

REVIEW ARTICLE

THE NEUROPHYSIOLOGY OF WELL-BEING. MINDFULNESS – AN UNTAPPED, INNATE WAY TO DECREASE THE EPIDEMIC OF UNWELCOME EATING BEHAVIORS

NEUROFIZJOLOGIA DOBREGO SAMOPOCZUCIA. UWAŻNOŚĆ – NIEWYKORZYSTANY, WRODZONY SPOSÓB NA OGRANICZENIE EPIDEMII NIEPOŻĄDANYCH ZACHOWAŃ ŻYWIENIOWYCH

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ABSTRACT

Introduction

The state of stress/anxiety or of wellbeing are physiologically determined by the interaction between the two parts of autonomic nervous system: the sympathetic (SNS) and parasympathetic (PNS) nervous system. It is increasingly understood that certain somatic disorders (binge eating, obesity, cardiovascular and autoimmune diseases, fibromyalgia etc.) have a psychological exacerbating component, closely linked to SNS overstimulation. Psychological distress promotes deposition of fat, mainly in abdominal area and is associated with weight gain. It also promotes the consumption of 'comfort foods' which are mostly high in fat and sugar, causing further weight gain.

Aim

The aim of the work is to present *Mindfulness* as a method of coping with stress and to highlight data encouraging its use, particularly in abnormal/excess eating behaviors.

Methods

Mindfulness is a kind of mental discipline that may help in restoring of disrupted SNS-PNS balance. It is originating from the 2.500-year-old Buddhist contemplative practices and adapted to suit non-religious contexts, including corporations, hospitals, schools, sports teams or armies. Research into the effect of mindfulness has shown that it may mitigate stress related damage by decreasing cortisol levels, lower blood pressure, increase immune functioning and increase telomerase activity.

Results and conclusions

Coping methods for stress are largely neglected in most treatment regimens. There are also no medical standards in this area. Disseminating the techniques of restoring sympathetic – parasympathetic balance, like mindfulness, may contribute to decreasing of prevalence of the diseases associated with SNS overstimulation, among them the epidemic of unwelcome eating behaviour. Evidently, more longitudinal studies that examine the mindfulness efficacy for the treatment of chronic illnesses would be of great benefit.

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STRESZCZENIE

Wstęp

Stres i niepokój oraz stan dobrego samopoczucia zależą fizjologicznie od interakcji między dwoma częściami autonomicznego układu nerwowego współczulnej i przywspółczulnej. Coraz bardziej zrozumiałe jest, że wiele zaburzeń somatycznych (otyłość, nadmierne spożywanie pokarmu, choroby sercowo-naczyniowe, autoimmunologiczne, fibromialgia itp.) posiada istotny komponent neurofizjologiczny, ściśle związany z nadmierną stymulacją współczulną. Stres sprzyja odkładaniu się tłuszczu, głównie w jamie brzusznej i wiąże się z przyrostem masy ciała. Promuje również spożywanie „komfortowych posiłków” bogatych w tłuszcze i cukry, powodując dalszy przyrost masy ciała.

Cel

Celem pracy jest zaprezentowanie *Uważności* jako skutecznej metody radzenia sobie ze stresem oraz przedstawienie danych medycznych zachęcających do jej stosowania, szczególnie w przypadku nieprawidłowych zachowań żywieniowych.

Metody

Uważność jest rodzajem dyscypliny mentalnej, która może pomóc w przywróceniu zaburzonej równowagi współczulno-przywspółczulnej. Wywodzi się z buddyjskich praktyk kontemplacyjnych liczących 2500 lat, które współcześnie zostały dostosowane i są używane w kontekstach niereligijnych: korporacjach, szpitalach szkołach, drużynach sportowych czy armiach. Badania nad wpływem uważności wykazały, że jej praktykowanie zmniejsza niepożądane działania stresu na organizm m.in. poprzez obniżenie poziomu kortyzolu i ciśnienia krwi, stymulację funkcji układu odpornościowego czy nasilenie aktywności telomeraz. Metody radzenia sobie ze stresem są powszechnie zaniedbywaną częścią schematów leczenia większości chorób. Brak również jakichkolwiek medycznych standardów w tym zakresie.

Wyniki i wnioski

Rozpowszechnianie technik przywracania równowagi współczulno-przywspółczulnej, takich jak uważność, może przyczynić się do zmniejszenia częstości występowania chorób związanych z nadmierną stymulacją współczulną, w tym epidemii niepożądanych zachowań żywieniowych. Niewątpliwie istnieje silna potrzeba przekrojowych, długotrwałych badań nad skutecznością praktyki uważności w leczeniu chorób przewlekłych.

Słowa kluczowe: stres, otyłość, zaburzenia odżywiania, równowaga współczulno-przywspółczulna, szczęście

Introduction

It is increasingly understood that certain somatic disorders have a psychological exacerbating component. Psychological distress may play a role in the development of disease by affecting the neuroendocrine system and modulating the immune system

(Kendall-Tackett 2010). The importance of psychological treatment becomes increasingly apparent. However, in the teaching and practice of medicine, there is a strong dichotomy that separates physical and psychological health care systems (Weiss et al.

2009). Interventions like Mindfulness Based Cognitive Therapy and Mindfulness Based Stress Reduction are based on ancient meditation techniques that aim to merge the two.

Mindfulness has been considered to be the 'heart' of Buddhist meditation (Thera 2014), but it should be noted that its teaching can be kept separate from its original religious or spiritual underpinnings (Kabat-Zinn 1982; Linehan 1993). An operational working definition put forth by Kabat-Zinn (2003) is ...'the awareness that emerges through paying attention on purpose, in the present moment, and non-judgmentally to the unfolding of experience moment by moment'... It involves focusing the practitioner's attention to the inner and outer realm of experience; the thoughts, senses, and emotions that arise. Unlike some other forms of meditation, such as Transcendental Meditation (Edenfield and Saeed 2012), thoughts that are 'unwelcome' or intrude during the process of focusing are not meant to be suppressed. Instead, they are to be accepted without judgment and allowed to pass on their own. The goal is to increase emotional and physical awareness and so to decrease avoidance of these concepts (Hölzel *et al.* 2011). The fundamental nature of an object is to be seen without cognitive distortion or bias (Brown, and Ryan 2004) and to eliminate its interpretation (Analayo 2004; Thera 2014). In fact, the nature of the intrusive thoughts may actually be explored to gain insight into them and to then develop more effective coping methods for them in the future (Edenfield and Saeed 2012).

The ability to think about things that are beyond what is being experienced at any given moment may be considered both a blessing, in that it helps one to learn and to plan, but also a curse. That is, the trait of letting attention drift or 'mind wandering' has been associated with depression (Smallwood 2009; Kristeller *et al.* 2014). Killingsworth and Gilbert (2010) illustrated this quite elegantly using a phone app for experience sampling. The app would request users to enter their

thoughts, feelings, and actions as they went about their daily lives; a database that includes nearly 5000 people was formed. Three main findings were had. The first is that mind wandering occurred significantly more frequently outside than inside a laboratory setting (46.9% of samples in at least 30 of the samples taken during every activity except making love). Second, people were much less happy when their minds were wandering. Despite the fact that they were more likely to think of happy thoughts, they were not any happier during the process of thinking of those things compared to thinking of what they were doing. That said, they were considerably less happy when thinking of neutral or unhappy things. Lastly, the best predictor of their happiness was what they were thinking of, not their current activity.

Aim

The aim of the work is to present Mindfulness as a method of coping with stress and to highlight data encouraging its use, particularly in abnormal/excess eating behaviors.

Methods and results

Physiology of stress

The body is governed by two interacting autonomic nervous responses. The parasympathetic may be seen as that dealing with relaxation while the sympathetic may be viewed that with stress or anxiety. Although it is obviously beneficial in certain circumstances where quick reaction is needed, overstimulation of the sympathetic system may lead excessive catecholamine release, vagal withdrawal, and activity of the renin – angiotensin system. Strong emotions, mediated by the limbic system of the brain, can cause the hypothalamic-pituitary axis (HPA) to be chronically activated leading to the release of corticotrophin releasing hormone and then adrenocorticotrophic hormone. This causes the release of the stress hormone cortisol by the adrenal cortex which, in excess, may both disrupt the HPA negative regulatory feedback loop

and cause an overproduction of inflammatory cytokines (Kuroki 2011). All of this taken together may cause such detrimental effects as hypertension, tachycardia, hyperglycemia, and muscle tension (Weiss *et al.* 2009) and lead on to produce chronic diseases including cardiovascular disease, diabetes, obesity, and autoimmune disorders (Kendall-Tackett 2010; Ross and Thomas 2010). It has been seen that almost one half of all Americans (117 million) have at least one chronic condition, with one quarter having 2 or more (Ward *et al.* 2014).

In short, the pace of life and the challenges that we face tilt the natural sympathetic – parasympathetic balance in favor of the sympathetic stimulation. This ensures success in life, for which we pay a very high price, the lack of happiness and the ‘sack’ of stress dependent diseases (Figure 1.)

language). In this respect, we require a process of desocialization to develop the parasympathetic response and to reach a natural sympathetic – parasympathetic balance.

A cultivation of the ability to activate the counteractive parasympathetic response more or less at will is the goal of mindfulness meditation. Research into the effect of mindfulness has shown that it may mitigate stress related damage by decreasing cortisol levels, lower blood pressure, increase immune functioning (Carlson *et al.* 2007; Sridharan *et al.* 2008; Ross and Thomas 2010) and increase telomerase activity (Hölzel *et al.* 2011; Jacobs *et al.* 2011).

Mindfulness based interventions (MBIs) have been shown to have beneficial effects on: chronic lower back pain; fibromyalgia; rheumatoid arthritis; psoriasis; type II diabetes

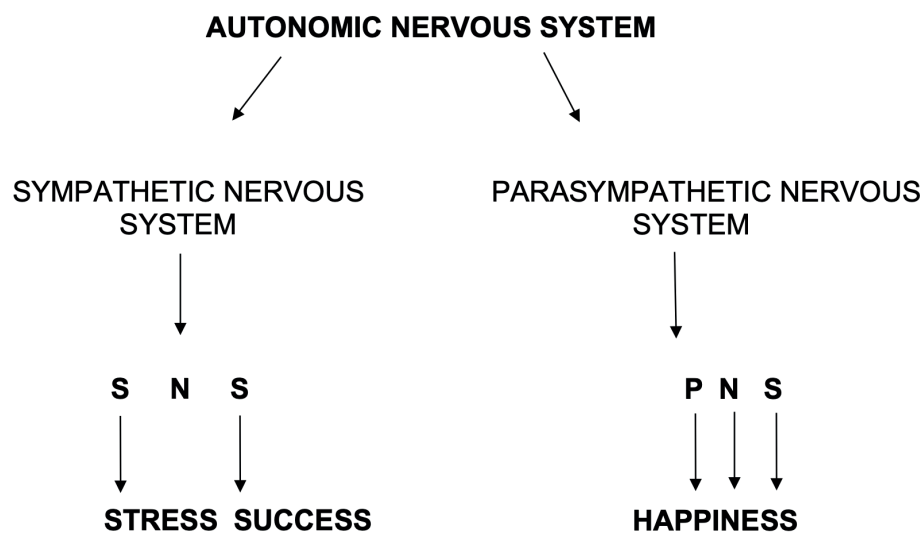


Figure 1. Useful in patient education a visual representation of the autonomic nervous system's general functions

We were raised and socialized in a culture of a permanent INPUT of data. As a result, even in such a ‘parasympathetically’ stimulating environment as the toilet, we find ourselves very often with a book, newspaper or some form of electronics. If this is not the case, many people, to reach this level of ‘input’, may seek it out in whatever is around (e.g. detergent description, even if in an unknown

mellitus; reducing perceived pain as well as an improved ability to cope with pain and decrease the depressive symptoms that may be associated; stress reduction; reducing negative mood states; improving the emotional wellbeing and quality of life of individuals dealing with chronic physical illness (hypertension, human immunodeficiency virus, depression secondary to pain; improve attention, reduce

stress and improve mood in adults and adolescents with ADHD (Attention-Deficit Hyperactivity Disorder) (Zylowska et al. 2008); and for eating disorders (Daubenmier et al. 2011; Kristeller and Wolever 2011).

Neurobiology and neuropsychology

Practice of mindfulness has been found to cause neuroplastic changes in the anterior cingulate cortex, the insula, the temporo-parietal junction, and the fronto-limbic network which can enhance self-regulation (Cahn and Polich 2006; Hölzel et al. 2007; Steptoe et al. 2008; Hölzel et al. 2011; Ventegodt et al. 2011). In particular, both neuroimaging and electroencephalography studies have shown differences in the activity of the prefrontal cortex (PFC) and anterior cingulate cortex (ACC) along with increased alpha and theta wave activity during meditation which is strongly associated with a state of relaxation. Part of this effect appeared to be dose dependent in that more experienced meditators had greater theta activity, suggesting that they had been better able to self-regulate and enter a state of deep relaxation (Cahn and Polich 2006). This has implications for those who suffer from psychiatric disorders such as depression and anxiety as these are associated with the brain regions examined, namely the PFC and limbic system (Hill et al. 2012).

Davidson et al. (Davidson et al. 2003) have shown an increase in EEG activity of the forebrain when positive emotions were experienced among mindfulness practitioners. Being that these biological and structural changes were seen, it suggests that mindfulness may provide benefit over a longer period of time, not just a transient improvement in mood.

It may be correctly assumed that such changes would have an effect on the performance of practitioners' performance on neuropsychological testing. They have been seen to have an increased ability to focus on a task during attention testing (Edenfield and Saeed 2012). Tang et al. (Tang et al. 2015) showed that participation in 5 days of integrative meditation practice and mindfulness

training improved performance in executive attention versus those without the training.

Discussion

Mindful Eating

Psychological distress may promote deposition of abdominal fat. This occurs via repeated activation of the hypothalamic-pituitary-adrenal axis, resulting in excessive secretion of cortisol which then binds glucocorticoid receptors triggering lipoprotein lipase into converting triglycerides to free fatty acids in adipocytes (Rosmond 2003). There are a greater number of glucocorticoid receptors in visceral adipocytes compared to peripheral ones which accounts for greater deposition in the region (Rebuffé-Scrive et al. 1992; Dallman et al. 2003). Cortisol also acts in conjunction with insulin to repurpose amino acids and fatty acids from the peripheral to abdominal regions for use by the liver for gluconeogenesis (Dallman et al. 2005). Abdominal adiposity is highly associated with the development of type 2 diabetes and cardiovascular disease. In comparison to subcutaneous fat, it results in the production of inflammatory molecules which promote insulin resistance and metabolic syndrome (Després 2006).

Psychological stress has been associated with weight gain. Two indicators of chronic psychological stress, job stress and low socioeconomic status, have been associated with the development of abdominal obesity in cross sectional and prospective studies (Brunner et al. 1997; Rosmond and Björntorp 2000; Brunner et al. 2007). Stress can also promote the consumption of 'comfort foods' which are mostly high in fat and sugar causing further weight gain (Dallman et al. 2003; Dallman et al. 2005). Self-identified stress eaters tend to gain more abdominal fat during stressful period as compared to those who deny having such habits (Epel et al. 2001). Coping methods for stress are neglected in most weight loss regimens. As seen, a reduction in cortisol levels through practice of mindfulness meditation will have a downstream effect on reducing

weight gain. Moreover, food restriction and the start of an exercise regime may themselves cause stress, limiting progress (Wing and Phelan 2005; Franz *et al.* 2007).

Kristeller *et al.* (2014) compared the effect that the 'MB-EAT' program would have versus a psychoeducational/cognitive-behavioral (PECB) intervention would have on patients with binge eating disorder (BED). The MB-EAT exercises focused on physical hunger and satiety cues, food intake, and the various triggers of bingeing. In particular, it enforced that three items made up the meditation training: breath/open awareness mindful meditations, guided eating meditation, and mini meditations throughout the day. They had found that 95% of the patients with BED no longer met criteria for BED at the four-month treatment period compared to 76% in the PECB group. 64% of the participants in both groups continued to have binge eating episodes, but for 60% in the mindfulness group, these were considered to be 'small' but continued to be 'large' in the PECB group. The MB-EAT program decreased binge eating by a clinically significant level, and the change was related to the amount of mindful meditation done.

In a study by Daubenmier *et al.* (2011), forty-seven obese or overweight women were either assigned to a mindfulness training program or put on wait list to assess for the effect of the treatment on stress eating. The treatment group improved in mindfulness, anxiety, and external based eating. There was no difference in cortisol awakening response (CAR), weight, or abdominal fat over time. However, the obese patients practicing mindfulness did have significant reductions in CAR and managed to maintain body weight while the control group's CAR remained the same and even gained weight. In all, it was successful at increasing mindfulness and awareness of bodily sensations, at reducing anxiety, and reducing the urge to eat due to emotions. A dose related response was also seen; those participants who gained greater levels of mindfulness had greater loss of abdominal fat.

Timmerman and Brown (2012) studied the effect that mindfulness and weight management classes would have on calorie consumption reduction in females who eat out frequently. 'Mindful Restaurant Eating' included knowledge about the nutritional content in restaurant foods, behavioral alteration methods, and mindful eating meditations while catering to individual preferences. They found that such a strategy was effective in reducing caloric and fat consumption and preventing weight gain. These reductions occurred despite no decrease in the frequency of the participants' eating out, implying that they were able to carry over the training to their homes.

Conclusions

It should be apparent that mindfulness has a role in the future of medicine, both in the clinical setting and the research realm. By teaching methods by which a patient can better cope with psychological stress, clinicians can hope to decrease the physical symptoms that come associated with chronic illness. A regulation of the neuroendocrine system may also help limit the progression of these diseases to act prophylactically. Clearly, the search for methods of disseminating the techniques of restoring sympathetic – parasympathetic balance lies in the interests of both patients and medical professionals. It may contribute to decreasing of prevalence of the diseases associated with SNS overstimulation, among them the epidemic of unwelcome eating behaviour – obesity and eating disorders. Evidently, more longitudinal studies that examine its efficacy for the treatment of chronic illnesses would be of great benefit.

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