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Emotional Regulation Through Mindfulness: Links to Health Behavior and the Role of Distressed (Type D) Personality

Regulação emocional através do Mindfulness: Ligações com comportamentos de saúde e o papel da Personalidade (Tipo D)

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REVIEW

Abstract

Emotional (dys) regulation is central to many forms of psychopathology and psychosomatic diseases. Little is known about the factors underlying individual differences in emotion regulation. It is plausible that both genetic (including stable personality factors) and environmental/socio-cultural influences determine one's emotion regulation. Type D ("distressed") personality, the combination of negative affectivity and social inhibition, has been associated with adverse health outcomes. Type D individuals have the tendency to experience negative emotions across time and situations but inhibit the expression of emotions and behavior because of fear of rejection or disapproval, which has proved to be unhealthy in the long term. Mindfulness as a form of emotion regulation is, in many ways, distant to the framing of emotion regulation in conventional scientific literature. With the growing evidence that mindfulness training can help people moderate distressing emotions and enhance positive affect, there is a need to clarify the mechanisms through which these effects occur, as well as their impact on health behaviors. Recent research outcomes indicate that mindfulness stress reduction training may not only affect psychological states, but also psychological trait characteristics, which in turn are relevant for one's health.Considering that health behaviors reflect a person's health beliefs, could mindful living actually be a continuous health promoter? This paper intends to offer an extended literature review on emotional regulation and mindfulness, focusing on the role of 'distressed' personality in a more general health promotion and behavioral change framework.

Keywords: emotion regulation, mindfulness, health behavior, type D personality.

Resumo

A (des) regulação emocional é prevalente em muitas formas de psicopatologia e doenças psicossomáticas. Pouco se sabe sobre os fatores subjacentes às diferenças individuais na regulação das emoções. É plausível que tanto a genética (incluindo fatores estáveis da personalidade) como fatores ambientais/socioculturais, determinem a própria regulação das emoções. A personalidade tipo D, correspondente à combinação de afetividade negativa e inibição social, tem sido associada a resultados adversos para a saúde. Indivíduos tipo D têm uma tendência para vivenciar emoções negativas ao longo do tempo e situações, mas inibindo a expressão de emoções e comportamentos devido ao medo da rejeição ou desaprovação, o que se provou como sendo prejudicial a longo prazo. O *mindfulness* como uma forma de regulação emocional é, em muitos aspectos, distante do enquadramento da regulação emocional na literatura científica convencional. Com a crescente evidência de que o treino em *mindfulness* pode ajudar pessoas a moderarem as emoções angustiantes assim como a melhorarem o afeto positivo, existe uma necessidade de esclarecer os mecanismos pelos quais estes efeitos ocorrem, bem como o seu impacto sobre os comportamentos de saúde. Resultados de investigações recentes indicam que o treino de redução de stress baseado no*mindfulness* pode não só afetar estados psicológicos, mas também características/traços psicológicos, que por sua vez são relevantes para a saúde. Considerando que os comportamentos de saúde refletem as crenças de saúde de uma pessoa, será que viver em plena consciência (de forma *mindful*) pode, na verdade, ser um promotor contínuo da saúde? Este trabalho pretende oferecer uma extensa revisão da literatura sobre a regulação emocional e *mindfulness*, focando o papel da personalidade tipo D num quadro de mudança comportamental e de promoção geral da saúde.

Palavras-Chave: regulação emocional, mindfulness, comportamentos de saúde, personalidade tipo D.

Introduction

Emotions and Emotional (Dys) Regulation

Contemporary emotion theories highlight the importance of emotions in reading behavioral, motor, and physiological responses, in facilitating decision making, in improving memory for important events, and in negotiating interpersonal interactions (Gross & Thompson, 2007). In a functionalist approach, they can be adaptive responses to the problems and opportunities that people face (Levenson, 1994). However, emotions aren't always helpful. They can hurt us as well as help us (Parrott, 1993). They are not adaptive when they are of the wrong type, when they come at the wrong time, or when they occur at the wrong intensity level. At times such as these, it may be useful to try to regulate our emotions (Werner & Gross, 2010).

Emotion regulation refers to the process of modulating one or more aspects of an emotional experience or response (Campos & Sternberg, 1981; Gross, 1998). An adaptive emotion regulation is assumed to be intrinsic to mental health and adaptive functioning generally (Gross & Munoz, 1995). The construct is assumed to refer to both subjective experience and emotion-related behavioral responses (Feldman-Barrett & Gross, 2001; Mauss, Evers, Wilhelm, & Gross, 2006), and concomitant changes in physiological, behavioral, and cognitive processes (Bridges, Denham, & Ganiban, 2004). It also refers to bottom-up (e.g. perceptual) processes such as appraisal, and top-down (e.g. cognitive) processes like working memory and volitional control of attention(Chiesa, Serretti, & Jakobsen, 2013). Emotion regulation also has an interpersonal element, extending to processes such as social interaction. For instance, strategies appear transferable between people, for instance between

mother and child (Cole, Martin, & Dennis, 2004).

Within the scope of this paper, only the concept of 'emotion regulation' was considered, considering that under the broader term of 'affect regulation' we can also find other regulatory processes, such as 'mood regulation' and 'self-regulation'(Jimenez, Niles, & Park, 2010). Briefly, emotion regulation corresponds to efforts to alter short-lived emotions as they arise while mood regulation refers to efforts to alter emotional experience of longer duration and more diffused quality (Gross, 1998). In turn, self-regulation refers to efforts to reduce discrepancies between one's current state or self-schema and a desired state by relying on feedback to alter thoughts, feelings and behavior (Baumeister & Heatherton, 1996; Carver & Scheier, 1996).

In recent years, scholars in the emerging field of emotion regulation have taken up the issue of how emotions may be altered or influenced. Typically, their focus has been on individuals and on interpersonal relations (Gross, 2007). This approach is grounded in previous work on psychological defenses (Freud, 1959), stress and coping (Lazarus, 1966), attachment (Bowlby, 1969), and self-regulation (Mischel, Shoda, & Rodriguez, 1989). At the individual level, emotion regulation refers to processes that are engaged when individuals try to influence the type or amount of emotion they (or others) experience, when they (or others) have them, and how they (or others) experience and express these emotions (Gross, 1998). Emotion regulation may be automatic or controlled, conscious or unconscious, and may have its effects at one or more points in the emotion generative process. Emotion regulation may change the degree to which emotion response components cohere as the emotion unfolds, such as when large changes in emotion experience and physiological responding occur in the

absence of facial behavior (Gross & Thompson, 2007).

Generally, it is well established that adaptive emotion regulation strategies (e.g., acceptance, problem solving, reappraisal) show weaker associations with psychopathology than maladaptive strategies (e.g., avoidance, self-criticism, hiding expression, suppression of experience, worry, rumination) (Aldao & Nolen-Hoeksema, 2012). Numerous psychological disorders, including psychosomatic diseases, are associated with affective instability and emotion dysregulation (Koenigsberg *et al*., 2010; Phillips, Drevets, Rauch, & Lane, 2003; Subic-Wrana, 2011; Werner & Gross, 2010). For example, there is an emerging consensus linking emotional dysregulation especially with depression and anxiety disorders (Aldao, Nolen-Hoeksema, & Schweizer, 2010). Increasingly, many other disorders are also being conceptualized and investigated from an emotion regulation perspective(Rottenberg & Gross, 2007). Aldao and Nolen-Hoeksema(2012) showed that a flexible implementation of adaptive strategies, such as acceptance and problem solving, in line with contextual demands, is associated with better mental health.Maladaptive emotion regulation strategies (such as avoidance)can promote greater distraction, suppression of thoughts or emotions, or social inhibition. It is also associated with increased distress (Mennin, Holaway, Fresco, Moore, & Heimberg, 2007; Moore, Zoellner, & Mollenholt, 2008). As mentioned, in general terms, maladaptive emotion regulation may arouse a psychological disorder, promoting higherdepression and anxiety,an issue that will be explored below.

Emotions and Type D Personality

Little is known about the factors underlying individual differences in emotion regulation. It is plausible that both genetic (including stable personality

factors) and environmental/socio-cultural influences determine one's emotion regulation (Maas, Laan, & Vingerhoets, 2011). According to Denollet(2005), maladaptive emotion regulation is present in individuals with Type D personality. This type of personality (also known as 'distressed personality'), associated with adverse health outcomes, describes individuals who simultaneously experience high levels of negative affectivity and social inhibition (Denollet, 2005). They also show an altered activation pattern in brain areas important for emotion perception (Kret, Sinke, & de Gelder, 2011).

Type D individuals are therefore characterized byhaving atendency to experience negative emotions across time and situations, paired with the inhibition of the expression of emotions and behavior (in social interactions) because of fear of rejection or disapproval. Although first Type D has been deemed as simply another measure of negative affect (Lesperance & Frasure-Smith, 1996), it is more than that as it also includes a way in which people deal with this negative affect (Denollet *et al*., 2006).This propensity has proved to be unhealthy in the long term. Strong evidence from a number of patient groups (Aquarius, Denollet, Hamming, & De Vries, 2005; Denollet, 2005; Schiffer *et al*., 2005) indicates that Type D is associated with increased psychological distress, including symptoms of depression and social alienation (Denollet, Sys, & Brutsaert, 1995; Pedersen, Van Domburg, Theuns, Jordaens, & Erdman, 2004), anger (Denollet & Brutsaert, 1998), anxiety (Pedersen, Van Domburg, *et al*., 2004), vital exhaustion (Pedersen & Middel, 2001), poorer quality of life (Al-Ruzzeh *et al*., 2005; Schiffer *et al*., 2005), and adverse clinical outcomes, including an elevated risk of rehospitalization, reinfarction, and mortality in cardiac patients (Denollet & Brutsaert, 1998; Denollet *et al*., 1996; Denollet, Vaes, &

Brutsaert, 2000; Pedersen, Lemos, *et al*., 2004).

According to Messerli-Bürgyand colleagues (2012), maladaptive emotion regulation and Type D personality, share similarities. The authors found a strong association between the two constructs, and showed that depressed mood and stress perception predictedhaving Type D personality independently. These data support Denolletand colleagues (1995) formulation of a generally higher stress perception in Type D personality, specially perceived distress in social interactions. Literature supports that these individuals tend to suppress the expression of emotions in social interactions. This suppression of threatening information and a tendency to keep unpleasant experiences out of one's mind may come at a cost. This might result in general emotional arousal, higher irritability and physiological hyper-reactivity to emotional stressors (Denollet, 1991). This may have adverse health consequences, up to an elevated risk of cardiac infarction and other cardiac events (Denollet, Gidron, Vrints, & Conraads, 2010). These consequences resemble those of maladaptive emotion regulation (Messerli-Bürgy *et al*., 2012), because it includes strategies to avoid, distort and escape from reality, as well as to over-control emotions. These processes are deemed to be inefficient and maladaptive coping strategies. Experimental research has shown that overcontrol or suppression of emotions in general results in increased physiological stress responses (Gross & Levenson, 1997; Levenson, 1994; Richards & Gross, 2000).

Although Type D has mainly been studied in cardiovascular patients, evidence is now emerging that Type D is also a vulnerability factor for decreased physical and mental health, and poor self-management in a wide variety of non-cardiovascular patient populations (Mols & Denollet, 2010a; Mols & Denollet, 2010b). Even though the Type D construct has been criticized as not providing an

obvious opportunity for treatment strategies (Lesperance & Frasure-Smith, 1996) - due to the fact that personality is generally considered to be stable across time and situations – Type D is associated with health-related behaviors, which may provide a clear target for interventions, as health behaviors are potentially modifiable (Williams *et al*., 2008).

Emotions, Type D, and Health Behavior

The study of emotions and health has undergone significant development in the last decades. Research was initially concerned with the influence of physiological reactions to outside aversive events (Selye, 1951), and subsequently with the influence of experienced negative emotions on the body's ability to fight infections (Cohen & Wills, 1985). More recently, Leventhal and Patrick-Miller (2000) have argued that emotions can be indicators of health. Such relationships usually assume a direct pathway between health and emotions. However, it is also plausible to envision indirect influences between emotions and health; for example, those in which emotions influence health behaviors, which in turn might influence health states. Traditional health behavior theories, such as the *health belief model* or the *theory of planned behavior* (Ajzen, 1985), have not been concerned with the influence of emotional states on health behavior. Such theories stand in contrast to a self-regulation perspective, as elaborated in the *parallel-processing model* (Leventhal, 1970) or the *cognitive-social health information processing* framework (Miller, Shoda, & Hurley, 1996). In both of these latter approaches, emotional states are given equal weight to the cognitive processing of a health threat. Still, the specific roles of emotions in health cognitions and health behavior have not as yet been well described, compared to the body of literature concerning the influence of health-related beliefs and illness representations on behavior (Lau &

Hartman, 1983; Meyer, Leventhal, & Gutmann, 1985). Within the scope of the present paper, only the possible roles that emotions may play in health behaviors will be addressed.

There are severalstudies providing evidence that emotionally distressed individuals are more likely to engage in maladaptive health behaviors, such as smoking, not practicing exercise, or having an unhealthy diet (Slaven-Lee, Padden, Andrews, & Fitzpatrick, 2011).Thus, these behaviors could represent one important mediator of the relationship between emotion, emotion regulation, Type D (distressed) personality and ill health(Williams *et al.*, 2008). For example, Pedersen and colleagues (2004) found a relationship between Type D status and smoking in their study with coronary heart disease patients. Type D individuals were more likely to smoke compared with non-Type-D individuals (37% vs. 29%). In addition, it is known that socially inhibited individuals are less likely to engage in health-promoting behavior(Kirkcaldy, Shephard, & Siefen, 2002). Williamsand colleagues (2008) examined the associations between Type D and health-related behaviors in a healthy sample, and found that Type D individuals show poorer health behaviors (e.g., eating a balanced diet, practicing regular exercise, getting regular medical checkups). Mommersteeg, Kupper, and Denollet (2010) investigated the associations between Type D, self-reported metabolic syndrome, and health behaviors (including smoking, alcohol use, exercise and dietary habits) in a healthy community sample. Broadly, the authors found that Type D was associated with metabolic syndrome and less healthy behaviors. In a more specific study, Borkoles, Polman, and Levy (2010) examined the association between Type D and exerciseprevalence among men. They found that Type D individualswere more sedentary and less active.With cardiac patients, recent studies demonstrated that Type Dindividuals were less likely to

adhere to theirmedication (Williams, O'Connor, Grubb, & O'Carroll, 2011a), and that they possessed a less favorable profile of illness beliefs (Williams, O'Connor, Grubb, & O'Carroll, 2011b). These latter results shed some light on why Type D individuals engage in less health-promoting behaviors.

Establishing a clearer relationship between Type D personality and health behavior is fundamental, since it could explain a possible mechanism between Type D and illnesses, but it also suggests that Type D is a risk factor for poor health in general (Gilmour & Williams, 2011; Williams *et al*., 2008).Considering the high prevalence of Type D personality in the general population (about 20-25%) (Denollet, 2005), and the associated health risks (e.g., a significant predictor of death in cardiac patients), it is highly important to explore possibilities for psychological interventions and behavior change.

Mindfulness as an Emotion Regulation Strategy

The concept of mindfulness has enticed various domains, such as basic emotion research, clinical science, and neurosciences (Goldin & Gross, 2010). Mindfulness is commonly defined as a kind of awareness that emerges through paying attention on purpose, in the present moment, and non-judgmentally to the unfolding of experience moment to moment (Kabat-Zinn, 2003). Bishop and colleagues (2004) proposed a more operational definition for researchers that emphasizes the regulation of attention and one's orientation to experience. In a parsimonious attempt, Feldman, Hayes, Kumar, Greeson, and Laurenceau (2007) report that common to these definitions are four components: 1) the ability to regulate attention, 2) an orientation to present or immediate experience, 3) awareness of experience, and 4) an attitude of acceptance or nonjudgment towards experience.

Assuch, mindfulness is disputed whether it is or is not a form of emotional regulation, because mindfulness is, in many ways, distant to the framing of emotion regulation in conventional scientific literature. In fact, the act of watching one's experience including emotions with equanimity rather than attempting to alter or control it is central to mindfulness (Nyklíček, 2011; Shapiro, Carlson, Astin, & Freedman, 2006). Literature suggests that a fundamental benefit of mindfulness training is that it promotes the ability to disengage from emotionally provocative material, freeing individuals to refocus their attention on other aspects of experience (Corcoran, Farb, Anderson, & Segal, 2011). Nevertheless, mindfulness is increasingly being conceptualized in terms of its regulatory capacity (Baer, 2003; Shapiro *et al*., 2006), as mindfulness does decrease negative emotions, such as feelings of anxiety and depression (Fjorback, Arendt, Ornbol, Fink, & Walach, 2011; Hofmann, Sawyer, Witt, & Oh, 2010). In addition, emotion regulation, along with nonattachment and rumination, was found to mediate the effects of mindfulness on decreasing psychological distress (Coffey & Hartman, 2008).

There are many apparent connections between mindfulness and emotion regulation. However, awareness of and attention for emotions, as assessed in emotion regulation scales,is often not related with reduced clinical problems or increased well-being, possibly because emotional awareness associated with critical judgment, lack of clarity, or difficulties regulating is in fact detrimental (Lischetzke & Eid, 2003). This suggests that it may be the quality of emotional awareness that is clinically relevant, particularly the mindfulness-related accepting/compassionate awareness (Bishop *et al*., 2004). Hayes and Feldman (2004) describe the ways that mindfulness practice may enhance emotion regulation abilities, by decreasing both

overengagement (e.g., rumination and entanglement) and underengagement (e.g., avoidance) with emotions and facilitating healthy, adaptive engagement that promotes clarity and functional use of emotional responses. Correlational research supports an association between mindfulness and reduced emotion regulation difficulties (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006; Hayes & Feldman, 2004). Thus, it is conceivable that aspects of mindfulness and emotion regulation difficulties account for shared variance inpsychological symptom severity (Roemer *et al*., 2009).

Recent studies indeed show a significant relationship between self-reported mindfulness and fewer difficulties in emotion regulation strategies (Feldman *et al*., 2007; Hill & Updegraff, 2012; Roemer *et al*., 2009). Mindfulness meditation practice has been shown to facilitate attentional self-regulation and emotional regulation (Kabat-Zinn, 1994). Recognizing the benefits of mindfulness, different intervention formats has emerged (Shonin, Van Gordon, & Griffiths, 2013). However, the most studied interventionis the Mindfulness-Based Stress Reduction (MBSR), a structured group program of mindfulness training developed by Kabat-Zinn (1990). There is also an increasing interest in mindfulness-based practices in the context of clinical interventions for anxiety and depression disorders, as well as other clinical problems (Allen, Chambers, & Knight, 2006; Carmody, 2009).

Goldin and Gross (2010) suggested that an emotion regulation framework (Gross, 2007) may help clarify the processes that underlie MBSR, which may be distinct from those implicated in other more traditional modalities such as cognitive-behavioral therapy. Although the MBSR does not include any explicit instruction for changing the nature of thinking, or emotional reactivity, it has been shown to diminish the habitual tendency to emotionally react to and

ruminateabout transitory thoughts and physical sensations (Ramel, Goldin, Carmona, & McQuaid, 2004; Teasdale *et al*., 2000), reducestress, depression, and anxiety symptoms (Chiesa & Serretti, 2009; Evans *et al*., 2008; Segal, Williams, & Teasdale, 2002)(seeFjorback *et al*.(Fjorback *et al*., 2011) for a recent systematic), modify distorted patterns of self-view (Goldin, Ramel, & Gross, 2009), and enhance behavioral self-regulation (Lykins & Baer, 2009).

Chambers, Gullone, and Allen (2009), in a review argue that MBSR may reduce symptoms of stress, anxiety, and depression by modifying emotion regulation abilities. However, it is not yet clear which specific abilities may be enhanced by MBSR (Nyklíček, 2011). This is because emotion regulation refers to a variety of strategies that can be implemented at different points during the emotion-generative process to influence which emotions arise, when and how long they occur, and how these emotions are experienced and expressed(Gross, 2007). Considering Gross's (1998) model of emotion regulation, there are five families of emotion regulation strategies, including situation selection, situation modification, attentional deployment, cognitive change, and response modulation. There is evidence that MBSR and long-term mindfulness meditation practice may especially directly influence attentional deployment (Goldin *et al*., 2009; Jha, Krompinger, & Baime, 2007; Ramel *et al*., 2004; Slagter, Lutz, Greischar, Nieuwenhuis, & Davidson, 2009). Although Lutz, Slagter, Dunne, and Davidson (2008) proposed that such mindfulness training might improve the capacity to disengage from aversive emotional stimuli, thus enabling greater emotional flexibility, the putative effects of mindfulness on emotional reactivity and attentional deployment require more empirical research.

Perspective on the Role of Mindfulness on Health Behaviors in Type D Individuals

With growing evidence that mindfulness training can help people moderate distressing emotions and enhance positive affect, there is a need to clarify the mechanisms through which these effects occur, as well as their potential impact on health behaviors (Keng, Smoski, & Robins, 2011; Roberts & Danoff-Burg, 2011; Salmoirago-Blotcher, Hunsinger, Morgan, Fischer, & Carmody, 2013). It is important to understand the relations among mindfulness, stress, and health, since it could contribute to the development of strategies to help preventing and treat somehealth problems.

Some research explored potential links between health-related behaviors (e.g., cigarette smoking, binge eating, lack of physical activity, risky sexual behavior) and mindfulness (Roberts & Danoff-Burg, 2011). The capacity for emotion regulation through mindfulnessmay be central to making and sustaining behavioral change, and programs that support this capacity represent an opportunity to improve behavioral outcomes (Williams & Thayer, 2009). As mentioned, mindfulness programs, including the MBSR (Kabat-Zinn, 1990), have been shown to enhance emotion regulation (Chambers *et al*., 2009; Goldin & Gross, 2010). Zvolensky, Solomon, and McLeish (2006), investigated the association ofmindfulness-based attention with both emotional complaints and perceived health status and functioning in a community sample. Results showed that greater levels of mindfulness-based attention were associated with lower depressive symptoms and with perceptions of a better physical and psychological functioning. However, the possible direct effects of mindfulness training on health-related behaviors still receiveonly limited attention. Some large survey-based studies have shown that higher mindfulness is

associated with increased physical activity, better sleep quality (Andersen *et al*., 2013; Carmody *et al*., 2011; Roberts & Danoff-Burg, 2011; Salmoirago-Blotcher *et al*., 2013), and healthier dietary habits (Carmody *et al*., 2012; Gilbert & Waltz, 2010; Salmoirago-Blotcher *et al*., 2013). In turn, some pilot studies of mindfulness interventions for smoking cessation have shown promising results on point prevalence abstinence rate (Brewer *et al*., 2011; Davis, Fleming, Bonus, & Baker, 2007), while mindfulness-based programs exist for unhealthy eating habits, especially as seen in eating disorders, such as binge eating disorder (Butryn *et al*., 2013; Kristeller & Hallett, 1999).

Because of the increased mortality risk in major depression and Type D cardiac patients and the limited influence of cognitive behavioral therapy on this risk (Berkman *et al*., 2003), further investigations on the effect of emotion-regulation-focused approaches in cardiac patients with specific psychological difficulties like Type D personality seem warranted. So far, Type D personality was not found to be influenced, but coping strategies of Type Ds have been shown to be modified (Martin *et al*., 2010). However, mindfulness is believed to produce fundamental changes in dimensions such as self-awareness, self-expression, and tolerance to negative emotional experience, with an important impact on a person's appraisal and belief systems (Feldman *et al*., 2007)and, more generally, in cognitive-affective integration. This may be associated with changes in scores on personality tests which are relevant to health. Recent research outcomes indicate that MBSR attenuates characteristics of Type D personality, which was statistically mediated by increased mindfulness (Nyklicek, van Beugen, & Denollet, 2012). The effects were found on both Type D characteristics, namely negative affectivity and social inhibition, and the effects were maintained even when changes in state

negative affect were controlled. The mediating effect by mindfulness suggests that mindfulness may indeed be the mechanism by which the intervention exerts its effects. Besides the general mechanism of mindfulness and its putative effects on emotion regulation, the decrease in social inhibition is of additional interest and importance. Participants in MBSR groups are taught, in a non-judgmental way, that it is perfectly alright to think, feel, and behave the way they do, probably decreasing feelings of discomfort when expressing oneself in social situations. As part of the Type D construct, social inhibition has been shown to be associated with a larger cancer incidence (Denollet, 1998) and an array of poorer cardiovascular outcomes (Denollet *et al*., 2000). Inhibition in general has been linked to greater health symptomatology (Consedine, Magai, Cohen, & Gillespie, 2002).

As previously referred, there is a higher prevalence of health risks among Type D individuals. Thus, it is imperative to perform more studies on mindfulness-based and other psychological interventions for patients with this profile. It is conceivable that when Type D characteristics decrease, this may be accompanied with enhanced emotion regulation and subsequently also more adaptive general health behaviors. To date, this has not been investigated.

Conclusion

In this paper, associations were discussed between emotion regulation, mindfulness, and health-related behaviors. In addition, the role of distressed personality (Type D) in these associations was reflected upon. It was shown that (i) emotions and emotion regulation play an important role in health, at least partially viahealth-related behaviors, (ii) Type D personality is associated with negative emotions, poor emotion regulation strategies, and poor health behaviors, while (iii) mindfulness seems to decrease

negative emotions, enhance positive moodand adaptive emotion regulation. Therefore, it is conceivable that mindfulness may also have favorable effects on health-related behavior.

As discussed, research on this topic is still rather scarce. However, especially correlational studies suggest that a positive association between mindfulness and healthy behaviors may exist and recently the application of mindfulness-based interventions to change unhealthy, especially addictive, behaviors is expanding rapidly. Well conducted randomized controlled trials including a sufficient number of participants are needed to properly address the issue if mindfulness is an effective method to change health-related behaviors.

Finally, as discussed, mindfulness has even been claimed to potentially even change a person's fundamental belief system, and, hence, personality characteristics. After the first randomized controlled study on the effects of mindfulness-based intervention on Type D characteristics, which has showed promising favorable results, future studies are needed to replicate and expend these more directly to health. Only a very limited number of controlled trials has examined the effects of mindfulness-based interventions on physical health, showing beneficial effects, such as blood pressure reduction (Campbell, Labelle, Bacon, Faris, & Carlson, 2012; Nyklíček, Mommersteeg, Van Beugen, Ramakers, & Van Boxtel, in press), and enhanced immune function in HIV-infected men (Creswell, Myers, Cole, & Irwin, 2009).

Several next steps may be envisioned regarding future research in the field of mindfulness, emotion regulation, personality, and health-related behavior. First, prospective cohort studies in people at risk for health problems due to unhealthy behaviors are recommended. Obesity seems to be an example of a field which may benefit from such studies, especially as obesity-related health

problems are rising dramatically and unhealthy diet and low levels of physical exercise are major cause of obesity. An example of such a study may be a prospective study following a cohort of individuals at risk for obesity (e.g., based on history of obesity in their family or recent weight development), and measuring repeatedly emotions, emotion regulation styles, mindfulness, Type D personality, eating and exercise habits, and body mass index (or hip-to-waist-ratio). Advances statistics such as mixed models or structural equation modeling may be used to unravel the development of associations over time. Furthermore, rigorous randomized controlled trials are needed examining the effects of mindfulness-based interventions on (Type D) personality, health behaviors, and physical health indices. Not only intermediate physiological function, such as glycemic control and blood pressure, but eventually also medical outcomes, such as the development of diabetes mellitus or cardiovascular disease may be examined. In such studies, change in emotion regulation and health habits may be examined as mediating mechanisms potentially leading to better health.

If found to be effective, as may be expected based on both theoretical considerations and previous empirical results, mindfulness may be an important factor not only for mental, but also for physical health.

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