Mindful Eating Practice and its Challenges: Insights from Expert Practitioners

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The exploration of mindfulness technologies and human-food interaction has received increased HCI interest, albeit limited research has explored the intersection of these separate areas. To address this gap, we interviewed 21 mindful eating expert practitioners, including nutritionists, dietitians, psychologists, or mindfulness coaches, to understand their mindful eating practices and the feasibility of technologies to support them. Findings indicate that mindful eating practitioners use mindful eating, mindfulness, and mental health interventions for their four client groups: those living with eating disorders, including mental health conditions, non-clinical conditions, and those interested in improving overall wellbeing. Findings also highlight the challenges of mindful eating practice, and we concluded with four design implications for addressing them.

Mindful eating practice, Food, Mindful eating, Mindful eating interventions, Practitioners

1. INTRODUCTION

Eating is a daily ritual that significantly impacts well-being and health, engaging multiple senses. Mindfulness meditation also involves bodily practices, which consistent findings have shown to support wellbeing and health ((Peterson and Pbert 1992; Kabat-Zinn et al. 1985). Jon Kabat-Zinn, the founder of Mindfulness Based-Stress Reduction (MBSR), defines mindfulness as "*the awareness that emerges through paying attention on purpose, in the present moment, and non-judgmentally to the unfolding of experience moment by moment*" (Kabat-Zinn 2003). Research has shown the benefits of mindfulness for physical conditions, such as alleviating pain (Chiesa and Serretti 2011; Zeidan et al. 2012), mental health ones such as depression (Klainin-Yobas et al. 2012; Piet and Hougaard 2011), and psychological wellbeing more broadly (Chiesa and Serretti 2009; Hofmann et al. 2011), including eating behaviours (Nelson 2017).

A growing body of Human-Computer Interaction (HCI) research over the last decade has explored the support for mindfulness practices through mindfulness technologies (Terzimehić et al. 2019) such as virtual reality (VR) (Kosunen et al. 2016) or haptic interfaces (Daudén Roquet et al. 2023), or the support for healthy eating (Epstein et al. 2016) particularly in Human-Food Interaction (HFI) area, which is defined as "*the interconnection between the self and food*" (Choi et al. 2014)(p.4). A review of HFI research showed the emphasis on technologies targeting source, production, track, and eating of food albeit with limited focus on mindful eating (Altarriba Bertran et al. 2019a), while another review highlighted the focus on growing, cooking, eating, and disposing of food, and the emerging interest in healthy eating and mindful eating (Khot et al. 2019). This latter research agenda has focused on a range of technologies, including smart tableware, wearables, 3D food printing, virtual or augmented reality, as well as mobile apps (Gayler et al. 2022). However, less work has integrated these two rather independent research areas to explore and support mindful eating practices (Epstein et al. 2016; Guluzade and Sas 2023), despite its acknowledged benefits for both physical and emotional health (Warren et al. 2017).

Much research has shown the benefits of mindful eating interventions for obese women with binge eating disorder (Kristeller and Hallett 1999) in reducing binge eating episodes, enhancing interoceptive

awareness, supporting weight loss and diabetes management, and reducing depressive symptoms (Kristeller 2015). Mindful eating involves present-moment awareness of eating by accepting thoughts, emotions, and behaviours around food, tuning into bodily sensations of hunger and fullness signals, eating slowly with small bites and portion sizes, and savouring the food while eating, showing gratitude, and not multitasking (Nelson 2017).

Designing for mindful eating is not trivial, as it extends the scope of mindfulness to include the human body, the food, and the eating experience. However, we know little about how mindful eating practitioners support their clients' practice of mindful eating, the practice itself, and its main challenges. These are essential starting points for exploring the potential of interactive technologies in addressing these challenges further. We report findings from interviews with 21 mindful eating practitioners, exploring their practice, clients, main interventions, and key challenges. Our work addresses the following research questions: **RQ1.** *Who are the clients of mindful eating practitioners, and why do they engage in mindful eating interventions?* **RQ2.** *Which interventions and technologies do mindful eating practitioners employ in their practice?* **RQ3.** *Which are the main challenges of mindful eating practices?*

2. BACKGROUND

We draw from HCI research on mindfulness technologies and eating experiences, particularly healthy eating, as well as the emerging work on mindful eating.

2.1. HCI Research on Mindfulness Technologies

Over the past decade, interest in mindfulness technologies has grown (Terzimehić et al. 2019). Mindfulness practices range from stillness-based forms like sitting meditation (Daudén Roquet and Sas 2021; Peng et al. 2024) to slow, repetitive movements like walking meditation (Cochrane et al. 2021, 2020) or mandala colouring (Daudén Roquet et al. 2023).

Despite being conceptualised as a body–mind practice (Terzimehić et al. 2019), most mindfulness technologies have focused on distal senses like sight and sound via audiovisual interfaces (Cochrane et al. 2021; Sas and Chopra 2015; Vidyarthi et al. 2012). Often, such interfaces map "*being mindful*" vs "*being mindless*" states to simple and easy to understand representations such as low vs high sound pitch, rain vs bird song, blue vs purple (Prpa et al. 2016). In contrast, emerging HCI work explores bodily engagement (Daudén Roquet and Sas 2020), including interfaces that use thermal haptic biofeedback to support interoception, or awareness of internal bodily sensations (Daudén Roquet and Sas 2021; Ezer et al. 2024) as well as through magic machine method (Andersen and Wakkary 2019; Li et al. 2023) for designing mindfulness technologies (Daudén Roquet and Sas 2020).

Most mindfulness technologies rely on wearable headbands capturing brain activity to provide real-time neurofeedback (Moran et al. 2016; Snyder et al. 2015; Turmo Vidal et al. 2023), often via audio (Cochrane et al. 2021; Vidyarthi et al. 2012) or visual interfaces (Amores et al. 2016; Peng et al. 2023), to help redirect attention to the present moment (Antle et al. 2018, 2019). Yet, mindful eating and how technologies can support bodily-food interaction remain underexplored in HCI despite growing interest in eating experiences (Daudén Roquet et al. 2023).

2.2. HCI Research on Healthy Eating and Mindful Eating Technologies

In their review of HFI research, Altarriba Bertran et.al (Altarriba Bertran et al. 2019b) showed the emphasis on technologies targeting functionalities, mainly addressing the tracking of food, rather than the full cycle from food production to waste disposal.

Another HCI strand supports healthy eating (Gayler et al. 2022), mainly through persuasive technologies for children and mobile apps for adults. For children, interactive tableware and gamification encourage vegetable intake (Joi et al. 2016), such as weight-sensitive tray reducing meal time (Lo et al. 2007), and smart chairs promoting attention and manners (Chen et al. 2018).

For adults, apps are used to track calories, nutrients, and activity (Bomfim et al. 2020), as well as social media for photo-based tracking of food and eating (Chung et al. 2017). With respect to the latter, scholars critique compulsive tracking for its link to eating disorders (EDs), and instead advocate food literacy (Bomfim et al. 2020), or just-in-time interventions like *FoodCensor* for monitoring engagement with food media and prompting user's reflection, as well as for tackling unconscious eating behaviours tied to external triggers (Choi et al. 2024). Other apps support symptom monitoring for EDs (Devakumar et al. 2021) or digestive disorders (Karkar et al. 2017). To support healthy or hedonic eating, other types of technologies include gustatory interfaces (Ranasinghe and Do 2016), AR/VR for food appearance (Nishizawa et al. 2016), auditory feedback (Koizumi et al. 2011; Mathiesen et al. 2019; Chen et al. 2024), olfactory cues (Narumi et al.

2011b), and multisensory methods altering taste and texture perception (Kleinberger et al. 2023; James et al. 2022).

In contrast to this body of work supporting eating practices, mindful eating has seen limited HCI focus. Mindful eating involves nonjudgmental awareness of hunger, fullness, and food's sensory qualities (Framson et al. 2009; Kristeller and Wolever 2014). Previous work has partly addressed some of these key aspects. For example, emerging technologies aim to support slow eating via wearables (Kim et al. 2016; Nicholls et al. 2022), smart tableware (Kadomura et al. 2013; Kim et al. 2016; Zhang et al. 2020; Nakamura et al. 2025), 3D-printing (Lin et al. 2020), or AR/VR for small bites, portions, or for chewing (Narumi et al. 2012; Sakurai et al. 2015). However, limited technologies explicitly support mindful eating, such as *Food4Thought* system, which uses daily "*crumbs*" to promote awareness (Epstein et al. 2016) but lacks focus on savouring and emotion (Framson et al. 2009).

A review of 13 apps (Guluzade and Sas 2023) found that only two apps, *Eat Right Now* and *MEAL*, fully supported mindful eating. Authors urge more features to enhance satiety awareness and mindful interventions. A recent functionality review of 27 commercial apps for mindful eating and EDs (Guluzade and Sas 2024) identified Cognitive Behaviour Therapy (CBT), guided meditations, and MB-EAT-inspired practices (Kabat-Zinn and Hanh 2009), such as the raisin meditation. Yet, few such apps offer tools for reflecting on hunger, portion size, or emotions associated with food and eating. Recent studies also explored mindful eating through conversational agents like the *Digital Sommelier*, which encourages savouring wine using visual and tactile cues (Parra et al. 2024), *MyndFood*, which promotes mindful cooking (Parra et al. 2023), or voice assistants (Zhang et al. 2023). To conclude, HCI has largely prioritised healthy and hedonic eating, with limited focus on mindful eating technologies.

2.3. Research on Mindful Eating Interventions

Mindfulness-based interventions improve eating behaviour and ED-related symptoms in adults (Kristeller et al. 2006; O'Reilly et al. 2014). Mindfulness-Based Cognitive Therapy (MB-CT) enhances body image and reduces emotional eating in women with EDs (Alberts et al. 2012), while MB-EAT addresses binge eating by distinguishing emotional from physiological hunger cues (Kristeller and Wolever 2014). Mindfulness techniques are also integrated into ED treatments, including Dialectical Behaviour Therapy (DBT), effective for bulimia nervosa (BN), BED, and comorbid substance abuse (Courbasson et al. 2012; Bankoff et al. 2012; Safer and Jo 2010; Safer et al. 2001), and Acceptance and Commitment Therapy (ACT), which offers an alternative to CBT (Juarascio et al. 2013).

Intuitive Eating (IE) promotes body and food awareness through hunger cues, emotional regulation, and body respect (Tribole and Resch 2012). It overlaps with mindful eating (Gast and Hawks 1998; Framson et al. 2009; Mathieu 2009), though its evidence is limited (Babbott et al. 2023; Bush et al. 2014; Linardon et al. 2021). IE is inversely linked to depression, anxiety, and disordered eating (Denny et al. 2013; Katcher et al. 2022; Warren et al. 2017). Mindful Eating and Active Living (MEAL), a family program incorporating MB-EAT elements, promotes healthy habits and addresses pediatric obesity (Burton and Smith 2020). Despite shared principles (Van Dyke and Drinkwater 2014), interventions differ, and limited trials and fidelity measures hinder comparison (Grider et al. 2021; Rezende et al. 2024). MB-EAT shows promising outcomes for binge eating and emotional regulation (Katterman et al. 2014; Warren et al. 2017), while IE (Babbott et al. 2023) and MEAL (Burton and Smith 2020) need further evaluation.

To conclude, despite the substantial work on mindful eating interventions such as MB-EAT in health research, its application in HCI has been limited.

3. METHOD

To address the research questions, we conducted semi-structured interviews with experts. In the following section, we describe the process of conducting the interviews and collecting the data, followed by an explanation of the analysis. The study received Institutional Ethics approval.

3.1. Participants

We used convenience and snowball sampling to recruit 21 mindful eating experts via professional platforms like LinkedIn, based on two criteria: (i) being registered dietitians, nutritionists, psychotherapists, psychologists, or mindful eating coaches, and (ii) having used mindful eating interventions for at least one year. 21 experts were recruited (19 female and 2 male), none identified as non-binary and disclosed their ethnicity, with an average age of 45 years, ranging from 26 to 62. The gender bias in our sample is not surprising, given the long-acknowledged feminisation of mental health professions (Rubinstein 2011). Participants, primarily from the USA and UK, had an average of 8 years of mindful eating practice (range 2-29).

Roles included registered dietitians (6/RD), nutritionists (5/N), dietitians (3/D), registered nutritionists

(2/RN), meditation coaches (2/MC), a clinical psychologist (1/CP), a psychotherapist (1/P), and an eating psychology coach (1/EPC). Education levels were Master's (12), Bachelor's (6), and PhDs (3). Eight participants reported using technologies such as mindfulness apps (e.g., Insight Timer, Plum Village, Headspace, Meditopia), mindful eating apps (Eat Right Now), health apps (Apple Health, MyFitnessPal, Noom), and communication tools (WhatsApp, Voxer).

3.2. Interviews

We started with an introduction to the study's aims, followed by individual, semi-structured interviews inquiring about experts' practices of supporting mindful eating, interventions they used, and challenges they encountered. Interviews were conducted online over Microsoft Teams and lasted about an hour. Each expert was compensated with the equivalent of a USD 100 Amazon voucher.

3.3. Data Analysis

Interviews were audio recorded, anonymised, and fully transcribed by the first author. For coding them, both authors followed a hybrid approach (Fereday and Muir-Cochrane 2006) for thematic analysis, which includes both interview data-driven, inductively generated codes (Boyatzis 1998), and deductively generated codes informed by previous work (Crabtree and Miller 1992). This combination complements the research questions, allowing the themes to emerge. Both authors developed the coding scheme iteratively, drawing from mindful eating literature and relevant HCI research. Deductively generated codes include aspects on mindful eating such as bodily awareness, slowly chewing, small bites, small portions, savouring food, non-judgmental attitude, healthy food, gratitude, not-multitasking (Framson et al. 2009; Hussein et al. 2017; Jordan et al. 2014; Kristeller and Wolever 2014; Mantzios 2021; Monroe 2015). The inductively generated codes include experts' tools, challenges and approaches to addressing them, as well as codes on how specific mindful eating aspects support or hinder mindful eating. The coding was conducted using Atlas/ti software (Friese 2019).

4. FINDINGS

4.1. Experts' Mindful Eating Practice: Clients

Our experts work with four types of clients: those living with EDs (13/21), including those with mental health conditions (10/21), non-clinical eating conditions (17/21), and those interested in overall wellbeing (17/21).

4.1.1. Clients living with EDs

An important finding is that most experts reported working with clients living with EDs, most commonly binge eating (12/21), anorexia (3/21), and bulimia (3/21) (Table 1). Binge eating, characterised by the consumption of large quantities of food in a short period, accompanied by a loss of control, is a defining feature of BED (Fairburn 2008). Anorexia involves a constant restriction of energy intake leading to significantly low body weight, accompanied by an intense fear of gaining weight and a distorted perception of one's body shape or size (Kaye et al. 2004). In contrast, bulimia nervosa is characterised by recurrent episodes of binge eating, consuming large quantities of food in a discrete period while feeling a loss of control, followed by inappropriate, harmful behaviour, such as self-induced vomiting, excessive exercise, or misuse of laxatives, to avoid weight gain (Kaye et al. 2004). Experts reported that the main concern related to all three conditions is patients' unhealthy eating patterns of food intake regulation: "*patients with binging or bulimic symptoms often have accelerated eating patterns, but then have erratic patterns of excessive intake and purging behaviour. In contrast, anorexic ones have the same and predictable patterns even if these patterns result in malnutrition*" (P7-N).

4.1.2. Clients living with mental health conditions

Experts also reported working with clients who experience both EDs and mental health conditions, such as depression (5/21) or anxiety disorders (5/21) (Table 2). Clinical mental health conditions, particularly anxiety disorders and depression, are closely linked to EDs. Such conditions can lead to patterns of overeating or restrictive eating, while trauma is often associated with emotional eating and BEDs (Van Wyk 2010). Mindful eating experts outlined the most common clinical mental health conditions, including anxiety disorders (5/21) or depression (5/21). An important outcome is that many of our mindful eating experts reported collaborating with psychologists or therapists (6/21) or clinicians (2/21) to recommend and deliver treatment for people living with both mental health and ED conditions.

4.1.3. Clients with non-clinical problematic eating

In contrast to clients living with diagnosed EDs, experts also reported working with individuals who engage in problematic eating (i.e., mindless, emotional, or restrictive eating), though they may not meet criteria for clinical diagnosis. Experts argued that such clients could benefit from early intervention to prevent the development of a diagnosed ED condition (Le et al. 2017). Restrictive eating and chronic dieting are closely related behaviours that often reinforce each other, identified

Table 1: *Clinical eating conditions (EDs) include anxiety disorders, bulimia nervosa, and binge eating disorders. MB-EAT is used for binge eating disorders (1/P, 1/CP, 2/D, 2/RD) and diabetes management (3/N, 3/RD). CBT is used for anorexia and bulimia nervosa (1/D, 1/RD, 1/RN each), and for binge eating disorders (2/D, 2/N, 1/RD, 1/P, 1/CP, 1/RN, 1/EPC).*

Interventions	Clinical eating conditions (EDs) (/21)			Physical/ chronic eating conditions (/21)
	Anorexia nervosa	Bulimia nervosa	Binge eating disorders	Diabetes management
MB-EAT			6/21	6/21
CBT	3/21	3/21	9/21	

Interventions	Mental health conditions (/21)	
	Anxiety disorders	Depression
CBT	5/21	5/21
MB-SR	3/21	4/21
MBCT	1/21	1/21

Table 2: *Mental health interventions for anxiety and depression include CBT (1/P, CP, MC, EPC, N); mindfulness-based stress reduction (MB-SR) for anxiety (2/MC, 1/EPC) and depression (1/N, 2/MC, 1/EPC); and mindfulness-based cognitive therapy (MB-CT) for anxiety (1/MC) and depression (1/MC).*

by most experts (16/21) as the most common condition (Table 3). Emotional eating, in which individuals eat in response to emotions such as stress, boredom, or sadness rather than physical hunger, is strongly associated with negative affect and maladaptive coping mechanisms (Macht 2008). These behaviours are closely interconnected, often stemming from attempts to regulate or suppress negative emotions.

Our experts noted that binge eating episodes (12/21) often occur as a result of emotional distress triggering emotional eating (12/21): "*chronic dieting can later lead to binge eating episodes, which in turn reinforce their beliefs and thoughts about themselves, such as failure, guilt, and lack of willpower. The aftermath of this situation becomes even more intense, eventually turning into emotional eating and other eating disorders*" (P7-N). Experts stated that many patients indicate a highly distorted relationship between food and their bodies (Table 3).

Body image is linked to eating behaviour and dietary choices, often influencing how individuals interact with food. The negative body image, characterised by dissatisfaction with one's physical appearance, can lead to disordered eating patterns, including restrictive eating, emotional eating, or binge eating (Cash 2000). Mindless eating, characterised by consuming food without attention, often occurs during distractions like watching television and can lead to overeating (Wansink and Sobal 2007), which is outlined by the nine experts as the most common eating habit.

4.1.4. Clients interested in wellbeing, with no diagnosed EDs & mental health conditions

Experts also outlined that they work with clients interested in wellbeing who do not have diagnosed EDs or mental health conditions, such as improving overall wellbeing (6/21), weight management (11/21), women's health (e.g., menopause) (2/21), or improving gut health/ digestion (1/21). Findings also indicate the importance of interdisciplinary expertise in supporting clients with ED or eating problems. Thus, most of our interviewed experts collaborate with mental health therapists (11/21) or medical doctors (7/21) to identify the best treatment. Only one expert mentioned collaborating with a company to analyse patients' gut health behaviour before and after treatment (P16-ECP).

4.2. Interventions for Mindful Eating Practice

Findings indicate four main interventions targeting mindful eating (14 experts), mindfulness meditation (4 experts), mental health (8 experts). Below we describe different interventions for four groups of clients, some of which are shared across groups.

4.2.1. Mindful Eating Interventions: Targeting EDs

Our experts reported using three mindful eating interventions, with MB-EAT being by far the most common (14/21), followed by Intuitive Eating (9/21), and to a lesser extent, Mindful Eating-Conscious Living (ME-CL) (2/21). MB-EAT and Intuitive Eating interventions show effectiveness in terms of increased compassion and acceptance toward their bodies and food: "*early in the sessions, some people may share that they don't necessarily experience a deep sense of embodied awareness or may have biases around certain foods. However, as the sessions progress, they often begin to feel more compassionate toward both their bodies and food, realising that the focus isn't on dieting but on cultivating awareness*" (P7-N). Experts also reported measurements for using paper and pencil questionnaires such as the Intuitive Eating Questionnaire (IEQ) (Tylka and Kroon Van Diest

Table 3: *Non-clinical problematic eating includes: restrictive eating, chronic dieting, emotional eating, mindless eating, relationship with body, and relationship with food. All experts use mindful eating interventions and mental health interventions to support all eating conditions. Regarding unstructured mindfulness interventions: MSC is used for emotional eating (1/RN, 1/MC); body image/ relationship with body (2/RD, 1/RN); DBT for emotional eating (1/N); ACT and CFT for mindless eating (1/RD).*

Interventions	Non-clinical problematic eating (/21)					
	Restrictive eating	Chronic dieting	Emotional eating	Mindless eating	Relationship with body	Relationship with food
MB-EAT	7/21	11/21	6/21	5/21	6/21	5/21
Intuitive eating		6/21	5/21		4/21	5/21
CBT	10/21	9/21	9/21	4/21	6/21	6/21
MSC			2/21		3/21	2/21
DBT			1/21			
ACT				1/21		
CFT				1/21		

2013) (1/21), Four-Facet Mindful Eating Scale (FFaMES) (Carrière et al. 2022) (1/21), or Five Facet Mindfulness Questionnaire (FFMQ) (Baer et al. 2006) (1/21).

Additionally, experts reported assessing the overall effectiveness of each intervention through self-designed surveys (4/21), questionnaires (4/21), or verbal feedback from patients (13/21). Regarding the continuity of its impact, experts (7/21) outlined that if patients continue the sessions, the effectiveness of the improvements is sustained; otherwise, it depends on the patients' self-motivation and discipline. Two experts send reminder emails regularly to check if any help is needed regarding post-intervention (2/21).

Experts outlined the tailoring of their interventions for relapsing clients (14/21): *"personalisation includes the intensity, duration, and depth of activities, ranging from simple breath exercise to detailed body scans or thought observation. The approach varies based on the client's personality and needs*" (P11-N). Experts also prefer to use MB-EAT for most of their clients due to its evidence-base, and structured plan: "*MB-EAT stands out among mindfulness approaches for its structured and evidence-based framework, offering a clear pathway to integrate mindfulness with eating habits in a way that feels both natural and transformative*" (P20-RD). A noticeable exception regarding MB-EAT use was reported by over a quarter of experts (5/21) who noted its limitation for people living with anorexia and bulimia, as it "*can sometimes intensify preexisting obsessions with food and body, reinforcing restrictive behaviours rather than alleviating them*" (P9-RD).

Findings also indicate that the MB-EAT interventions tend to take place through one-hour weekly sessions, over 4 to 10 weeks, during which experts make use of a rich set of technologies, most often mobile apps for mindfulness, i.e., Insight Timer (3/21), Meditopia (1/21), and Plum Village (1/21), for mindful eating, i.e., Eat Right Now (1/21), or for physical health apps (i.e., weight management) such as MyFitnessPal (2/21), Calorie Counter (2/21), and Noom (1/21).

The limited use of mindful eating apps is surprising, given the rich set of functionalities of top-rated commercial apps for mindful eating (Guluzade and Sas 2023, 2024), which indicate their potential value for clients to use between sessions with their therapists. In contrast to the limited use of mindful eating apps, practitioners did recommend meditation apps to their clients albeit, these are to be used in silo, rather than being integrated within the MB-EAT intervention. Concerning dieting apps, particularly for clients with clinical eating conditions, concerns were raised about their emphasis on tracking which may lead to a strained relationship with food which can promote disordered eating (7/21): "*logging and categorizing food using various colors makes them overly preoccupied with their food choices, even when they didn't intend to be*" (P10-CP).

Experts use intuitive eating, particularly overcoming diet mindset (6/21): "*intuitive eating often attracts those transitioning away from dieting, but many struggle to eat intuitively due to years of ignoring their body's signals. Chronic dieters, for example, may associate hunger suppression with "winning" at dieting, reinforcing disconnection from their hunger cues*" (P9-RD). Despite its strengths, limitations are also outlined (4/21): "*mindfulness bridges this gap by helping individuals reconnect with their body, emotions, and behaviour, allowing them to recognise and honour hunger and fullness. Without this mindful awareness, intuitive eating can feel unattainable, as the foundational skills needed to trust and respond to the body's signals are missing*" (P9-RD).

People with EDs may have a comorbidity of diabetes due to problematic eating and poor glycemic control (Herpertz et al. 1998). Mindful eating has shown promise as a complementary approach in diabetes management, as it can help individuals regulate glucose levels, improve dietary habits, and enhance emotional wellbeing through present-moment awareness and reducing stress (Gregg et al. 2007), as reported by six experts: "*mindful eating helps people with diabetes make more intentional food choices, reduce overeating, which improves glycemic control*" (P12-N).

Our experts reported using unstructured mindfulness interventions: Mindful Self Compassion (MSC)(Neff and Germer 2013) (4/21), DBT (1/21), ACT (1/21), and Compassion Focused Therapy (1/21), to develop compassion toward self, particularly for patients with EDs: "*the two key elements are self-kindness and self-compassion, supported by body awareness. Emotional resilience stems from our ability to hold ourselves with kindness; without this, we tend to reject or suppress difficult emotions, limiting our tolerance for them*" (P14-MC).

4.2.2. Mental Health Interventions

For mental health conditions associated with problematic eating, our experts reported the use of CBT (6/21 experts), followed by MB-SR (4 experts), and Mindfulness-Based Cognitive Therapy (MB-CT) (1) (Table 2).

Experts use cognitive behavioural interventions such as CBT, MB-SR, and MB-CTs. CBT is a structured, evidence-based treatment targeting negative thought patterns and behaviour to address psychological issues like depression and anxiety (Beck 1979). It is based on the interconnection of thoughts, emotions, and behaviour, aiming to modify one to influence the others (Hofmann et al. 2012). Experts reported using it: "*because food cravings often start with a thought, followed by an emotion, and then a behaviour that supports that thought. However, we encourage awareness of your thoughts, emotions, and behaviour. By becoming more aware, you might choose to respond differently, opting not to eat and doing something else instead*" (P2-N). Findings also indicate challenges associated with CBT which: "*can feel overly mechanical for some clients. It assumes everyone can rationally challenge thoughts, but for those with deep emotional eating triggers, mindfulness-based approaches are more holistic"* (P21-MC).

Experts also mentioned using MB-SR, a valid and much-used mindfulness intervention developed for treating anxiety (Peterson and Pbert 1992; Kabat-Zinn et al. 1985). This involves experiential learning through eight weekly group sessions, a half-day retreat, and a mindfulness meditation practice Unlike CBT, which focuses on changing the content of thoughts, MBSR supports awareness of one's thought process (Lao et al. 2016). Findings indicate experts' use of MB-SR to alter their patients' relationship with stressful thoughts and events by decreasing emotional reactivity and enhancing cognitive appraisal (5/21): "*the underlying issue of emotional or stress eating, which often correlates with mood issues and other factors - it's all naturally interconnected. So, when I work on mindful eating, I also incorporate MBSR techniques*" (P16-ECP).

A third, albeit less used, mental health intervention is MB-CT, integrating MBSR and CBT (Lao et al. 2016): "*in cases where depression or mood disorders drive disordered eating, MBCT may be more effective than eating-focused mindfulness interventions (P14-MC).* Such interventions show effectiveness in terms of clients' increased compassion and acceptance toward their bodies and food, which a few experts reported measuring with paper and pencil questionnaires (6/21) or paper-based word clouds (1/21): "*we create a group word cloud at the start and end of the course, capturing patients' emotions. Early clouds often highlight anxiety or stress, while final ones typically feature positive words like hopefulness"* (P21-MC).

4.2.3. Holistic Interventions for Wellbeing

Holistic interventions address wellbeing's interconnected physical, emotional, and social aspects, offering a comprehensive approach to health (Kabat-Zinn 2003). Our experts (9/21) reported that the MB-EAT intervention has been shown to enhance overall wellbeing by fostering a non-judgmental awareness of the present moment. Encouraging a focus on the sensory experience of food and recognizing hunger and fullness cues, helps reduce overeating and promotes healthier dietary choices, thereby facilitating weight management; while CBT is used for habitual changes (6/21) and improving gut health (1/21), particularly in the case of menopause (2/21): "*most of my clients are women, with a significant number experiencing menopause-related challenges. Menopause often comes with symptoms such as increased anxiety, depression, and weight changes, which can further exacerbate anxiety and depression. I find mindful eating to be a particularly useful approach for menopausal women*" (P8-RN).

Alongside mindful eating and mental health interventions, experts use mind-body practices such as somatic techniques (3/21) as a part of holistic interventions: "*it helps people identify their needs and explore how to meet the basic human needs of safety, satisfaction, and connection. Being human can be a barrier because we all have strengths and*

weaknesses. My goal is to help someone discover for themselves what will be empowering and what may be getting in their way" (P13-RN). These findings suggest that experts use top-rated mobile apps to support mindfulness interventions (Guluzade and Sas 2023), albeit with limited use of apps targeting mindful eating.

4.3. Challenges of Mindful Eating Practice

Experts also highlighted challenges associated with MB-EAT interventions, including those related to body, eating attitudes, and mindset.

4.3.1. Challenges related to bodily awareness

Mindful eating, in essence, involves tuning into the body by listening to internal bodily sensations of hunger and satiety cues, while being aware of triggers such as thoughts and feelings that can lead to overeating (Stahl and Goldstein 2019). Findings indicate three main challenges related to the human body, namely clients' limited bodily awareness, savouring food, and slowly chewing and pausing. Experts reported people's limited interoceptive awareness of bodily cues associated with eating, such as hunger, thirst, sensory-specific satiety, stomach fullness, muscle tension, or breathing (7/21): "*most patients have lost touch with the subtle signals of their bodies, which leaves them disconnected from their physical and emotional needs*" (P9-RD).

Mindful eating requires present moment awareness, involving paying attention to the sensory aspects of food: sight, taste, sound, texture, and smell (Hanh and Cheung 2011). More than half of our experts (13/21) mentioned their efforts to support people in learning how to savour food in the present moment by bringing awareness to the experience of eating. The basic principles of mindful eating involve slowing down the eating rate by increasing the number of chews, chewing thoroughly before swallowing, taking smaller bite sizes, pausing between bites, and eating smaller portions (Monroe 2015). Most people, however, eat without awareness, so learning to chew slowly is not trivial.

4.3.2. User attitude towards eating & limited literacy

Findings suggest three main challenges pertaining to clients' problematic attitude towards food, namely judgemental attitude towards food or eating, diet mentality, and limited gratitude towards food, as well as a knowledge-related challenge, such as limited literacy for healthy eating. Mindful eating is "*a non-judgmental awareness of physical and emotional sensations while eating or in a food-related environment*" (Framson et al. 2009). Self-judgment is rooted in guilt and shame about unhealthy eating behaviour, which eleven experts outline as one of the main challenges.

Findings indicate limited support for the non-judgmental attitude towards eating. Indeed, the only interactive technology that practitioners mentioned, particularly in relation to this challenge, is meditation apps, suggested by 7/21 practitioners: "*I would like to send meditation reminders to my patients via a mobile app whenever I see they need it*" (P9-RD).

All experts reported diet mentality as another challenge of mindful eating interventions. Labeling food as 'good' or 'bad', 'healthy' or 'unhealthy' is a key aspect of the diet mentality and a significant issue for people with problematic eating behaviour: "*the goal is to help people nourish themselves with wholesome foods and show them how significantly the foods we eat impact our physical health. It's important to emphasise that eating a piece of cake won't make you sick, turn you into a diabetic, or cause you to gain five kilos. We want to shift away from this mindset and let them know it's okay to enjoy cake*" (P7-N).

Diets typically emphasize eating guidelines, such as recommendations on food choices, portion sizes, calorie tracking, and self-restrictions, intending to achieve specific desired outcomes (Nelson 2017), which is fundamentally different than mindful eating, thus some people may find difficult to understand as they need to relearn trust in their body (10/21): "*they are a lot more familiar with classical dieting, so it provides them with some kind of safety, whereas mindfully eating is something that they haven't experienced before, and they are uncertain about what results they can expect*" (P19-RD).

Mindful eating meditation can be a profoundly spiritual act, and with this greater awareness and insight, it cultivates a profound sense of gratitude and appreciation of the food being consumed, fostering a connection to nature and its sources (Hanh and Cheung 2011). Gratitude for food was mentioned by two experts (P4-P, P8-RN). Mindful eating incorporates healthy foods, in terms of ingredients, and food preparation (Jordan et al. 2014), and more than half of the experts (12/21) provide psychoeducation.

4.3.3. Challenges related to eating environment

Another aspect of mindful eating is not multitasking during meals, which is crucial for preventing overeating (Monroe 2015), as suggested by 7/21 experts. Experts outlined that individuals who habitually eat with external stimuli such as TV, phone, or book, may find it difficult to change the habit: "*it can condition the brain to associate eating*

with distraction, which makes it challenging to adopt mindful eating" (P16-EPC).

Such behaviours become automatic and emotionally comforting, serving as coping mechanisms to distract from boredom or stress (Moynihan et al. 2015). In turn, these can lead to mindless eating, which limits the ability to recognise bodily signals, so people overeat (Kononova et al. 2018). Shifting to mindful eating, by paying full attention to the food and eliminating external distractions, allows supports reconnecting with bodily signals (Monroe 2015), as indicated also in this illustrative quote: "*breaking the screen-eating habit isn't about denial, but about rediscovering the richness of a mindful meal, I suggest eating at the dinner table and start with at least one screen-free meal per day" (P6-RN).*

5. DISCUSSION

We now revisit the initial research questions. Findings indicate that mindful eating experts work with four types of clients: (i) those living with EDs, (ii) those with mental health conditions, (iii) those with non-clinical eating concerns, and (iv) those interested in overall wellbeing.

Regarding EDs, experts highlighted that the primary concern is related to patients' unhealthy eating patterns and difficulties regulating their food intake. For clients with mental health conditions, such as anxiety disorders and depression, there is a close link to non-clinical problematic eating behaviour, including restrictive eating, chronic dieting, emotional eating, mindless eating, and an unhealthy relationship with both the body and food. Restrained eaters, who follow a self-imposed cognitive strategy to restrict food intake and control body weight (Herman and Mack 1975), represent an important factor influencing eating behaviour. They tend to eat at a constant rate compared to unrestrained eaters, who typically eat at a decelerated rate (Zandian et al. 2009). Satiety remains relatively steady at the beginning of a meal and then increases linearly in restrained eaters. In contrast, in unrestrained eaters, satiety follows a similar curve but levels off by the end of the meal (Westerterp-Plantenga 2000). Experts also work with individuals who do not have clinical conditions but are solely interested in improving their overall wellbeing.

Findings also highlight the value of interdisciplinary expertise in assisting clients with EDs or related problematic eating conditions. As a result, many of the experts we interviewed work closely with mental health therapists or medical doctors to determine the most effective treatment approach. We identified the main target group of mindful eating experts, offering guidance for HCI scholars interested in designing technologies that address diverse client needs relating to eating behaviour and overall wellbeing. Despite growing interest in HCI for designing technologies to regulate or support healthy eating behaviour (Epstein et al. 2016), limited attention is given to individuals living with such challenging conditions. Scholars can aim to contribute by designing and developing mindful eating technologies that support bodily awareness more effectively.

For the treatment of such conditions, experts use four main types of interventions, including (i) mindful eating, (ii) mindfulness meditation for eating behaviour, (iii) therapeutic interventions, and (iv) holistic interventions for mental health. Experts use MB-EAT for both clinical and non-clinical conditions, as well as for intuitive eating interventions in non-clinical conditions. Concerning the main challenges of mindful eating interventions, practitioners indicated their impact on many aspects of mindful eating. Such challenges include people's limited bodily awareness, insufficient savouring of food, and insufficiently slow chewing and pausing.

With respect to the first challenge of limited bodily awareness, we can draw inspiration from previous HCI works focused on bodily awareness mainly through mindfulness technologies (Daudén Roquet and Sas 2021), or affective interfaces (Sanches et al. 2019; Umair et al. 2021, 2019). Although limited, such HCI exploration has focused on supporting mindful eating. With respect to savouring food, most relevant previous work has taken place in the HFI community, which explored, for instance, technologies such as 3D-printed food (Lin et al. 2020), AR/VR (Narumi et al. 2011a,b) to alter the taste or texture experience of eating food, conversational agents for digital commensality supporting, for instance, wine tasting (Parra et al. 2024). Interestingly, from the three challenges related to bodily awareness, slow chewing has arguably been the most explored in previous work, especially in HFI, for example, through wearable technologies (Kim et al. 2016), and smart tableware (Kadomura et al. 2013; Zhang et al. 2019, 2020), with limited attention, however, being given to pausing, which experts highlighted as important for supporting mindful eating.

Another main challenge of the mindful eating practice is clients' problematic attitudes towards food, specifically judgmental attitudes, diet mentality, limited gratitude towards food, and limited literacy for healthy eating. With respect to diet mentality, previous HCI work has also highlighted the ethical challenges of mobile apps and social media for

facilitating a judgmental attitude towards one's body, particularly for users living with eating disorders (Chung et al. 2017; Guluzade and Sas 2024), thus we argue for novel mindful eating technologies fostering non-judgmental attitude (in addition to merely limiting judgmental attitude). Such technologies may extend current ones, such as mindful eating apps, (Guluzade and Sas 2023, 2024), with wearables or smart tableware, to better support real-time guided mindful eating.

With regard to the challenge of users' limited literacy in healthy eating, we can draw on extensive HCI research on healthy eating, primarily through mobile apps that track calories, nutrients, and physical activities (Bomfim et al. 2020), or social media platforms for photo-based tracking of eating experiences (Chung et al. 2017). The latter in particular were also critiqued due to compulsive self-tracking of calories in the context of weight loss, and particularly for users living with eating disorders, who could benefit from being supported to develop literacy for a nutritious diet (Bomfim et al. 2020). Apps have also been explored for monitoring eating behaviour, integrated with monitoring of thoughts and feelings to support tracking and management of symptoms associated with eating disorders (Devakumar et al. 2021), or tracking food triggers to manage symptoms of digestive disorders (Karkar et al. 2017). With respect to gratitude, limited work has focused on this aspect (Donga and Hemmady 2022). We argue for the value of future mindful eating technologies, further supporting users' gratitude towards food.

Not at least, findings indicate a challenge related to the eating environment, such as multitasking while eating, which was mentioned as a common problematic behaviour hindering mindful eating. In this respect, we can draw inspiration from previous HFI research, which explored how to limit multitasking during eating experiences, particularly through smart tableware technologies (Khot et al. 2020). These technologies provide, for instance, haptic feedback once the user's gaze is detected on the screen. However, limited such work has focused on technologies to support users' nonjudgmental attitude towards food and their eating practices.

To conclude, emerging research in the field often focuses on supporting certain aspects of mindful eating without incorporating the insights of experts in this practice. However, these insights are crucial for building a stronger empirical foundation for designing mindful eating technologies in order to further enhance their effectiveness.

6. DESIGN IMPLICATIONS

Our findings open up design opportunities for novel mindful eating technologies, addressing the identified challenges.

To address the challenge of users' limited bodily awareness, HCI scholars interested in mindful eating technologies could draw from research on mindfulness technologies highlighting increased interoceptive awareness, for example, through real-time haptic feedback (Daudén Roquet and Sas 2021). We can also consider novel mindful eating interfaces that prompt users to reflect on their bodily sensations before and after eating, thus supporting increased awareness of hunger and satiety.

To address the challenge of users' problematic attitude towards food and eating, besides leveraging mindfulness technologies, and avoiding the harmful impact of calorie tracking of dieting apps (Bomfim et al. 2020; Karkar et al. 2017), our findings also indicate the value of novel interfaces supporting a non-judgmental attitude towards eating. We can imagine novel technologies in the form of psychoeducation apps, or innovative interfaces informed by compassion therapy (Mah et al. 2021). These could leverage framing to provide visualisations of user-tracked data that emphasise positive rather than negative behaviours, thus promoting self-compassion and reflection, instead of rumination (Loerakker et al. 2024).

To address the third challenge related to eating environments, we can imagine new classes of mindful eating technologies which explicitly limit multitasking, particularly on screen and media interfaces, rather than attempting to accommodate it. For example, we can imagine sensitively designed novel smart tableware that entirely fosters users' focused attention on food and the eating experience. This contrasts previous HFI research on technologies targeting mindful eating, designed around multitasking on screens (Khot et al. 2019).

Finally, we also call for ensuring the ethical aspects of mindful eating technologies, and the need to account for the tensions between the above design implications. For instance, supporting bodily awareness of hunger or satiety cues may foster a judgemental attitude towards eating experience and one's body. This calls for the sensitive design of interfaces that promote bodily awareness, as over-emphasis of these types of bodily cues may also support excessive rumination (Loerakker et al. 2024).

7. CONCLUSION

The exploration of HCI in mindfulness technologies and human-food interaction has garnered growing attention, though research combining these areas remains relatively sparse. To address this, we conducted interviews with 21 mindful eating expert practitioners to gain insights into their practices and evaluate the potential role of technology in supporting them. Our findings shed light on the four main types of client groups and the challenges associated with mindful eating and four design implications to address such challenges.

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