

# Mindful Eating: A Review Of How The Stress-Digestion-Mindfulness Triad May Modulate And Improve Gastrointestinal And Digestive Function

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## Abstract

Much research associated with mindful eating pertains to weight loss, so this review is novel in that it explores mindful eating in a broader context of it attenuating the widespread problem of chronic stress disturbing gastrointestinal function. This attenuation is rooted in stress offsetting biological homeostasis and mindfulness being a widely studied stress-reduction intervention due to its ability to promote parasympathetic nervous system (PSNS) dominance. The stress-digestion-mindfulness triad is a hypothesized construct, integrating what is

understood about the digestive system with literature about the nervous system, neuro-endocrine-immune signaling, stress, and mindfulness. Thus, the plausibility of mind-body practices (e.g., mindful eating), which maintain PSNS dominance, helping to cultivate autonomic nervous system (ANS) homeostasis vital for optimal digestive function is established. The clinical utility of the stress-digestion-mindfulness triad involves a clinician-friendly application of mindful eating to improve digestive function.

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## The Stress-Digestion Connection

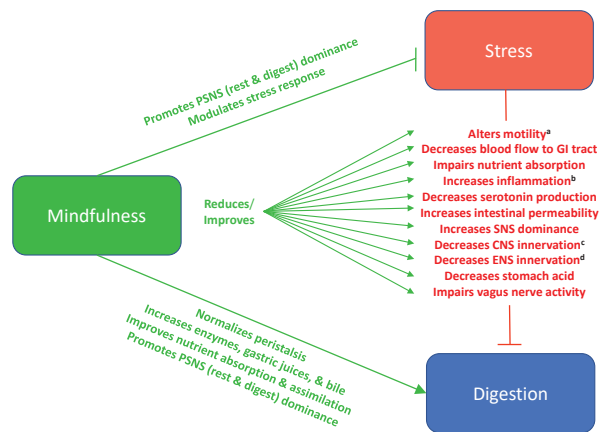
Stress is related to functional gastrointestinal disorders (FGID) such as irritable bowel syndrome (IBS)<sup>1</sup> and functional dyspepsia.<sup>2</sup> Notably, FGID severity is proportional to the use of healthcare resources<sup>3</sup> and decreased quality of life.<sup>4</sup> UK and Canada with equal demographic proportions across countries. Questions included the Rome IV diagnostic questionnaire, demographics, medication, somatization, quality of life, and organic gastrointestinal (GI) Given the prevalence of stress in America, stress-reduction interventions are prudent for minimizing FGIDs.

Impacting biological homeostasis, stress is the juncture at which mindfulness can be narrowed into the construct of mindful eating. This vantage point illuminates the role of mindful eating in optimizing digestive function. Stress may result from real or perceived threats that are contextualized as positive or negative. While colloquial

conversation is rife with references to psychosocial stressors, sources of stress vary—e.g., stress may be physical (e.g. manual labor, sleep deprivation, extreme exertion), chemical (e.g. alcohol, drugs, pesticides, pollutants), mental (e.g. anxiety, worry, long work hours), emotional (e.g. anger, fear, sadness), and nutritional (e.g. food allergies, micronutrient deficiencies).

Stress often carries a negative connotation, but it is purposeful during life-threatening situations or conditions that require provocation. This involves evaluating stressors and responding to them with physiological resilience via mobilization of metabolic resources needed for the “fight-or-flight” response. Two functions comprise the stress response: (1) surveillance, which assesses internal and external threats, and (2) effector, which mobilizes metabolic resources needed to respond to the threat. Metabolic reserve—the ability of organ systems and tissues to maintain integrity for physiological resilience during stress—safeguards against poor health outcomes that could result from the abrupt physiological changes that characterize the stress response. However, chronic stress may impair metabolic reserve.<sup>5</sup> The body is designed to return to homeostasis following acute stress, but chronic stress is problematic. It impairs homeostasis, prevents positive behavioral changes, and contributes to chronic disease<sup>6</sup> and gastrointestinal issues.<sup>7</sup>

**Figure 1. Stress—Digestion—Mindfulness Triad**



- <sup>a</sup>Motility: decreased motility increases risk of dysbiosis; increased motility impairs nutrient absorption
- <sup>b</sup>Inflammation: increases pro-inflammatory cytokines, resistance to cortisol's initial anti-inflammatory effect
- <sup>c</sup>CNS innervation: dysregulated motility, stomach pain, nausea, vomiting, diarrhea
- <sup>d</sup>ENS innervation: disrupted small segmentation contractions, peristalsis, and Migrating Motor Complex (MMC)

### Mindfulness and Mindful Eating

#### Mindfulness

Mindfulness—a keen awareness of an individual's emotions and body without judgment—has various branches (e.g., meditation, mindful eating), imparts psychological and physiological benefits<sup>8-10</sup> and is widely accessible. Research supports mindfulness-based stress reduction (MBSR) programs to be effective interventions for myriad chronic health conditions,<sup>11</sup> including gastrointestinal disorders.<sup>12</sup> For example, IBS sufferers respond favorably to MBSR programs utilizing practices such as diaphragmatic breathing, body scan, and meditation to target symptomology (e.g., pain from abdomen distension).<sup>13</sup> Increased stress, which mindfulness programs address, is the unifying theme in such conditions. Since stress is part of most individuals' lives, mindfulness is indicated as a preventative and therapeutic intervention.<sup>14</sup>

#### Mindful Eating

Mindful eating is the act of eating while being in a state of non-judgmental awareness, shifting one's attention to the food and mind-body connection. Thus, allowing exploration of the complex cognitive-biological experience of eating. This healing eating mode favorably affects problematic eating habits (e.g., desensitizing hunger and satisfaction cues)<sup>13</sup> and digestive disturbances attributed to stress.<sup>15</sup> Refer to Figure 1, Table 1 and Appendix A for a detailed discussion of how these attenuations occur and strategies to implement mindful eating.

#### Stress-Digestion-Mindfulness Triad

The stress-digestion-mindfulness triad is a hypothesized construct (See Figure 1), integrating what is understood about digestive function with literature about the nervous system, neuro-endocrine-immune signaling,

stress, and mindfulness. Accepted physiology characterizes the interaction between the digestive and nervous systems—including the influence of gut hormones and the HPA-axis—and how stress impairs digestive function. This is bridged with evidence from human trials showing mindfulness practices as effective strategies for reducing symptom burden among those with FGIDs.<sup>12,16-19</sup>

The ANS and central nervous system (CNS) extrinsically innervate the digestive system for proper digestive function, while the same is accomplished by intrinsic innervation by the enteric nervous system (ENS).<sup>20,21</sup> Approximately 90% of the serotonin in the body is concentrated in the ENS<sup>22</sup> where it is synthesized and released by enterochromaffin (EC) cells.<sup>23</sup> Serotonin is significant because it influences bowel motility, and senses and communicates information such as pain to the CNS.<sup>22,24,25</sup> Research in women with IBS has found that tryptophan (serotonin precursor) depletion leads to altered central and peripheral serotonin, and the associated emotional arousal and pain sensitivity consistent with IBS.<sup>26</sup>

#### The Central Nervous System

The CNS promotes the muscular motility of the esophagus and stomach, and stomach acid secretion in response to the activated vago-vagal reflex.<sup>20,21</sup> When CNS innervation is lost, dysregulated motility causes gastrointestinal symptoms such as stomach pain, nausea, vomiting, and diarrhea.<sup>20</sup> Hence, stress contributes to FGIDs such as IBS due to motility disturbances causing variations in gastric emptying and colonic contractions.<sup>27,28</sup>

#### The Autonomic Nervous System

The ANS also contributes to a dysregulated stress response and impaired digestive function. The ANS—responsible for maintaining homeostasis via chemical

messengers—is subdivided into the sympathetic nervous system (SNS) or noradrenergic system, PSNS or cholinergic system, and ENS. While the SNS activates the fight-or-flight response during times of perceived or real threat, the PSNS elicits the rest-and-digest state. Therefore, PSNS activation is needed for optimal digestion.<sup>29,30</sup>

The PSNS can be activated through mindfulness practices (e.g., alternate nostril breathing).<sup>31</sup> And established physiological knowledge shows that PSNS supports digestion by increasing salivary secretions, and stimulating gastric juices, digestive enzymes, and bile to facilitate nutrient assimilation and extraction.<sup>30</sup> Thus, it is plausible that mind-body practices (e.g., mindful eating), which maintain PSNS dominance, help cultivate ANS homeostasis vital for optimal digestive function.

### The Enteric Nervous System

Impaired ENS functioning may occur, which results in dysregulated bowel motility. Stress, along with infection gastrointestinal disturbances such as indigestion and IBS, may alter ENS function.<sup>32</sup> The ENS, also known as the gut-brain axis or the body's second brain (i.e., gut-brain), functions independent of the CNS but utilizes similar neurons and chemical messengers. Composed of over 100 million intrinsic neurons lining the walls of the gastrointestinal tract—from the esophagus to the internal anal sphincter<sup>21,33,34</sup>—the ENS is responsible for innervating the gastrointestinal tract.

The ENS is essential for controlling digestive functions such as small segmentation contractions that help mix contents with digestive enzymes and bring ingested food into contact with the intestinal wall for absorption. The retardation of contents moving through the intestine enhances digestion and absorption. Another ENS-controlled function includes peristalsis, rhythmic contractions or wave-like movements, helping to propel food through the esophagus and small intestine.<sup>35</sup> Isolated contractions move contents orally and aborally (i.e., toward and away from the mouth), while segmentation contractions mix contents over a short distance in the intestine. Regarding peristalsis, contraction and relaxation occur, but contents move aborally.<sup>36</sup>

The Migrating Motor Complex (MMC) is also under ENS control.<sup>37–40</sup> The vagus nerve controls the action of the MMC in the stomach, but not the intestine. And gut hormones initiate different MMC phases.<sup>41</sup>

### Gut and Brain Bidirectionality

The CNS and ENS work synergistically to communicate information via neurotransmitters in a bidirectional manner between the gut and brain.<sup>21</sup> When the brain perceives poor external factors (i.e., stress), it releases chemicals that stimulate the gut-brain to divert blood flow away from the gastrointestinal tract and toward organs that support survival (i.e., away from the trunk). When digestion is disturbed, the gut-brain communicates distress to the brain. Consequences include perturbations

to mood and general health. Counteracting this, mindful eating may reduce stress to establish an environment that optimizes digestive capacity.<sup>12,13,15</sup>

### HPA-Axis and the Chronic Stress Response

Chronically elevated cortisol may lead to impaired digestive function—e.g., increased intestinal permeability, impaired absorption of micronutrients, abdominal pain or discomfort, and local and systemic inflammation as evidenced by soldiers combat-training.<sup>42</sup> Chronic HPA-axis activation induces inflammation; resistance to the initial anti-inflammatory effect of cortisol develops, increasing pro-inflammatory cytokines<sup>43</sup> and risk for inflammation-related issues (e.g., increased intestinal permeability) that may play a role in FGIDs.<sup>44–46</sup>

### Clinical Application

The connection between neurogastrointestinal physiology and stress constructs a foundation for the clinical application of mindful eating to improve digestion. Research into the specialized branch of mindfulness—mindful eating—is in its infancy and has focused on weight loss through mindful-eating strategies. These include mindfulness meditation, breathing exercises, and facilitated discussions. Nevertheless, positive behavior change (i.e., increased awareness of internal signals, emotions, and external triggers) resulting in weight loss, and improved emotional stress and eating behavior are partly attributed to mindfulness-induced stress reduction.<sup>47,48</sup> A systematic review and meta-analysis<sup>49</sup> shows that mindfulness is integral to dealing with stress and mindfulness interventions are considered lifestyle medicine for diverse conditions, including those that impair digestion. Stress physiology is universal, but how individuals cope with stress influences health outcomes.

Mindful eating is an opportunity to non-judgmentally become aware of internal and external cues, sensations, and emotions.<sup>50</sup> And it nurtures PSNS dominance—the condition of the nervous system associated with reduced stress. For additional details about interventions that foster mindful eating, refer to Table 1 and Appendix A.

When working with patients, clinicians must help them identify stress—individuals might not know how they experience stress—and should assess current eating practices. To identify stressors, clinicians may ask patients to select relevant symptoms from a list of stress-related symptoms, categorized into physical, emotional, mental, and social symptoms. During this process, clinicians can ask patients the last time they experienced each indicated symptom of stress and examine the events leading up to their presentations. Attention may be given to stressful events that correspond to digestive symptoms. This approach helps explore the antecedents and triggers of stress and compromised digestive capacity, which could be used to develop intervention strategies and overcome barriers to positive behavior changes. In addition, to assess

current eating practices, clinicians can administer the Mindful Eating Questionnaire (MEQ), which covers five domains: (1) disinhibition, (2) awareness, (3) external cues, (4) emotional response, and (5) distraction.<sup>51</sup>

Patients may maintain a mindful-eating journal in which they record the time of the stress, symptom(s) of stress, eating activities surrounding the stress (i.e., before, during, and after symptom manifestation), and any internal self-talk that occurred. Recording this information helps affirm the reality of the issue, enhancing patients' abilities to acknowledge problematic stress and take action. Based on research indicating that handwriting notes versus typing notes leads learners to better internalize information in a

cognitively meaningful way,<sup>52</sup> a hand-written journal (as opposed to typing or using a mobile application) reasonably facilitates improved cognitive processing.

Once patients identify stress and its cause(s), clinicians can help patients bring non-judgmental awareness to their physical and emotional responses to eating, while empowering them to identify and listen to their internal hunger and satiety cues.<sup>53</sup> Motivational interviewing is a notable tool for exploring mindful-eating practices with which patients concur. Nonetheless, the utility of integrating mindful-eating interventions into clinical practice for improved eating behaviors, especially related to stress, is supported by the validity of the MEQ.<sup>51</sup>

**Table 1.**

**Clinical Application**

1. Help patients identify stressors, along with antecedents and triggers, and frequency using a mindful-eating journal
2. Have patients complete the Mindfulness Eating Questionnaire (MEQ) to identify strengths that can be leveraged and areas to develop further
3. Utilizing motivational interviewing techniques, partner with patients to select mindful-eating practices from the chart below that align with their needs and readiness for change

Intervention	Benefits	Sample Exercises
<p><b>Eating Slowly:</b> Thoroughly chewing food aids breaking down food into absorbable components via mechanical and enzymatic actions. Simultaneously, increased time spent on chewing fosters awareness of chewing, while also promoting identification and response to internal signals.</p>	<ul style="list-style-type: none"> <li>• Mechanically breaks down food<sup>54</sup></li> <li>• Salivary α-amylase begins starch digestion<sup>55</sup></li> <li>• Lingual lipase begins dietary fat digestion<sup>56</sup></li> <li>• Helps mucous in saliva bind broken down food constituents, forming bolus &amp; lubricating it for esophageal passage<sup>57</sup></li> <li>• Promotes salivary enzymes involved in PSNS activity, provoking downstream digestive processes (e.g., pancreatic enzymes, peristalsis)</li> <li>• Part of cephalic phase of digestion—involves neural regulation of downstream gastric acid secretion—via cholinergic neurons, gastric distension, and intestinal peptides<sup>58</sup></li> </ul>	<ul style="list-style-type: none"> <li>• Chew each mouthful 30 times</li> <li>• Place fork down between bites</li> <li>• Take deep breaths between bites</li> </ul>
<p><b>Meditation:</b> Meditation and diaphragmatic breathing modulate the stress response.</p>	<ul style="list-style-type: none"> <li>• Shifts nervous system toward PSNS dominance, supporting rest-and-digest state<sup>12,59,60</sup></li> </ul>	<ul style="list-style-type: none"> <li>• Listen to a guided meditation and engage in breath work before meals (Free videos are available online)</li> </ul>
<p><b>Hunger and Satiety:</b> Food choices and eating driven by hunger and satiety signals influence digestion.</p>	<ul style="list-style-type: none"> <li>• Appreciate internal and external factors influencing awareness,<sup>61</sup> food choices, and hunger-scale ratings</li> </ul>	<ul style="list-style-type: none"> <li>• Use a hunger scale before eating</li> <li>• Answer self-inquiry questions (See Appendix A) in mindful-eating journal before meals to increase awareness of internal and external milieu</li> </ul>
<p><b>Engaging Senses:</b> Tasting food is one component of mindful eating. As sentient beings, all of the senses (e.g., smelling food, seeing food, touching food) are equally important.<sup>61,62</sup></p>	<ul style="list-style-type: none"> <li>• Distinguish food compounds that stimulate digestive secretions (e.g., saliva, gastric juices)</li> <li>• Identify emotions (e.g., fear of foods linked to previous experience of suboptimal digestion)</li> </ul>	<ul style="list-style-type: none"> <li>• Suck on fresh lemon half to appreciate its sourness</li> <li>• Hold dark chocolate in mouth to appreciate its bitterness</li> </ul>
<p><b>External Environment:</b> The external environment characterizes emotions about eating and influences the nervous system.<sup>62</sup></p>	<ul style="list-style-type: none"> <li>• Foster a mindful-eating environment to help shift nervous system toward PSNS dominance</li> </ul>	<ul style="list-style-type: none"> <li>• Use attractive plates, glasses, utensils</li> <li>• Clear table of items unrelated to meals</li> <li>• Remove electronic devices from room</li> <li>• Light a candle</li> </ul> <p>(See Appendix A for gradual implementation process)</p>

**Additional Resources**

- *Mindful Eating on the Go: Practices for Eating with Awareness, Wherever You Are* by Jan Chozen Bays, MD
- *The Slow Down Diet: Eating for Pleasure, Energy, and Weight Loss* by Marc David
- *Eating Mindfully: How to End Mindless Eating and Enjoy a Balanced Relationship with Food* by Susan Albers, PsyD
- *The Mindfulness Diet* by Doug Hanvey, MS



## Conclusion

Mindful eating is a non-standardized protocol that complements other interventions to optimize digestive function, while enhancing self-acceptance, mind-body-food awareness, and overall wellness. Consequently, a variety of practices from evidence-based mindfulness programs may be used to individualize care based on patients' needs and readiness for change.

Central to mindful-eating practices for improved digestion is the attenuated stress response, encouraging nervous-system regulation to promote homeostasis needed for the rest-and-digest mode. Gastrointestinal and neuro-endocrine-immune signaling, and internal and external inputs comprise a complex psychosocial-physiological network that modulates optimal health. Within the context of that complex network, mindful eating offers a scientifically-proven, effective way to help regulate the stress response for optimal digestive function, which is the cornerstone of wellness and survival.

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## APPENDIX A

Specific elaborations to support sample exercises in Table 1 (Clinical Application).

### Hunger and Satiety

#### Sample exercise self-inquiry questions:

- How do I feel before, during, and after eating (e.g., stressed, overwhelmed, bored, hungry, lightheaded, tired)?
- Am I salivating before placing food into my mouth?
- How does my tongue help me receive the food and am I aware of this muscular organ?
- Are my feelings rooted in my physical or emotional bodies, or both?

### External Environment

#### Sample exercise implementation strategy:

Partner with patients to identify one change they can make to create a more serene eating environment. Once successful, implement another change. Repeat this sequence until a relaxing eating environment is established.