	51.15	25.73	0.087	0.02
Feeling connected to the ecclesial community of faith	25.19	26.83	28.32	26.23	0.507	0.00

* *Cohen's w.*

The analysis of the data did not show a statistically significant difference in age, the “intensity of belief,” the “degree of religiosity,” the “intensity of spirituality,” the “degree of feeling connected to a ecclesial community of faith” between the intervention groups in the baseline situation. The effect size Eta² is between 0 and 2%, which signifies negligible differences. The results are illustrated in Table 2.

3.2.2 Differences in the Questionnaires

The t-test for independent samples are used to determine whether the relaxation and meditation groups differ in the baseline situation with regard to the given questionnaires.

Table 3: Differences in baseline data in the questionnaires depending on the intervention group

	Relaxation		Meditation			
	M	SD	M	SD	<i>p</i>	Eta2
Multidimensional inventory of religious/spiritual well-being (MI-RSB-48)						
General religiosity	30.84	11.64	29.05	9.69	0.345	0.01
Forgiveness	38.56	7.10	37.17	7.13	0.271	0.01
Hope immanent	41.03	4.54	38.81	5.07	0.010	0.05
Connectedness	33.01	10.03	29.53	8.31	0.036	0.04
Hope transcendent	36.37	6.08	34.77	7.50	0.185	0.01
Expericence of Sense and Meaning	40.09	5.12	38.93	5.73	0.231	0.01
Total score	219.90	29.55	208.86	28.52	0.035	0.04

Scales for the relationship with God and religious coping (SGrC)

	Relaxation		Meditation		<i>p</i>	Eta2
	M	SD	M	SD		
Helpful behavior	3.64	1.19	3.50	0.98	0.499	0.00
Ruling God	1.55	0.50	1.65	0.59	0.303	0.01
Passive God	2.51	0.85	2.55	0.89	0.802	0.00
Behavior of God	2.57	0.51	2.57	0.47	0.981	0.00
Positive feelings	3.49	1.19	3.35	1.02	0.459	0.00
Negative feelings toward self	1.61	0.70	1.43	0.45	0.094	0.02
Negative feelings toward God	1.63	0.65	1.48	0.45	0.117	0.02
Feelings of God	2.24	0.64	2.09	0.46	0.107	0.02
Positive religious coping	3.25	1.29	2.98	1.06	0.199	0.01
Negative religious coping	1.39	0.50	1.31	0.44	0.335	0.01
Religious coping	2.32	0.75	2.15	0.61	0.150	0.02
Sense of coherence (SOC)						
Sense of coherence	64.07	10.35	63.98	9.09	0.959	0.00
McGill Pain Questionnaire						
McGill 15	4.75	5.99	4.62	6.17	0.902	0.00
MCGILL B	16.02	18.58	12.22	16.23	0.229	0.01
MCGILL C	0.64	0.90	0.47	0.75	0.263	0.01
Centrality scale (Z10)						
Z10	3.28	0.96	3.08	0.87	0.207	0.01
Brief Symptom Inventory (BSI)						
Somatization	0.39	0.46	0.37	0.36	0.772	0.00
Obsessive-Compulsive	0.64	0.45	0.64	0.47	0.957	0.00
Interpersonal Sensitivity	0.53	0.41	0.48	0.43	0.534	0.00
Depression	0.27	0.32	0.29	0.33	0.709	0.00
Anxiety	0.41	0.32	0.37	0.37	0.561	0.00
Hostility	0.45	0.39	0.46	0.42	0.938	0.00
Phobic Anxiety	0.17	0.23	0.12	0.21	0.158	0.02
Paranoid Ideation	0.46	0.44	0.38	0.38	0.248	0.01
Psychoticism	0.28	0.30	0.18	0.26	0.046	0.03
Addition	0.39	0.38	0.36	0.35	0.664	0.00
GSI	0.40	0.23	0.37	0.22	0.420	0.01
GS	21.10	11.95	19.43	11.52	0.424	0.01
Somatization stress tendency	1.96	1.94	1.87	1.55	0.776	0.00
Obsessive-compulsive stress tendency	2.81	1.59	3.00	1.82	0.527	0.00
Interpersonal sensitivity stress tendency	1.56	1.14	1.53	1.31	0.906	0.00

	Relaxation		Meditation		<i>p</i>	Eta2
	M	SD	M	SD		
Depression stress tendency	1.34	1.41	1.52	1.59	0.502	0.00
Anxiety stress tendency	1.84	1.09	1.65	1.35	0.385	0.01
Hostility stress tendency	1.60	1.21	1.50	1.07	0.613	0.00
Phobic Anxiety stress tendency	0.66	0.89	0.47	0.83	0.205	0.01
Paranoid Ideation stress tendency	1.79	1.39	1.58	1.36	0.388	0.01
Psychoticism stress tendency	1.12	1.10	0.75	0.99	0.050	0.03
Additional stress tendency	1.07	0.97	1.10	0.93	0.875	0.00
PST	15.75	7.64	14.97	8.44	0.583	0.00
PSDI	1.31	0.31	1.29	0.28	0.789	0.00
Visual analog scale						
Subjective experience of stress before	21.41	23.26	27.57	28.67	0.189	0.01
Subjective experience of pain before	39.21	29.52	45.53	31.07	0.240	0.01

As can be seen in Table 3, the groups differ statistically significantly with respect to the subscale “hope immanent” and the subscale “connectedness” and the total score of the multidimensional inventory of religious/spiritual well-being (MI-RSB total score). Compared to the relaxation group, the meditation group had lower values on average on the subscale “hope immanent.” Meditation, therefore, is less positive about the future and less optimistic about life turning out to be positive. Compared to the relaxation group, the meditation group also had lower values on the subscale “connectedness,” and the religious/spiritual well-being is lower on average for the meditation group than for the relaxation group. This means that the meditation group feels less embedded and connected, i.e. transcendent, with their fellow human beings and nature, has a lower level of religious/spiritual well-being and thus fewer religious/spiritual coping resources compared to the relaxation group. Furthermore, statistically significant differences are seen between the groups with regard to the subscale “psychoticism” and “psychoticism stress tendency” of the brief symptom inventory. Here, too, the average values of the meditation group for the two mentioned scales are below those of the subscale “psychoticism” and “psychoticism stress tendency” in the relaxation group. However, these statistically significant differences between the groups can be described as small in terms of their effect strength. In all other scales, there is no statistically significant difference between the two groups.

3.2.3 Differences in Baseline Data with Regard to Physiological Parameters

The t-test for independent samples will be used to determine whether the relaxation and meditation groups differ with regard to the physiological parameters in the baseline situation.

Table 4: Differences in baseline data with regard to physiological parameters depending on the intervention group

	Relaxation		Meditation		<i>p</i>	Eta2
	M	SD	M	SD		
Cold detection threshold	29.72	1.34	29.62	1.59	0.701	0.00
Warm detection threshold	33.82	1.15	34.15	1.59	0.173	0.02
Cold pain threshold	9.15	8.37	6.21	6.20	0.025	0.04
Heat pain threshold	45.15	4.05	46.73	3.06	0.015	0.05
Manometer before CPTest 1	8.44	2.47	8.23	2.30	0.634	0.00
Heart rate baseline	67.18	8.90	68.62	9.71	0.383	0.01
Cold pressor test sec	20.82	13.42	24.43	20.79	0.242	0.01
Widespread pain index cold	46.21	29.69	49.92	25.46	0.452	0.00
Widespread pain index hot	60.50	25.43	60.85	27.14	0.940	0.00
Heart rate water	73.37	9.63	74.68	9.19	0.436	0.01

The t-test for independent samples shows a statistically significant difference between intervention groups in terms of “cold pain threshold before” and “heat pain threshold before” (see Table 4). The “cold pain threshold before” is on average higher in the relaxation group than in the meditation group and the “heat pain threshold before” is on average lower in the relaxation group than in the meditation group. That means that the relaxation group exhibits a lower cold pain threshold and a lower heat pain threshold on average than the meditation group. However, both differences show only a small effect strength. There are no statistically significant differences between the two groups to begin with regard to “cold detection threshold,” “warm detection threshold,” “widespread pain index hot,” “widespread pain index cold,” “cold pressor test,” “manometer,” and “heart rate (RHR).”

3.2.4 Change in the Individual Pain Experience

In the following, question 1 will be examined on whether or not the intervention group, the meditation group, and the relaxation group with regard to their change in individual pain experience (cold and warm detection thresholds, pain threshold for heat and cold, pain intensity for heat and cold, pain tolerance, and pressure pain) are different after the intervention. For that, a t-test for independent samples for the change in individual pain experience and a regression to validate the findings was calculated. The change was defined as the difference between post-measurement and pre-measurement.

The assumptions formulated in this context are as follows:

a) Detection threshold:

H0: There is no difference between the groups in the change in the detection threshold.

H1: There is a difference between the groups in the change in the detection threshold.

b) Pain detection thresholds for heat and cold:

H0: There is no difference between the groups in the change in pain threshold.

H1: There is a difference between the groups in the change in pain threshold.

c) Pain intensity/widespread pain index for heat and cold:

H0: There is no difference between the groups in the change in widespread pain index/pain intensity.

H1: There is a difference between the groups in the change in widespread pain index/pain intensity.

d) Pain tolerance:

H0: There is no difference between the groups in the change in pain tolerance.

H1: There is a difference between the groups in the change in pain tolerance.

e) Pressure pain:

H0: There is no difference between the groups in the change in pressure pain.

H1: There is a difference between the groups in the change in pressure pain.

Table 5: Changes in physiological parameters depending on the intervention group

	Relaxation		Meditation		<i>p</i>	Eta2
	M	SD	M	SD		
Cold detection threshold	0.00	1.38	0.11	1.53	0.661	0.00
Warm detection threshold	-0.32	0.96	-0.47	1.14	0.432	0.01
Cold pain threshold	-2.36	7.54	-1.25	4.46	0.306	0.01
Heat pain threshold	1.83	3.36	1.29	2.17	0.282	0.01
Manometer CPTest 2-CPTest 1	-0.07	1.30	-0.01	1.62	0.809	0.00
Heart rate end baseline	-2.39	5.41	-4.02	4.82	0.079	0.03
Cold pressor test sec	0.22	6.56	3.10	6.99	0.020	0.04
Widespread pain index cold	-3.91	14.96	-9.07	15.21	0.056	0.03
Widespread pain index hot	-3.90	11.86	-9.00	13.92	0.027	0.04
Heart rate water	-2.21	5.17	-2.36	4.35	0.868	0.00

The change was calculated as the difference between post-measurement and pre-measurement.

Using t-tests for independent samples, a statistically significant difference in the individual pain experience with regard to the change in the cold pressure test and the change in the widespread pain index for heat could be confirmed between the relaxation group and the meditation group. The results are illustrated in Table 5. With approximately the same cold and warm detection thresholds as well as approximately the same pain thresholds for cold and heat, the research participants in the meditation group showed a significantly higher pain tolerance in the cold pressor test after the intervention compared to the relaxation group. Furthermore, the research participants of the meditation group rated the pain intensity for widespread pain index for heat statistically significantly lower after the intervention than the relaxation group. In addition, there was a tendency towards an influence in the change in the pain intensity for cold. Here, too, the meditation group compared to the relaxation group showed a tendency towards a stronger reduction in pain intensity. The findings were additionally confirmed by regression analysis because statistically significant group differences in the cold pain thresholds and in the heat pain threshold as well as in the total score of the MI-RSB-48 and the subscale “psychoticism” of the brief symptom inventory were found in the baseline values. Taking into account the influence of religiosity (MI-RSB-48/FSB total score), “psychoticism” (BSI psychoticism subscale), “cold pain threshold,” and “heat pain threshold,” the statistically significant effects of the intervention could be secured within the framework of a linear regression analysis. This showed a statistically significant influence of the intervention with regard to the change in pain tolerance in the cold pressor test (see Table 6) as well as a statistically significant influence of the intervention with regard to the change in widespread pain index for heat. The results are illustrated in Table 7.

With regard to the cold and warm detection threshold, the pain threshold for both cold and heat, and the pressure pain, no statistically significant group change could be found (see Table 5).

Table 6: Change prediction in the cold pressor test through the intervention, religiosity, “psychoticism,” “cold pain threshold,” and “heat pain threshold”

Predictor	Beta	<i>p</i>
Intervention	.228	.017
MI-RSB-48/FSB total score	.168	.065
Brief symptom inventory subscale “psychoticism”	-.071	.431
Cold pain threshold before	-.104	.336
Heat pain threshold before	-.085	.436

Dependent variable: Difference cold pressor test sec

Table 7: Change prediction in the “widespread pain index heat” before through the intervention, religiosity, subscale “psychoticism,” “cold pain threshold,” and “heat pain threshold”

Predictor	Beta	<i>p</i>
Intervention	-.221	.020
MI-RSB-48/FSB total score	-.123	.170
Brief symptom inventory subscale “psychoticism”	.037	.676
Cold pain threshold before	-.136	.209
Heat pain threshold before	-.130	.234

Dependent variable: Difference “widespread pain index hot”

Consequently, question 2 should be examined on whether the intervention group, the meditation group, and the relaxation group differ with regard to the progression of the descending pain inhibition. The descending pain inhibition was measured at a total of four points in time: in the baseline phase, before and after the cold pressor test; and after the intervention phase and also before and after the cold pressor test.

The assumption formulated in this context is as follows:

H0: There is no difference between the groups in the progression of descending pain inhibition.

H1: There is a difference between the groups in the progression of descending pain inhibition.

Using a two-factor variance analysis with the intermediate subject factor intervention and the inner subject factor measurement time, no statistically significant change in the progression

of the manometer could be found between the intervention groups (principle effect progression: $F(2.61;328.27) = 2.14$, $p = .104$, partial $\eta^2 = .02$, Greenhouse-Geisser epsilon = 0.87; correlation progression x intervention: $F(2.61;328.27) = 0.19$, $p = .878$, partial $\eta^2 = .00$, Greenhouse-Geisser epsilon = 0.87).

3.3 Findings of the Secondary Outcomes

3.3.1 Difference in the Change in the Psychometric Parameters

Question 3 will also be examined on whether the intervention groups - the meditation group, and the relaxation group differ with regard to the change in the psychometric parameters. The change was defined as the difference between post-measurement and pre-measurement.

The assumption formulated in this context is as follows:

H0: There is no difference between the groups in the change in the psychometric parameters.

H1: There is a difference between the groups in the change in the psychometric parameters.

As can be seen in Table 8, a statistically significant difference in the subscale "general religiosity," the subscale "forgiveness," and the subscale "connectedness" as well as the total score of the questionnaire on religious/spiritual well-being could be found using a t-test for independent samples. Compared to the relaxation group after the intervention, the meditation group showed a statistically significantly higher expression in the dimension faith in God, who is merciful and to whom a feeling of closeness can be established. They had a more positive outlook for the future and had a stronger feeling of satisfaction, security, and trust in God's help.

Moreover, compared to the relaxation group, the meditation group showed a stronger expression in the dimension that depicts the willingness of people to forgive and wish their enemies well and in the absence of hatred and the avoidance of revenge. Compared to the relaxation group, the meditation group showed a stronger feeling of transcendence after the intervention, felt more strongly connected to something greater, increasingly reported a feeling of spiritual connection to others as well as to nature, and generally showed an increase in religious/spiritual well-being i.e. in religious/spiritual coping resources.

Furthermore, a statistically significant group difference with regard to the subscale

“behavior of God” could be found as well as a tendency in the subscale “passive God,” the scale on the relationship with God and on religious coping. The meditation group had a more positive image of God after the intervention and a stronger feeling and more trust in God’s help and felt more supported than the relaxation group. There was a statistically significantly stronger decrease in the “paranoid stress tendencies” of the brief symptom inventory in the relaxation group compared to the meditation group. In all other subscales and total scores there were no statistically significant group differences.

Table 8: Changes in psychometric parameters depending on the intervention group

	Relaxation		Meditation			
	M	SD	M	SD	<i>p</i>	Eta2
Multidimensional inventory of religious/spiritual well-being (MI-RSB-48)						
General religiosity	0.06	3.48	1.80	4.53	0.018	0.05
Forgiveness	0.51	3.25	2.43	3.84	0.003	0.07
Hope immanent	0.82	2.64	0.86	3.72	0.939	0.00
Connectedness	0.01	3.01	1.49	4.12	0.025	0.04
Hope transcendent	1.21	2.61	0.98	3.18	0.662	0.00
Expericence of Sense and Meaning	-0.64	3.80	0.10	3.54	0.259	0.01
Total score	1.97	9.28	6.86	9.58	0.004	0.06
Scales for the relationship with God and religious coping (SGrC)						
Helpful behavior	-0.09	0.40	-0.15	0.56	0.502	0.00
Ruling God	-0.13	0.39	-0.27	0.47	0.083	0.02
Passive God	0.01	0.61	-0.21	0.62	0.052	0.03
Behavior of God scale	-0.07	0.30	-0.20	0.40	0.040	0.03
Positive feelings	0.00	0.46	-0.07	0.37	0.340	0.01
Negative feelings toward self	-0.13	0.39	-0.14	0.31	0.811	0.00
Negative feelings toward God	-0.16	0.35	-0.18	0.28	0.664	0.00
Feelings of God scale	-0.10	0.26	-0.13	0.22	0.395	0.01
Positive religious coping	0.03	0.39	0.03	0.44	0.970	0.00
Negative religious coping	-0.07	0.31	-0.10	0.33	0.660	0.00
Religious coping scale	-0.02	0.27	-0.02	0.32	0.926	0.00
Sense of coherence (SOC)						
Sense of coherence	1.93	6.04	1.17	4.86	0.440	0.01
McGill Pain Questionnaire						
McGill 15	0.34	3.29	-0.53	2.85	0.113	0.02
MCGill B	0.69	10.92	0.24	6.03	0.774	0.00

	Relaxation		Meditation		<i>p</i>	Eta2
	M	SD	M	SD		
McGill C	-0.17	0.70	-0.07	0.41	0.321	0.01
Centrality scale (Z10)						
Z10	-0.07	0.22	-0.06	0.21	0.768	0.00
Brief Symptom Inventory (BSI)						
Somatization	-0.09	0.23	-0.06	0.18	0.496	0.00
Obsessive-Compulsive	-0.08	0.27	-0.10	0.27	0.665	0.00
Interpersonal Sensitivity	-0.12	0.27	-0.08	0.30	0.424	0.01
Depression	-0.04	0.19	-0.04	0.16	0.855	0.00
Anxiety	-0.08	0.19	-0.07	0.20	0.812	0.00
Hostility	-0.07	0.25	-0.09	0.17	0.622	0.00
Phobic Anxiety	-0.05	0.15	-0.02	0.13	0.221	0.01
Paranoid Ideation	-0.10	0.30	-0.03	0.29	0.157	0.02
Psychoticism	-0.05	0.26	-0.02	0.20	0.413	0.01
BSI addition	-0.02	0.19	-0.08	0.20	0.120	0.02
GSI	-0.07	0.11	-0.06	0.10	0.509	0.00
GS	-3.78	6.05	-3.13	5.12	0.522	0.00
Somatization stress tendency	-0.21	0.76	-0.15	0.99	0.719	0.00
Obsession-compulsion stress tendency	-0.22	1.10	-0.32	1.26	0.646	0.00
Interpersonal sensitivity stress tendency	-0.25	0.90	-0.07	0.92	0.258	0.01
Depression stress tendency	-0.10	0.76	-0.17	0.76	0.636	0.00
Anxiety stress tendency	-0.31	0.78	-0.17	0.81	0.312	0.01
Hostility stress tendency	-0.16	0.86	-0.05	0.75	0.436	0.01
Phobic Anxiety stress tendency	-0.16	0.66	-0.07	0.45	0.348	0.01
Paranoid Ideation stress tendency	-0.37	0.99	-0.03	0.86	0.043	0.03
Psychoticism stress tendency	-0.21	0.87	-0.05	0.87	0.315	0.01
Additional stress tendency	-0.09	0.54	-0.20	0.63	0.283	0.01
PST	-2.07	3.57	-1.27	3.81	0.218	0.01
PSDI	-0.10	0.20	-0.13	0.26	0.469	0.00

The change was calculated as the difference between post-measurement and pre-measurement.

3.3.2 Difference Between the Groups in the Change in the Subjective Experience of Stress and Pain

Question 4 will also be examined on whether the intervention group - the meditation group, and the relaxation group differ with regard to the change in the psychometric parameters of the visual analog scale concerning stress and pain. The change was defined as the difference between post-measurement and pre-measurement.

The assumptions formulated in this context are as follows:

a) Subjective experience of pain:

H0: There is no difference between the groups in the change in the subjective experience of pain.

H1: There is a difference between the groups in the change in the subjective experience of pain.

b) Subjective experience of stress:

H0: There is no difference between the groups in the change in the subjective experience of stress.

H1: There is a difference between the groups in the change in the subjective experience of stress.

With regard to the change in the “subjective experience of stress” and the change in the “subjective experience of pain,” the relaxation group and the meditation group did not show any difference. That means that the meditation group and the relaxation group felt the subjectively experienced stress as well as the subjectively experienced pain before and after the intervention almost the same. The results are illustrated in Table 9.

Table 9: Difference between the groups in the change in the subjective experience of stress and pain

	Relaxation		Meditation		<i>p</i>	Eta2
	M	SD	M	SD		
Subjective experience of stress	-1.39	19.81	-5.45	25.33	0.313	0.01
Subjective experience of pain	-2.13	22.41	-3.73	28.59	0.725	0.00

The change was calculated as the difference between post-measurement and pre-measurement.

3.3.3 Differences Between the Groups in the Subjective Experience of Spirituality and Relaxation

Furthermore, question 5 is to be examined on whether the intervention groups - the meditation group, and the relaxation group differ with regard to the subjective experience of spirituality and the subjective experience of relaxation.

The assumptions formulated in this context are as follows:

b) Subjective experience of relaxation:

H0: There is no difference between the groups in the subjective experience of relaxation.

H1: There is a difference between the groups in the subjective experience of relaxation.

c) Subjective experience of spirituality:

H0: There is no difference between the groups in the subjective experience of spirituality.

H1: There is a difference between the groups in the subjective experience of spirituality.

As can be seen in Table 10, a statistically significant difference with regard to the “subjective experience of spirituality” could be determined. Compared to the relaxation group, the meditation group showed higher values in the “subjective experience of spirituality” during the intervention, although with regard to the “subjective experience of relaxation” during the intervention, no statistically significant difference in the groups could be found. The meditation group subjectively felt more spiritual on average during the intervention than the relaxation group, while the subjectively experienced relaxation was felt approximately the same by both groups.

Table 10: Differences between the groups in the subjective experience of spirituality and relaxation

	Relaxation		Meditation		<i>p</i>	Eta2
	M	SD	M	SD		
Subjective experience of spirituality	46.32	34.42	69.33	25.55	0.000	0.13
Subjective experience of relaxation	84.54	23.97	90.62	21.91	0.139	0.02

3.3.4 Connection between Religiosity/Spirituality and the Parameters of the Individual Pain Experience

To answer the question – Is there a connection between religiosity/spirituality and the individual pain experience (cold and warm detection threshold, pain threshold for heat and

cold, pain intensity for heat and cold, pain tolerance, and pressure pain)? – the correlations between the MI-RSB-48 and its sub-dimensions, the SGrC and its sub-dimensions, the centrality scale, the sense of coherence and the visual analog scales on the “intensity of spirituality” and “intensity of belief,” the “degree of religiosity,” and the “connection to an ecclesial community of faith” as well as the parameters of individual pain experience (perception for heat and cold, pain threshold for heat and cold, pain intensity for heat and cold, pain tolerance, and pressure pain) are calculated.

The assumption formulated in this context is as follows:

H0: There is no connection between religiosity/spirituality and the individual pain experience.

H1: There is a connection between religiosity/spirituality and the individual pain experience.

As can be seen in Table 11, statistically significant positive correlations between the “cold pressor test before the intervention (CPTest 1)” and the MI-RSB-48 total score ($r = .18$; $p < .05$) as well as the subscale “connectedness” ($r = .22$; $p < .05$) could be seen. Furthermore, statistically significant positive correlations between the “cold pressor test after the intervention (CPTest 2)” and the MI-RSB-48 ($r = .19$; $p < .05$) as well as the subscale “connectedness” ($r = .21$; $p < .05$) could be seen.

Thus, higher religious/spiritual well-being of the research participants, more religious/spiritual coping resources, a safer and more trusting relationship with God or the Divine, an increased feeling of contentment, security and trust in His/Its help, as well as having the feeling of being a part of something greater – the feeling of being spiritually connected to fellow human beings and nature, are accompanied by a higher pain tolerance before and after the intervention.

With regard to the widespread pain index for heat, statistically significant negative connections among the widespread pain index for heat before the intervention and the MI-RSB-48 total score ($r = -.26$; $p < .01$), the subscale “general religiosity” ($r = -.18$; $p < .05$) and the subscale “connectedness” ($r = -.30$; $p < .01$) were found. That means that higher religious/spiritual well-being of the research participants, more religious/spiritual coping resources, a safer and more trusting relationship with God or the Divine, a strong feeling of contentment, security and trust in His/Its help, as well as having the feeling of being a part of something greater – a feeling of being spiritually connected to fellow human beings and nature, are accompanied by a lower pain intensity for heat before the intervention.

Furthermore, negative statistically significant connections were shown among the widespread pain index for heat before the intervention and the centrality scale ($r = -.20$; $p < .05$), the visual analog scale “intensity of belief” ($r = -.22$; $p < .05$), the “degree of religiosity” ($r = -.17$; $p < .05$) as well as for the analog scale “intensity of spirituality” ($r = -.28$; $p < .01$), the subscale “positive religious coping” ($r = -.20$; $p < .05$), and the scale “religious coping” ($r = -.19$;

$p < .05$) of the SGrC.

The more centrally the religiosity or spirituality is integrated into the lives of the research participants, the higher the intensity of belief or the intensity of spirituality and the degree of religiosity is perceived, the safer and more trusting the relationship with God or the Divine is, the stronger the belief that there is a greater meaning to be found, and the lower the assessment of the widespread pain index for heat or the pain intensity for heat before the intervention is.

The “connection to an ecclesial community of faith” shows no statistically significant correlation to a widespread pain index for an experimentally induced heat pain before the intervention.

With regard to the widespread pain index for heat, after the intervention, statistically significant negative connections could be seen with the MI-RSB-48 total score ($r = -.29$; $p < .01$), the subscale “general religiosity” ($r = -.23$; $p < .01$), the subscale “connectedness” ($r = -.28$; $p < .01$) as well as for the subscale “forgiveness” ($r = -.22$; $p < .05$). That means that a higher religious/spiritual well-being of the research participants, more religious/spiritual coping resources, a safer and more trusting relationship with God or the Divine, a feeling of contentment, security and trust in His/Its help, as well as having the feeling of being a part of something greater or having the feeling of being spiritually connected to fellow human beings and nature, as well as having the willingness to forgive and to wish an enemy well are accompanied by a lower evaluation of the widespread pain index for heat after the intervention.

Furthermore, statistically significant negative correlation could be found among the widespread pain index for heat after the intervention and the centrality scale ($r = -.24$; $p < .01$), the visual analog scale “intensity of belief” ($r = -.27$; $p < .01$), as well as the visual analog scale “intensity of spirituality” ($r = -.25$; $p < .01$), the subscales “positive religious coping” ($r = -.25$; $p < .01$), and the scale “religious coping” ($r = -.23$; $p < .01$) of the SGrC. Consequently, an integral or central value of spirituality in the lives of the research participants, a higher perception of the intensity of spirituality and the intensity of belief, an increased use of positive religious coping i.e. religious coping, as well as a secure and trusting relationship with God or the Divine, a stronger belief that there is greater meaning to be found, as well as a higher religious/spiritual state of well-being are accompanied by a lower pain intensity for heat or a lower widespread pain index for heat after the intervention.

The “degree of religiosity” or rather the “connection to an ecclesial community of faith” shows no statistically significant correlation to a widespread pain index for an experimentally induced heat pain after the intervention.

No statistically significant correlation could be found for the pain intensity for cold before and after the intervention i.e. for the widespread pain index for cold before and after

the intervention. Thus, the perceived pain intensity for cold before as well as for after the intervention is not related to the religious/spiritual well-being of the research participants.

A positive statistically significant correlation was shown for the cold pain threshold before the intervention and the visual analog scale "connection to an ecclesial community of faith" ($r = .18$; $p < .05$), as well as for the "cold pain threshold after the intervention" and the subscale "negative religious coping" ($r = .27$; $p < .01$) of the SGrC. This means that a higher attachment of persons to an ecclesial community of faith is accompanied by a lower pain threshold for cold before the intervention. The more people feel abandoned or punished, the lower the cold pain threshold after the intervention.

Positive statistically significant correlation with the subscale "passive God" ($r = .21$; $p < .05$) as well as with the subscale "behavior of God" ($r = .21$; $p < .05$) of the SGrC could be found for the pain threshold for heat after the intervention. A passive image of God or a higher personal responsibility of the persons is connected with a higher pain threshold for heat after the intervention.

A negative statistically significant correlation between heat perception after the intervention and the subscale "feelings of God" ($r = -.18$; $p < .05$) of the SGrC could be found for perception, but no statistically significant correlation for the perception of heat or for the perception of cold before the intervention or the perception of cold after the intervention. The more pronounced or the stronger the feelings are, the faster the persons perceive the change in temperature towards heat after the intervention.

For the pressure pain, a negative statistical correlation could be found between the pressure pain before the cold pressor test (CPTest1) before the intervention and the subscale "meaning" ($r = -.20$; $p < .05$) of the MI-RSB-48 as well as between the subscale "meaning" and the pressure pain after the CPTest 1 before the intervention ($r = -.21$; $p < .05$) and the pressure pain after the cold pressor test 2 (CPTest 2) after the intervention ($r = -.19$; $p < .05$). Furthermore, a negative statistical correlation could be determined between the subscale "hope transcendent" of the MI-RSB-48 and the pressure pain after the cold pressor test 2 after the intervention ($r = -.19$; $p < .05$). That means that the higher the experiences of authentic feelings, deep affection, and true friendship are, the more there is a sufficient understanding of the meaning of life, the more meaningful experiences of openness and honesty were made, the higher the ability to be so absorbed by something that you forget everything around you, and the more the recognition of the transience of life and the hopeful assumption that there is life after death are, the lower the pressure pain threshold.

For the pressure pain after the intervention before the cold pressor test 2 and the subscale "passive God" ($r = .19$; $p < .05$) of the SGrC, a positive statistically significant connection could be found. A passive image of God is and the more a person feels

abandoned, the more pressure pain they endure during the pressure test after the intervention before the cold pressor test 2.

Table 11: Statistically significant connection between religiosity/spirituality and the parameters of the individual pain experience

	WPI b	CP test 1	WPI a	CP test 2	CPT b	WDT a	CPT a	HPT a	PPT_bCP T1	PPT_aCP T1	PPT_bCP T2	PPT _n CPT 2
<i>FS B G</i>	-.26 **	.18 *	-.29 **	.19 *								
<i>AR</i>	-.18 *		-.23 **									
<i>VE</i>			-.22 *									
<i>AL</i>	-.30 **	.22 *	-.28 **	.21 *								
<i>HT</i>												-.19 *
<i>BS</i>									-.20*	-.21*		-.19 *
<i>Pa G</i>								.21*			.18*	
<i>Ver h G</i>								.21*				
<i>Gef G</i>							-.18*					
<i>Pos Co p</i>	-.20 *		-.25 **									
<i>Neg Co p</i>							.27* *					
<i>Rel Co p</i>	-.19 *		-.23 **									
<i>Z 10</i>	-.20 *		-.24 **									
<i>IdG</i>	-.22 *		-.27 **									
<i>Ad R</i>	-.17 *											
<i>IdS</i>	-.28 **		-.25 **									
<i>Vk G</i>					.18*							

Note: ** = $p \leq .01$; * = $p \leq .05$; *FSB G* = MI-RSB-48 total score; *AR* = subscale “general religiosity” of the MI-RSB-48; *VE* = subscale “forgiveness” of the MI-RSB-48; *AL* = subscale “connectedness” of the MI-RSB-48; *VT* = subscale “hope transcendent” of the MI-RSB-48; *BS* = subscale “experience of sense and meaning” of the MI-RSB-48; *PaG* = “passive God” of the SGrC; *Verh G* = “behavior of God” of the SGrC; *Gef G* = subscale “feelings of God” of the SGrC; *Pos Cop* = “positive religious coping of the SGrC; *Neg Cop* = “negative religious coping of the SGrC”; *Rel Cop* = subscale “religious coping” of the SGrC; *Z10* = centrality scale; *IdG* = intensity of belief;

AdR = degree of religiosity; IdS = intensity of spirituality; VkG = connection to the ecclesial community of faith; WPIb = widespread pain index heat before; CPTest 1 = cold pressor test before; WPIa = widespread pain index heat after; CPTest 2 = cold pressor test after; CPTb = cold pain threshold before; WDTa = warm detection threshold after; CPTa = cold pain threshold after; HPTa = heat pain threshold after; PPT_bCPTest 1 = manometer before cold pressor test 1; PPT_aCPTest 1 = manometer after cold pressor test 1; PPT_aCPTest 2 = manometer after cold pressor test 2.

3.3.5 Connection between Religiosity/Spirituality and the Parameters of the Change in the Individual Pain Experience

To answer question 7 – Is there a connection between religiosity/spirituality and the change in the individual pain experience (pain threshold for heat and cold, pain intensity for heat and cold, pain tolerance, and pressure pain)? – the correlations between the MI-RSWB-48 and its sub-dimensions, the SGrC and its sub-dimensions, the centrality scale, the sense of coherence and the visual analog scales on the “intensity of belief,” the “degree of religiosity,” the “intensity of spirituality,” and the “connection to an ecclesial community of faith,” as well as the parameters of the change in individual pain experience were calculated. The change was defined as the difference between post-measurement and pre-measurement.

The assumption formulated in this context is as follows:

H0: There is no connection between religiosity/spirituality and the change in individual pain experience.

H1: There is a connection between religiosity/spirituality and the change in individual pain experience.

Statistically significant correlations could be found for the dimension “behavior of God” of the SGrC and the change in the cold pressor test ($r = .19$; $p < .05$) as well as for the subscale “passive God” of the SGrC and the “change in the perception of heat” ($r = -.17$; $p < .05$). That means that a pronounced “behavior of God”, a more negative image of God before the intervention is accompanied by a greater increase in pain tolerance. The more passive the image of God is before the intervention, the faster the persons perceive a change in temperature towards heat.

3.3.6 Heart Rate Progression

Using a two-factor variance analysis for dependent measurements, the progression of the

heart rate during the experiment was analyzed depending on the time of measurement and the intervention group. Thereby, a statistically significant principle effect of the timing could be seen ($F(6.08;705.64) = 100.45$, $p < .001$, partial $\eta^2 = .46$, Greenhouse-Geisser epsilon = 0.76). Individual comparisons according to Bonferroni show an increase in the heart rate during the cold pressor test before and after the intervention compared to the baseline measurement. There was, however, a decrease in the heart rate compared to the baseline after the cold pressor test (CPTest 1 and CPTest 2) and during the intervention (see Fig. 2). Neither the main effect intervention group nor the interaction between the intervention group and the time of the measurement were statistically significant.

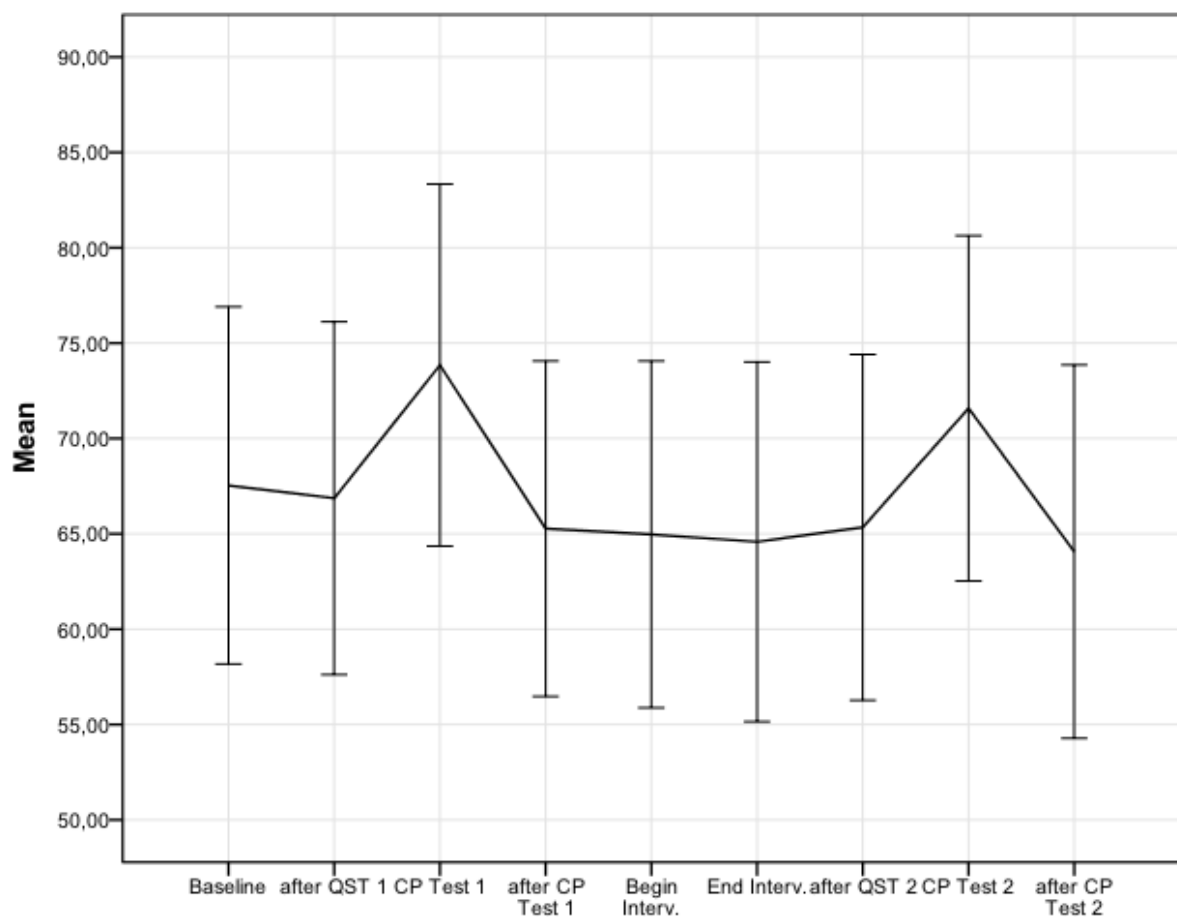


Fig 2: Progression of the heart rate in the overall sample ($n = 118$)

3.3.7 Connection Between Religiosity/Spirituality and the Heart Rate

Consequently, question 8 will be considered, namely whether there is a connection between religiosity/spirituality and the heart rate.

To that effect, the correlations between the MI-RSB-48 and its sub-dimensions, the SGrC and its sub-dimensions, the centrality scale, the sense of coherence and the visual analog scales on the “intensity of belief,” the “degree of religiosity,” the “intensity of spirituality,” and the “connection to an ecclesial community of faith,” as well as the heart rate were calculated.

The assumption formulated in this context is as follows:

H0: There is no connection between religiosity/spirituality and the heart rate.

H1: There is a connection between religiosity/spirituality and the heart rate.

By means of correlation analysis, statistically significantly negative connections could be found between the connection to an ecclesial community of faith and the heart rate baseline ($r = -.19$; $p < .05$) as well as the heart rate during the cold pressor tests before the intervention (CPTest 1) ($r = -.18$; $p < .05$). A higher connection to an ecclesial community of faith is associated with a lower heart rate baseline before the intervention and a lower heart rate during the cold pressor test before the intervention (CPTest 1). Furthermore, statistically significant positive correlations between the heart rate at the end of the intervention with the subscale “positive religious coping” ($r = .19$; $p < .05$) and the subscale “positive feelings” ($r = .20$; $p < .05$) of SGrC could be seen. That means that the more positive the feelings toward God are and the more positive religious coping is utilized, the higher the heart rate is at the end of the intervention. Positive feelings towards God ($r = .23$; $p < .05$) and an increased positive religious coping ($r = .19$; $p < .05$) are also related to a higher heart rate after the cold pressor test 2 (CPTest 2). Moreover, a statistically significant positive connection could be found between the subscale “forgiveness” of the MI-RSB-48 and the heart rate after the CPTest 2 ($r = .20$; $p < .05$) and the heart rate after the quantitative testing (QST 2) after the intervention. A greater willingness of people to forgive and wish their enemies well as well as the absence of hatred and the avoidance of revenge, consequently a more pro-social behavior, is accompanied by a higher heart rate after the cold pressor test 2 as well as a higher heart rate after the QST 2.

3.3.8 Connection Between Religiosity/Spirituality and the Change in the Heart Rate

To answer question 9 – Is there a connection between religiosity/spirituality and the change in heart rate? –, the correlations between the MI-RSB-48 and its sub-dimensions, the SGrC and its sub-dimensions, the centrality scale, the sense of coherence and the visual analog scales on the “intensity of belief,” the “degree of religiosity,” the “intensity of spirituality,” and the “connection to an ecclesial community of faith,” as well as the change in heart rate were calculated. The change was defined as the difference between the end measurement and the baseline i.e. post-measurement and pre-measurement.

The assumption formulated in this context is as follows:

H0: There is no connection between religiosity/spirituality and the change in heart rate.

H1: There is a connection between religiosity/spirituality and the change in heart rate.

As can be seen in Table 12, statistically significant positive connections could be seen especially with regard to the subscales “helpful behavior” ($r = .22$; $p < .05$), “positive feelings ” ($r = .23$; $p < .05$), “negative feelings toward self” ($r = .18$; $p < .05$), „feelings of God“ ($r = .21$; $p < .05$), „positive religious coping“ ($r = .25$; $p < .01$) as well as the dimension „religious coping“ ($r = .27$; $p < .01$) of the SGrC and the change in the heart rate between the end measurement and the baseline. This means that the more the persons feel that they are supported and guided by God, the safer and the more trusting the relationship with God or the Divine, the stronger the belief that there is greater meaning to be found, and the higher the humility towards God, then the stronger the increase of the heart rate between the final measurement and the baseline measurement.

Consequently, it could also be shown that the more religious/spiritual coping resources were available to the persons, i.e., the higher their religious/spiritual well-being ($r = .19$; $p < .05$) is, the higher the overall religiosity ($r = .21$; $p < .05$), the more central the religiosity or spirituality in their lives is ($r = .24$; $p < .01$), the stronger the intensity of belief ($r = .31$; $p < .01$) and the intensity of spirituality ($r = .27$; $p < .01$) is perceived, the higher the degree of religiosity ($r = .27$; $p < .01$) and the connection to an ecclesial community of faith ($r = .19$; $p < .05$) are, the more the heart rate rose between the end measurement and the baseline measurement.

Table 12: Statistically significant correlations between the change in the heart rate and religiosity/spirituality

	FSB G	AR	HVH	PGef	NGef S	Gef G	Pos Cop	Rel Cop	Z10	IdG	AdR	IdS	VkG
RHRE-B	.19*	.21*	.22*	.23*	.18*	.21*	.25**	.27**	.24**	.31**	.27**	.27**	.19*
RHRCPT										.18*			

Note: ** = $p \leq .01$; * = $p \leq .05$; the change was calculated as the difference between post-measurement and pre-measurement. FSB G = MI-RSB-48 total score; AR = subscale “general religiosity” of the MI-RSB-48; HVH = helpful behavior, PGef = “positive feelings”; NGef S = “negative feelings toward self”; NGef G = “negative feelings God”; Gef G = “feelings of God”; Pos Cop = “positive religious coping”; Rel Cop = “religious coping”; SOC1 3 = sense of coherence; Z10 = centrality scale; IdG = “intensity of belief”; AdR = “degree of religiosity”; IdS = “intensity of spirituality”; VkG = “connection to the ecclesial community of faith”; RHRE-B = heart rate post-measurement pre-measurement before intervention, RHRCPT = change in heart rate between the CPT2-CPT1

3.3.9 Connection Between Subjective Stress, Subjective Pain, Subjective Relaxation, Subjective Spirituality and Religiosity/Spirituality

Below, the correlations between the MI-RSB-48 and its sub-dimensions, the SGrC and its sub-dimensions, the centrality scale, the sense of coherence and the visual analog scales on the “intensity of belief,” the “degree of religiosity,” the “intensity of spirituality,” and the “connection to an ecclesial community of faith,” and the visual analog scales on the “subjective experience of stress,” “subjective experience of pain,” “subjective experience of relaxation,” as well as on the “subjective experience of spirituality” are calculated.

The assumption formulated in this context is as follows:

H0: There is no connection between religiosity/spirituality and the subjective sensations (stress, pain, relaxation, and spirituality).

H1: There is a connection between religiosity/spirituality and the subjective sensations (stress, pain, relaxation, and spirituality).

By means of correlation-analytical evaluation, a statistically significant connection between the subjectively experienced stress before the intervention and the negative religious coping ($r = .20$; $p < .05$) or the religious coping ($r = .20$; $p < .05$) could be determined. The higher the disastrous world view and the more the research participants quarrel with God or the Divine and understand their suffering to be a punishment of God or the Divine, the higher the subjectively experienced stress after the first pain test (QST 1) before the intervention is. The subjective pain after the pain test 1 (QST 1), i.e., before the intervention, however, is increasingly less the more positive the feelings towards oneself in relation to God are ($r = -.18$; $p < .05$) and the stronger the person’s feeling are of being a part of something greater, i.e.,

the stronger the feeling of a spiritual connection to other people is ($r = -.18$; $p < .05$). Moreover, the subjective pain after the pain test 2 (QST 2) after the intervention is increasingly less the more positive the feelings towards oneself in relation to God are ($r = -.18$; $p < .05$) and the stronger the person's feeling is of being a part of something greater, i.e., the stronger the feeling of a spiritual connection to other people is ($r = -.28$; $p < .01$).

The more religious/spiritual coping resources are available to the persons ($r = .21$; $p < .05$), i.e., the higher their religious/spiritual well-being is ($r = .20$; $p < .05$), the greater the subjective relaxation regardless of the intervention. Furthermore, an optimistic and confident attitude towards the future ($r = .20$; $p < .05$) as well as positive feelings towards God ($r = -.20$; $p < .05$) and a higher subjectively experienced spirituality ($r = .37$; $p < .01$) is accompanied by a higher degree of relaxation of the research participants.

A higher subjective spiritual experience of the persons irrespective of the intervention is related to a higher intensity of belief ($r = .18$; $p < .05$), a higher intensity of spirituality ($r = .24$; $p < .01$), and a higher integral value of these in the persons' value systems ($r = .18$; $p < .05$). Furthermore, a more trusting relationship with God or the Divine ($r = .21$; $p < .05$), positive feelings such as satisfaction, security and trust in His/Its help ($r = .18$; $p < .05$), as well as a stronger feeling of being a part of something greater, i.e., a stronger spiritual connection with fellow human beings and nature ($r = .22$; $p < .05$) and increased religious coping ($r = .19$; $p < .05$), or positive religious copying ($r = .21$; $p < .05$), is accompanied by a higher subjective spiritual experience of the persons.

4 Discussion

According to the study by Breivik et al. (2006), many people with pain live without adequate pain management and are thus severely impaired with regard to their mental state, their quality of life, their self-identity, their relationships, as well as social contacts and their ability to work. In recent years, some new studies have examined the connection between religiosity or spirituality and pain and the effects of religious or spirituality interventions on pain. Nevertheless, the data that is available on the effectiveness of religious/spiritual interventions in the area of pain continues to be sparse and inconsistent. Earlier studies consistently reported positive psychological and physical findings of meditation techniques on health (Grossman, Niemann, Schmidt & Walach 2004), yet only a few tried to collect and

thoroughly unravel the effect of meditation and the different components of religiosity and spirituality (coping, emotions, etc.) on different areas such as pain perception, pain intensity, pain tolerance, and on pain processing.

By means of a guided meditation, the present study aimed to shed more light on the effects on the different pain sensations (cold and heat pain stimulus and pressure pain stimulus), pain perception, pain intensity, pain tolerance, and therefore on pain processing, on cardiovascular reactivity to these stimuli, on religious/spiritual well-being, on the psychological well-being, and its changes. It was assumed that the guided meditation has a higher physical, psychological, and religious or spiritual added value in healthy research participants compared to the relaxation condition.

There was also the question of how the different pain sensations such as pain perception, pain intensity, pain tolerance, as well as the cardiovascular reactivity to these stimuli and their changes are connected to the degree of religiosity/spirituality and the underlying mechanisms such as religious/spiritual emotions, cognitions, and coping strategies of the research participants. In this respect, it was assumed that a reduced sensation of pain is accompanied by the presence of religiosity/spirituality.

Many methods and tools are necessary for creating a clearer picture of the different manifestations of religiosity or spirituality on pain. For this reason, the focus of this study, based on preliminary work by Wachholtz and Pargament (2005), was placed on two different areas: on the one hand, on the area of physiological data on pain experience (pain detection threshold, pain intensity, pain tolerance) and the cardiovascular reactivity (heart rate) on these induced stressors i.e. pain stimuli, and on the other hand on the participants' subjective response to the pain as well as the intervention through psychological and religious/spiritual variables (Sollgruber et al., 2018). Physiological variables provided detailed objective information about the participants' pain perception and pain tolerance; cardiovascular reactivity served as an objective indicator of the response to the stress experienced, which was experimentally induced through pain testing. In addition, subjective perception of the pain and stress on pain testing with regard to pain processing as well as the subjective perception of relaxation and spirituality with regard to the intervention were collected (Sollgruber et al., 2018). Also, the religious/spiritual, mental well-being, and sensation of pain were collected by means of a questionnaire before and after the intervention (Sollgruber et al., 2018). By combining these areas of subjective responses and objective measures, we gained insight into the effectiveness of the techniques on the different sensations and perceptions.

In summary, the study supports most of the hypotheses proposed in this project (Sollgruber et al., 2018). Thus, the meditation group was able to develop a higher pain

tolerance in the cold pressor test and a lower pain sensation/lower pain intensity in the widespread pain index for heat during a 20-minute meditation (Sollgruber et al., 2018). Additionally, the group developed better religious/spiritual well-being in these 20 minutes, had more religious spiritual coping resources, was able to forgive others more easily, was more optimistic and confident about the future, felt a closer connection to other people and nature, and was more positively inclined towards God or the Divine.

4.1 Meditation – Pain and Heart Rate Reactivity

Compared to the relaxation group, the meditation group was able to develop a higher pain tolerance during a 20-minute meditation with approximately the same cold and heat detection threshold and with approximately the same pain threshold for cold and for heat. The group that practiced meditation also reported that compared to the relaxation group it had a lower pain intensity in terms of thermal pain, but there was no difference or only tendencies in intensity for cold pain. That means that the participants of both groups perceived the heat as well as the cold stimulus almost equally as quickly, showed an approximately equal pain threshold for cold as well as for heat and evaluated these stimuli as equally painful and stressful; however, the use of the religious/spiritual meditation technique seemed to have a higher tolerance or endurance towards a cold-induced pain and also seemed to develop a lower sensitivity to the widespread pain index for heat (Sollgruber et al., 2018). The meditation group, therefore, did not change its sensitivity to heat or cold – how quickly they perceive a change in temperature – and not to pain either – from when they felt a stimulus as being painful; it seems that subjective perception is not changed by the use of a meditation technique, but only its evaluation and the coping with this pain and consequently how well they tolerated this level of pain (Sollgruber et al., 2018). This altered state does not seem to be a dissociation in which the participant reduces the focus on the body in order to withstand the discomfort for a longer time as this would also be accompanied by a changed sensitivity or changed cold and heat detection thresholds; rather, this seems to be a changed process of consciousness, which makes it possible for people to evaluate adverse conditions differently, consequently being able to cope with or tolerate them better and, as a result, withstand the discomfort for a longer duration of time (Sollgruber et al., 2018).

Thus, the differences between the groups do not lie in the lower sensitivity with regard to sensory pain perception but in the difference in the cognitive and emotional processing of

pain, which is therefore accompanied by a low sensitivity to the affective and sensory dimensions of pain (Sollgruber et al., 2018). This means that the data suggests that meditation leads to a psychic or cognitive process of re-evaluation, which consequently changes the evaluation of pain and thus the pain tolerance (Sollgruber et al., 2018).

Similar to other studies which researched the effects of spiritual practices on experimentally-induced pain, the practice of religious/spiritual meditation in this study did not change the pain intensity with regard to cold pain (Keefe et al. 2001; Wachholtz & Pargament 2005, Sollgruber et al., 2018); however, the meditation had an effect on how well the subjects tolerated the pain level for cold and how intense they evaluated a heat pain (Sollgruber et al., 2018). Thus, there seems to be a qualitative difference in the evaluation of pain intensity (based on the valuation on the widespread pain index) with regard to a strength of cold and heat pain. A religious/spiritual meditation did not, however, have any influence on the pressure pain threshold or deep pain and on the descending pain processing (Sollgruber, Bornemann-Cimenti, Szilagyi et al. 2018).

Though differences in pain tolerance between the groups did arise, the expected corresponding heart rate reactivity to the pain did not appear between the groups. Significant differences in the expected progression of events occurred with respect to the timing: The heart rate increased during the cold pressor test 1, then decreased compared to the baseline while the participants were practicing their respective techniques, increased again during the cold pressor test 2, decreasing once more as expected after the cold pressor test 2. These findings are in line with the subjectively experienced stress, which was perceived almost equally in both groups (Sollgruber et al., 2018). Further in-depth data analyses showed no statistically significant correlation between the heart rate and pain tolerance or the lower widespread pain index for heat for experimentally induced pain. Thus, statistically significant group differences could be found neither with regard to subjectively experienced stress (VAS) nor on the basis of objective data (heart rate). This suggests that the existing differences in pain tolerance and pain intensity are to be found in the altered state of consciousness and the resulting cognitive emotional assessments and not in the different stress levels of the groups.

It therefore seems that meditation is accompanied by a shift in perspective, which in turn requires self-regulation, self-management, and cognitive and emotional behavioral flexibility. This shift enables the person practicing the meditation to re-frame negative cognitive and emotional assessments in the sense of a re-evaluation into positive assessments.

It seems that the state cultivated and developed through meditation used in the present paper is accompanied by special qualities of attention and consciousness. In this state of consciousness, there is a profound shift in the relationship to thoughts and emotions (Bear, 2003, Sollgruber et al., 2018).

Bishop et al. (2004) assigned this state of consciousness of mindfulness to two components. The first component includes self-regulation of attention so that it is aligned with the immediate experience, enabling an increased perception of mental events in the present. The second component includes the assumption of a certain attitude towards the experiences made in the present moment – an attitude marked by curiosity, openness, and acceptance. This means that this attitude of accepting the experience is not a passive, resigned attitude towards the present circumstance but rather an inviting experience that one encounters openly and which – even if difficult – is not seen as a problem but rather as a challenge. This, in turn enables people to evaluate adverse conditions differently, in the sense of a decentered attitude from a meta-level, and consequently to cope with or tolerate the experience better.

Meditation thus offers a method for changing pain tolerance and pain intensity (for heat) (Sollgruber et al., 2018). It seems that this method results in a remarkable pain reduction in people with relatively little effort, regardless of the participants' degree of religiosity or spirituality.

4.2 Religious/Spiritual Well-Being and Meditation

Essential discoveries were brought by the findings concerning effectiveness of the meditation with religious/spiritual content with regard to religious/spiritual well-being. In the manipulation check, the meditation group reported a relevant difference in the subjectively experienced spirituality (Sollgruber et al., 2018). During the 20-minute meditation, the group said they experienced themselves in a more intense spiritual way and reported more spiritual experiences than the relaxation group. In addition, the group reported an increased sense of community and connectedness in the sense of a religious/spiritual connection to God or the Divine as well as to nature and fellow human beings. A closer analysis of the data revealed an increase in positive feelings such as optimism, hope, security, contentment, peace, mercy, and confidence in finding support in God or the Divine (Sollgruber et al., 2018). The people in the group were able to forgive others more easily and were themselves more merciful and peaceful (Sollgruber, Bornemann-Cimenti, Szilagyi et al. 2018).

Furthermore, they reported a heightened feeling of transcendence and an overall improvement in their religious/spiritual well-being. More coping resources were therefore at their disposal. The meditation of the current study could thus strengthen the connection by allowing people to concentrate on the positive aspects of their relationship with God or the

Divine in the sense of transcendence. However, it could not only strengthen the relationship with God or the Divine but also the feelings of unity and spiritual networking with the persons close by. This is also likely to be crucial for the quality of the experience and the action. A more detailed analysis of the data showed that the more positive the feelings toward God or the Divine are and the stronger the feeling of transcendence or the stronger the feeling of a spiritual connection with other people is perceived, the lower the subjectively felt pain is.

It seems that meditation is accompanied by a shift in perspective, which in turn requires self-regulation, self-management, and cognitive and emotional behavioral flexibility. This shift enables the person practicing the meditation to re-frame negative cognitive and emotional assessments in the sense of a re-evaluation into positive assessments.

In previous studies, spiritual meditation already correlated with feelings of spiritual support, spiritual connection, peace, quiet (cf. Alexander et al. 1991; Carlson et al. 1988), optimism, and decreased anxiety and led to an improved mood. A more positive mood is associated with reduced sensitivity to pain and a higher ability to cushion the resulting negative consequences (Wachholtz & Pargament 2008).

Meditation can therefore influence a number of different areas that have an impact on pain sensation and pain tolerance, or are associated with a low sensitivity with regard to the affective and sensory dimensions of pain (Sollgruber et al., 2018). This suggests that the physiological advantages of meditation lie in the qualitative experience or in the qualitative difference (Sollgruber et al., 2018).

4.3 Connection of Religiosity/Spirituality and Pain

It seems as if the quality of religiosity or spirituality has a significant influence on the experience of pain in general as well as on the subjectively experienced stress and consequently on the affective and sensory dimensions of pain. Thus, a higher connection of the persons to an ecclesial dogmatic community of faith goes hand in hand with a lower threshold of pain for cold, and the more the persons feel that they are being abandoned or punished, the lower the threshold of pain for cold after an intervention (regardless of the intervention) is. Thus, the pressure pain threshold is also connected to a negative dogmatic and punishing image of God.

A passive image of God, and the more people feel abandoned or punished, the higher the pressure pain threshold in the test after an intervention. A disastrous world view, a quarrel with God or the Divine, as well as having the feeling of being punished or tested by

God or the Divine goes hand in hand with a higher degree of experienced stress. Hence, negative religious coping goes hand in hand with a higher subjectively experienced stress. The more positive the feelings toward God or the Divine are and the stronger the feeling of transcendence or the stronger the feeling of a spiritual connection with other people is perceived, the lower the subjectively felt pain is, however.

Ang, Kroenke and McHorney (2006) were able to show in their study that the severity of pain is more closely connected to the psychological and physical well-being than localization of the pain is. The data in the present study shows that higher religious/spiritual well-being and thus more religious spiritual coping resources of the research participants as well as a safer and more trusting relationship with God or the Divine, i.e., positive religious coping, positive feelings such as satisfaction, security, optimism, hope, mercy, and finding support in God or the Divine, thus trust in His/Its help, a feeling of transcendence, of being a part of something larger than oneself are linked to a higher pain tolerance in general. In particular, the stronger the feeling of transcendence is perceived – a spiritual connection with God or the Divine, fellow human beings, and nature –, the higher the pain tolerance of the person.

It seems that through the power of faith, the ability to cope with pain is improved. Through resource activation, the patient is supported in his/her ability to accept pain, thus influencing the pain assessment and consequently the handling of the pain. The more spiritual coping resources are at a person's disposal, the safer and more trusting the relationship with God or the Divine is, the stronger the feeling of contentment, security and trust in His/Its help is, and the stronger the feeling of transcendence and the feeling of being spiritually connected to fellow human beings and nature is perceived, and the higher the willingness of the persons is to forgive and to wish their enemies well, then the lower the pain intensity for heat pain is.

A further essential finding of the study is that the quality of faith has a substantial influence on the perception of pain and also on the handling of it. Ergo, above all, spirituality and its central role in the life of the research participants is connected to a lower pain intensity for heat or the widespread pain index for heat after an intervention. Consequently, a more strongly perceived spirituality as well as a stronger belief that there is a greater meaning to be found and a higher spiritual well-being is accompanied by a lower pain intensity for heat or the widespread pain index for heat after an intervention. Furthermore, the more religious/spiritual coping resources are available to the persons, i.e., the higher their religious/spiritual well-being is and the more optimistic and confident they are about the future, the greater the subjective relaxation.

Spiritual persons, whose spirituality plays a central role in their lives and has a positive connotation, thereby have this available to them as a dispositional coping resources, thus feel more spiritual.

The data suggests that a meditation supports the development of optimism and confidence and has an influence on the assessment process of religious and spiritual belief systems. People can thus view potentially stressful situations not as a threat to personal identity but as an opportunity for spiritual growth and learning or as part of a larger divine plan.

These findings seem to indicate that patients with a positive image of God or the Divine are more likely to evaluate their pain differently and withstand painful conditions for longer. Contrary to a previous study by Dezutter et al. (2011), which showed using 202 patients with chronic pain that prayer is positively connected to pain tolerance and that the relationship between prayer and pain tolerance depends on the religiosity of the pain patients (believers versus non-believers), the change in pain tolerance and pain intensity in the current study did not depend on the religiosity or spirituality of the research participants but is related to the effect of meditation (based on regression). The results suggest that the meditation technique can act as a support in the area of pain management for both religious/spiritual and non-religious/non-spiritual persons. The data suggests that religiosity or spirituality does not already have to be present as a major central or integral component in their value system in order to be effective.

4.4 Constraints and Future Directions

Although the 20-minute guided meditation influenced pain tolerance and pain intensity in the expected direction, this study nevertheless shows some limitations.

As this is a kind of pilot study, the population of participants consisted of a healthy population and, due to the completion of the study, there is a lack of follow-up data as well as data from pain patients. While the current study provided promising results after only 20 minutes of guided meditation, it leaves open the question of whether these benefits would be maintained in the long term or whether these effects could also be found in pain patients. Future studies should focus on pain patients and/or follow-up data to investigate the duration of the effectiveness of the effects (Sollgruber et al., 2018).

Often, spirituality is defined as the experience of transcendence, of connection, and of the meaning of life, integrating the search for the sacred. These definitions mirror a construction of spirituality which is individualized and not necessarily associated with traditional religion. Such secularization of spirituality is an expression of a growing tendency in western societies to retain some aspects of religiosity such as transcendence, while rejecting the institutional

and doctrinal aspects of organized religion (Pargament & Raiya, 2007). According to Pargament (1999), religiosity and spirituality often overlap in content, which is why they should be examined in relation to each other but also as independent concepts. The present study tried to examine the relationship between objective data and subjective experiences and religious as well as spiritual variables in order to gain an insight into the thoughts and feelings of the participants during the different conditions and interventions and consequently into the ongoing internal processes. However, a more detailed analysis and a distinction between religiosity and spirituality is required (Sollgruber et al., 2018). These two terms are often used interchangeably (Kennedy, 2004) and often no clear distinction is made between them (Hood et al., 2009). People use the same terms for different meanings. Consequently, a more precise survey of the subjectively experienced experiences of religiosity, spirituality, pain, and relaxation (Sollgruber et al., 2018), e.g., by means of short standardized interviews, is to be recommended as well as a distinguishing of subjectively experienced religiosity and subjectively experienced spirituality in the visual analog scales in the manipulation check is to be distinguished. Furthermore, a qualitative survey of the meditation technique and the mantras used would be useful. For meditation is not only an intervention but also a kind of art and can stand in contrast to the different religious spiritual convictions of the individual, which can then also have a negative effect on the sensations and the perception or thoughts and feelings of the practitioners. The participants of the present study were mainly Roman Catholic, only a small number had a different denomination. The concept of love in the mantra used is an essential part of the Christian faith. That is why subsequent studies should also concentrate on the effectiveness of the used meditation on different religious affiliations.

Different approaches would make more complex path analyses possible that would help deepen our understanding of the relationship between meditation (Sollgruber et al., 2018), stress, and their connection to pain and how to process it.

4.5 Conclusion

The present study showed that the meditation group was able to develop a higher pain tolerance in the cold pressor test as well as a lower pain sensation or a lower intensity of heat pain (Sollgruber et al., 2018) for an experimentally induced pain compared to the relaxation group in a 20-minute meditation.

Additionally, the subjects developed better religious spiritual well-being in these 20 minutes, used more positive religious coping resources, had more religious spiritual coping

resources at their disposal, were able to forgive others more easily, and were more optimistic and confident about their future. They felt connected to God or the Divine and felt closer to other people and nature and were more positive towards God or the Divine.

According to earlier studies, religiosity and spirituality are relevant for psychological and physical parameters of health and illnesses. Religiosity and spirituality alone, however, are not necessarily a positive factor. It can also be interpreted as a punishment of God or repentance for a past "sinful life." The result is a feeling of "being at His/Its mercy," a passive, dependent attitude, which is accompanied by negative, passive coping strategies and thus leads to a reduced effort to relieve pain (Koenig et al. 2012).

In a survey conducted by Appel et al. (2010), it could be shown, however, that especially in the group of pain patients the proportion of negative coping is significantly higher than in breast cancer patients. Thus, the quality of religiosity or spirituality should certainly be taken into account in the treatment of pain patients in order to determine whether this is a resource for the patient or a source of anxiety and distress. Furthermore, the promotion of false hope for a miracle cure or the implementation of guilt can lead to disappointment and further depression, often accompanied by a worsening of the pain (Koenig et al., 2012). In order to fully understand pain patients and their quality of experience, mental processes should be addressed (Murken, 2010). Thus, possible internal conflicts, negative beliefs as well as negative images (of God) may be found, and the integration of alternative values or positive beliefs could potentially be promoted.

According to a study conducted by Breivik et al. (2006), one in five of the 4,839 participants with chronic pain that were questioned stated that they had lost their job because of pain. Approximately a third of the persons that were not retired said that their current employment status or their work hours were influenced by pain.

The effect that pain has on the ability to work has effects on the economy and on society. Just as the costs are related to the loss of productivity due to working hours and reduced work efficiency, there are also the costs of losing skills when people are forced to reduce their hours or stop working altogether (Blyth et al. 2003).

Moreover, it is known that social compensation, retirement pensions, and other so-called indirect costs represent a burden on the economy that is much higher than the direct costs of health care (Jensen et al. 2004).

In the course of dealing with an illness, patients question their own possibilities and try to change their habits. Researchers of the biopsychosocial model have conducted many studies in order to understand pain and to discover coping strategies that can be used to reduce or tolerate pain and increase the quality of life. It seems that a 20-minute meditation brings about profound effects for this short amount of time (Sollgruber et al.,

2018). Meditation thus offers a recognized and validated method for changes in pain tolerance and pain intensity (for heat) (Sollgruber et al., 2018). The results suggest that this meditation, regardless of whether religiosity or spirituality already exists as an integral component in the value system of the persons, can function with little effort in the area of pain management and moreover has a positive effect on religious/spiritual well-being (Sollgruber et al., 2018). Consequently, improved pain tolerance, reduced pain sensation, and increased religious/spiritual coping resources would help people in continuing their daily activities (Sollgruber et al., 2018). This would also benefit their mental health and quality of life. Meditation can therefore influence a number of different areas that have an impact on pain sensation and pain tolerance, i.e., are accompanied by a low sensitivity with regard to the affective and sensory dimensions of pain (Sollgruber et al., 2018). The information obtained from this study suggests that meditation can promote both physical and psychological religious/spiritual health (Sollgruber et al., 2018). Further studies are required, however, to determine whether meditation includes similar implications for patients suffering from pain (Sollgruber et al., 2018).

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6 Appendix

6.1 Instruction for relaxation

You now have 20 minutes to relax with your eyes closed. Please take a position that allows you to sit comfortably and relaxed for 20 minutes. During the relaxation you will be played an empty tape and at the end of these 20 minutes you will hear the words "Please end your relaxation session now, open your eyes and turn your attention outwards again". This is the indication that the "time is up".

Please open your eyes again and wait for the next instruction.

It is essential that you do not sleep during this 20 minutes relaxation time or think about stressful things, but turn your attention to this relaxation exercise. If, however, you notice that you have become distracted, don't worry; just focus on the relaxation again and continue to do so.

If you have any questions or anything is unclear, please ask your questions now.

When everything is clear and you are ready, please take your comfortable, relaxed position, close your eyes and start to relax.

6.2 Instruction for meditation

Now you have 20 minutes to relax with your eyes closed and to turn to meditation. In this, different spiritual techniques are used. Spiritual can, but does not have to be understood in the Christian denominational sense. If you find the term „divine“ or „sacred“ unsuitable, you can replace it with Higher Power, Allah, JHWH, Tao, Brahman, Prajna, All-One, Great Power, Everything, Source, or whatever you conceive it to be.

For the meditation, please take a sitting position which allows you to sit comfortably and relaxed for 20 minutes. This meditation will be played to you by means of a tape and at the end of these 20 minutes you will hear the words "Please end your meditation now, open your eyes and turn your attention outwards again". This is the indication that the time is up. Please open your eyes again and wait for the next instruction.

It is essential that you do not sleep while meditating or think about stressful things, but focus on this meditation. If, however, you notice that you have become distracted, don't worry; just concentrate on the meditation again and continue to do so.

If you have any questions or anything is unclear, please ask your questions now.

When everything is clear and you are ready, please take your comfortable, relaxed position, close your eyes, focus on your breathing and start to relax.