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Literature Review

Exploring Mindfulness: A Comprehensive Review of Its Potential Impact on Functional Dyspepsia Management

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Abstracts

Introduction: This review examines the potential benefits of mindfulness-based interventions for individuals with functional dyspepsia by exploring how mindfulness practices—such as mindfulness-based cognitive therapy (MBCT), yoga, and dialectical behavior therapy (DBT)—may improve symptom relief, psychological well-being, and overall quality of life in patients suffering from this condition. By analyzing existing literature, this review highlights the promising role of mindfulness in offering a holistic approach to managing functional dyspepsia. **Methods:** A comprehensive literature search of related articles written in English was conducted using PubMed and Google Scholar databases, with keywords including "Mindfulness", "Meditation", "Yoga", and "Functional Dyspepsia". **Results:** Studies have revealed that mindfulness-based cognitive therapy (MBCT), yoga, and dialectical behavioral therapy (DBT) may reduce symptoms of functional dyspepsia and improve quality of life in patients with functional dyspepsia. **Conclusion:** Despite the promising findings of the initial studies, further rigorous research is needed to fully understand and confirm the effectiveness of mindfulness techniques in managing functional dyspepsia.

Keywords: Mindfulness, Mindfulness-Based Interventions, Functional Dyspepsia, Management, Alternative Therapies

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INTRODUCTION

As a common disorder of gut-brain interaction, functional dyspepsia affects about 7% of individuals in the general community, the majority of whom are managed in primary care [1]. The concept of functional dyspepsia has evolved over the last 35 years, shifting from a broad definition to one that only covers cardinal symptoms such as epigastric pain or burning, postprandial fullness, or early satiation. Diagnosis is also made after the patient shows no evidence of structural abnormality. The Rome IV Criteria [2], which are among the most current and widely used diagnostic criteria for functional dyspepsia, divide this condition into two categories: postprandial distress syndrome (PDS) and epigastric pain syndrome (EPS). Both subtypes are frequently encountered in both primary-care and specialty-care settings. About 10–30% of people around the world have functional dyspepsia. Studies in North America, for example, have reported a prevalence of 10% with the application of the Rome IV Criteria. However, the percentage of patients assessed only represents a small portion of the overall population affected by this disorder. Approximately 40% of patients only consult primary-care physicians, typically after their symptoms have gotten worse and more frequent. Less than 20% of patients are referred to specialists for further evaluation. In Indonesia, dyspepsia remains the fifth and sixth most common disorder in inpatient and outpatient settings [3]. Although dyspepsia may be caused by gastritis or ulcers, which have noticeable symptoms, the burden of functional dyspepsia remains high.

Current treatments and management for functional dyspepsia involve peripheral-acting agents (i.e., H. pylori test-and-treat strategy, acid suppression therapy, and prokinetic medications) and central-acting agents (e.g., antidepressants). Both antibiotics and probiotics may be used in some cases of functional dyspepsia [2].

Multiple stress-influenced, interconnected pathways, such as the central and peripheral stress systems, connect the gut and the brain and overlap with the pathways of the gut-brain axis. Meanwhile, the gastrointestinal tract with the enteric nervous system (ENS) is innervated by the autonomic nervous system (ANS), providing pathways for stress-induced modulation of gastrointestinal sensorimotor functions [4]. This theory also correlates with interoception, namely the ability of the brain to sense and process information regarding the internal physiological state of the body, which can also be affected by gut microbiomes and their metabolites. Additionally, interoception affects homeostatic reflexes, which also occur in the ENS. The autonomic nervous system modulates the enteric nervous system in regulating gastrointestinal motility, blood flow, and secretion in the physiological state. Moreover, the ANS has the ability to modulate intestinal barrier integrity, GI motility, secretory processes, and mucosal immune response. Changes in regional transit and GI motility are highly influenced by various factors, including emotional states, stress levels, and sleep. For example, acute and chronic stress can inhibit GI tract function. This interaction is bidirectional; therefore, abnormalities are suspected to cause disorders such as irritable bowel syndrome (IBS), functional dyspepsia, chronic abdominal pain, and psychiatric disorders [5].

Stress may affect the amount and composition of gut microbiota, where previous studies have reported a decrease in Lactobacillus sp. and Bifidobacterium spp, as well as an increase in E. coli. [6], for example, argued that higher production of catecholamines, adrenaline, and epinephrine can result in a rise in E. coli [6].

Mindfulness has its origin in the Buddhist spiritual tradition. Nonetheless, notable disparities exist between this understanding and the conceptualization prevalent in contemporary psychology, as outlined in numerous studies. McCaw (2019)

predominantly adopted the framework of mindfulness as delineated in contemporary psychology [7], notably stemming from the seminal work of Kabat-Zinn (1982), as the most widely used framework in mindfulness-based intervention for clinical use.

Bishop proposed two main components in defining mindfulness according to this framework [8]:

- Self-Regulation of Attention: This component involves sustaining attention, switching attention, and inhibiting elaborative processing toward the present moment. In this regard, the limited capacity of attention is directed fully toward the present moment. Distractions are acknowledged as events or objects of observation without any preconceived beliefs or notions, and attention is then redirected toward the focus of attention in the present moment.
- Orientation to Experience: This component involves adopting a stance of acceptance and openness toward new experiences. In this regard, individuals approach experiences with curiosity and receptivity, thus allowing for a deeper engagement with the present moment.

In summary, mindfulness is defined as a process of regulating attention to cultivate a state of non-elaborative awareness in the present moment, along with fostering an attitude of curiosity, openness to experience, and acceptance. It involves gaining insights into one's mental processes and adopting a de-centered perspective, wherein these mental processes can be experienced in terms of their subjectivity (compared to their necessary validity), and their transient nature rather than their permanence. Furthermore, mindfulness is conceptualized as both a mode of awareness and a psychological process.

Mindfulness may help reduce stress and improve mental health through several mechanisms [9]. Mostly, individuals spend a significant portion of their time in a state of mindlessness, commonly referred to as mind-wandering. This involves thoughts that are independent of any stimulus and are unrelated to the tasks at hand or the present moment. Unhappiness and negative emotions frequently correlate with thoughts anchored in the past. Additionally, a ruminative thinking style can exacerbate low moods or negative emotions, although they are not always related. Negative mind-wandering can be characterized by decreased attention to external stimuli and the activation of the brain's default mode network (DMN). This can be counteracted by practicing meditation that involves mindfulness, where individuals are trained to 'be here now' and foster a non-judgmental awareness of the present moment. Studies have demonstrated that meditation training not only improves the salience network and central executive network but also suggests an anti-correlation with DMN activity.

Mood and anxiety disorders are often characterized by deficits in executive attention. Conversely, mindfulness meditation positively correlates with an increase in executive control. According to prior studies, mindfulness practice may ameliorate these deficits by influencing how individuals distribute their limited attentional resources.

Several reviews have highlighted emotional regulation as another key mechanism by which mindfulness practice may bolster our resilience to stress. Mindfulness training has been shown to mitigate stress-related illnesses by influencing cognitive coping strategies. In this regard, mindfulness contributes to reduced stress levels partly by fostering a mechanism that promotes positive appraisal. Furthermore, mindful emotional regulation enhances the cognitive regulation mechanisms in the prefrontal cortex while simultaneously down-regulating activities in regions associated with emotional processing, such as the amygdala.

Mindfulness Application in Clinical Settings and Modern Medicine

There have been various applications of

mindfulness in clinical settings over the last few decades. Interventions that use elements of mindfulness are termed Mindfulness-Based Interventions, hereinafter referred to as MBIs. Among the most notable MBIs are Mindfulness-Based Stress Reduction (MBSR) developed by Kabat-Zinn in 1982, Mindfulness-Based Cognitive Therapy (MBCT), and Dialectical Behavioral Therapy (DBT) [10].

MBIs have been applied to various cases of mental health problems, with moderate-to-strong effects on reducing depression and anxiety, a moderate effect on reducing stress even among relatively healthy or at-risk populations, and small-to-large effects on reducing craving in addiction patients. In addition, there has been preliminary evidence that MBIs are effective for treating insomnia, eating disorders, and psychosis [11].

MBIs are applicable not only to mental health problems. These interventions have also been used in reducing symptoms of physical health problems, e.g., for patients with chronic pain. MBIs have also been shown to lower blood pressure in patients with hypertension, enhance symptom control in cardiovascular diseases such as stroke, and improve symptoms in patients with cancer, particularly those concerning cancer-related fatigue and pain. Mindful eating has also been considered an effective long-term management of weight control and obesity [11].

As one of the most prominent MBIs, Mindfulness-Based Stress Reduction (MBSR) includes sessions dedicated to mindful yoga within its curriculum, underscoring the interconnectedness of yoga and mindfulness practices. Unlike traditional mindfulness interventions, yoga incorporates physical exercise components alongside contemplative practices. Similarly, Dialectical Behavioral Therapy (DBT) also involves mindfulness as the most foundational skill, while simultaneously encompassing multiple other skills. Thus, for exploratory purposes, it is crucial to note the efficacy of such interventions due to the number of similar mechanisms.

While studies on the use of mindfulness in functional dyspepsia remain very limited, there has been well-established research about the application of mindfulness-based intervention for other clinical problems, especially in chronic pain and other functional gastrointestinal disorders such as irritable bowel syndrome. Therefore, it is necessary to observe how mindfulness intervention works on these clinical problems since functional dyspepsia has elements of chronic pain and a few overlapping mechanisms with irritable bowel syndrome.

A meta–analysis by Pei et al. (2021) shows that MBCTs or MBIs have several effects on depression that occurs alongside chronic pain, although there may not be a significant difference in the pain intensity outcome [12]. Similarly, recent reviews have reported that mindfulness-based interventions produce modest effects on pain symptom reduction [13]. While changes in pain intensity may be limited, evidence suggests that mindfulness enhances patients' tolerance and acceptance of pain, thereby improving their overall relationship with their symptoms [14]. These findings emphasize the heterogeneous nature of pain experiences and highlight the need for more rigorous clinical trials with larger sample sizes and standardized protocols.

Previous meta-analyses and systematic reviews about the use of MBIs in other gastrointestinal disorders have also shown some promising results. [15], for example, has found some beneficial effects of MBI on the treatment of inflammatory bowel syndrome, including small effects on reduced stress (short-term and long-term) and improved health-related quality of life (such as better bowel movement), as well as a moderate effect on patients' emotional response towards their condition. In addition, MBI can reduce pain in IBS [16]. Nevertheless, there is no statistically significant effect of MBI on anxiety in the treatment of IBS.

METHODS

Articles written in English were searched in PubMed and Google Scholar databases using keywords including 'mindfulness', 'meditation', 'yoga', and 'functional dyspepsia' or their variations, with no restrictions on the year of publication. The literature search was conducted in February 2024. The inclusion criteria are:

a. Full-text available; and
b. Clear reference to functional dyspepsia in the abstract or content of the paper.

A total of 11 journal articles were selected based on these criteria. After examining the contents, five of these articles were excluded due to the lack of significant mention of mindfulness intervention and functional dyspepsia, with one article being excluded due to the unavailability of its full text. 2 Additional text was excluded due to being more than 5 years old. Therefore, four articles were critically and thoroughly reviewed.

RESULTS

Similarly, Kim et al. (2020) also conducted a study to evaluate the efficacy of Mindfulness-Based Cognitive Therapy (MBCT) in treating functional dyspepsia (FD). The study involved 28 patients diagnosed with FD according to the ROME III Criteria. Among these participants, 15 patients participated in an 8-week MBCT Program, with 2 dropouts due to time constraints, while the remaining 13 patients received treatment as usual. The primary outcome of the experiment was assessed using the Subjective-Clinical-Assessment Functional Dyspepsia (SCA-FD) Questionnaire, with secondary measures using the Subjective-Clinical-Assessment General Health (SCA-GH), FD-specific Quality of Life (SF-NDI), and Depression, Anxiety, and Stress Scales (DASS).

Patients in the MBCT group reported significant improvements in their SCA-FD and SF-NDI scores, notwithstanding the study's limited statistical power due to its small sample size ($p>0.05$; it was predicted that it would require a minimum of 50 patients to achieve a statistically significant result). With regard to their functional dyspepsia symptoms and general health, patients who received MBCT tended to feel better compared to those receiving usual treatment. This is shown in the responses of the SCA-FD Questionnaire, where 9 out of 10 patients in the treatment group reported feeling better compared to 5 out of 11 patients in the control group. Similarly, 8 out of 11 patients in the treatment group expressed that they felt better in their general health, compared to 6 out of 11 patients in the control group. Furthermore, there is a reduction in both SF-NDI (-8.8 vs -0.7, with the p-value between groups of 0.02) and DASS scores (-19.8 vs -5.5, with the p-value between groups of 0.13) in patients receiving MBCT, compared to those receiving treatment as usual. Nonetheless, these findings suggest that MBCT shows great potential in reducing symptoms and enhancing the quality of life for FD patients. However, while participants in the treatment group also experienced lower severity of depression and anxiety according to the scale, this improvement did not translate to overall improvements in their quality of life. In addition, the study highlights subjective challenges associated with MBCT, such as time commitment and the need for ongoing guidance and cohesive group dynamics. Patients in the MBCT group nonetheless noted that this program helped them understand triggers for their symptoms and provided coping mechanisms, which they found particularly beneficial compared to education alone. Despite lacking sufficient statistical significance, the study demonstrates the feasibility of conducting a future Randomized Controlled Trial (RCT) and suggests that MBCT can be proven efficacious with a larger sample size.

Conducted a case series to examine the use of yoga therapy as a complementary treatment for functional dyspepsia patients. In their study, patients underwent yoga therapy in conjunction with medication and were monitored weekly for 30 days. The

therapy consisted of five sessions per week, encompassing two supervised sessions and three home practice sessions, following a protocol provided by the researchers. Significant reductions were observed in the scores of dyspepsia symptoms, including bloating, epigastric pain, and regurgitation. The findings of the study underline the potential efficacy of yoga in managing functional dyspepsia symptoms [17].

Subsequently, Setia et al. (2023) discussed the possible mechanisms through which yoga may contribute to the management of functional dyspepsia, namely: 1) downregulating the sympathetic axis and increasing vagal tone to counteract impaired gastric and duodenal motility, which is often stress-induced; 2) improving gastric accommodation by increasing NO levels in serum and reducing anxiety; 3) reducing gastric hypersensitivity by enhancing vagal tone and increasing GABA levels; 4) reducing duodenal inflammation through decreased pro-inflammatory cytokines, increased serotonin levels, and changed mucosal patterns of stomach; 5) managing mood disorders, such as stress and anxiety, which are among the more established triggers for FD patients; and 6) managing GBA axis dysfunction by enhancing beneficial bacteria through top-down (i.e., reducing stress) and bottom-up approaches (e.g., reducing duodenal inflammation) [18].

A study in 2019 ompared the efficacy of conventional therapy (common treatment), adjunctive anti-anxiety medication, and dialectical behavior therapy (DBT) in treating functional dyspepsia [19]. The study included a sample size of 60 patients, with 20 individuals being allocated to each treatment group (Group A receiving DBT + Pantoprazole; Group B receiving anxiolytic drugs vs pantoprazole; and Group C receiving only pantoprazole). Significant reductions in the severity of dyspepsia symptoms were observed in the group that received the DBT intervention, compared to the control group (Group A −15.4±6.61; Group B -3.85±2.77; and Group C −7.8±4.02). furthermore, significant reduction in the Beck anxiety score was also observed in the groups that received DBT and anxiolytics compared to the control group (Group A −5.75±2.53; Group B −7.3±3.19; and Group C −2.60±1.5). These findings suggest that DBT can be a beneficial adjunctive treatment for functional dyspepsia.

DISCUSSIONS

Alternative therapies for functional gastrointestinal disorders are essential for lowering the severity of their symptoms. This is because a prolonged use of proton-pump inhibitors (PPIs) may have adverse effects, despite their proven efficacy. Long-term use of PPIs can cause changes in the gut microbiota environment and modulate immune response. Some studies have also reported that long-term use of PPIs may contribute to small intestinal bacterial overgrowth (SIBO) or other infections of bacteria such as Clostridium difficile [20], by directly affecting gastric acid, therefore making the stomach and intestine more prone to bacterial colonization and infection. Further dysbiosis of the gut microbiota may then result in gastrointestinal symptoms such as abdominal pain, nausea, vomiting, and diarrhoea. This suggests that the use of other modalities alongside PPI treatment to reduce treatment duration is crucial to prevent long-term usage of PPIs.

Although previous studies on this topic are still very limited, their findings reveal a promising role of MBI or similar interventions for the management of functional dyspepsia. Numerous studies and meta-analyses have been conducted to evaluate the effects of mindfulness-based interventions on reducing pain, which correlate closely with functional dyspepsia patients, particularly those with epigastric pain syndrome (EPS). Several studies on MBCT have highlighted significant improvements in pain-related functional dyspepsia symptoms. According to these studies, MBCT alleviates symptoms

associated with both epigastric pain and postprandial distress syndromes, such as bloating.

The mechanism of how mindfulness may help these patients can be referred to multiple comprehensive studies of mindfulness-based intervention and the pathophysiology of functional dyspepsia itself. Functional dyspepsia patients often experience stress, anxiety, and mood disorders. One of the existing studies has shown that there is a tendency towards unhealthy coping mechanisms in rumination, as well as a lower tendency towards positive appraisal and acceptance. Mindfulness-based intervention has long been well-established in fostering positive appraisal and acceptance. Multiple prior studies have explained how mindfulness-based interventions and their derivatives can alleviate symptoms of functional dyspepsia. The mechanism of how yoga may reduce symptoms of functional dyspepsia can be translated well into how mindfulness can do the same, due to how much it taps into the same mechanism.

Despite its potential, problems remain in the implementation of MBIs regarding the commitment of patients to undergo the intervention. This is in line with the findings of other meta-analyses in different clinical problems, where time commitment may become a problem in performing MBI [16]. Other weaknesses of clinical trials that involve MBI, as with other commonly performed RCTs involving MBIs, include inadequate sample size and the absence of long-term follow-up. In addition, a control group is highly required, since numerous studies on MBI RCTs had no control groups. Most long-term follow-ups in other clinical problems, however, show consistent beneficial effects if patients continue their practices. An expert meditator is considered to have different brain activation compared to a beginner, and this may indicate that the long-term beneficial effects of mindfulness are likely to be felt [9].

Most studies and clinical trials involving MBI employed variations of MBCT and MBSR. Yoga is also often used as another complementary mind-body therapy that has a similar mechanism to mindfulness. Most of the experiments with mindfulness are designed with an instructor and a weekly session. Meanwhile, it is crucial to give homework and advise patients to do their own sessions outside of the scheduled session for additional benefits. It is unclear whether a video-based instruction or digital session may have similar effects as the usual MBI, but it might be worth exploring such a method due to easier access for the treatment group. Other methods of MBI, such as mindful eating (a variation of meditation purely focused on focused attention or open monitoring meditation) or other transcendental meditations, are rarely done and might be a fascinating avenue to pursue in the future. The use of mindfulness scales, such as KIMS, FFMQ, or other validated mindfulness scales, may help in ensuring whether the MBI methods given to the patients are effective in developing mindfulness on the intervention target. Such scales are rarely given to the experimental group and can be included in future studies along with questionnaires that explore the reduction of symptoms (such as SCA-FD, Quality of life questionnaire, etc.).

CONCLUSIONS

Mindfulness shows enormous potential as a complementary therapy to the common treatment for functional dyspepsia. Benefits of mindfulness in the management of functional dyspepsia may include reduced symptoms of both epigastric pain syndrome and postprandial distress syndrome, improved quality of life, and reduced anxiety or depression comorbidity. In this regard, mindfulness can help patients reduce their stress levels, develop a healthier coping mechanism, and improve their perceived relationship to their symptoms. However, although the results of preliminary studies seem promising, robust clinical trials that

involve the use of mindfulness in functional dyspepsia remain very limited. Therefore, further studies are recommended to focus on the intervention by establishing a special group and designing a better approach with clear control groups, long-term follow-ups, and inclusion of symptomatic, quality-of-life-related, and mindfulness scales to monitor the effects of the intervention.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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